

Appendix 14.2

Hazard log



Hazard Workshop Swansea Tidal Lagoon (Appendix 14.2)

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1.0 Introduction

- 1.0.0.1 In order to provide expert opinion and local knowledge, a hazard workshop was undertaken to create a hazard log that was project and site specific. The hazard log identifies hazards caused or changed by the introduction of structures within the proposed Swansea Tidal Lagoon. It also details the risk associated with the hazard and the controls put in place to reduce the risk. The log includes both industry standard and additional mitigation measures required to show that the hazards associated with the Tidal Lagoon are **Broadly Acceptable** or **Tolerable** on the basis of As Low As Reasonably Practicable (ALARP) declarations.

2.0 Details and Attendance

- 2.0.0.1 The proposed Swansea Tidal Lagoon hazard workshop was held on 30th April 2013 in Swansea to identify the navigational hazards associated with the development. This workshop was attended by maritime stakeholders, as outlined in Table 2.1.

Table 2.1 Hazard Workshop Invitees

Invitee	Company/Organisation
Gill Lock	Tidal Lagoon Swansea Bay
Rebecca Smith	Tidal Lagoon Swansea Bay
Ton Fijen	Tidal Lagoon Swansea Bay
Sam Westwood	Anatec
Jenny Brown	Anatec
Miles Chidlow	ABP
Adrian Lester	Chamber of Shipping
Huw Morgan	County and City of Swansea
Ted Osborn	Cruising Association
Dave Bulley	Local Fisherman
Steve Jones	MCA
Bob Minty	Neath Port Authority
Godfrey Pullen	Neath Port Authority
R.W. Hemming	Neath Port Authority
Stephen Boshier	Neath Port Authority

Invitee	Company/Organisation
Christos Andreau	Neath Port Authority
Jaime Voisey	Neath Port Authority
Ross Doig	Neath Port Authority
Alana Murphy	RYA
Marion Warlow	South West Wales Fisheries Committee
Ian Lloyd Owen	Swansea Dry Docks
Karl Dunn	Swansea Dry Docks
Steve Kern	Swansea Marina
Bill Arnold	Swansea Port Health Authority
Gillian Morgan	Swansea Port Health Authority
Ian Thomas	Tawe Boat club
Colin Thomas	Thomas Shellfish Limited

3.0 Hazard Workshop Process

- 3.0.0.1 As part of the workshop, key maritime hazards associated with structures in the proposed Swansea Tidal Lagoon were discussed and noted. Where appropriate, vessel types were considered separately to ensure the risk levels were assessed for each and the control options could be identified on a type-specific basis, e.g., risk control measures for fishing vessels differ to those for commercial vessels. Other general hazards associated with the construction, decommissioning and operation phases, such as dropped objects, man overboard, pollution incidents and search and rescue operations, were also discussed.
- 3.0.0.2 After the workshop, the risks associated with the hazards were ranked based on the discussions held during the workshop and mitigation measures were identified.

4.0 Hazard Log

4.0.0.1 This annex presents full details of the hazards which were logged and ranked during the workshop for the proposed Swansea Bay Tidal Lagoon, held in Swansea on 30th April 2013. Note that the initial risk assessment was undertaken assuming industry standard mitigations are in place, therefore the final column highlights mitigations above that level which could be considered by the project.

Receptors/ area	Hazard Title	Hazard Detail	Phase (C, O/M, D)	Industry Standard Risk Reduction Measures (Assumed In Place)	Possible Causes	Most Likely Consequences without mitigation	Most Likely			Worst Case Consequences without mitigation	Worst Case			Risk Reduction Measures (Risk assessment was undertaken assuming industry standard mitigation is in place, therefore this column highlights mitigations above that level that could be considered by the project)	Additional Comments/ mitigation being considered during detailed design	Anticipated Residual Risk assuming that appropriate mitigation measures are put in place. Outlined measures are described in columns Q and R and further mitigation options will be identified as part of the detailed assessment undertaken during the EIA.		
							Consequence	Frequency	Risk		Consequence	Frequency	Risk			Consequence	Frequency	Risk
Search and Rescue Operators and All Sea Users- inside lagoon	Change to current Search and Rescue responses	Due to the presence of the lagoon wall, RNLI vessels from Port Talbot and The Mumbles will not be able to access the lagoon and alternative means of rescuing people from the water will be required. This has the potential to delay response times compared to baseline conditions.	All		• Presence of lagoon	• Delayed response	2	3	Tolerable	• Loss of life due to delayed response	5	2	Unacceptable	- Slipway with emergency response RIB within lagoon - Coordination with event organiser to ensure site support vessels during busy periods (eg sporting events);	Slipways at two locations within the lagoon (boating centre and offshore O&M building), RIB.	2	1	Broadly Acceptable
All Sea Users inside and outside lagoon	Person falling from vessel drifts into turbines	Person in the water after falling from a vessel could drift into the turbines with the current. This impact would be present for sea users inside and outside of the lagoon boundary due to the bi-directional generation.	All	IALA O-139	- Strong current including that created by turbines - Man overboard - Vessel capsizes	- Shut down of turbines and business implications - Emergency rescue of persons from water	3	2	Tolerable	- Loss of life - Severe disruption to business operations - Major reputation damage	5	1	Tolerable	- Marked exclusion area around turbines (with wire/buoy system) - Extensive promulgation of information - Additional aids to navigation, where appropriate - Coordination with event organiser to ensure site support vessels during busy periods (eg sporting events); - Develop emergency shut down procedure for turbines, from manned facility on turbine housing - Quick response time for shutting down turbines - Enforcement of wearing lifejackets for relevant activities within the lagoon - Further understanding of currents	All of the mitigation identified is being integrated into the lagoon. Information on current flows at is in Chapter 4 EIA. This information will be publically available.	2	2	Broadly Acceptable

All Vessels inside and outside lagoon	Drifting vessel allision with turbine housing or lagoon wall	A Not Under Command (NUC) vessel which is drifting could be dragged towards the turbine housing due to the currents created by the turbines and allide with the structure or lagoon wall.	All		- Engine failure - Machinery failure - Human error - Strong current including that created by turbines - Adverse weather conditions	- Minor damage to vessel / infrastructure - Minor injury to vessel crew member - Minor delay in operations and reputation damage	2	4	Tolerable	- Major damage to vessel / infrastructure - Multiple fatalities - Major delay in operations and reputation damage	5	2	Unacceptable	- Emergency shut down procedure for turbines, from manned facility on turbine housing - Marked exclusion area around turbines (with wire/buoy system) - Emergency grounding of vessel - Further understanding of currents at different depths	All of the mitigation identified is being integrated into the lagoon. Information on current flows at is in Chapter 4 EIA. This information will be publically available.	2	2	Broadly Acceptable
All Vessels outside lagoon	Vessel allision with lagoon wall at high water during severe adverse weather	There may be times at high water during severe adverse weather when the lagoon wall is not visible due to overtopping, creating an allision risk for all vessels.	All		- Presence of lagoon - Severe adverse weather	- Moderate damage to vessel / infrastructure - Moderate injury to vessel crew member	3	2	Tolerable	- Major damage to vessel / infrastructure - Multiple fatalities	5	1	Tolerable	- Extensive promulgation of information - Additional aids to navigation - including clear day and night marks around the lagoon boundary - Procedures for dealing with significant adverse weather	All of the mitigation identified is being integrated into the lagoon.	3	1	Broadly Acceptable
All Vessels - outside lagoon	Grounding due to reduced water depth in navigational channels and rivers	Due to the currents created by the turbines and the presence of the lagoon, there could be increased siltation in navigational channels, therefore reducing water depth and creating a risk of vessels grounding	All		Increased siltation due to presence of lagoon	- Minor damage to vessel / infrastructure - Minor injury to vessel crew member	2	2	Broadly Acceptable	- Major damage to vessel / infrastructure - Multiple fatalities	5	1	Tolerable	- Hydrographic surveys of channels - Maintenance dredging as required to mitigate increased siltation in navigational channels when the lagoon is in place - Promulgation of information to notify of any changes in water depth and additional maintenance dredging - Modelling of sedimentation patterns	Detailed modelling has been undertaken to determine the potential for siltation in navigation channels. Mitigation will be put in place to maintain the current situation (Chapter 6).	2	1	Broadly Acceptable
All Vessels - outside lagoon	Lagoon lights not visible against shore based lights	Vessels approaching the lagoon may not be able to distinguish between lights marking the structure and shore based lights	All	IALA O-139 Lighting and marking to be discussed in consultation with THLS/MCA	Presence of lagoon	- Visual confusion for mariners - Delayed entry to port - Minor damage to vessel if it allides with structure	2	2	Broadly Acceptable	- Major damage to vessel / infrastructure if it allides with structure - Multiple fatalities	5	1	Tolerable	- Extensive consultation to consider lighting and marking in consultation with THLS and stakeholders - Promulgation of information through Notices to Mariners, local clubs/ facilities and other appropriate media	- Lighting requirements are in agreement with regulators - Promulgation of information through Notices to Mariners, local clubs/ facilities and other appropriate media	2	1	Broadly Acceptable

All Vessels outside lagoon	Effects of light pollution during construction and operation	Increased lights during construction and operation phases may lead to visual navigation issues for mariners especially at night and in restricted visibility, potentially increasing vessel to vessel collisions	All	IALA O-139 Lighting and marking to be discussed in consultation with THLS	• Presence of lagoon	• Additional pilotage required • Visual confusion for mariners • Vessel to vessel collision • Leading lights no longer effective • Delayed entry to port	1	2	Broadly Acceptable	• Moderate damage to vessel / infrastructure	4	1	Tolerable	• Extensive consultation to consider lighting and marking in consultation with THLS and stakeholders • Agree lighting with local stakeholders for all phases of the development • Promulgation of information through Notices to Mariners, local clubs/ facilities and other appropriate media	• Lighting requirements has been agreed with regulators • Promulgation of information through Notices to Mariners, local clubs/ facilities and other appropriate media	1	1	Broadly Acceptable
All Vessels outside lagoon	Increased vessel to vessel collision risk	Increased risk of encounters, and therefore collision risk, for vessels displaced by the lagoon boundary which are all now transiting in the same area	All	COLREGS	• Presence of lagoon • Displacement of vessels into the same sea space	• Minor damage to vessel / infrastructure • Minor injury to vessel crew member • Minor damage to vessel / infrastructure • Minor injury to vessel crew member • Disruption to port activities if it is a port vessel which collides with work vessel • Disruption to construction, maintenance or decommissioning	2	3	Tolerable	• Major damage to vessel / infrastructure • Multiple fatalities	5	2	Unacceptable	• Additional aids to navigation, where appropriate • Promulgation of information through Notices to Mariners	• Navigation aids agreed with MCA will be designed into Project • Promulgation of information through Notices to Mariners	2	1	Broadly Acceptable
All Vessels inside and outside lagoon	Vessel to vessel collision risk with work vessels on site	Due to the presence of work vessels on site (some of which may be restricted in their ability to manoeuvre), there is an increased vessel to vessel collision risk.	Construction, Decommissioning Major Maintenance	COLREGS	• Presence of work vessels on site	• activities	2	2	Broadly Acceptable	• Moderate damage to vessel / infrastructure • Disruption to port activities if it is a port vessel which collides with work vessel • Disruption to construction, maintenance or decommissioning activities	4	1	Tolerable	• Work procedures and planning • Promulgation of information • Widen Neath Port Authority channel • Keep construction vessels clear of channels during peak navigational periods	• All mitigation will be adopted. The proposed positioning of lagoon walls relative to both channels and works on Neath channel have been determined through discussion with both ports. Entrance to Neath channel will be widened.	2	1	Broadly Acceptable
All Vessels outside lagoon	Wave reflection affecting vessel navigation in normal weather conditions	The reflection of waves could create additional waves within the rivers and channels in normal or adverse weather conditions, therefore affecting the safe approach to the Tawe and Neath channels.	All		• Presence and angle of inclination of lagoon wall • Adverse weather	• Minor damage to vessel / infrastructure • Minor injury to vessel crew member • Vessel grounding • Port closures	2	3	Tolerable	• Major damage to vessel / infrastructure • Multiple fatalities • Vessel grounding • Port closures	5	2	Unacceptable	• Widen Neath Port Authority channel • Wall designed to minimise reflection by considering the angle of the wall and reducing slope • Additional modelling (fully validated model with local tides)	• Wall has been designed to minimise wave reflection. Modelling undertaken to determine local wave climate under normal and extreme weather conditions (Chapter 6). Neath channel entrance will be widened.	2	2	Broadly Acceptable

All Vessels outside lagoon	Wave reflection affecting vessel navigation in adverse weather conditions	The combined effect of adverse weather and reflection of waves making conditions difficult for vessels	All		• Presence and angle of inclination of lagoon wall • Adverse weather	• Minor damage to vessel / infrastructure • serious Injury to vessel crew member • Vessel grounding • Port closures	2	3	Tolerable	• Major damage to vessel / infrastructure • Multiple fatalities • Vessel grounding • Port closures	5	2	Tolerable	• Widen Neath Port Authority channel • Wall designed to minimise reflection by considering the angle of the wall and reducing slope • Additional modelling (fully validated model with local tides)	• The wall has been designed to minimise wave reflection. Modelling has been undertaken to determine local wave climate under normal and extreme weather conditions (Chapter 6). Neath channel entrance will be widened.	3	1	Broadly Acceptable
Commercial Vessels outside	Impacts on vessels current emergency plans	Vessels with pilots currently navigating in the channel to Neath in an emergency situation will use grounding as a mitigation, this will not be possible due to presence of the lagoon wall	All		• Presence of lagoon wall	• Delayed entry to port • Existing emergency plans inappropriate	3	2	Tolerable	• Major business impacts • Minor injury to vessel crew	4	1	Tolerable	• Widen Neath Port Authority channel • Emergency response planning in conjunction with stakeholders	• Widening of Neath Channel has been incorporated into project design.	2	1	Broadly Acceptable
Vessel Bound for Swansea Dry Docks outside lagoon	Vessel towed in with no rudder or not under own power	Vessels being towed into Swansea Dry Dock may be impacted by the presence of the lagoon	All		• Presence of lagoon	• Vessels delayed when entering port because presence of lagoon makes operation more technical • Business impacts on Swansea Dry Docks	2	2	Broadly Acceptable	• Loss of business • Damage to vessel while being towed or towing vessel	4	1	Tolerable	• Consideration of Swansea channel when designing lagoon • Skilled operators from Swansea Dry Docks towing in vessels	• The lagoon wall relative to the Tawe channel has been positioned in discussion with the ports.	1	2	Broadly Acceptable
Commercial Ferry	Impact on commercial ferries bound to/from Swansea Port	If the ferry service returns to Swansea (Fastnet Line service which operates between Swansea and Cork but has not been operational since 2011), there may be limited access windows to the port	All		• Presence of lagoon	• Ferry delayed in entering port	2	2	Broadly Acceptable	• Potential loss of future business	4	1	Tolerable	• Consideration of Swansea channel when designing lagoon • Planning of vessel movements in conjunction with operators if ferry service returns	• The lagoon wall relative to the Tawe channel has been positioned in discussion with the ports. Further consideration of ferry would be undertaken should a ferry service resume.	1	2	Broadly Acceptable
Pilot Boarding Station outside lagoon	Impacts on use of existing pilot boarding stations	The current pilot boarding stations may be impacted by the presence of the lagoon due to proximity to the lagoon wall	All		• Presence of lagoon • Adverse weather	• Minor effect on current pilot practices	2	2	Broadly Acceptable	• Moderate effect on current pilot practices	3	2	Tolerable	• Move pilot boarding station slightly further south in consultation with relevant harbour authorities to increase distance between pilot boarding station and lagoon wall	• This has been integrated into design	1	1	Broadly Acceptable
Pilot Vessels and Tugs outside lagoon	Vessel displacement	Displacement of pilot vessels and tugs which currently cross the lagoon site	All		• Presence of lagoon	• Vessel displacement • Commercial implications	2	5	Tolerable	• Loss of business due to commercial implications of losing current routes (such as increased fuel costs)	4	2	Tolerable	• Overnight pontoon located within Port Talbot outer harbour to reduce number of vessel transits	• Potential options to mitigate adverse effects will be considered during detailed design	2	3	Tolerable

Recreational vessels outside lagoon	Vessel allision with lagoon wall in adverse weather	Recreational vessels could be blown into the wall in strong winds.	All		- Adverse weather - strong winds - Human error	- Minor damage to vessel / infrastructure - Minor injury to vessel crew member	2	3	Tolerable	- Major damage to vessel / infrastructure - Multiple fatalities	5	2	Unacceptable	- Promulgation of information - Additional aids to navigation, where appropriate - Coordination with event organiser to ensure site support vessels during busy periods (eg sporting events)	All mitigation will be progressed in detailed design	2	2	Broadly Acceptable
Recreational vessels outside lagoon	Vessel stuck on lagoon wall	Drifting recreational vessels, or vessels out during strong winds, could get stuck on the slope of the lagoon wall	All		- Engine failure - Machinery failure - Human error - Adverse weather - strong winds	- Minor damage to vessel / infrastructure - Minor injury to vessel crew member	2	2	Broadly Acceptable	- Major damage to vessel / infrastructure - Multiple fatalities	5	2	Unacceptable	- Promulgation of information - Additional aids to navigation, where appropriate - Coordination with event organiser to ensure site support vessels during busy periods (eg sporting events)	All mitigation will be progressed in detailed design	2	2	Broadly Acceptable
Recreational vessels inside lagoon	Siltation within lagoon reducing water depth	Siltation within the lagoon wall reducing the water depth and creating a navigational hazard for recreational vessels within the lagoon	operation		- Presence of lagoon - Particle displacement and settlement within the lagoon	Minor damage to vessel / infrastructure	2	2	Broadly Acceptable	Moderate damage to vessel / infrastructure	4	1	Tolerable	- Hydrographic surveys of lagoon - Promulgation of information to notify of any changes in water depth - Further modelling by TLSB of sedimentation patterns within the lagoon	Detailed modelling has been undertaken to determine the potential for siltation in the lagoon. Mitigations will be put in place to maintain appropriate levels for recreational use.	2	1	Broadly Acceptable
Fishing vessels outside lagoon	Loss of transit routes	The presence of the lagoon wall will result in the loss of transit routes for vessels fishing in Swansea Bay which will increase journey times and fuel costs	All		Presence of lagoon	- Potential change to fishing vessel transit routes - Commercial implications	2	3	Tolerable	Loss of business due to commercial implications of losing transit routes (such as increased fuel costs)	3	2	Tolerable	Consultation with local users	Enhancement measures for the marine environment include lobster hatchery and encouraging reef effect of lagoon wall.	2	3	Tolerable

5.0 Tolerability of Risks

5.0.0.1 The Anticipated Residual Risk assuming that appropriate mitigation measures are put in place included eighteen of the risks at broadly acceptable and 2 in the tolerable region.