Appendix 6.4

Summary of model run scenarios for Coastal Processes EIA

Assessment	Modelling software used	ID	Model Run Details	Notes
Effects on hydrodynamics (water levels and flows)	DHI MikeFM-HD (hydrodynamics)	1	- Baseline scenario (no lagoon) - 15-day mean Spring/Neap cycle - Annual mean discharges entering from the main fluvial sources.	- Assessment to investigate the potential effects of the lagoon on the hydrodynamic conditions across the wider bay. - Baseline model calibrated against measured water level and flow speed data across the study area (as detailed further in Appendix 6.1, Volume 3)
		2	- Scheme scenario (with lagoon included and construction-dredged area deepened) - 15-day mean Spring/Neap cycle - Annual mean discharges entering from the main fluvial sources. - Turbine and sluice gate operation controlled using 'gate' structures, with periods of operation and discharge volumes validated against the output of the engineering turbine-modelling.	
Effects on hydrodynamics including climate change effects	DHI MikeFM-HD	3	- Baseline scenario (no lagoon) - Mean spring tide - Annual mean discharges entering from the main fluvial sources. - Sea-level rise for 2100 based on UKCP09 medium emissions, 95% prediction	- Assessment to investigate the potential effects of the lagoon on the combined hydrodynamic and sea-level rise conditions across the wider bay.
		4	- Scheme scenario (with lagoon included and construction-dredged area deepened) - Mean spring tide - Annual mean discharges entering from the main fluvial sources. - Sea-level rise for 2100 based on	

			UKCP09 medium emissions, 95% prediction - Turbine and sluice gate operation controlled using 'gate' structures, with periods of operation controlled by the stated head difference controls derived from the engineering turbine-modelling.	
Effects on hydrodynamics including meteorological surge effects	DHI MikeFM-HD	5	- Baseline scenario (no lagoon) - Mean spring tide - Annual mean discharges entering from the main fluvial sources. - Added surge of 1.5m	- Assessment to investigate the potential effects of the lagoon on the combined hydrodynamic and surge conditions across the wider bay.
		6	- Scheme scenario (with lagoon included and construction-dredged area deepened) - Mean spring tide - Annual mean discharges entering from the main fluvial sources. - Added surge of 1.5m - Turbine and sluice gate operation controlled using 'gate' structures, with periods of operation controlled by the stated head difference controls derived from the engineering turbine-modelling.	
Effects on waves	DHI MikeFM-SW (spectral wave)	7	- Baseline scenario (no lagoon) - Mean high water spring water level - Extreme events from south-west approach direction (0.1, 1, 10, 20 return periods)	- Assessment to investigate the potential effects of the lagoon on the wave conditions across the wider bay. - Baseline model calibrated against measured wave height,

			-Specific extreme events from south-east approach direction (0.1, 10 return periods)	period and direction data across the study area (as detailed further in Appendix 6.1, Volume 3).
		8	- Scheme scenario (with lagoon included and construction-dredged area deepened) - Reflection coefficient for lagoon wall of 0.3 (based on engineering design) - Mean high water spring water level - Extreme events from south-west approach direction (0.1, 1, 10, 20 return periods) -Specific extreme events from south-east approach direction (0.1, 10 return periods)	
Effects on waves including climate change effects	DHI MikeFM-SW	9	- Baseline scenario (no lagoon) - Mean high water spring water level - Sea-level rise for 2100 based on UKCP09 medium emissions, 95% prediction - Extreme events from south-west approach direction (0.1, 1, 10, 20 return periods) -Specific extreme events from south-east approach direction (0.1, 10 return periods)	- Assessment to investigate the potential effects of the lagoon on the combined wave and sea-level rise conditions across the wider bay.
		10	- Scheme scenario (with lagoon included and construction-dredged area deepened)	

			- Reflection coefficient for lagoon wall of 0.3 (based on engineering design) - Mean high water spring water level - Sea-level rise for 2100 based on UKCP09 medium emissions, 95% prediction - Extreme events from south-west approach direction (0.1, 1, 10, 20 return periods) -Specific extreme events from south-east approach direction (0.1, 10 return periods)	
Effects on waves including meteorological surge effects	DHI MikeFM-SW	11	- Baseline scenario (no lagoon) - Mean high water spring water level - Added surge of 1.5m - Extreme events from south-west approach direction (0.1, 1, 10, 20 return periods) -Specific extreme events from south-east approach direction (0.1, 10 return periods)	- Assessment to investigate the potential effects of the lagoon on the combined wave and surge conditions across the wider bay.
		12	- Scheme scenario (with lagoon included and construction-dredged area deepened) - Reflection coefficient for lagoon wall of 0.3 (based on engineering design) - Mean high water spring water level	

			- Added surge of 1.5m - Extreme events from south-west approach direction (0.1, 1, 10, 20 return periods) -Specific extreme events from south-east approach direction (0.1, 10 return periods)	
Fate of the sediment plume potentially generated during lagoon wall construction activity (dredging of bed material and filling of Geotubes®)	DHI MikeFM-PT (particle tracking)	13	- Construction activity along the western arm of the lagoon wall - Construction of a 150m stretch of lagoon wall (including multiple Geotube® filling operations and back-fill of sediment in the core of wall) - 15-day mean Spring/Neap cycle - Annual mean discharges entering from the main fluvial sources. - No waves included in plume assessment (tide-only scenario considered as worst case due to reduced resuspension and dispersion) - Characteristics and volumes of released sediment from each stage (dredging and filling) informed by PSA results from relevant locations within the dredge-area inside the lagoon and a conservative estimate of release rates provided by the dredging company - Relative durations of each activity (dredging and filling) informed by	- Assessment to investigate the magnitude and extent of any sediment plume (in regard of suspended sediment concentrations and associated sedimentation) arising from the construction activity on the lagoon walls.

			conservative estimates provided by the dredging company and the developer	
		14	- Construction activity along the eastern arm of the lagoon wall - Construction of a 150m stretch of lagoon wall (including multiple Geotube® filling operations and back-fill of sediment in the core of wall) - 15-day mean Spring/Neap cycle - No waves included in plume assessment (tide-only scenario considered as worst case due to reduced resuspension and dispersion) - Characteristics and volumes of released sediment from each stage (dredging and filling) informed by PSA results from relevant locations within the dredge-area inside the lagoon and a conservative estimate of release rates provided by the dredging company - Relative durations of each activity (dredging and filling) informed by conservative estimates provided by the dredging company and the developer	
Fate of the sediment plume potentially generated during disposal activity at the Swansea	DHI MikeFM-PT	15	- Disposal activity at a series of locations within the Swansea Outer Spoil Ground	- Assessment to investigate the magnitude and extent of any sediment plume (in regard of

Outer Spoil Ground			- 15-day mean Spring/Neap cycle - Annual mean discharges entering from the main fluvial sources. - Disposal activity is assessed to continue throughout the 15-day assessment period, based on a conservative estimate of timings (dredging, filling of hopper, transit to site, disposal, return) provided by the developer. - No waves included in plume assessment (tide-only scenario considered as worst case due to reduced resuspension and dispersion) - Characteristics and volumes of released sediment during disposal informed by PSA results from relevant locations within the turbine array site and the capacity of the dredge hopper.	suspended sediment concentrations and associated sedimentation) arising from the dredge disposal activity at the Outer Spoil Ground.
Effects on transport of fine (mud) sediment	DHI MikeFM-MT (mud transport)	16	- Baseline scenario (no lagoon) - 48-hour period covering a mean spring tide - Annual mean discharges entering from the main fluvial sources. - Including wave effects from a 10 in 1-year return period south-westerly wave condition - Initial bed thickness informed by conceptual understanding of the baseline environment (including	- Assessment to investigate the potential changes in mud transport as a result of the lagoon being in place (including effects on siltation within the lagoon, changes to deposition in the wider bay area and changes to navigation channel maintenance dredging requirements). - Validation of baseline SSC

			information collected during project benthic, geotechnical and geophysical surveys). - Suspended sediment boundary conditions informed by conceptual understanding of the wider baseline environment (including an existing assessment of SSC values within the Bristol Channel and Severn Estuary undertaken for the Severn Tidal Power SEA)	values carried out using the results of the project metocean survey.
		17	- Scheme scenario (with lagoon included and construction-dredged area deepened) - 48-hour period covering a mean spring tide - Annual mean discharges entering from the main fluvial sources. - Including wave effects from a 10 in 1-year return period south-westerly wave condition - Initial bed thickness informed by conceptual understanding of the baseline environment (including information collected during project benthic, geotechnical and geophysical surveys). - Suspended sediment boundary conditions informed by conceptual understanding of the wider baseline environment (including an existing assessment of SSC values within the	

			Bristol Channel and Severn Estuary undertaken for the Severn Tidal Power SEA)	
Effects on transport of non-cohesive (sand) sediment	DHI MikeFM-ST (sand transport)	18	- Baseline scenario (no lagoon) - 48-hour period covering a mean spring tide3 - Annual mean discharges entering from the main fluvial sources. - Including wave effects from a range of south-westerly wave conditions (10 in 1-year to 1 in 20-year return periods) - Initial bed thickness informed by conceptual understanding of the baseline environment (including information collected during project benthic, geotechnical and geophysical surveys). - Range of sediment grain sizes assessed (fine sand to medium/coarse sand)	- Assessment to investigate the potential changes in sand transport as a result of the lagoon being in place and relative changes used to inform the assessment of medium to long-term changes in morphology through Expert Geomorphological Assessment.
		19	- Scheme scenario (with lagoon included and construction-dredged area deepened) - 48-hour period covering a mean spring tide - Annual mean discharges entering from the main fluvial sources. - Including wave effects from a range of south-westerly wave conditions (10 in 1-year to 1 in 20-year return periods)	

			- Initial bed thickness informed by conceptual understanding of the baseline environment (including information collected during project benthic, geotechnical and geophysical surveys). - Range of sediment grain sizes assessed (fine sand to medium/coarse sand)	
Bathymetry sensitivity tests	DHI MikeFM-HD	20	- Baseline scenario (no lagoon) - Inclusion of sand-bar feature in the western part of the bay, on the intertidal fronting the Swansea University.	- Sensitivity test to investigate the effect that the inclusion of the western sand-bar has on the baseline model outputs.
		21	- Baseline scenario (no lagoon) - Landward adjustment to the location of the sand-bar feature in the eastern part of the bay, on the intertidal fronting Crymlyn Burrows	- Sensitivity test to investigate the effect that the location of the eastern sand-bar has on the baseline model outputs, since beach profile analysis shows a general landward migration of the feature between 1998 and 2013.
		22	- Baseline scenario (no lagoon) - Seaward adjustment to the location of the sand-bar feature in the eastern part of the bay, on the intertidal fronting Crymlyn Burrows	