Liverpool Bay CCS Ltd

HYNET CARBON DIOXIDE TRANSPORTATION AND STORAGE PROJECT - OFFSHORE

RESPONSE TO REQUEST FOR FURTHER INFORMATION – REGULATION 14(1) THE MARINE WORKS (ENVIRONMENTAL IMPACT ASSESSMENT) REGULATIONS 2007 (AS AMENDED)

Technical Note: Physical Processes

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Glossary

Term	Meaning
Environmental Impact Assessment	A statutory process by which certain planned projects must be assessed before a formal decision to proceed can be made. It involves the collection and consideration of environmental information, which fulfils the assessment requirements of the EIA Directive and EIA Regulations, including the publication of an Environmental Impact Assessment (EIA) Report.
Maximum Design Scenario (MDS)	The maximum design parameters of each Proposed Development asset (both on and offshore) considered to be a worst case for any given assessment but within the range of the Project Description Envelope.
Project	The HyNet Carbon Dioxide Transportation and Storage Project.
Project Design Envelope (PDE)	Also known as the Rochdale Envelope, the PDE concept is routinely utilised in both onshore and offshore planning applications to allow for some flexibility in design options, particularly offshore, and more particularly for foundations and turbine type, where the full details of the project are not known at application submission but where sufficient detail is available to enable all environmental impacts to be appropriately considered during the EIA.
Proposed Development	The offshore components of the Project which are subject of this Environmental Statement, as described in Volume 1, Chapter 3: Proposed Development Description.

Acronyms and Initialisations

Acronym / Initialisation	Description
CBRA	Cable Burial Risk Assessment
CEA	Cumulative Effects Assessment
CD	Chart Datum
EIA	Environmental Impact Assessment
Eni	Eni UK Limited
ES	Environmental Statement
HVDC	High Voltage Direct Current
JNCC	Joint Nature Conservation Committee
LAT	Lowest Astronomical Tide
MEPE	Mostyn Energy Park Extension
MDS	Maximum Design Scenario
MPA	Marine Protected Area
NRW	Natural Resources Wales
O&M	Operations and Maintenance
OFTO	Offshore Electricity Transmission
OP	Offshore Platform
PDE	Project Design Envelope
OWF	Offshore Wind Farm
PoA	Point of Ayr
PoAX	Point of Ayr Cable Crossing
RIAA	Report to Inform Appropriate Assessment
SAC	Special Areas of Conservation
SPA	Special Protection Area
SSC	Suspended Sediment Concentrations
SSSI	Sites of Special Scientific Interest

Units

Acronym	Description
%	Percentage
cm	Centimetres (distance)
km	Kilometres (distance)
m	Metres (distance)
m^2	Metres squared (area)
m^3	Metres cubed (volume)
mg/l	Milligrams per litre (concentration)
mm	Millimetres (distance)

Contents

Tables

Figures

1 PHYSICAL PROCESSES

1.1 Introduction

This Technical Note provides further information, detail, and assessment to the information presented in Volume 2, Chapter 6 of the ES (Physical Processes), and should be read alongside it. Additional Technical Notes have been produced for Marine Biodiversity and the Report to Inform Appropriate Assessment (RIAA).

1.2 Consultation

Relevant post-application consultation was received on the 29th of April 2024 from Natural England and on the 14th of May 2024 from Natural Resources Wales (NRW). The feedback and advice in relation to Physical Processes has been summarised in Table 1-1 and is accompanied by either a response or a reference to a section within this Technical Note where the matter is addressed where a more detailed response was appropriate.

Table 1-1: Relevant Post-Application Consultation for Physical Processes

Consultee	Consultation	Where and How Addressed
Natural England	Natural England and JNCC produced a joint guidance document which provides advice on the key sensitivities of habitats and Marine Protected Areas (MPAs) in English waters to cabling within the proposed Round 4 leasing areas (Natural England & JNCC, 2019). Developers should follow the best practice advice provided within this document, including advice on which MPA features are especially sensitive to cabling pressures.	The guidance provided on the SharePoint site for “Natural England’s advice on the environmental considerations and use of data and evidence to support offshore wind and cable projects in English waters.” has been accessed and used to inform the assessment of effects methodology (see Offshore ES Chapter 5, section 5.2). In terms of physical processes, it is noted that the focus of the cited document is on benthic habitat sensitivity and that all designated sites and relevant qualifying interests for the physical processes have been assessed in accordance with the methodology outlined.
Natural England	The future baseline scenario section is currently quite broad, with limited site-specific information or assessment of the future baseline scenario within the study area.	Further information is presented in **Section 1.3**.
Natural England	The ES states that cable protection will only be necessary in the form of cable crossings with the justification that the nature of the seabed accommodates cable burial to the required depth. We advise that this is assessed within the Cable Burial Risk Assessment (CBRA) to test assumptions made throughout the ES.	For the Proposed Development the preferred form of cable protection is cable burial with sand wave clearance as appropriate. Several studies have been undertaken for this project including seabed mobility studies (ENI, 2017), developing geological ground models (ENI/Boskalis, 2022), and these, combined with assessments of site specific survey data, have been used to determine the seabed preparation and cable burial parameters. The OFFSHORE POWER CABLE PROTECTION REQUIREMENT-1025H0BSRV84107_CDFE06_43 Report, submitted with the Marine Licence Application, provides a comprehensive analysis of the subsea cable protection study conducted for the Liverpool Bay CCS T&S project area. The study represents the initial Cable Burial Risk Assessment (CBRA) and utilises both qualitative and quantitative approaches to assess the various hazards that could potentially affect the integrity of subsea cables. The study utilised the

Consultee	Consultation	Where and How Addressed
		data from the Phase 2c Nearshore Engineering Geological Ground Model 1025H0BGRV09420. The study identified that the cables should be buried to a target depth of 2-3m and need only be protected using external protection (e.g. concrete mattresses, and rock berms) at third-party crossings of other cables. Minimises the risk of underwater allision with cable protection, anchor or fishing gear interaction with subsea cables and interference with magnetic position fixing equipment. The external cable protection at the third-party crossings will also reduce interactions between metocean regime (wave, sand and currents) and the seabed structures. The study was informed by the guidance set out in DNV-RP-0360 – Offshore Power Cables in shallow Water. By evaluating the study area and the activities expected near the platforms and cable routes, several principal hazards were identified. These hazards included: 1. Coastal changes at the Point of Ayr landfall; 2. High fishing intensity and potential interaction with fishing gear; 3. Risks associated with shipping lanes and dropped anchor interaction; and 4. Possibility of dropped objects from platforms on subsea cables. The potential for cable exposure has been recognised and the project description includes provision for the reburial of cables up to the entire length over the lifetime of the project. It is not anticipated however that the entire cable would become exposed during the lifetime of the project, but rather that up to the equivalent length would require reburial, i.e. potential repeated exposure and reburial in regions of increased seabed mobility. These areas will be identified by procedural monitoring and any changes to cable protection, seabed morphology, and cable exposure during the operation phase will be determined and mitigated accordingly. The Applicant will prepare a Final Cable Specification and Installation Plan (CSIP) post consent, which will include the detailed cable burial specifications (in accordance with the specific policies set out in the North West Inshore and North West Offshore Coast Marine Plans (HM Government, 2021)) and cable protection, as necessary. The CSIP will confirm the cable burial depth, following the detailed design and pre-construction, confirmatory surveys, in accordance with industry good practice, minimising the risk of cable exposure. The CSIP will also ensure that cable crossings are appropriately designed to mitigate environmental effects, these crossings are being agreed with the relevant third-parties, with heads of terms agreed in advance of CSIP submission. The CSIP will include a detailed CBRA to enable informed judgements regarding burial depth to maximise the chance of cables remaining buried whilst limiting the amount of

Consultee	Consultation	Where and How Addressed
		sediment disturbance to that which is necessary. Measures will reduce the amount of cable exposed during the operations and maintenance phase by increasing the distance between the seabed surface and the top of the cables. The use of a cable burial depth alongside the cable installation strategy should provide sufficient depth to avoid exposure.
Natural England	As part of the mitigation measures set out in Table 6.14, the applicant has proposed "suitable implementation and monitoring of cable protection. However, the monitoring specification has not been defined within the ES. We advise that further information is provided on the proposed cable protection monitoring. We also advise that where possible, the surveys should review recoverability of the seabed from cabling work.	The preferred form of cable protection is cable burial at 2-3 m below the seabed. With regard to cable and cable protection monitoring, the Carbon Storage Permit application was supported by a document titled the Monitoring Plan (MP), which describes the annual asset integrity monitoring, that is set out in the Applicant's existing Asset Integrity Management System (AIMS). The annual asset integrity monitoring will be a continuation of that currently carried out for the existing operational infrastructure (cables, pipelines, platforms, wells, etc.)., as required by the Safety Case Regulations (SCR 2015) This will be carried out on an annual basis and include inspection of all CCS subsea assets, including electrical cables, with drop down video (DDV) and photographic stills. The monitoring locations will identify any uncovered sections and the status of the external cable protection at crossing points along the new electrical cables.
Natural England	We note that the following projects have not been included in the list of other projects, plans and activities considered within the CEA: • Area 457 aggregate extraction renewal licence (EIA/2023/00003). • Mersey Tidal Power Project (due to submit EIA scoping report in Q3 2024).	Further information is presented in **Section 1.5.**
NRW	NRW (A) seek clarification on the correct amount of subsea power cable to be installed. We are concerned the worst-case scenario might not have been assessed in the ES. We also seek clarification on what dimensions were used for the numerical modelling undertaken in Volume 3, Appendix H, Physical Processes Technical Report.	The Applicant would like to reassure NRW that there are no inconsistencies in the reported lengths of cables. Chapter 3 describes that there are five proposed electrical cables in total: 1. From Point of Ayr to Douglas, there are the 2 x cables in parallel from PoA to Douglas OP each of which is 33,990m in length. That makes 67.98km (67,980m). (*We acknowledge that this has on occasion been rounded to 70km*). 2. From Douglas OP to Hamilton North satellite platform, 32.34km. 3. From Douglas OP to Hamilton Main satellite platforms, 14.89km. 4. From Douglas OP to each of the satellite platforms, 32.34km, 14.89km, and 10.87km respectively. This equals a total linear distance for all five cables of 126.04km, as also stated in ES Chapter 7.

Consultee	Consultation	Where and How Addressed
		NRW will appreciate that there are slightly different MDS for different impacts, hence why the MDS is defined within each individual topic chapter and indeed for each individual impact. In Chapter 6 we are addressing physical processes, for example the generation of sediment when installing the cables. The MDS for this impact relates to the Suspended Sediment Concentration (SSC) generated by the installation of each of the two cables separately. This is because the cables are installed sequentially at different times. The results of our SSC modelling show that the SSC concentrations generated from one cable would have returned to background levels before the installation of the next cable. The modelling also shows that any overlap in the geographical extents of elevated SSC would be in proximity to the Douglas OP, albeit at a different time. Through the assessment of alternatives process which forms an integral part of any EIA, only one cable will now be installed between Point of Ayr (PoA) and the New Douglas platform, instead of the two, as was assessed in the ES. Therefore the predicted impacts and MDS in terms of SSC remain unchanged, however, it will only occur on one occasion for the cable installation between Point of Ayr and the New Douglas platform.
NRW	NRW (A) advise that further evidence is required to support the conclusion that potential impacts of SSC plumes and associated sediment deposition due to sand wave clearance and cable installation activities associated with the construction phase are of minor adverse significance. Maximum SSC and maximum sedimentation values should be used in assessing the worst-case scenario, but average values are reported which underestimates the maximum concentrations and deposition values. This could underestimate the magnitude of the secondary impacts of SSC plumes and associated deposition of suspended sediments, see benthic comments, fish and ornithology comments relating to secondary impacts of SSC plumes. Note the use of maximum values for SSC and sediment deposition should also be used in the assessment of operation and maintenance and decommissioning phases.	Further information is presented in **Section 1.4**.
NRW	The ES indicates the removal of West Hoyle bank could have significant implications to coastal flood risk and nearshore sediment transport pathways, therefore, an assessment of recoverability in terms of form and function of the sandbank from sand wave clearance (147,000m^3 over two weeks) is required. NRW (A)	**Errata** There has been an inconsistency in the naming of the West Hoyle Spit within the ES. There are references to "West Hoyle Bank", which the Applicant appreciates is a different coastal feature located close to Hilbre Island on the east side of the Dee Estuary. This is an editorial error, and all references in the ES to "West Hoyle Bank"

Consultee	Consultation	Where and How Addressed
	recognise West Hoyle Bank is characterised as 'active' and that the recovery of the bank is enhanced by mitigation measures relating to infilling, however, a time-frame differentiating between days, weeks or months of expected recoverability is not presented. Due to the magnitude of the sand wave clearance and proposed dredging works, compared to the size of the sandbank, a quantitative assessment of recovery is required. A quantitative understanding of sand wave migration rates over West Hoyle Bank would provide a robust assessment of recoverability. We note calculating migration rates would require repeat bathymetric survey data, the Wales Coastal Monitoring Centre provide additional bathymetric data for West Hoyle Bank (Data | Wales Coastal Monitoring Centre (wcmc.wales)).	should refer to West Hoyle Spit, which is the coastal feature to the north of the Welsh Channel. The Applicant can therefore confirm that there will be no project activities on or in the vicinity of the West Hoyle Bank. There is therefore no proposal to remove the West Hoyle Bank, with the subsequent impacts on coastal protection and the grey seal haul out area. The Project worst-case proposal was to excavate a temporary trench across the West Hoyle Spit to facilitate burial of our proposed electrical cable. **<u>Project methodology update</u>** On a point of clarification, the Marine Licence application, and Environmental Statement (ES) project description (see Offshore ES Chapter 3) presented two cable route options to negotiate the West Hoyle Spit between the Point of Ayr and the New Douglas platform. The worst case scenario, assessed within the ES, followed in parallel alignment with the existing natural gas pipeline crossing West Hoyle Spit whilst the preferred option, presented in the ES, runs to the east and does not cross West Hoyle Spit. It was never proposed or intended to remove the entire West Hoyle Spit. For the worst case scenario, to take the cable directly across the West Hoyle Spit, would have required dredging a channel (most likely with a barge operated backhoe dredger). This channel would be circa 7 m in depth; with approximately 3 m to take the Bank down to LAT, then approximately 3 m depth for cable burial. The excavated material would be side cast along the length of the trench, and then backfilled after cable installation. Since publication of the ES and submitting the Marine Licence application, the Applicant has been in negotiations with contractors for the supply and installation of the offshore electrical cables. The outcome of these negotiations is that the cables will not be installed across the West Hoyle Spit and will follow the preferred option to the east. Additionally, only one cable will now be installed between Point of Ayr and the New Douglas platform, instead of the two originally proposed. This also means that there will be a simultaneous lay and burial of the electrical cable requiring only one passage of the cable lay vessel between Point of Ayr and the New Douglas platform, instead of the four that would have been needed. This means that the 'worst-case' assessed in the ES will not occur and the West Hoyle Spit will be undisturbed. As a result, the worst-case environmental effects will be avoided and are not predicted to occur. **<u>Future baseline scenario</u>** Further information regarding the Future Baseline Scenario is presented in **Section 1.3.**

Consultee	Consultation	Where and How Addressed
NRW	NRW (A) seek clarity on the commitment and ability for cable protection height to affect no greater reduction in water depth than 5% where cable crossings are required in 5.8m water depth, equating to protrusion of no more than 0.29m. NRW (A) seek clarification on the course of action in the event the commitment to 'no greater reduction in water depth than 5%' is not practical.	Further information is presented in **Section 1.6: Cable crossings in shallow water**.
NRW	The assessment of changes to SSC and sediment deposition uses average values from the modelling study. Average values of modelled SSC and sediment deposition values do not represent the worst-case scenario required to appropriately assess secondary impacts to other receptors such as Benthic, Fish and Ornithology. Maximum values of SSC and sediment deposition values are required to determine the significance of secondary impacts of elevated SSC and sediment deposition values arising from the proposed seabed preparation and cable installation works before cumulative impacts can be considered appropriately. NRW (A) advise that the assessment should clearly state how maximum values of SSC and sediment deposition vary with time and distance as a result of works included in the construction phase.	Further information is presented in **Section 1.4**.
NRW	The potential cumulative impacts of drilling and sand wave clearance within Awel y Môr array area and the activities of the proposed works are assessed. NRW (A) seek clarification whether the value of 50mg/l represents the worst-case scenario, we advise a value representative of a spring flood tide is used to assess the worst-case scenario. An assessment of the maximum SSC values in the area of overlap between the Port of Mostyn Energy Park and the development has been provided (up to 100 mg/l for both plumes combined). However, no assessment has been provided of the combined value of sedimentation due to the proposed works and the Port of Mostyn Energy Park. We advise this value should be provided in order to support the assessment conclusion that the effect will be negligible.	Further information is presented in **Section 1.5**.
NRW	NRW (A) agree with the conclusion that whilst not a designated feature, West Hoyle Bank influences the wave energy approaching the coastline and	**Errata** There has been an inconsistency in the naming of the West Hoyle Spit within the ES. There are references to "West Hoyle Bank", which the

Consultee	Consultation	Where and How Addressed
	the exchange of sediments with the adjacent coastline. We also agree that the removal of this sandbank has significant implications to coastal flood risk. We recognise the dynamic nature of sediment transport and morphological features is widely accepted within the scientific community, however, a baseline understanding of the magnitude or variability of the role West Hoyle Bank plays in controlling sediment exchange with the coastline is not provided. We advise that this section requires more detailed evidence such as sand wave migration rates to establish a baseline understanding of the physical processes controlling this feature before the potential impacts of the proposed works are considered. We recognise calculating migration rates would require repeat bathymetric survey data and note the Wales Coastal Monitoring Centre provide additional bathymetric data for West Hoyle Bank (Data | Wales Coastal Monitoring Centre (wcmc.wales)).	Applicant appreciates is a different coastal feature located close to Hilbre Island on the east side of the Dee Estuary. This is an editorial error, and all references in the ES to "West Hoyle Bank" should refer to West Hoyle Spit, which is the coastal feature to the north of the Welsh Channel. The Applicant can therefore confirm that there will be no project activities on or in the vicinity of the West Hoyle Bank. There is therefore no proposal to remove the West Hoyle Bank, with the subsequent impacts on coastal protection and the grey seal haul out area. The Project worst-case proposal was to excavate a temporary trench across the West Hoyle Spit to facilitate burial of our proposed electrical cable. **<u>Project methodology update</u>** On a point of clarification, the Marine Licence application, and Environmental Statement (ES) project description (see Offshore ES Chapter 3) presented two cable route options to negotiate the West Hoyle Spit between the Point of Ayr and the New Douglas platform. The worst case scenario, assessed within the ES, followed in parallel alignment with the existing natural gas pipeline crossing West Hoyle Spit whilst the preferred option, presented in the ES, runs to the east and does not cross West Hoyle Spit. It was never proposed or intended to remove the entire West Hoyle Spit. For the worst case scenario, to take the cable directly across the West Hoyle Spit, would have required dredging a channel (most likely with a barge operated backhoe dredger). This channel would be circa 7 m in depth; with approximately 3 m to take the Bank down to LAT, then approximately 3 m depth for cable burial. The excavated material would be side cast along the length of the trench, and then backfilled after cable installation. Since publication of the ES and submitting the Marine Licence application, the Applicant has been in negotiations with contractors for the supply and installation of the offshore electrical cables. The outcome of these negotiations is that the cables will not be installed across the West Hoyle Spit and will follow the preferred option to the east. Additionally, only one cable will now be installed between Point of Ayr and the New Douglas platform, instead of the two originally proposed. This also means that there will be a simultaneous lay and burial of the electrical cable requiring only one passage of the cable lay vessel between Point of Ayr and the New Douglas platform, instead of the four that would have been needed. This means that the 'worst-case' assessed in the ES will not occur and the West Hoyle Spit will be undisturbed. As a result, the worst-case environmental effects will be avoided and are not predicted to occur.

Consultee	Consultation	Where and How Addressed
		Therefore the 'worst-case' assessed in the ES will not occur as the cable will not cross the spit. It is therefore not critical to provide detailed sand wave migration rates to establish a baseline understanding of the physical processes controlling this feature before the potential impacts of the proposed works and recovery rates are considered as the West Hoyle Spit will be undisturbed. **Future baseline scenario** Notwithstanding, a more detailed future baseline scenario, including the role and function of the West Hoyle Spit is provided in **Section 1.3**.
NRW	NRW (A) advise that the future baseline scenario section requires more detailed and site-specific evidence to be included in the ES to satisfy the Environmental Impact Assessment (EIA) regulations requirement that ‘a description of the relevant aspects of the current state of the environment and an outline of the likely evolution thereof without implementation of the project as far as natural changes from the baseline scenario can be assessed with reasonable effort, on the basis of the availability of environmental information and scientific knowledge’.	Further information is presented in **Section 1.3**.
NRW	NRW (A) seek clarification that the worst-case scenario has been modelled to assess the potential impacts of increased suspended sediment concentrations (SSC) due to cable installation activities between PoA Terminal and Douglas OP. This section reports ‘one cable represents the maximum installation scenario’, while Table 6.9, page 39 reports ‘two cable lengths’. Clarification is sought.	In line with the previous response, NRW will appreciate that there are slightly different MDS for different impacts, hence why the MDS is defined within each individual topic chapter. With regards to physical processes, the MDS for SSC relates to the plume generated by the installation of each cable separately. This is because the cables are installed sequentially at different times and concentrations generated from one cable would have returned to background levels before installation of the next cable. Through the assessment of alternatives process, only one cable will now be installed between Point of Ayr and the New Douglas platform, instead of the two, as was assessed in the ES. Therefore the predicted impacts and MDS in terms of SSC remain unchanged, however, it will only occur on one occasion for the cable installation between Point of Ayr and the New Douglas platform.
NRW	NRW (A) note additional cable protection measures have not been assessed as part of the operation and maintenance (O&M) phase as the applicant does not anticipate cable exposure due to planned burial depths of 2-3m. NRW (A) have recently advised on another development in the area, the East-West Interconnector, where cables have become exposed and required cable protection twice in the course of 3	For the Proposed Development the preferred form of cable protection is cable burial with sand wave clearance as appropriate. Several studies have been undertaken for this project including seabed mobility studies (ENI, 2017), developing geological ground models (ENI/Boskalis, 2022), and these, combined with assessments of site specific survey data, have been used to determine the seabed preparation and cable burial parameters. The potential for cable exposure has been recognised and the project description includes

Consultee	Consultation	Where and How Addressed
	years. One of the Kilometre Points (KP) that has become exposed is in close proximity to this development's proposed cable route. NRW (A) advise the applicant considers this information when informing their decision to not include the requirement for cable protection during the O&M phase.	provision for the reburial of cables up to the entire length over the lifetime of the project. It is not anticipated however that the entire cable would become exposed during the lifetime of the project, but rather that up to the equivalent length would require reburial, i.e. potential repeated exposure, and reburial in regions of increased seabed mobility. These areas will be identified by procedural monitoring and any changes to cable protection, seabed morphology, and cable exposure during the operation phase will be determined and mitigated accordingly. Regarding cable protection monitoring, the Carbon Storage Permit application was supported by a document titled the Monitoring Plan (MP), which describes the annual asset integrity monitoring, that is set out in the Applicant's existing Asset Integrity Management System (AIMS). The annual asset integrity monitoring will be a continuation of that currently carried out for the existing operational infrastructure (cables, pipelines, platforms, wells, etc.)., as required by the Safety Case Regulations (SCR 2015). This monitoring will be carried out on an annual basis and include inspection of all CCS subsea assets, including electrical cables, with drop down video (DDV) and photographic stills. The monitoring locations will identify any uncovered sections and the status of the external cable protection at crossing points along the new electrical cables.

1.3 Future Baseline Scenario

The baseline environment for physical processes is not static and will exhibit a degree of natural change over time, particularly in relation to sediment transport. Such changes will occur with or without the proposed development in place, due to natural variability. The magnitude and impact on physical processes consist of short term changes, such as seasonality, and longer term changes (i.e. as a result of climate change) and vary across the study area, generally in relation to water depth.

The shorter term changes are most notable in nearshore areas, particularly in the vicinity of the West Hoyle Spit and the associated coastline. West Hoyle Spit acts as a natural breakwater and is notoriously dynamic, with bathymetric change across the mouth of the Dee Estuary being commonplace. West Hoyle Spit is understood to influence both the exchange of sediments with the adjacent coastline and the wave climate approaching the coastline (Kenyon and Cooper, 2005). Indeed, the north-south channel across the Spit which was approximately aligned with the natural gas pipeline and 3 m in depth, was present in surveys conducted in 1993 but was completely infilled by 2019, (ENI/Boskalis, 2022). Further increases in the Bank height were present in 2022 surveys. During this period accretion meant the Talacre Beach migrated approximately 50 m offshore. Analysis of mapped features from satellite data between 2016 and 2022 showed that the banks have undergone two complete cycles of increase and reduction in extent – with average extents being of similar magnitude over this period (ABPmer, 2018).

It should be noted that the project description (see Offshore ES Chapter 3) outlined two potential cable routes between the Point of Ayr and the New Douglas platform. The "worst case scenario" followed in parallel alignment with the existing natural gas pipeline crossing West Hoyle Spit whilst the "preferred option" runs to the east and does not cross West Hoyle Spit. Through the assessment of alternatives process which forms an integral part of any EIA, and ongoing discussions with cable installation contractors, the preferred option has been identified for cable installation and the West Hoyle Spit will remain undisturbed. The cable route will pass through the natural channel sited to the east of the Spit, as illustrated in Figure 1-1, which shows the alignment presented in the ES. Therefore the future baseline scenario and post construction scenarios in terms of physical processes are indistinguishable in this respect. Further refinement of the preferred route alignment has recently been carried out, as shown in Figure 1-2, which has eliminated the right angled bends along the first 3.25 km of the cable route from the HDD exit pit at the MHWS mark on Talacre Beach and around West Hoyle Spit.

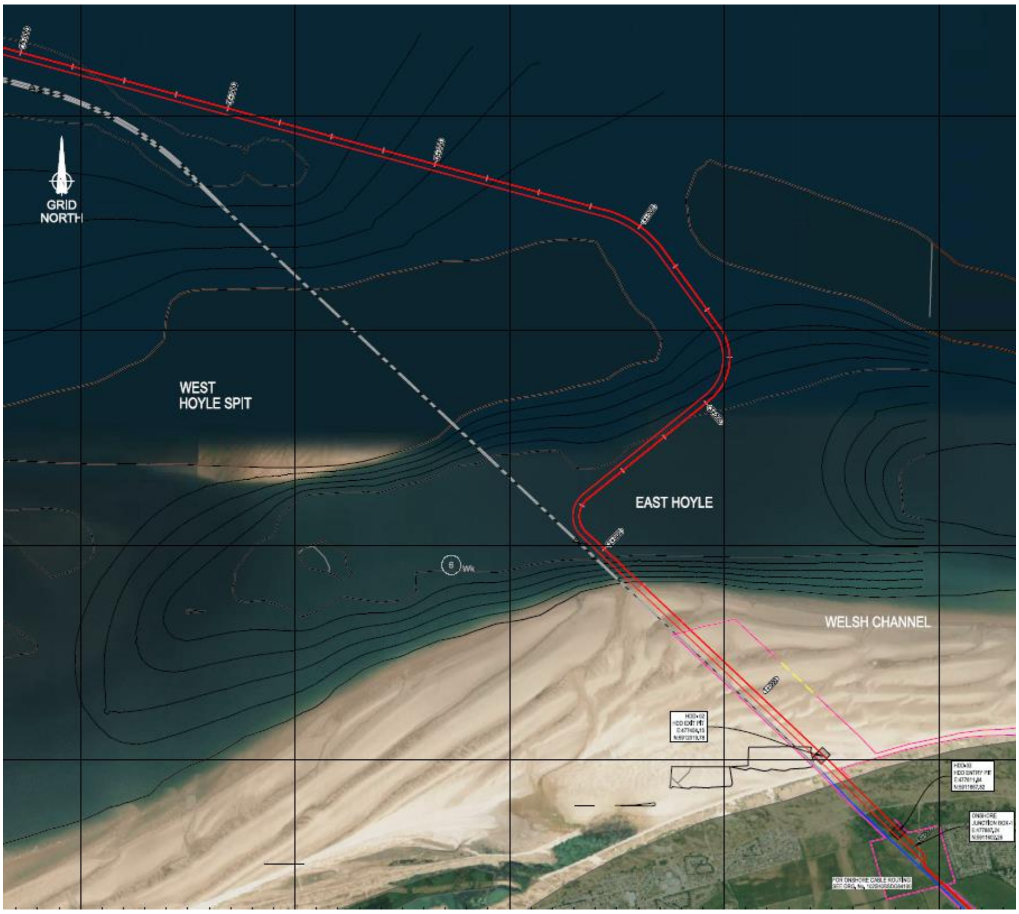

Figure 1-1: Indicative Offshore Power Cable alignment (red line) through West Hoyle Spit as presented in ES

The project lifespan is 25 years and over this period, in addition to the short term natural variation, the changes due to climate change may become evident. The effects of climate change are multifaceted and will affect physical processes in a variety of ways. Generally, these drivers can be broken down into those related to sea level rise and meteorological conditions.

In the Denbighshire local authority region the predicted sea level rise for current day to 2100 is 0.77m for the 70%'ile (Welsh Government, 2021). When this is considered in relation to return period water levels over the lifespan of the project, a c. 0.275 m rise in sea level (Palmer, 2018) is equivalent to the current 1 in 50 year return period water level occurring every 5 years (Environment Agency, 2018).

The impact of sea level rise on tidal conditions and sediment transport will be dependent on the present day water depths. In offshore and nearshore areas an increase in water depth would generally reduce sediment transport as the influence of the tidal currents are less pronounced on the seabed with increasing depth. In intertidal regions the opposite occurs and areas above current mean high water level, which in the past will only have experienced transport during storm events, would become intertidal and subject to sediment transport processes. In the context of North Hoyle Spit this would result in the Bank's northern side experiencing reduced transport as it has a shallow gradient with a greater inter-tidal area which is reduced over time by increasing water levels, effectively moving the Bank offshore. Within estuaries, the shape of the estuary and in-bank capacity determine the effects of an increase in water level. Within the Dee Estuary the tidal sand and mud flats would reduce tidal amplitude, whilst the mounting constriction further into the estuary would cause squeezing, amplify tidal range and potentially increase water levels further. These assertions are demonstrated by modelling studies undertaken within the East Irish Sea, (Lui et al, 2015).

There have been no changes made to wave climate projections within UKCP18 (Palmer, 2018). However, studies have implied a potential correlation between higher frequency of Atlantic storms with increased wave height in the north-east Atlantic and conditions in the Irish Sea, as the centres of the storm track to the north of Britain (Howarth, 2005). Due to significant uncertainty of both the future position of storm track over the UK and projections of wave climate, designers are advised to account for a 5% increase in offshore wind speed and wave height over the lifetime of the project, (Welsh Government (2022).

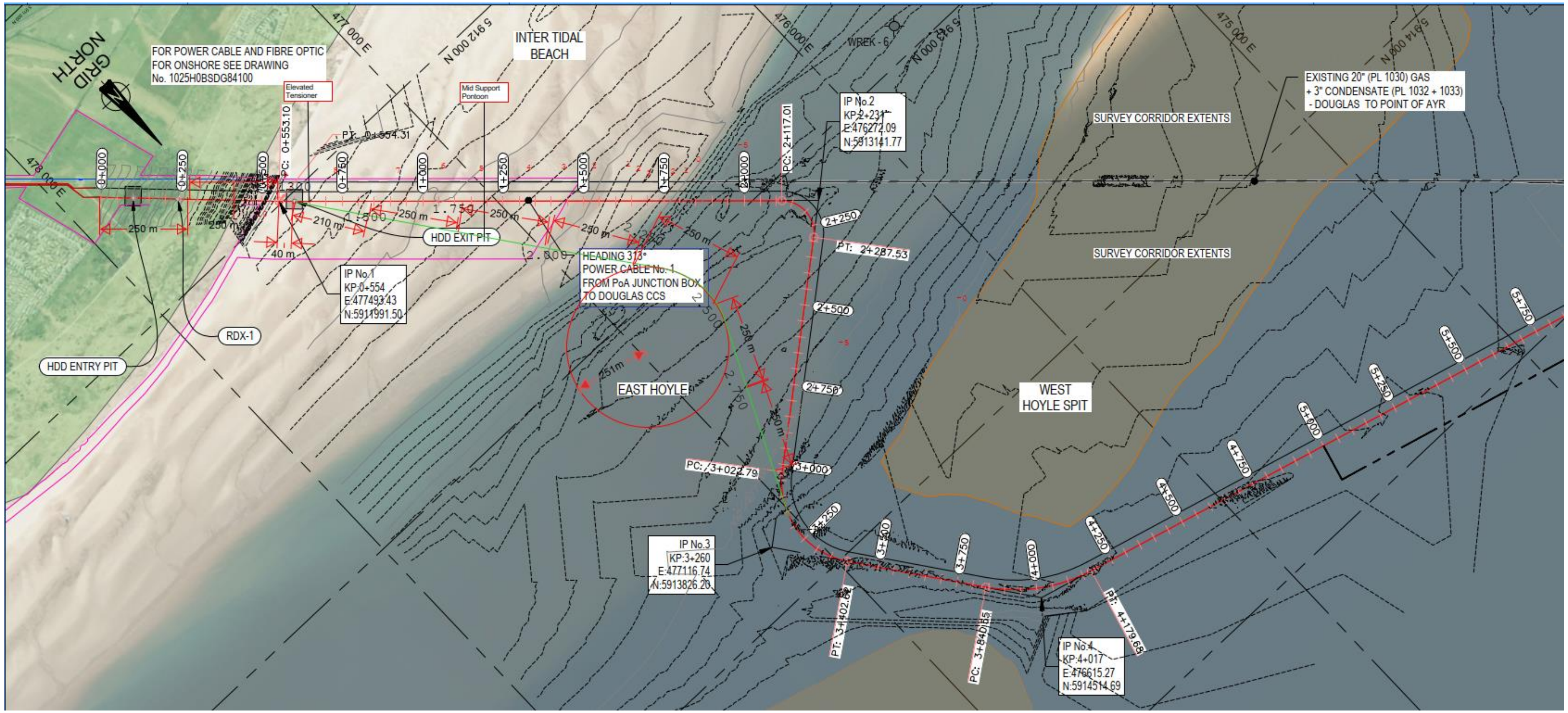

Figure 1-2: Updated Indicative Offshore Power Cable alignment (green line) through West Hoyle Spit to eliminate right-angled bends

As with sea level rise the influence of a 5% rise in wave climate will depend on current and future water depths. In offshore areas, where the water is deeper and wave penetration does not extend to the seabed, there will be little change in conditions (besides the wave climate itself). Within the study area the peak wave heights are typically less than 3 m therefore a 5% increase will have limited impact. Of greater importance is the combination of increased water levels and wave heights. The increased water depth means that waves may develop further and penetrate closer inshore, thus increasing shoreline erosion in exposed or unprotected areas. Although increased water depth would potentially increase the wave climate, sandbank development is driven by tides and sediment source rather than waves (Kenyon and Cooper, 2005). Within the context of the study area the West Hoyle Bank would continue to act as a natural breakwater as it evolves.

Changes in tidal surge levels are difficult to isolate as tides and surge interact with one another. The simplest example being an area of depression changing the timing of a tide, e.g. a pressure system running inshore and forcing high water to occur earlier than the predicated tide would, through arithmetic analyses, give a very large surge value accompanied by a negative surge at the time of predicted high water. Additionally, in some locations such as the study area, where tidal range is significant, only when the peak of the surge occurs in combination with high or near high water conditions, are the water levels greater than those seen routinely through the tidal cycle. It is therefore more appropriate to consider total water levels. The final aspect relating to future conditions is the increased storminess which will influence both the impact of individual storms but also return period water levels. Offshore sediment transport regimes tend to be governed by tidal flow, whilst onshore storm events are important. Large quantities of sediment may be moved offshore or deposited onshore during the course of an event. The scale of these impacts will depend on the nature of the coastline and whether any or sufficient defences are in place.

To this end, the future baseline and evolution of the coastline will also depend on the existing management strategies and any potential changes of approach. The Proposed Development is located in Sub-cell 11a – Great Orme’s Head to Southport (North West & North Wales Coastal Group, 2012) which includes numerous shoreline defence structures which have led to a lowering of beach levels, erosion of dunes and the need for beach management. The Shoreline Management Plan recommends a policy of Hold the Line via the maintenance and improvement of defences across the subcell, up to 2030. In the longer term a policy of Managed Realignment is recommended. During the majority of the lifetime of the project, i.e. next 20 years, overall net gains of intertidal saltmarsh, sandflat, mudflat and dune habitats are predicted. From that point forward the preferred management option indicates that offshore sediment supply, supplemented by beach management should be sufficient to balance sea level rise. There is the potential for dune and beach gains resulting from beach management and intertidal gains due to managed realignment.

1.4 Additional Information on Increased Suspended Sediment Concentrations and Sediment Deposition

The numerical modelling detailed within the Physical Processes Technical Report was used to inform the Physical Process, Benthic Ecology and Marine Mammals chapters of the ES. The report provides maximum, average and instantaneous values of SSC for trenching, piling and sand wave clearance activities. Also provided are maximum, average, and final sedimentation depths for each individual operation. These indicators should be considered collectively, as a single parameter such as maximum value, may not be representative for a parameter which varies significantly both spatially and temporally. In terms of the physical process assessment, typical values of increases in SSC are applicable to assessment as short term elevations are less critical for these coastal processes, particularly when the greatest values of SSC relate to the placement of material along the route. Each of the related disciplines applied the parameters most appropriate for their assessment from the modelling data provided.

It should be noted that the project description (see Offshore ES Chapter 3) outlined two potential cable routes between the Point of Ayr and the New Douglas platform. The worst case scenario, assessed within the ES, followed in parallel alignment with the existing natural gas pipeline crossing West Hoyle Bank whilst the preferred option, presented in the ES, runs to the east and does not cross West Hoyle Bank. Through the assessment of alternatives process which forms an integral part of any EIA, the preferred option has been identified for cable installation (see Figure 1-1) and only one cable will now be installed between Point of Ayr and the New Douglas platform, instead of the two. Therefore the 'worst-case' assessed in the ES will not occur and the West Hoyle Bank will remain undisturbed.

The sand wave clearance South of Douglas OP is anticipated to generate a plume with an average suspended sediment level of 100 mg/l. These levels would be localised and only persist for a short period. Due to the relatively small size of the sand wave clearance operation, maximum suspended sediment concentrations during excavation are restrained to within 200 m of the seabed release with a peak value of c.1400 mg/l at the point of mobilisation. The finer sediments that remain suspended and carried further in the tidal ellipsis show maximum concentrations of <100 mg/l and are constrained to the location's tidal ellipse. Plumes extend c.12 km west and a similar distance east with maximum SSC of 1 mg/l, but with little movement north or south.

All sedimentation occurs along the c.8 km wide tidal ellipse, with maximum deposition limited to <50 mm within 10 m of the point of excavation and average deposition of <30 mm (peak values of c.14 mm). This represents the larger coarser sediment that is not suspended for as long or carried as far as the finer sands/muds. The maximum sedimentation across the remaining footprint is <1 mm with this material being redistributed on subsequent tides.

Two drilling events were modelled to simulate releases incurred from the drilling of two new monitoring wells at Hamilton Main and Hamilton North. A 100% washout of both monitoring well holes is assumed, this release accounts for the release of fine drilling muds which will create the largest spatial plume i.e. travel furthest. This means well drilling events were modelled with twice the volume of the hole size (with 50% being the drilled sediment and 50% being the drilling mud/fluid).

For both drilling operations maximum SSC and sedimentation values occurred in the direct vicinity of the drill sites. At Hamilton Main peak SSC values experienced at the drill site are limited to c.360 mg/l, however, peak values are limited in time and extent, with values typically <30 mg/l. The plume itself extends c.8 km to the east and west. It is evident that the greatest sedimentation depths occur at the drilling site itself with localised values of up to c.70 mm occurring within c.50 m of the site. One day after the cessation of drilling, deposition values around the drill site can be in excess of 50 mm, however, a vast majority of deposition due to released sediment is under 0.03 mm. This is explained by the coarser material remaining at the drill site whilst the finer mud particles are dispersed on successive tides.

A similarly sized plume of suspended sediments is produced at Hamilton North, with slightly more northward/southward dispersion. Maximum suspended sediment concentrations are limited to 500 mg/l in the direct vicinity of the drill site and are generally less than 5 mg/l across the rest of the plume envelope. One day after the cessation of drilling, deposition can be 100 mm in the direct vicinity of the drill site however again quickly decreases to negligible levels within c. 500 m distance from the release point.

For the installation of both the PoA Terminal to Douglas OP (33.99 km) and the Douglas to Lennox Inter-OP cable (32.34 km) a trench of up to 3 m in width and 3 m in depth with a triangular cross section may be excavated. The plumes produced by other Inter-OP cables can be assessed using the results of modelling completed for the Douglas to Lennox cable. The Douglas to Hamilton Main Inter-OP cable shares a largely similar cable route as the Douglas to Lennox cable, with a much reduced cable length. The Douglas to Hamilton North cable also features a reduced cable length and reduced residual current speeds, therefore both can be expected to demonstrate similar if not reduced SSC plumes and associated deposition. It is noted that in these areas material settles during slack water and then is re-suspended, therefore the arithmetic maximum sedimentation represents the greatest sedimentation at any given location throughout the course of the operation, i.e. the same 'parcel of sediment' may occur in multiple locations due to this process and the apparent sedimentation may be overestimated if this parameter is viewed in isolation.

The largest plumes are generated by cable installation activities given the magnitude of sediment disturbed using the cable trencher, and the length of works both in terms of the spatial extent and the duration of the activity. For the PoA Terminal to Douglas OP cable, during peak concentrations over the course of trenching, the plume may extend up to 15 km to the west, however, even at peak values do so at background levels (<1 mg/l). Localised maximum suspended sediment concentrations seen along the cable route south of the Douglas OP are generally <10,000 mg/l. However, SSC increases rapidly over the very shallow drying areas, with maximum values in excess of 300,000 mg/l, peaking at c.640,000 mg/l in the shallowest water and located within the trench. The water depths associated with these concentrations are typically <0.5m and therefore illustrate dredged material falling to the bed in the immediate vicinity, with little opportunity for dispersion due to the water depth. Peak values are c. 300 mg/l at the edge of the trenching and are quickly reduced to background levels a short distance from the cable path.

As noted in the previous operations, the material settles during slack water and then is re-suspended to form a secondary plume which becomes amalgamated. Maximum sedimentation occurs within c.30 m of the cable route and is limited to <300 mm with peak deposition of c.175 mm, where the coarser material has settled within close proximity to the cable path. An analysis of sedimentation at slack water one day after the cessation of trenching, shows that some of the previously sedimented material has been re-suspended, only to settle again at slack water.

The trenching from Douglas to Lennox shows a larger plume than that seen for PoA to Douglas, due in part to the finer nature of the sediment further out to sea, and the stronger littoral currents. Maximum suspended sediment concentrations occur within c.50 m the trenching route, with values more than 300 g/l, and peak values of c.70 g/l at the location at which trenching is undertaken. Maximum sedimentation during the trenching phase also occurs along the cable route within c.50 m, however even so deposition is limited to <50 cm (peak of c.32 cm). It is noted that the trenching activities are in alignment with the axis of tidal flow. Average sedimentation is limited to <100 mm with peak values of c.70 mm, however, outside the area of project physical work, deposition is limited to negligible levels, with maximum values of <5 mm. Sedimentation one day after the cessation of trenching shows that fine sands and resuspended sediment settle during slack water.

The Douglas to Hamilton Main Inter-OP cable plume can be largely characterised by the Douglas to Lennox cable results, due to a highly similar route that diverges only slightly to reach the Hamilton Main OP. Similar SSC values can be expected, with the greatest again occurring along the cable route itself. Likewise, similar sedimentation values will be very similar and limited to <100 mm.

The Douglas to Hamilton North Inter-OP cable plume will differ slightly spatially, extending further to the north and reaching the extents of the physical processes study area, in some cases potentially leaving the boundary by small distances. Similar SSC values can be expected, with the greatest again occurring along the cable route itself. Again, sedimentation values will be very similar to those experienced for the modelled cable routes.

Increases in SSC levels are predicted to persist for a short period following construction activities, i.e. settlement occurs within a few tidal cycles. The coarser material settles within a few minutes and remains in the vicinity of the works whilst finer sediments settle during the following slack water, within one tidal excursion. Only the finest sand and mud particles are re-suspended and dispersed on successive tides in line with the underlying sediment transport regime. Natural variations in background SCC, such as those associated with storm events in Liverpool Bay, would comprise much higher proportions of silt from river sources and may remain in suspension for a longer period than the offshore sediments mobilised during the construction phase.

Sediment plumes associated with the PoA Terminal to Douglas OP cable will result in increased SSC within the Dee Estuary SAC/SPA/SSSI. Peak SSC values within the Dee Estuary arising from cable installation are greatly reduced from those along the cable route, with values of up to 30 mg/l for short periods, whilst average values are expected to be within the range of background concentrations at <3 mg/l. The site's mudflats and sandflats would remain stable and continue to support hydrodynamic processes, as well as the communities which utilise them. This is because maximum sedimentation is expected to be <0.5 mm and occur only at the mouth of the estuary.

Due to the lack of SSC plume overlap and sedimentation with the Ribble and Alt Estuaries SPA, Ribble Estuary SSSI, Sefton Coast SSSI, Mersey Narrows and North Wirral Foreshore SPA, North Wirral Foreshore, and Flyde MCZ, there is no pathway for effect. Therefore, the magnitude of the impact is assessed as no change.

Processes such as sand wave clearance South of Douglas OP, and monitoring well drilling, are assessed as not significant at receptors, given the limited spatial nature of plumes generated, the sedimentation experienced, and distance from the various designated sites. Likewise, the Douglas to Lennox/Hamilton Main/Hamilton North Inter-OP cable installation is assessed to not impact any receptor, given the significant distance between designated sites and cable paths.

1.5 Additional Information on Cumulative Increased Suspended Sediment Concentrations and Sediment Deposition

As previously noted, the numerical modelling detailed within the Physical Processes Technical Report was used to inform the Physical Process, Benthic Ecology, and Marine Mammals chapters of the ES. The report provides maximum, average and instantaneous values of SSC for trenching, piling and sand wave clearance activities. Also provided are maximum, average and final sedimentation depths for each individual operation. In terms of the physical processes assessment, typical values of increased SSC are applicable to the assessment as short term elevations are less critical for these coastal processes. Each of the related disciplines applied the parameters most appropriate for their assessment from the modelling data provided. The physical processes chapter details an MDS and modelling parameters specific to the assessment of the physical processes impacts on the associated receptors. Other chapters are assessing different impacts and receptors so they can (and will) have a different MDS and apply different aspects of the model studies (e.g. max SSC or accumulated sedimentation from different operations).

Within the context of the CEA in most cases the stated values provide upper values which are rated to maximum SSC and sedimentation and the terms typical, or average, refer to the SSC across the plume or across the sedimentation footprint.

In terms of additional projects the Mostyn Energy Park Extension (MEPE) was included in the physical processes CEA with the ES Chapter 6: Physical Processes. This project was added to the assessment as an outcome of the NRW Fitness Check. The Mersey Barrage is a Tier 3 project for which there is little detail at this point, as the project is yet to submit scoping or make an application. From what is known of the project, the construction phase will not overlap with that of the Proposed Development. The potential impacts on physical processes for the Proposed Development have been determined to be SSC, water quality, and seabed morphology whilst the principal impact of the barrage is likely to be changes to tidal flows. Whilst the operational phase would ultimately overlap, the Proposed Development would not alter tidal flows as, apart from cable protection at cable crossings, the new infrastructure is below bed levels and the remainder of the infrastructure is pre-existing, having been in place for the past 30 years. Further updates to the physical processes CEA are provided in the following section. This includes the Area 457 aggregate extraction renewal licence, illustrated in Figure 1-3, which has moved forward since the Offshore ES document was prepared.

The construction phase of the Proposed Development is expected to coincide with the proposed development of Awel y Môr Offshore Wind Farm. Construction activities may result in increased SSC and given the close proximity of works, it is likely that there will be interaction with sediment plumes from the Proposed Development if the works are undertaken at the eastern end of the site when the PoA Terminal to Douglas OP cable is being installed. Plumes produced during drilling and sand wave clearance activities within the Awel y Môr Array Area would provide the greatest instantaneous SSC of up to 50 mg/l on flood tides, which may reach the Proposed Development area of project physical work. These concentrations relate to spring tides where the overlapping extent and the likelihood of overlap are greatest. During neap tides there is a potential for the SCC associated with Awel y Môr Offshore Wind Farm to be further increased, potentially doubling the maximum instantaneous values during springs. However, the spatial extent and likelihood of interaction would be greatly reduced. It is also noted that Awel y Môr Offshore Wind Farm is located to the west of the proposed development and the flood tide runs to the east therefore sediment plumes from the Proposed Development are moving away to the east with SSC *c*. 30 mg/l beyond the immediate vicinity of the works. Maximum deposition arising from the Proposed Development is less than 1 mm within the footprint of the Awel y Môr Offshore Wind Farm and only occurs to the east of the site.

The construction phase of the Proposed Development is expected to coincide with the construction and operation and maintenance phases of the MEPE and associated maintenance dredging activities. Re-dredging of the existing berth pocket along the existing quay wall to – 9 m CD will be required (*c*. 400,000 m^3) whilst the largest dredging operation will take the form of the re-dredging of the main navigation channel to a depth of -4 m CD (*c*. 3 million m^3). Cable installation activities produce SSC plumes that extend into the Dee Estuary and overlap with the location of construction activities and dredging at the Port of Mostyn for the MEPE. However, they do so at background levels i.e., maximum values <3 mg/l. It can therefore be judged that although a cumulative impact may arise within the Dee Estuary receptors, the change in SSC would be of negligible significance and recoverable. Similarly, the associated maximum sedimentation due to the Proposed Development is well below 0.1 mm at the location of the MEPE.

The largest overlap in SSC would occur if the disposal of dredged material within the Mostyn Deep disposal site occurred simultaneously with cable installation activities between PoA and Douglas OP on a flood tide. However, overlapping plumes in the vicinity of West Hoyle Spit and within the Dee Estuary would be unlikely, as sediment plumes would be traversing in parallel and not towards one another as they are advected on the same tidal current. Maximum SSC values in the vicinity can be up to 100 mg/l for both plumes. Maximum sedimentation due to cable installation activities between the PoA Terminal and Douglas OP is less than 1 mm at the Mostyn Deep disposal site and given the nature of the site (i.e. for disposal), this would be inconsequential for the site. In areas along the tidal axis between the two sites, maximum deposition due to the proposed development is <0.5 mm, and this region already experiences high seabed mobility and sediment transport rates.

During the construction phase of the Proposed Development, the Mares Connect cable will be in construction. This may result in increased suspended sediment concentrations, as the cable directly intersects the PoA Terminal to Douglas OP export cable from the Proposed Development. The trenching activities for both projects may run concurrently, and interaction of SSC plumes may occur. However, the concentration of suspended sediment would reduce significantly moving further from the PoA to Douglas trenching route with interacting plumes falling below 10 mg/l within 20 m of the Proposed Development. With cable installation along the preferred route having been identified there will no longer be seabed preparation activities across West Hoyle Spit. Therefore, cumulative impacts with respect to the Mares Connect cable would be reduced from those previously identified within the Offshore ES and would be not significant.

Westminster Gravels will be renewing their aggregate extraction licence in Area 457 in Liverpool Bay. This area is shown relative to the Area of Project Physical Work in Figure 1-3. The Environmental Statement is planned for submission in 2024 and as such this is a Tier 3 project. This is because there is no current information regarding the timing of any proposed activity, and whether dredging activity would coincide with the construction phase of the Proposed Development. The Area 457 spans the Douglas to Hamilton North cable therefore cumulative impacts are likely if the aggregate site is active when the northern section of the Douglas to Hamilton North cable is being installed. Although, due to the east to west orientation of tidal flow, activities in other areas are unlikely to cause cumulative impacts. The maximum SSC beyond the immediate vicinity of the cable installation (i.e. *c*. 100 m) would be in the order of 100 mg/l to 300 mg/l, whilst the maximum sedimentation in these areas would be 1 mm to 3 mm. The contribution from extraction activities will depend largely on the volume and method used to remove material. Generally, during aggregate extraction, spill levels are kept to a minimum (*c*. 3%) to provide cost efficient extraction. Any cumulative SSC and sedimentation would not extend to any of the designated areas or relevant qualifying interests for the physical processes assessment.

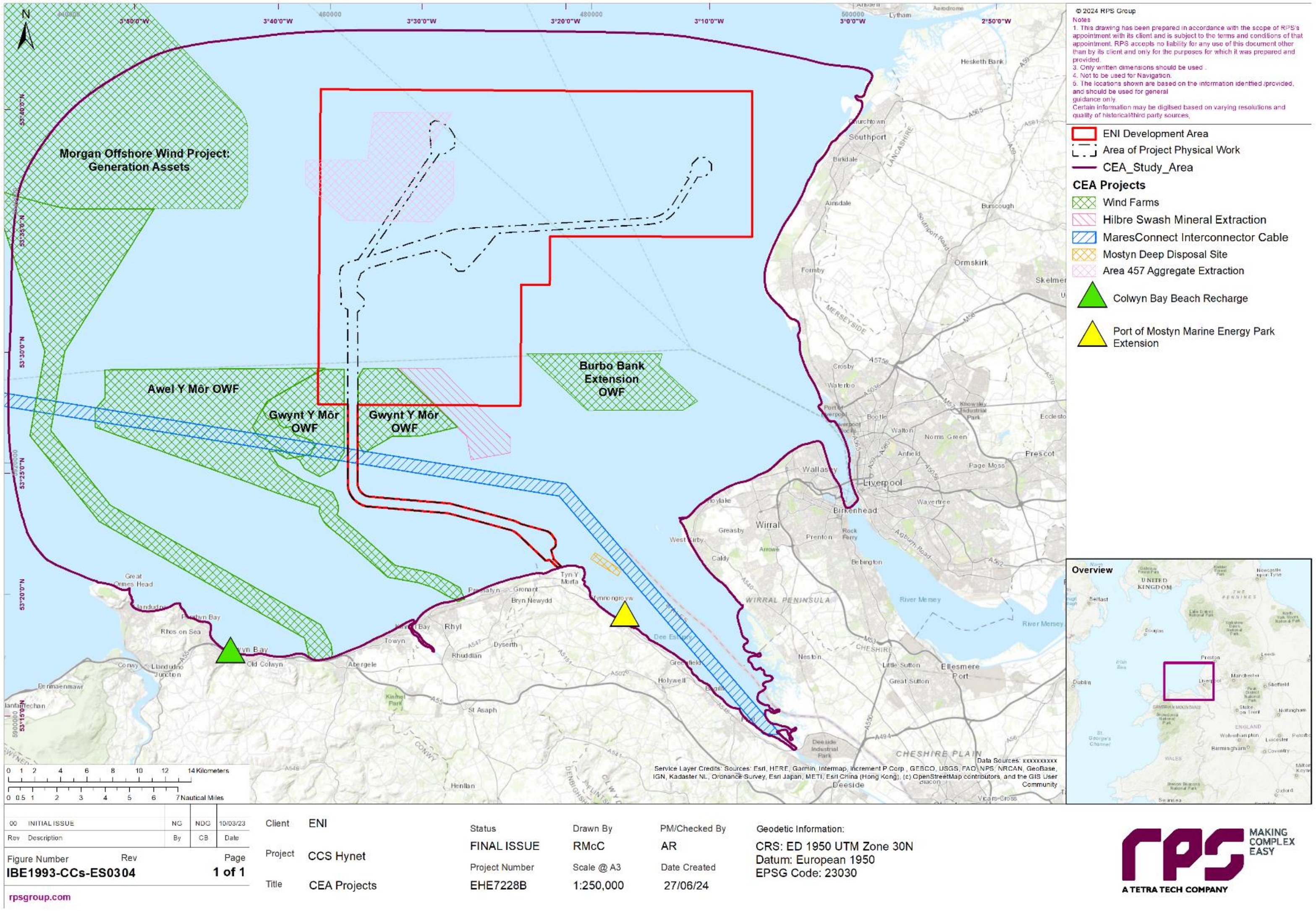

Figure 1-3: Other Projects, Plans and Activities Screened into the Cumulative Effects Assessment

1.6 Cable Crossings in Shallow Water

The project description (Offshore ES Chapter 3) includes details of the cable crossings in Table 3.6 which is reproduced below in Table 1-2. This table outlines all the cable crossings that are along the Point of Ayr to Douglas platform cable. The cable crossings for the inter-platform cables to the three satellite platforms are either within the 500 m clearance zone of the New Douglas platform, and/or cross Eni infrastructure. All are in water depth in excess of 25 m. Table 1-2 gives the water depths, and water depths above berm height. This shows that for crossings PoAX 1 (Burbo Bank OWF), PoAX 2 & 3 (North Hoyle OWF), and PoAX 4 & 5 (Gwynt y Môr OWF) there will be a reduction in clearance above the berm 0.8 m in height, as the water in these locations is very shallow; 5 m, 7 m, and 12 m respectively. The revised project description has determined that only one cable will now be installed, so only three export cable crossings (PoAX 1, 2, & 4) will be required within limited water depths where the restriction of 5% water depth reduction to cable protection height cannot be met throughout the tidal cycle.

Table 1-2: Design Envelope: Third Party Cable Crossings

Crossing ID	Third-party owner	UTM Easting (m)	UTM Northing (m)	Water depth (m)	Water above berm (m)	Berm height (m
PoAX-1	Ørsted Burbo Bank wind farm	470974.84	5916002.39	**5**	4.2	0.8
PoAX-2	Greencoat UK Wind North Hoyle wind farm	468795.03	5916535.10	**7**	6.2	0.8
PoAX-3		*468776.17*	*5916536.68*	*7*	*6.2*	*0.8*
PoAX-4	Gwynt y Môr OFTO, Gwynt y Môr wind farm	461904.20	5917763.30	**12**	11.2	0.8
PoAX-5		*461875.07*	*5917817.57*	*12*	*11.2*	*0.8*
PoAX-6		461713.35	5924702.50	20	19.2	0.8
PoAX-7	National Grid/Scottish Power, Western Link HVDC cable	461713.35	5930787.10	30	29.2	0.8
PoAX-8		461713.35	5930818.38	30	29.2	0.8

In such cases the design of the cable crossing reduces the potential impacts of physical processes by the use of layered protection which gradually changes in height, as illustrated in Figure 1-4 and Figure 1-5. Each layer of the modular post lay concrete mattress is 0.3 m in height. At the approach to the crossing there will be a single layer of mattressing which then overlays the cable as it emerges from the bed and is surface laid. The cable will then be laid over a single layer of mattressing placed on the bed at the crossing point. This is then covered with either a single layer of mattressing, or rock. For crossings PoAX-1, and PoAX-2 the concrete mattress protection as shown in Figure 1-4, the distance of the touchdown points either side of the crossing is circa 5 m. Therefore the 0.8 m berm height occurs for a limited distance <10 m and for the majority of the crossing the obstruction on the bed is between 0.3 m and 0.5 m in height (i.e. a small proportion of each shallow water crossing exceeds 5% of the water depth). The rock protection for PoAX-4 shown in Figure 1-5 the 0.8 m berm height will occur over its full length of up to 200 m. Therefore, only crossings PoAX-1, PoAX-2, and PoAX-4 will be within very shallow water and will form a gradual reduction in water depth, lowering the potential impacts of physical processes.

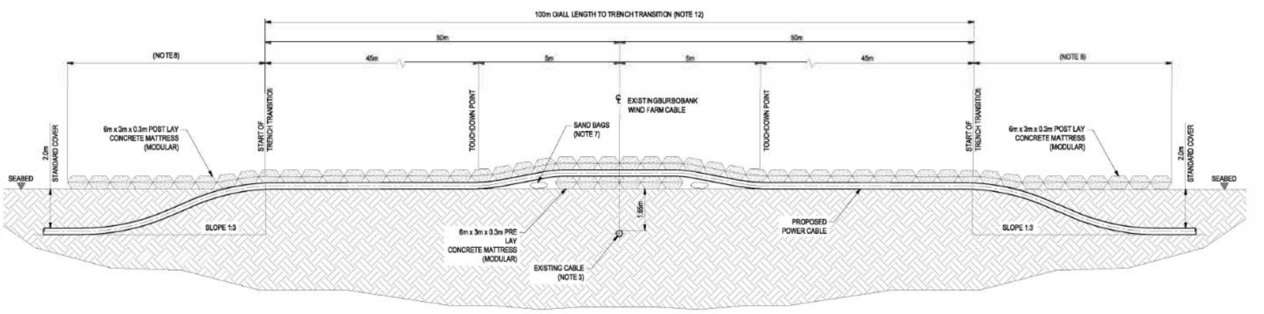

Figure 1-4: Typical Schematic Layout of Concrete Mattress Protection at Cable Crossing

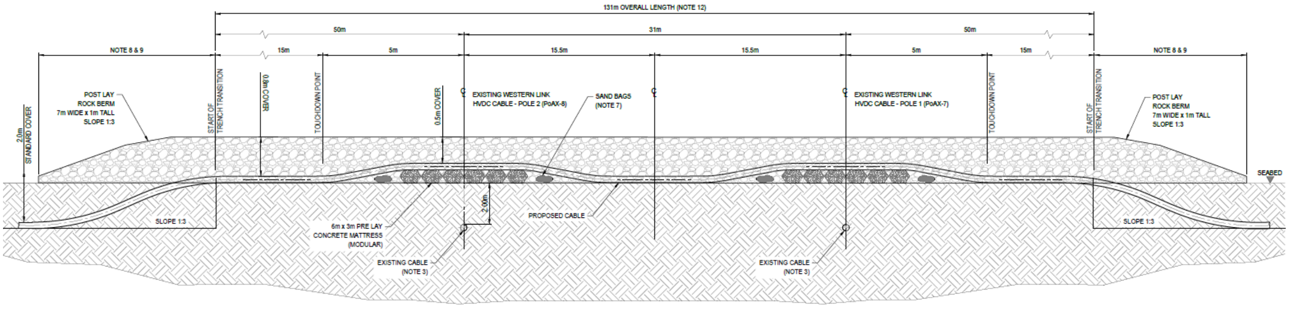

Figure 1-5: Typical Schematic Layout of Rock Berm Protection at Cable Crossing

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