ATTACHMENT 12(A)

Pre-application correspondence

Billington Alistair

From: Alvarez, Maria <maria.alvarez@cyfoethnaturiolcymru.gov.uk>
Sent: 25 November 2022 10:04
To: Billington Alistair
Cc: Smith Donald; Cislaghi Raffaella
Subject: RE: PA2211 HyNet
Attachments: Notes from NRW-MLT meeting on 18.11.22_MA.docx; Biosecurity Risk Assessment Template Maintenance Dredging.dotx

Hello Alistair,
Please find attached my edits to the notes, thank you. I am also attaching the Biosecurity Risk Assessment which will be requested by advisors . This is always a requirement of applications involving dredge and disposal Natural Resources Wales / Marine licence application forms. As indicated, NRW advisors are in the process of reviewing the form and it might have been updated by the time of submission.
I am expecting a response from our legal team early next week. I will be in touch as soon as I can.
Finally, as per the firs point int eh notes, I have emailed Natalie at WSP to set a pre-application case with us, but I have not received any response.
Best regards,
Maria

From: Billington Alistair <Alistair.Billington@external.eni.com>
Sent: 24 November 2022 17:42
To: Alvarez, Maria <maria.alvarez@cyfoethnaturiolcymru.gov.uk>
Cc: Smith Donald <Donald.Smith@eni.com>; Cislaghi Raffaella <Raffaella.Cislaghi@eni.com>
Subject: RE: PA2211 HyNet

Hello Maria,

Many thanks for the reminder.
Yes, please do share the slides with your colleagues in Advisory.
I have attached two plans from our EIA Scoping Report, as follows:

1. A plan showing the jurisdictional boundaries in relation to our infrastructure.
2. A plan showing the new infrastructure along with all the other developments in Liverpool Bay. As you can see that the new infrastructure is repurposing and mainly following the alignment of the existing pipelines as far as the new cabling is concerned.

Also attached are some notes of our meeting, so please feel free to comment on these, and we will then finalise for our records.

If you have any further questions, please do let me know.

Many thanks and kind regards

Alistair

From: Alvarez, Maria <maria.alvarez@cyfoethnaturiolcymru.gov.uk>
Sent: 24 November 2022 13:07
To: Billington Alistair <Alistair.Billington@external.eni.com>
Subject: RE: PA2211 HyNet

Hello Alistair,

Would it be ok for me to share the slides with our advisory colleagues in NRW?
Also, could you please send the map with the England/Wales border in relation to the project and the cables to Lenox, Hamilton and Hamilton North platforms?
Best regards,
Maria

From: Billington Alistair <Alistair.Billington@external.eni.com>
Sent: 18 November 2022 11:54
To: Alvarez, Maria <maria.alvarez@cyfoethnaturiolcymru.gov.uk>
Cc: Smith Donald <Donald.Smith@eni.com>; Cislaghi Raffaella <Raffaella.Cislaghi@eni.com>
Subject: RE: PA2211 HyNet

Dear Maria,

Thank you very much for your time this morning. It was very good to meet you.
We are very grateful for the advice and recommendations that you made to us, and thank you for sending through the link below. We will make good use of those.

Please find attached a PDF version of the slides, and I will source a figure with the jurisdictional boundaries of Welsh and English water in relation to our infrastructure and send that through to you.

Many thanks and kind regards

Alistair

From: Alvarez, Maria <maria.alvarez@cyfoethnaturiolcymru.gov.uk>
Sent: 18 November 2022 11:41
To: Billington Alistair <Alistair.Billington@external.eni.com>
Cc: Smith Donald <Donald.Smith@eni.com>; Cislaghi Raffaella <Raffaella.Cislaghi@eni.com>
Subject: RE: PA2211 HyNet

Hello Alistair,

It was nice to meet you earlier and getting a better understanding of the project.
As promised please find the WNMP signposting document attached.
For your information here are some useful links to:

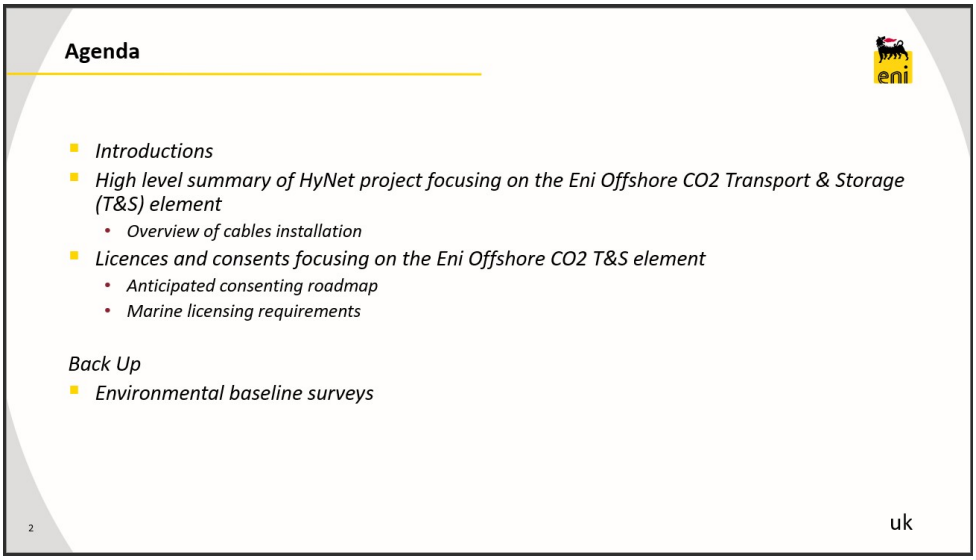
- a flow chart of the B3 application process marine-licensing-band-3-application-process-flowchart.pdf (cyfoethnaturiol.cymru),
- the EIA for marine activities Natural Resources Wales / Environmental Impact Assessment for marine activities,
- applying to a ML Natural Resources Wales / Applying for a marine licence

Once I get the slides from you and a map of the cable locations and country boundaries I will be able to provide the remaining information regarding the requirement for a ML.
Regards,
Maria

From: Billington Alistair <Alistair.Billington@external.eni.com>
Sent: 17 November 2022 16:44
To: Alvarez, Maria <maria.alvarez@cyfoethnaturiolcymru.gov.uk>
Cc: Smith Donald <Donald.Smith@eni.com>; Cislaghi Raffaella <Raffaella.Cislaghi@eni.com>
Subject: RE: PA2211 HyNet

Good afternoon, Maria,

We are looking forward to meeting with you tomorrow. Our proposed agenda is set out below:



I can also confirm that no PO is needed for your invoicing.

Have a good evening.

Many thanks and kind regards

Alistair

From: Alvarez, Maria <maria.alvarez@cyfoethnaturiolcymru.gov.uk>
Sent: 15 November 2022 14:01
To: Billington Alistair <Alistair.Billington@external.eni.com>
Cc: Smith Donald <Donald.Smith@eni.com>; Cislaghi Raffaella <Raffaella.Cislaghi@eni.com>
Subject: RE: PA2211 HyNet

Hello Alistair,

Yes, that should be fine. I will need to understand the scoping of the project so it will be a good opportunity to do that. I will try and answer as many questions and ensure I respond to those I need to give some more thought. It might be worth coming up with a short agenda or specific queries you may have toward the licensing process.

Could you please confirm a PO number will not be necessary for invoicing? If that is not the case, I will need to have a PO number in place before the meeting. As you are aware, bespoke pre-application advice is chargeable at an hourly rate of £120 per hour. Charges would cover any potential preparation, the meeting as well as follow up work.

Best regards,
Maria

From: Billington Alistair <Alistair.Billington@external.eni.com>
Sent: 15 November 2022 11:17
To: Alvarez, Maria <maria.alvarez@cyfoethnaturiolcymru.gov.uk>
Cc: Smith Donald <Donald.Smith@eni.com>; Cislaghi Raffaella <Raffaella.Cislaghi@eni.com>
Subject: RE: PA2211 HyNet

Good morning, Maria,

That's great that you have been assigned to our case, we look forward to speaking with you.

Many thanks for providing details of your availability. Could we take up your offer of a meeting on Friday morning from 09:30-11:30? I can send a Teams invite once you have confirmed.

We can discuss our understanding of the marine licencing requirements for the scope of our project.

Many thanks and kind regards

Alistair

From: Alvarez, Maria <maria.alvarez@cyfoethnaturiolcymru.gov.uk>
Sent: 14 November 2022 15:27
To: Billington Alistair <Alistair.Billington@external.eni.com>
Cc: Smith Donald <Donald.Smith@eni.com>
Subject: PA2211 HyNet

Good afternoon Alistair,

I have now been assigned to this case. I have read the emails and think it would be best to have a meeting to discuss the project. I will then be in the position to advise you on the marine licensing requirements. I could have a meeting Thursday anytime but from 12-2 and Friday morning. Also free Monday from 10am. Let me know if any of those days are suitable.
You have been assigned the case number PA2211, please make sure you quote tis number in any communication to us.
Best regards,
Maria
Maria Alvarez, MSc. PhD

Swyddog Arbenigol Arweiniol (Trwyddedu Morol)/ Lead Specialist Officer (Marine Licensing)
Cyfoeth Naturiol Cymru / Natural Resources Wales
Ty Cambria/ Cambria House, 29 Newport Road, Cardiff, CF24 0TP
Ffon/phone: +44 300 065 3477

(Rhagenway Hi/Hithau – Pronouns She/Her)

From: Billington Alistair <Alistair.Billington@external.eni.com>
Sent: 08 November 2022 13:11
To: Marine Licensing <marinelicensing@cyfoethnaturiolcymru.gov.uk>
Cc: Smith Donald <Donald.Smith@eni.com>

Subject: RE: [EXTERNAL] RE: Liverpool Bay CCS Limited – HyNet Carbon Dioxide Transportation and Storage Project Offshore - Marine Licencing

Dear Chris,

Thank you very much for providing the very helpful feedback on the consenting process for a Marine Licence application.

We would like to confirm that we wish to receive bespoke pre-application advice for our application. We understand that there is unlikely to have been precedence for a CCS project that crosses jurisdictional boundaries between Welsh and English waters, including carbon storage, and associated cable laying ancillary works.

The Applicant for the CCS Project, and the Marine Licence, if required, would be Liverpool Bay CCS Limited, however, for the invoicing details will be **Eni UK Limited**, which is the parent organisation. The billing details are as follows:

Customer: Eni UK Limited
Invoice Address: FAO: Giuliana Britti
Eni UK Ltd.
10 Ebury Bridge Road,
London,
SW1W 8PZ

Email: giuliana.britti@eni.com

We would anticipate the scope of the bespoke advice to cover the following:

- The requirement to apply for a marine licence for the cable works in Welsh waters, which would be ancillary to the main Carbon Storage site, and covered by the overarching EIA for the whole CCS Project Offshore (in both Welsh and English waters).
- If required, confirmation of which Marine Licence Band the cable works would fall under, and the minimum requirements for the content of the application.
- Understanding and confirmation of the minimum design information required in the Marine Licence application form and supporting documents.
- Confirmation of the timing of the marine licencing application and determination, considering also the Carbon Storage Permit process and timing (OPRED/NSTA).

If there are items that we have not included above that you would wish to ask Eni UK Limited, then please do include those in the service scope.

Please do let us know if there are any additional requirements prior to putting the service agreement in place.

We look forward to being able to speak with you about this project in due course.

Many thanks and kind regards

Alistair

From: Marine Licensing <marinelicensing@cyfoethnaturiolcymru.gov.uk>
Sent: 21 October 2022 12:51
To: Billington Alistair <Alistair.Billington@external.eni.com>
Subject: [EXTERNAL] RE: Liverpool Bay CCS Limited – HyNet Carbon Dioxide Transportation and Storage Project Offshore - Marine Licencing

Hello Alister,

Many thanks for getting in touch. The full process for determining an EIA application is available on our website: here. Please note that Band 3 EIA applications do not have a service level agreement timescale and are charged at £120/hour. Band 3 projects are varied and often complex in nature so determination time can vary significantly.

However, to help with your project planning we have listed some mean average and maximum times taken to determine different Band 3 marine licences from 2014 to the end of 2021 below. These times are not service levels and we may take longer depending on the information submitted.

Band 3 works type	Average time (months)	Maximum time to date (months)
Coastal Defence Schemes	5	5
Aggregates	12	25
Offshore Renewables	14	25
All other Band 3 applications which require an EIA	15	24

If you wish to receive bespoke pre-application advice, please let us know, together with your invoicing details. This advisory service is charged at £120/hour.

Alternatively you may with to contact NRW Advisory directly by contacting marine.advice@cyfoethnaturiolcymru.gov.uk. They will be able to provide you with advice on potential impacts of the project.

We do recommend that for all EIA application, developers request a scoping opinion from ourselves. Information on scoping opinions is detailed here.

All the best,

Chris Roscoe

Swyddog Trwyddedu Morol / Marine Licensing Officer
Cyfoeth Naturiol Cymru / Natural Resources Wales
Ffôn/ Phone: 03000 65 3474
Symudol / Mobile: 07768 421 043
Llys Afon, Hwlffordd / Llys Afon, Haverfordwest
Siaradwr Cymraeg

cyfoethnaturiol.cymru / naturalresources.wales

From: Billington Alistair <Alistair.Billington@external.eni.com>
Sent: 21 October 2022 10:08
To: Marine Licensing <marinelicensing@cyfoethnaturiolcymru.gov.uk>
Cc: Cislaghi Raffaella <Raffaella.Cislaghi@eni.com>; Smith Donald <Donald.Smith@eni.com>
Subject: Liverpool Bay CCS Limited – HyNet Carbon Dioxide Transportation and Storage Project Offshore - Marine Licencing

Dear Marine Licencing Team,

Eni UK Limited intends to develop, through their Eni group affiliate Liverpool Bay CCS Limited, the "HyNet Carbon Dioxide Transportation and Storage Project Offshore" (hereafter "the Proposed Development"). The Proposed Development forms part of the wider HyNet North West project, which is a hydrogen supply and Carbon Capture and Storage (CCS) project (reference to HyNet project web site at: https://hynet.co.uk).

The Proposed Development will require new electrical and fibre optic cable connections from the Point of Ayr (PoA) Terminal onshore to the carbon dioxide (CO_2) storage site offshore, as ancillary works to provide power for CO_2 injection.

We would therefore like to discuss with NRW-MLT any Marine Licence requirement for the installation of the cables (and any associated external cable protection), which would lie entirely in Welsh Waters and connect the PoA Terminal to the CO_2 storage site.

We would therefore welcome the opportunity to discuss the details of the process and timing for the Marine Licence application and approval with an NRW-MLT Case Manager, and how this process would fit with the Environmental Impact Assessment (EIA) that we will be carrying out to support the Proposed Development. We intend to carry out an EIA and prepare a single overarching Environmental Statement (ES) to support both the Marine Licence (if confirmed required) and the Carbon Storage Permit applications.

Additionally, before making this application, we may need to carry out a number of marine surveys along the route of the proposed cables to inform our design. We would therefore welcome the opportunity to discuss the need for any notification/licencing requirements for these surveys from NRW-MLT.

Many thanks for your assistance with this query and we would welcome the opportunity to discuss further.

If you have any questions, or require further information, please do not hesitate to let us know.

Kind regards

Alistair Billington
Eni UK Limited
07554 008 227

****
Emails may be monitored for security purposes. This communication contains information which is confidential and is for the exclusive use of the addressee(s). If you are not a named addressee, please inform the sender immediately and also delete the
communication from your system. Any views or opinions presented are solely those of the author and do not necessarily represent those of eni UK Limited., unless otherwise specifically stated. This email has been swept by antivirus software and is believed to
be free of computer viruses, etc. Recipients must, however, employ their own anti-virus precautions, as Eni UK Limited. cannot warrant that received emails are virus-free.

Eni UK Limited
Eni House
10 Ebury Bridge Road
London SW1W 8PZ
Registered in England (Company No. 862823)
****

****

Eni UK Limited
Eni House
10 Ebury Bridge Road
London SW1W 8PZ
Registered in England (Company No. 862823)
****

****
Emails may be monitored for security purposes. This communication contains information which is confidential and is for the exclusive use of the addressee(s). If you are not a named addressee, please inform the sender immediately and also delete the
communication from your system. Any views or opinions presented are solely those of the author and do not necessarily represent those of eni UK Limited., unless otherwise specifically stated. This email has been swept by antivirus software and is believed to
be free of computer viruses, etc. Recipients must, however, employ their own anti-virus precautions, as Eni UK Limited. cannot warrant that received emails are virus-free.

Eni UK Limited
Eni House
10 Ebury Bridge Road
London SW1W 8PZ
Registered in England (Company No. 862823)
****

****
Emails may be monitored for security purposes. This communication contains information which is confidential and is for the exclusive use of the addressee(s). If you are not a named addressee, please inform the sender immediately and also delete the
communication from your system. Any views or opinions presented are solely those of the author and do not necessarily represent those of eni UK Limited., unless otherwise specifically stated. This email has been swept by antivirus software and is believed to
be free of computer viruses, etc. Recipients must, however, employ their own anti-virus precautions, as Eni UK Limited. cannot warrant that received emails are virus-free.

Eni UK Limited
Eni House
10 Ebury Bridge Road
London SW1W 8PZ
Registered in England (Company No. 862823)
****

****
Emails may be monitored for security purposes. This communication contains information which is confidential and is for the exclusive use of the addressee(s). If you are not a named addressee, please inform the sender immediately and also delete the
communication from your system. Any views or opinions presented are solely those of the author and do not necessarily represent those of eni UK Limited., unless otherwise specifically stated. This email has been swept by

antivirus software and is believed to
be free of computer viruses, etc. Recipients must, however, employ their own anti-virus precautions, as Eni UK Limited. cannot warrant that received emails are virus-free.

Eni UK Limited
Eni House
10 Ebury Bridge Road
London SW1W 8PZ
Registered in England (Company No. 862823)
****

Minutes

Date: 30/03/22 **Meeting at:** Microsoft Teams

Subject / purpose: TCPA Intertidal Ecological Survey Approach

Attendees:
Matt Harris (MH) – WSP
Jess Vevers (JV) – WSP
Nic Macmillan (NM) – TCPA Lead WSP
Mike Field (MF) – Fish surveys Ecospan
Helen Nagle (HN) – RPS EIA Lead
Ross Griffin (RG) – Ocean Ecology
Leonie Richardson (LR) – NRW Case Manager
Ida Nielson (IN) – NRW fish specialist
Leyne Nieva (LN) – NRW benthic ecology specialist

Apologies:

Minutes:		**Action by:**
1	NRW advised that for the offshore elements, a lot of information potentially already exists from the surveys and assessments that have been carried out for the offshore wind farms. There would be merit in looking at the existing offshore wind farm documentation that should be available online.	RPS and Ocean Ecology
2	NRW advised that there would be a need to look at sand eel habitats and spawning areas, as well as those for herring. NRW advised that sand eel habitat going to be of most interest.	RPS and Ocean Ecology
3	TCPA – Draft ES due in May and consultation begins. Final ES to be submitted in August.	WSP
4	WSP presented the proposed methodology for the inter-tidal survey works. NRW recognised that the timing and spatial extent of the inter-tidal survey was proportionate for the spatial and temporal extent of the proposed shore works.	WSP
5	NRW raised the requirement for fish surveys and noted that autumn is best time of year for species richness. However, NRW recognised that the spatial and temporal extent of works is not thought to be a concern for fish, and that there is also considerable information already available regarding fish interests in this area. NRW therefore recommended that, in light of existing	WSP

	knowledge, fish surveys would not add further to this knowledge and would not be required for the project. NRW therefore advised the use of available data to assess the impacts on the fish assemblage rather than undertake the planned survey work.	
6	RPS presented the proposed methodology for the sub-tidal survey and showed that a cruciform sampling pattern would be applied at each platform site. Triplicate sampling and physico-chemical analysis would be carried out at for each sample location. NRW confirmed that the methodology was proportionate to identified risks and that it reflected standard approaches.	RPS
7	NRW advised that the existing datasets, combined with those available from the British Geological Survey (BGS), and the proposed project-specific surveys should provide an adequate baseline for the offshore baseline.	RPS and Ocean Ecology
8	There may be a requirement for a phase 2 intertidal survey, to provide quantitative data for the assessments. WSP will require condition data on the different intertidal habitats for the BNG assessment as well. Need to provisionally book in some dates for the intertidal phase 2 survey.	WSP

Cyfoeth Naturiol Cymru
Natural Resources Wales

Ein cyf/Our ref: CAS-214353-M3D6
Eich cyf/Your ref: FUL/000246/23

Maes Y Ffynnon,
Penrhosgarnedd,
Bangor,
Gwynedd
LL572DW

ebost/email:
northplanning@cyfoethnaturiolcymru.gov.uk
Ffôn/Phone: 03000 65 4227

Flintshire County Council,
Ty Dewi Sant,
St. Davids Park,
Ewloe,
CH5 3FF

10/05/2023

Annwyl Syr/Madam / Dear Sir/Madam,

BWRIAD / PROPOSAL: RETENTION AND USE OF EXISTING STRUCTURES, PLANT AND ANCILLARY DEVELOPMENT (INCLUDING ACCESS ROADWAY AND LANDSCAPING) FORMING THE POINT OF AYR GAS TERMINAL FOR THE TRANSPORT OF CO2 AND THE DEMOLITION/REMOVAL OF REDUNDANT STRUCTURES AT THE TERMINAL; CONSTRUCTION AND USE OF NEW INFRASTRUCTURE REQUIRED FOR CO2 SERVICE AT THE POINT OF AYR GAS TERMINAL; RETENTION AND USE OF THE EXISTING 20 DIAMETER GAS PIPELINE, CONDENSATE PIPES AND ASSOCIATED CABLES FROM THE POINT OF AYR GAS TERMINAL TO THE MEAN LOW WATER SPRING MARK FOR THE TRANSPORT OF CO2 AND ASSOCIATED ACTIVITIES; REMOVAL OF THE SHUT DOWN VALVE COMPOUND ASSOCIATED WITH THE EXISTING 20 DIAMETER GAS PIPELINE FROM THE POINT OF AYR GAS TERMINAL TO THE MEAN LOW WATER SPRING MARK AND APPROPRIATE RESTORATION/REMEDIATION; CONSTRUCTION AND USE OF TWO 33KV ELECTRICITY AND FIBRE OPTIC CONNECTIONS FROM POINT OF AYR GAS TERMINAL TO THE MEAN LOW WATER SPRING MARK; AND CONSTRUCTION AND USE OF TWO KIOSKS AND ASSOCIATED FENCED COMPOUNDS LOCATED ON THE LINE OF THE PROPOSED 33KV ELECTRICITY AND FIBRE OPTIC CONNECTIONS.

LLEOLIAD / LOCATION: LAND WEST OF STATION ROAD, TALACRE

Thank you for consulting Cyfoeth Naturiol Cymru / Natural Resources Wales about the above, which we received on 31 March 2023.

We have concerns with the application as submitted because inadequate information has been provided in support of the proposal. To overcome these concerns, you should seek further information from the applicant regarding Protected Sites, flood risk and Water Framework Directive compliance. If this information is not provided, we would object to this planning application. Further details are provided below.

We also advise that based on the information submitted to date, conditions regarding protected species, contamination and biosecurity should be attached to any planning permission granted. Without the inclusion of these conditions, we would object to this planning application.

1) Protected Sites

Special Area of Conservation (SAC), Special Protection Area (SPA), Ramsar site

1.1 We have concerns that a significant effect from the proposed development on the Dee Estuary SAC, SPA and Ramsar site cannot be ruled out. The application is located within these designated sites.

1.2 The proposed cable trenching works and associated temporary access road along the beach should be considered in your Authority's Habitats Regulations Assessment (HRA). Having reviewed the information submitted we are unable to agree at this stage that there is enough evidence to conclude no Likely Significant Effect to the above sites. We have therefore sought to identify those areas below where we consider that further information is required in order for you to undertake your HRA.

1.3 Should you also conclude that the proposed development is likely to have a significant effect on the Dee Estuary SAC/SPA/Ramsar site, we look forward to being consulted on your appropriate assessment under Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended).

Intertidal mudflats and sandflats

1.4 Environmental Statement (ES) Chapter 4: Consideration of Alternatives, paragraph 4.6.10 Foreshore Cables, explains that "*The yellow route was discounted, but the dashed yellow option may eventually be selected over the orange option depending on the shifting nature of the sand banks*." We advise that you seek clarification on whether the dashed yellow route is still in scope for this application and whether it has been assessed.

1.5 With reference to ES Chapter 9: Biodiversity, para. 9.5.21, Impact assessment methodology, Duration, we advise that habitat loss longer than 5 years should be classed as long-lasting. This is based on the reporting cycle requirements outlined in Article 6a of the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019.

1.6 In ES Chapter 9, para. 9.8.7 the applicant proposes the use of a plough to excavate a trench and bury the cable within the intertidal zone. However, in ES Chapter 3: para. 3.4.58, the applicant notes that whilst the use of a plough is the preferred option, if the plough is '*proved to be unsuitable for the cable installation then a cable trencher will be employed*'. Potential impacts to intertidal habitats from the use of a cable trencher (including the recovery time) are greater than that of the use of a plough. We therefore advise that the worst-case scenario (i.e., the use of the cable trencher)

should be assessed, in line with the Rochdale Envelope approach. This equally applies to the consideration of water quality impact in the HRA.

1.7 Potential impacts to the Annex I mudflat and sandflat habitat from siltation and turbidity effects and accidental pollution during construction have been identified in ES Chapter 9: para. 9.9.25 but have not subsequently been assessed. Furthermore, several potential impacts resulting from the cable installation activities that could have an impact on the Annex I mudflat and sandflat habitat have not been assessed. We therefore advise that the following potential impacts should be scoped in and assessed:

- *Impacts from accidental pollution events*
- *Impacts from increases in suspended sediment concentration and associated deposition (siltation and turbidity effects)*. This includes impacts from cable installation and repair/maintenance activities and indirect impacts to intertidal habitats (including the Annex I mudflats and sandflats feature) from increased suspended sediment and smothering from suspended sediment plumes generated during construction. This is of particular importance if a cable trencher is used.
- *Release of sediment bound contaminants* - Disturbance of the seabed during construction, operation and decommissioning activities could cause toxicity effects through mobilisation of contaminated sediment during preparation works, cable laying and cable repair activities, which could impact the surrounding benthic communities.
- *Introduction and spread of invasive non-native species* – via marine vessels proposed to be used as part of the cable installation works.
- *Impacts from electromagnetic fields (EMF)* – With reference to ES Chapter 9: para. 9.9.93, potential EMF impacts from the operation of the cables have been assessed against the fish species that were recorded within the Dee Estuary SAC. As noted by the applicant, many benthic invertebrate species are known to be able to detect EMF. There is some evidence that EMFs affect crustacea behavioural patterns which would potentially include certain species under Section 7 (Environment Wales Act 2016) e.g., crawfish *Palinurus elephas*. We advise that these should be reviewed and assessed (where appropriate) as part of the application.

1.8 With reference to ES Chapter 9: para. 9.9.21, we advise that clarification is sought on what activity is expected to result in "*the loss of sections of intertidal mudflat S7 Priority habitat/mudflat and sandflat Annex I habitat*" and what area of habitat loss this equates to. We would not expect any long-lasting habitat loss as a result of the cable trenching as the trench would be backfilled.

1.9 Based on the sensitivity of the biotopes to the impact and the expected recovery rate we do not expect the impact from temporary habitat loss, and/or disturbance from the cable installation on the biotopes that were encountered during the Phase I Habitat Survey, to be of major and/or moderate significance. This impact is expected to be temporary, and the habitat should return to pre-impact conditions within the short-term following return of the sediment. However, we are unable to confirm this without

clarification of the extent of the area that will be impacted. Mitigation measures such as the use of matting to reduce compaction of the sediment could be used, but further information is needed to understand these impacts. Therefore, until the following information is provided, we are unable to agree with the assessment conclusions regarding biotopes:

- An assessment of the impact of temporary habitat loss and/or disturbance from cable installation against the biotopes (*ES Habitat Survey Report, Annex E, Figure 3.1 Biotope Map of the Survey Area*) recorded during the Phase I habitat survey using the information provided in Marine Evidence based Sensitivity Assessment (MarESA) (e.g., sensitivity, resilience and expected recovery rate). This should assess the impact from disturbing the sediment as a result of the cable laying activities and potentially from the use of vehicles on the beach to install the cable (e.g., use of a mobile tracked machine). The assessment should also include the total extent of the impact i.e., the area in m^2 and or km^2 of impact and furthermore, what this equates to (percentage) of the Annex I mudflat and sandflat feature of the Dee Estuary SAC and to the whole Dee Estuary SAC. Clarification is also sought on any mitigation measures in relation to the impact of tracked vehicles that might be required.

1.10 Regarding ES Chapter 9: para. 9.9.85 we note that the operation of the repurposed pipeline is expected to increase the temperature of the soil and associated habitats around the pipeline. We advise that clarification is sought on whether an increase in temperature is expected in the intertidal zone; if so, potential impacts on the Annex I mudflats and sandflat feature should be assessed.

1.11 With reference to ES Chapter 19: Combined and Cumulative Effects, until the potential impacts to intertidal habitats from the cabling activities have been scoped in and assessed appropriately, we are unable to agree that the effects to ecological receptors are non-negligible and can therefore be scoped out of the cumulative effects assessment. Please note these comments are also applicable to *Appendix 19.1 – Inter-Project effects assessment*.

1.12 With reference to ES Chapter 19: Table 6-2. Potential effects upon the Dee Estuary/Aber Dyfrydwy SAC, Annex I mudflat and sandflat feature the potential for the cable installation and repair/maintenance activities to result in increases in sediment-bound contaminants and suspended sediment concentration (SSC) leading to siltation and turbidity effects and thus impacts to the Annex I features of the Dee Estuary SAC has not been screened in and assessed. This is of particular importance if a cable trencher is to be used so we advise that it should be appropriately assessed.

1.13 With reference to ES Chapter 19: Table 6-2. Potential effects upon the Dee Estuary/Aber Dyfrydwy SAC, subsection (a), we advise that further assessment should be undertaken to support the conclusions of the HRA. LSE from habitat loss and/or disturbance to the Annex I mudflat and sandflat feature resulting from cable installation activities have been identified and some evidence relating to the resilience and recovery of the habitat has been presented. We advise that given an LSE has been identified, the impact should be assessed at Stage 2 Appropriate Assessment

against the conservation objectives for the feature, with the appropriate evidence to rule out an adverse effect on site integrity presented.

1.14 With regards to Appendix A - Section 6.4.2 (a) of the shadow HRA, we welcome plans to work at low water to avoid the potential impacts of SSC plumes on Annex I protected features (Chapter 9, Table 9-21). However, we advise further assessment regarding the practicality of working only at low water if trenching is employed as the cable installation method. For example, whether it would be possible to undertake the cable laying work within one low water period as outlined in Appendix 18.3 – Water Framework Directive Assessment, Table 4-14. If any cable laying works take place outside low water, we advise that the potential for SSC plumes should be assessed, in particular, the possibility for smothering of protected features, by the deposition of sands and fine material, mobilised by trenching activities.

1.15 We also advise further assessment regarding the transition of cable laying methods beyond mean low water springs (MLWS). We acknowledge that this application covers activities to MLWS, however, in order to assess the impacts of cable laying activities within the intertidal zone the methods for continuing these works past MLWS need to be understood. For example, whether intertidal cable laying would commence only once a Marine License for cabling below MHWS has been granted.

1.16 Until the above is carried out we are unable to agree with the conclusions of the shadow HRA.

Estuaries

1.17 We note that, providing the exit pit and cables can be situated 2-3m below the ground, rock armour and cable protection would not be required. However, we advise that you seek clarification that backfilling associated with the exit pit would restore the original profile of the beach, to ensure the alongshore sediment transport pathways will not be interrupted.

1.18 We also advise that you seek clarification that cable laying methods would not change the overall profile of the intertidal area. For example, if trenching methods are employed, backfilling methods should ensure the original gradient of the intertidal area is restored, to minimise the potential for secondary impacts to physical processes and thus sediment transport pathways.

Bird features

1.19 We note that to avoid disturbing the overwintering bird features of the Dee Estuary SPA and Ramsar site the applicant intends to avoid carrying out works during the overwintering period of September – March inclusive, but they have stated that if this is not feasible and works must be carried out between September and March, this would be under supervision of the ECoW. We advise that if works are undertaken during the overwintering period, they should not be undertaken two hours either side of high tide to avoid disturbance to the overwintering bird features of Dee Estuary

SPA and Ramsar site. We advise that this is secured as part of the application and reflected in your Authority's HRA. There would be no overlap with the overwintering bird features of Dee Estuary SPA and Ramsar site if these works were undertaken outside of the overwintering period (September - March inclusive).

1.20 Table 5.3 and para. 5.2.10 of the shadow HRA details that during pre-survey assessment, three qualifying species of the Dee Estuary SPA and Ramsar site (teal, black-tailed godwit, and curlew) were found to occur in abundances >1% of the designations' 5-year population within the Warren Farm field parcels. In the absence of a categoric commitment to undertake trenching works within the Warren Farm field parcel(s) outside the September to March period, we consider that there is likely to be a disturbance effect upon over-wintering bird species features of the Dee estuary SPA/Ramsar site. Over-wintering birds are likely to avoid the Warren Farm area, whilst works activity occurs. However, it is unclear how long the proposed works are likely to take at Warren Farm, so the level of risk is uncertain at this stage.

1.21 We therefore advise that you seek clarification regarding the period of time anticipated for open trenching, the area affected and the total time to complete the works at Warren Farm in order to assess the level of likely impact to the affected bird features of the SPA/Ramsar site.

1.22 We note the need to remove hedgerows and trees to allow for cabling to occur. However, it is not clear where such removal is expected to occur. If it is proposed in the vicinity of Warren Farm, this should be assessed in the HRA. The hedgerows surrounding the Warren farm fields are important as 'screening' to protect over-wintering birds from disturbance activities along the road and adjacent caravan park. Adequate mitigation / replacement with mature specimens should therefore be implemented for any removal, in order to continue the screening benefit.

1.23 As the decommissioning activity could have impacts on breeding and overwintering birds, we advise that a separate assessment process should be completed prior to any decommissioning works taking place.

Fish features

1.24 With reference to ES Chapter 9: Biodiversity, para. 9.4.5, Tables 9-5 and 9-6 Elements of the Assessment with Likely Significant Effects During Construction (Point of Ayr Terminal) and Foreshore, we advise that diadromous fish elements of both the River Dee and Bala Lake SAC (Atlantic salmon, sea lamprey and river lamprey) and Dee Estuary SAC are scoped in to your Authority's HRA, as the estuary forms the migration route to the riverine SAC.

1.25 We note that ES Chapter 15: Noise and Vibration, para. 15.9.14 details the potential for piling to be required as part of the modifications to the Point of Ayr (PoA) terminal. However, it is not clear where within the PoA application site the piling may be required. We therefore advise that your Authority confirms whether piling would be required within the intertidal zone. If piling would occur in the intertidal zone, then

further information/mitigation would be required to inform your Authority's HRA. We advise that project-specific noise modelling may be required if other mitigation cannot be implemented, depending on the size of piles and duration of piling.

Site of Special Scientific Interest

1.26 We consider the proposals have the potential to impact upon the Dee Estuary SSSI and Gronant Dunes and Talacre Warren SSSI. Providing the impact pathways referenced above for the Dee Estuary SAC/SPA/Ramsar site are adequately addressed, we consider the features of the Dee Estuary SSSI will also be adequately safeguarded.

1.27 However, the ES does not assess whether there will be any impacts to the little tern feature of Gronant Dunes and Talacre Warren SSSI, e.g., from cabling installation through this site. Whilst we note that this area does not appear to be within the red line boundary of the proposed development, we advise that effects on this SSSI feature should be assessed within the ES (see our Schedule 1 bird advice below regarding little terns).

1.28 Recreational parking issues are currently affecting the integrity of the protected nature conservation sites on land outside the red line boundary of the application but within the applicant's ownership. Currently, an important transitional and mosaic area of sand dune / foredune and developing saltmarsh (within the protected sites) is used for car parking. The current application proposes to use this as a temporary parking area for access to the foreshore. In addition, there is currently a 10-year planning permission to alleviate some of the above parking pressure, also within the protected sites at Gamfa Wen; this permission is nearing its end.

1.29 From previous discussions with your Authority we recognise that redevelopment in this area provides opportunities to offer appropriate recreational parking at Talacre, potentially on the made-ground area of the former colliery post-completion of the works, including the area where the applicant seeks to place a temporary compound / works site. This area could form part of a wider consideration of managed parking within Talacre. Any relief of traffic pressure in Talacre would contribute to reducing the impact on protected sites features.

2) Flood Risk

2.1 Whilst the proposal involves the redevelopment of an extant gas storage site, it will constitute important infrastructure and as such it is critical that flood risk is properly understood and demonstrated manageable. We consider the FCA currently submitted is insufficient to inform your decision-making process in accordance with TAN15 and advise that further work is needed to address this.

2.2 Our Flood Risk Map confirms the site to be within Zone C1 of the Development Advice Map (DAM) contained in Technical Advice Note (TAN) 15: Development and Flood

Risk (2004). The Flood Map for Planning identifies the application site to be at risk of flooding and falls into Flood Zones 2/3 (Rivers/Sea) / Recorded Flood Extents.

2.3 Section 6 of TAN15 requires the Local Planning Authority to determine whether the development at this location is justified. Therefore, we refer you to the tests set out in section 6.2 of TAN15. If you consider the proposal meets the tests set out in criteria (i) to (iii), then the final test (iv) is for the applicant to demonstrate through the submission of a Flood Consequences Assessment (FCA) that the potential consequences of flooding can be managed to an acceptable level.

2.4 We have reviewed the information submitted in support of this planning application, including the draft Environmental Statement (specifically chapter 18), the Flood Consequences Assessment (FCA) (Appendix 18.2, dated March 2023), and the Outline CEMP.

2.5 For your Authority's awareness, we have previously provided comments on the proposal for the statutory pre-application consultation and at that time we raised some concerns in relation to the FCA. However, our comments raised during the statutory pre-application consultation have not been addressed in the FCA. Our concerns remain, as summarised below:

- Your Authority should assure itself that the FCA assesses flood risks over the "agreed" lifetime of development. We have previously questioned the 25-year lifetime referred to within the FCA. The FCA does not refer to any correspondence between the applicant and your Authority confirming that this is a suitable lifetime of development. We would advise that a development lifetime of 75 years should typically be applied for such development proposals.

- The FCA should fully assess, for the **agreed** development lifetime, the flood depths and flood hazards across the site during the design flood event, which is the 0.5% annual probability tidal event, including allowance for climate change and breach of the existing flood defences. We note that paragraphs 5.4.10 and 5.4.12 of the FCA have considered the 75-year lifetime of development breach scenarios. The FCA shows that for the Talacre breach location, flood depths at the terminal would be in the region of 1.1m. Your Authority should note that only a **mean** figure has been presented, whereas we advise that a maximum flood depth should be used. When maximum depths are considered, flood depths at the site could be in the region of **2.2m**. The site is therefore considered to be at significant risk of flooding. Whilst we acknowledge that the FCA considers a longer lifetime of development than is proposed (on the basis your Authority agrees to a 25-year lifetime of development) the 75-year assessment is the best available information available at this time to inform your consideration of the application.

- The assessment of the impact on flood risk elsewhere (for the PoA Terminal development) is not currently sufficient. The impact of the development proposed in the tidal floodplain should be investigated in more detail, as we do not consider

it appropriate to assume that the impact would be negligible. The FCA should explain the nature and scale of any changes in development footprints and potential impacts this could have on displacement of tidal floodwaters in a breach event.

- In respect to flood risk mitigation, the measures proposed are limited to the implementation of an updated flood plan. There is also no reference to any further mitigation measures in Table 7-12 of Chapter 7 – Climate Resilience of the ES. Given the nature of the development (redevelopment of a site with an existing less vulnerable land use) and the potential flood risk at the site, we would expect further measures to be implemented to provide flood risk betterment compared to current conditions. The FCA does not comment on whether the new structures on the site can be raised compared to the previous structures, or if any flood resilience/resistance measures can be implemented. We advise that the FCA is updated to comment on this and advise whether any further mitigation measures can be implemented.

2.6 As it is for your Authority to determine whether the risks and consequences of flooding can be managed in accordance with TAN15, we recommend you consider consulting other professional advisors on matters such as emergency plans, procedures, and measures to address structural damage that may result from flooding. Please note, we do not normally comment on the adequacy of flood emergency response plans and procedures accompanying development proposals, as we do not carry out these roles during a flood. Our involvement during a flood emergency would be limited to delivering flood warnings to occupants/users.

3) Water Framework Directive (WFD)

3.1 The following advice relates to our review of Appendix 18.3: Water Framework Directive Assessment (doc. ref. T.4.3.18.3). We note that the proposed cable trenching works and associated temporary access road along the beach have the potential to affect the WFD water bodies, as such they should be considered in your Authority's WFD compliance assessment. Having reviewed the information submitted we are unable to agree at this stage with the conclusions of the applicant's WFD compliance assessment. We have therefore sought to identify those areas below where we consider that further information is required in order for you to undertake your WFD compliance assessment.

3.2 It should be noted that the Cycle 3 River Basin Management Plans referred to in para. 2.3.14, were released in 2022. We therefore advise that your Authority uses the final 2022 information to inform its WFD compliance assessment.

3.3 With reference to Tables 3-15 and 3-16, paragraphs 3.2.88 to 3.2.91, we agree that the WFD compliance assessment has correctly identified most protected areas associated with marine water quality, though it has not considered the Dee Estuary SPA. We advise that this should be included in your Authority's WFD compliance assessment.

3.4 Table 4-3 identifies cockle and saltmarsh habitat within 500m of the development. Cockles are scoped in to detailed assessment, but saltmarsh is not. We advise that saltmarsh should be scoped in to detailed assessment for your WFD compliance assessment and any impacts from pollution or potential physical damage should be assessed.

3.5 We note that in Table 4-3, the activities (foreshore works and Point of Ayr works) have been considered separately within the WFD compliance assessment and as such, there is no assessment of the total footprint of the works on each transitional or coastal water body. We advise that the total footprint of works on each water body should be calculated and made available to provide evidence for your WFD compliance assessment.

3.6 Furthermore, within Tables 4-5 and 4-14, it has not been identified that there is the potential to release Environmental Quality Standards Directive (EQSD) chemicals. We consider that there is a risk of accidental spills, and these should be considered in the context of the WFD.

3.7 We advise that if there is a potential need for cable protection (Table 4-11) this should be assessed within the hydromorphology section of your WFD compliance assessment.

3.8 We advise that any conclusions developed as a result of our marine fisheries comments (see para's 1.24 and 1.25 above) should be included in your WFD compliance assessment.

3.9 Table 4-14 states that trenching will take place in the foreshore and that it will be complete within one tidal cycle, and as such there is no risk for sediment mobilisation which could pass on risk to other receptors (e.g., *Mytilus edulis*, Table 5-3). We advise that you seek evidence to confirm the feasibility of this and clarity on contingency measures if this is not achievable.

3.10 It is specified in Tables 4-14 and 5-3 that the CEMP will deal with any issues relating to *Mytilus edulis*. We advise that you seek confirmation that the potential for sediment resuspension and subsequent smothering has been considered.

4) Protected Species

4.1 We consider that sufficient information has been submitted to enable the potential impact on protected species to be determined. However, we advise that appropriate conditions are included on any planning permission granted. We have therefore taken the opportunity to provide some advice on the scope of the information that should be included in support of discharging these conditions.

4.2 NRW would refer the Local Authority to the Chief Planning Officer's letter dated 01 March 2018 which advises Local Planning Authorities to attach an informative

regarding licence requirements to all consents and notices where European Protected Species are likely to be present on site.

General

4.3 The species technical appendices refer to the National Planning Policy Framework (NPPF). The NPPF sets out the Government's planning policies for England and how these should be applied. However, since this application is located in Wales, we advise that the LPA should assure itself that the proposals would accord with Planning Policy Wales (edition 11).

4.4 We note reference to conservation status but no specific reference to Current Conservation Status (CCS) or Favourable Conservation Status (FCS). There is also no reference to EC EPS Guidance regarding this e.g., *Commission notice Guidance document on the strict protection of animal species of Community interest under the Habitats Directive* C/2021/7301 final. However, we would not be concerned about this being considered as part of the EPS licensing application for the proposals. The Applicant should note that a hierarchical geographical scaled approach may not be applicable when demonstrating no detriment to maintenance of FCS; the above EC guidance indicates assessments at various spatial scales.

Bat species

4.5 From the information submitted, we consider that the proposed development represents a lower risk for bats, as defined in our guidance document '*Natural Resources Wales Approach to Bats and Planning* (2015)'.

4.6 Bats and their breeding and resting places are protected under the Conservation of Habitats and Species Regulations 2017 (as amended). Where bats are present and a development proposal is likely to contravene the legal protection they are afforded, the development may only proceed under licence issued by Natural Resources Wales, having satisfied the three tests set out in the Regulations (please also refer to Paragraph 6.3.7 of Technical Advice Note 5: Nature Conservation and Planning). Please note, for the purposes of providing advice at the planning application stage, our comments are limited to the test relating to "*demonstration of no detriment to the maintenance of the favourable conservation status of European protected species*".

4.7 We agree with the assessment and conclusion regarding bat species. We note that likely impacts to bats include indirect disturbance to two confirmed common pipistrelle roosts via noise, vibration and lighting, disturbance of foraging and commuting activity via artificial lighting if any night works are required (and permanently during operation of the Block Valve Stations), and severance of commuting habitat and potential reduction in foraging habitat from the loss of hedgerows.

4.8 We note that the following measures are proposed to reduce disturbance to bats:

- the works will be undertaken under a Precautionary Working Method Statement

- a toolbox talk will be given to brief site contractors on the potential presence of bats, identification and the legal protection. It will also outline the measures to be taken if a bat is found on site (T-BD-025 of the Register of Environmental Actions and Commitments "REAC" Document Reference: T.5.3)
- Construction works restricted to daylight hours, as far as practicable, to avoid the need for any artificial lighting during the works (except during winter) (T-BD-014 of the REAC Document Reference: T.5.3).
- The noise level associated with the works will be assessed in relation to the bat roost location and, if considered loud enough to have an impact, noise mitigation features will be implemented, such as sound barriers. As far as possible, construction hours will be limited to daylight hours, avoiding night-time work (T-BD-024 of the REAC Document Reference: T.5.3).
- Where night works are unavoidable, measures to avoid unnecessary lighting disturbance to bats will be detailed in a Lighting Management Plan following current best practice guidance (Ref. 9.58) (T-BD-015 of the REAC, Document Reference: T.5.3).

4.9 We advise that the proposed development is likely to harm or disturb the bats or their breeding sites and resting places at this site. Therefore, we advise that the REAC (Document Reference: T.5.3) is included in the 'approved list of plans / documents' condition within the decision notice should consent for the project be granted.

4.10 Furthermore, given the possible impacts, we advise that a bat conservation plan condition be attached to any planning permission granted for this proposal. The bat conservation plan should include:
(a) precautionary methods of working (method statements),
(b) external lighting/internal light spillage plans,
(c) monitoring, and,
(d) ECA Key Performance Indicators.

4.11 Please consult us again if any further information shows that this is no longer a lower risk case for bats.

Great Crested Newt (GCN)

4.12 We note the assessment and conclusions regarding GCN and we concur with these. We note that no GCN have been recorded during the surveys. Due to the lack of confirmed GCN presence during the surveys and an absence of GCN records within close proximity, we note that GCN are considered likely absent from the PoA Terminal and all of the Block Valve Stations (BVS) locations but are assumed to be present within the Red Line Boundary of the Foreshore Works due to previous records. Therefore, likely absence cannot be concluded, and precautionary presence has been assumed.

4.13 We note the proposed GCN conservation plan condition and advise that the GCN conservation plan includes:

1) A provision requiring GCN Ecological Compliance Audit Key Performance Indicators (KPI's) to be defined, and,
2) Updating of site management plans to include reference to GCN.

Natterjack toad

4.14 We note the assessment's conclusion that natterjack toad are known to be present in the application area and have the potential be present within the Red Line Boundary within the Foreshore Works and PoA Terminal.

4.15 The assessment notes that the operation of the pipeline will result in a permanent change in ground temperature along the pipeline route and a 10m buffer either side, but with significant changes limited to the pipeline itself and a 1m buffer either side. A permanent increase in soil temperatures in areas of suitable natterjack toad habitat could disrupt breeding cycles and hibernation behaviour resulting in long-term or permanent effects on the populations of the species. The current heat modelling information indicates that significant effects will be limited to the pipeline route itself and a 1m buffer either side, where suitable natterjack toad habitat exists but none have previously been recorded. However, we would advise your Authority to explore whether there is an opportunity to reduce this even further through heat proof insulation.

4.16 We note that full details of the finalised mitigation measures will be included in a Natterjack Toad Species Conservation Plan, which could be secured by an appropriate condition. We advise that the natterjack toad conservation plan includes:
1) A provision requiring monitoring and submission of records into the Wales Natterjack Monitoring Scheme hosted by Cofnod,
2) A provision requiring natterjack toad Ecological Compliance Audit Key Performance Indicators (KPI's) to be defined, and,
3) Updating of management plans to include natterjack conservation objectives informed by conservation status attributes.

Sand lizard

4.17 We note the conclusions of the assessment regarding sand lizards. Table 9-5 of Chapter 9 (Biodiversity) refers to the possible impact on *reptiles* at the PoA terminal but does not refer to sand lizards specifically although these are referred to in Tables 9-6 and 9-7 for other aspects of the works. Clarification is therefore sought on the possible presence of sand lizard at the PoA terminal.

4.18 We note that no sand lizards were recorded during the Habitat Suitability Assessment, but suitable habitat to support them is present within the Red Line Boundary and there is a known population within the Talacre dune system, and habitat connectivity between the Red Line Boundary and areas where the closest sand lizard records are located.

4.19 The assessment notes that the operation of the pipeline will result in a permanent change in ground temperature along the pipeline route and a 10m buffer either side, but with significant changes limited to the pipeline itself and a 1m buffer either side. A permanent increase in soil temperatures in areas of suitable sand lizard habitat could disrupt breeding cycles and hibernation behaviour resulting in long-term or permanent effects on the populations of the species. The current heat modelling information indicates that significant effects will be limited to the pipeline route itself and a 1m buffer either side, where suitable sand lizard habitat exists but none have previously been recorded. However, we would advise your Authority to explore whether there is an opportunity to reduce this even further through heatproof insulation.

4.20 We note the proposed sand lizard conservation plan condition and advise that the sand lizard conservation plan includes the following:

1) A provision requiring monitoring and submission of records into the relevant recording database managed by Cofnod.
2) A provision requiring sand lizard Ecological Compliance Audit (ECA) Key Performance Indicators (KPI's) to be defined.
3) Updating of management plans to include sand lizard conservation objectives informed by conservation status attributes.

Otter

4.21 We concur with the submitted assessment and conclusions regarding otters. Based on the extents of proposed works relative to the various watercourses present around the PoA Terminal and Foreshore Works, we note that direct impacts to otters are expected to be avoided. However, there is considered to be the potential for indirect impacts, including disturbance by light spill, noise and vibration, and pollution events in the watercourses killing fish and leading to a reduction of foraging opportunities. These impacts may be incurred during both the construction and decommissioning stages.

4.22 We therefore advise that an otter conservation plan condition is attached to any planning permission granted for this application, which includes:

- Details of the extent and location of suitable otter habitat to be impacted by the Proposed Development;
- Details of protective measures to be taken to minimise impacts to otters;
- Details of timing, phasing and duration of construction activities and conservation measures;
- Details of measures to prevent or reduce incidental capture or killing of otter;
- Where applicable, information on how the long-term site security of mitigation or compensation measures will be assured;
- Submission of Otter ECA Key Performance Indicators (KPI's)
- Updating of management plans to include otter conservation objectives as informed by conservation status attributes

Water vole

4.23 We concur with the submitted assessment and conclusions regarding water voles. We note that there no confirmed evidence of water vole has been recorded during the surveys and there were no records of water vole presence identified within 2km of the Red Line Boundary, but several waterbodies suitable to support water vole are located within or close to the Red Line Boundary. We note that impacts may be incurred during both the construction and decommissioning stages.

4.24 We therefore advise that a water vole conservation plan condition is attached to any planning permission granted for this application and advise that this includes:

- details of the extent and location of suitable water vole habitat to be impacted by the Proposed Development,
- details of protective measures to be taken to minimise impacts to water vole,
- details of timing, phasing and duration of construction activities and conservation measures,
- details of measures to prevent or reduce incidental capture or killing of water vole,
- where applicable, information on how the long-term site security of mitigation or compensation measures will be assured,
- submission of water vole ECA Key Performance Indicators (KPI's), and,
- updating of management plans to include consideration of water vole.

Schedule 1 birds (Wildlife and Countryside Act 1981, as amended)

4.25 We advise that the detailed Construction Environmental Management Plan (CEMP) should address the following points. We would wish to be a named party for consultation on this document at the Discharge of Condition stage.

4.26 Regarding barn owls, the Outline CEMP (T-BD-030) states that "*If significant disturbance is expected and cannot be mitigated for via standardised measures, a mitigation licence from NRW is likely to be required to legally permit disturbance of any nesting barn owls*". However, we advise that any activity that causes disturbance should be subject to a Schedule 1 disturbance licence.

4.27 We welcome that "*internal surveys of the buildings barn owls may be using will be carried out prior to any works to check for the presence of nesting barn owls*". We advise that this should include any suitable barn owl breeding habitat within at least 100m of the red line boundary. Any works within 100m of an active barn owl nest would require appropriate and effective mitigation to be implemented.

4.28 We also advise that similar pre-construction checks for the presence of Cetti's warbler (suitable breeding habitat within 25m of the red line boundary) and peregrine (suitable breeding habitat within the red line boundary) should be completed and accompanying mitigation measures for avoiding disturbance to these Schedule 1 species outlined in the detailed CEMP.

4.29 We advise that as currently proposed, the works could cause disturbance to little tern. For example, paragraph 7.5.7 of Appendix A: Habitats Regulations Assessment – Information to Inform an Appropriate Assessment, states that "*a watching brief would be undertaken by the ECoW in relation to the established Little Tern colony if any construction works are to be undertaken around the PoA Terminal between April and July, inclusive*", and para. 7.5.8 states that "*If any birds are showing disturbance behaviour within the 300m buffer zone during any stage of the works, the ECoW would stop work until it can be determined that disturbance has subsided*". We advise that disturbing the birds, then stopping works after the disturbance has occurred, would still be classed as a disturbance of a Schedule 1 species, as the disturbance event will have already occurred.

4.30 We therefore advise that the detailed CEMP should include a commitment that, if construction works are due to be undertaken between April and July inclusive, and if there is any habitat with the potential to be used for little tern nesting within 300m of the development, the Ecological Clerk of Works (ECoW) should check for little tern breeding activity before any works are undertaken. If nesting little tern are present within 300m of the proposed development, no works should be undertaken.

Decommissioning

4.31 Decommissioning and restoration measures should be agreed prior to the expiration of the planning permission and implemented to prevent any long-term environmental impacts as a result of the development. We therefore advise that a detailed decommissioning condition is attached to any planning permission granted for this application that includes but is not limited to:

(a) Ecological surveys and assessment to inform the detail of decommissioning works,

(b) Following (a) the submission of a decommissioning plan to the satisfaction of the LPA. Provisions of the plan to include, but not be limited to:

- Defined nature conservation after-use site restoration objectives,
- Method statements including timings and duration, and,
- Land tenure post decommissioning to be approved by the LPA with decisions materially informed by the definition of a "responsible" body under Part 7 of the Environment Act 2021.

Management Agreement

4.32 We note that Chapter 9 of the ES refers to the Management Agreement dated June 2000, which was entered into in accordance with the power contained in Section 16 of the National Parks and Access to the Countryside Act 1949. However, no reference is given to extant Section 106 obligations. We therefore advise that any planning permission granted for the application at Point of Ayr includes an appropriate updated Section 106 Agreement, in perpetuity, which includes:

a) Continued requirement for, and reference to, the Section 16 Management Agreement and the four associated and underpinning management plans;

b) Provision of resources for management, surveillance and wardening [including actions associated with the restoration and enhancement of current conservation status for habitats and species identified by NRW] for at least the construction, operation and decommissioning phases of the proposal;
c) Reporting of actions to the relevant local biological records centre;
d) The tenure of land identified as being of conservation interest including all land subject to statutory nature conservation designations shall only be transferred to a body that accords with the definition of a "responsible" body under Part 7 of the Environment Act 2021; and,
e) Confirmation that the land subject to the nature conservation designations and Section 16 management agreement shall only be used for nature conservation purposes for the duration of operation and decommissioning phases of the proposal.

4.33 In the event that planning permission is granted NRW would welcome further discussions with the Applicant regarding the scope of any updates to the extant management plans and would advise that these consider:
a) Actions that require licensing under protected species regulatory regimes,
b) Inclusion of management prescriptions for sand lizard and natterjack toad,
c) Required skills and competencies, and,
d) Aims and objectives informed by the conservation status concept listed in the Bonn Convention and in accordance with Part 3 of EC Guidance Note C (2021) 7301.

4.34 As part of the Environment (Wales) Act Section 6 duty we wish to highlight that there is an opportunity for your Authority, to explore further biodiversity enhancement at the Point of Ayr site. For example, a management plan, established through a Section 106 agreement, with the intention of positive conservation management to encourage the use by feeding and roosting over-wintering estuarine bird features and to encourage breeding of wader species such as redshank (*Tringa totanus*), for the colliery field, centred upon grid reference SJ13029, 82882 (between SJ12603, 83331 & SJ13281, 82591), post-completion of the works. Although outwith the red line boundary of this application, we understand the field is within the applicant's ownership and within the Dee estuary SSSI/SPA/Ramsar site. Management prescriptions could aim to replicate those already made and agreed for the Warren Farm management plan. The management plan could become a component part of an amendment to the existing section 16 management agreement between Eni and NRW.

4.35 We would welcome the opportunity to provide further advice regarding management plans if the LPA is minded to approve the proposal.

5) Contamination

Detailed Construction Environmental Management Plan

5.1 We advise that the detailed CEMP should outline a risk assessment methodology for how unexpected contamination would be dealt with. Other risks may consist of unusually high groundwater and high seepage rates, potentially of contaminated groundwater. The detailed CEMP should therefore provide a methodology for managing such risks.

5.2 We note that groundwater within the Point of Ayr area is within a few metres of the ground surface and becomes shallower towards the coast. The groundwater is likely to be saline and under a tidal influence. However, the spatial extent of the saline intrusion and tidal influence does not appear to have been defined. We therefore advise that this information should be provided in the detailed CEMP.

5.3 Groundwater levels at the BVSs have not been determined although the information in paragraphs 1.2.36 and 1.2.37 of Appendix 18.1 – Assessment of Likely Effects suggests that they may be a few metres below the ground surface in these locations. However, it is unknown when the Trial Pits were excavated and hence whether the conditions reported are for drier periods of the year. Wet winters may increase groundwater levels in shallow aquifers and superficial deposits although levels would also be influenced by the degree to which rainfall can recharge into the local ground. We therefore advise that clarification is provided about this in the detailed CEMP.

5.4 Figure 18.3: Groundwater Dependent Terrestrial Ecosystems shows the extent of GWDTE in the vicinity of the PoA area. A risk assessment to determine the nature of interaction with the GWDTE arising from the construction and operation of the upgraded PoA area does not appear to have been completed. We therefore advise that the following information should be provided in the detailed CEMP:

- the sequencing and duration of particular tasks and phases required to deliver the particular infrastructure for the project such as the works required to upgrade the PoA terminal, and the works associated with the foreshore and cabling.
- clarification about how much the current ground profile at the PoA Terminal and BVSs would need to be altered including the excavation, treatment if necessary and reuse/removal of Made Ground, in order for the PoA Terminal to be prepared for construction such as for the piled foundations or the proposed cabling.
- the degree to which GWDTE would be interacted with by the proposed works should be assessed in detail. The assessment should be based on a Preliminary Construction Plan which would then be amended as more detail is made available as to how the proposed engineering works would be performed.

5.5 We note that a Groundwater Management and Monitoring Plan (GWMMP) would be implemented alongside the detailed CEMP. We advise that the scope of this plan should include consideration of dewatering impacts to the Gronant Dunes and Talacre Warren SSSI and we would wish to be a named party for consultation on this

document at the Discharge of Condition stage. The proposed GWMMP should be informed by the detailed CEMP.

5.6 We also note that the Materials Management Plan, Soils Management Plan, Dewatering Management Plan and Earthworks Specification would be included in the detailed CEMP. We would therefore wish to be a named party for consultation on this document at the Discharge of Condition stage.

5.7 We also advise that the following conditions regarding ground contamination should be applied to any planning permission granted for the proposals:

Condition 1: Land affected by contamination

No development or phase of development, in a specific parcel of land known to be / suspected of contamination, shall commence until the following components of a scheme to deal with the risks associated with contamination at the site, has been submitted to and approved in writing by the Local Planning Authority.

1. A preliminary risk assessment which has identified:
   - all previous uses
   - potential contaminants associated with those uses
   - a conceptual model of the site indicating sources, pathways and receptors
   - potentially unacceptable risks arising from contamination at the site

2. A site investigation scheme, based on (1) to provide information for a detailed assessment of the risk to all receptors that may be affected, including those off site.

3. The results of the site investigation and the detailed risk assessment referred to in (2) and, based on these, an options appraisal and remediation strategy giving full details of the remediation measures required and how they are to be undertaken.

4. A verification plan providing details of the data that will be collected in order to demonstrate that the works set out in the remediation strategy in (3) are complete and identifying any requirements for longer-term monitoring of pollutant linkages, maintenance and arrangements for contingency action.

The remediation strategy and its relevant components shall be carried out in accordance with the approved details.

Justification: To ensure the risks associated with contamination at the site have been fully considered prior to commencement of development as controlled waters are of high environmental sensitivity; and where necessary remediation measures and long-term monitoring are implemented to prevent unacceptable risks from contamination.

Condition 2: Contamination verification report

Prior to the occupation or operation of the development or phase of development, a verification report demonstrating completion of works set out in the approved remediation strategy and the effectiveness of the remediation shall be submitted to and approved in writing by the Local Planning Authority. The report shall include results of sampling and monitoring carried out in accordance with the approved verification plan to demonstrate that the site remediation criteria have been met. It shall also include a long-term monitoring and maintenance plan for longer-term monitoring of pollutant linkages, maintenance and arrangements for contingency action, as identified in the verification plan. The long-term monitoring and maintenance plan shall be carried out in accordance with the approved details.

Justification: To ensure the methods identified in the verification plan have been implemented and completed and the risk associated with the contamination at the site has been remediated prior to occupation or operation, to prevent both future users of the land and neighbouring land are minimised, together with those to controlled waters, property and ecological systems, and to ensure that the development can be carried out safely without unacceptable risks to workers, neighbours and other offsite receptors.

Condition 3: Long-term monitoring plan

Prior to the occupation or operation of the development or phase of development, a long-term monitoring plan for land contamination shall be submitted and approved in writing by the Local Planning Authority. The long-term monitoring plan should include:

- Details of the methods and triggers for action to be undertaken
- Timescales for the long-term monitoring and curtailment mechanisms *e.g.,* a scheme of monitoring for 3 years unless the monitoring reports indicate that subsequent monitoring is or is not required (for x years)
- Timescales for submission of monitoring reports to the LPA *e.g.,* annually
- Details of any necessary contingency and remedial actions and timescales for actions
- Details confirming that the contingency and remedial actions have been carried out

The monitoring plan shall be carried out in accordance with the approved details, within the agreed timescales.

Justification: A land contamination long-term monitoring plan should be submitted prior to occupation or operation, to ensure necessary monitoring measures are approved to manage any potential adverse impacts as a result of development on protected sites, habitats and water quality.

Condition 4: Unsuspected contamination

If, during development, contamination not previously identified is found to be present at the site then no further development (unless otherwise agreed in writing with the Local Planning Authority) shall be carried out until a remediation strategy detailing how this unsuspected

contamination shall be dealt with has been submitted to and approved in writing by the Local Planning Authority. The remediation strategy shall be carried out as approved.

Justification: To ensure the risks associated with previously unsuspected contamination at the site are dealt with through a remediation strategy, to minimise the risk to both future users of the land and neighbouring land, and to ensure that the development can be carried out safely without unacceptable risks.

Condition 5: Surface water drainage

No infiltration of surface water drainage into the ground at the PoA/BVS sites is permitted other than with the express written consent of the local planning authority, which may be given for those parts of the site where it has been demonstrated that there is no resultant unacceptable risk to controlled waters. The development shall be carried out in accordance with the approval details.

Justification: To prevent both new and existing development from contributing to or being put at unacceptable risk from or being adversely affected by unacceptable levels of water pollution.

Condition 6: Piling

No development or phase of development shall commence until details of piling or any other foundation designs using penetrative methods sufficient to demonstrate that there is no unacceptable risk to groundwater have been submitted to and approved in writing by the Local Planning Authority. The piling/foundation designs shall be implemented in accordance with the approved details.

Justification: Piling/foundation details should be submitted to ensure there is no unacceptable risk to groundwater during construction and methods/design are agreed prior to the commencement of development or phase of development.

6) Biosecurity

6.1 We consider the submitted assessment and conclusions to be satisfactory, although we advise that Chytrid (an amphibian fungus) has been recorded at Talacre. We note that an Invasive Species Management Plan is proposed in the REAC (Document T.5.3) and outline OCEMP (Document T.5.1). We advise that the following condition is attached to any planning permission granted for the proposals:

Condition: No development, including site clearance, shall commence until a Biosecurity Risk Assessment, and Method Statement that considers invasive non-native species and specific diseases (e.g., Chytrid) has been submitted to and approved in writing by the Local Planning Authority. The risk assessment shall include measures to prevent the introduction of and where present control, removal or for the long-term management of invasive species both during construction and operation. The risk assessment shall consider landscaping and other related plans.

The Biosecurity Risk Assessment shall be carried out in accordance with the approved details.

Justification: To ensure that an approved Biosecurity Risk Assessment is implemented to secure measures to prevent or control the spread and effective management of any invasive non-native species and listed diseases at the site.

7) Water quality

7.1 We note that a 10m³ containment sump will be present to contain spillages of any drilling fluid and a plant-friendly alternative to bentonite would be used during HDD. HDD drilling fluids should be managed to ensure that there is no potential for interaction with water courses. Measures to achieve this should be described in the detailed CEMP, including the process for decommissioning any temporary containment sumps.

7.2 We note that pollution, sediment mobilisation and sewage management referred to in ES Chapter 18 (para. 18.8.1) would be addressed via the detailed CEMP. While we agree with the water quality aspects of the Outline CEMP, we note that the detailed CEMP would include a sediment management plan and a surface water monitoring and management plan. We would therefore wish to be a named party for consultation on the detailed CEMP during the Discharge of Condition stage.

8) Other Matters

8.1 Our comments above only relate specifically to matters included on our checklist, *Development Planning Advisory Service: Consultation Topics* (September 2018), which is published on our website. We have not considered potential effects on other matters and do not rule out the potential for the proposed development to affect other interests.

8.2 We advise the applicant that, in addition to planning permission, it is their responsibility to ensure they secure all other permits/consents/licences relevant to their development. Please refer to our website for further details.

8.3 If you have any queries on the above, please do not hesitate to contact us.

Yn gywir / Yours faithfully,

Chris Jones
Uwch Gynghorydd - Cynllunio Datblygu / Senior Advisor - Development Planning
Cyfoeth Naturiol Cymru / Natural Resources Wales

Appendix A: Advice for the Applicant/Developer

The following advice is provided for the Applicant/Developer, and we would therefore be grateful if you could share it with them.

Environmental Permitting (England and Wales) Regulations 2016

The Point of Ayr terminal is currently regulated by NRW under the Environmental Permitting (England and Wales) Regulations 2016 for the refining of gas. The Operator should continue to communicate with NRW regarding the permit surrender, land condition requirements and other permit requirements.

Marine License

We would welcome clarification on when the Applicant intends to apply for the Marine License for the works from the Mean High Water Spring tidal limit to the Douglas offshore platform.

Flood Risk Activity Permit

For open cut crossings located on main rivers, a bespoke Flood Risk Activity Permit (FRAP) would be required under the Environmental Permitting (England and Wales) Regulations (EPR) 2016, for both the permanent and temporary works. The permanent works application would need to include details such as depth of cover beneath the bed of the main river and level of pipe/cable within an 8m/16m distance from the banks of the main river, and the final route alignment. A temporary works application would need to be supported by a detailed method statement, including the cable's installation method and how flood risk would be managed during installation. Service crossings below the bed of a main river using trenchless techniques (such as Horizontal Directional Drilling) can be registered as an exempt flood risk activity under the EPR 2016, subject to certain key conditions being met as per part 4 of Schedule 3 of the EPR 2016. A FRAP may also be required for any works in, over, under or within 8m of a fluvial main river (including any defences on that main river), or 16m of a tidal main river (including any defences on that main river), or within a flood plain. Please see our website for further information: Natural Resources Wales / Flood risk activity permits.

Abstraction/impoundment licenses

We note from paragraph 18.5.17 (Chapter 18, ES) that an abstraction licence would not be required for any temporary dewatering activities. We acknowledge that NRW's website states that an abstraction licence is not required when "*draining water (dewatering) to prevent interference with building or engineering works, where the abstraction lasts for less than 6 consecutive months, subject to restrictions*" and also an abstraction licence is not required if the abstraction is less than 20 cubic metres per day. However, during the construction phase we advise that the applicant should consider any dewatering activities on a site-by-site basis and if necessary, obtain further advice from NRW to confirm whether the activity is exempt or requires an abstraction or impoundment licence.

Species licensing

Although we acknowledge the low risk of Great Crested Newts (GCN) being present, we advise the applicant to consider applying for an EPS license on a precautionary basis to minimise delays in the event that GCN were discovered on site.

Regarding natterjack toad, we advise that the works should be carried out in accordance with the provisions of an appropriate EPS license issued by NRW under Regulation 55 (2) (e) of the Conservation of Habitats and Species Regulations 2017 (as amended).

We note that the assessment implies that only significant disturbance would require an EPS license for sand lizard. We advise that significance is not a statutory criterion when considering the requirement for EPS licenses and any activity that causes disturbance is subject to licensing. We therefore advise that works are to be carried out in accordance with the provisions of an appropriate sand lizard EPS license issued by NRW under Regulation 55 (2) (e) of the Conservation of Habitats and Species Regulations 2017 (as amended).

We note the Applicant's comments in respect of EPS licensing and otters. We advise that EPS licenses for otters may be required if features are confirmed that could function as otter breeding sites or resting place within 30m of any water course and/or works are considered to have the potential to cause disturbance to otters.

We advise the Applicant that as currently proposed, the works could cause disturbance to little tern. We advise that as little tern is listed as a Schedule 1 species in the Wildlife and Countryside Act 1981 (as amended), disturbance to little tern nests, eggs or dependent young is not permissible unless licenced by NRW through a Schedule 1 disturbance license.

Lead Local Flood Authority

Flintshire County Council drainage department in their capacity as lead local flood authority may be able to advise on any local problems in relation to surface water disposal and any associated flood risk.

HyNet North West

TECHNICAL NOTE – Biodiversity

DATE:	01 August 2023	**CONFIDENTIALITY:**	Public
SUBJECT:	Biodiversity		
PROJECT:	HyNet TCPA – PoA Terminal and Foreshore Works	**AUTHOR:**	MB, MH, BH & SS
CHECKED:	NP	**APPROVED:**	JF

1. INTRODUCTION

1.1. PURPOSE OF THIS DOCUMENT

1.1.1. This document has been prepared on behalf of Liverpool Bay CCS Limited ('the Applicant'), who intends to construct new, and modify existing, infrastructure associated with underground natural gas pipelines and equipment within the Point of Ayr (PoA) Terminal in Flintshire to operate with carbon dioxide (known hereafter as the 'Town and Country Planning Act (TCPA) Proposed Development'). Two separate full Planning Applications were submitted to Flintshire County Council (FCC), one for the three Block Valve Stations (BVS) located along the route of the existing natural gas pipeline (ref. FUL/000633/23), and the other for the PoA Terminal and Foreshore Works (ref. FUL/000246/23), with this document providing clarifications on the PoA Terminal and Foreshore Works application.

1.1.2. Natural Resources Wales (NRW) and FCC have each provided statutory consultation responses following reviews of the Environmental Statement (ES) and Habitats Regulations Assessment (HRA) report submitted as part of the Planning Application for the PoA Terminal and Foreshore Works (ref: FUL/000246/23). Many of these comments relate to requests for clarification on details of the works proposed to be undertaken as part of the TCPA Proposed Development and their potential impacts on Important Ecological Features. These, in turn, largely relate to the Foreshore Works and the specific methods to be employed to allow the works to be completed within an ecologically sensitive area.

1.1.3. This document provides the Applicant's response to NRW and FCC's comments relating to biodiversity. This document provides clarifications of the working methods to be employed during the Foreshore Works (including timings, equipment, and specific areas to be affected) in **Section 2**. These are referred to throughout the direct responses to each comment from NRW and FCC in **Tables 3.1** and **3.2**. The intention is for this document to clarify the ES and HRA reports, providing additional clarity to support the information previously submitted.

1.1.4. This document is supported by the following two technical appendices:

- **Appendix A Offshore Environmental Statement Report (Draft), Physical Processes Technical Report**
- **Appendix B Soil Temperature Analysis – P908 Onshore Pipeline (Extended)**

1.2. THE TCPA PROPOSED DEVELOPMENT

1.2.1. The TCPA Proposed Development will form part of the wider HyNet North West Project (the 'Project'). The Project is an innovative low carbon hydrogen and carbon capture, transport and storage project that will unlock a low carbon economy for the North West of England and North Wales and put the region at the forefront of the UK's drive to net zero. The details of the project can be found in the main TCPA documentation. The TCPA Proposed Development is solely for the carbon dioxide capture and transport segment of the wider Project.

1.2.2. The TCPA Proposed Development comprises the construction (including the removal and / or replacement of existing equipment, known as 'disinvestment'), operation, and decommissioning of the PoA Terminal and associated infrastructure, and the construction of three BVSs.

1.2.3. The modification to the existing PoA Terminal includes disinvestment of redundant natural gas infrastructure that cannot be used with carbon dioxide and installing new plant and equipment (such as a carbon dioxide compression system), so the PoA Terminal can function with carbon dioxide. The Foreshore Works includes removing the existing Shut Down Valve, which is installed on the Foreshore Pipeline (west of the PoA Terminal); using the existing PoA to Douglas Pipeline to transport carbon dioxide for safe storage in Liverpool Bay; and the installation of electric power cables and fibre optic cables (the Foreshore Cables).

1.2.4. A full description of the Proposed Development is detailed in **Chapter 3 – Description of the TCPA Proposed Development** (Document Reference: T.4.2.3) of the ES.

2. OVERVIEW OF CABLE INSTALLATION TECHNIQUES

2.1. OVERVIEW

2.1.1. The offshore cables will be installed across the inter-tidal area using either plough trenching, cable trenching or a combination of both these installation techniques, depending on ground conditions along the specific cable route. The installation techniques discussed in the following sections relate to the approximate 1,200m length of Foreshore Cable from the Horizontal Directional Drilling (HDD) exit pit, located just above Mean High Water Spring (MHWS) mark, to the Mean Low Water Spring (MLWS) mark. These methods of installation have been identified as the most appropriate, as their use would mean that intertidal material is neither removed from the area nor temporarily stored during excavation.

2.1.2. The electrical cable will be laid across the offshore seabed first and brought towards the shore, where it will be connected to a jack-up cable tensioner located at the MLWS mark. The cable will then be connected to the 'pull-in rope' that has been pulled down the beach from the HDD exit pit across rollers that have been laid out along the inter-tidal area at approximately 2m intervals. **Figure 1** shows a cross section of this arrangement.

2.1.3. **Photograph 1** shows a backhoe excavator next to the cable rollers, which would be used to guide the cable while it is being pulled from offshore towards the HDD exit pit.

2.1.4. Once the shore pull-in activity is completed, cable burial operation can be executed using a plough trencher or cable trencher.

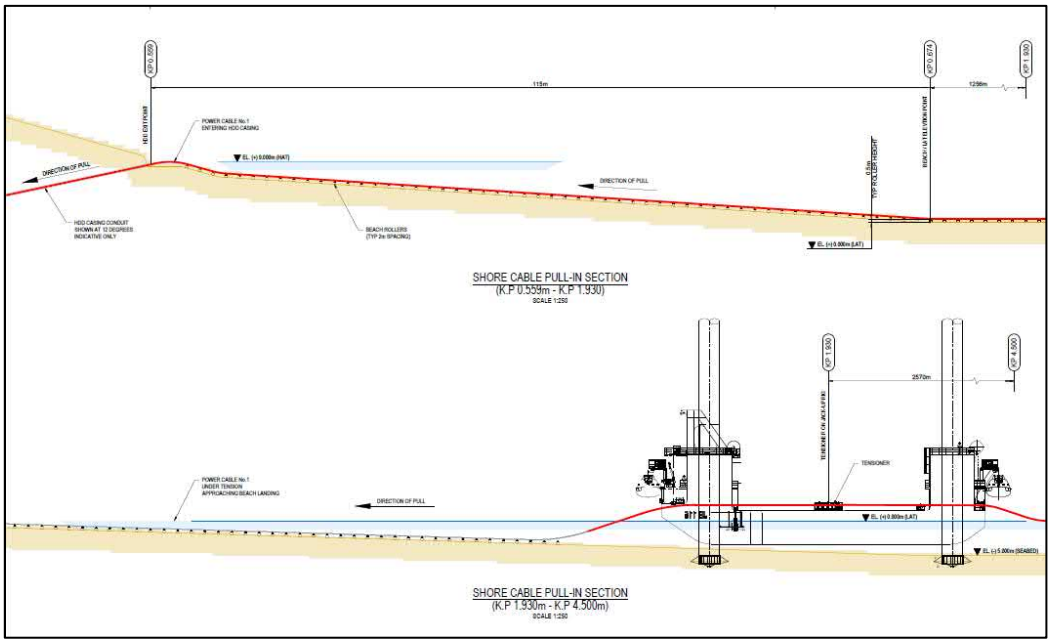


Figure 1: Cross section of cable lay and pull across the inter-tidal area from HDD exit pit to MLWS

Photograph 1: Photo of cable lay across an inter-tidal area, similar to Talacre Beach, from a HDD exit pit, to jack-up cable tensioner located at approximately MLWS mark. Rollers can be seen laid across the inter-tidal with an adjacent backhoe excavator to guide the cable

2.2. CABLE PLOUGH TRENCHING INSTALLATION TECHNIQUE

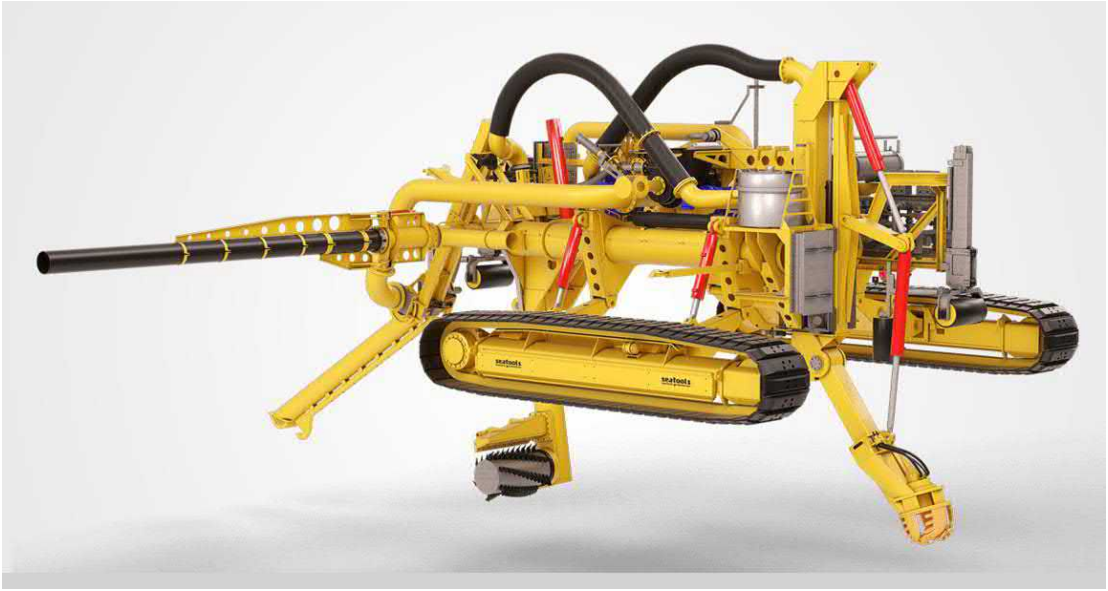
2.2.1. The plough trenching installation technique is expected to have a total working width of 15m, as this accounts for the overall width of the plough as it traverses the surface on its skis. The skis are designed to minimise the disturbance on the surface. The plough 'slices' a trench approximately 1-1.5m in width, while simultaneously burying the cable to the desired burial depth of 3m. This area of disturbance is localised between the plough skis. On this basis, the potential Zone of Disturbance (ZoD) under the cable burial equipment would be approximately 18,000m^2, with around 1,800m^2 (10%) of this area disturbed by either the plough or cutter blades.

2.2.2. A typical cable plough is illustrated in **Photograph 2**, showing the plough engaged. Some spoil does arise in this instance from the shearing action caused by the plough. The majority of sediment falls back into the trench as the plough progresses forwards, and the cable is placed at the base of the trench. These ploughs can trench through a wide variety of soils and are particularly suited to projects where long continuous lengths of cables are to be buried through variable ground conditions.

Photograph 2: Typical cable plough (Photo Credit Boskalis)

2.3. CABLE TRENCHING INSTALLATION TECHNIQUES

2.3.1. A similar ZoD would also result from the use of a cable trencher, albeit the cable trenchers tend to be self-propelled on tracks (rather than skis on the plough trencher), as shown in **Photograph 3**. Therefore, the impacts of cable trenching are expected to be similar to plough trenching.



Photograph 3: Example of a Typical Trencher

2.4. TIMETABLE

2.4.1. **Figure 2** shows a preliminary schedule for the construction works associated with the PoA Terminal. Please note that this is preliminary and subject to change.

2.4.2. **Figures 3** and **4** show the timetable for the laying and burial of the electrical and Fibre Optic (FO) cables.

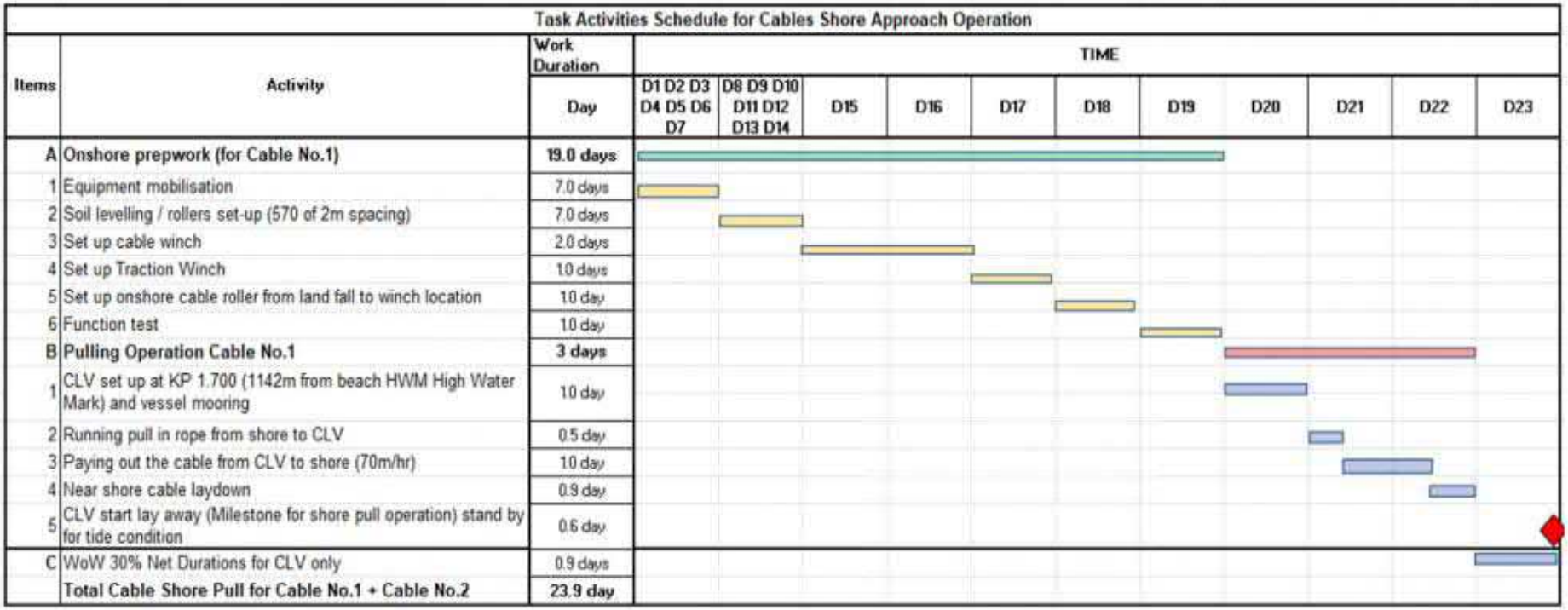
2.4.3. The allocated activity durations for the foreshore pull in operation are presented in **Figure 3**.

2.4.4. Details of activity durations for the cable burial are presented in **Figure 4**.

PRELIMINARY

	Weeks - October 2025 to May 2026																														
Point of Ayr Construction Activity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Mobilisation & Demobilisation	12	12	12																											12	12	6
Site Clearance & Prep		18	18	18	18	18																										
Excavation			6	12	12	12	12																									
Civils (inc Access Road, Paving)							6	6	6									12	12	12	12	12	12									
Piling			12	12	12																											
Foundations (inc Formwork & Rebar) & Backfill						18	18	18	18	18	18																					
Kiosk Building								18	18	18	18	18	18																			
Structural, Piperacks, Cable Trays									12	12	12	12	12	12	12																	
Mechanical / Piping										24	24	24	24	24	24	24	24	24	24													
E&I														36	36	36	36	36	36	36	36											
Commissionning																				12	12	12	12	12	12	12	12	12	12	12	12	
Finishing Works																														6	6	
Cable trenching																								8	8	8	8					
Cable HDD work																										12	15	15	20			
BVS removal																						12	12	12	12							

Figure 2: Preliminary PoA Terminal Construction Schedule



Task Activities Schedule for Cables Shore Approach Operation			
Items	Activity	Work Duration	TIME
		Day	D1 D2 D3 D4 D5 D6 D7 / D8 D9 D10 D11 D12 D13 D14 / D15 / D16 / D17 / D18 / D19 / D20 / D21 / D22 / D23
A	**Onshore prepwork (for Cable No.1)**	**19.0 days**	
1	Equipment mobilisation	7.0 days	
2	Soil levelling / rollers set-up (570 of 2m spacing)	7.0 days	
3	Set up cable winch	2.0 days	
4	Set up Traction Winch	1.0 days	
5	Set up onshore cable roller from land fall to winch location	1.0 day	
6	Function test	1.0 day	
B	**Pulling Operation Cable No.1**	**3 days**	
1	CLV set up at KP 1.700 (1142m from beach HWM High Water Mark) and vessel mooring	1.0 day	
2	Running pull in rope from shore to CLV	0.5 day	
3	Paying out the cable from CLV to shore (70m/hr)	1.0 day	
4	Near shore cable laydown	0.9 day	
5	CLV start lay away (Milestone for shore pull operation) stand by for tide condition	0.6 day	
C	WoW 30% Net Durations for CLV only	0.9 days	
	Total Cable Shore Pull for Cable No.1 + Cable No.2	**23.9 day**	

Figure 3: Foreshore Pull-in Operation Duration

Cable Burrial Task Durations											
Items	Activity	Work Duration	TIME								
		Day	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
A	**Cable No.1 Burrial**	**7.0 days**										
1	Mobilisation	2.5 days										
2	Cablle Burrial (rate 3000m/day)	1.5 days										
3	Intervention Works	2.5 days										
4	As-Built Survey	0.5 day										
B	WoW 30% Net Durations	2.1 days										
	Total Cable Shore Pull for Cable No.1	**9.1 days**										

Figure 4: Cable Burial Duration

2.4.5. The following conservative assumptions were taken into account:

- Total Cable Shore Pull Length – ~1700m.
- Cable Pull-in Winch Speed – 70m/hour.
- Allowable Tide Operational Window (during summer period) – approximately 8.2h/day. See **Figure 5**.
- Cable route bathy and seabed profile was assumed to be following existing 20" PoA - Douglas pipeline.

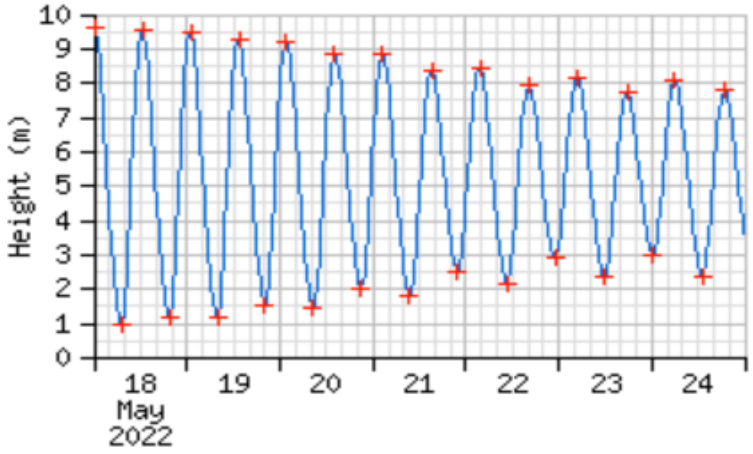


Figure 5: Tide Chart for May 2022

2.4.6. It cannot be guaranteed that the cable installation across the inter-tidal area would only be carried out at low tide. There are many factors that would influence the timing that cannot be guaranteed at this time.

2.5. BENTHIC INVERTEBRATES

2.5.1. It should be noted that The Crown Estate (TCE) commissioned RPS Group Limited (RPS) to undertake a desk study to collate information on offshore electrical cable installation techniques and seabed recovery, in support of the Plan Level HRA for Offshore Wind Leasing Round 4 (**Ref. 1**).

2.5.2. This study examined benthic community data, following cable plough installation of the North Hoyle offshore wind farm export cable in 2003. It concluded benthic community data collected along the cable route (although not directly over the cable), in areas of gravelly sand, were very similar to other inshore control sites indicating no significant impact. The absence of any identifiable trend in sediment particle size characteristics associated with construction suggests that there has been no subsequent effect on the benthic invertebrate communities.

2.6. SEDIMENT DISPERSION

2.6.1. The preliminary results from the sediment dispersion numerical modelling, carried out for the offshore Environmental Impact Assessment (EIA) are presented within **Appendix A Offshore Environmental Statement Report (Draft), Physical Processes Technical Report (RPS, 2023).** Whilst this indicates suspended sediment plumes from cable installation activities show periods of increased turbidity, the suspended material is retained within the sediment cell and therefore would be subsequently assimilated into the existing sediment transport regime. The sediment dispersion numerical modelling also indicated that the majority of material would be deposited within 30m of the cable laying operations, with a peak deposition of 175mm of sediment, with coarser material being deposited close to the cable trencher. It also showed that suspended sediments may reach into the Dee Estuary during cable installation, but generally do so at background levels, i.e., 30mg/l (**Ref. 2**).

2.7. SOIL TEMPERATURE ANALYSIS

2.7.1. With regards to the soil temperature analysis for the TCPA Proposed Development, the analysis is now completed and is presented within **Appendix B Soil Temperature Analysis – P908 Onshore Pipeline (Extended) (Wood, 2023).**

2.7.2. Further detail in relation to the temperature analysis and findings is presented in **Tables 3.1 and 3.2** below, in relation to specific comments provided by NRW and FCC.

2.8. BIOSECURITY RISK ASSESSMENT

2.8.1. A Biosecurity Risk Assessment, required as part of the offshore EIA, will be submitted with the Marine Licence Applications, using the template supplied by NRW Marine Licencing Team (NRW-MLT). A Biosecurity Method Statement, approved by NRW-MLT, will then be implemented throughout the construction of the TCPA Proposed Development. The Biosecurity Method Statement will detail the locations and extent of any Invasive Non-Native Species (INNS) identified, alongside appropriate measures to control and prevent spread or propagation of INNS. High-level recommendations for the treatment and removal of INNS will be identified.

2.8.2. Appropriate good hygiene measures (e.g. Check, Clean, Dry methods) will be detailed. Workers should be equipped with the necessary equipment, Personal Protective Equipment (PPE) and substances to implement biosecurity control measures, including effective hygiene and sanitation practices.

2.9. VESSEL PROCUREMENT

2.9.1. The Applicant’s Marine Transportation Manual sets out its procedure for the ‘Technical Evaluation of vessels proposed for long term chartering’ for marine works that will be used in the tender process. When procuring naval services, a dedicated technical

specification is prepared, which contains the minimum technical requirements, as described in the following sections.

2.9.2. The technical specification is composed of the following three main parts:

1. Scope of Works (SoW): brief description of the activities to be carried out by the vessels.
2. Minimum Technical Requirements: minimum technical/safety requirements that the proposed vessels must fulfil. These are mainly related to the Classification Society, the vessel age, the reference codes and standards, safety system redundancy and vessel propulsion and power generator redundancy.
3. Additional Requirements: additional requirements related to particular aspects such as dynamic positioning system, on-board crane, helideck, deck load capacity, tank load capacity, accommodation, etc. These requirements must be defined by the relevant technical unit and discussed with the Applicant's logistic department.

2.9.3. During the call for tender phase, the bidders shall propose vessels in compliance with the requirements defined in the technical specifications. The technical screening of the vessels will be carried out by the Applicant.

2.9.4. In general, the technical evaluation of the proposed vessel (documentation review activity only) is composed of two main parts:

1. Compliance with the above-mentioned technical requirements by means of the vessel brochure;
2. Checking of the certificates and the compliance with the international regulations related to the vessel.

2.9.5. With regard to the above point 2, the bidders will be required to provide a variety of documentation, as applicable to the particular type of the proposed vessel based on the tonnage and whether the vessel is sailing domestic or international waters. This includes the following:

- Anti-Fouling System – Certificate of Compliance
- Ballast Water Management – Certificate of Compliance

2.9.6. These will demonstrate how the vessel will meet the requirements of the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM), and the International Convention for the Prevention of Pollution from Ships (MARPOL).

2.9.7. **Figure 6** shows an order of magnitude calculation for I a 33kV, three core x 630sqmm cable with a current rating of 750A (although the Applicant's will be less than this), along with grounded metallic sheath and buried to a 1m depth below the surface (the Applicant's cable has a target burial depth of 3m across the intertidal zone).

2.9.8. Unlike the AC export cables from offshore wind farms, the Applicant's cables for the TCPA Proposed Development are DC, so there will be no detectible electric fields external to the metallic sheath. However, the cable will generate static magnetic fields, which will not be screened by the metallic sheath.

2.9.9. The curves in the graph represent the anticipated magnetic field at 0m (purple), and 0.5m (black) distance from the top of the cable. Values are in microtesla (µT).

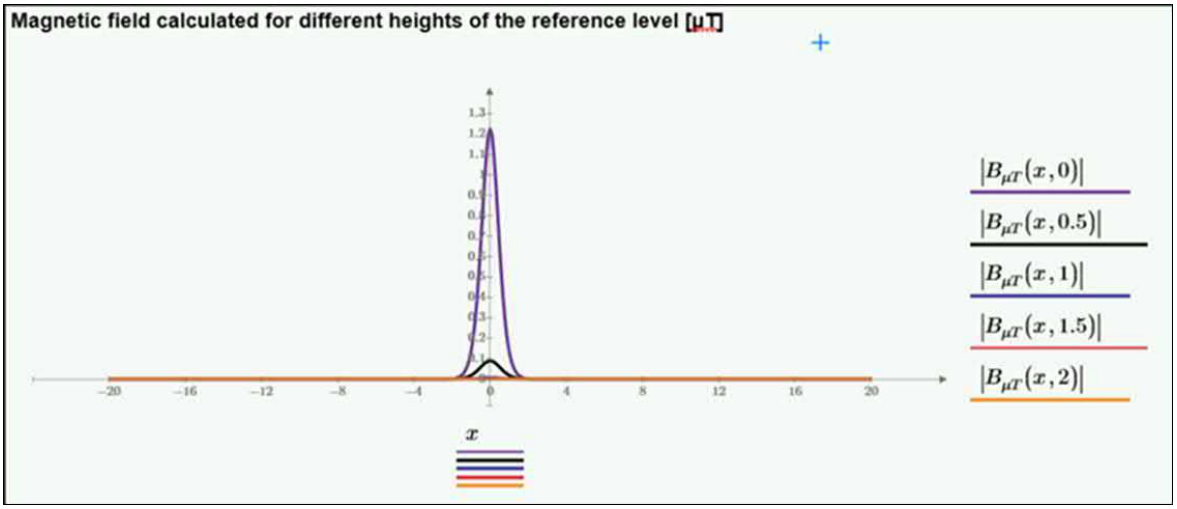


Figure 6: At the seabed (i.e. 1.0m above the cable) the magnetic field will be ~0.1uT, and at 0.5 m above the cable (i.e. 0.5m below the seabed) ~1.2uT

2.9.10. These are extremely low values, and these values are much lower than any of those cited from the published literature on the matter where effects may occur on marine life, for example CMACS (2003) (**Ref. 3**) and Gill et. al (2009) (**Ref. 4**).

3. THE APPLICANT'S RESPONSE

3.1. THE APPLICANT'S RESPONSE TO NATURAL RESOURCES WALES

3.1.1. **Table 3.1** details the comments from NRW following review of the ES and HRA report submitted as part of the Planning Application for the PoA Terminal and Foreshore Works (ref: FUL/000246/23). The Applicant's responses to these comments are also provided.

Table 3.1 – Comments from Natural Resources Wales and Responses

Comment Reference		Section:	NRW Comment:	Applicant's Response
1	1.4	Intertidal mudflats and sandflats	Environmental Statement (ES) Chapter 4: Consideration of Alternatives, paragraph 4.5.10 Foreshore Cables, explains that "*The yellow route was discounted, but the dashed yellow option may eventually be selected over the orange option depending on the shifting nature of the sand banks*". We advise that you seek clarification on whether the dashed yellow route is still in scope for this application and whether it has been assessed.	The dashed yellow and orange routes presented within **Insert 4-1** of **Chapter 4 Consideration of Alternatives (Document Reference: T.4.2.4)** of the ES both remain under consideration and were both assessed within the ES and HRA. The dashed yellow and orange routes are in the same location (east side of the existing PoA to Douglas Pipeline between MHWS and MLWS), following the same alignment up to the MLWS covered by the ES and HRA supporting the Planning Application FUL/000246/23. The benefit of the dashed yellow route is that it follows the orange route onshore, so it does not protrude east and provides a more accessible route for construction vessels. However, the issue associated with constructability between the two spits offshore remains (water rushes between the two spits at speed). Therefore, the dashed yellow route and the orange route are both still under consideration. The final choice will be made during detailed design. This is because each route requires bespoke cable installation vessels to implement, and the availability of the vessels cannot be confirmed at this time. Sediment dispersion modelling has been

Comment Reference		Section:	NRW Comment:	Applicant's Response
				carried out for the reasonable worst-case installation scenario, and both options are being assessed in the Offshore EIA that will support the Marine Licence application to NRW-MLT.
2	1.5	Intertidal mudflats and sandflats	With reference to ES Chapter 9: Biodiversity, para. 9.5.21, Impact assessment methodology, Duration, we advise that habitat loss longer than 5 years should be classed as long-lasting. This is based on the reporting cycle requirements outlined in Article 6a of the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019.	**Section 9.5.21** of **Chapter 9 Biodiversity** of the **ES (Document Reference: T.4.2.9)** defines the criteria for the duration of time an impact/effect is expected to last. Short-term is considered to be up to one year; medium-term is considered to be between one and 10 years and long-term is considered to be greater than 10 years. The Applicant notes NRW's advice on the length of time against which habitat loss should be considered long-term. Notwithstanding, due to the temporary nature and scale of the cable laying works, as well as the composition of the macrofaunal communities present, rapid recolonisation of disturbed sediment is expected within two years. Therefore, this remains a medium-term impact and would not change the impact assessment or conclusions of the ES. It should also be noted that the area in which the works will be undertaken is classed a depositional area, so any trenches will be quickly infilled over a short period of time.
3	1.6	Intertidal mudflats and sandflats	In ES Chapter 9, para. 9.8.7 the applicant proposes the use of a plough to excavate a trench and bury the cable within the intertidal zone. However, in ES Chapter 3: para. 3.4.58, the applicant notes that whilst the use of a plough is the preferred option, if proved to be unsuitable for	The use of a cable trencher as opposed to a cable plough could result in a greater area of impact due to the potential impacts of sediment compaction from the trencher's tracks. This could potentially result in an estimated impacted area of 18,000m^2 using the trencher compared to an estimated 1,800m^2 using the plough. Notwithstanding the above, the impacts from sediment mobilisation on receptors will be the same as that for the plough methodology, as the area of sediment mobilisation will be the same for both methods.

Comment Reference		Section:	NRW Comment:	Applicant's Response
			the cable installation then a cable trencher will be employed. Potential impacts to intertidal habitats from the use of a cable trencher (including the recovery time) are greater than that of the use of a plough. We therefore advise that the worst-case scenario (i.e., the use of the cable trencher) should be assessed, in line with the Rochdale Envelope approach. This equally applies to the consideration of water quality impact in the HRA.	As discussed in the response to comment reference 2 above, due to the temporary nature and scale of cable laying works, combined with the cable laying works being located within a depositional area for sediment, any trenches will be quickly infilled over a short period of time. Furthermore, rapid recolonisation of disturbed sediment is expected within two years. Therefore, in a worst-case scenario, the use of a cable trencher is still anticipated to have the same medium-term impact presented within the submitted ES and HRA on the intertidal habitat in the absence of any additional mitigation.
4	1.7	Intertidal mudflats and sandflats	Potential impacts to the Annex I mudflat and sandflat habitat from siltation and turbidity effects and accidental pollution during construction have been identified in ES Chapter 9: para. 9.9.25 but have not subsequently been assessed. Furthermore, several potential impacts resulting from the cable installation activities that could have an impact on the Annex I mudflat and sandflat habitat have not been assessed. We therefore advise that the following	Temporary disturbance of priority habitat/Annex I mudflat and sandflat habitat will be caused by the cable installation works through the foreshore, by either a cable plough or cable trenching machine. Sediment disturbed during the installation will be backfilled by the machine, so loss would be temporary and localised. If using the cable trenching machine (worst-case scenario) and in the absence of any additional mitigation, an area of approximately 18,000m^2 (1.8 ha) would be impacted. This includes the area of sediment directly disturbed by the installation of the cable and the area of sediment potentially compacted under the tracks of the machine. Based on this information, the area of habitat within the red line boundary to be temporarily disturbed is expected to be 18.40% of the total intertidal mudflats and sandflats habitat area within the red line boundary of the TCPA Proposed Development,

Comment Reference		Section:	NRW Comment:	Applicant's Response
			potential impacts should be scoped in and assessed: • Impacts from accidental pollution events • Impacts from increases in suspended sediment concentration and associated deposition (siltation and turbidity effects). This includes impacts from cable installation and repair/maintenance activities and indirect impacts to intertidal habitats (including the Annex I mudflats and sandflats feature) from increased suspended sediment and smothering from suspended sediment plumes generated during construction. This is of particular importance if a cable trencher is used. • Release of sediment bound contaminants – Disturbance of the seabed during	although only 0.017% of the extent of the mudflats and sandflats habitat within the Dee Estuary SAC. Due to the temporary and localised nature of the works and the habitats present, it is considered that effects will be of Minor adverse significance (therefore not significant). Potential impacts resulting from the cable installation activities on the Annex I mudflat and sandflat habitat have been considered and are discussed below. There would be no changes to the overall conclusions of the **ES** and **HRA**: • Accidental pollution events during construction activities have the potential to impact the mudflat and sandflat habitats, through release of industrial chemicals such as fuel and lubricants. As the intertidal works will be undertaken at low tide where possible, it will allow any potential pollution events to be contained and localised to the works area. This would therefore reduce the potential for spread and scale of impacts. If a spill occurs during high tide works, the release will be dispersed through tidal flow, thus reducing the severity of the spill. In addition to these factors, the species present within the works area are of medium sensitivity to pollution and have a medium resistance (to hydrocarbons and synthetic compounds) and have the ability to recolonise areas relatively quickly. Accidental pollution events and control measures will be detailed within the detailed CEMP and standard procedures will be followed in order to reduce potential impacts. Pollution controls are currently detailed within measures **T-GN-002, T-BD-017** and **T-BD-019** the **REAC (Document Reference: T.5.3)** and **Section 4.2** of the **OCEMP (Document Reference: T.5.1).**

Comment Reference		Section:	NRW Comment:	Applicant's Response
			construction, operation and decommissioning activities could cause toxicity effects through mobilisation of contaminated sediment during preparation works, cable laying and cable repair activities, which could impact the surrounding benthic communities. • Introduction and spread of invasive non-native species via marine vessels proposed to be used as part of the cable installation works. • Impacts from electromagnetic fields (EMF) With reference to ES Chapter 9: para. 9.9.93, potential EMF impacts from the operation of the cables have been assessed against the fish species that were recorded within the Dee Estuary SAC. As noted by the applicant, many benthic invertebrate species are	• The release of sediment-bound contaminants during cable laying and cable maintenance activities has the potential to impact benthic communities through toxicity effects. However, where possible the works will be undertaken at low tide and the trenches would be backfilled through natural deposition. As such, this reduces the potential impacts, which will be localised in nature. In addition, the species present within the works area are of medium sensitivity and resilience to chemical pressures and are able to recolonise rapidly. Therefore, the effects from sediment-bound contaminant release are likely to be negligible (not significant). • As described **Section 1.7.3** of **Appendix A Offshore Environmental Statement Report (Draft), Physical Processes Technical Report,** suspended sediment plumes for seabed preparation activities were quantified. In all cases, the material released was native to the bed sediments and, although there are periods of increased turbidity, the material was retained in the sediment cell and would be subsequently assimilated into the existing sediment transport regime. Suspended sediments may reach into the estuary during cable trenching from PoA to Douglas, but generally do so at background levels, i.e., 30mg/l. As such, significant effects are not predicted. • Mobilisation of specialised vessels in order to undertake the cable laying work has the potential to introduce INNS, through release of ballast water and from larval release from

Comment Reference		Section:	NRW Comment:	Applicant's Response
			known to be able to detect EMF. There is some evidence that EMFs affect crustacea behavioural patterns which would potentially include certain species under Section 7 (Environment Wales Act 2016) e.g., crawfish Palinurus elephas. We advise that these should be reviewed and assessed (where appropriate) as part of the application.	the hulls of vessels. As the vessels will be moored below MLWS and will offload the cable into the intertidal zone, the spread of INNS will be controlled by the implementation of a Biosecurity Risk Assessment as described in **Section 2.8 Biosecurity Risk Assessment**. Biosecurity mitigation measure detailed within **T-BD-032** of the **REAC (Document Reference: T.5.3)** and **OCEMP (Document Reference: T.5.1)** • The Electro Magnetic Field (EMF) generated by the cables is likely to be ~0.1µT at the seabed for a cable buried at 1m deep, which is below the levels which have impacts upon marine life, including fish and marine invertebrates (as detailed above in **paragraph 1.1.3**). In addition, the cables will be buried 3m below the surface through the intertidal zone, which will mean that the EMF at the surface will be even less than the ~0.1µT. Furthermore, the habitats present along the intertidal section of the cable route – intertidal sand and mudflats – are not optimal for species such as the crawfish *Palinurus elephas*, which has a habitat preference of rocky exposed coasts with depths of 5-400m. In addition to this, the desk study and field surveys did not identify any other benthic invertebrates that are sensitive to EMF. Therefore, the potential effects are likely to be negligible (not significant). • Cable repair activities would be no worse in terms of potential impacts than installation activities already assessed.

Comment Reference		Section:	NRW Comment:	Applicant's Response
5	1.8	Intertidal mudflats and sandflats	With reference to ES Chapter 9: para. 9.9.21, we advise that clarification is sought on what activity is expected to result in the "*loss of sections of intertidal mudflat S7 Priority habitat/mudflat and sandflat Annex I habitat"* and what area of habitat loss this equates to. We would not expect any long-lasting habitat loss as a result of the cable trenching as the trench would be backfilled.	Temporary disturbance (rather than loss) to priority habitat will be caused by the installation of the cable installation works through the foreshore, by either a cable plough or cable trenching machine. The term disturbance has been used in this response as the Applicant agrees that there would be no long-term habitat loss given the backfilling of the trench. If using the cable trenching machine (worst-case scenario) and in the absence of any additional mitigation, an area of approximately 18,000m^2 (1.8 ha) would be impacted. This includes the area of sediment directly disturbed by the installation of the cable and the area of sediment potentially crushed under the tracks of the machine. Based on this information, the area of habitat within the red line boundary of the TCPA Proposed Development to be temporarily disturbed is expected to be 18.40% of the total intertidal mudflats and sandflats habitat area, although only 0.017% of the extent of the mudflats and sandflats habitat within the Dee Estuary SAC. Sediment disturbed during the installation will be backfilled by the machine, subsequent infilling from deposited suspended sediments, as well as natural deposition, so disturbance would be temporary and localised.
6	1.9	Intertidal mudflats and sandflats	Based on the sensitivity of the biotopes to the impact and the expected recovery rate we do not expect the impact from temporary habitat loss, and/or disturbance from the cable installation on the biotopes that were encountered during the Phase I Habitat Survey, to be of major and/or moderate significance. This impact is	Please see response to comment reference 5 above. Due to the temporary and localised nature of the works and the habitats present, the Applicant agrees that effects would not be of moderate or major significance. It is considered that effects of habitat disturbance during construction will be of minor adverse significance (therefore, not significant). The use of track matting to reduce the impacts from compaction could reduce the area of impact to that within the trenched area. However, this may not be required due to the short-term nature of

Comment Reference		Section:	NRW Comment:	Applicant's Response
			expected to be temporary, and the habitat should return to pre-impact conditions within the short-term following return of the sediment. However, we are unable to confirm this without clarification of the extent of the area that will be impacted. Mitigation measures such as the use of matting to reduce compaction of the sediment could be used, but further information is needed to understand these impacts. Therefore, until the following information is provided, we are unable to agree with the assessment conclusions regarding biotopes.	the works and the high resilience of the habitat types and species present.
7	1.9	Intertidal mudflats and sandflats	An assessment of the impact of temporary habitat loss and/or disturbance from cable installation against the biotopes (ES Habitat Survey Report, Annex E, Figure 3.1 Biotope Map of the Survey Area) recorded during the Phase I habitat survey using	The predominant habitat type identified within the survey area was *Macoma balthica* and *Arenicola marina* in littoral muddy sand. This habitat and its associated species are resilient to change and able to recolonise following disturbance relatively quickly, with studies showing that recolonisation of dug/disturbed areas taking place with two to three months[1]. Recolonisation time will depend upon factors such as recruitment and migration of adults into the disturbed area, however it is expected that disturbed areas will be fully recolonised within two years.

[1] https://www.marlin.ac.uk/habitats/detail/1087#sensitivity_review

Comment Reference		Section:	NRW Comment:	Applicant's Response
			the information provided in Marine Evidence based Sensitivity Assessment (MarESA) (e.g., sensitivity, resilience and expected recovery rate). This should assess the impact from disturbing the sediment as a result of the cable laying activities and potentially from the use of vehicles on the beach to install the cable (e.g., use of a mobile tracked machine). The assessment should also include the total extent of the impact i.e., the area in m2 and or km2 of impact and furthermore, what this equates to (percentage) of the Annex I mudflat and sandflat feature of the Dee Estuary SAC and to the whole Dee Estuary SAC. Clarification is also sought on any mitigation measures in relation to the impact of tracked vehicles that might be required.	The Dee Estuary SAC covers a total of 10,573.73 ha of intertidal mudflats and sandflats not covered by water at low tide. The intertidal cable works have the potential to impact 1.8 ha (worst-case scenario when considering the use of a cable trenching machine), equating to 0.017% of this habitat type within the SAC. Therefore, effects to the intertidal mudflats and sandflats of the SAC are considered to be of negligible significance due to the scale of the impacts and the resilience of the habitats present. The use of track matting to reduce the impacts from compaction could reduce the area of impact to that within the trenched area. However, this may not be required due to the short-term nature of the works and the high resilience of the habitat types and species present.
8	1.10	Intertidal mudflats and sandflats	Regarding ES Chapter 9: para. 9.9.85 we note that the operation of the repurposed pipeline is expected to	Soil temperature analysis of three locations, including the intertidal mudflats and sandflats habitat, was carried out by Wood in 2023 and is presented in **Appendix B Soil Temperature Analysis – P908 Onshore Pipeline (Extended).**

Comment Reference		Section:	NRW Comment:	Applicant's Response
			increase the temperature of the soil and associated habitats around the pipeline. We advise that clarification is sought on whether an increase in temperature is expected in the intertidal zone; if so, potential impacts on the Annex I mudflats and sandflat feature should be assessed.	The results of this analysis concluded that there was no significant impact on soil/sand temperature near the surface as a result of the Foreshore Pipeline. The report concluded that during summer months, the temperature at 0.1m below the surface would be 1.8°C above ambient temperature (18.6°C compared to 17°C), whereas during winter it would be 2.3°C above ambient (5.3°C compared to 3°C). A more detailed analysis method (CFD modelling) was undertaken, which indicated that the temperature of soil/sand 10m either side of the pipe was affected by the presence of the pipeline. However, the greatest impacts to temperature change were within 1m of the pipe. These temperature changes are within the tolerance levels of the habitats and species present within the pipeline area (**Ref. 6**). Therefore, significant effects are not predicted.
9	1.11	Intertidal mudflats and sandflats	With reference to ES Chapter 19: Combined and Cumulative Effects, until the potential impacts to intertidal habitats from the cabling activities have been scoped in and assessed appropriately, we are unable to agree that the effects to ecological receptors are non-negligible and can therefore be scoped out of the cumulative effects assessment. Please note these comments are also applicable to Appendix 19.1 Inter-Project effects assessment.	See **Section 2 - Overview of Cable Installation Methodology** for details on the methods and activities involved for the cable installation. As in the responses to comment reference 4 to 6, above, 1.8 ha of the intertidal mudflats and sandflats habitat within the red line boundary of the TCPA Proposed Development is expected to be temporarily disturbed as a result of the cable trenching activities. However, this equates to only 0.017% of the extent of the mudflats and sandflats habitat within the Dee Estuary SAC. The habitats and species present within the works area are resilient to disturbance and have the potential to recolonise within months of the works being completed. The MarESA assessment for this habitat type indicates that the habitat and populations should be fully recovered within two years of cessation of works. The species present are also moderately tolerant to increases in sediment temperature, with the modelled temperature changes falling within

Comment Reference		Section:	NRW Comment:	Applicant's Response
				these tolerances **(Ref. 6)**. The responses to comment references 4, 6 and 8, above, conclude that no significant effects (moderate significance or above, in line with the EIA methodology used throughout the assessment) will be incurred as a result of the proposed cable trenching works. As such, there is no change to the conclusions on significant effects present in **Chapter 9: Biodiversity (Document Reference T.4.2.9)** of the ES. In turn, the assessments within **Chapter 19: Combined and Cumulative Effects (Document Reference T.4.2.19) and Appendix 19.1: Inter-Project Effects (Document Reference T.4.4.19.1)** of the ES are considered to remain valid.
10	1.12	Intertidal mudflats and sandflats	With reference to ES Chapter 19: Table 6-2. Potential effects upon the Dee Estuary/Aber Dyfrydwy SAC, Annex I mudflat and sandflat feature the potential for the cable installation and repair/maintenance activities to result in increases in sediment-bound contaminants and suspended sediment concentration (SSC) leading to siltation and turbidity effects and thus impacts to the Annex I features of the Dee Estuary SAC has not been screened in and assessed. This is of particular importance if a cable trencher is to be used so we	Table 6.2 referenced by NRW is found within the **HRA report (Document Reference T.5.4)** and not ES Chapter 19. As such, the Applicant assumes that this comment relates to the HRA. As detailed in **paragraph 2.6.1** above, preliminary results from the sediment dispersion numerical modelling, carried out for the offshore EIA, indicate that suspended sediment plumes from all cable installation activities showed that while there are periods of increased turbidity, the suspended material is retained in the same sediment cell and would be subsequently assimilated into the existing sediment transport regime. Suspended sediments may reach into the Dee Estuary during cable installation, but generally do so at background levels, i.e., 30mg/l. The sediment plume modelling also concluded that the majority of sediment deposition would take place within 30m of the cable laying activities. Therefore, impacts and effects will be localised and temporary (**Section 1.7.3.1** of **Appendix A Offshore Environmental Statement Report (Draft), Physical Processes**

Comment Reference		Section:	NRW Comment:	Applicant's Response
			advise that it should be appropriately assessed.	**Technical Report**). Overall, LSE are not predicted in relation to siltation and turbidity.
11	1.13	Intertidal mudflats and sandflats	With reference to ES Chapter 19: Table 6-2. Potential effects upon the Dee Estuary/Aber Dyfrydwy SAC, subsection (a), we advise that further assessment should be undertaken to support the conclusions of the HRA. LSE from habitat loss and/or disturbance to the Annex I mudflat and sandflat feature resulting from cable installation activities have been identified and some evidence relating to the resilience and recovery of the habitat has been presented. We advise that given an LSE has been identified, the impact should be assessed at Stage 2 Appropriate Assessment against the conservation objectives for the feature, with the appropriate evidence to rule out an adverse effect on site integrity presented.	Table 6.2 referenced by NRW is found within the **HRA report (Document Reference T.5.4)** and not ES Chapter 19. As such, the Applicant assumes that this comment relates to the HRA. Table 6.2 of the **HRA report (Document Reference T.5.4)** assesses LSE upon the Dee Estuary SAC. This includes an assessment of direct habitat loss of the mudflats and sandflats Annex I habitat. In summary, no LSE in relation to habitat loss of the mudflats and sandflats SAC qualifying feature were identified. The only LSE identified for the mudflats and sandflats qualifying feature was in relation to hydrological effects. This was carried through to the Appropriate Assessment, mitigation measures were detailed, and no adverse effects on the integrity of this feature were predicted. Since the HRA was undertaken, further details on the cable installation methodology have been provided (as detailed in **Section 2**, above). This information reaffirms the conclusions made in the HRA report of no LSE in relation to mudflats and sandflats associated with habitat loss. As mentioned in the responses to comment references 5 and 7 above, the Dee Estuary SAC covers a total of 10,573.73 ha of intertidal mudflats and sandflats not covered by seawater at low tide. The intertidal cable works have the potential to temporarily disturb 1.8 ha, equating to 0.017% of this habitat type within the Dee Estuary SAC. As detailed in comment reference 5 above, there would be no long-term habitat loss given the backfilling of the trench (temporary disturbance of habitat only).

Comment Reference		Section:	NRW Comment:	Applicant's Response
				Due to the nature of the foreshore within the project area, the topography will return to its pre-works state after several tidal cycles due to the physical processes in this location and as described previously utilising information from **Appendix A Offshore Environmental Statement Report (Draft), Physical Processes Technical Report**. The predominant habitat type identified within the survey area (and cable route) was *Macoma balthica* and *Arenicola marina* in littoral muddy sand. This habitat and its associated species are resilient to change and able to recolonise following disturbance relatively quickly, with studies showing that recolonisation of dug/disturbed areas taking place with two to three months. Recolonisation time will depend upon factors such as recruitment and migration of adults into the disturbed area. However, it is expected that disturbed areas will be fully recolonised within two years. As such, it is expected that the abundance of typical species of the mudflat and sandflat feature within the SAC will be maintained. Overall, given the total extent of the works and methodology to be used, LSE are not predicted in relation to the loss or disturbance of qualifying mudflat and sandflat habitat of the Dee Estuary SAC. Therefore, the assessment made in the HRA report is still considered valid.
12	1.14	Intertidal mudflats and sandflats	With regards to Appendix A – Section 6.4.2 (a) of the shadow HRA, we welcome plans to work at low water to avoid the potential impacts of SSC plumes on Annex I protected features (Chapter 9, Table 9-21). However, we	As detailed in **paragraph 1.1.2** above, the Applicant confirms that it cannot be guaranteed that the cable installation across the intertidal area would only be carried out at low tide. There are many factors that would influence the timing that cannot be guaranteed at this time. Please refer to **Figure 3** and **Figure 4** for proposed schedules of cable laying activities, suggesting that it would not be possible to undertake the cable laying within one low tide water period.

Comment Reference		Section:	NRW Comment:	Applicant's Response
			advise further assessment regarding the practicality of working only at low water if trenching is employed as the cable installation method. For example, whether it would be possible to undertake the cable laying work within one low water period as outlined in Appendix 18.3 Water Framework Directive Assessment, Table 4-14. If any cable laying works take place outside low water, we advise that the potential for SSC plumes should be assessed, in particular, the possibility for smothering of protected features, by the deposition of sands and fine material, mobilised by trenching activities.	The potential for suspended sediment concentrations and potential for smothering of protected features has been considered above in the response to comment reference 10, with no LSE to qualifying mudflat and sandflat habitat of the Dee Estuary SAC predicted.
13	1.15	Intertidal mudflats and sandflats	We also advise further assessment regarding the transition of cable laying methods beyond mean low water springs (MLWS). We acknowledge that this application covers activities to MLWS, however, in order to assess the impacts of cable laying activities within the	It can be confirmed that intertidal cable laying would commence only once a Marine Licence for cabling below MHWS has been granted. Cable laying would commence offshore from the Douglas platform towards the shore, and to do this would require a Marine Licence. The impacts of the cable laying beyond MLWS have been assessed in the Offshore EIA for the Marine Licence.

Comment Reference		Section:	NRW Comment:	Applicant's Response
			intertidal zone the methods for continuing these works past MLWS need to be understood. For example, whether intertidal cable laying would commence only once a Marine License for cabling below MHWS has been granted.	
14	1.17	Estuaries	We note that, providing the exit pit and cables can be situated 2-3m below the ground, rock armour and cable protection would not be required. However, we advise that you seek clarification that backfilling associated with the exit pit would restore the original profile of the beach, to ensure the alongshore sediment transport pathways will not be interrupted.	It can be confirmed that backfilling associated with the exit pit would restore the original profile of the beach, to ensure the alongshore sediment transport pathways will not be interrupted. It should also be noted that the HDD exit pit would be located above the MHWS mark, which is illustrated in the cross-section extract in **Figure 1**.
15	1.18	Estuaries	We also advise that you seek clarification that cable laying methods would not change the overall profile of the intertidal area. For example, if trenching methods are employed, backfilling methods should ensure the original gradient of the Intertidal area is restored, to minimise the potential for secondary impacts to physical	The Applicant confirms that cable laying methods would not change the overall profile of the intertidal area.

Comment Reference		Section:	NRW Comment:	Applicant's Response
			processes and thus sediment transport pathways.	
16	1.20	Bird features	Table 5.3 and para. 5.2.10 of the shadow HRA details that during pre-survey assessment, three qualifying species of the Dee Estuary SPA and Ramsar site (teal, black-tailed godwit, and curlew) were found to occur in abundances >1% of the designation 5-year population within the Warren Farm field parcels. In the absence of a categoric commitment to undertake trenching works within the Warren Farm field parcel(s) outside the September to March period, we consider that there is likely to be a disturbance effect upon over-wintering bird species features of the Dee estuary SPA/Ramsar site. Over-wintering birds are likely to avoid the Warren Farm area, whilst works activity occurs. However, it is unclear how long the proposed works are likely to take at Warren Farm, so the level of risk is uncertain at this stage.	The Applicant agrees that, in the absence of mitigation, there is the potential for LSE as a result of disturbance to teal, black-tailed godwit and curlew of The Dee Estuary SPA/Ramsar. This conclusion has been made within the **HRA report (Document Reference T.5.4)** and disturbance taken through to Appropriate Assessment. Based on the preliminary draft programme of works (**Figure 2**), the works at Warren Farm would be carried out over an eight-week period (approximately). Should it not be possible to avoid the over-wintering period, appropriate mitigation has been identified in the **HRA report (Document Reference T.5.4)**. This includes avoidance of construction works during periods of significant number or levels of activity of SPA/Ramsar qualifying bird species within the disturbance buffer of 300m from the works, monitoring by an ECoW and temporal restrictions. These commitments are included in the **OCEMP (Document Reference T.5.1)** and **REAC (Document Reference T.5.3)**; measure **T-BD-049**. Following the implementation of the above mitigation, the Applicant considers that there would be no adverse impact to the integrity of the Dee Estuary SPA as a result of bird disturbance during construction.

Comment Reference		Section:	NRW Comment:	Applicant's Response
17	1.21	Bird features	We therefore advise that you seek clarification regarding the period of time anticipated for open trenching, the area affected and the total time to complete the works at Warren Farm in order to assess the level of likely impact to the affected bird features of the SPA/Ramsar site.	The preliminary draft programme of works, shown in **Figure 2**, shows that the cable lay and pull would take around 14 days to complete for the whole cable from the Douglas platform to the PoA terminal. It would then take around seven days for the burial activities from PoA to Douglas. It is currently uncertain how much of this period would involve activity on Talacre Beach. However, there would be pre-lay activities such as laying the rollers along the inter-tidal area at approximately 2m intervals from the HDD exit pit to the MLWS mark. It is therefore likely that there would be activity on the beach during the whole of this 21-day period. The works across Warren Farm would be associated with the cable trenching, cable HDD work and block-valve station removal. This would be carried out over an eight-week period (approximately). The above information has been used to assess the level of likely impact to the affected bird features of the SPA/Ramsar site, as detailed in the response to comment reference 16, above.
18	1.22	Bird features	We note the need to remove hedgerows and trees to allow for cabling to occur. However, it is not clear where such removal is expected to occur. If it is proposed in the vicinity of Warren Farm, this should be assessed in the HRA. The hedgerows surrounding the Warren Farm fields are important as 'screening' to protect over-wintering birds from disturbance activities	The Applicant confirms that there will be no removal of hedgerows from Warren Farm (as shown on the Landscape layout plan and Tree Protection Plan, **Appendix 9.1** of the **ES, Document Reference: T.9.1.1**) or from the PoA Terminal. Where there are hedgerows present, HDD will be used, avoiding the need to remove any hedgerows. Therefore, the current HRA assessment and mitigation presented remains accurate.

Comment Reference		Section:	NRW Comment:	Applicant's Response
			along the road and adjacent caravan park. Adequate mitigation / replacement with mature specimens should therefore be implemented for any removal, in order to continue the screening benefit.	
19	1.25	Fish features	We note that ES Chapter 15: Noise and Vibration, para. 15.9.14 details the potential for piling to be required as part of the modifications to the Point of Ayr (PoA) terminal. However, it is not clear where within the PoA application site the piling may be required. We therefore advise that your Authority confirms whether piling would be required within the intertidal zone. If piling would occur in the intertidal zone, then further information/mitigation would be required. We advise that project-specific noise modelling may be required if other mitigation cannot be implemented, depending on the size of piles and duration of piling.	The Applicant confirms that no piling activities will be required within the intertidal zone during the cable laying and burial, therefore further mitigation is not proposed.
20	1.27	SSSI	The ES does not assess whether there will be any	Gronant Dunes and Talacre Warren SSSI is designated for botanical, entomological and ornithological reasons. Within

Comment Reference		Section:	NRW Comment:	Applicant's Response
			impacts to the little tern feature of Gronant Dunes and Talacre Warren SSSI, e.g., from cabling installation through this site. Whilst we note that this area does not appear to be within the red line boundary of the proposed development, we advise that effects on this SSSI feature should be assessed within the ES (see our Schedule 1 bird advice below regarding little terns).	**Chapter 9** of the **ES (Document Reference T.4.2.9)**, the ornithological features have been grouped together for assessment, rather than being assessed on a species-by-species basis. However, the Applicant acknowledges that the SSSI supports nationally important numbers of Little Tern, with the largest breeding colony in Wales being present on one of the shingle spits at Gronant Beach. The Applicant assumes that this is what is being referred to as '"this area" in the comment from NRW. The established Little Tern breeding colony at Gronant Beach is located approximately 1.5km to the west of the nearest area of works associated with the TCPA Proposed Development. The potential disturbance distance for Little Tern during the breeding season is 100m to 300m (**Ref. 5**) and assesses their overall likely sensitivity to disturbance as 'medium'. Given the distance between the TCPA Proposed Development and the Little Tern breeding colony, there will be no direct impacts to Little Tern resulting from any works during the construction or decommissioning phases. Furthermore, given maximum disturbance distance of Little Tern relative to the location of the TCPA Proposed Development, there are expected to be no indirect disturbance impacts arising from the construction, operation or decommissioning phases. As such, likely effects to the breeding Little Tern feature of the Gronant Dunes and Talacre Warren SSSI are expected to be negligible (not significant).
21	1.28 & 29	SSSI	Recreational parking issues are currently affecting the integrity of the protected nature conservation sites on land outside the red line	The Applicant has noted this comment.

Comment Reference		Section:	NRW Comment:	Applicant's Response
			boundary of the application but within the Applicant's ownership. Currently an important transitional and mosaic area of sand dune / foredune and developing saltmarsh (within the protected sites) is used for car parking. The current application proposes to use this as a temporary parking area for access to the foreshore. In addition, there is currently a 10-year planning permission to alleviate some of the above parking pressure, also within the protected sites at Gamfa Wen; this permission is nearing its end. From previous discussions with your Authority, we recognise that redevelopment in this area provides opportunities to offer appropriate recreational parking at Talacre, potentially on the made-ground area of the former colliery post-completion of the works, including the area where the applicant seeks to place a temporary compound / works	

Comment Reference		Section:	NRW Comment:	Applicant's Response
			site. This area could form part of a wider consideration of managed parking within Talacre. Any relief of traffic pressure in Talacre would contribute to reducing the impact on protected sites features.	
		Protected Species		
22	4.3	General	The species technical appendices refer to the National Planning Policy Framework (NPPF). The NPPF sets out the Government's planning policies for England and how these should be applied. However, since this application is located in Wales, we advise that the LPA should assure itself that the proposals would accord with Planning Policy Wales (edition 11).	The Applicant has noted this comment.
23	4.4	General	We note reference to conservation status but no specific reference to Current Conservation Status (CCS) or Favourable Conservation Status (FCS). There is also no reference to EC EPS Guidance regarding this e.g.,	Consideration of CCS and FCS will be included within any subsequent EPS licence application. The Applicant has considered impacts to species at the appropriate geographical scale and the context of likely impact from construction and operation.

Comment Reference		Section:	NRW Comment:	Applicant's Response
			Commission notice Guidance document on the strict protection of animal species of Community interest under the Habitats Directive C/2021/7301 final. However, we would not be concerned about this being considered as part of the EPS licensing application for the proposals. The Applicant should note that a hierarchical geographical scaled approach may not be applicable when demonstrating no detriment to maintenance of FCS; the above EC guidance indicates assessments at various spatial scales.	
24	4.15 / 4.19	Natterjack Toad / Sand Lizard	The assessment notes that the operation of the pipeline will result in a permanent change in ground temperature along the pipeline route and a 10m buffer either side, but with significant changes limited to the pipeline itself and a 1m buffer either side. A permanent increase in soil temperatures in areas of suitable natterjack toad/sand lizard habitat could disrupt	As discussed in response to Comment Reference 8, above, soil temperature analysis was carried out by Wood in 2023 and is presented within **Appendix B Soil Temperature Analysis – P908 Onshore Pipeline (extended)**. The results of this analysis concluded that there was no significant impact on soil/sand temperature near the surface as a result of the Foreshore Pipeline. The Foreshore Pipeline had minimal impact on the change in soil/sand temperature after a distance of ~1m from the top of the pipe. In particular, when an area of 'dune' habitat was subject to detailed analysis, it showed that the effect of the pipeline on ground temperature was minimal compared to the other locations due to the dunes having a larger soil layer over the pipe.

Comment Reference		Section:	NRW Comment:	Applicant's Response
			breeding cycles and hibernation behaviour resulting in long-term or permanent effects on the populations of the species. The current heat modelling information indicates that significant effects will be limited to the pipeline route itself and a 1m buffer either side, where suitable natterjack toad and Sand Lizard habitat exists but none have previously been recorded. However, we would advise your Authority to explore whether there is an opportunity to reduce this even further through heat proof insulation.	The dune habitat analysed during the soil temperature analysis corresponds to the natterjack toad/sand lizard habitat present within the red line boundary. Based on this information and the minor degrees of change predicted, it is not considered likely that natterjack toad/sand lizard breeding cycles or hibernation would be disrupted as a result of the Foreshore Pipeline operations. The use of heat-proof insultation around the Foreshore Pipeline has been previously considered. However, the installation of the insulation would require large-scale works, including excavation of the pipeline. This would create significant disturbance to natterjack toad and sand lizard habitat within the dunes and would counteract the mitigation currently proposed to reduce impacts to this area. Given the limited difference in temperature caused by the Foreshore Pipeline, the benefits of the use of insulation are not considered proportional to the impacts of installation (habitat damage and loss).
25	4.17	Sand Lizard	We note the conclusions of the assessment regarding sand lizards. Table 9-5 of Chapter 9 (Biodiversity) refers to the possible impact on *reptiles* at the PoA terminal but does not refer to sand lizards specifically although these are referred to in Tables 9-6 and 9-7 for other aspects of the works. Clarification is therefore sought on the possible presence of sand lizard at the PoA terminal.	Within **Appendix 9.11 Sand Lizard Technical Appendix** of the **ES (Document Reference: T.4.3.9.11), Section 3.2.5,** the habitats present within the PoA Terminal were determined to be unfavourable for sand lizard, comprising largely hardstanding, buildings, grazed improved grassland or small stands of woodland. Therefore, their presence within the PoA Terminal is considered unlikely, though the presence of other reptile species remains possible. As such, sand lizard is not included within **Table 9-5** of **Chapter 9 Biodiversity** of the **ES (Document reference: T.4.2.9)** and are not considered further in relation to the PoA Terminal. In addition, sand lizard is not included within **Table 9-7** of **Chapter 9** of the **ES**, as reptiles are not considered to be present within the BVSs and are scoped out of the BVSs assessment.

Comment Reference		Section:	NRW Comment:	Applicant's Response
				Sand lizards are included within **Table 9-6 of Chapter 9** of the **ES** as the Foreshore Works encompasses habitats suitable to support sand lizard, including parts of the Talacre Dune system where populations of sand lizard are known to be present. As stated within **Section 9.6.117** of the **ES,** '*due to the nature of the TCPA Proposed Development in this area, no sand lizard habitat is expected to be directly affected*.' HDD will be undertaken beneath the dune system, avoiding impact to sand lizard habitat. Mitigation measures in relation to sand lizards will also be detailed within a species conservation plan.
26	4.26	Schedule 1 birds (CEMP)	Regarding barn owls, the Outline CEMP (T-BD-030) states that '*If significant disturbance is expected and cannot be mitigated for via standardised measures, a mitigation licence from NRW is likely to be required to legally permit disturbance of any nesting barn owls.* However, we advise that <u>any</u> activity that causes disturbance should be subject to a Schedule 1 disturbance licence.	The Applicant notes this advice and will apply for the appropriate licencing as required.
27	4.27	Schedule 1 birds (CEMP)	We welcome that: *'internal surveys of the buildings barn owls may be using will be carried out prior to any works*	The Applicant has noted this comment.

Comment Reference		Section:	NRW Comment:	Applicant's Response
			to check for the presence of nesting barn owls. We advise that this should include any suitable barn owl breeding habitat within at least 100m of the red line boundary. Any works within 100m of an active barn owl nest would require appropriate and effective mitigation to be implemented.	
28	4.28	Schedule 1 birds (CEMP)	We also advise that similar pre-construction checks for the presence of Cetti's warbler (suitable breeding habitat within 25m of the red line boundary) and peregrine (suitable breeding habitat within the red line boundary) should be completed and accompanying mitigation measures for avoiding disturbance to these Schedule 1 species outlined in the detailed CEMP.	The Applicant has noted this comment.
29	4.29/ 4.30	Schedule 1 birds	We advise that as currently proposed, the works could cause disturbance to little tern. For example, paragraph 7.5.7 of Appendix A: Habitats Regulations Assessment Information to Inform an Appropriate Assessment,	The Applicant has noted this comment, which would be covered under the scope of the ECoW.

Comment Reference		Section:	NRW Comment:	Applicant's Response
			states that '*a watching brief would be undertaken by the eCoW in relation to the established Little Tern colony if any construction works are to be undertaken around the PoA Terminal between April and July, inclusive* para. 7.5.8 states that '*If any birds are showing disturbance behaviour within the 300m buffer zone during any stage of the works, the eCoW would stop work until it can be determined that disturbance has subside".* We advise that disturbing the birds, then stopping works after the disturbance has occurred, would still be classed as a disturbance of a Schedule 1 species, as the disturbance event will have already occurred. We therefore advise that the detailed CEMP should include a commitment that, if construction works are due to be undertaken between April and July inclusive, and if there is any habitat with the potential	

Comment Reference		Section:	NRW Comment:	Applicant's Response
			to be used for little tern nesting within 300m of the development, the Ecological Clerk of Works (eCoW) should check for little tern breeding activity before any works are undertaken. If nesting little tern are present within 300m of the proposed development, no works should be undertaken.	
		Biosecurity		
30	6.1	Biosecurity	We consider the submitted assessment and conclusions to be satisfactory, although we advise that Chytrid (an amphibian fungus) has been recorded at Talacre. We note that an Invasive Species Management Plan is proposed in the REAC (Document T.5.3) and outline OCEMP (Document T.5.1). NRW proposes a Biosecurity Risk Assessment planning condition to be included.	The Applicant has noted this comment.
		Appendix A Advice to the Applicant/Developer:		
31		Environmental Permitting	The Point of Ayr terminal is currently regulated by NRW under the Environmental Permitting (England and Wales) Regulations 2016 for	The Applicant has noted this comment.

Comment Reference		Section:	NRW Comment:	Applicant's Response
			the refining of gas. The Operator should continue to communicate with NRW regarding the permit surrender, land condition requirements and other permit requirements.	
32		Marine Licence	We would welcome clarification on when the Applicant intends to apply for the Marine License for the works from the Mean High Water Spring tidal limit to the Douglas offshore platform.	The current project programme would see the Marine License application for the works from the MHWS tidal limit to the Douglas offshore platform being made following completion of the Offshore EIA at the end of September 2023.
33		Species licensing	Although we acknowledge the low risk of Great Crested Newts (GCN) being present, we advise the applicant to consider applying for an EPS license on a precautionary basis to minimise delays in the event that GCN were discovered on site. Regarding natterjack toad, we advise that the works should be carried out in accordance with the provisions of an appropriate EPS license issued by NRW under Regulation 55 (2)I) of the Conservation of Habitats and	As detailed within **paragraphs 9.6.101 to 9.6.103** of **Chapter 9** of the **ES**, two historic records of GCN were present within the Talacre dune system in the desk study data. However, surveys undertaken concluded the likely absence of GCN. Based on the survey findings and number of records for the area, GCN are not expected to be encountered during the works and licensable impacts are not predicted. However, precautionary working methods are proposed, as secured by measure **T-BD-038** of the **REAC (Document Reference T.5.3)** and **OCEMP (Document Reference T.5.1).** The Applicant acknowledges NRWs advice in relation to applying for an EPS licence on a precautionary basis, but does not propose to apply for a licence at this stage. The Applicant acknowledges that, in the unlikely event that a GCN is discovered during the works, works would cease and an EPS licence may be required.

Comment Reference		Section:	NRW Comment:	Applicant's Response
			Species Regulations 2017 (as amended). We note that the assessment implies that only significant disturbance would require an EPS license for sand lizard. We advise that significance is not a statutory criterion when considering the requirement for EPS licenses and any activity that causes disturbance is subject to licensing. We therefore advise that works are to be carried out in accordance with the provisions of an appropriate sand lizard EPS license issued by NRW under Regulation 55 (2) (e) of the Conservation of Habitats and Species Regulations 2017 (as amended). We note comments in respect of EPS licensing and otters. We advise that EPS licenses for otters may be required if features are confirmed that could function as otter breeding sites or resting place within 30m of any water	The Applicant agrees with the remainder of the points regarding EPS licencing and will apply for the appropriate licencing as required.

Comment Reference		Section:	NRW Comment:	Applicant's Response
			course and/or works are considered to have the potential to cause disturbance to otters. We advise the Applicant that as currently proposed, the works could cause disturbance to little tern. We advise that as little tern is listed as a Schedule 1 species in the Wildlife and Countryside Act 1981 (as amended), disturbance to little tern nests, eggs or dependent young is not permissible unless licenced by NRW through a Schedule 1 disturbance license.	

3.2 THE APPLICANT'S RESPONSE TO FLINTSHIRE COUNTY COUNCIL

3.2.1. **Table 3.2** below details the comments from FCC following review of the ES and HRA report submitted as part of the Planning Application for the PoA Terminal and Foreshore Works (ref: FUL/000246/23). The Applicant's responses to these comments are also provided.

Table 3.2 - Comments from Flintshire County Council and Responses

Comment Reference 3.2.2.		**3.2.3. Section** 3.2.4.	**3.2.5. FCC Comment**	**3.2.6. Applicant's Response**
HRA T.5.4 Considers the potential for adverse effects on integrity upon European Sites.				
38	4a	Dee Estuary SPA and Ramsar – Noise and Visual Disturbance	HRA ref considers the noise modelling for the PoA terminal and Warren Farm Ponds conclude that construction noise levels will not cause a significant disturbance due to the existing ambient noise levels. Visual disturbance during construction is considered the more likely but the following activites could cause disturbance without mitigation: *Sudden single noise of over 60dB (at the bird) e.g. single or initial pile impact, dropping of piles on hard surface in undisturbed environment.* • *Continuous/repetitive noise over 72dB (at the bird) e.g. ongoing percussive or Movax vibro-piling (depending on receptor distance).*	The Applicant agrees with FCC's statements, which align with the information presented within the HRA (**Document Reference T.5.4**), in evidence (b) beneath Table 6.3 (The Dee Estuary SPA). This concludes that LSE are not predicted as a result of general construction noise. However, there is potential for LSE (in the absence of mitigation) as a result of visual disturbance and those items listed in italics within FCC's comment. The HRA details appropriate mitigation to address potential disturbance (discussed further in comment reference 39 below).

Comment Reference 3.2.2.		3.2.3. Section 3.2.4.	3.2.5. FCC Comment	3.2.6. Applicant's Response
			• *Close proximity of activities to birds e.g. works or works access undertaken less than 100m from bird activity* • *Works on foreshore, where there is potentially a substantially greater level of impact compared to similar works on bank crest. Some habituation may be possible.* • *Workers operating outside of plant e.g. single operative working on the bank may have a greater impact than an operational excavator or other plant.* • *Workers vacating plant e.g. when an operator vacates an excavator or other plant, then disturbance levels can increase.* • *Works access e.g. access by operators along bank crest to and from plant can have a greater disturbance effect than the plant operation.* • *Large/fast moving machinery e.g. slow moving vehicles can have a lower impact than fast. However, vehicles stopping can cause a flight response.* • *3rd parties accessing along the foreshore.*	

Comment Reference 3.2.2.		3.2.3. Section 3.2.4.	3.2.5. FCC Comment	3.2.6. Applicant's Response
39	4a i	Dee Estuary SPA and Ramsar – Noise and Visual Disturbance, Foreshore Works	The best option to demonstrate no effect on Dee Estuary SPA/Ramsar features with certainty, is timing the works to those months when migratory and wintering waders and wildfowl are not present. Mitigation proposed is to avoid construction works during periods of significant numbers within a disturbance distance of 300m. Construction works between April and August will avoid an impact on the migratory/wintering birds but construction has not been confirmed for this time period. REAC T-BD- 037 references mitigation measures including avoidance of a 3 hour high tide period and screening if avoidance of the overwintering period cannot be avoided while T-BD-049 provides more general information with no mention of screening. To avoid an impact on the SPA/Ramsar features the hierarchy of proposals needs to be clearly set out. For example a) works undertaken April to August, if not achievable then b) works avoiding key winter period Nov – February when peak counts were recorded but with recommended ecological checks and avoidance of 2 hours either side of high tide (NRW response) and use of	As detailed in comment reference 16 of **Table 3.1** above, based on the preliminary draft programme (**Figure 2**), the works at Warren Farm wetlands, dune and inter-tidal habitat would be carried out over an eight-week period (approximately). This timeframe is intended to allow the cable installation works in more favourable weather conditions. The Applicant acknowledges the need for a hierarchy to the approach of works and mitigation. As detailed in measures **T-BD-037 and 049** of the **REAC (Document Reference T.5.3**), if avoiding works completely during the overwintering period is not feasible, measures would be implemented to reduce the potential for disturbance. This includes avoiding a three-hour period either side of high tide, avoidance of construction works during periods of significant number or levels of activity of SPA/Ramsar qualifying bird species, monitoring by an ECoW and, where necessary, the implementation of screening. The approach taken and mitigation developed is considered appropriate and proportionate to

Comment Reference 3.2.2.		3.2.3. Section 3.2.4.	3.2.5. FCC Comment	3.2.6. Applicant's Response
			screens for certain works eg HDD pits; c) mid - winter working only with appropriate screening. Depending on the proximity of the various works being undertaken in the SDV field – removal of the SDV, Installation of the two Submarine Cable Junction Box containers in separate enclosures, HDD dune entrance location and associated compounds – screening of these works may be an option to prevent visual disturbance if spring/summer work cannot be achieved. What are the length of times proposed for construction across Warren Farm wetlands, dune and inter-tidal habitat?	the predicted level of impact. Following the implementation of the proposed mitigation, the Applicant considers that there would be no adverse impact to the integrity of the Dee Estuary SPA/Ramsar as a result of bird disturbance during construction.
40	4a ii	Dee Estuary SPA and Ramsar – Noise and Visual Disturbance, PoA Terminal and Llawndy Wetland	Species recorded within 300m of the PoA Terminal and Llawndy Farm ponds included Teal, Pintail and Black-tailed Godwit. The numbers did not exceed 1% of the SPA population threshold using data from the citation and the more recent WeBS data. Llawndy ponds are well screened and while the surveys did not meet the 1% SPA population threshold, it is used by SPA/Ramsar features and there should be consideration of the potential to cause noise and vibration impacts if not visual	The Applicant confirms agreement with the statements made by FCC in relation to the % of SPA populations recorded during surveys. In relation SPA/Ramsar qualifying bird species at Llawndy Farm ponds, the potential for disturbance during works has been considered. Further details on the approach to mitigation are detailed in comment response 39 above.

Comment Reference 3.2.2.		3.2.3. Section 3.2.4.	3.2.5. FCC Comment	3.2.6. Applicant's Response
			disturbance if works are undertaken during winter months. Breeding Little Tern – 300m is considered to be the predicted disturbance buffer for medium impacts. Constant background noise will not cause disturbance, and sudden loud events shouldn't either due to the distance from the breeding site. A watching brief with regards to the Little Tern colony is proposed if works are undertaken at the terminal between April and July REAC T-BD-049. Relevant noise level monitoring should be included as part of this watching brief.	The Applicant confirms that noise level monitoring would form part of the monitoring undertaken by the ECoW to determine the potential for disturbance to qualifying species of the SPA/Ramsar (reference to the ECoW and watching brief is detailed in measure **T-BD-049** of the **REAC (Document Reference T.5.3**).
41	4b	Dee Estuary SPA and Ramsar – Impacts to the aquatic environment	Impacts are unlikely, providing there are pollution prevention and surface water management is included within the OCEMP and REAC.	The Applicant agrees with FCC. **T-WR-004 to T-WR-029** of the **REAC (Document Reference T.5.3)** include measures for pollution prevention and surface water management during the construction phase. These measures are included in the **OCEMP (Document Reference T.5.1).**
42	4c	Dee Estuary SPA and Ramsar – Air Quality	Changes in air quality are unlikely providing Construction Dust is controlled by a Dust management plan and CEMP.	The Applicant agrees with FCC. A Dust Management Plan was submitted with the planning application within **Annex A of the OCEMP (Document Reference: T.5.1)**. The Dust Management Plan will be implemented by

Comment Reference 3.2.2.		3.2.3. Section 3.2.4.	3.2.5. FCC Comment	3.2.6. Applicant's Response
			The proposed infrequent nature of major venting events plus the procedures to control emissions during operation as stated has no significant effect on air quality.	the Construction Contractor and includes measures to control emissions, in addition to dust and PM10 mitigation measures.
43	5a i	Dee Estuary SAC – Impacts to Dune and Estuarine Habitats	The Proposed HDD under sand dunes is welcomed to avoid direct impact on dune features and associated protected species, Natterjack toads (and Sand Lizards). Natterjack Toads are known to be present within the red line boundary within the foreshore works and PoA terminal but with the nearest known breeding pond located 20m away. Mitigation measures are set out in REAC T-BD-042-043 but this needs to reflect NRW's requirement for a Natterjack Toad Species Conservation Plan as set out in ES Ch 9 Para 9.10.31.	A Species Conservation Plan will be produced outlining the finalised mitigation measures for Natterjack toads as detailed within item **T-BD-048** of the **REAC (Document Reference T.5.3)** and **OCEMP (Document Reference T.5.1)**. The Applicant will ensure that commitments **T-BD-029** of the **REAC (Document Reference T.5.3)** and **OCEMP (Document Reference T.5.1)** are taken forward such that the construction contractor includes the requirement for a Species Conservation Plan for sand lizards within the detailed CEMP.
44	5a ii	Dee Estuary SAC – Intertidal Works	An intertidal plough will be used to lay cable on completion of creation of the cable route through the dunes. The zone of disturbance for the cable installation is expected to be around 15 metres total width for each cable. The two cables from PoA Terminal to Douglas Offshore Platform are	Please see **Section 2.3** for further details on the cable trencher installation methodology. Please see comment references 3 to 9 within **Table 3.1** for clarifications on potential impacts to the priority habitat/Annex I habitat caused by the cable installation works using a cable

Comment Reference 3.2.2.		3.2.3. Section 3.2.4.	3.2.5. FCC Comment	3.2.6. Applicant's Response
			expected to be laid at a minimum separation distance of 30 metres, within two separate trenches. The minimum cables burial depth (top of cables) is expected to be between two and three metres. The spatial extent of the effect will be very small and of short duration. Works will be undertaken at low tide to reduce the risk of sediment contamination. NRW have raised issues regarding their installation; clarification is required regarding their concerns the key one being confirmation that an intertidal plough will be used rather that trenching as suggested elsewhere in the ES. Operational impacts: Compression at the PoA Terminal will increase the temperature of the CO2 and although cooled by the air coolers as far as practicable, the CO2 will remain above ambient temperature. Heat modelling (ref 9.56) indicates that ground soil 10m either side of the pipeline will be affected by the presence of hot fluid inside the pipe but there will be a minimal impact on change in temperatures of soil or sand beyond a distance of	plough or cable trenching machine through the Foreshore area. Please see responses to comment references 4 and 24 within **Table 3.1** for details relating to heat modelling and EMF, in response to NRW's comments. Please see comment reference 12 within **Table 3.1** for clarification on potential impacts to the Dee Estuary from sediment dispersion numerical modelling.

Comment Reference 3.2.2.		3.2.3. Section 3.2.4.	3.2.5. FCC Comment	3.2.6. Applicant's Response
			approx.. 1m from the top of the pipe due to the low thermal conductivity of soil and sand. Electromagnetic Fields (EMF) are generated by the current that passes through the cables. However, they are only likely to be detectable within the immediate vicinity of the cables with negligible impact at 0.5m above them. The depth of the cables means there is not likely to be a significant impact on fish or benthic invertebrates, however NRW require clarification.	
45	5a iii	Dee Estuary SAC – Foredunes	The HDD exit hole location and relevant equipment yard will fall within the intertidal habitat adjacent to the sensitive embryonic/foredune habitat. A temporary access route for the foreshore works is proposed along the boundary of the dune habitat which comprises bare sand. The route will be matted to minimize damage. REAC: T- BD- 005 REAC: T BD 047 references the specific pollution prevention measures to be put in place.	No response required.
46	5a iv	Dee Estuary SAC – Compound	Compound (temporary Parking Area) will be located in the Talacre Beach car park, on bare ground within the existing fenced parking area and will avoid sensitive saltmarsh habitat. Protective	No response required.

Comment Reference 3.2.2.		3.2.3. Section 3.2.4.	3.2.5. FCC Comment	3.2.6. Applicant's Response
		(temporary parking area)	measures/fencing and monitoring will be provided to avoid damage REAC T-BD-006	
47	5b	Dee Estuary SAC – Impacts to aquatic environment construction pollution / operational discharge	Pollution prevention and surface water management is included within the OCEMP and REAC. A Biosecurity Risk Assessment and a non native invasive species management plan will be produced to address potential spread of invasive non-native species from inter-tidal ploughing activities. REAC T-BD-032-033	The Applicant confirms that pollution prevention measures and surface water management are secured within measures **T-WR-004 to T-WR-029** of the **REAC (Document Reference D.5.3).** The Applicant also confirms that mitigation in relation to INNS (Biosecurity Method Statement) is secured within measures **T-BD-032 and 033** of the **REAC (Document Reference D.5.3).**
48	5c	Dee Estuary SAC – Changes in air quality	Dust management plan to be provided as part of the agreed CEMP to include use of screens/barriers, covering of stock pile soils, dust suppression techniques etc as necessary to prevent dust deposition on the saltmarsh habitat.	A Dust Management Plan was submitted with the planning application within **Annex A of the OCEMP (Document Reference: T.5.1).** It will be implemented by the Construction Contractor and includes measures to control emissions, in addition to dust and PM10 mitigation measures.
49	5d	Dee Estuary SAC – Heat generation and	Compression at the PoA Terminal will increase the temperature of the CO2 and although cooled by the air coolers as far as practicable, the CO2 will remain above ambient temperature. Although the	Please see the response to comment reference 24 within **Table 3.1**, which provides further details in relation to temperature modelling and potential impacts to natterjack

Comment Reference 3.2.2.		3.2.3. Section 3.2.4.	3.2.5. FCC Comment	3.2.6. Applicant's Response
		Electromagnetic fields	Foreshore Pipeline will be buried and insulated by its concrete coating, there is the potential for this to increase the temperature of the surrounding environment of the Foreshore Pipeline which has the potential to impact natterjack toad and sand lizard breeding opportunities and hibernation behaviour. Currently there are no natterjack toad or sand lizards found within the red line boundary but the long term proposals are to enable the populations to expand. Heat modelling (ES Ch 9 Ref 9.56) indicates that ground soil 10m either side of the pipeline will be affected by the presence of hot fluid inside the pipe but there will be a minimal impact on change in temperatures of soil or sand beyond a distance of approx. 1m from the top of the pipe. What is the estimated depth of cables under the dunes? Presumably this will be as a depth that will not impact burrowing natterjacks (or sand lizards)? **iii) PoA Construction compound within colliery site** in close proximity to the Dee estuary and associated saltmarsh/mudflats/reedbeds to the south and east.	toad and sand lizard. This relates to a similar query raised by NRW. In relation to the estimated depth of the cables, as detailed in **paragraph 2.2.1**, cables would be buried to the desired depth of 3m. As detailed in responses to comment references 8 and 24 of **Table 3.1** above, soil temperature analysis (**Appendix B Soil Temperature Analysis – P908 Onshore Pipeline (extended)**) showed that the pipeline had minimal impact on the change in soil/sand temperature over a distance of approximately 1m from the top of the pipe. Natterjack toads typically burrow to depths of less than 50cm (although can be deeper in winter) (**Ref. 7**) and sand lizard burrow to up to 1m deep (**Ref. 8**). Therefore, when considering the depth of the pipe (3m) and the minimal impact on change in temperature beyond 1m from the top of the pipe, impacts to burrowing natterjack toad and sand lizard are not predicted as a result of heat changes. The Applicant acknowledges the potential for screening in relation to working areas close to

Comment Reference 3.2.2.		3.2.3. Section 3.2.4.	3.2.5. FCC Comment	3.2.6. Applicant's Response
			There is already tree and shrub planting in situ but temporary screening can be provided to prevent noise and visual impacts on the estuarine habitats.	saltmarsh/mudflat/reedbed habitat, notably in relation to reducing disturbance to qualifying bird species of The Dee Estuary SPA and Ramsar. Measure **T-BD-037** of the **REAC (Document Reference D.5.3)** makes reference to this provision, if needed.
Other Habitats and Species Associated with the Application Site				
50	6a	Open Mosaic Habitat	Open mosaic habitat (Env. Act Section 7 listed habitat of biodiversity importance) will be impacted by the construction compound within the colliery site. By its nature the habitat reduces in value as bramble and scrub regenerate. There is therefore potential to mitigate and enhance this habitat through the removal of invasive non-native species (INNS), break up of existing concrete to create bare ground and shallow scrapes. Enhancement of this habitat is included as BNG. The proposed Biosecurity risk assessment and INNS management includes removal of cotoneaster to enhance this habitat. T-BD032-033.	The Applicant has noted this comment.

Comment Reference 3.2.2.		3.2.3. Section 3.2.4.	3.2.5. FCC Comment	3.2.6. Applicant's Response
			Further details of the area to be enhanced and its subsequent management can be conditioned.	
51	6b	Sand Lizard	Sand Lizard introduced into dunes with sand patching management undertaken to encourage their spread throughout the system over time. HDD under dunes will avoid construction impacts but as for Natterjack Toads there is potential for noise and vibrational impacts. Mitigation measures are set out in REAC T-BD-029 but this needs to reflect NRW's requirement for a Sand Lizard Species Conservation Plan as set out in ES Ch 9 Para 9.10.49	Please see comment reference 25 in **Table 3.1.**
52	6c	Otter	Otter present in and around PoA terminal and foreshore works – importance of reasonable avoidance measures supervised by an ECoW and linked to the CEMP as referenced in REAC T-BD 027.	The Applicant has noted this comment.
53	6d	Water Vole	Water vole – no recent records but indirect impacts avoided through measures set out in REAC T-BD-028.	The Applicant has noted this comment.
54	6e	Badgers	Badgers – Two subsidiary setts within the foreshore works area, close to the HDD, will be	The Applicant has noted this comment.

Comment Reference 3.2.2.		3.2.3. Section 3.2.4.	3.2.5. FCC Comment	3.2.6. Applicant's Response
			avoided in the first instance; if buffer zones cannot be adhered to, a mitigation licence will be obtained from NRW which may restrict working from July to December. A further three setts are within close proximity to, but not directly impacted by the Point of Ayr HDD exit pit. Mitigation measures are set out in the REAC (T-BD-020 – 023). Updated surveys will ensure accurate mitigation.	
55	6f	Bats	Two Common Pipistrelles in day roosts were recorded at Warren Farm outside the red line boundary but which have the potential to be disturbed by foreshore works. Mitigation measures are set out in REAC T-BD 024-026. A lighting management plan will be developed to avoid unnecessary lighting disturbances to bats REAC T-BE-015	The Applicant has noted this comment.
56	6g part a	Barn Owls	Barn owls confirmed present but not nesting near the proposed localised compound at Warren Farm (Location 1); breeding was confirmed at Location 2 some 400m from this site. Detailed surveys will be undertaken to monitor the barn owls, if nesting is confirmed in Location 1 additional mitigation measures will be required to minimise noise disturbance measures. NRW have advised that	Please see comment references 26 and 27 in **Table 3.1** on barn owl mitigation.

Comment Reference 3.2.2.		3.2.3. Section 3.2.4.	3.2.5. FCC Comment	3.2.6. Applicant's Response
			any activity that causes disturbance should be subject to a Schedule 1 disturbance licence and that works within a buffer of 100m from a breeding site would require appropriate and effective mitigation. REAC T-BD-30-31 needs to reflect this.	
57	6g part b	Cettis Warbler	Cettis warbler at Llawndy – As above however, the large bund and existing vegetation currently buffers the PoA and proposed demolition and construction works from Llawndy ponds. Works are proposed outside of the nesting season as far as is practical with nests protected by suitable buffers following surveys. REAC T-BD-035. Noise monitoring of the works at Point of Ayr may assist any watching brief as per Little Terns if during the nesting period.	Please see the response to comment reference 20 within **Table 3.1** for information on noise monitoring and impact assessment for Little Terns and comment reference 28 within **Table 3.1** in relation to Cetti's warbler.
58	6g part c	Other nesting birds	Other nesting birds- avoidance/mitigation measures referenced within the REAC T-BD-013 & T-BD-035. Avoidance of nesting birds within the dunes will be avoided by the HDD but mitigation measures for ground nesting birds such as skylark in the "SDV" field and its use as a temporary compound also needs to be referenced within the REAC.	The Applicant has noted this comment and confirms that the commitment within the REAC will be progressed to the detailed CEMP such that this requirement is included.

Comment Reference 3.2.2.		3.2.3. Section 3.2.4.	3.2.5. FCC Comment	3.2.6. Applicant's Response
59 a	6h	Amphibians and Reptiles	No GCN have been recorded at Point of Ayr but occasional ad hoc records within dunes; abundant Common toad occur within Warren farm and Llawndy ponds and Common lizard are present throughout the dune habitat. The REAC references - importance of reasonable avoidance measures supervised by an ECoW. NRW require a Species Conservation plan to avoid impacts to GCN, the associated reasonable avoidance measures will also apply to Common Toads and Common Reptiles. T-BD-041	A Species Conservation Plan will be produced outlining the finalised mitigation measures for great crested newts.
SSSI Management Agreements				
60	7	SSSI Management Agreements	Currently there are Management agreements in place which ENI are committed to in agreement with NRW to ensure favourable management of the designated sites in perpetuity. This includes separate management plans for Talacre dunes and the Warren for dune habitats and associated notable species, plus Llawndy farm and Warren farm for migratory and wintering waders and wildfowl. While these Management Plans/Agreements are separate to the Planning application, they are the	The Applicant has noted this comment.

Comment Reference 3.2.2.		3.2.3. Section 3.2.4.	3.2.5. FCC Comment	3.2.6. Applicant's Response
			means to provide mitigation/compensation through the long-term management and monitoring. Have additional opportunities to mitigate for the continued use of the PoA terminal and to further enhance the Dee Estuary designations been considered?	
Biodiversity Net Benefit				
61	8a	Biodiversity Net Benefit	BNG calculations exclude the designated sites but includes the a) Open Mosaic Habitat on Previously Developed Land (OMPDL) which is planned for use as the Centralised Compound. Enhancement will include breaking up of concrete slabs to allow natural regeneration, creation of small pool and removal of the Invasive cotoneaster. b)The watercourse PoAD2 which will be achieved through native tree planting within 10m of each bank for 200m of the watercourse length. Other habitats will be reinstated eg hedgerows removed to gain access. A Landscape plan which details the reinstated hedgerows, new landscaping around the terminal	The Applicant has noted this comment.

Comment Reference 3.2.2.		3.2.3. Section 3.2.4.	3.2.5. FCC Comment	3.2.6. Applicant's Response
			and the BNB proposals can be provided via condition.	
Conclusions				
62	9	HRA	NRW have raised a number of specific issues in particular a) the intertidal works that need further clarification in particular whether the works can be undertaken using the plough rather than a cable trencher. b) Warren Farm wintering bird disturbance –the REAC needs to be more specific with regards to the mitigation proposals and timetable of works. If the issues raised by NRW are adequately addressed within the supporting HRA, this can then be adopted by the LPA.	Please see responses to comment references 1-12 within **Table 3.1** for information/clarification on the works taking place within the intertidal zone. Please see responses to comment references 18 and 19 within **Table 3.1** regarding wintering bird populations at Warren Farm.
63	9	Non-designated species	With regards to the non-designated species and habitats and species the mitigation measures put forward are acceptable with tweaks to the REAC and detail to be provided in the CEMP. NRW have requested Conservation Plans for Protected Species: Natterjack Toads, Sand Lizard and Otter. To ensure that the mitigation measures are implemented on the ground this needs to be	A Species Conservation Plan will be produced outlining the finalised mitigation measures for Natterjack toads; measure T-BD-048 in the REAC and OCEMP. The Applicant will advise the Construction Contractor to include the requirement for a Species Conservation Plan for sand lizards. The requirement for a Species Conservation Plan for sand lizards will be

Comment Reference 3.2.2.		3.2.3. Section 3.2.4.	3.2.5. FCC Comment	3.2.6. Applicant's Response
			one document that the CEMP can readily link to, or separate documents that can be readily summarized within the CEMP.	secured by a suitably worded planning condition.
64	9	Landscape plans	Similarly details the reinstated hedgerows, any new landscaping and the BNB proposals can be provided on one landscape drawing with an accompanying management plan detailing the aftercare and management period.	Retained, reinstated and created habitats are captured on the post-development figures (**Figure 5.2.2**) of **Annex A** of the **BNG Assessment** (**Document Reference T.5.2**). These figures have been informed by the landscape drawings developed for the TCPA Proposed Development. As identified in **paragraph 9.10.105** of **Chapter 9** of the **ES (Document Reference T.4.2.9)**, a Landscape and Ecological Management Plan (LEMP) would be prepared to provide details on aftercare and ongoing management. The LEMP is referred to within the BNG (**Document Reference T.5.2**) as a Habitat Management Plan. The LEMP could be secured via a planning condition.

REFERENCES

- **Ref. 1**: RPS (2019) Review of Cable Installation, Protection, Mitigation and Habitat Recoverability. Available at: www.rpsgroup.com/media/4295/review-of-cable-installation-protection-mitigation-and-habitat-recoverability.pdf
- **Ref 2:** CEFAS (2016) *Suspended Sediment Climatologies around the UK*
- **Ref. 3:** CMACS (2003) A baseline assessment of electromagnetic fields generated by offshore windfarm cables. COWRIE Report EMF – 01-2002 66.
- **Ref. 4:** Gill, A.B., Huang, Y., Gloyne-Philips, I., Metcalfe, J., Quayle, V., Spencer, J. and Wearmouth, V. (2009). COWRIE 2.0 Electromagnetic Fields (EMF) Phase 2: EMF-sensitive fish response to EM emissions from sub-sea electricity cables of the type used by the offshore renewable energy industry. COWRIE-EMF-1-06.
- **Ref. 5:** Goodship, N.M. and Furness, R.W. 2022. Disturbance Distances Review: An updated literature review of disturbance distances of selected bird species.
- **Ref. 6:** Sommer, A., Klein, B., and Pörtner, H.O. (1997). Temperature induced anaerobiosis in two populations of the polychaete worm *Arenicola marina* (L.). Journal of Comparative Physiology, series B, 167, 25-35.
- **Ref. 7:** Denton, J, S and Beebee, J.C.T. (1993). Summer and winter refugia of natterjacks (*Bufo calamita*) and common toads (*Bufo bufo*) in Britain. Herpetological Journal, Volume 3. 90-94.
- **Ref. 8:** https://www.wildlifetrusts.org/wildlife-explorer/reptiles/sand-lizard [Accessed July 2023].

APPENDIX A – OFFSHORE ENVIRONMENTAL STATEMENT REPORT (DRAFT), PHYSICAL PROCESSES TECHNICAL REPORT, RPS, 2023

Liverpool Bay CCS Ltd

HYNET CARBON DIOXIDE TRANSPORTATION AND STORAGE PROJECT - OFFSHORE

Environmental Statement Report
Appendix F1: Physical Processes Technical Report

EHE7228B
Liverpool Bay CCS Limited
Version Rev01
May 2023
Physical Processes
Technical Report

rpsgroup.com

Document status					
Version	**Purpose of document**	**Authored by**	**Reviewed by**	**Approved by**	**Date**
Rev01	Draft	RMcC	NRS		
File Reference					

Prepared by:

RPS

Ryan McConnell
Graduate Scientist

Elmwood House
74 Boucher Road, Belfast
Co. Antrim BT12 6RZ

T +44 2890 667 914
E ryan.mcconnell@rpsgroup.com

Prepared for:

Liverpool Bay CCS Limited

Donald Smith
HSE Manager

Liverpool Bay CCS Limited
Eni House, 10 Ebury Bridge Road, London SW1W 8PZ

T +44 207 344 6247
E donald.smith@eni.com

GLOSSARY

Term	Meaning
The Applicant	This is Liverpool Bay CCS Ltd . Please use 'the Applicant' when referring to the entity making the application and the entity that ultimately develops/operates the HyNet Carbon Dioxide Transportation and Storage System.
Bathymetry	The measurement of water depth in oceans, seas and lakes.
Bed resistance coefficient	Represents the roughness or friction applied to the flow by the seabed.
"Do Nothing" Scenario	The environment as it would be in the future should the proposed project not be developed.
Ebb tide	The tidal phase during which the water level is falling.
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 Statement (ES).
Erosion	Depletion of sediment in the intertidal region.
Fetch	Length in the wind direction of the marine area where water waves are generated by wind.
Flood tide	The tidal phase during which the water level is rising.
High Water Mark	The level reached by the sea at high tide.
Highest Astronomical Tide	The highest tidal height predicted to occur under average meteorological conditions and any combination of astronomical conditions.
Hydrodynamic boundary conditions	The conditions used in a model boundary which can included surface elevation and velocity which will affect the rest of the model domain. The boundary condition can vary with time and along the boundary.
Intertidal region	An area of a shoreline that is covered at high tide and uncovered at low tide.
Lee	Shelter from wind or weather given by an object.
Littoral currents	Flow derived from tide and wave climate.
Low Water Mark	The level reached by the sea at low tide.
Lowest Astronomical Tide	The lowest tidal height predicted to occur under average meteorological conditions and any combination of astronomical conditions.
Magnitude	Size, extent and duration of an impact.
Mean High Water	The highest water level reached during and average tide.
Mean High Water Spring	The most inshore level location reached by the sea at high tide during mean high water spring tide. This is defined as the average throughout the year, of two successive high waters, during a 24-hour period in each month when the range of the tide is at its greatest.
Mean Low Water Spring	The most offshore location reached by the sea at low tide during low water spring tide. This is defined as the average throughout the year, of two successive low waters, during a 24-hour period in each month when the range of the tide is at its greatest.

Term	Meaning
Mean Sea Level	The average tidal height over a long period of time.
Metocean	Refers to the syllabic abbreviation of meteorology and (physical) oceanography.
Mitigation Measure	Measure which would avoid, reduce, or remediate an impact
Neap tide	Tide that occurs when the sun and moon are at right angles to each other and the gravitational pull of the sun partially cancels out the pull of the moon on the ocean.
Non-statutory stakeholder	Organisations with whom the regulatory authorities may choose to engage who are not designated in law but are likely to have an interest in a proposed development.
Project Design Envelope	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.
Refraction	The change in direction of a wave passing from one medium to another caused by its change in speed.
Residual Impact	Residual impacts are the final impacts that occur after the proposed mitigation measures have been put into place, as planned.
Sandwave	A lower regime sedimentary structure that forms across from tidal currents.
Scour protection	Measures to prevent loss of seabed sediment around any structure placed in or on the seabed (e.g. by use of protective aprons, mattresses, rock and gravel placement).
Sedimentation	The process of settling or being deposited as a sediment.
Significant wave height	Mean wave height (trough to crest) of the highest third of the waves.
Slack tide	Tidal phase at which the current turns from flood to ebb (high-water slack tide) or from ebb to flood (low-water slack tide).
Spectral waves	Describes the distribution of wave energy with frequency (1/ period) and direction.
Spring tide	Tide that occurs when the sun and moon are directly in line with the Earth and their gravitational pulls on the ocean reinforce each other.
Suspended Particulate Matter	Particles that are suspended in the water column.
Turbidity	The quality of being cloudy, opaque, or thick with suspended matter.
Wave height	The distance from trough to crest of a wave.
Wave period	The time it takes for two successive crests (one wavelength) to pass a specified point.

ACRONYMS

Acronym	Description
ADCP	Acoustic Doppler Current Profiler
BERR	Department for Business Enterprise and Regulatory Reform
BODC	British Oceanographic Data Centre
CCO	Coastal Channel Observatory
CD	Chart Datum (generally defined as LAT)
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
ClV	Cleveleys
DA	Depth Averaged
DHI	Danish Hydraulic Institute
ECMWF	European Centre for Medium Range Forecasts
EMODnet	European Marine Observation and Data Network
EIA	Environmental Impact Assessment
ES	Environmental Statement
GyM	Gwynt y Môr
HAT	Highest Astronomical Tide
HDD	Horizontal Directional Drilling
HWM	High Water Mark
LAT	Lowest Astronomical Tide
LWM	Low Water Mark
MDS	Maximum Design Scenario
MEDIN	Marine Environmental Data and Information Network
MHW	Mean High Water
MHWN	Mean High Water Neaps
MHWS	Mean High Water Springs
MLWN	Mean Low Water Neaps
MLWS	Mean Low Water Springs
NOAA	National Oceanic and Atmospheric Administration
NRW	Natural Resources Wales
OP	Offshore Platform
OSP	Offshore Service Platform
PoA	Point of Ayr
PSA	Particle Size Analysis
PT	Particle Tracking
SPM	Suspended Particulate Matter

SSC	Suspended Sediment Concentration
SSS	Side Scan Sonar
TSSF	Tide and Storm Surge Forecast
UKCS	United Kingdom Continental Shelf
UKHO	United Kingdom Hydrographic Office

UNITS

Acronym	Description
º	Degrees (angle from True north)
cm/s	Centimetre per second (speed)
mm	Millimetre (distance)
m	Metre (distance)
m^3	Cubic metres (volume)
m^3/h	Cubic metres per hour (rate of change)
km	Kilometre (distance)
Kg/s	Kilograms per second (rate of release)
$m^3/d/m$	Cubic metres transported per day per metre width of transport path (i.e. perpendicular to direction of transport)
m/s	Metres per second (speed)
mg/l	Milligrams per litre (suspended sediment concentration)

CONTENTS

Tables

Figures

1 PHYSICAL PROCESSES TECHNICAL REPORT

1.1 Introduction

This Physical Processes Technical Report provides information relating to the physical environment and processes for the offshore components of the Hynet Carbon Dioxide Transportation and Storage System (hereafter referred to as 'the Proposed Development'). The purpose of the technical report is to provide details of the supporting study undertaken by means of numerical modelling. It describes the current baseline conditions and quantifies the changes as a result of cable trenching and monitoring well drilling activities. This report is divided into two main sections:

- Baseline conditions – describing current hydrography and sedimentology
- Construction phase changes – describing the dispersion and fate of sediment mobilised during construction phase activities.

For the purposes of this physical processes technical report, physical processes are defined as encompassing the following elements:

- Tidal elevations and currents
- Waves
- Bathymetry
- Seabed sediments
- Suspended sediments
- Sediment transport

1.2 Study area

The Proposed Development physical processes study area, as shown in Figure 1.1, is defined as the area encompassing the development area, plus a buffer of one tidal excursion. The *c.*8 km buffer around the development area previously used in the Project EIA Scoping Report (RPS, 2022), has been updated on the basis of tidal ellipse modelling along the proposed cable route. The updated physical processes study area accounts for this tidal excursion and was extended to account for residual currents along the coastline. It therefore illustrates the areas potentially affected by changes in water quality (increases in Suspended Sediment Concentration (SSC)).

The physical processes study area forms the focus for the assessment. However, the extent of the numerical models employed in undertaking the study is not limited to this region, and should they arise, would therefore identify potential impacts beyond the physical processes study area, both further offshore, and along the shoreline.

1.2.1 Intertidal area

The offshore topic of physical processes study area includes the intertidal area. This intertidal area overlaps with the onshore topic of Geology, Hydrology, Soils and Flood Risk (landward of Mean Low Water Springs (MLWS)).

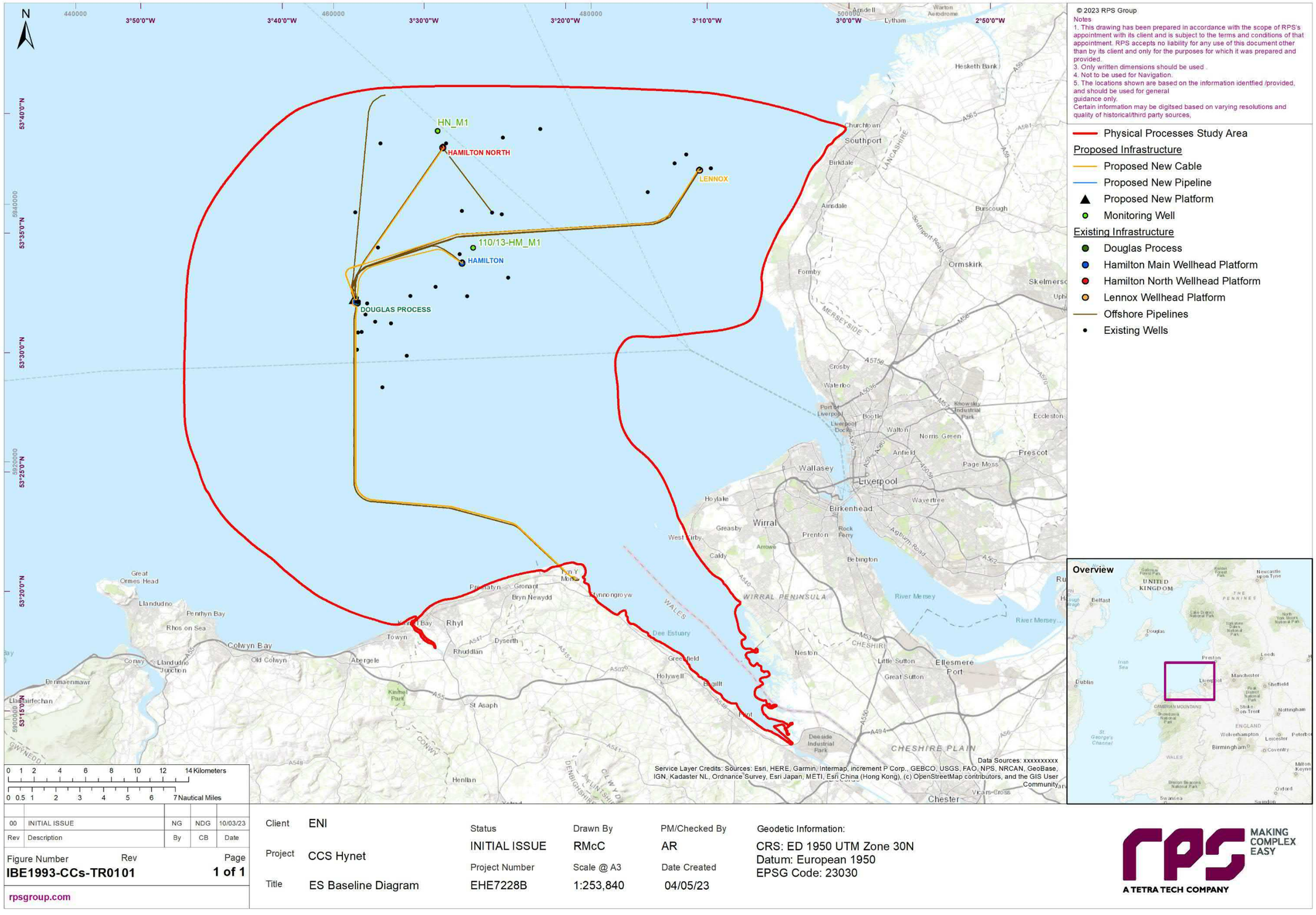


Figure 1.1: Proposed Development physical processes study area.

1.3 Methodology

The physical processes study was undertaken to provide information on potential changes to physical processes and the fate of mobilised sediment during the construction phase by means of numerical modelling. Numerical models were developed and calibrated using a combination of publicly available datasets and those collected specifically for the Proposed Development.

The models were used to undertake simulations of site preparation and cable trenching activities to quantify potential increases in Suspended Sediment Concentration (SSC) and subsequent deposition. This information was then applied in the context of the physical processes environmental impact assessment and those of related disciplines.

Numerical modelling

Numerical modelling techniques were used to describe baseline tide, wave, and sediment transport regimes. The MIKE suite of software was employed, as a single model mesh could be used to simulate these processes both individually and in combination. The model domain is shown in Figure 1.2. The MIKE suite of models is a widely used industry standard modelling suite developed by the Danish Hydraulic Institute (DHI). It has been approved for use by industry and government bodies including Natural Resources Wales. The MIKE suite is a modular system that contains a number of different but complementary modules encompassing different physical processes. These are summarised in Table 1.1 and described in further detail within the relevant sections. The modelled parameters are presented in

Table 1.2

Table 1.1: Mike suite of models

Simulation	Model	Description
Baseline tidal flow	MIKE21 Flexible Mesh (FM) modelling system	The FM Module is a 2-dimensional, depth averaged hydrodynamic model which simulates the water level variations and flows in response to a variety of forcing functions in lakes, estuaries, and coastal areas. The water levels and flows are resolved on a mesh covering the area of interest when provided with bathymetry, bed resistance coefficient, wind field, hydrodynamic boundary conditions, etc.
Baseline wave climate	MIKE21 Spectral Wave (SW)	The wave modelling was undertaken using the spectral wave model, MIKE21 SW. The waves were computed on the same grid as the tidal flows. The model resolves the wave field by simulating wind generation of waves within the model domain and the propagation of externally generated swell waves through the domain. The model setup ensured that the detail of both locally generated wind waves and swell conditions from further afield were captured.
Baseline littoral currents	MIKE21 FM and SW	The MIKE suite facilitates the coupling of models. The depth averaged hydrodynamic model, used for the tidal modelling, coupled with a spectral wave model, provides a full wave climate incorporating the impact of water levels and currents on waves and wave breaking. Using this, the littoral currents (i.e. those currents driven by tidal, wave, and meteorological forces) were examined.
	MIKE21 Sediment Transport (ST)	This module enables assessment of bed sediment transport rates and initial rates of bed level change for non-cohesive sediment resulting from currents or combined wave-current flows. The model combines inputs from both the hydrodynamic model and, if required, the wave propagation model. It uses sediment size and gradation to determine the bed level changes and sediment transport rates.
Offshore seabed preparation	MIKE21 Particle Tracking (PT)	The Particle Tracking module was implemented for offshore construction activities as it has the advantage that it could be

Simulation	Model	Description
Drill cuttings Offshore cable installation		used to describe the transport of material released in a specific part of the water column. In this way, the dispersion would not be over-estimated, or the corresponding sedimentation underestimated.
Nearshore seabed preparation Nearshore cable preparation	MIKE21 Mud Transport (MT)	The MIKE Mud Transport (MT) module allows the modelling of erosion, transport, and deposition of cohesive and cohesive/granular sediments. This model is suited to sediment releases in the water column and allows sediment sources which may vary spatially and temporally. Utilised for activities that coincide with flooding and drying areas.

Table 1.2: Summary of Modelled Environmental Variation Scenarios.

Variation/ operation	Description	Parameter modelled
Seabed features clearance Section 1.7.1	Dispersion modelling relating to sand wave clearance channels cleared for cable laying, through sand wave features.	South of Douglas OP: • Clearance is undertaken along two sandwaves across lengths of 100m and 15m, each channel being 10m wide and 3m in depth. • Mass flow excavator used in 3-day clearance operation, with a rate of release of 27.71kg/s. West Hoyle Bank: • Dredged channel through *c*.1km West Hoyle Bank, each channel being 21m wide and 7m in depth. • Backhoe dredger used in 14-day clearance operation, with a rate of release of 295kg/s.
Drill cuttings Section 1.7.2	Dispersion modelling related to suspended sediments from drilling of monitoring wells	Drilling parameters: • 26” section drilled through 30.48m of sand/silt and 84.43m of the Mercia Mudstone Group. • 17” section below section 1 drilled through a further 518.16m of the Mercia Mudstone Group. • 100% hole washout accounting for abrasive drilling sediment (drilling muds) simulated. • Drilled at 40m/h over the course of c.16 hours.
Cable installation Section 1.7.3	Dispersion modelling of suspended sediment arising from cable installation via trenching.	Trenching operation parameters: • Trench 3m wide at seabed and 3m deep with triangular cross section; • Trenching undertaken at 450m/h;

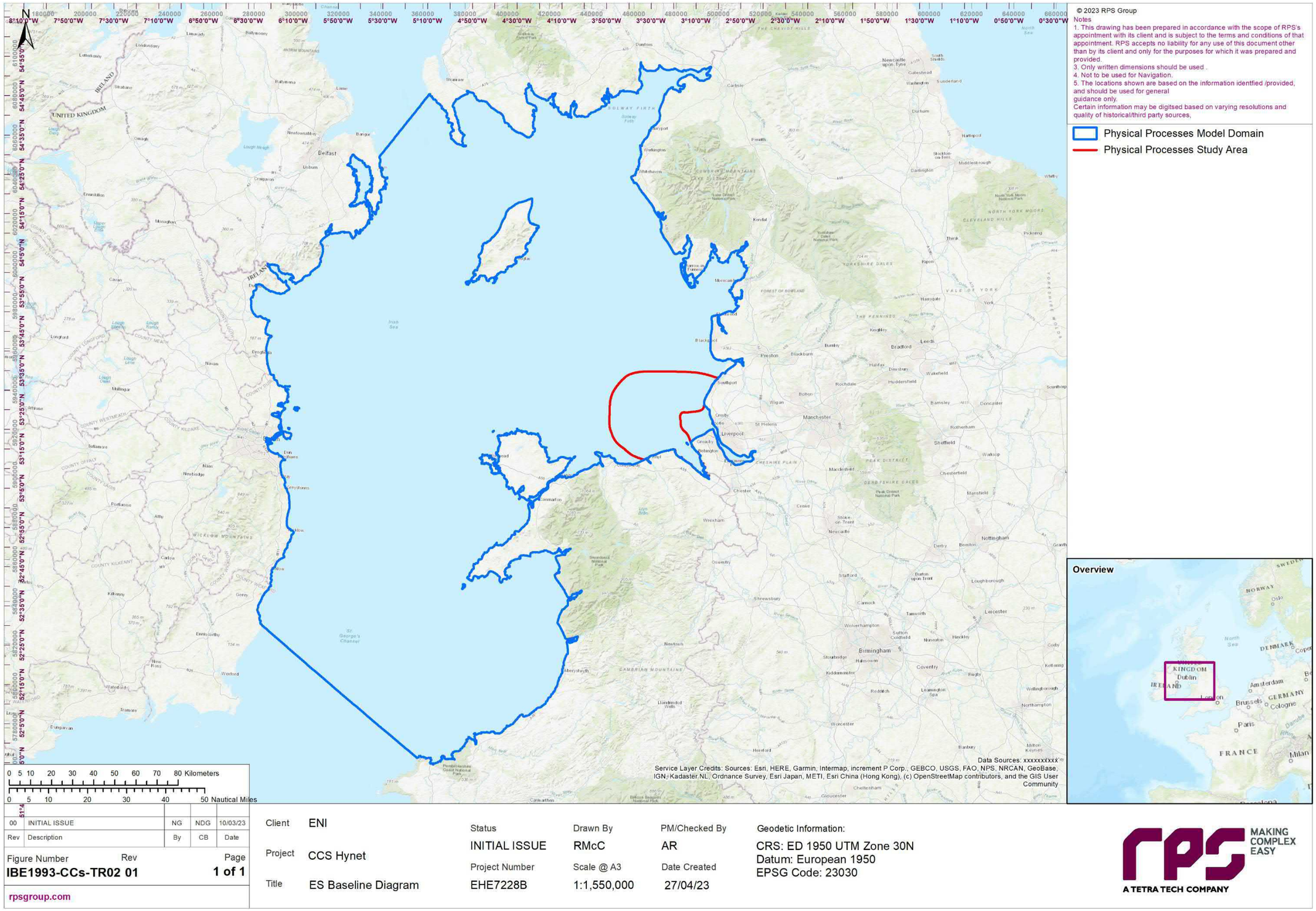


Figure 1.2: Model domain (blue outline).

1.4 Desktop study

Information on physical processes within the Physical Processes Study Area was collected through a detailed desktop review of existing studies and datasets. These are summarised at Table 1.3 below.

Table 1.3: Summary of key desktop reports.

Title	Source	Year	Author
Mona Offshore Wind Project Generation Assets Preliminary Environmental Information Report (PEIR) - Technical Report	https://www.morganandmona.com/en/consultationhub/	2023	RPS Group
Morgan Offshore Wind Project Generation Assets Preliminary Environmental Information Report (PEIR) - Technical Report	https://morecambeandmorgan.com/morgan/consultationhub/	2023	RPS Group
European Marine Observation and Data Network (EMODnet) – Seabed classification	https://www.emodnet-geology.eu/	2022	EMODnet
European Marine Observation and Data Network (EMODnet) – Bathymetry data	https://www.emodnet-bathymetry.eu/	2022	EMODnet
European Marine Observation and Data Network (EMODnet) – Metocean data	https://map.emodnet-physics.eu/	2022	EMODnet
Department for Environment Food and Rural Affairs – Bathymetry data	https://environment.data.gov.uk/DefraDataDownload	2022	DEFRA
The Environment Agency National LiDAR Programme	National LIDAR Programme - data.gov.uk	2022	Environment Agency
National Oceanic and Atmospheric Administration (NOAA) –Atmospheric data	DHI Metocean Data Portal	2022	NOAA
National Network of Regional Coastal Monitoring Programmes	https://coastalmonitoring.org/cco/	2022	Coastal Channel Observatory
Centre for Environment, Fisheries and Aquaculture Science (CEFAS) – wave data	https://wavenet.cefas.co.uk/map	2022	CEFAS
ABPmer Data explorer	https://www.seastates.net/explore-data/	2022	ABPmer
Hydrography of the Irish Sea, SEA6 Technical Report	UK Government	2005	Howarth M.J.
Atlas of UK Marine Renewable Energy Resources	https://www.renewables-atlas.info/	2022	ABPmer
Geology of the seabed and shallow subsurface: The Irish Sea.	British Geological Survey	2015	Mellett et al.
British Geological Survey – sediment sample data	https://mapapps2.bgs.ac.uk/geoindex_offshore	2022	BGS
Suspended Sediment Climatologies around the UK.	Department for Business, Energy & Industrial Strategy (BEIS)	2016	Cefas
Metocean Data collection for the Ormonde offshore wind project.	Marine Data Exchange	2011	Geotechnical Engineering and Marine Surveys (GEMS)
Irish Sea Zone Hydrodynamic measurement campaign	Marine Data Exchange	2010 to 2013	EMU Ltd (now Fugro Ltd)
Admiralty Tide Tables	United Kingdom Hydrographic Office (UKHO)	2022	UKHO
Marine Environmental Data Information Network (MEDIN) Seabed Mapping Programme	Admiralty Marine Data Portal	2022	MEDIN
Integrated Mapping for the Sustainable Developments of Ireland's Marine Resource (INFOMAR) Seabed Mapping Programme	Geological Survey Ireland (GSI) and Marine Institute	2022	INFOMAR

Title	Source	Year	Author
Long term wind and wave datasets	European Centre for Medium-range Weather Forecast (ECMWF)	2022	ECMWF
UK tide gauge network and database of current observation	British Oceanographic Data Centre (BODC)	2021	BODC
UK Climate Projections (UKCP)	Met Office	2018	Met Office
Review of aggregate dredging off the Welsh coast	HR Wallingford	2016	HR Wallingford
A user-friendly database of coastal flooding in the UK from 1915-2014	Scientific Data (journal)	2015	Haigh et al.
Awel y Môr Offshore Windfarm PEIR and ES	Awel y Môr Offshore Wind Farm Ltd.	2021 & 2022	RWE Renewables
Burbo Bank Extension Offshore Windfarm Environmental Statement	https://www.marinedataexchange.co.uk/	2013	Ørsted
Walney Extension Offshore Wind Farm Environmental Statement	https://www.marinedataexchange.co.uk/	2013	Ørsted
Natural Variability of Turbidity in the Regional Environmental Assessment (REA) Areas.	https://www.marinedataexchange.co.uk/	2011	MALF
North West England and North Wales SMP22 - SMP2	http://www.hoylakevision.org.uk/wp-content/uploads/2012/11/SMP2Main.pdf	2011	Halcrow Group Ltd
Cell Eleven Tidal and Sediment Study Phase 2	https://coastalmonitoring.org/	2010	Halcrow Group Ltd
Cell Eleven Regional Monitoring Strategy (CERMS)	https://coastalmonitoring.org/	2010	Halcrow Group Ltd
Walney 1 & 2 Offshore Windfarm Environmental Statements	https://www.marinedataexchange.co.uk/	2006	Ørsted
West of Duddon Sands Offshore Windfarm Environmental Statement	https://www.marinedataexchange.co.uk/	2006	RSK Envvironment Ltd
DTI Strategic Environmental Assessment Area 6, Irish Sea, seabed and surficial geology and processes	British Geological Survey	2005	Holmes and Tappin
Ormonde Offshore Windfarm Environmental Statement	https://www.marinedataexchange.co.uk/	2005	Rudall Blanchard Associates
Barrow Offshore Windfarm Environmental Statement	https://www.marinedataexchange.co.uk/	2005	Royal HaskoningDHV
British Oceanographic Data Centre	National Oceanography Centre	various	National Oceanography Centre
Designated sites (SPAs and SACs)	JNCC mapping data (https://jncc.gov.uk/mpa-mapper/)	2022	JNCC
Designated sites (SSSIs)	Defra Spatial Data Download	2022	DEFRA
Designated Ramsar sites	Map (ramsar.org)	2022	Ramsar

1.5 Site-specific surveys

A summary of the surveys undertaken to inform the Physical Processes EIA is outlined in Table 1.4 below.

Table 1.4: Summary of site-specific survey data.

Title	Extent of survey	Overview of survey	Survey contractor	Date	Reference to further information
Hynet Carbon Capture Storage and Decommissioning Benthic Survey Report 2022	*Proposed Development area of physical work*	*Benthic/ sedimentary survey carried out via seabed imagery and grab sampling utilised for particle size analysis (PSA)*	*Ocean Ecology Ltd.*	*2022*	*To be included in appendices*

1.6 Baseline Environment

1.6.1 Bathymetry

The model domain had full bathymetry data coverage and was populated using a combination of data sources. Primarily bathymetry data was sourced from the MEDIN Seabed Mapping Programme via the Admiralty Marine Data Portal as shown in Figure 1.3 Each of the datasets for the east Irish Sea area was combined into a single set giving priority to the most recent survey data. For areas within regions which did not have coverage from the MEDIN dataset further data was sourced from the DEFRA Survey Data Download site (DEFRA, 2022). This was undertaken for specific bays such as Conwy Bay and the Dee Estuary.

For the remaining model domain, the EMODnet 100m resolution tiled data was utilised (EMODnet, 2020). This database is available under the European Inspire Directive and provides access to data in a variety of formats, datums and resolutions based on a combination of survey datasets. All data was converted, where necessary, to mean sea level datum generally with a resolution of at least three times the mesh resolution to ensure that coastal features were represented within the numerical modelling, as illustrated in Figure 1.4.

The resolution of the model bathymetry was designed to reflect variations in water depth and bed forms for the accurate simulation of tidal currents. Additional model resolution was also included to incorporate the installation of the Proposed Development infrastructure. Across the physical processes study area, the resolution varied between circa 500m at its western extent, down to 10m along the cable trenching route. With increasing distance from the physical processes study area, the cell size was increased but maintained at a level which retained model accuracy. Figure 1.5 illustrates the mesh resolution within the tides, waves and sediment transport model.

The extent of the domain, Figure 1.2, was designed to provide the basis for a model which could be utilised for tide, wave, and sediment transport modelling. The focus of the study is a tidal excursion from the proposed cable route, to quantify sediment dispersion, however, a larger domain has the benefit of identifying any potential effects beyond the physical processes study area.

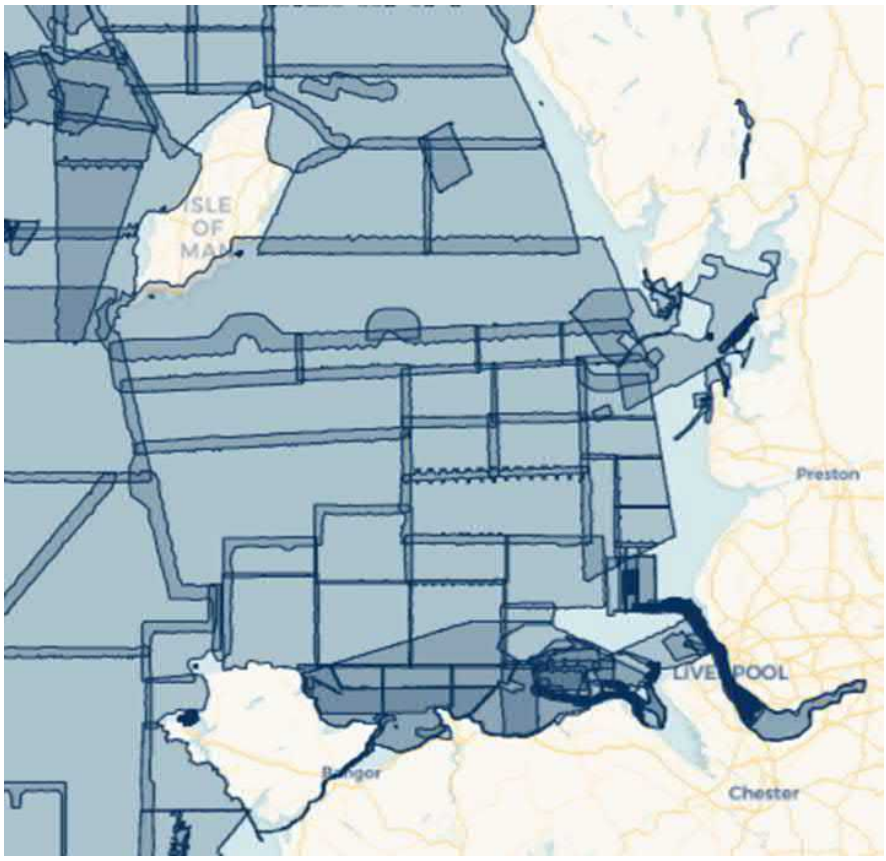


Figure 1.3: MEDIN bathymetric data coverage.

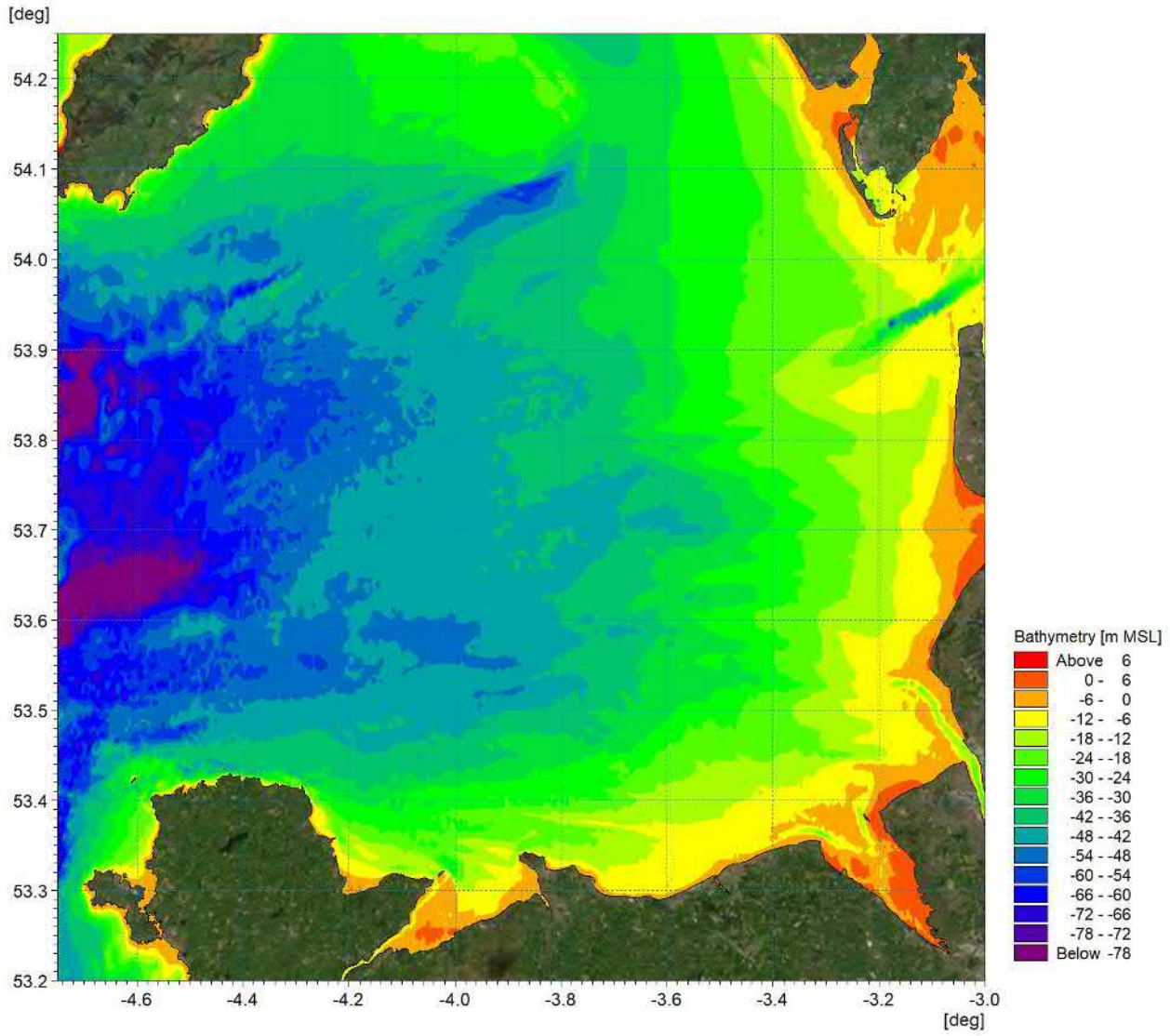


Figure 1.4: Model bathymetry within the east Irish Sea.

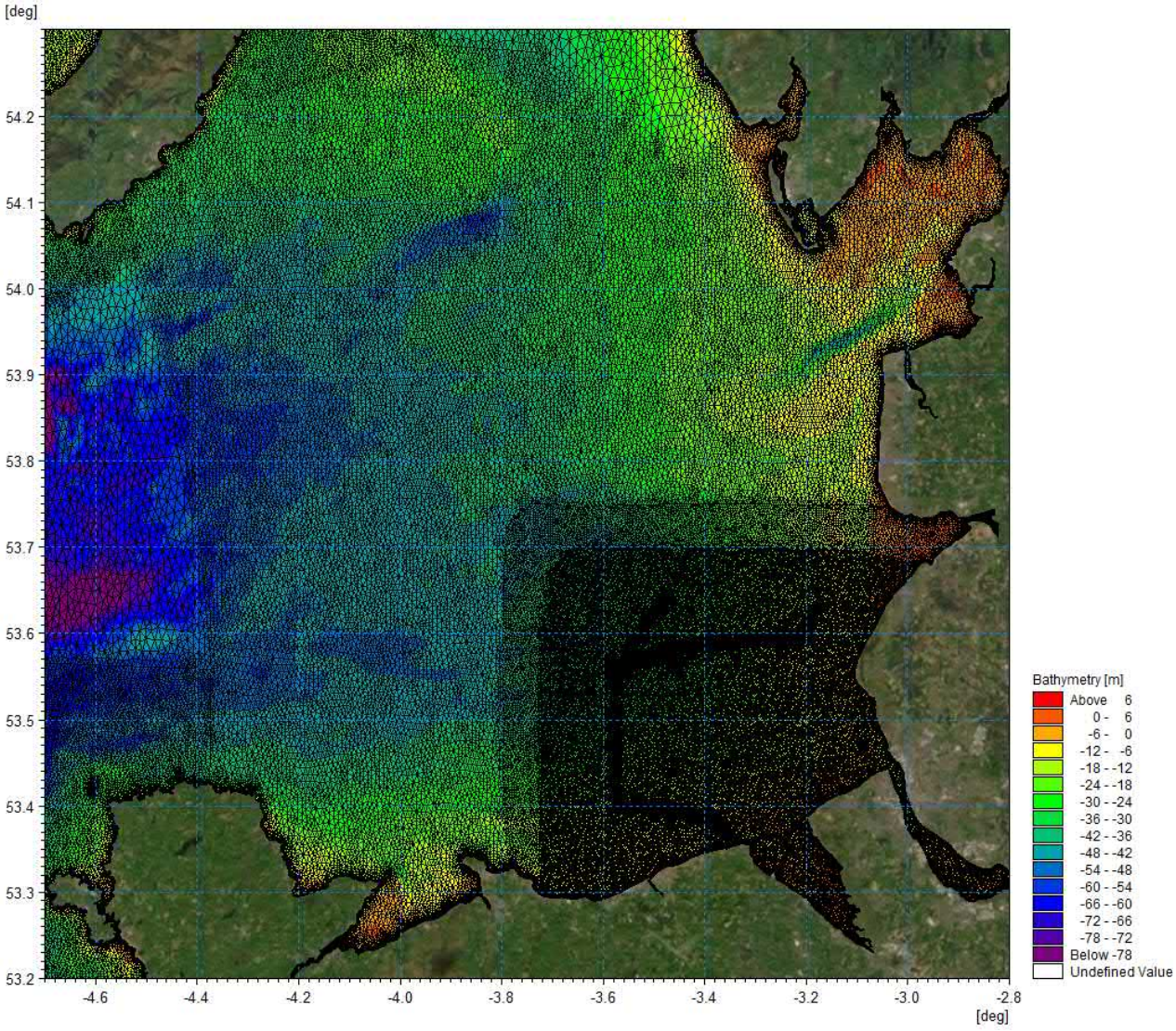


Figure 1.5: Model mesh utilised for dispersion modelling.

1.6.2 Hydrography

The UKHO states that the mean tidal range at the Standard Port of Holyhead is approximately 3.65m whilst at Douglas it is 4.55m. The tidal characteristics shown in **Error! Reference source not found.** in metres referenced to Chart Datum (CD):

Table 1.5: Tidal Levels at Standard Ports.

Tidal Level	Holyhead	Douglas
Lowest Astronomical Tide (LAT)	0.0	-0.3
Mean Low Water Springs (MLWS)	0.7	0.8
Mean Low Water Neaps (MLWN)	2.0	2.4
Mean Sea Level (MSL)	3.3	3.8

Tidal Level	Holyhead	Douglas
Mean High Water Neaps (MHWN)	4.4	5.4
Mean High Water Springs (MHWS)	5.6	6.9
Highest Astronomical Tide (HAT):	6.3	7.9

The semi-diurnal tides are the dominant physical process in the Irish Sea moving into the Irish Sea from the Atlantic Ocean through both the North Channel and St. George's Channel. The tidal range in the Irish Sea is highly variable with the range in Liverpool Bay exceeding 10m on the largest spring tides, the second largest in Britain.

The tidal flow simulations which form the basis of the study were undertaken using the MIKE21 FM flexible mesh modelling system. The FM Module is a two-dimensional, depth averaged hydrodynamic model which simulates the water level variations and flows in response to a variety of forcing functions in lakes, estuaries and coastal areas. The water levels and flows are resolved on a mesh covering the area of interest when provided with bathymetry, bed resistance coefficient, hydrodynamic boundary conditions, etc.

The tidal model was driven using boundary conditions extracted from RPS' Tide and Storm Surge Forecast (TSSF) model of Irish coastal waters (RPS, 2018), the extent and bathymetry of which is illustrated in Figure 1.6. This model was also developed using flexible mesh technology, with the mesh size (model resolution) varying from circa 24km along the offshore Atlantic boundary to circa 200m around the Irish coastline. These boundaries were fully defined 'flather' boundaries for which both surface elevation and current vectors are specified.

Principal hydrometric resources used for calibration such as ADCP wave buoy data, Admiralty tidal harmonics, British Oceanographic Data Centre (BODC) (BODC, 2023), and Coastal Channel Observatory (CCO), are illustrated in Figure 1.7. The locations of the selection of calibration data presented in this document for tidal flow are shown in Figure 1.8.

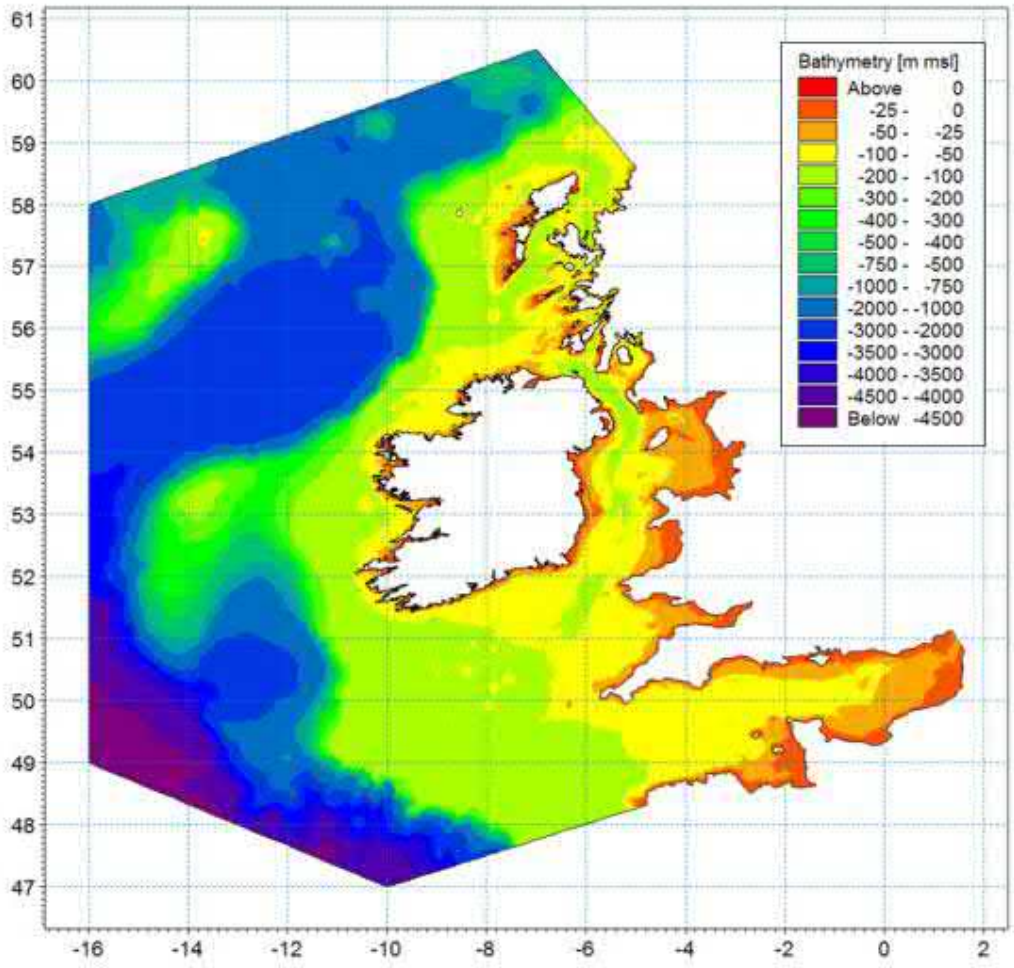


Figure 1.6: Extent and bathymetry of Irish Seas tidal and storm surge model.

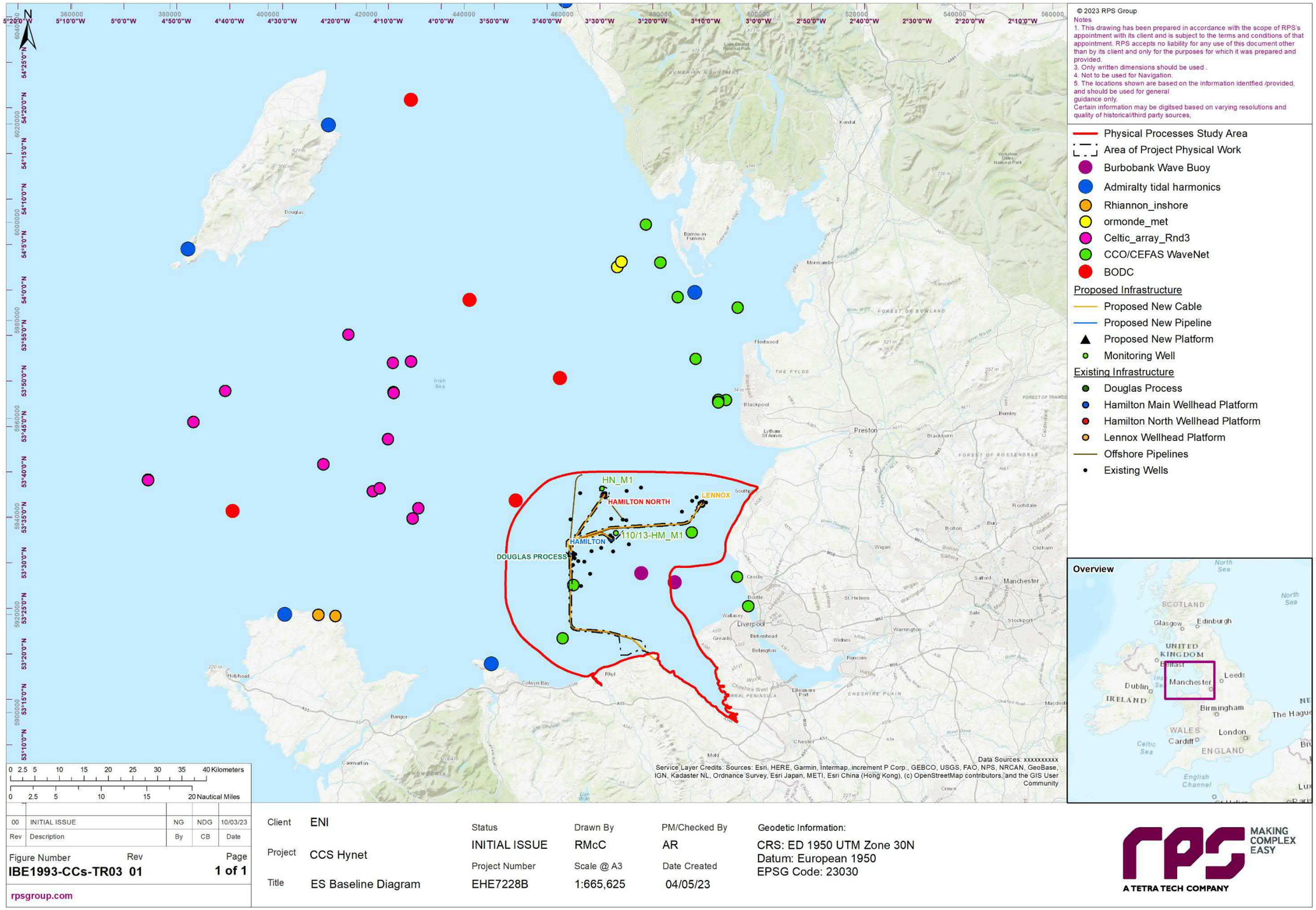


Figure 1.7: Availability of metocean datasets across the eastern Irish Sea

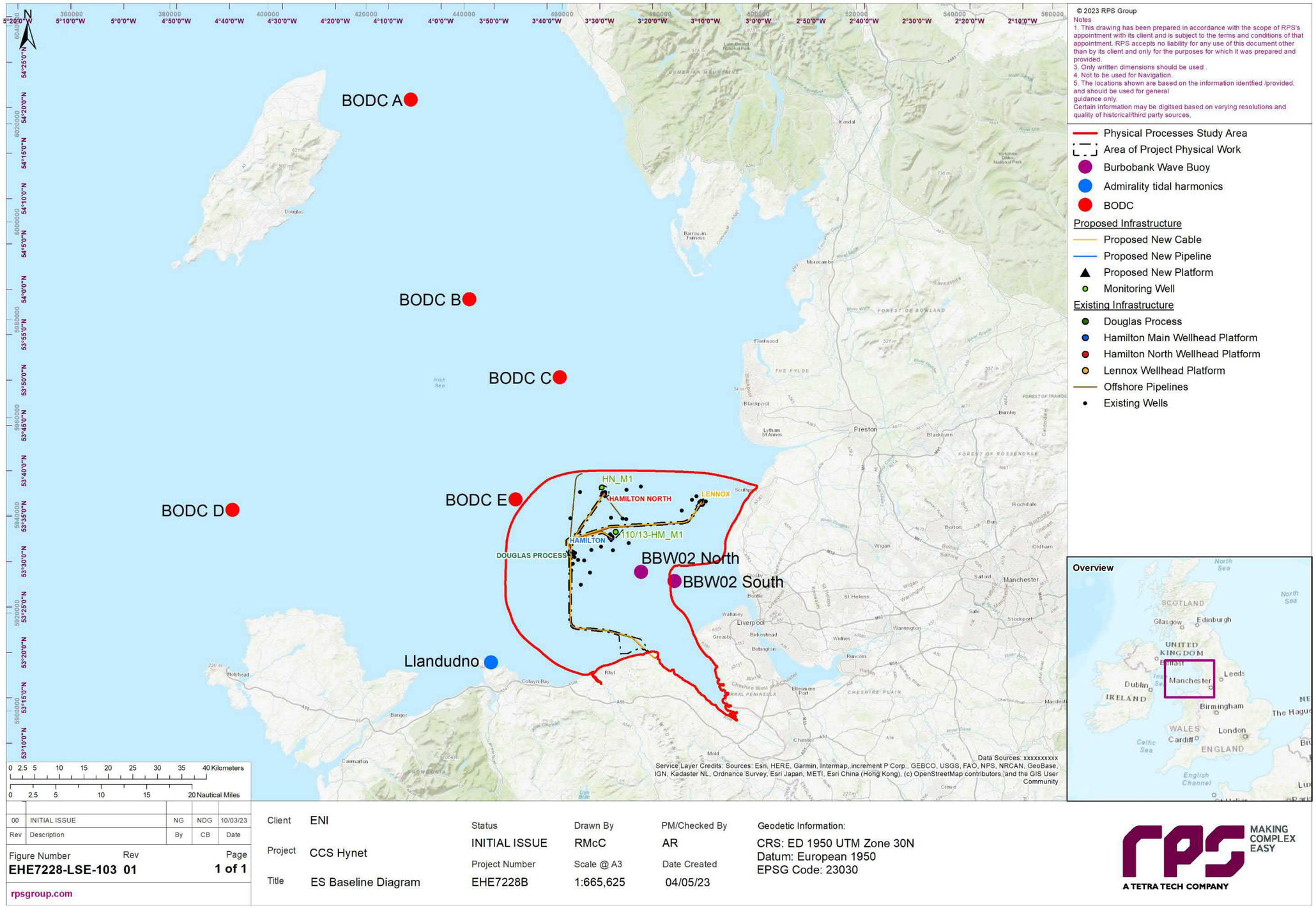


Figure 1.8: Location of calibration data presented.

Figure 1.9 shows the comparison of the modelled (red) and Admiralty tidal levels predicted from harmonic analysis (blue) at Llandudno. The model correlated well through both spring and neap tidal phases.

ADCP plots are presented illustrating spring and neap tides both within and in proximity to the physical processes study area. These compare modelled results with the SEAWATCH Midi185 wave buoy data collected at two locations east of the ENI Development Area by Fugro (Fugro, 2016) for the BurboBank 02 offshore wind farm site (referred to as BBW02). Despite its name the wave buoy also takes measurements of current speed and direction through the water column via its subsea sensor. This ADCP data was sourced via the Marine Data Exchange portal (Marine Data Exchange, 2023). Each plot displays the current speed data on the left axis and the current direction on the right axis. The modelled depth average current speed is shown by a red trace and current direction by a black trace. The measured data was collected at various water depths, (surface, seafloor, and depth averaged) noted within the legend.

The wave buoy and modelled tidal current data are presented in Figure 1.10 to Figure 1.13 and show similar trends in that that current speeds during neap tides are half of the speed during spring tides. As well as the flood tide approaching from an easterly direction with the ebb tide being slightly weaker. The modelled data fits within the range of the Fugro measured data following similar tidal flow patterns.

For each location of BODC data, a pair of plots are presented firstly relating to spring tides and secondly neap tides. In each plot the current speed data is presented on the left axis whilst the current direction is presented to the right. The modelled depth average current speed is shown by a red trace and current direction by an orange trace. The measured data was collected at various water depths noted within the legend.

Sites A and B are presented in Figure 1.14 to Figure 1.17 and indicate that the flood tide which approaches the physical processes study area from an easterly direction is more dominant than the ebb tide. Peak neap tidal current speeds are typically half of those experienced during spring tide. The modelled data largely lie within the range of the measured data and replicates the asymmetric tidal flows patterns.

This is also the case for site C shown in Figure 1.18 and Figure 1.19 for spring and neap respectively. Current directions and the dominance of flood tides are replicated with the model domain. Tidal currents at site D are more strongly bi-directional as flow is accelerated around Anglesey as illustrated in Figure 1.20 and Figure 1.21. It is noted that there is a wide variation in the measured tidal currents with respect to depth and 70m at this location would represent near bed conditions. The model does however correlate in terms of current directionality and the dominance of flood tide currents.

Finally, in close proximity to the ENI Development Area, site E, the tidal current speeds and directions are well represented by the model. This is the case for both spring, Figure 1.22, and neap, Figure 1.23, tidal flows. The calibration data demonstrates that the numerical model simulates the tidal currents in the region. This includes the representation of the dominant flood tide.

To provide a representation of tidal flows across the domain Figure 1.24 and Figure 1.25 illustrates tidal patterns during peak ebb and flood on a neap tide, whilst Figure 1.26 and Figure 1.27 illustrates the spring tide. Residual tidal flows, and how they drive sediment transport regimes, are examined in section 1.6.6.

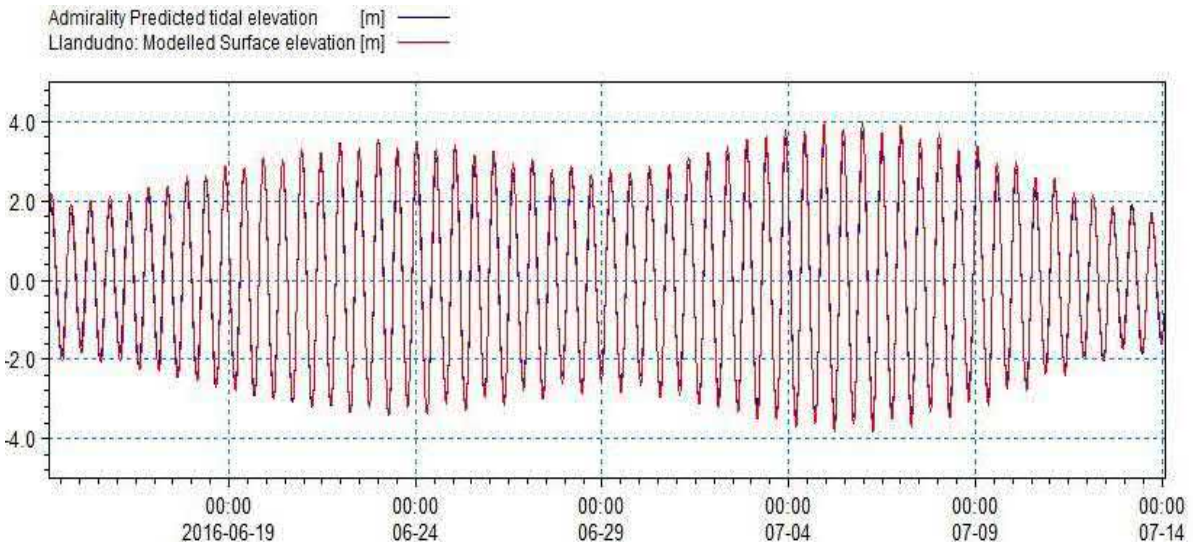


Figure 1.9: Comparison of model and admiralty harmonic tide data for Llandudno.

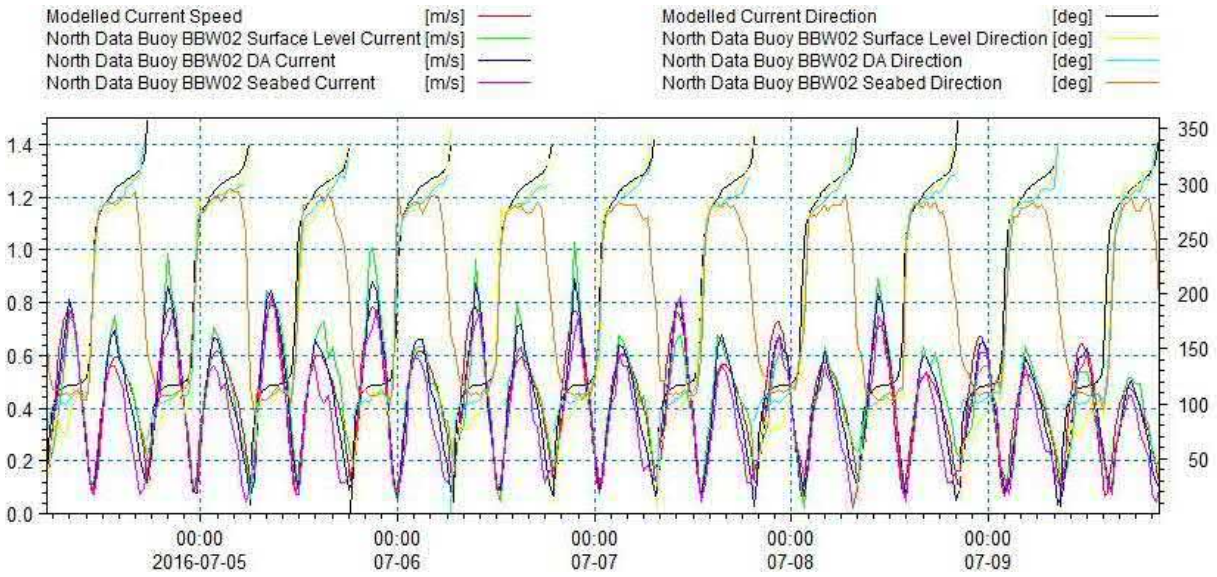


Figure 1.10: Comparison of model and recorded Burbobank North Wave Buoy ADCP data (Fugro) 53°30.113' N, 003°21.687' E - current speed and direction spring

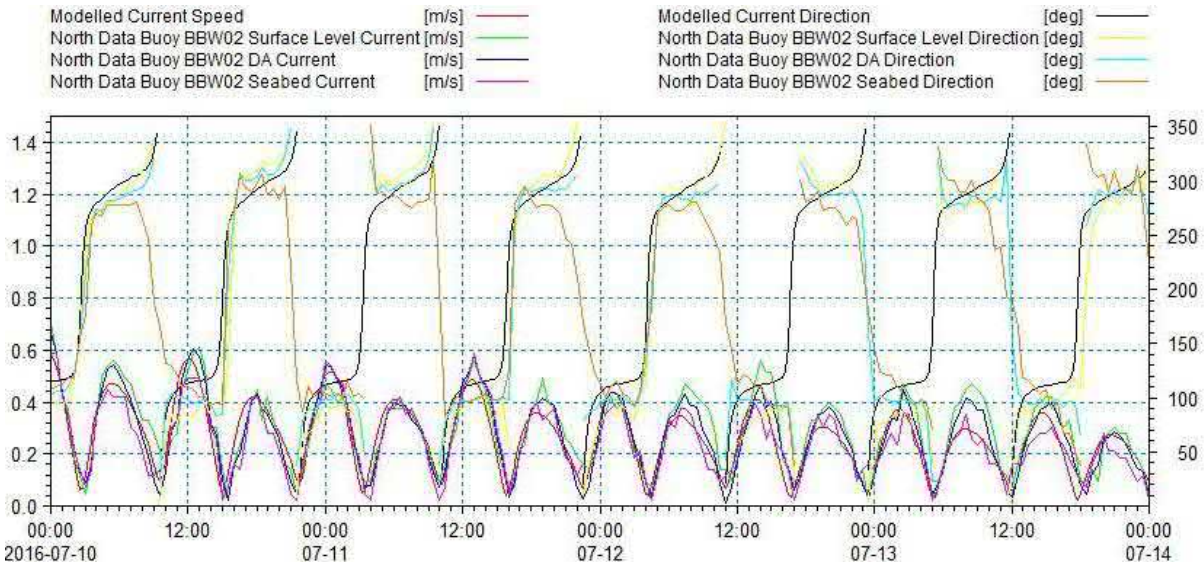


Figure 1.11: Comparison of model and recorded Burbobank North Wave Buoy ADCP data (Fugro) 53°30.113' N, 003°21.687' E - current speed and direction neap

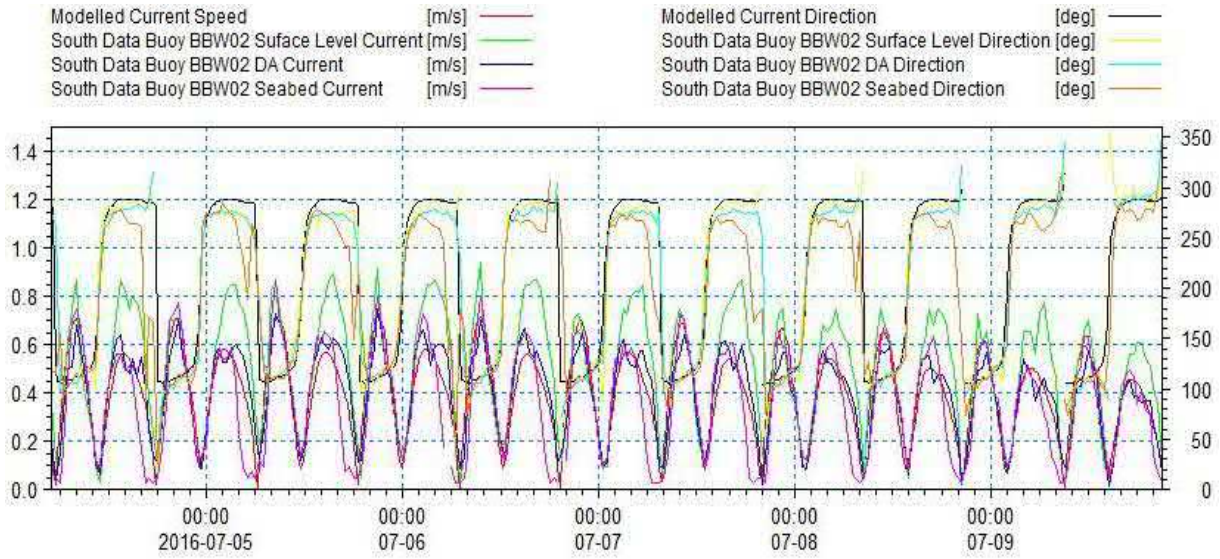


Figure 1.12: Comparison of model and recorded Burbobank South Wave Buoy ADCP data (Fugro) 53°29.101' N, 003°15.533' E - current speed and direction spring

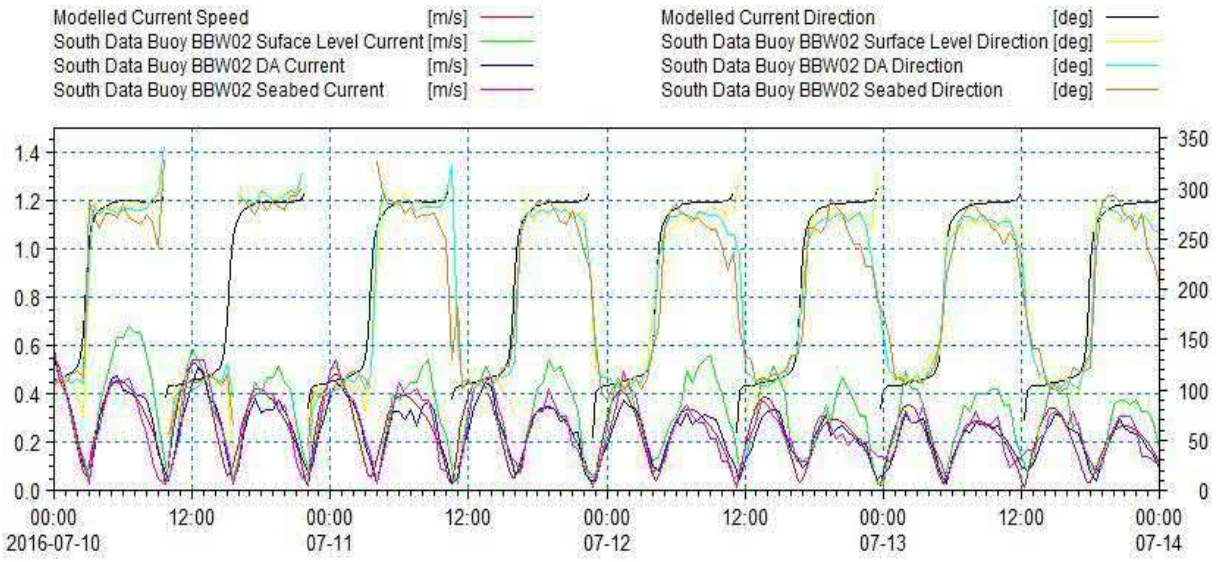


Figure 1.13: Comparison of model and recorded Burbobank South Wave Buoy ADCP data (Fugro) 53°29.101' N, 003°15.533' E - current speed and direction neap

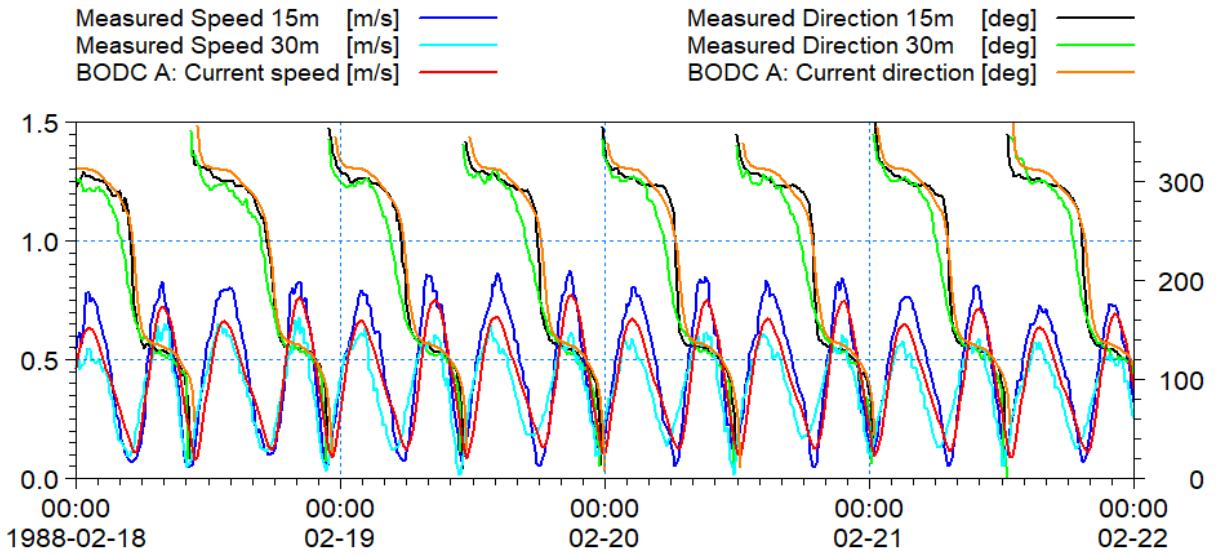


Figure 1.14: Comparison of model and recorded data BODC Location A – current speed and direction spring

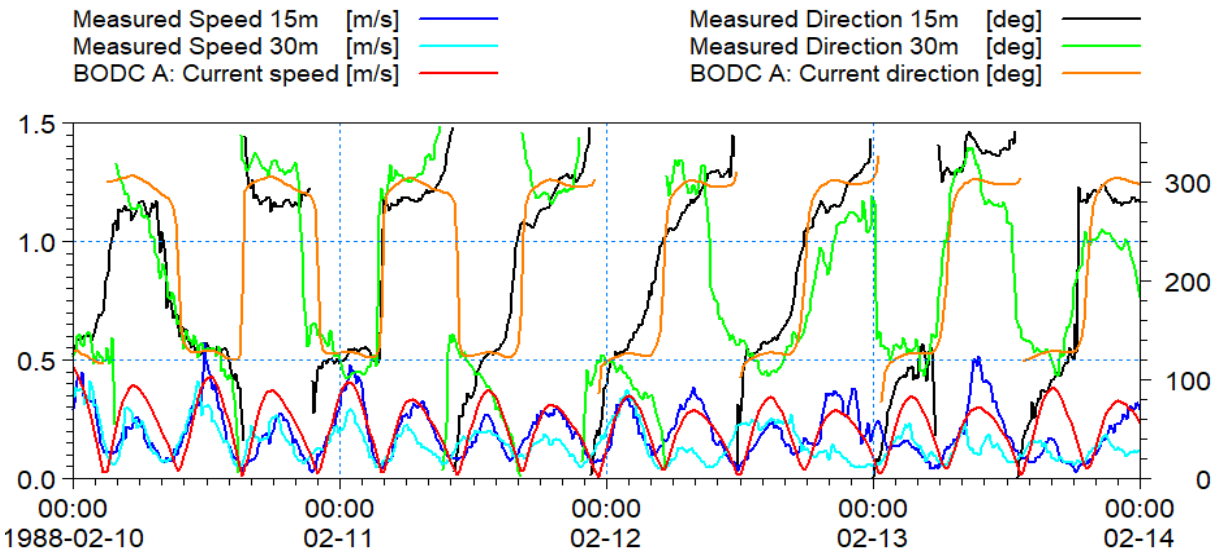


Figure 1.15: Comparison of model and recorded data BODC Location A – current speed and direction neap

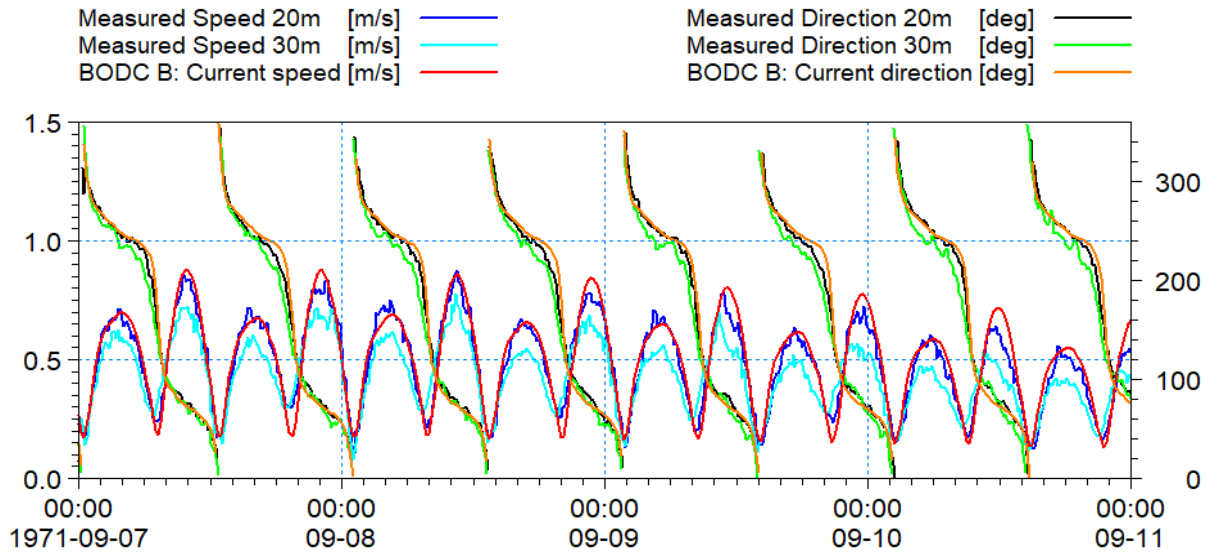


Figure 1.16: Comparison of model and recorded data BODC Location B – current speed and direction spring

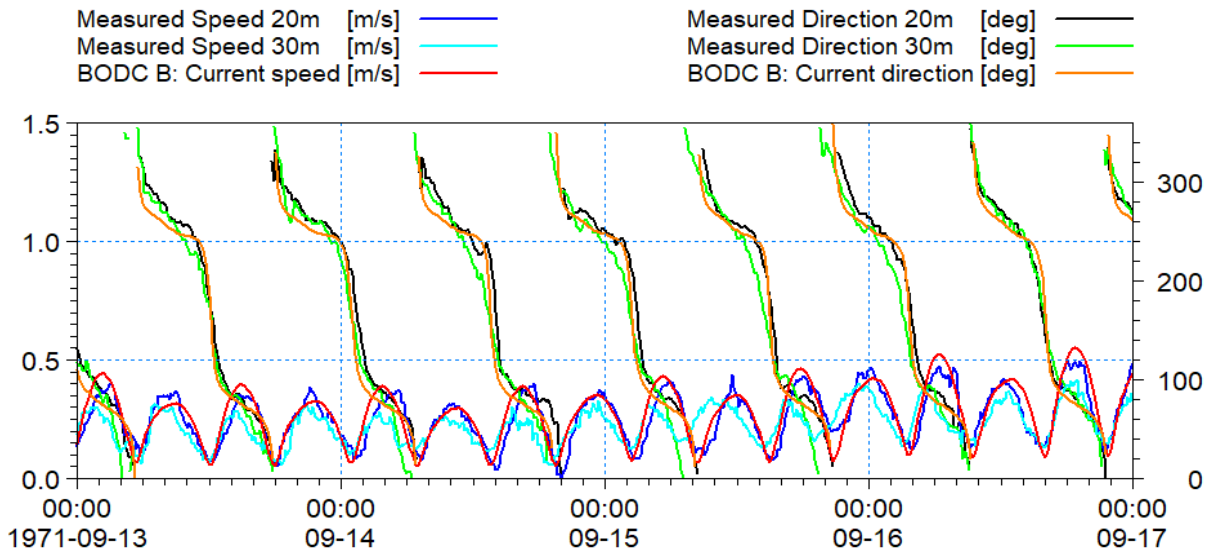


Figure 1.17: Comparison of model and recorded data BODC Location B – current speed and direction neap

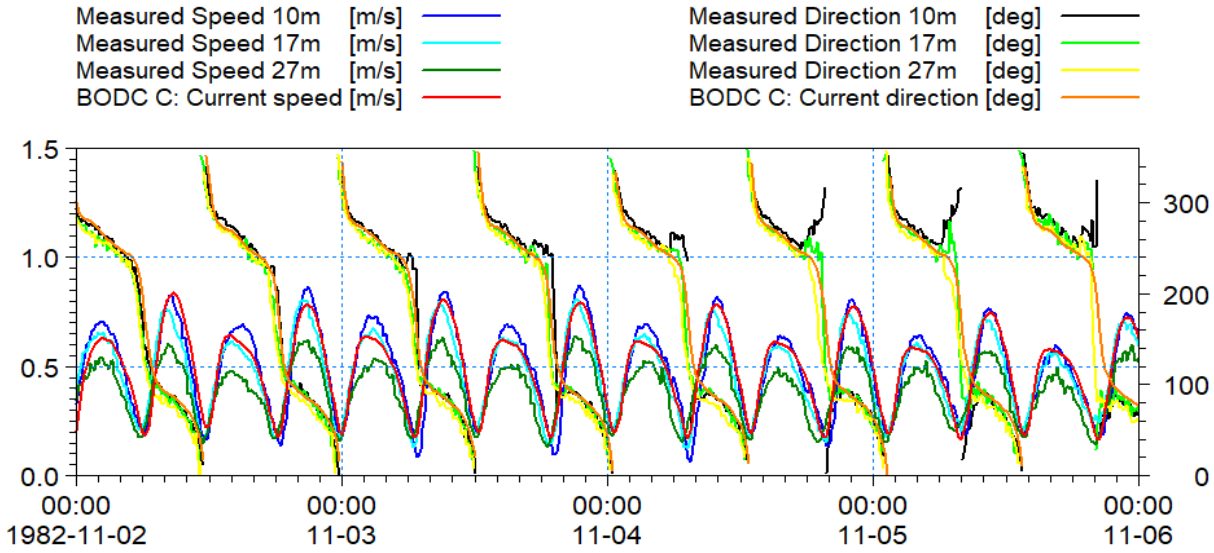


Figure 1.18: Comparison of model and recorded data BODC Location C – current speed and direction spring

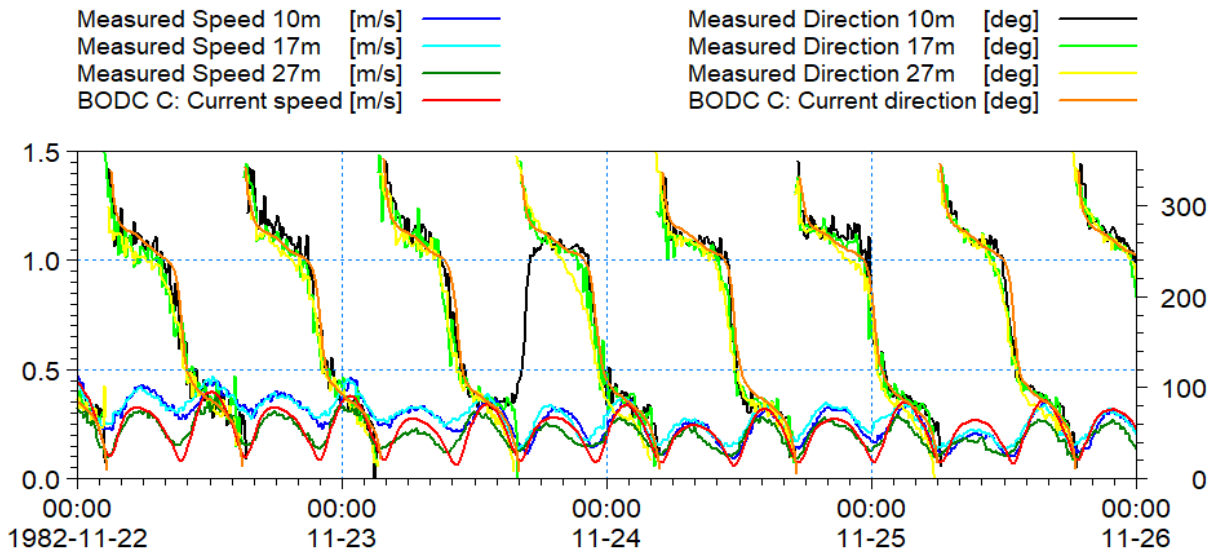


Figure 1.19: Comparison of model and recorded data BODC Location C – current speed and direction neap

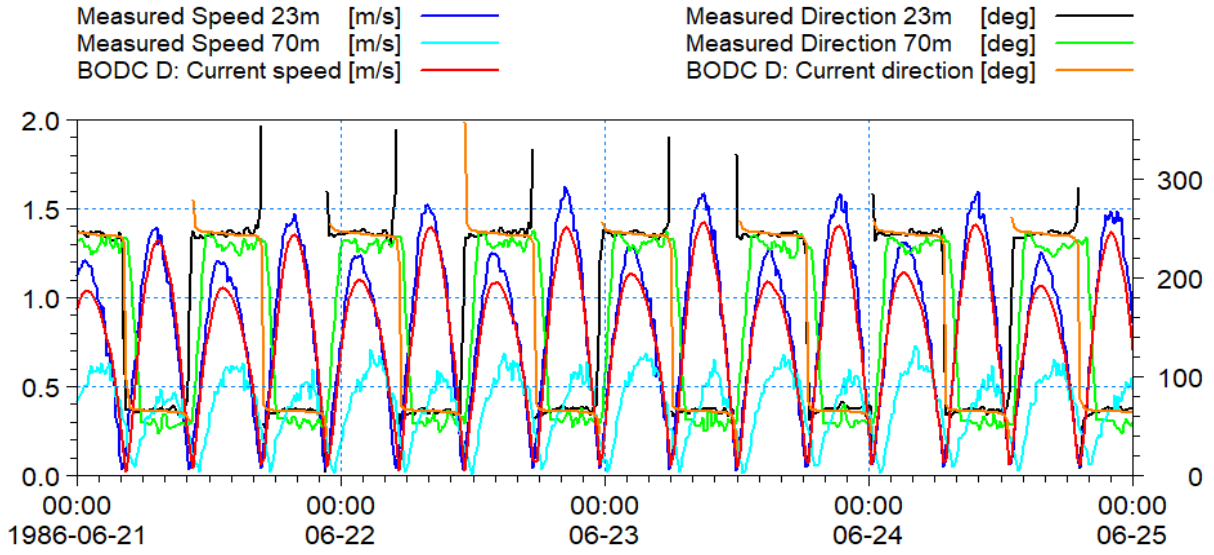


Figure 1.20: Comparison of model and recorded data BODC Location D – current speed and direction spring

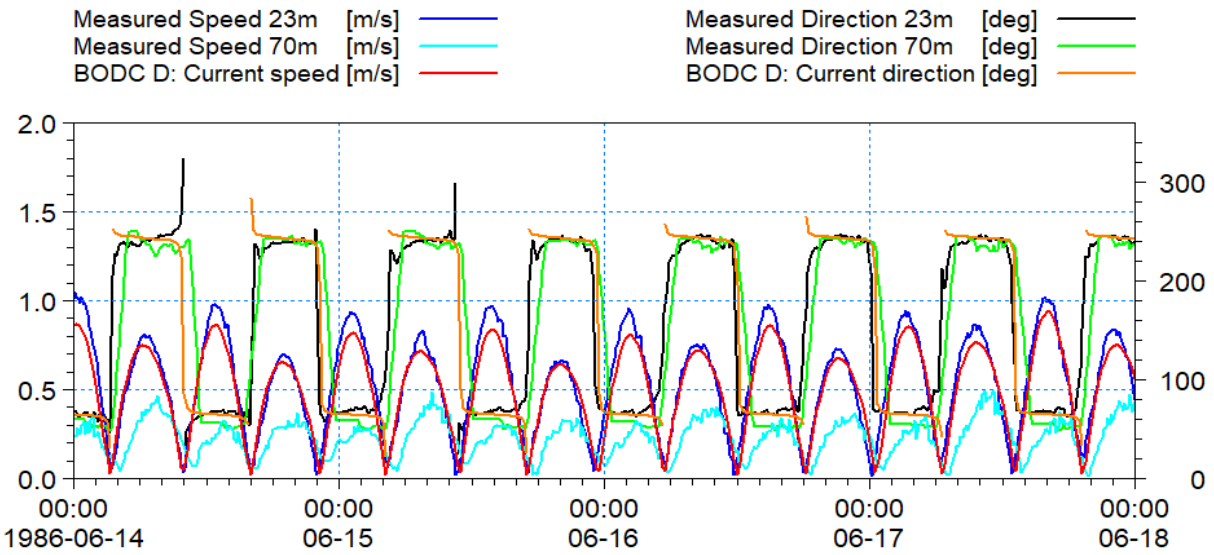


Figure 1.21: Comparison of model and recorded data BODC Location D – current speed and direction neap

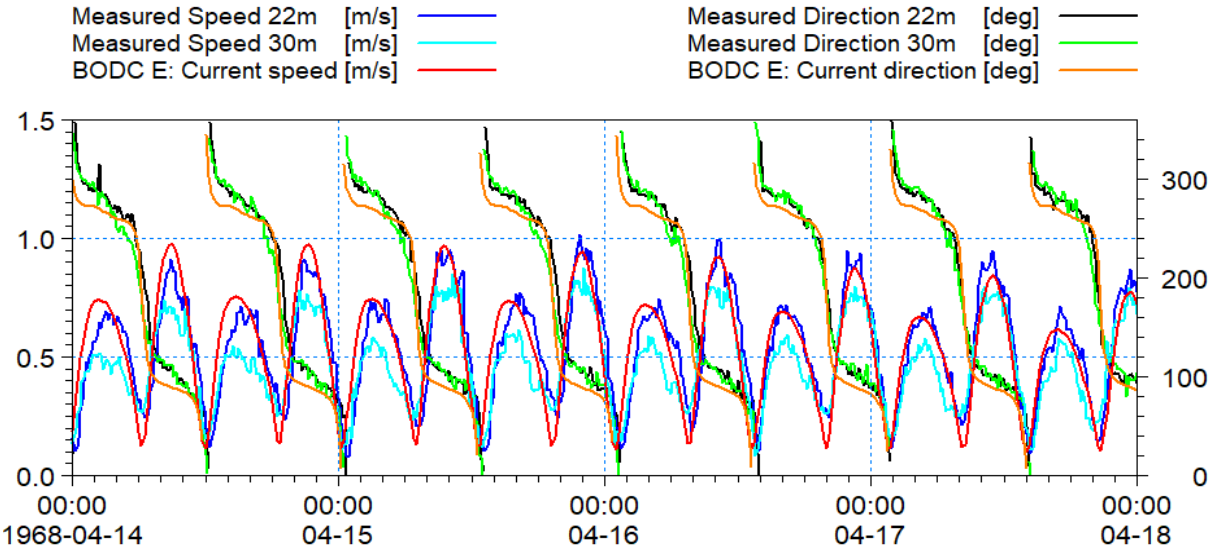


Figure 1.22: Comparison of model and recorded data BODC Location E – current speed and direction spring

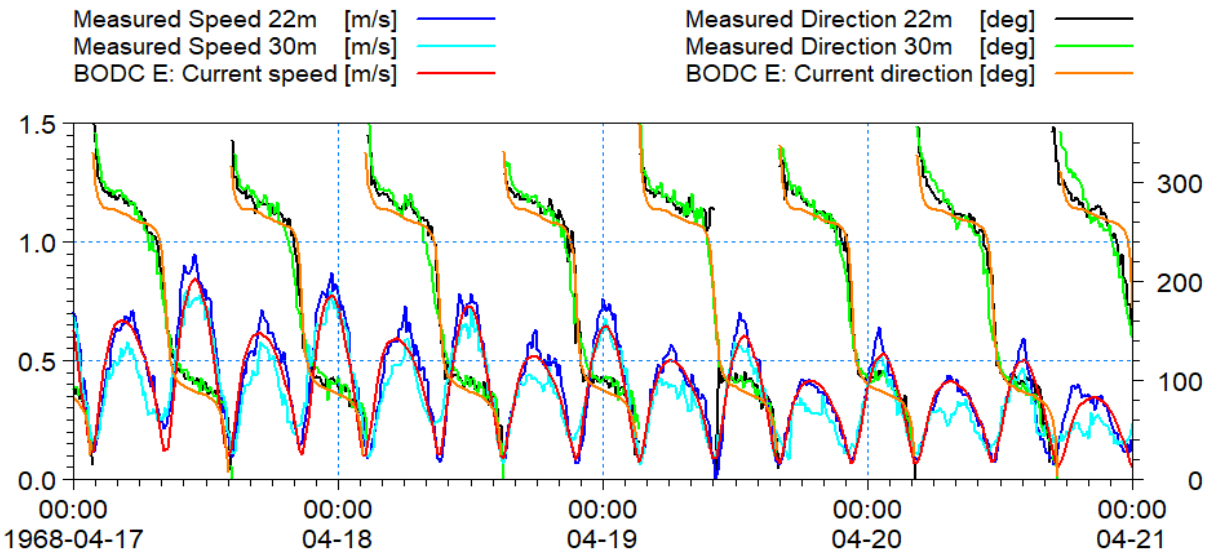


Figure 1.23: Comparison of model and recorded data BODC Location E – current speed and direction neap

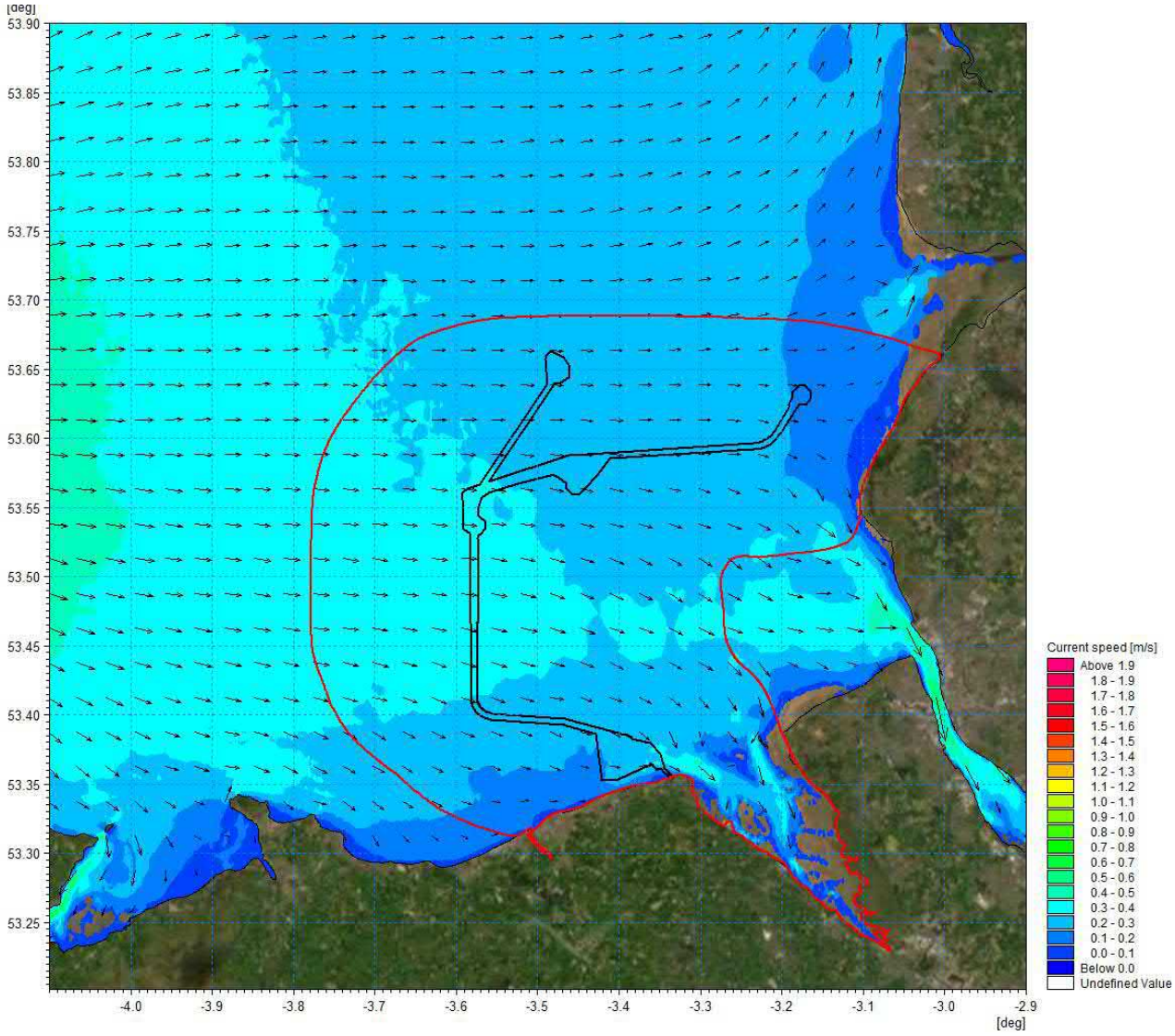


Figure 1.24: Tidal flow patterns – neap tide flood.

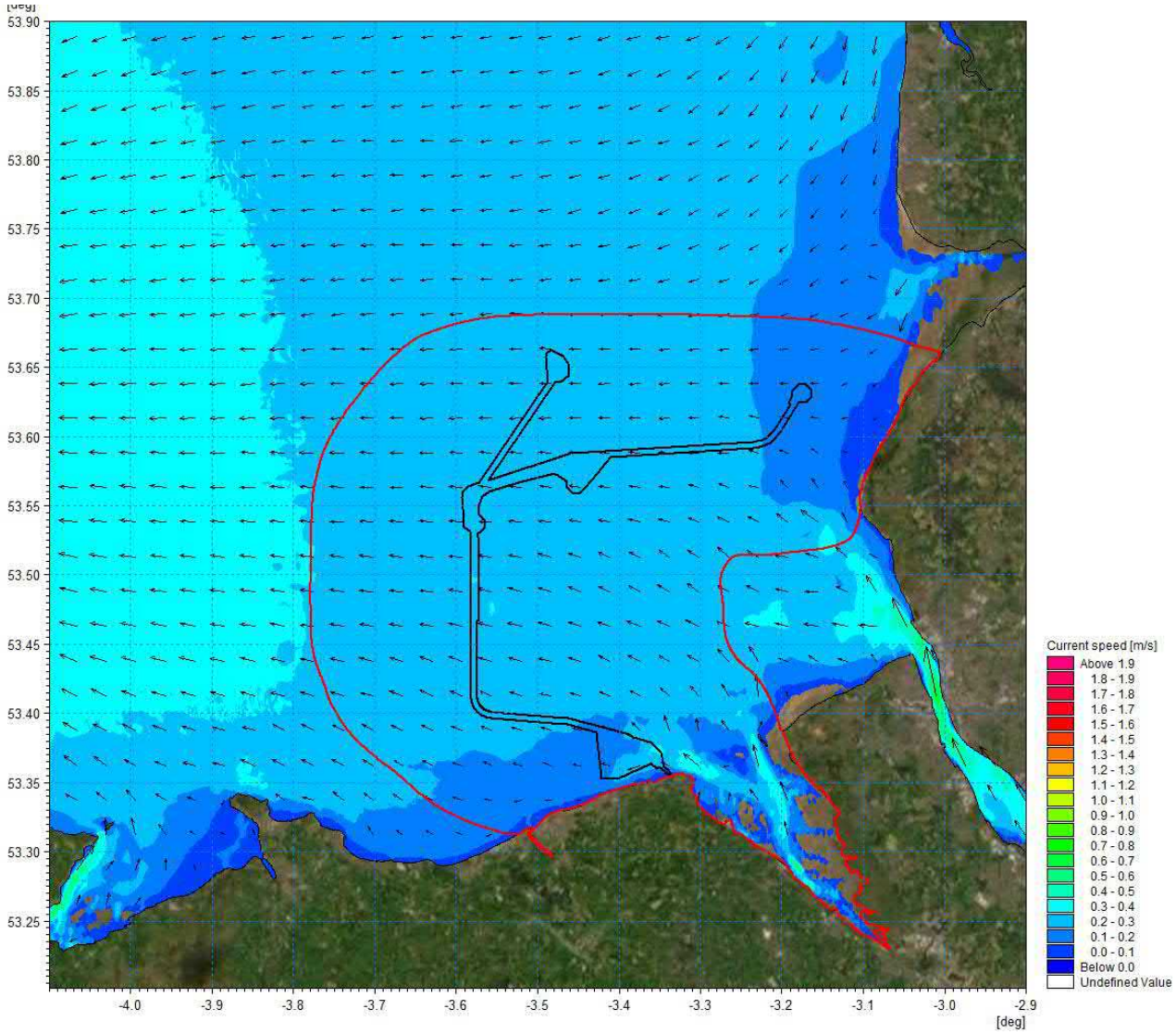


Figure 1.25: Tidal flow patterns – neap tide ebb.

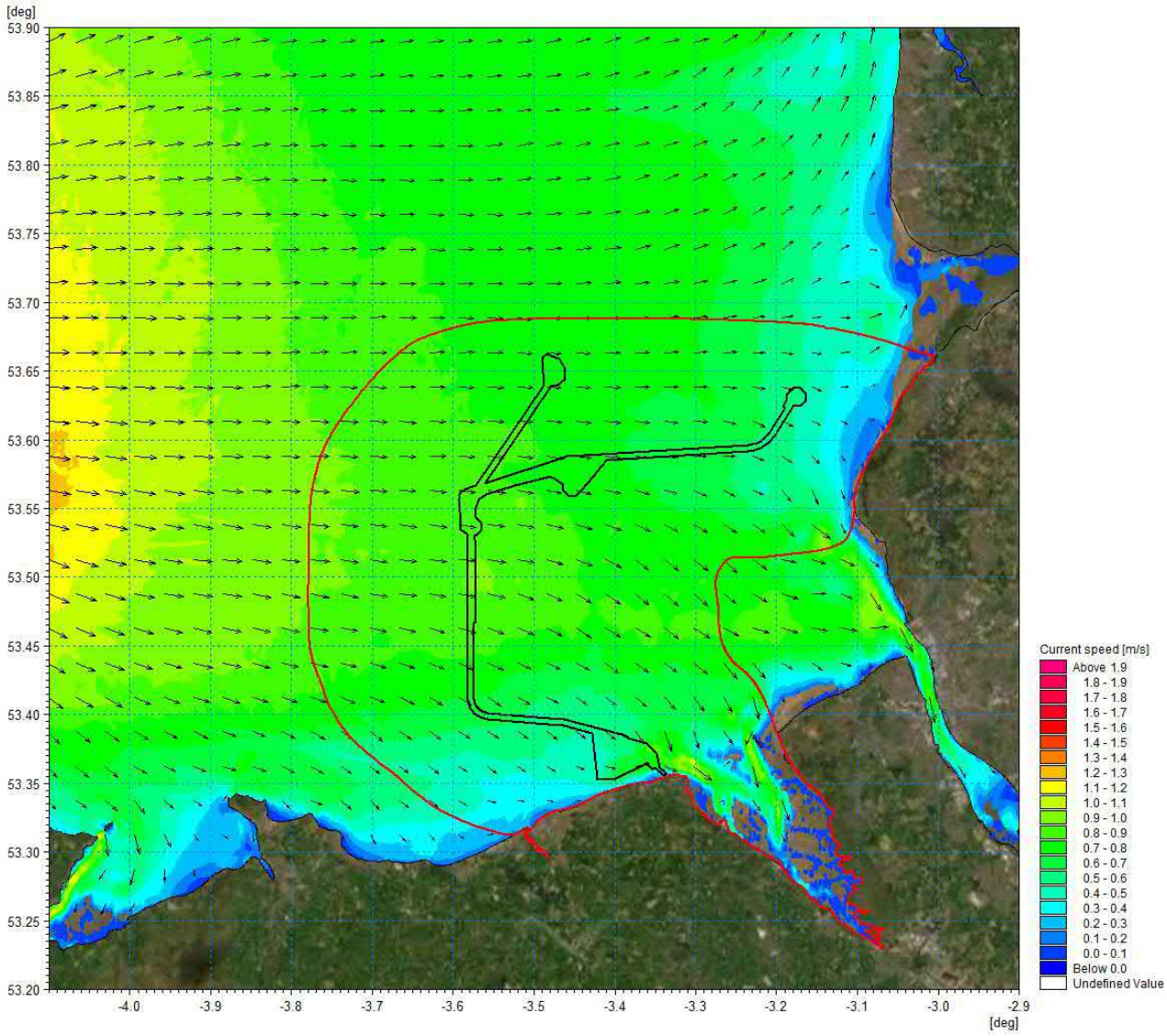


Figure 1.26: Tidal flow patterns – spring tide flood.

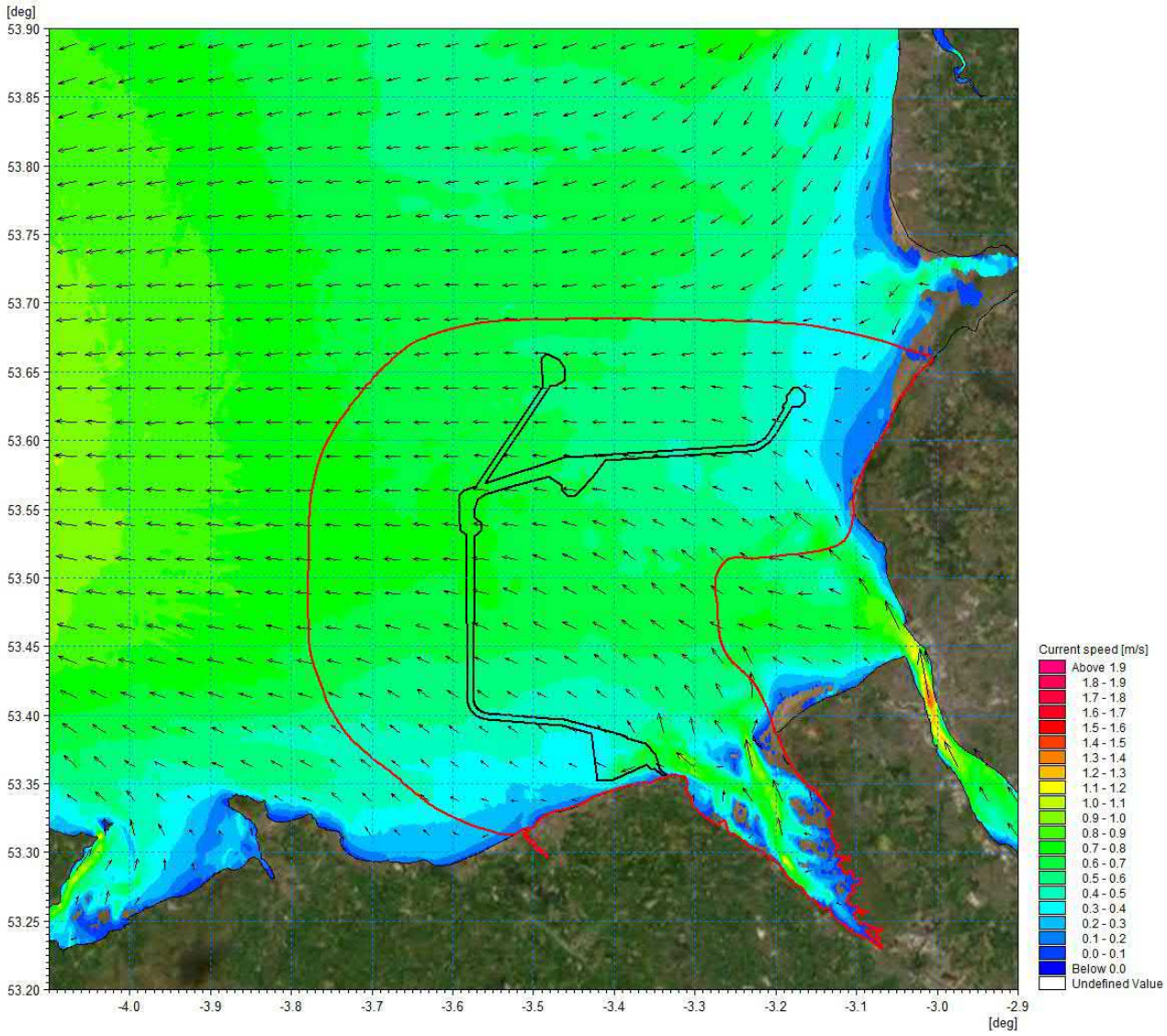


Figure 1.27: Tidal flow patterns – spring tide ebb.

1.6.3 Wave climate

Waves in the east Irish Sea are highest to the southwest of the Isle of Man with the highest mean annual significant wave height of 1.39m recorded between the Isle of Man and Anglesey. Significant wave height is reduced closer to the coast with the lowest significant wave height of 0.73m recorded to the west of the Dee Estuary (ABPmer, 2008). In the physical processes study area mean annual wave height ranges from 0.8m to 1.1m. Over 40% of the waves arise from the west with a majority of significant wave heights (>2m) also arriving from the west (ABPmer, 2018). This is illustrated in Figure 1.28 which shows the wave rose for a point located within this area. Similarly, the corresponding wind rose presented in Figure 1.29 which illustrates the predominant winds are from the west and southwest with the site being located in the lee of the Isle of Man.

As offshore waves transfer from the deep offshore water to shallower coastal areas, a number of important modifications may result due to interactions of offshore deep-water waves with the seabed, with the resultant modifications producing shallow water waves. These physical 'wave transformation' interactions include:

- Shoaling and refraction (due to both depth and current interactions with the wave)
- Energy loss due to breaking
- Energy loss due to bottom friction

- Momentum and mass transport effect.

The wave model developed for the assessment was calibrated using data collected during storm Christoph which occurred during January 2021. The model simulated water levels using boundary data extracted from the RPS storm surge model and applied meteorological conditions from the European Centre for Medium-range Weather Forecasting (ECMWF) operational dataset (ECMWF, 2022). Wave conditions at the model boundary were also provided from the ECMWF operational dataset.

The model output data was then compared with measured data obtained from the National Network of Regional Coastal Monitoring Programmes held by the CCO at the locations shown in Figure 1.30. For each of the two locations three parameters are presented relating to mean wave direction, significant wave height and peak wave period.

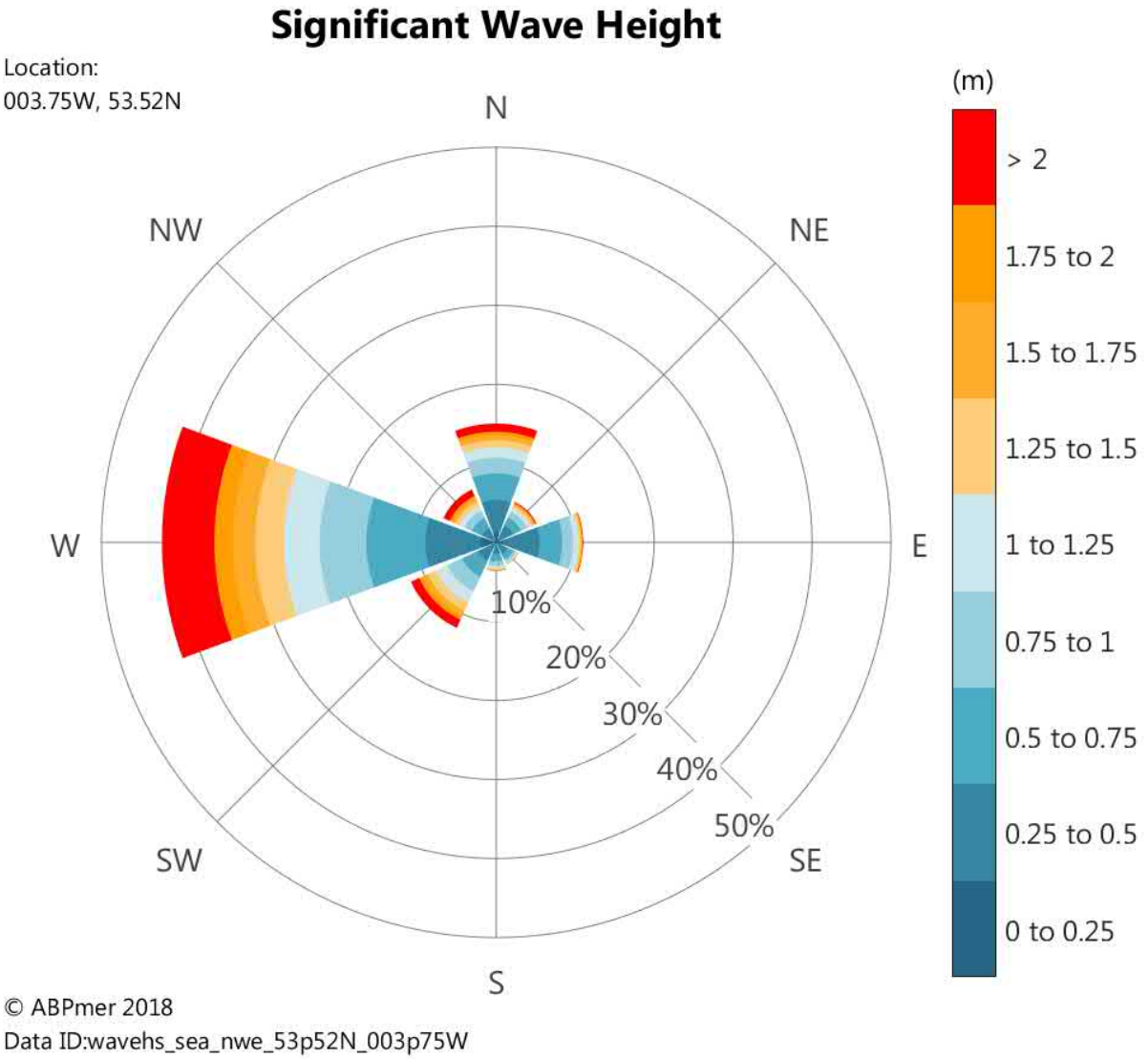


Figure 1.28: Wave rose for the Hynet physical processes study area.

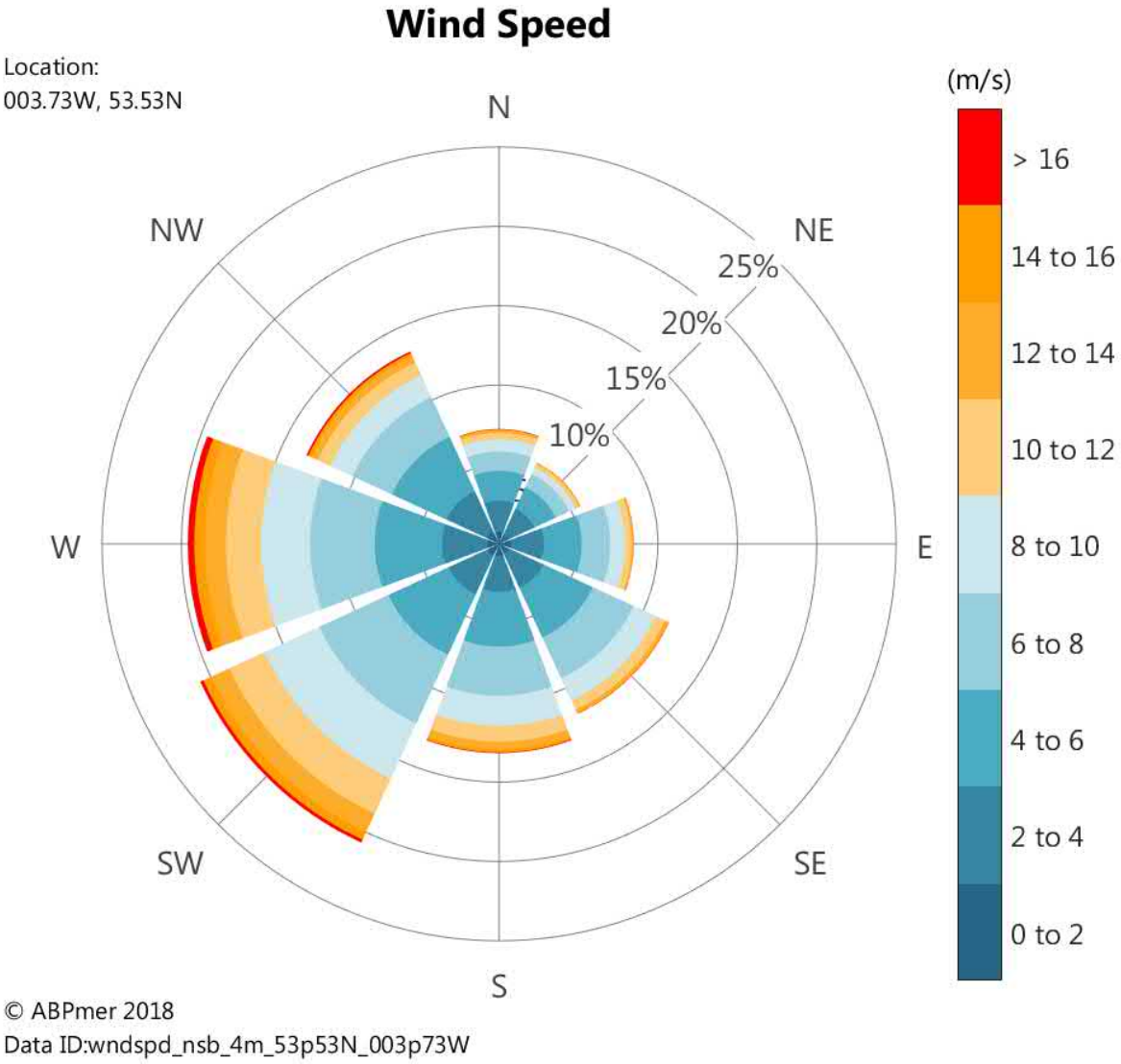


Figure 1.29: Wind rose for Hynet physical processes study area.

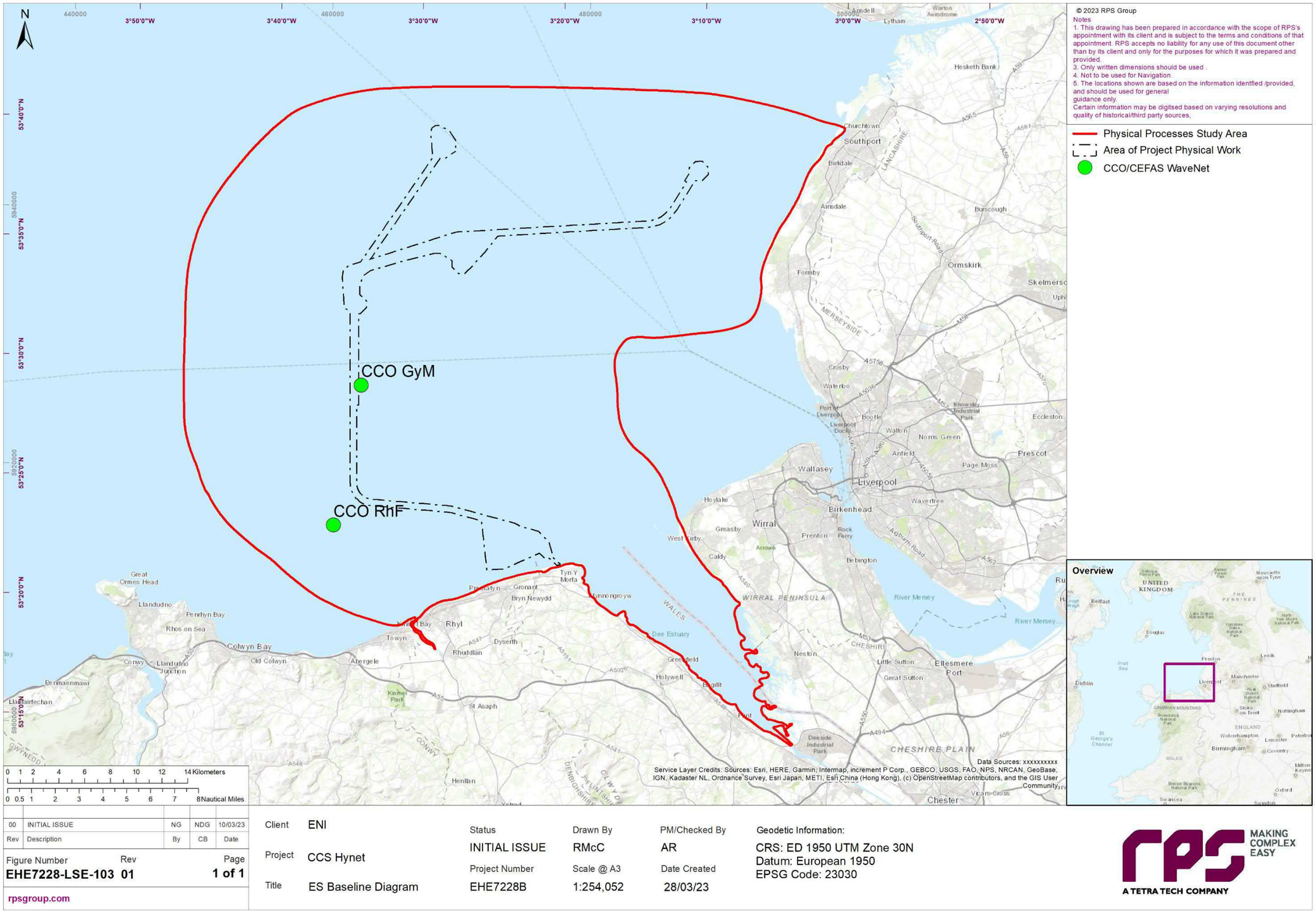


Figure 1.30: Location of wave calibration data presented.

Both the Gwynt y Môr (GyM) (Figure 1.31 to Figure 1.33) and Rhyl Flats (RfH) (Figure 1.34 to Figure 1.36) located along the Area of Proposed Development Physical Work show a good correlation between modelled and monitored data. Thus, there is confidence that baseline conditions are presented accurately.

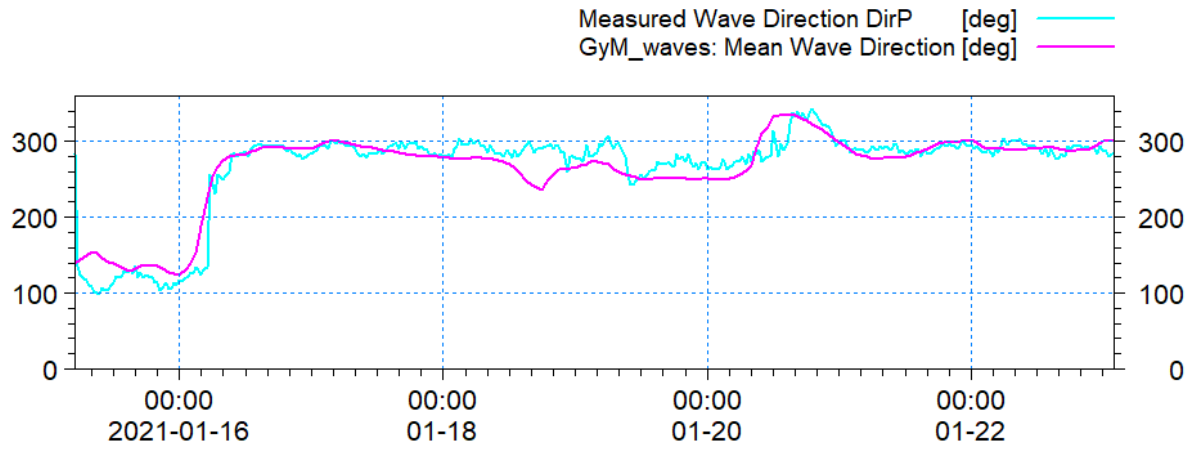


Figure 1.31: Validation of modelled mean wave direction with measured data at GyM.

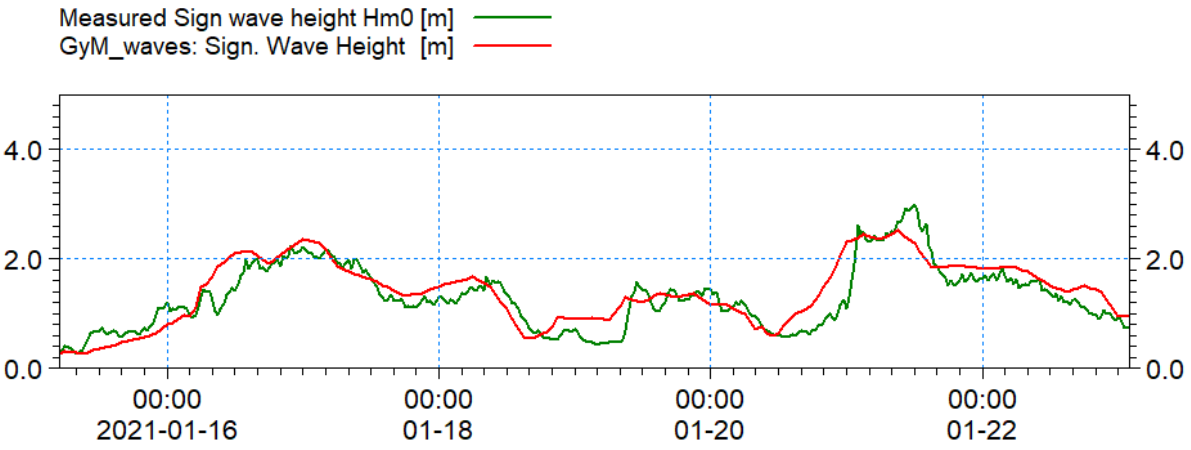


Figure 1.32: Validation of modelled significant wave height with measured data at GyM.

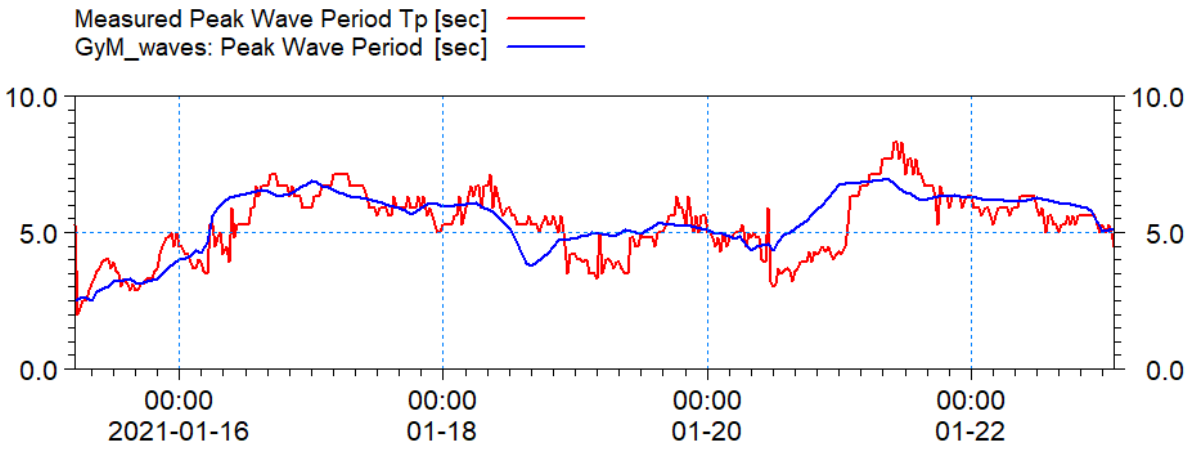


Figure 1.33: Validation of modelled peak wave period with measured data at GyM.

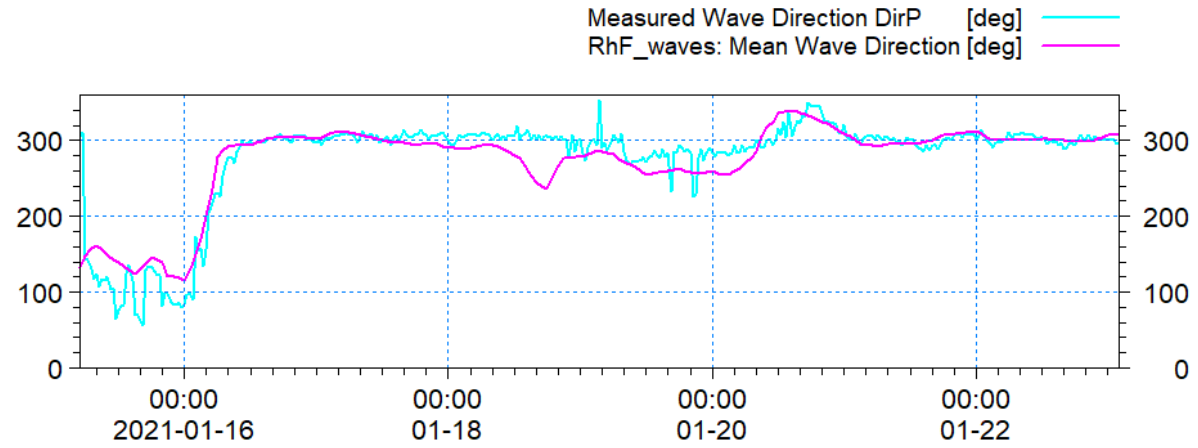


Figure 1.34: Validation of modelled mean wave direction with measured data at RhF.

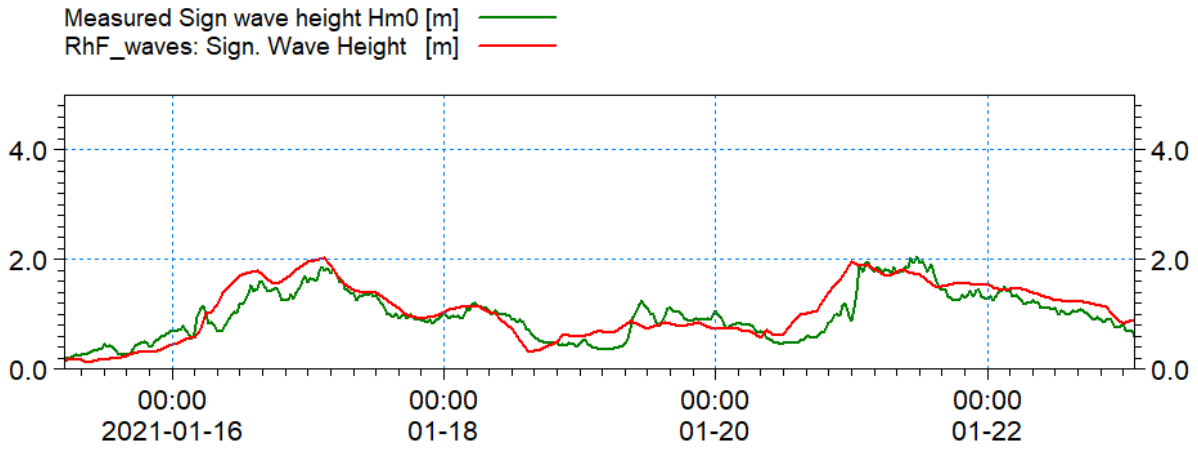


Figure 1.35: Validation of modelled significant wave height with measured data at RhF.

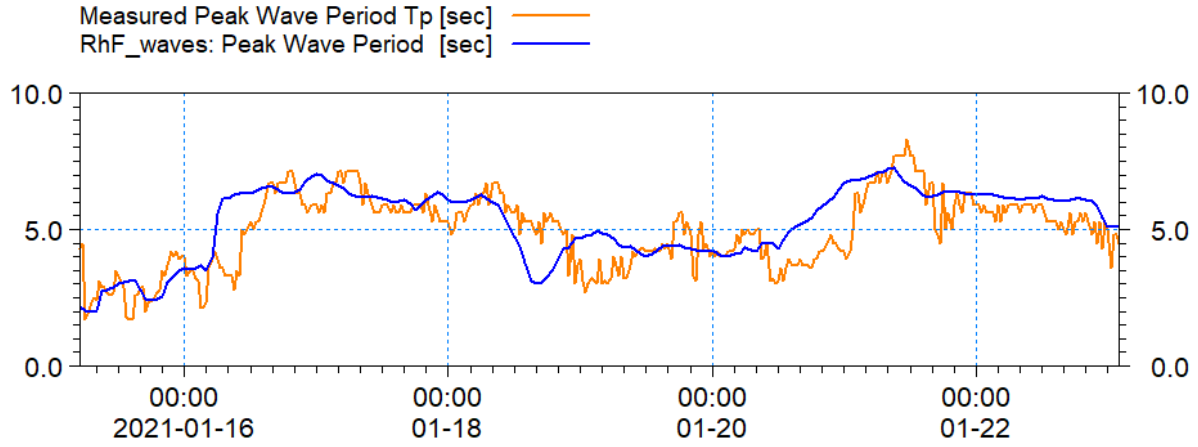


Figure 1.36: Validation of modelled peak wave period with measured data at RhF.

In order to establish baseline wave climate, a full metocean study was not essential however representative sea-states were required. An analysis was undertaken to determine the offshore conditions for which waves reach the site from all directions. Twenty-two years of data were obtained from the ECMWF operational dataset for locations on the north and south boundaries of the model domain. Extreme value analysis using peak over threshold was undertaken for each 30º sector to determine the 1in1 and 1in20 year offshore wave climate.

These were then used as boundary conditions within the wave modelling to determine the resultant wave climate at the site and across the physical processes study area.

In addition to boundary wave data, it was necessary to analyse the wind field to include the contribution of local wind seas. For this, a representative point for each of the key directions, was identified and utilised from the National Oceanic and Atmospheric Administration (NOAA) 40-year dataset. This was analysed on the same sectoral basis as the wave data to give an indication of the return period wind speed. Figure 1.37 shows the model domain with wind and wave roses relating to the forcing data.

The wave modelling was undertaken using the spectral wave model, MIKE21 SW, to provide a full wave climate and wave breaking across the physical processes study area. The model used a quasi-stationary formulation which meant that for each event the wave field fully established over a number of numerical iterations until convergence was reached. The model resolves the wave field by simulating wind generation of waves within the model domain and the propagation of externally generated swell waves through the domain. The model setup ensured that the detail of both locally generated wind waves and swell conditions from further afield were captured.

The following set of figures (Figure 1.38 to Figure 1.41) show the wave climate for four 1in1 year return period events from the principal directions; north (000°), northeast (030°), southwest (240º) and west (270°) direction respectively. These sectors were selected to be representative of the characteristics of the wave climate. The wave modelling was undertaken at mean high-water (MHW) being the high-water level on an average tide. Figure 1.41 shows the waves approaching from the west and demonstrates, as anticipated, the largest waves approach from this sector.

A second set of figures are presented relating to the 1in20 year return period; Figure 1.42 to Figure 1.45. These show data for the same sectors and tidal height as the 1in1 year return period.

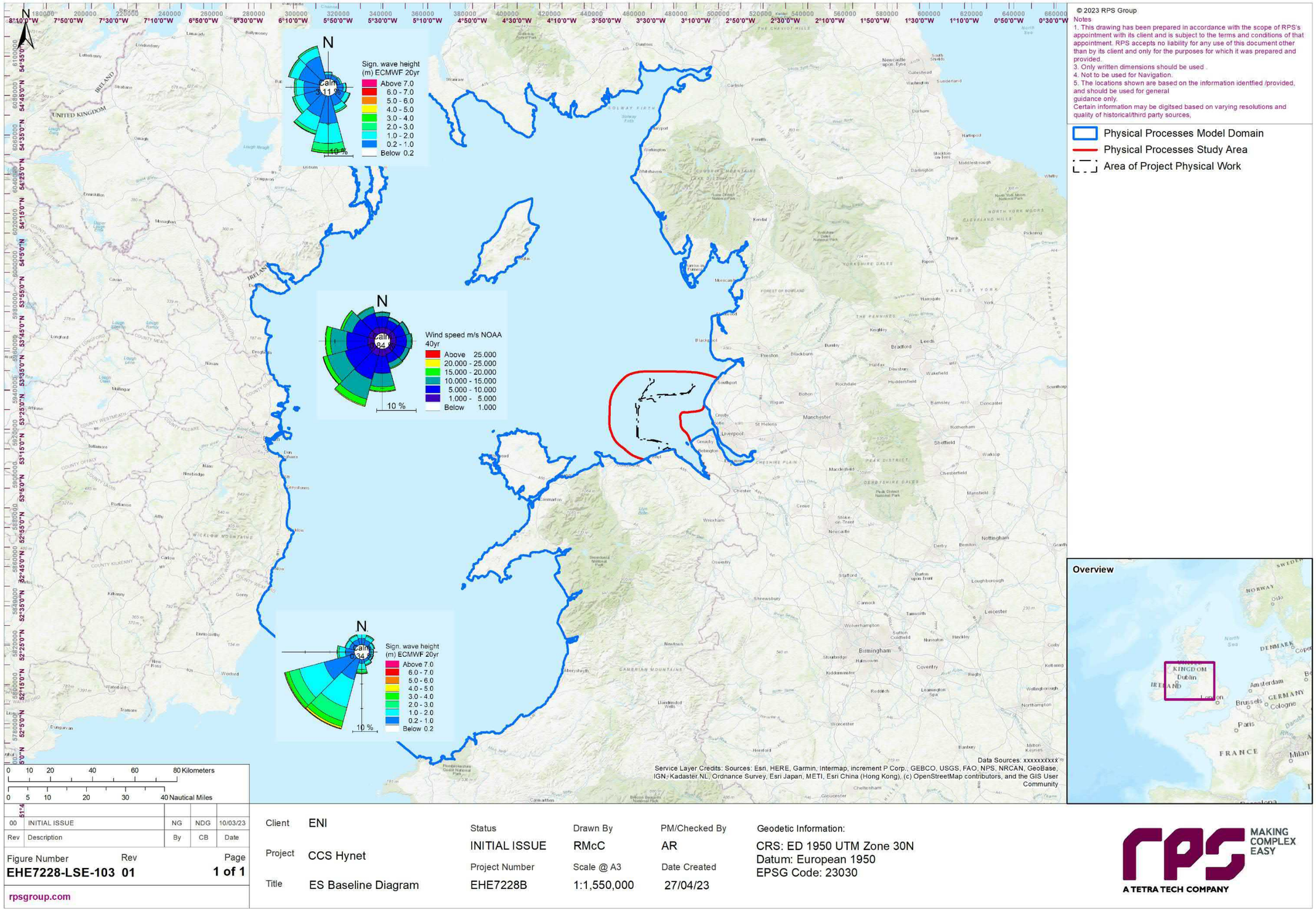


Figure 1.37: Wave roses for model boundaries - 22-year ECMWF Dataset and wind rose for 40 year NOAA dataset.

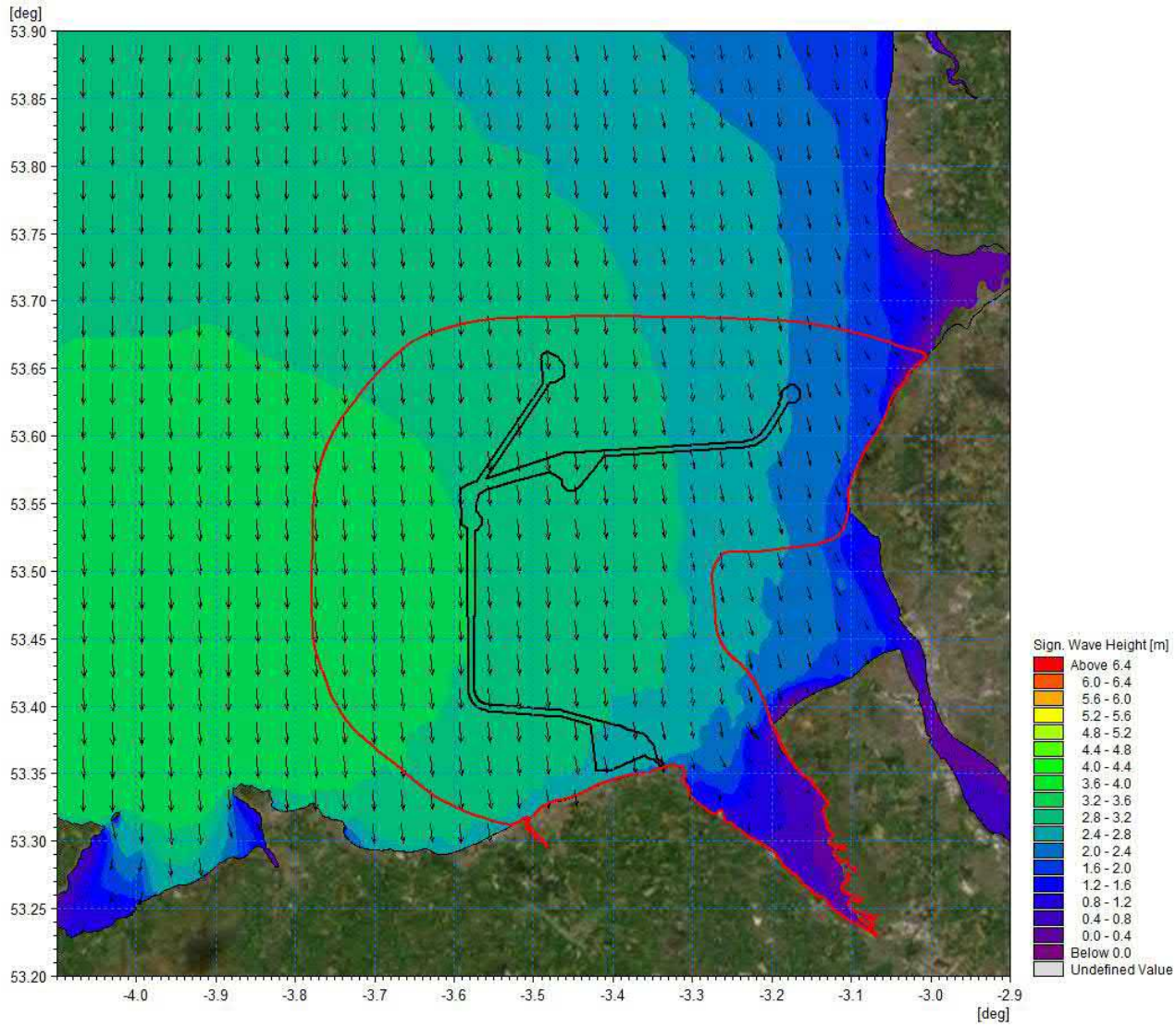


Figure 1.38: Wave climate 1:1 year storm from 000° MHW.

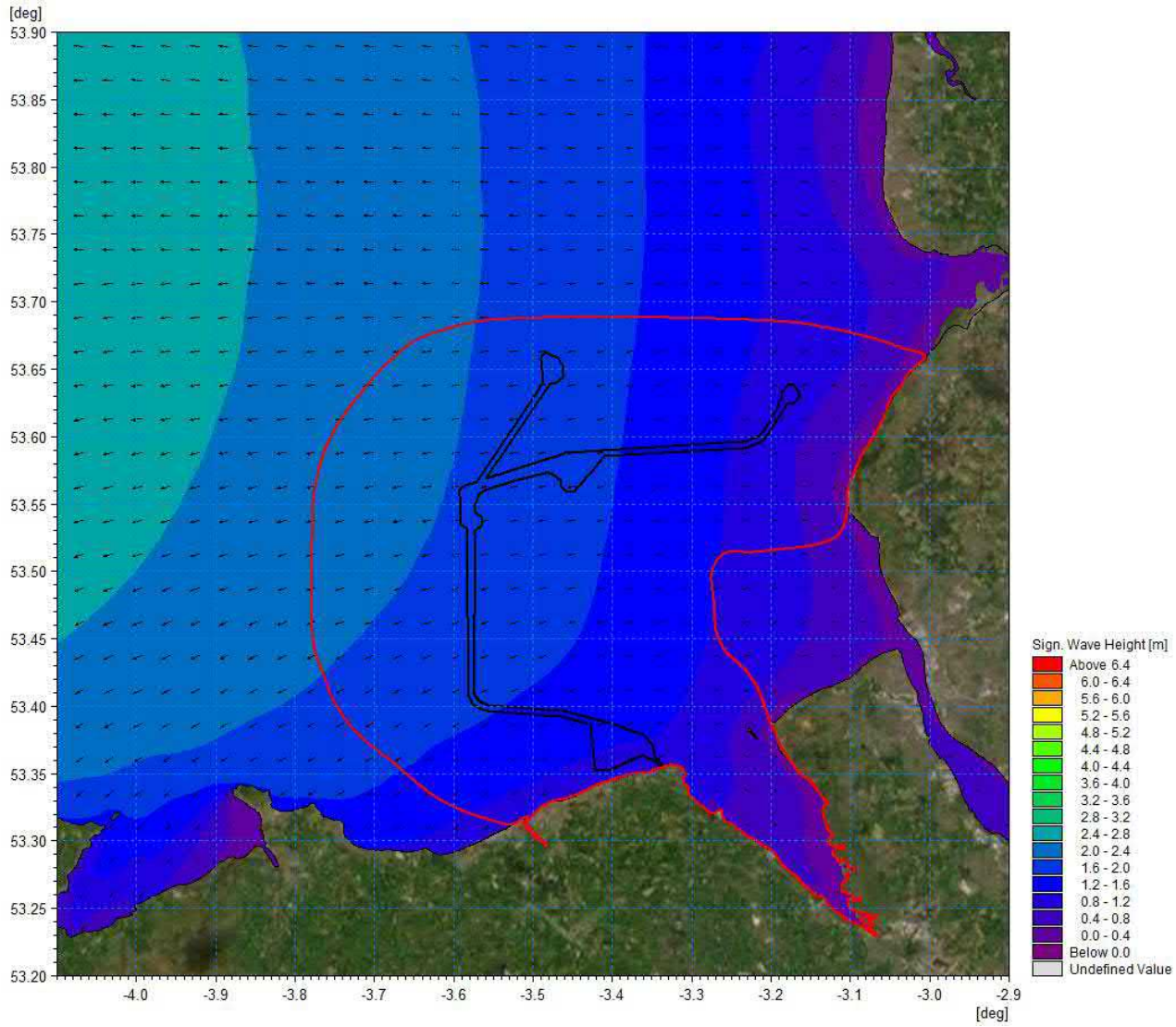


Figure 1.39: Wave climate 1:1 year storm from 090° MHW.

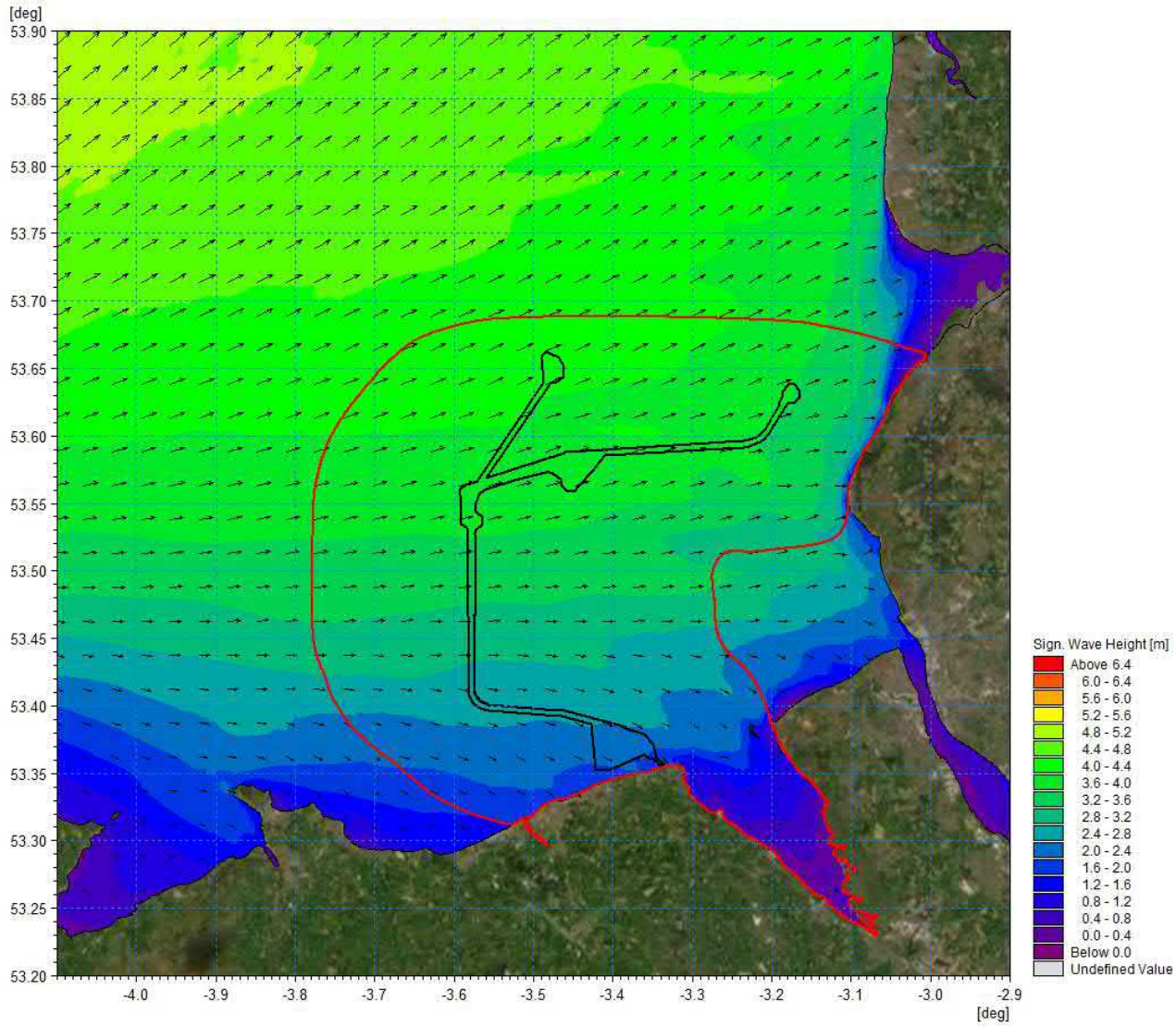


Figure 1.40: Wave climate 1:1 year storm from 240° MHW.

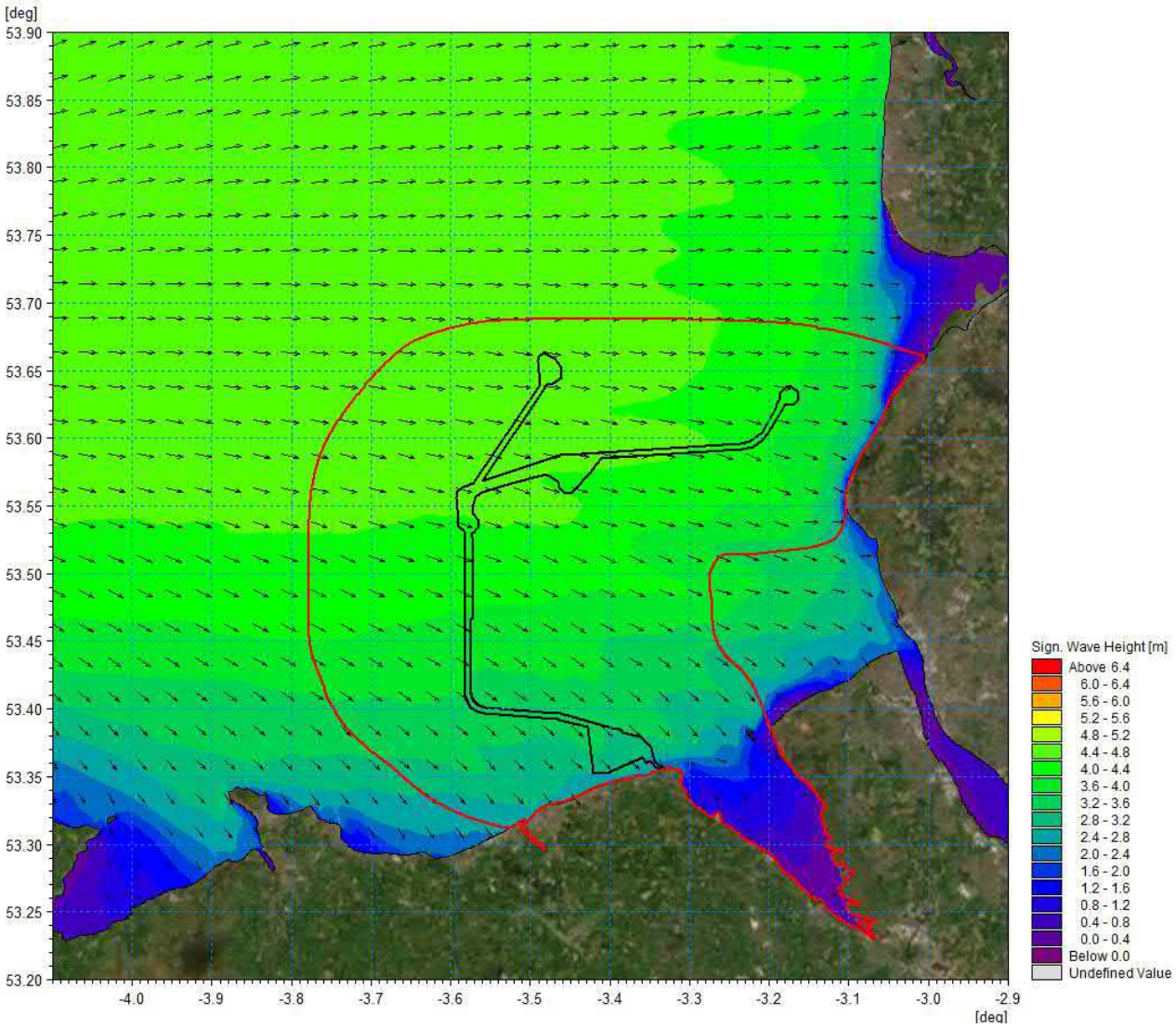


Figure 1.41: Wave climate 1:1 year storm from 270° MHW.

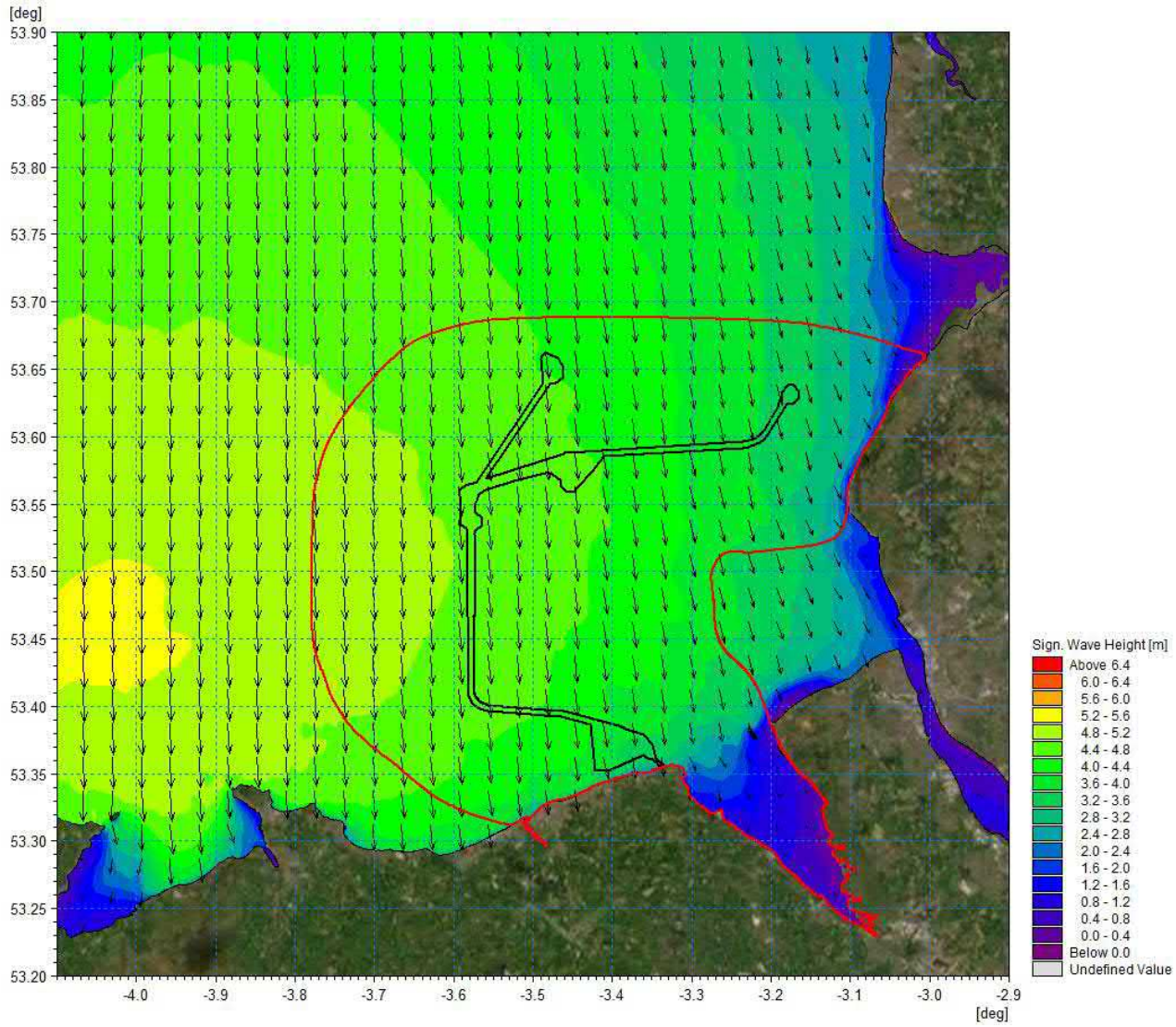


Figure 1.42: Wave climate 1:20 year storm from 000° MHW.

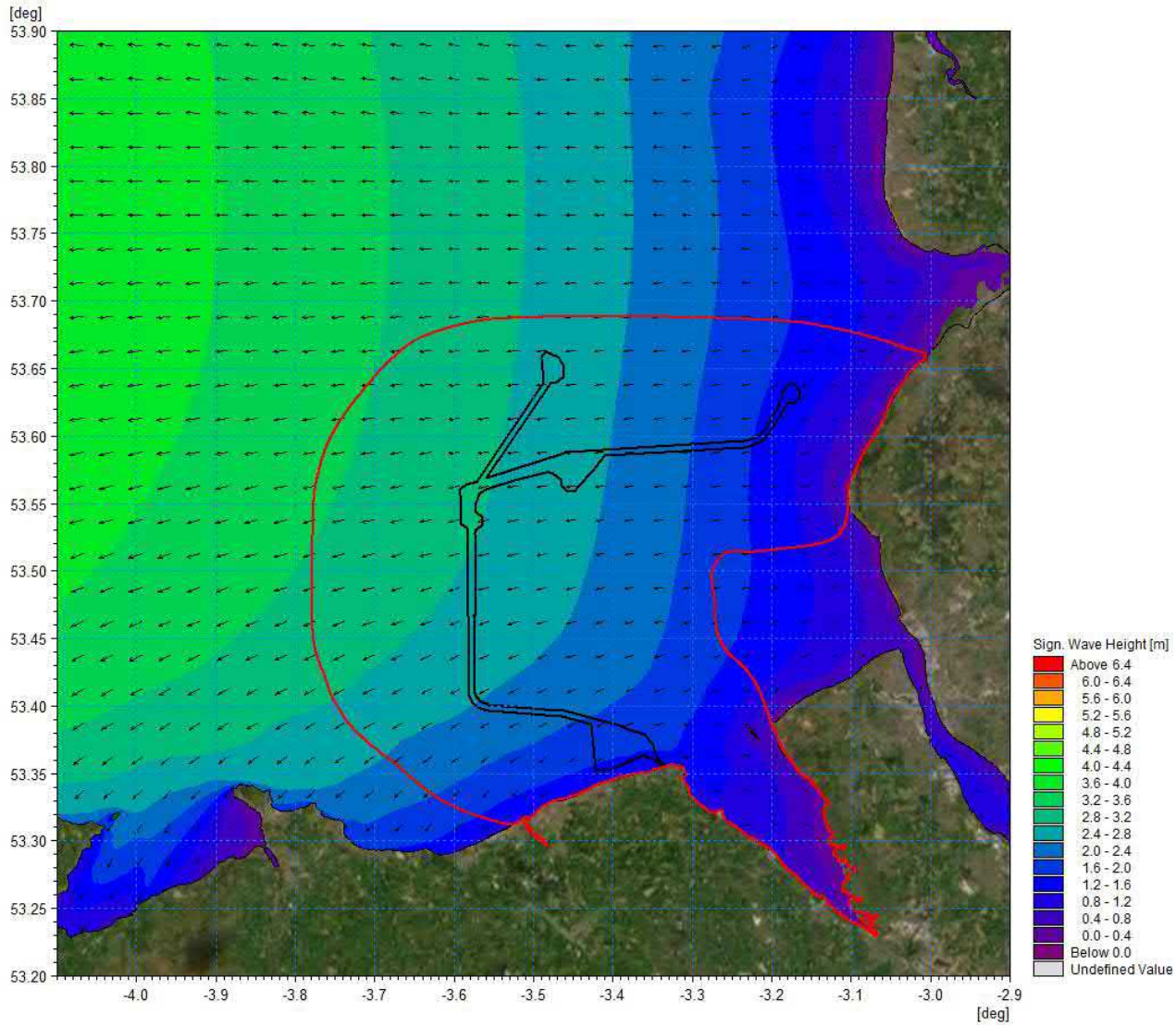


Figure 1.43: Wave climate 1:20 year storm from 090° MHW.

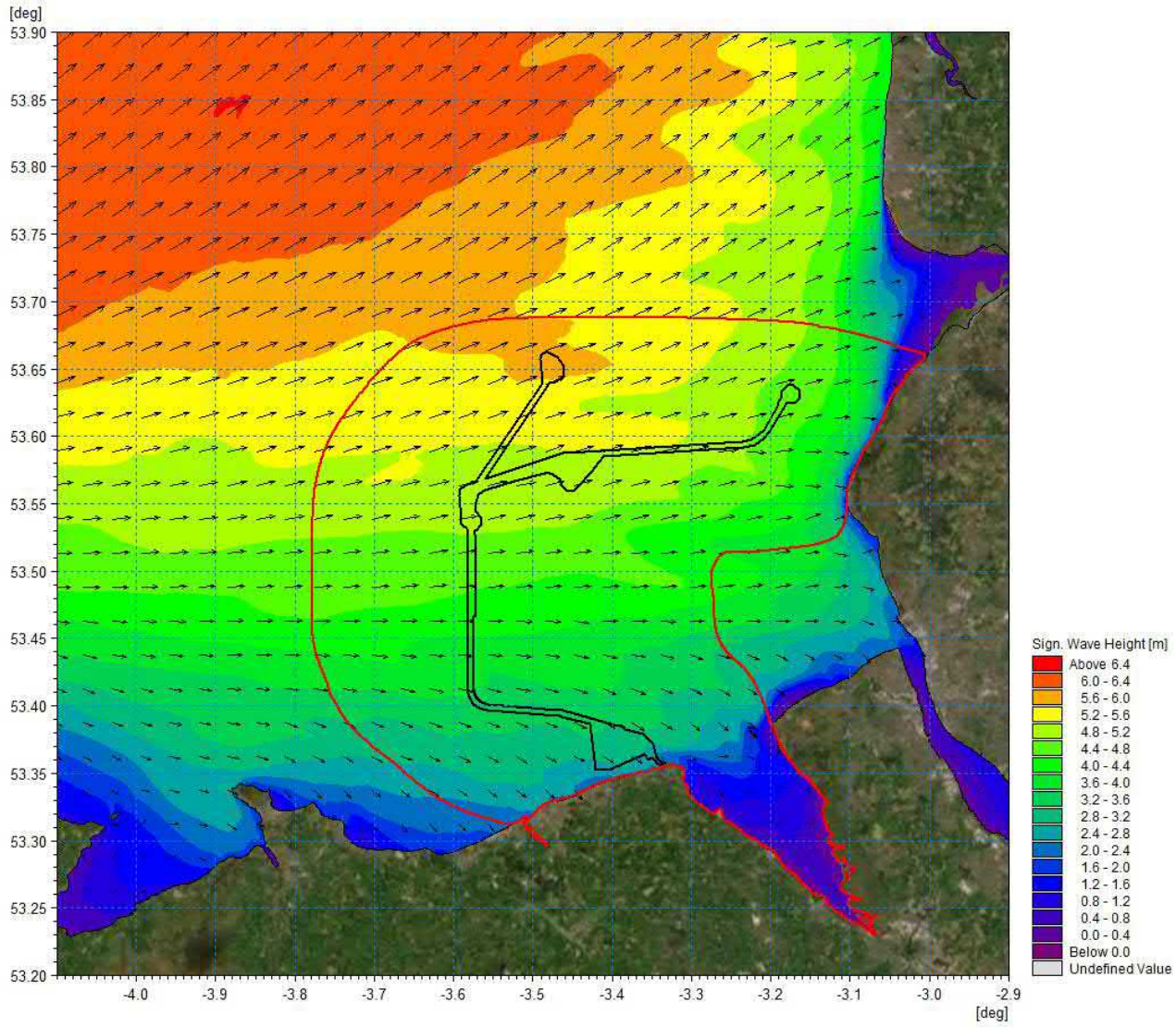


Figure 1.44: Wave climate 1:20 year storm from 240° MHW.

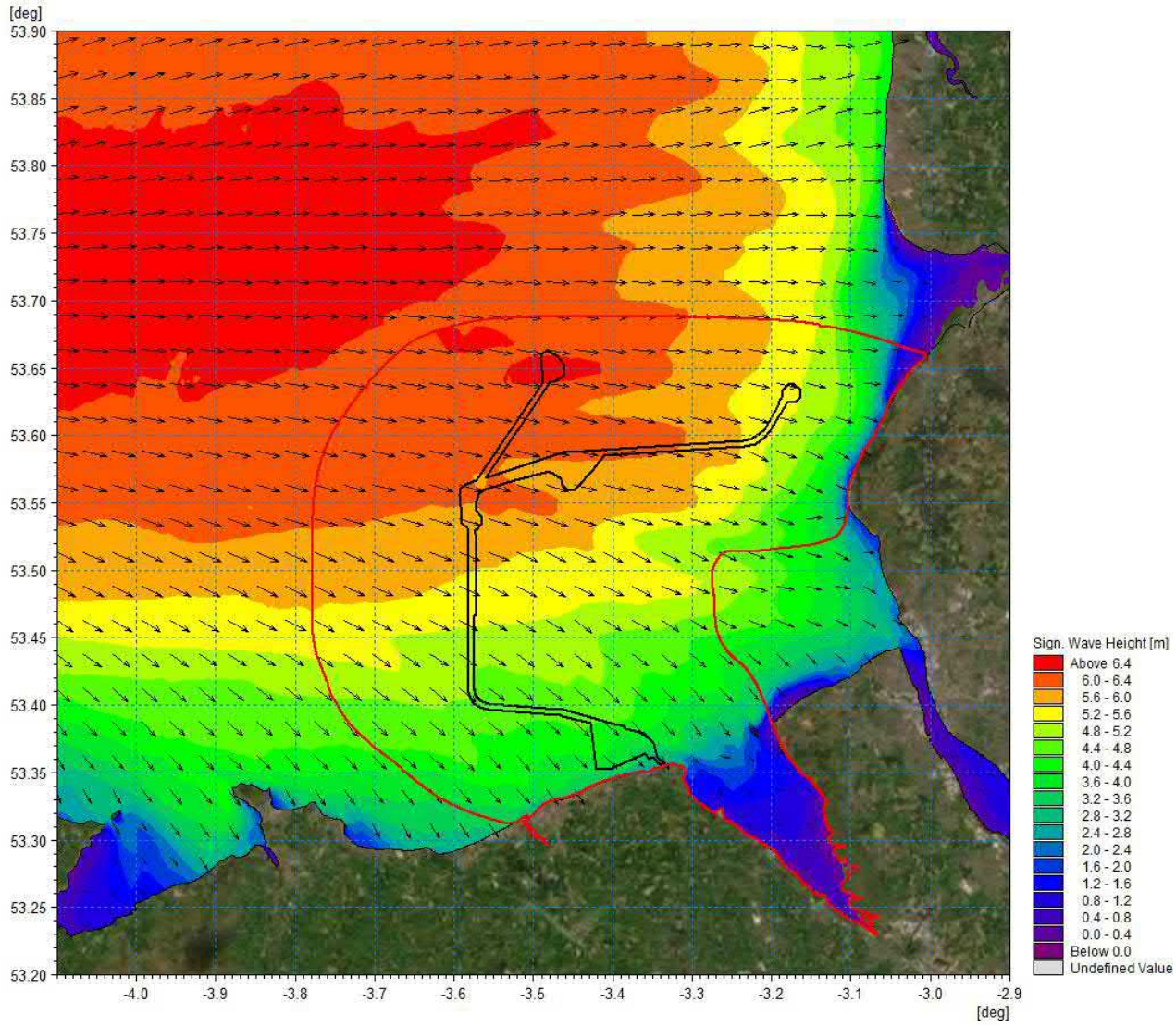


Figure 1.45: Wave climate 1:20 year storm from 270° MHW.

1.6.4 Littoral currents

The MIKE suite facilitates the coupling of models. The depth averaged hydrodynamic model, used for the tidal modelling, coupled with the spectral wave model, provides a full wave climate incorporating the impact of water levels and currents on waves and wave breaking. Using this, the littoral currents (i.e. those currents driven by tidal, wave, and meteorological forces) were examined.

The 1in1 year storm from 270° sector was simulated with the inclusion of spring tides to encompass a wide range of tidal conditions and the resulting flood and ebb currents are presented in Figure 1.46 and Figure 1.47 respectively. These correspond with the (calm) tidal plots presented in Figure 1.26 and Figure 1.27. As expected, the presence of the southeast going waves increase the currents on the flood tide whilst reducing them on the ebb.

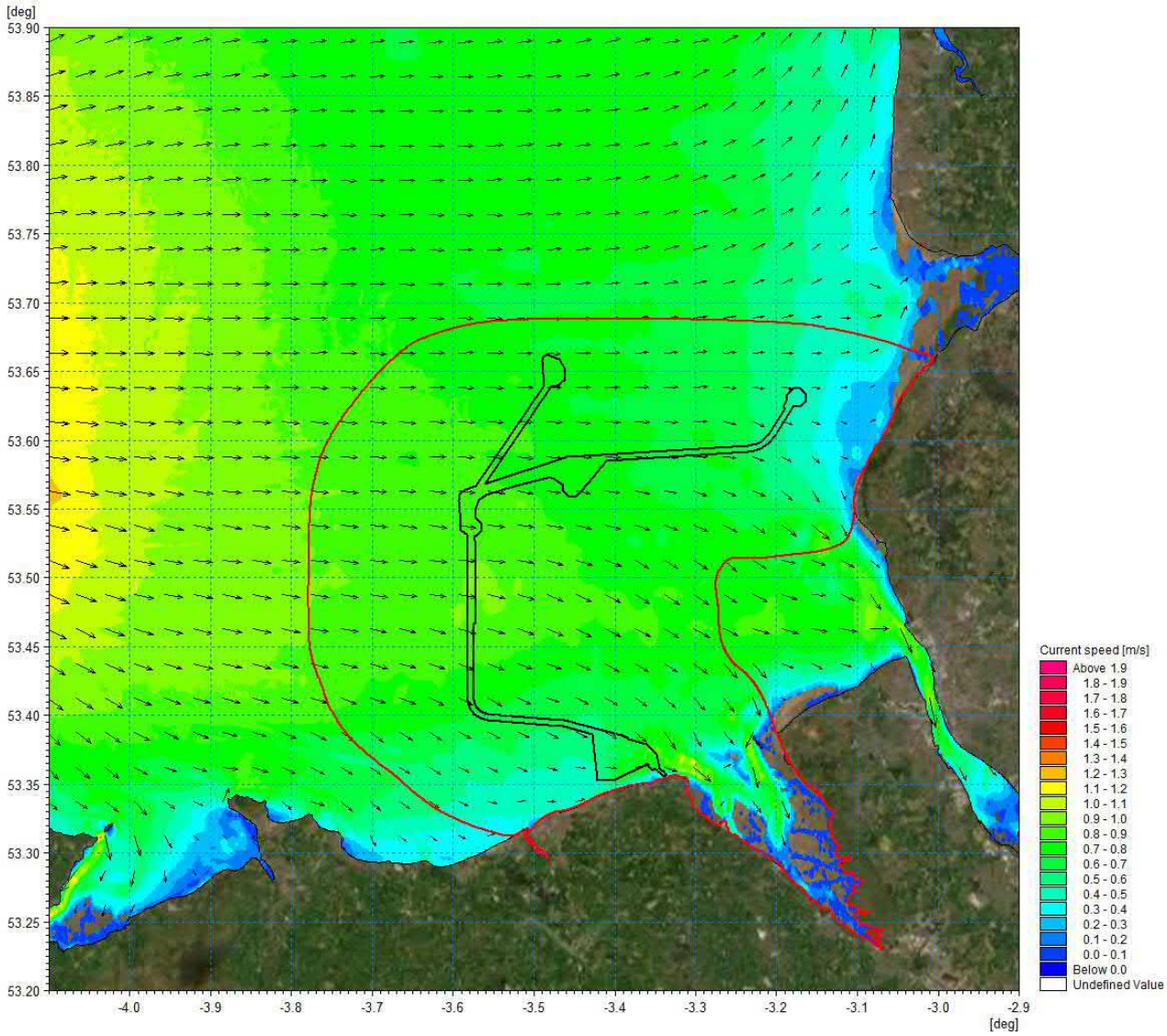


Figure 1.46: Littoral current 1:1 year storm from 270° - Flood Tide.

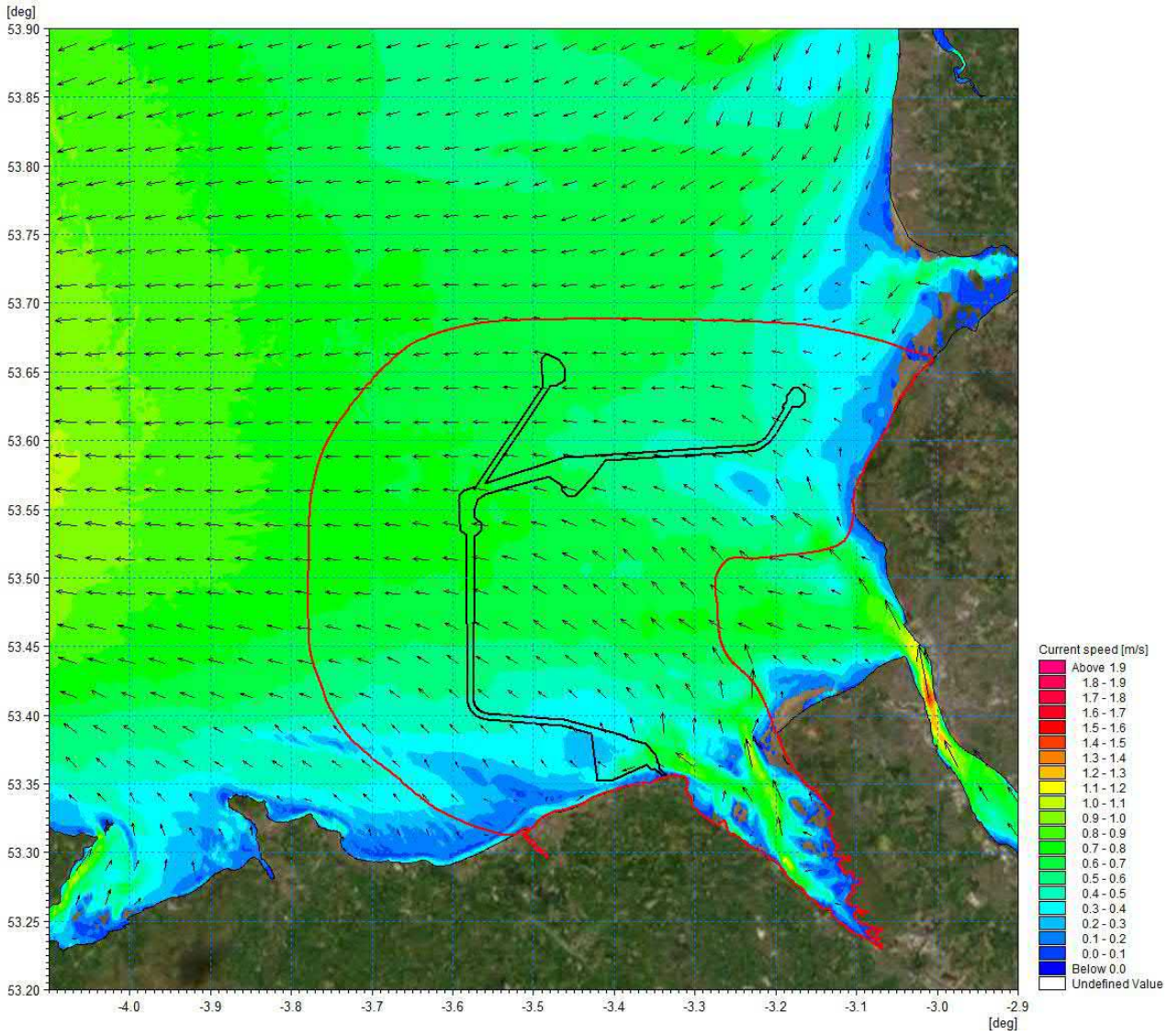


Figure 1.47: Littoral current 1:1 year storm from 270° - Ebb Tide.

1.6.5 Sedimentology and seabed substrate

An understanding of seabed substrate types is required to assess the potential impacts that may arise due to the installation of export cables and monitoring well drilling.

The sediment grading properties applied within the modelling for both sediment transport baseline and characterisation of mobilised material, during seabed preparation and installation, was derived from a number of sources including the British Geological Survey (BGS) datasets (BGS, 2023), as illustrated in Figure 1.48. These datasets included both generalised Folk classification from borehole logs and detailed particle analysis data.

Site specific information was also used to inform modelled sediment grading, collected via grab sample by Ocean Ecology Limited in 2022 (Ocean Ecology , 2022) as part of a subtidal benthic survey to inform the Environmental Impact Assessment (EIA). Sediment samples were obtained for 23 stations within the physical processes study area and analysed through particle size analysis (PSA). To inform the modelling study seabed sediment information was required beyond the extent of survey datasets, and the EMODnet Geology database (EMODnet , 2022) was utilised. The seabed classification shown in Figure 1.49 shows both the grab sample data collected by Ocean Ecology Limited and EMODnet classification data.

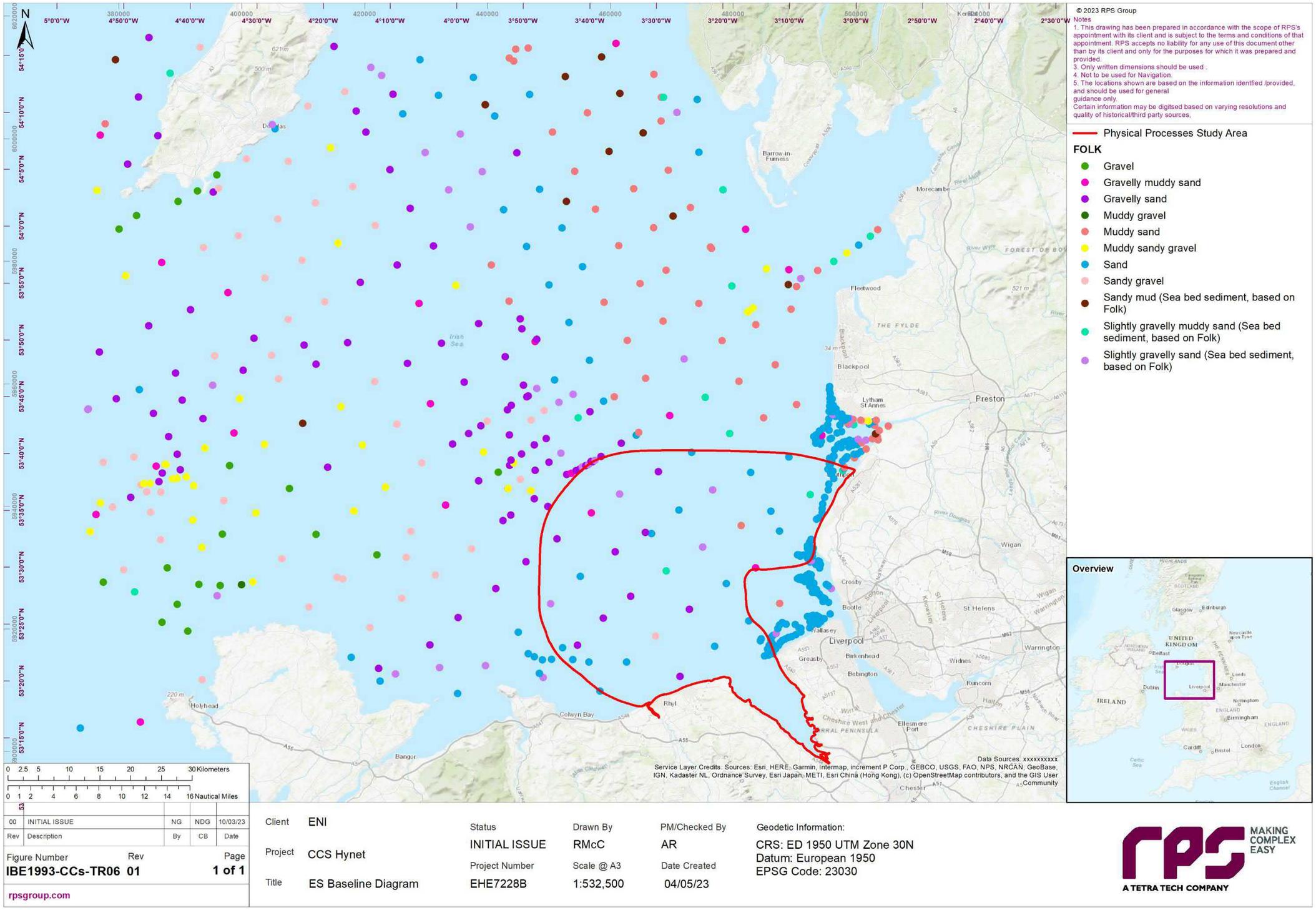


Figure 1.48: Seabed classification British Geological Survey.

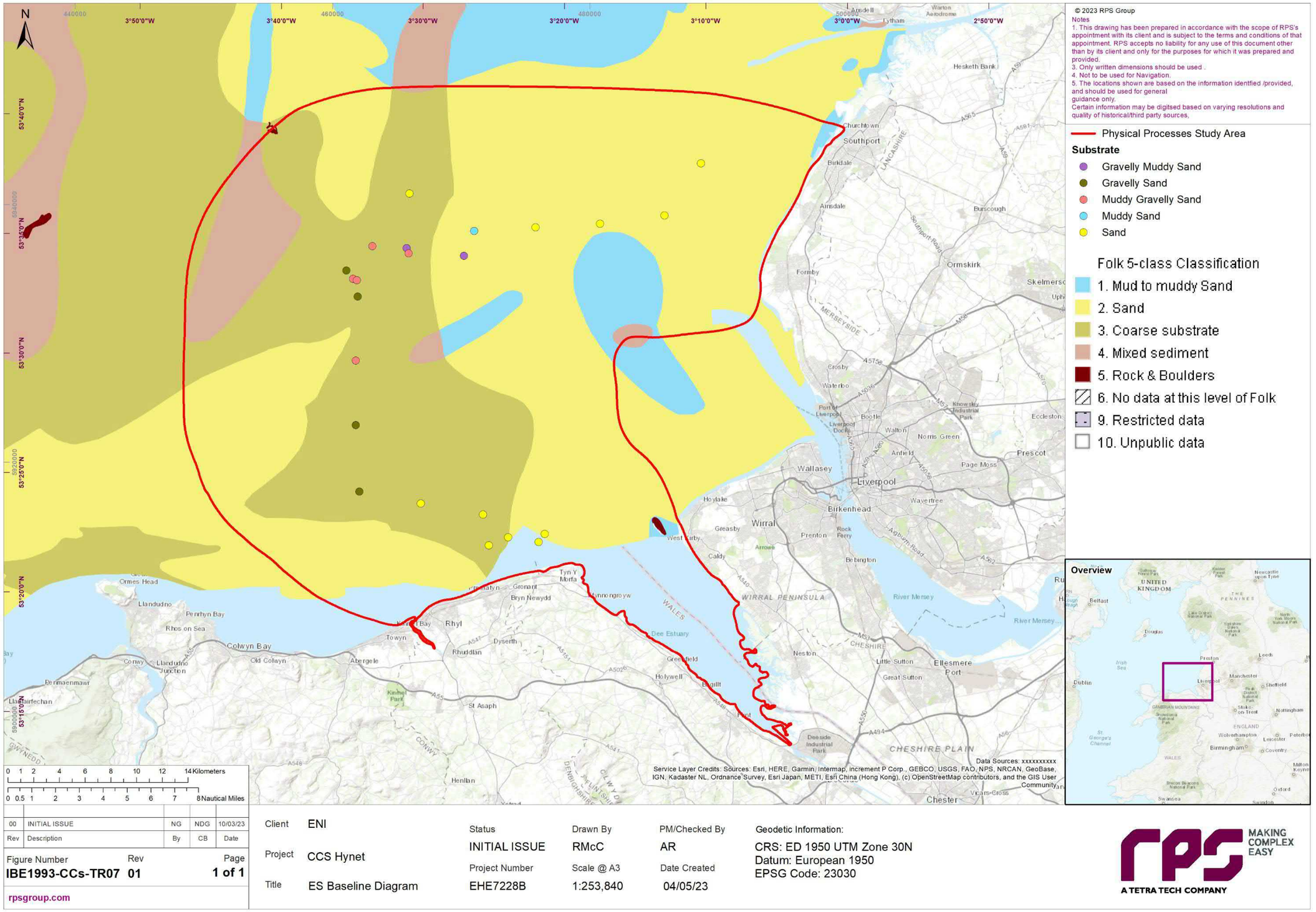


Figure 1.49: Seabed substrate geology comprised of site-specific grab samples and EMODnet.

1.6.6 Sediment transport

The MIKE21 Sediment Transport module enables assessment of bed sediment transport rates for non-cohesive sediment resulting from currents or combined wave-current flows. It was used to determine the sediment transport pattern within the model domain. The model combines inputs from both the hydrodynamic model and, if required, the wave propagation model. It used sediment characterisation provided by site specific survey and EMODnet data as presented in the previous section to determine the sediment transport characteristics.

It is noted that for a detailed sediment transport study greater detail of sediment characteristics across the model domain and along the coastline would be required. In the context of providing a baseline description of sediment transport patterns, the sediment characteristics identified within the survey and sampling were interpolated to those areas in the EMODnet data with similar sediment classifications.

The model domain was set up with a layer of mobile bed sediment. In areas where sediment is present an initial layer depth was set to 3m and tapered to zero in the areas of rocky outcrops to ensure that sediment was not exhausted during the simulated events. Sediment transport was examined relating to spring tidal conditions over the course of two tidal cycles (one day) to provide a 'snap-shot'. The simulation included a period for the hydrodynamics to stabilise and develop across the domain prior to sediment transport being enabled (i.e. a "warm-up" period).

Three aspects were examined:

- Residual current, which is the net flow over the course of the tidal cycle. This is effectively the driving force of the sediment transport
- Potential sediment transport over this period
- Potential sediment transport during flood and ebb tides. This provides information for a 'snap-shot' in time to enable the process to be illustrated.

The residual current is presented in Figure 1.50 and it should be noted that a log scale has been used to cover the range of residual current speeds encountered. The current vectors indicate residual flow into the east Irish Sea from the north and west which correlates with this region being a sediment sink. There are strong circulatory currents where tidal flows interact with headlands and embayments.

An indication of transport rate is shown in Figure 1.51, again using a log scale palette as the values within the offshore regions are several orders of magnitude smaller than those along the coastline. The greatest transport rates are seen in areas where finer sand fractions are present and in estuaries and at headland where tidal currents are strongest. The mechanism is more clearly illustrated in Figure 1.52 and Figure 1.53 for flood and ebb tides respectively. It is evident that transport rates are highest during the dominant flood tide and the region is a sediment sink.

By way of completeness, residual currents relating to the 1in1 year return period storm approaching from 270º are also presented, Figure 1.54. As anticipated, the littoral currents and dominant flood tide significantly increase easterly residual currents particularly along the Welsh coastline. This in turn would result in increased sediment transport rates during storm conditions.

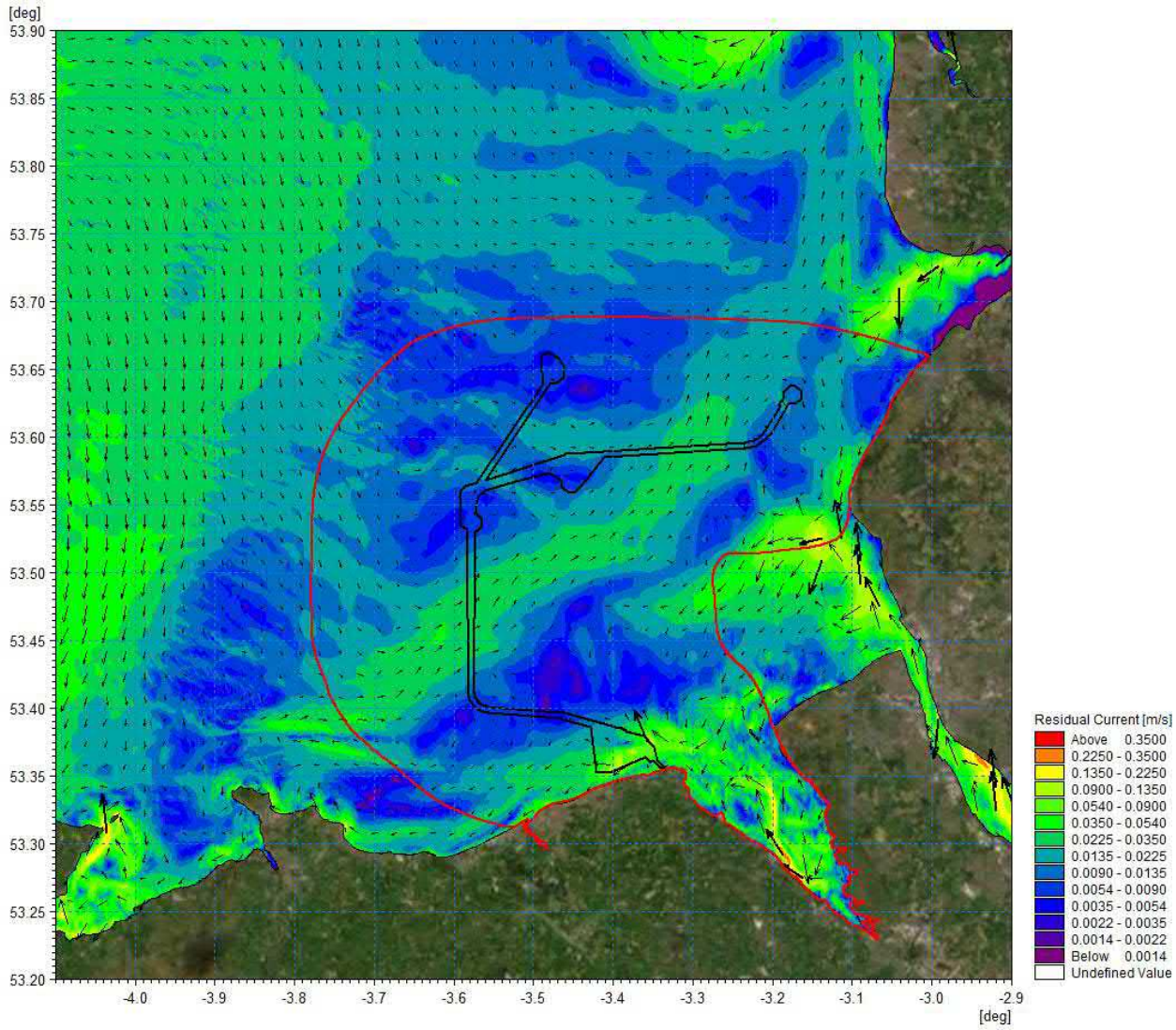


Figure 1.50: Residual current spring tide.

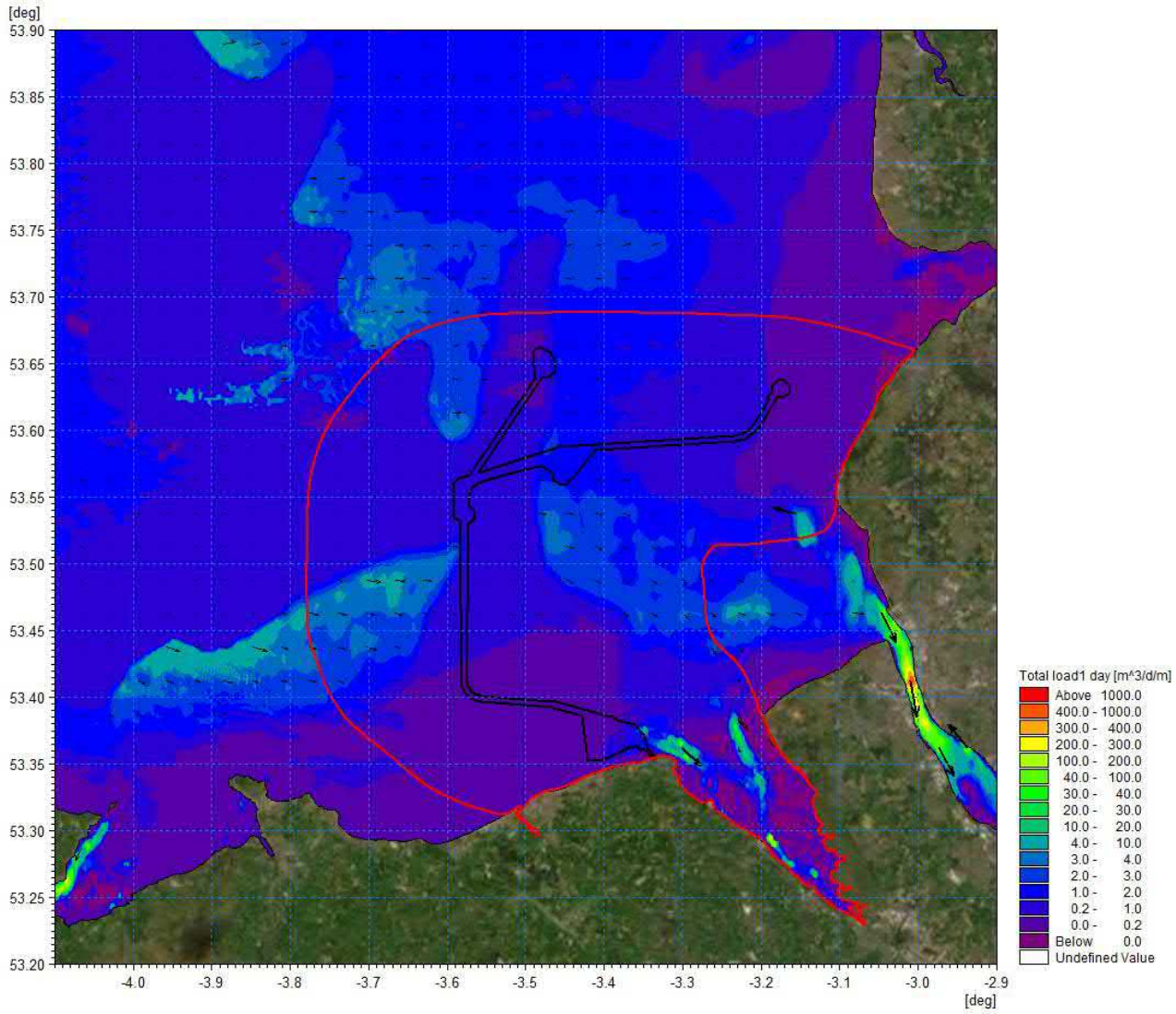


Figure 1.51: Potential sediment transport over the course of 1 day (two tide cycles).

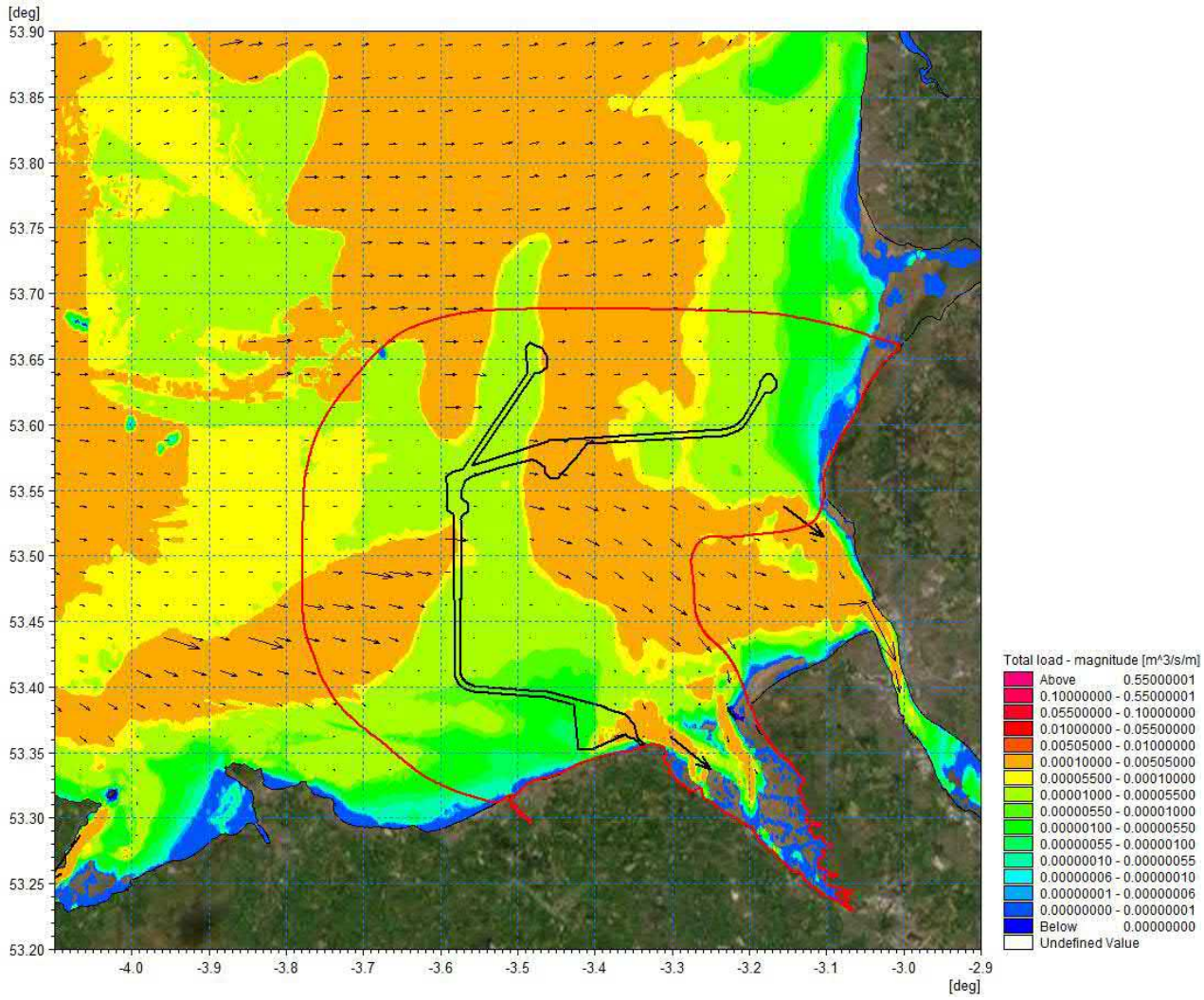


Figure 1.52: Sediment transport – flood tide.

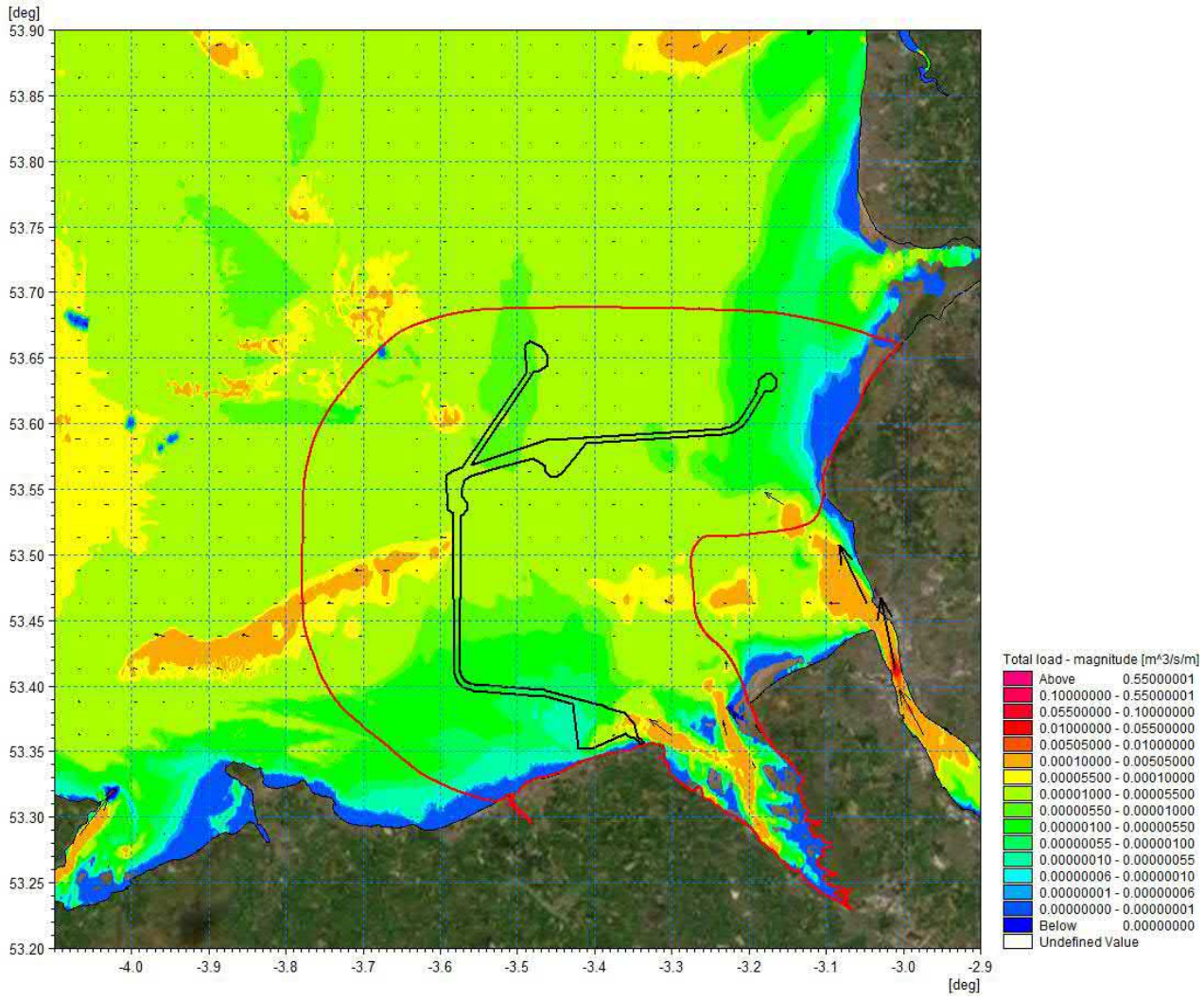


Figure 1.53: Sediment transport – ebb tide.

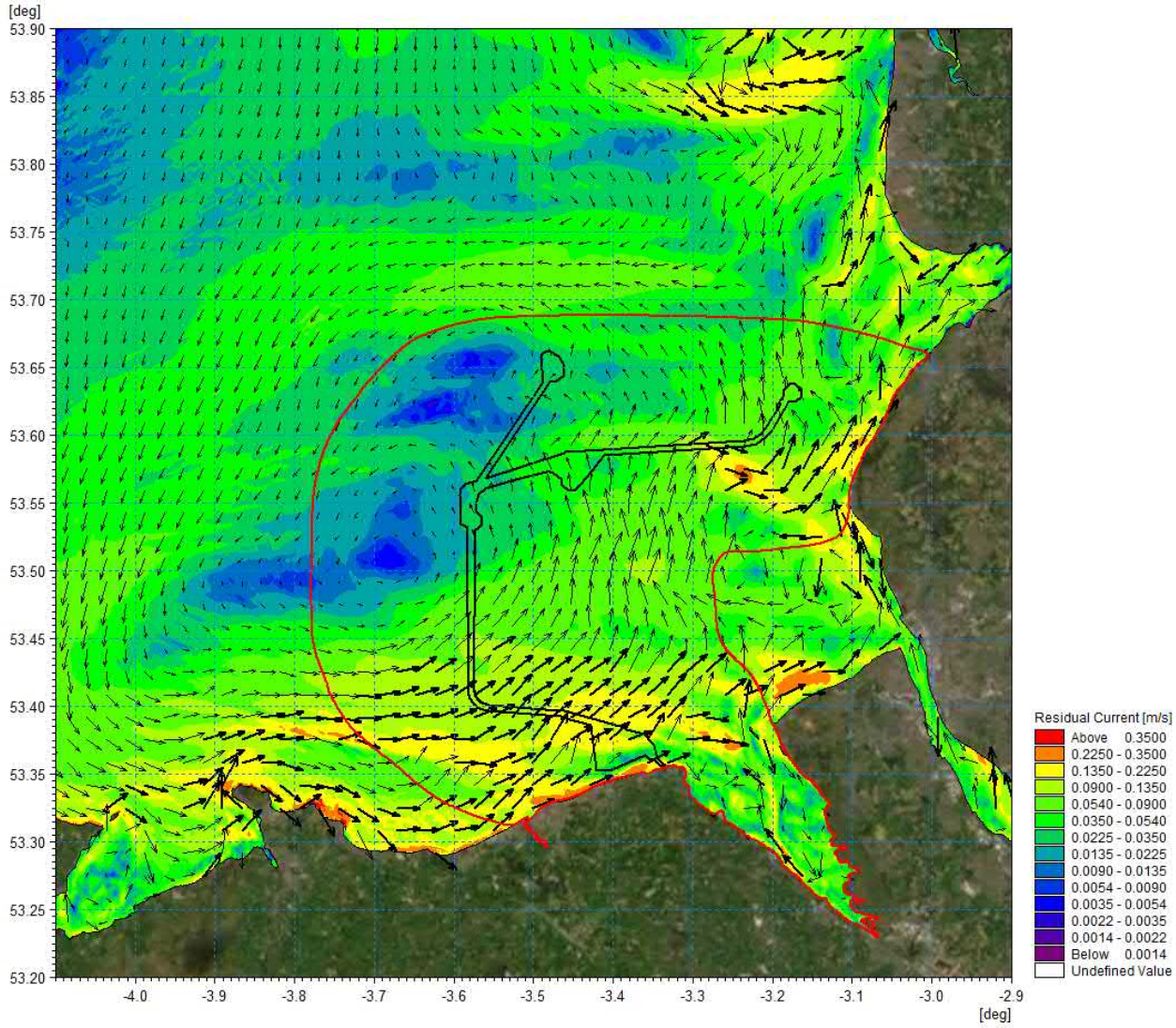


Figure 1.54: Residual current spring tide with 1:1 year storm from 270º.

1.6.7 Suspended sediments

The principal mechanisms governing Suspended Sediment Concentration (SSC) in the water column are tidal currents, with fluctuations observed across the spring-neap cycle and across the different tidal stages (high water, peak ebb, low water, peak flood). It is key to note that SSCs can also be temporarily elevated by wave-driven currents during storm events. During high-energy storm events, levels of SSC can rise significantly, both near bed and extending into the water column. Following storm events, SSC levels will gradually decrease to baseline conditions, regulated by the ambient regional tidal regimes. The seasonal nature and frequency of storm events supports a broadly seasonal pattern for SSC levels.

CEFAS Climatology Report 2016 (CEFAS, 2016) and associated dataset provides the spatial distribution of average non-algal Suspended Particulate Matter (SPM) for the majority of the UK Continental Shelf (UKCS). Between 1998 and 2005, the greatest plumes are associated with large rivers such as those that discharge into the Thames Estuary, The Wash and Liverpool Bay, which show mean values of SPM above 30mg/l. The levels of SPM reported by CEFAS between 1998 to 2005 of approximately 0.9mg/l to 3mg/l. Higher levels of SPM are experienced more commonly in the winter months; however, due to the tidal influence, even during summer months the levels may become elevated. CEFAS SPM data within the physical processes study area is presented in Figure 1.55.

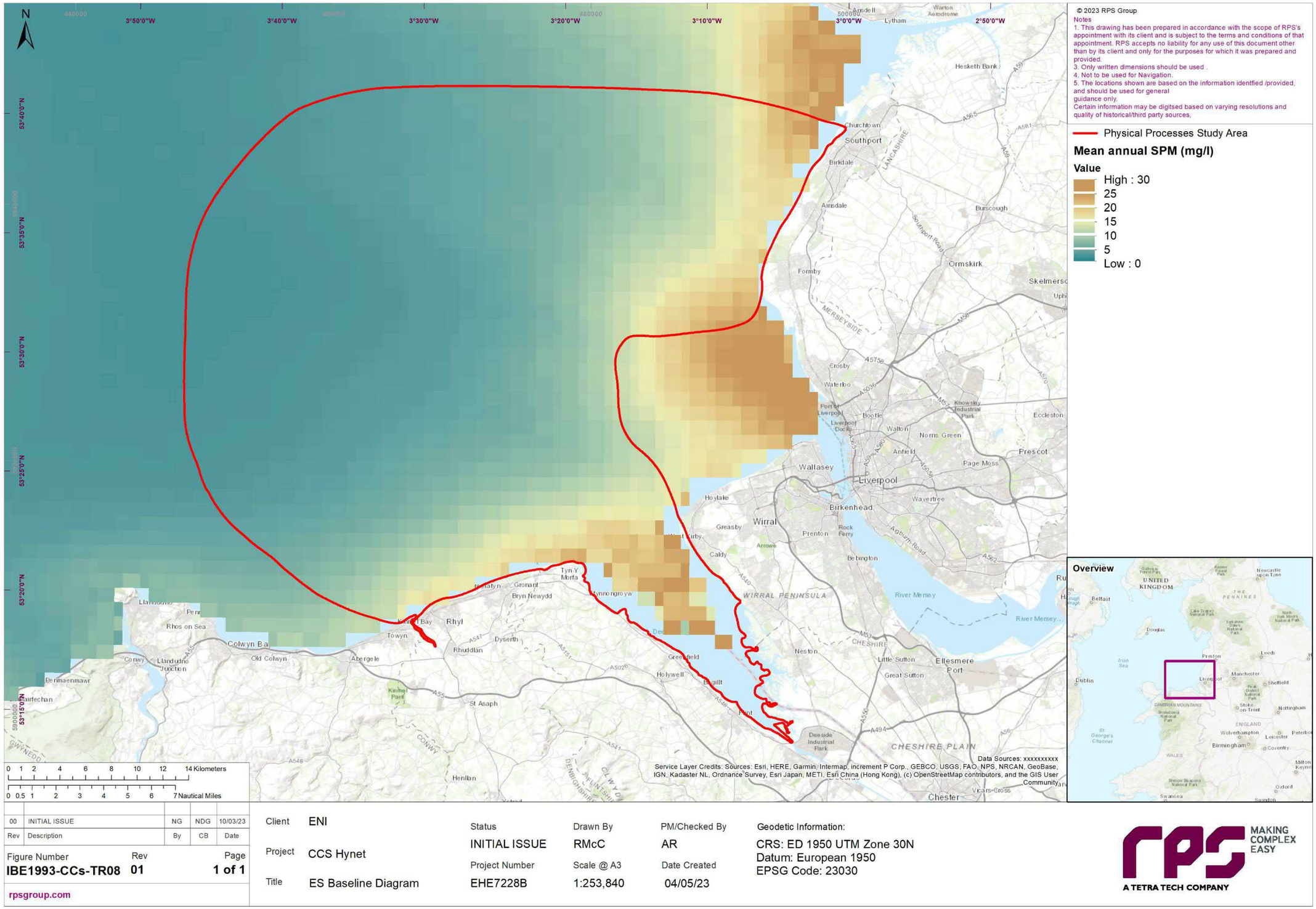


Figure 1.55: Distribution of average non-algal suspended particulate matter – CEFAS.

1.7 Potential changes during construction

The principal construction elements relate to the transport and fate of sediment brought into suspension due to seabed preparation, the drilling of monitoring wells, and the laying of cables. Modelling was undertaken for a representative sample of works to be undertaken, i.e. cable laying from the Lennox OP to Douglas OP and from Douglas OP to the shore to provide information to be utilised in the EIA.

In each scenario the modelling examined excess suspended sediment concentration (SSC) arising from the proposed activities (i.e. ambient SSC were not included). Baseline studies outlined in Section 1.6.7 indicate that turbidity levels vary greatly across the domain and throughout the year, being relatively low in deep water areas compared with active sediment transport mechanisms within the estuaries. Therefore, the excess SCC data presented would be applicable independent of the season in which the operations are undertaken.

The baseline residual currents and sediment transport modelling has corroborated the knowledge that the east Irish Sea is a sediment sink with active sediment transport processes. Sedimented material arising from the construction phase activities would therefore be amalgamated into the sediment transport regime. The numerical modelling provides depth averaged suspended sediment concentration values and do not therefore differentiate between bed load and water column suspended sediment.

During each phase of the assessment the transport of suspended sediment was modelled by undertaking simulations that released sediment at a rate and location appropriate to each type of construction. The sediment released was defined according to the characteristics derived from site specific survey data at each specific location. Where a number of locations were encountered, such as a dredging path, then a representative grading was used.

1.7.1 Seabed preparation

Due to the nature of the seabed in the development area, the cable installation will require seabed preparation in the form of seabed features clearance. The Project Design Envelope (PDE) presented by the Proposed Development description outlined in Volume 1, Chapter 3: Proposed Development Description of the ES indicates that sand waves are to be cleared along the cable route in two locations, south of the existing Douglas platforms, and at West Hoyle Bank.

Clearance activities south of the Douglas OP are set to be undertaken across two sections where sand waves are present with average heights of *c.*3m and lengths of *c.*100m and *c.*15m respectively. To enable the laying of cables, a *c.*10m wide corridor will be excavated using a mass flow excavator/ jet sled, which will suspend sediment at the seafloor.

At West Hoyle Bank in order to allow the laying of the cable directly across the feature, a dredged channel will be necessary. During clearance activities material will be side cast along the *c.*1,000m length of channel and backfilled after cable installation. The trench width is expected to be *c.*21m in width and *c.*7m in depth.

Two representative clearance operations were assessed within the modelling, one relating to the sand waves south of Douglas OP and a second for West Hoyle Bank. The grab sample survey data was used to identify the sediment grading of the two clearance areas. The modelling undertaken to quantify the potential increases in suspended sediment concentration and sedimentation simulated the two different approaches to seabed preparation.

The Particle Tracking (PT) module was utilised for the offshore sand clearance south of Douglas as it had the advantage that it could be used to describe the transport of material released in a specific part of the water column. In this way, the dispersion would not be over-estimated or the corresponding sedimentation under-estimated by the application of a current profile through the water column. Alternatively, the Mud Transport (MT) module was used to describe the sandwave clearance across West Hoyle Bank. This sandbank dries at low water and as such PT is not appropriate for use in flooding and drying area. The MT module despite its name can be used to model both cohesive (mud) and non-cohesive/granular sediments (sand) and therefore is applicable to the sandy sediments of West Hoyle.

1.7.1.1 South of Douglas

The sand waves south of Douglas OP were cleared at rate of 27.71kg/s along the 10m wide route across a period of 3 days. The displaced material was released along the channels 100m and 15m in length at the seafloor, accounting for the mechanism of release caused through the use of a mass flow excavator. The redistributed material was classified using the sediment properties identified from the grab sampling undertaken along the route simulated, as follows:

- Gravel: 23.2%
- Coarse sand: 10.3%
- Medium sand: 44.4%
- Fine sand: 5.5%
- Very fine sand/mud: 16.6%.

Due to the relatively small size of this sand wave clearance operation, maximum suspended sediment concentrations during excavation are restrained to within 200m of the seabed release with a peak value of *c.*1400mg/l at the point of mobilisation. The finer sediments that remain suspended and carried further in the tidal ellipsis shows maximum concentrations of <100mg/l. Average SSC values during excavation, as shown in Figure 1.58, are limited to <100mg/l and are constrained to the location's tidal ellipse. Plumes extend *c*.12km west to within *c*.500m of the borders of the physical processes study area, extending a similar distance east, but with little movement north or south.

As shown in Figure 1.59- Figure 1.61, all sedimentation occurs along the *c*.8km wide tidal ellipse, with maximum deposition limited to <50mm within 10m of the point of excavation and average deposition of <30mm (peak values of *c*.14mm). This represents the larger coarser sediment that is not suspended for as long or carried as far as the finer sands/muds. Figure 1.61 showing sediment deposited one day after the cessation of excavation presents the sediment that settles at slack water, with values again limited to <30mm.

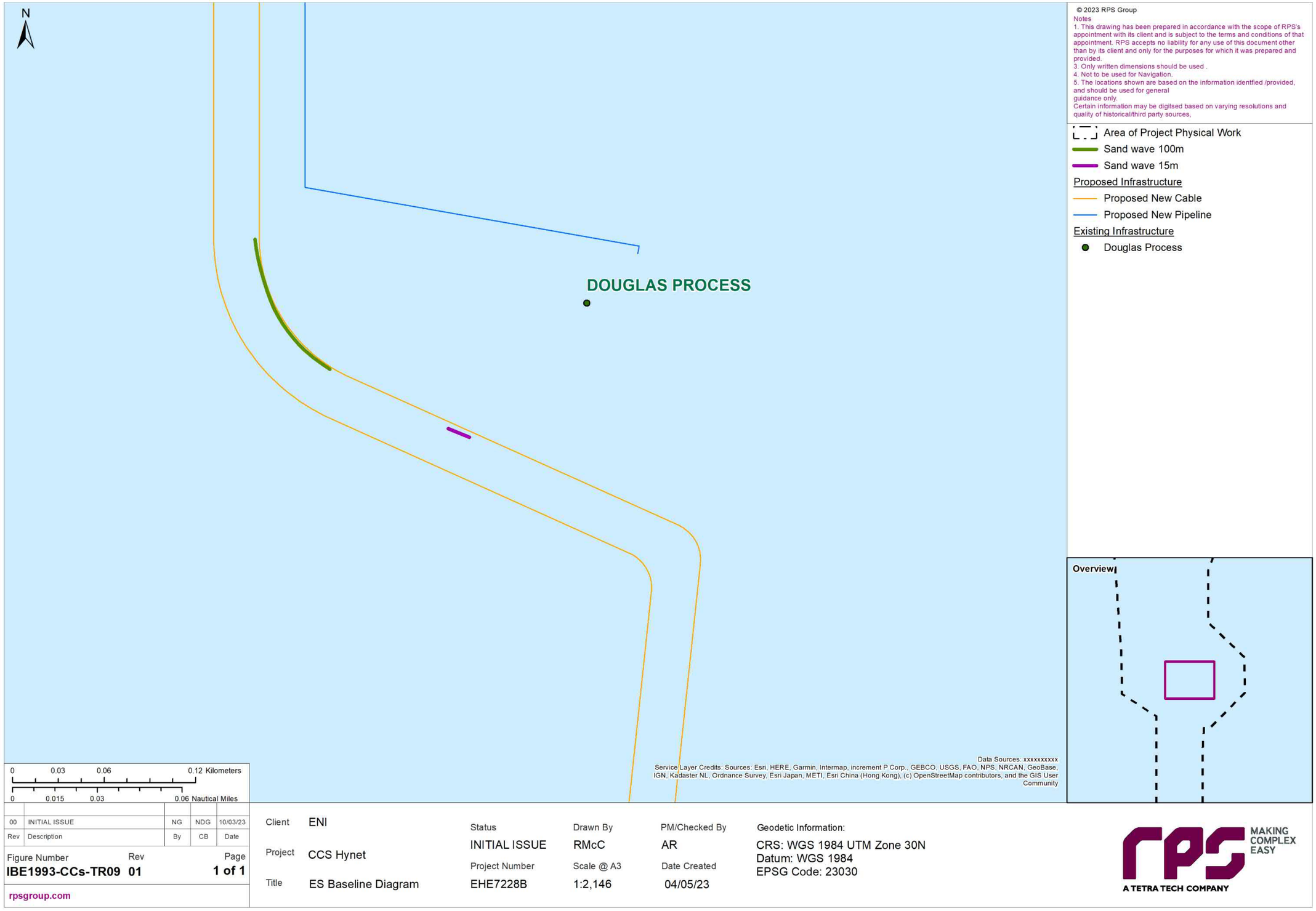


Figure 1.56: Modelled paths for sand wave clearance south of Douglas OP.

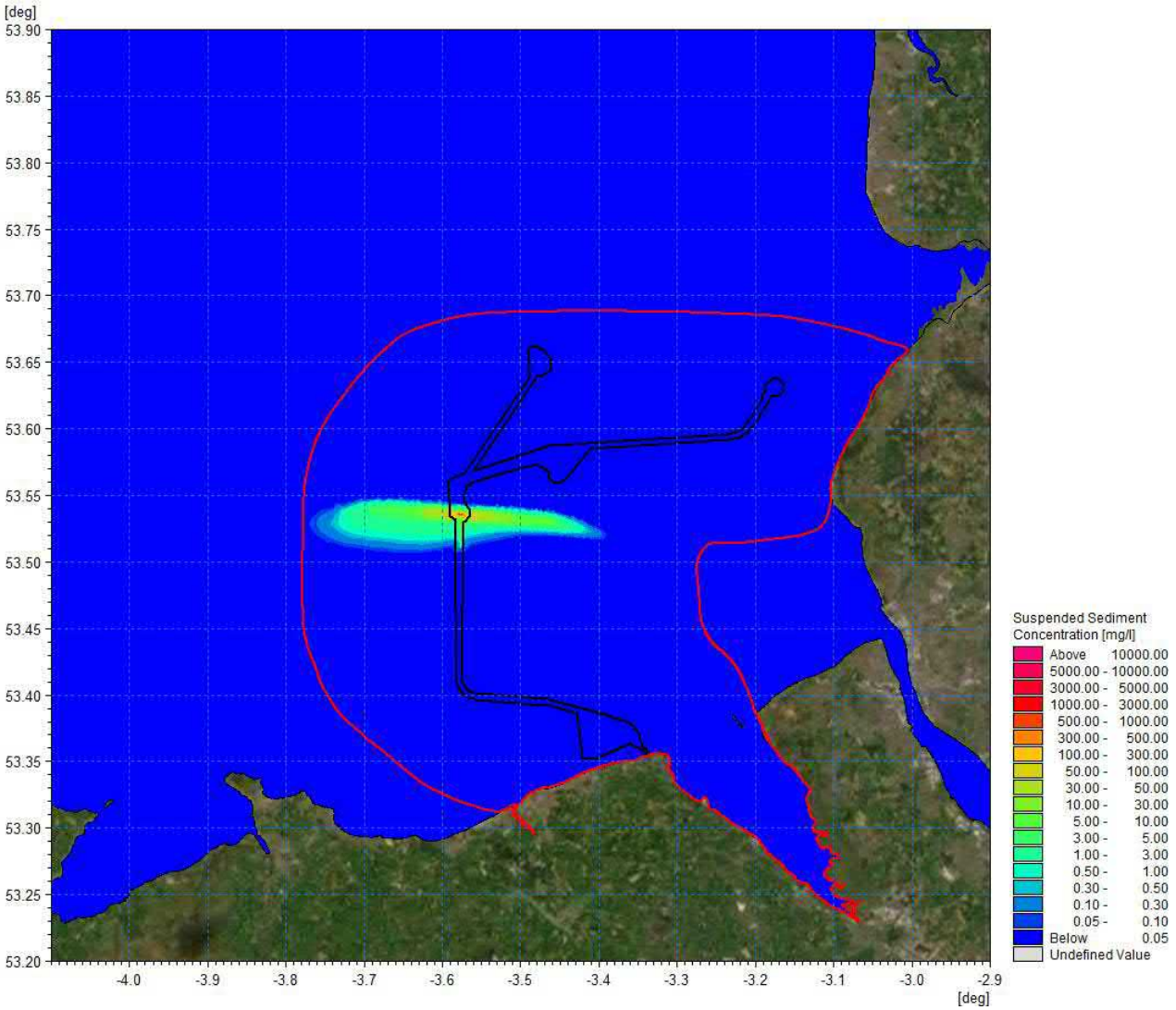


Figure 1.57: Maximum suspended sediment concentration over excavation phase – South of Douglas.

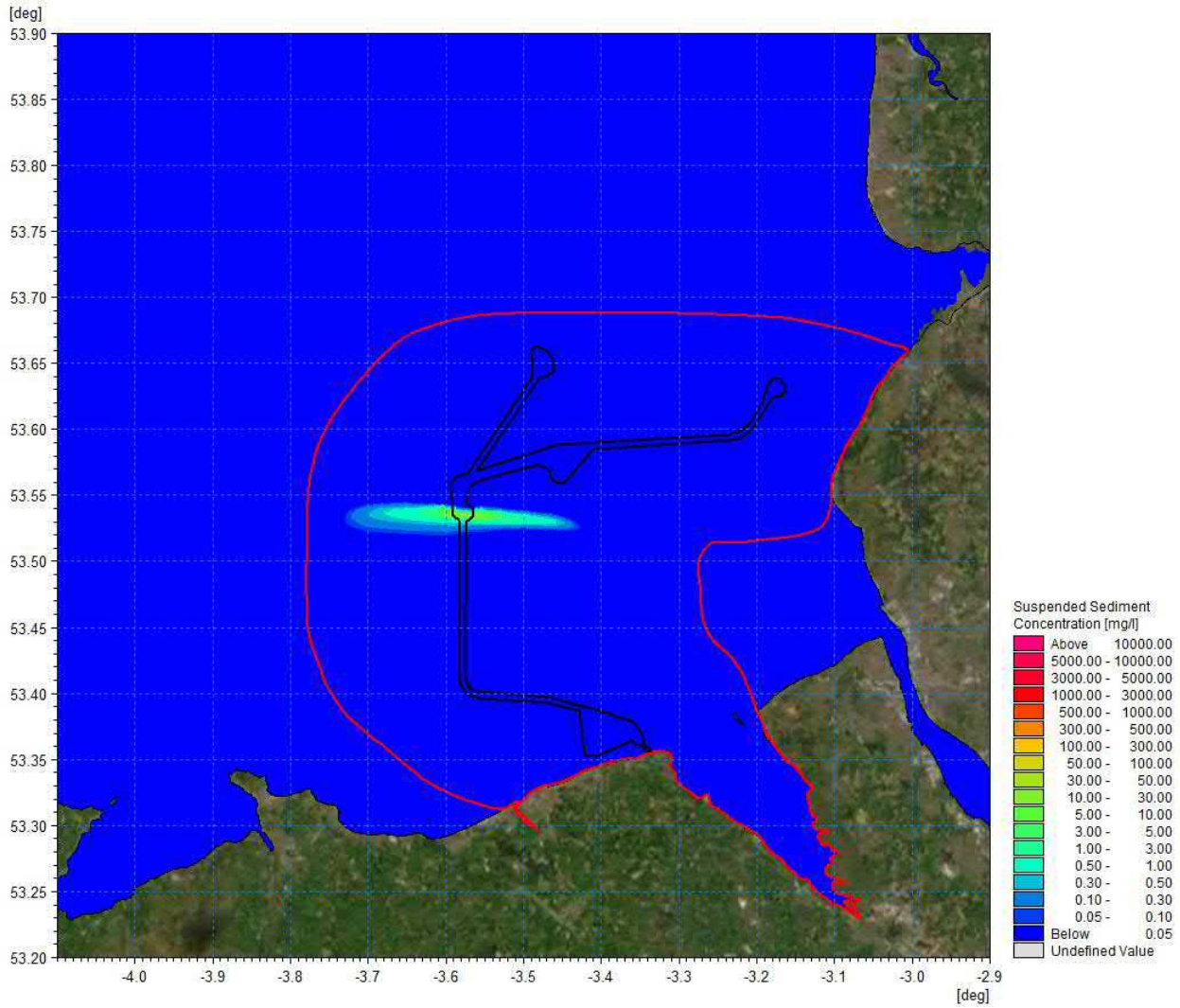


Figure 1.58: Average suspended sediment concentration over excavation phase – South of Douglas.

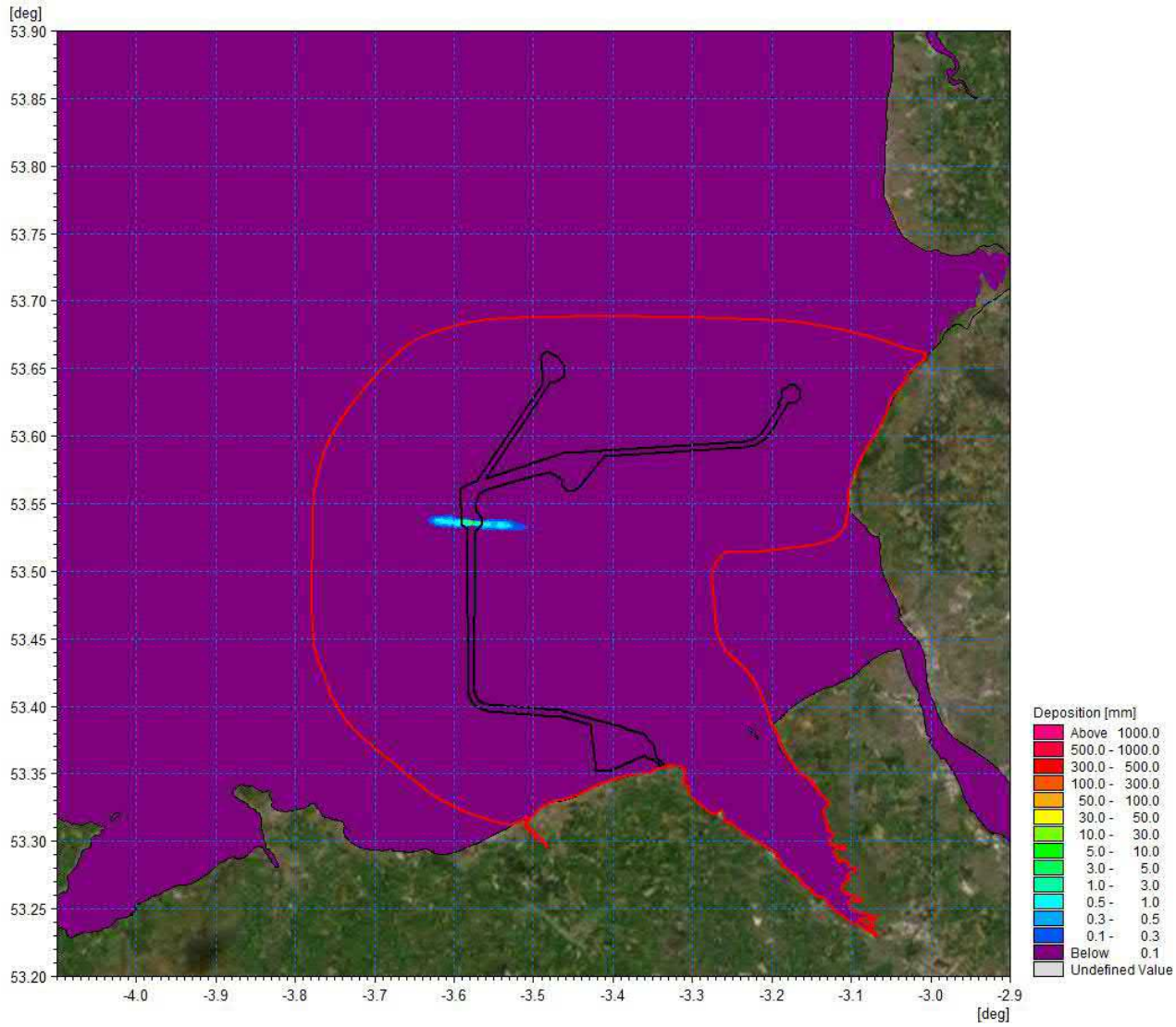


Figure 1.59: Maximum sedimentation over excavation phase – South of Douglas.

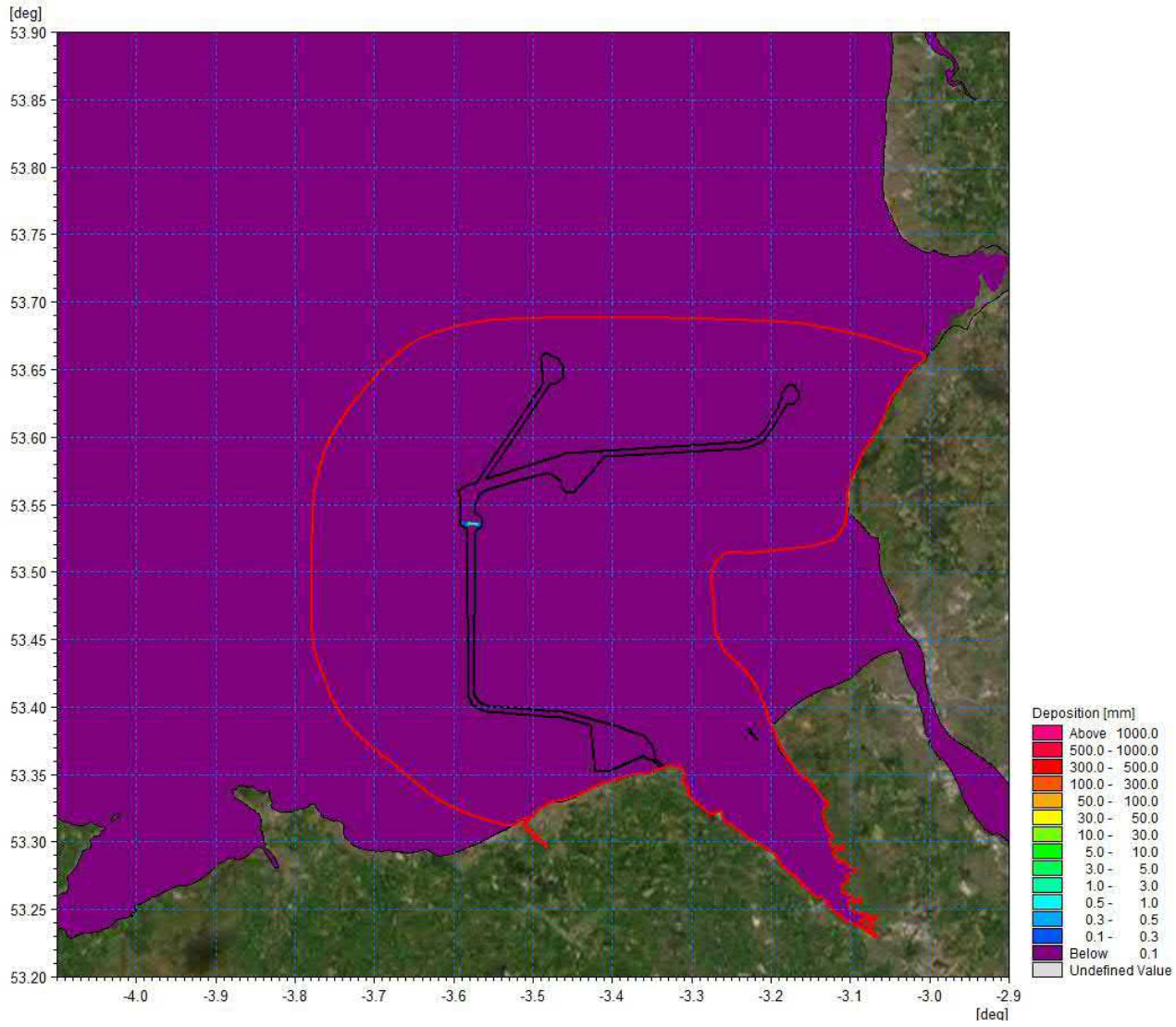


Figure 1.60: Average sedimentation over excavation phase – South of Douglas.

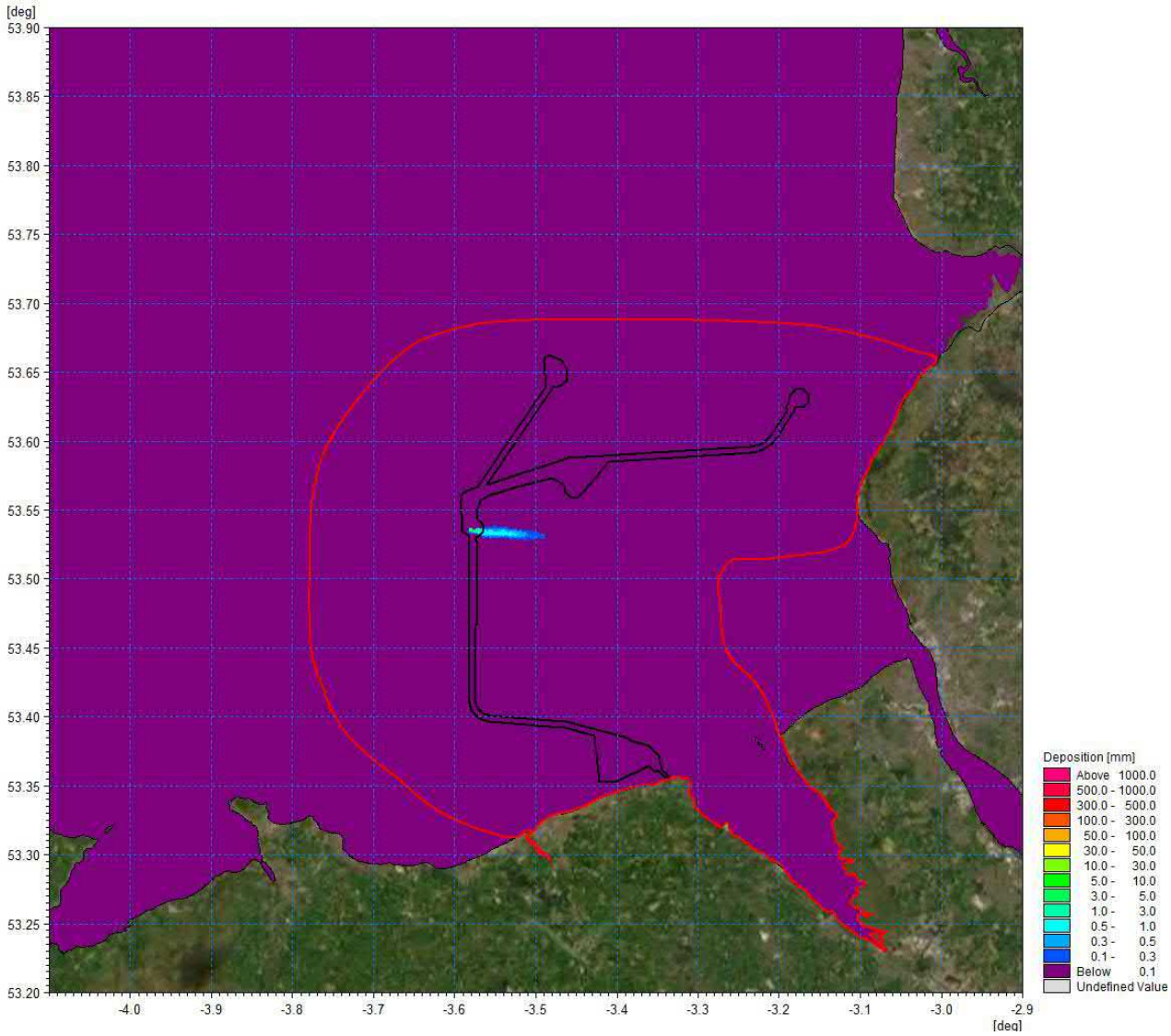
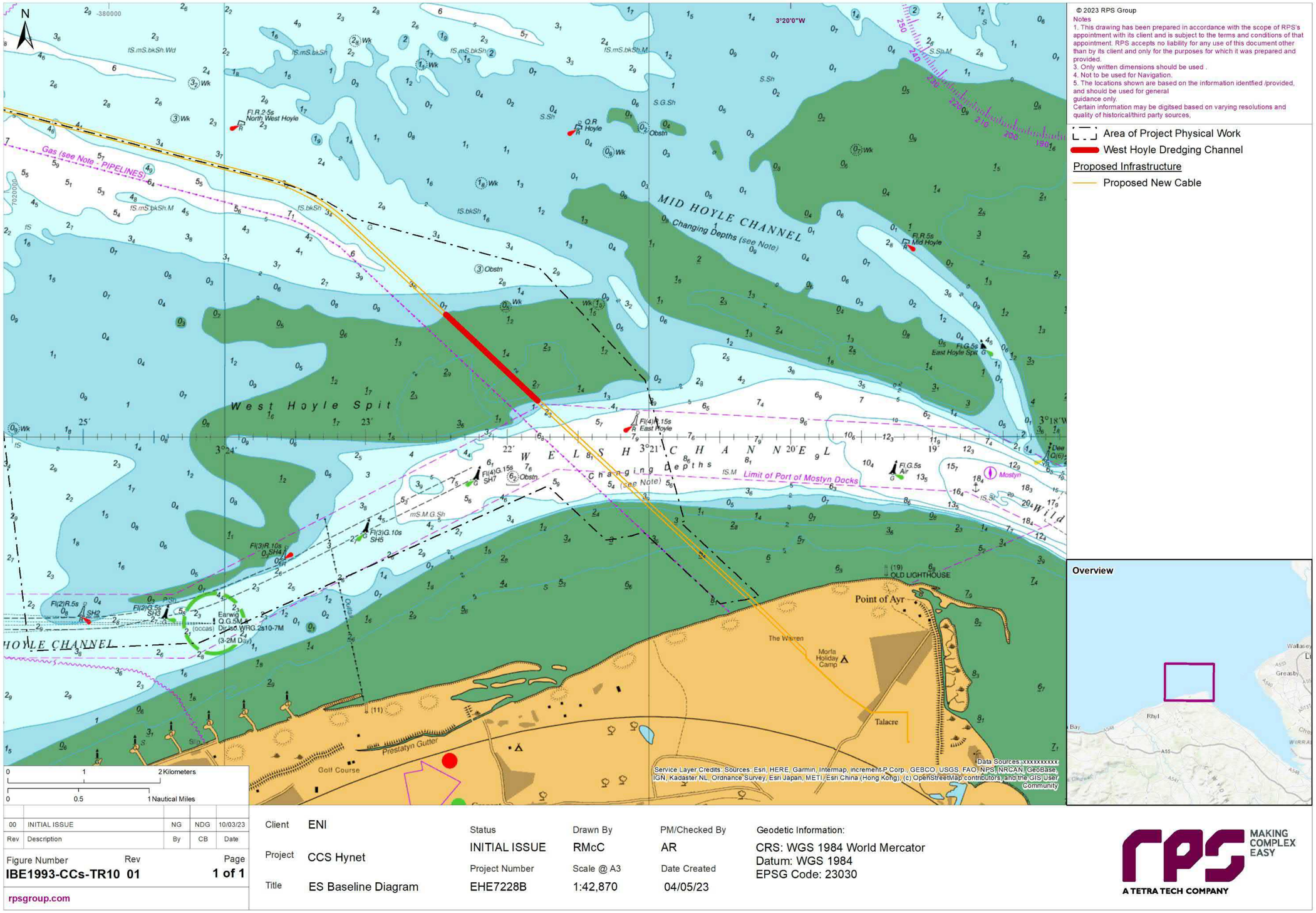


Figure 1.61: Sedimentation one day after cessation of excavation – South of Douglas.

1.7.1.2 West Hoyle Bank

The dredging of a channel through West Hoyle Bank was simulated with a 1km length with a depth of 7m and 21m in width and was modelled with a rate of release of *c*.295kg/s uniformly released throughout the water column. The operation took approximately 14 days to complete over a range of tidal conditions. The dredging path through West Hoyle Bank is displayed in Figure 1.62.



Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
3. Only written dimensions should be used .
4. Not to be used for Navigation.
5. The locations shown are based on the information identfied /provided, and should be used for general guidance only.
Certain information may be digitsed based on varying resolutions and quality of historical/third party sources;

Area of Project Physical Work
West Hoyle Dredging Channel

Proposed Infrastructure
Proposed New Cable

0 1 2 Kilometers
0 0.5 1 Nautical Miles

Rev	Description	By	CB	Date
00	INITIAL ISSUE	NG	NDG	10/03/23

Figure Number IBE1993-CCs-TR10 Rev 01 Page 1 of 1

rpsgroup.com

Client ENI
Project CCS Hynet
Title ES Baseline Diagram

Status INITIAL ISSUE
Project Number EHE7228B
Drawn By RMcC
Scale @ A3 1:42,870
PM/Checked By AR
Date Created 04/05/23

Geodetic Information:
CRS: WGS 1984 World Mercator
Datum: WGS 1984
EPSG Code: 23030

MAKING COMPLEX EASY
A TETRA TECH COMPANY

Figure 1.62: Modelled dredge path across West Hoyle Bank.

The redistributed material was classified using the properties identified from the grab sampling undertaken along the route simulated.

- Gravel: 0.0%
- Coarse sand: 2.5%
- Medium sand: 53.2%
- Fine sand: 44.3%
- Very fine sand/mud: 0.0%.

As shown by Figure 1.63 and Figure 1.64, suspended sediments during dredging are concentrated around the dredge path and the coastline at the mouth of the Dee Estuary, with maximum plume extents reaching 25km southeast to the mouth of the River Dee. Maximum SSC values in excess of 300g/l occur along the dredging route itself, to a peak of c.320g/l, reflecting the. Concentrations are seen to be generally greater inshore where water depths are shallower. Along the western coast of the Dee Estuary maximum values can fall within the range of 3,000-10,000mg/l, however, in most areas fall below 30mg/l. SSC values that either border, or in exceptional cases, exit the physical processes study area, have concentrations limited to <1mg/l. Where the plume exits the physical processes study area on its eastern border, it does so by <500m. Average concentrations along the dredge route are limited to <3,000mg/l, whereas concentrations are generally <10mg/l in the development area, and <3mg/l in the wider physical processes study area.

The sedimentation figures shown in Figure 1.65 - Figure 1.67, demonstrate that all sedimentation occurs within the physical processes study area, with maximum values of c.5m adjacent to the dredged channel, as to be expected with the volume of material sidecast. Average sedimentation values outside of the dredge path are generally limited to <50mm, and <10mm outside of the area of development area. The average deposition shown in Figure 1.66, presents sedimentation at negligible depths 8km into the mouth of the Dee Estuary. Sedimentation one day after the cessation of dredging activity further demonstrates that deposited material is focussed in close proximity to the dredge path, beyond which deposition is generally below <100mm.

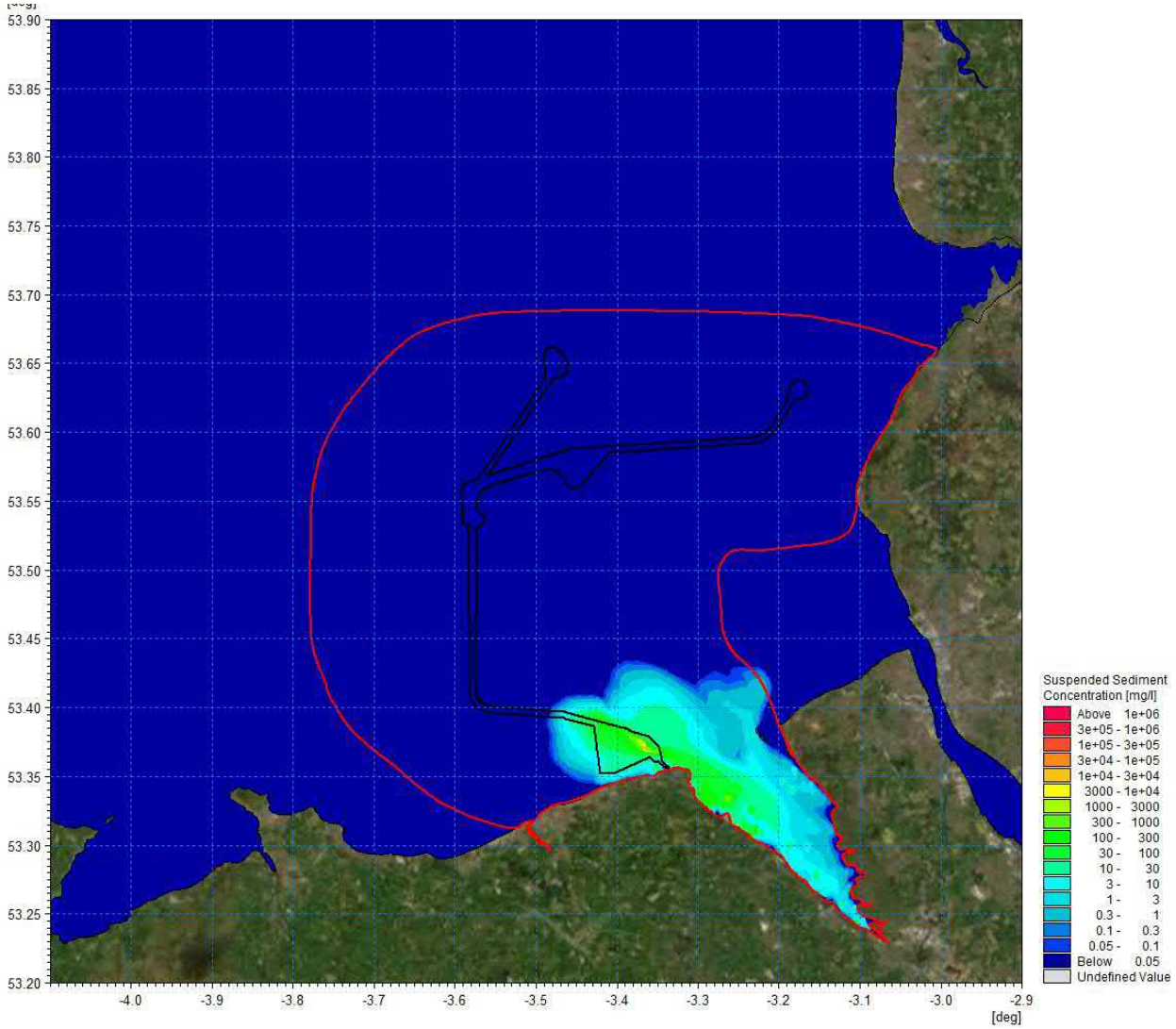


Figure 1.63: Maximum suspended sediment concentration over dredging phase – West Hoyle Bank.

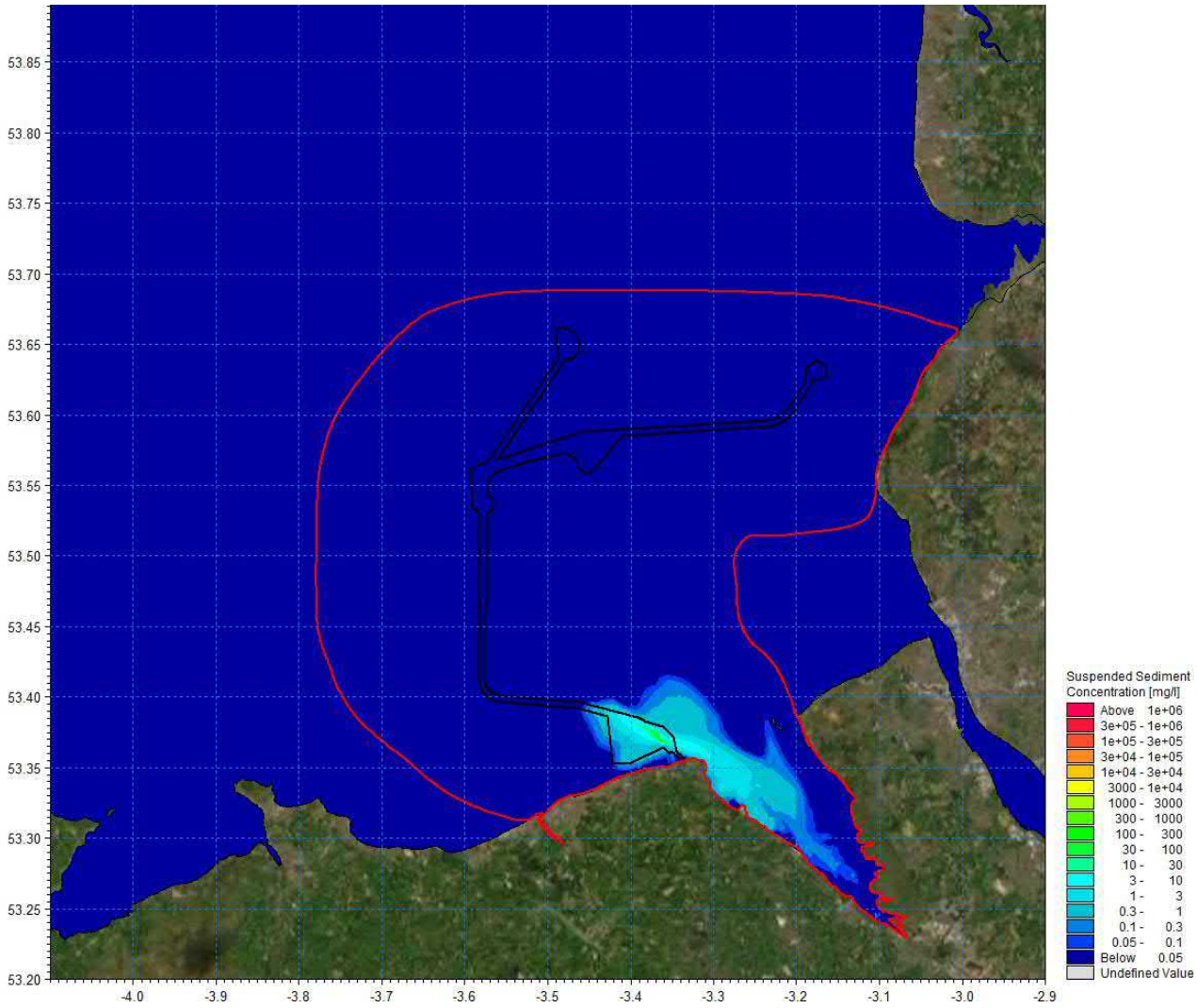


Figure 1.64: Average suspended sediment concentration over dredging phase – West Hoyle Bank.

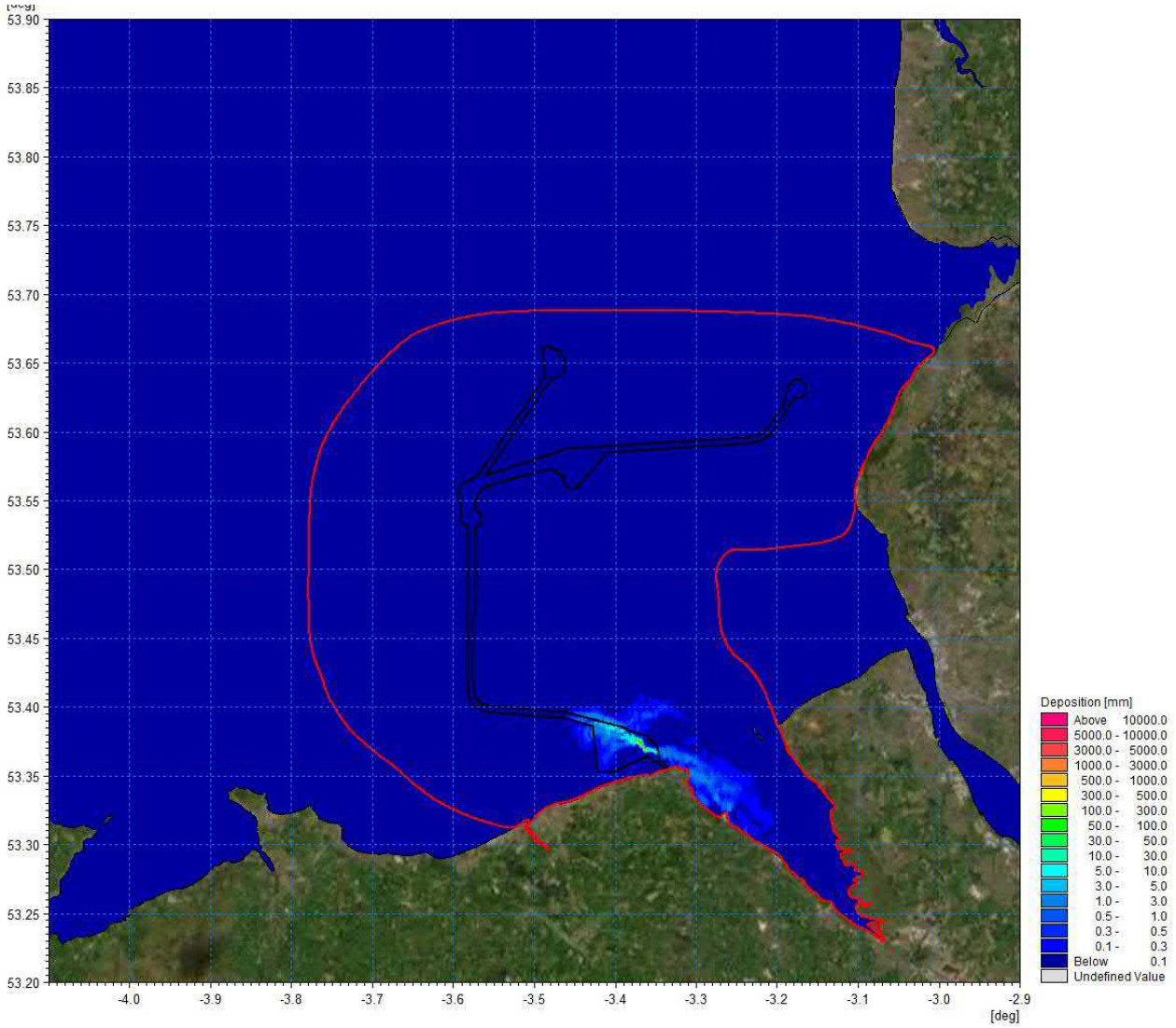


Figure 1.65: Maximum sedimentation over dredging phase – West Hoyle Bank.

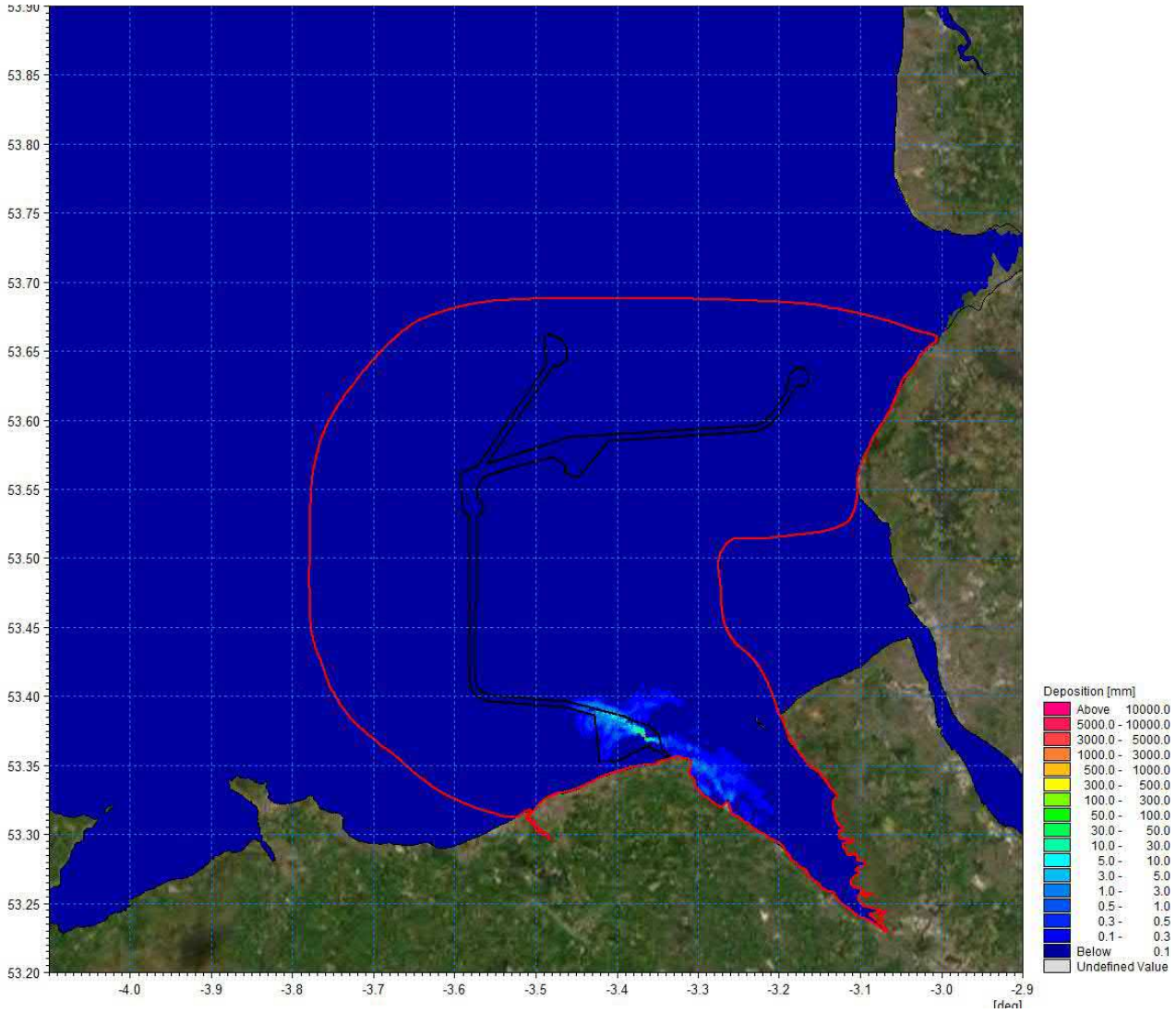


Figure 1.66: Average sedimentation over dredging phase – West Hoyle Bank.

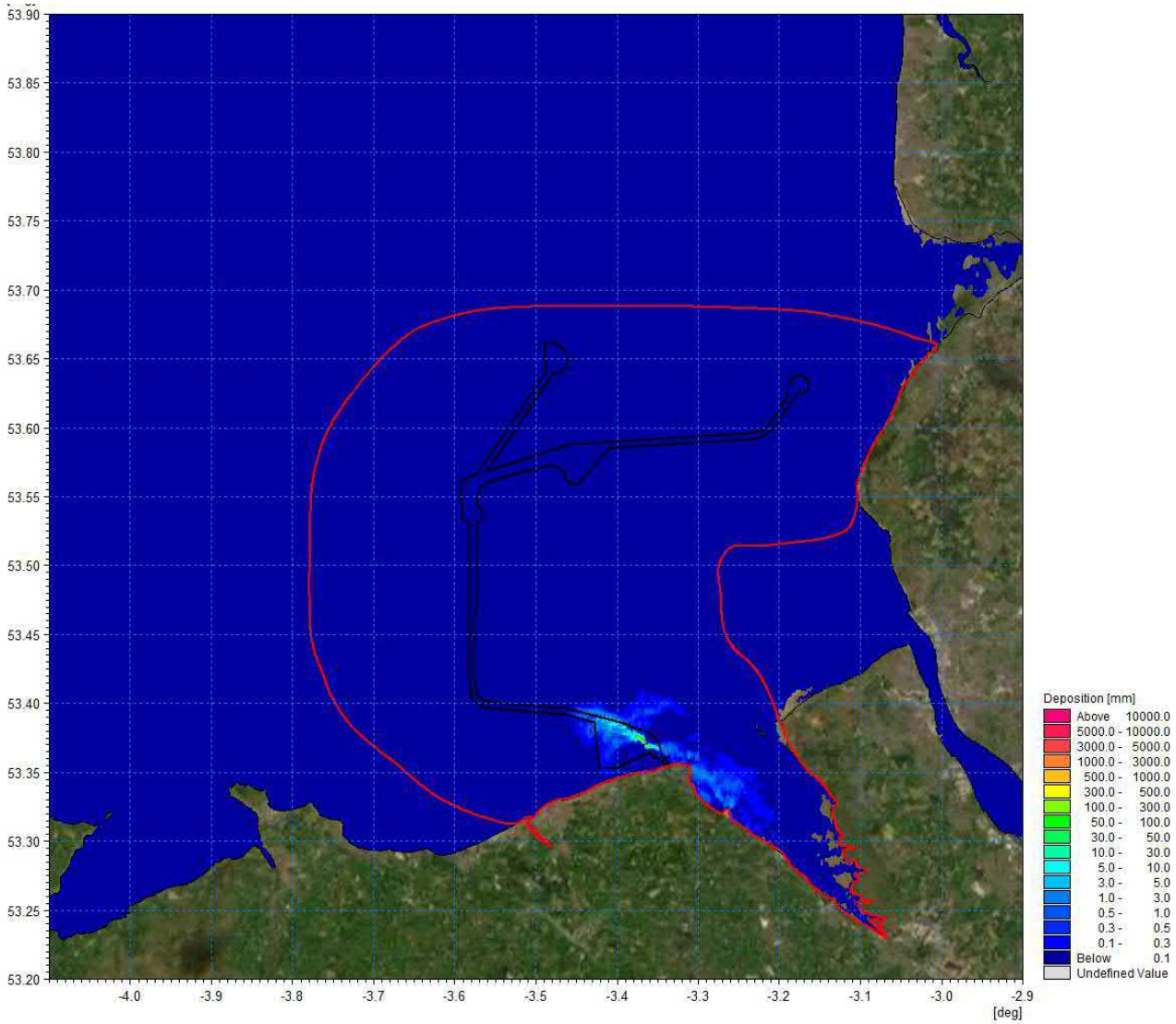


Figure 1.67: Sedimentation one day after cessation of dredging – West Hoyle Bank.

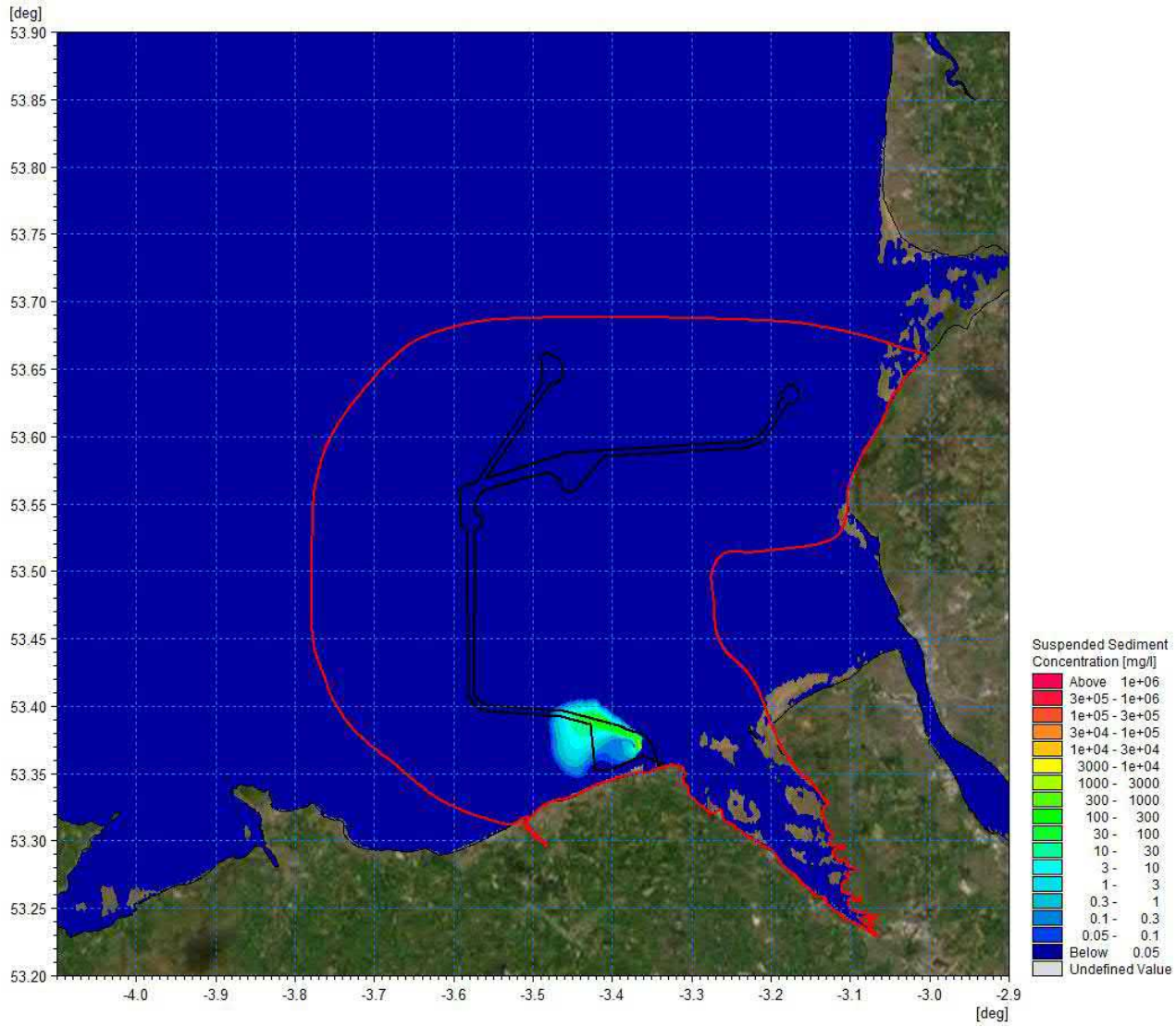


Figure 1.68: Suspended sediment concentration day 1 ebb – West Hoyle Bank.

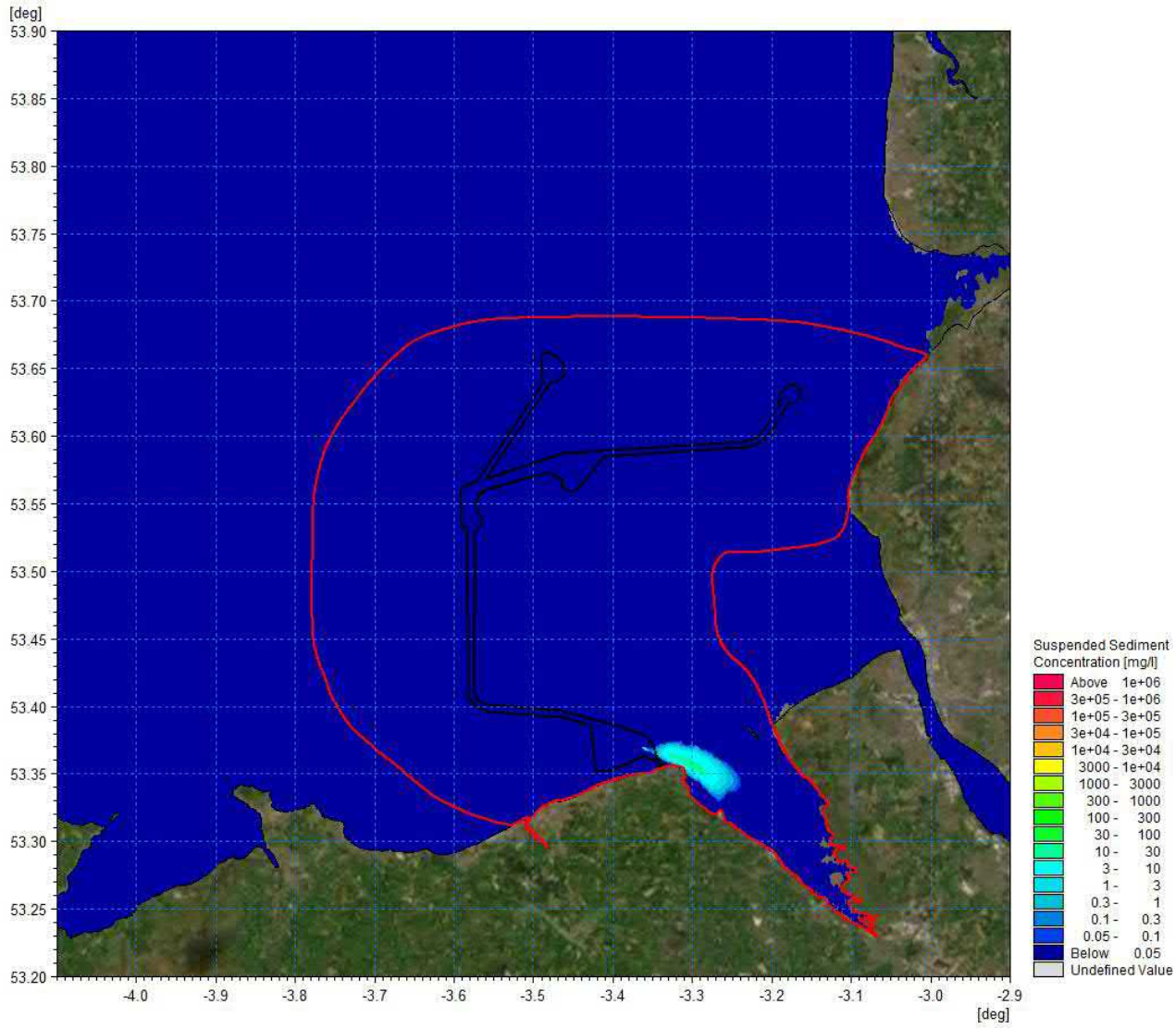


Figure 1.69: Suspended sediment concentration day 1 flood – West Hoyle Bank.

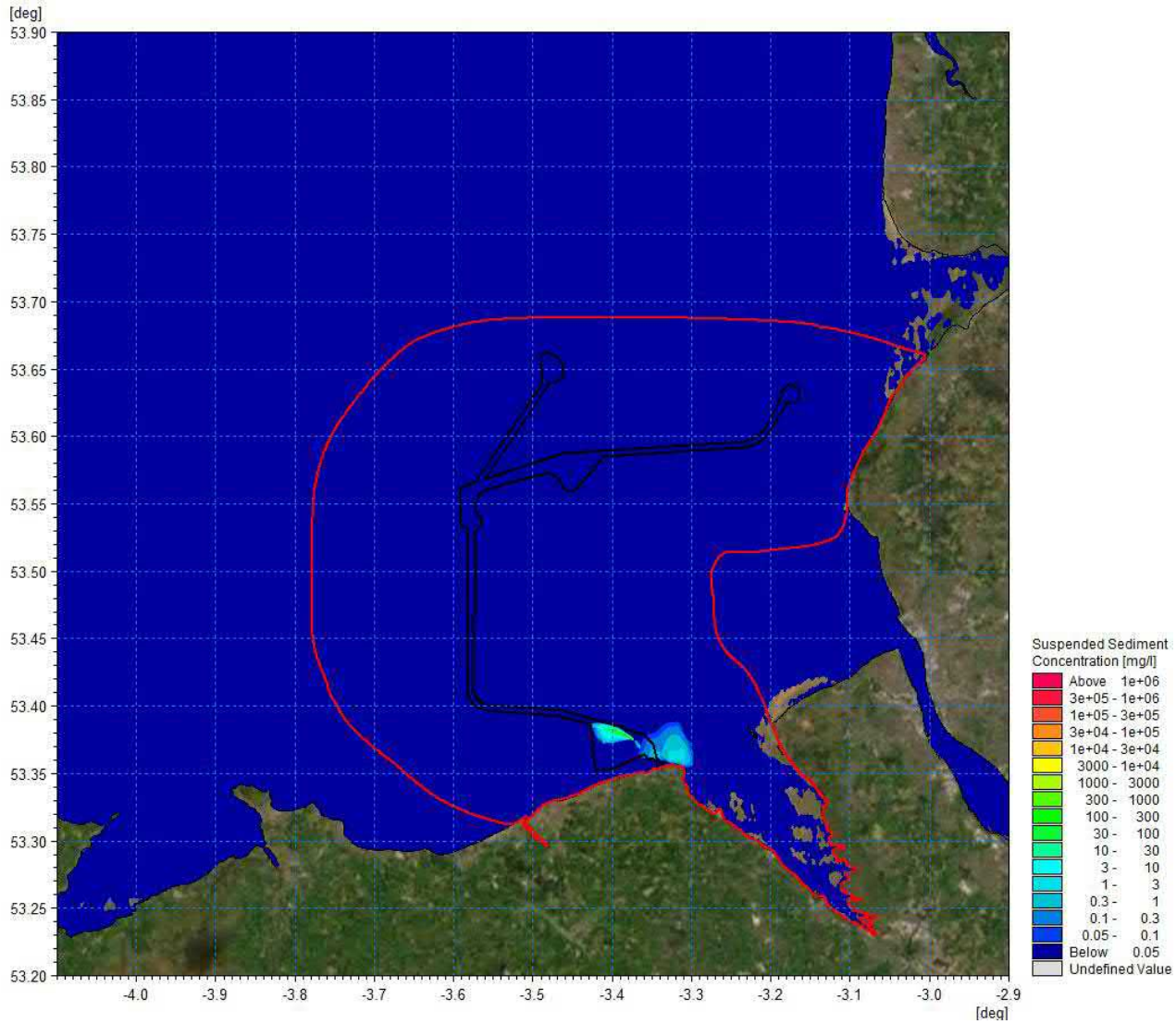


Figure 1.70: Suspended sediment concentration final day ebb – West Hoyle Bank.

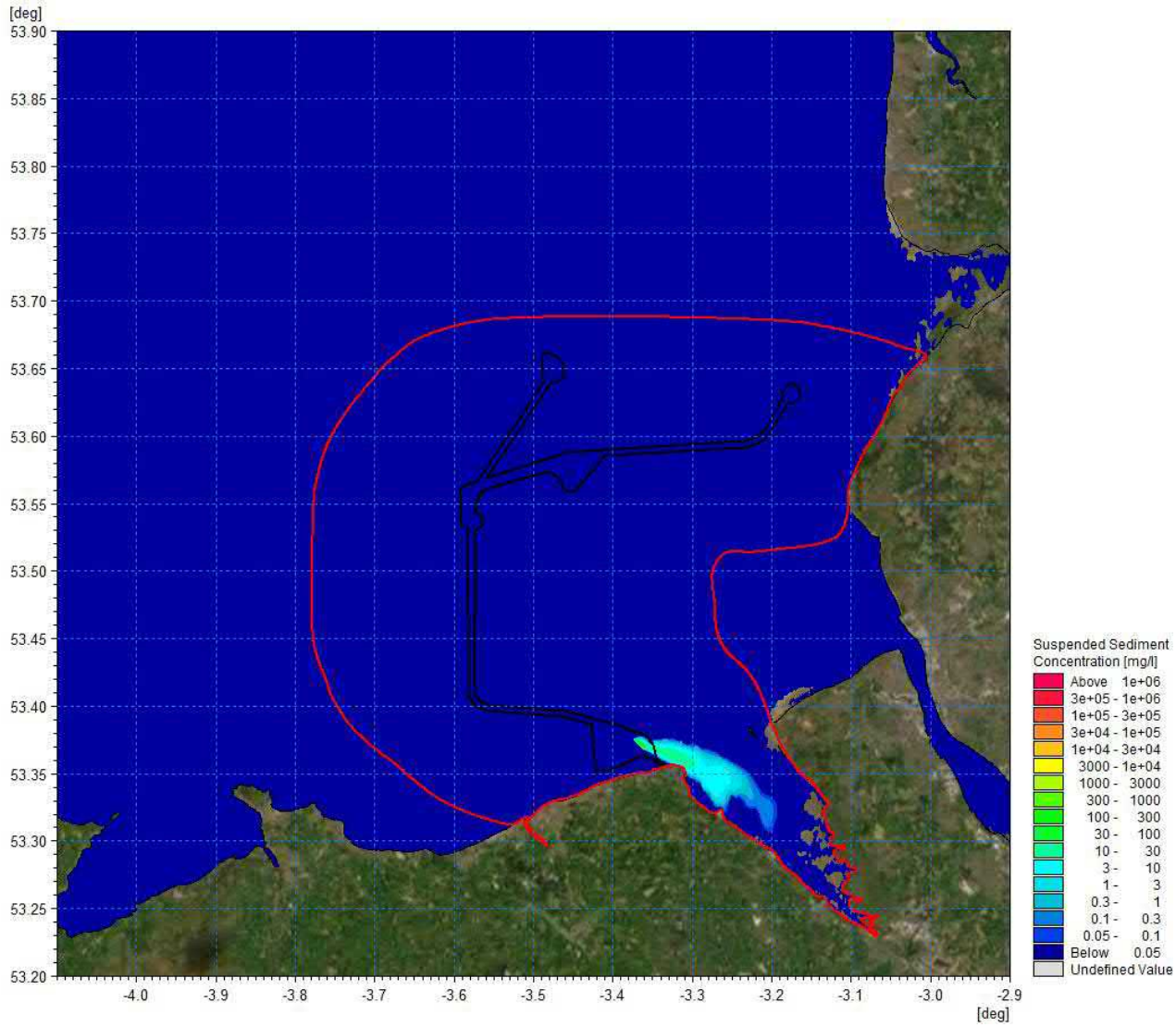


Figure 1.71: Suspended sediment concentration final day flood – West Hoyle Bank.

1.7.2 Drill cuttings

The PDE presented in Volume 1, Chapter 3 Proposed Development Description of the Offshore ES includes for the drilling of two new monitoring wells situated at Hamilton Main and Hamilton North, locations shown in Figure 1.72. Both wells require the drilling of two sections the first of which is a 26" opening in which the 20" conductor will be encased, and a second and deeper 17" section. The first section will involve penetration of the surface sand and silt layer and then the use of seawater and sweeps drilling to penetrate the coarser Mercia Mudstone Group below. The first section will see the clearance of *c.*30.48m of sand and silt and the drilling of c.84.43m of coarser sediment. The second section will be drilled with water-based mud and will also penetrate through the Mercia Mudstone Group which is largely composed of claystone, over a vertical length of *c.*518.16m. Both lengths of the 26" and 17" holes have been modelled with an assumed 100% washout, i.e., twice the volume of the cavity is released as cuttings. The rate of drilling for both wells was 40m/h with the individual operations taking approximately 16 hours each. Given both wells are positioned offshore and involve releases at a number of locations in the water column the PT module was implemented.

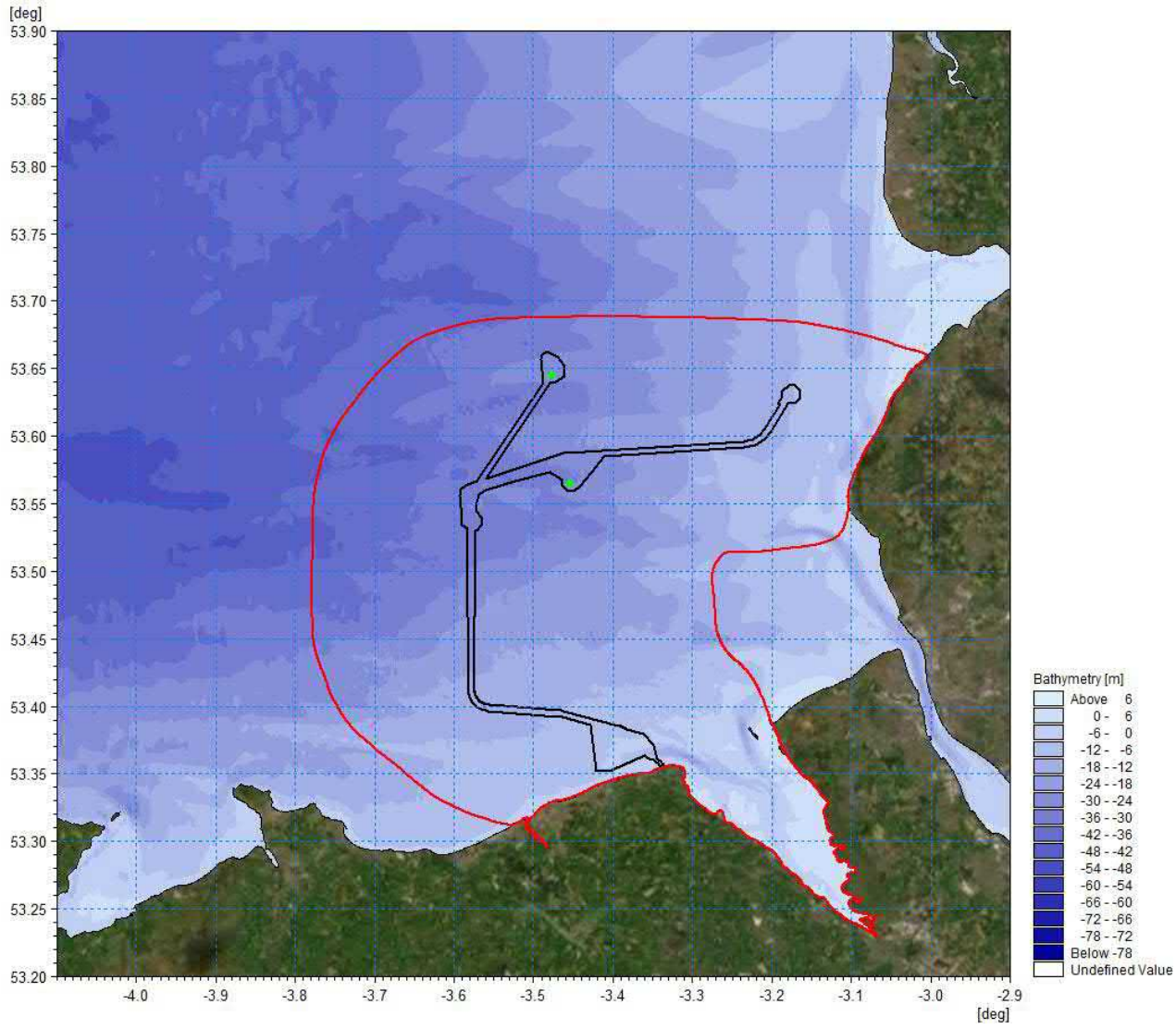


Figure 1.72: Modelled Drilling locations

1.7.2.1 Hamilton Main

The sediment composition at the Hamilton Main location is comprised of mixed sediments with a sediment grading as follows implemented in the simulation:

- Gravel: 7.7%
- Coarse sand: 29.3%
- Medium sand: 31.5%
- Fine sand: 17.5%
- Very fine sand/mud: 14.0%.

The maximum suspended sediment concentrations (SSC) and average SSC plots are shown in Figure 1.73 and Figure 1.74 respectively. Maximum concentrations across the plume can rise in excess of 300mg/l to a peak of *c*.360mg/l, however maximum concentrations are generally are limited to <20mg/l. The extents of the plume reach *c*.8km to the east and west following the tidal ellipse, with concentrations within background level range (as described in Section 1.6.7) along its extremities. The average concentrations are typically <30mg/l at the drill site and reduce rapidly with distance from the discharge location.

Figure 1.75 and Figure 1.76 showing maximum and average sedimentation during the drilling phase demonstrate that sediment is retained within the sediment cell and settles along the length of the tidal ellipse. It is evident that the greatest sedimentation depths occur at the drilling site itself with localised values of up to *c*.70mm occurring within *c*.50m of the site. Average deposition across the area can be up to *c*.30mm at the drill site but is generally less than a tenth of a millimetre across the tidal ellipse. Analysis of sedimentation 1 day after cessation of drilling activities, as displayed in Figure 1.77, shows the sediment can stay suspended for a considerable time before it finally settles; this would relate to the fine drilling mud fraction. As seen in the figure, around the drill site deposition values can be in excess of 50mm however a vast majority of deposition due to released sediment is under 0.03mm. This is explained by the coarser material remaining at the drill site whilst the finer mud particles are dispersed with residual currents.

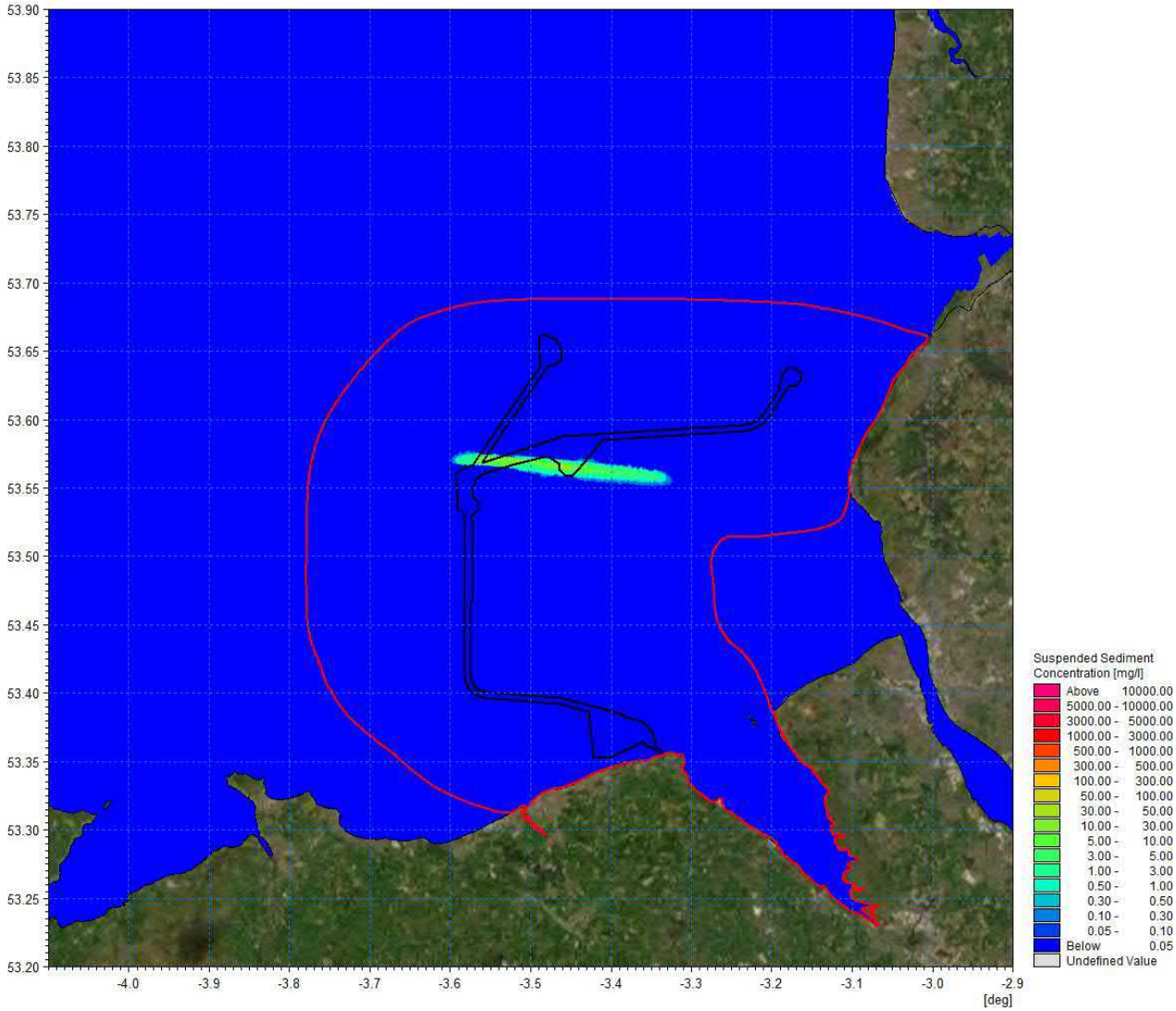


Figure 1.73: Maximum suspended sediment concentration over drilling phase - Hamilton Main.

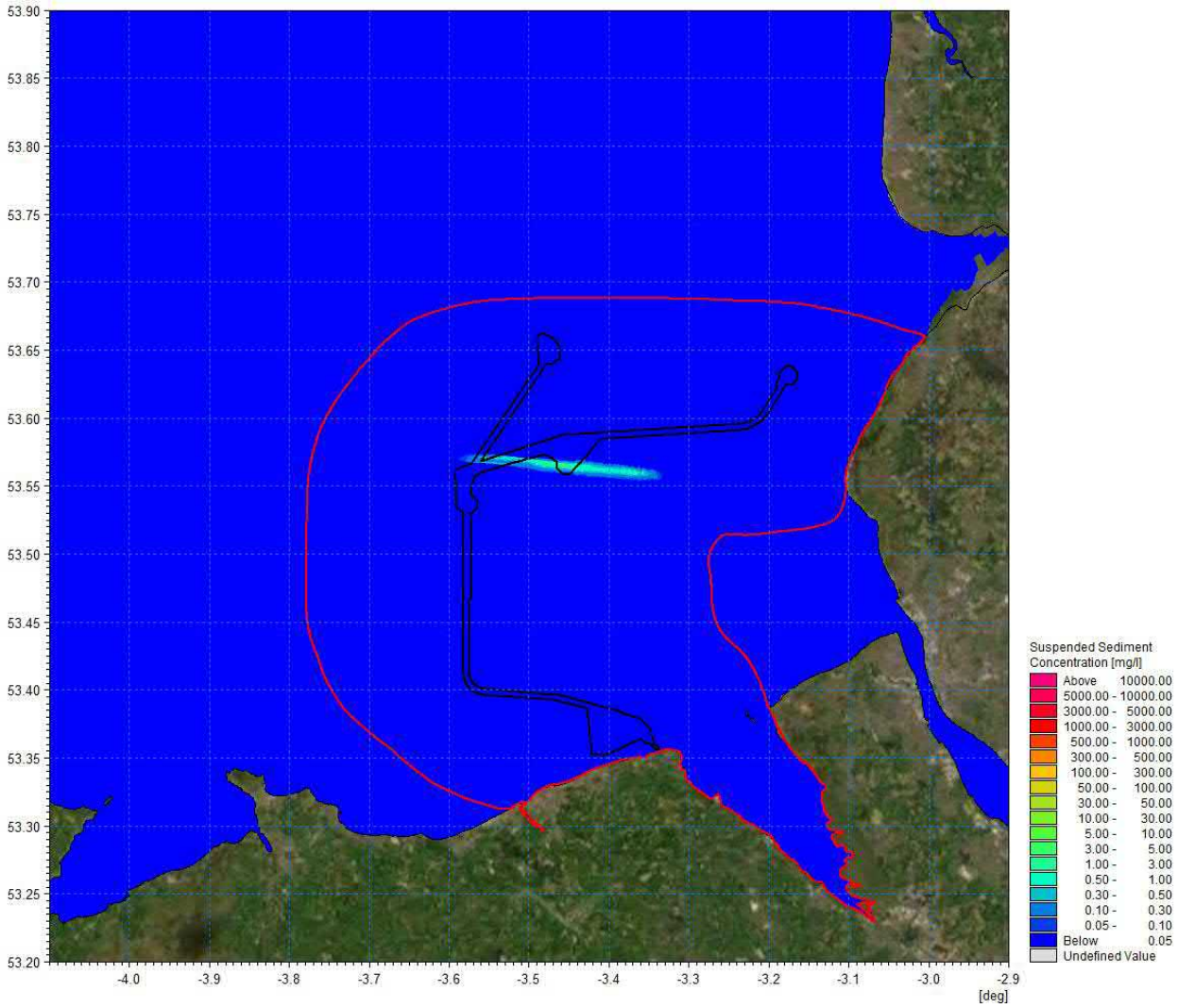


Figure 1.74: Average suspended sediment concentration over drilling phase - Hamilton Main.

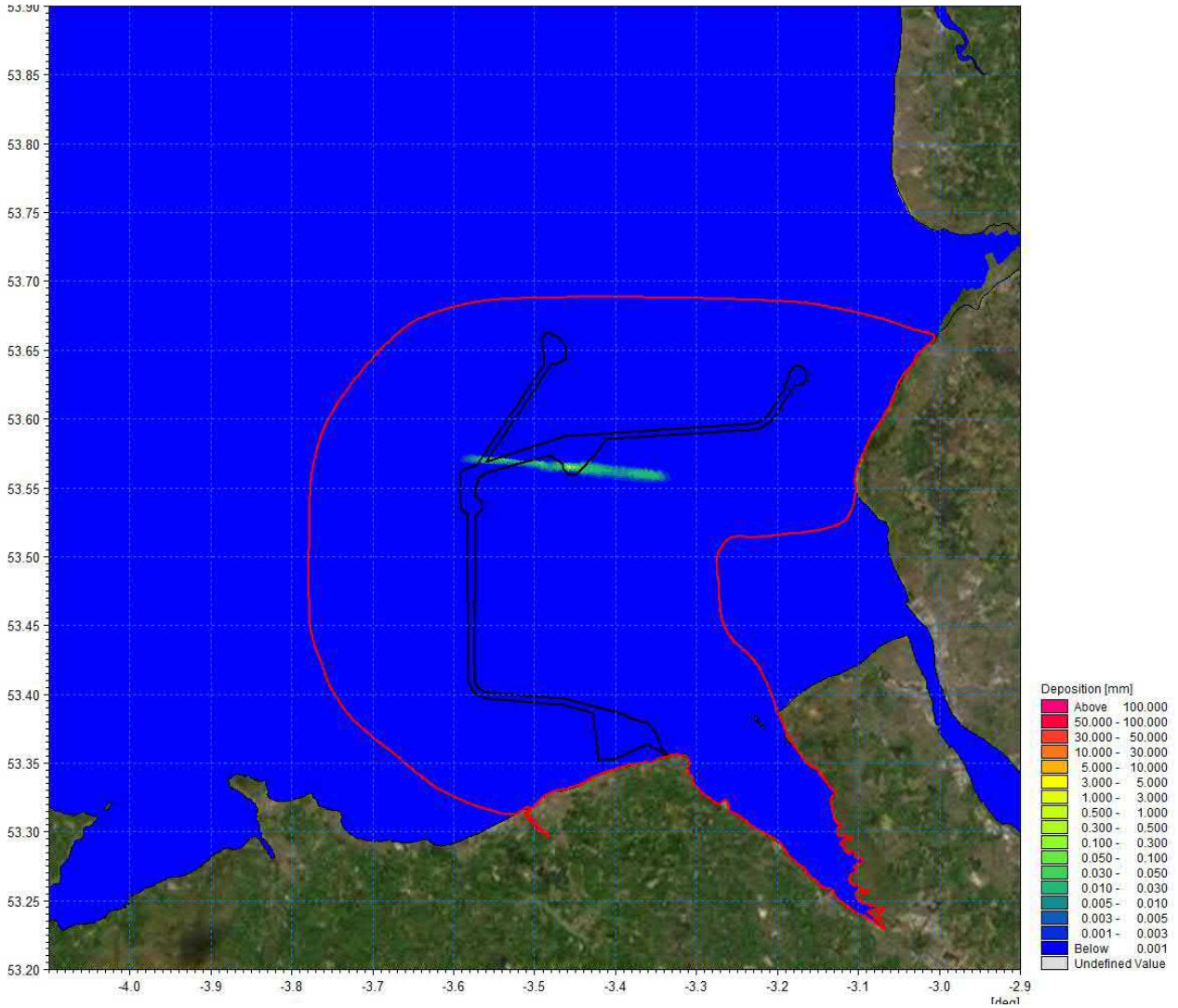


Figure 1.75: Maximum sedimentation over drilling phase - Hamilton Main.

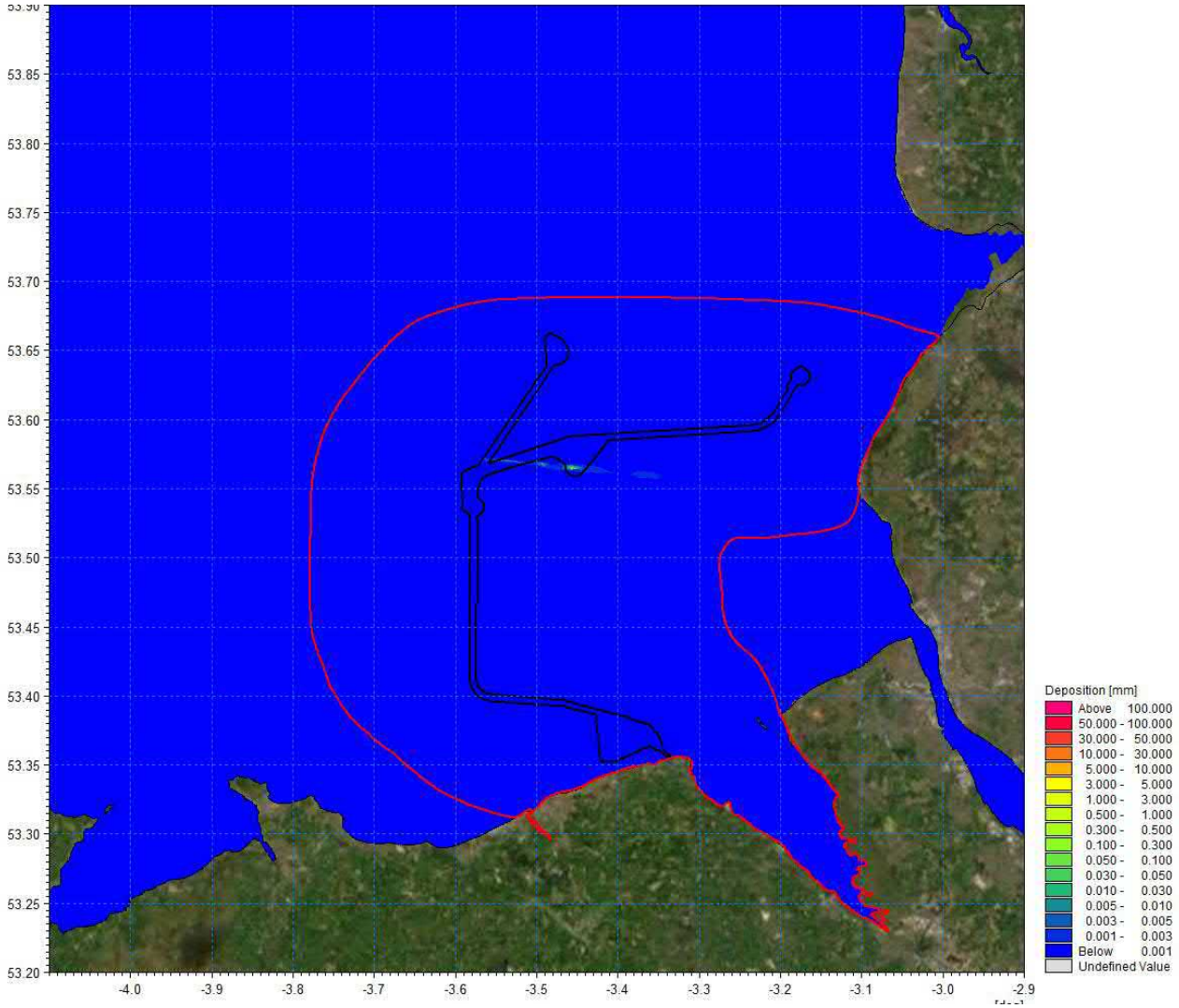


Figure 1.76: Average sedimentation over drilling phase - Hamilton Main.

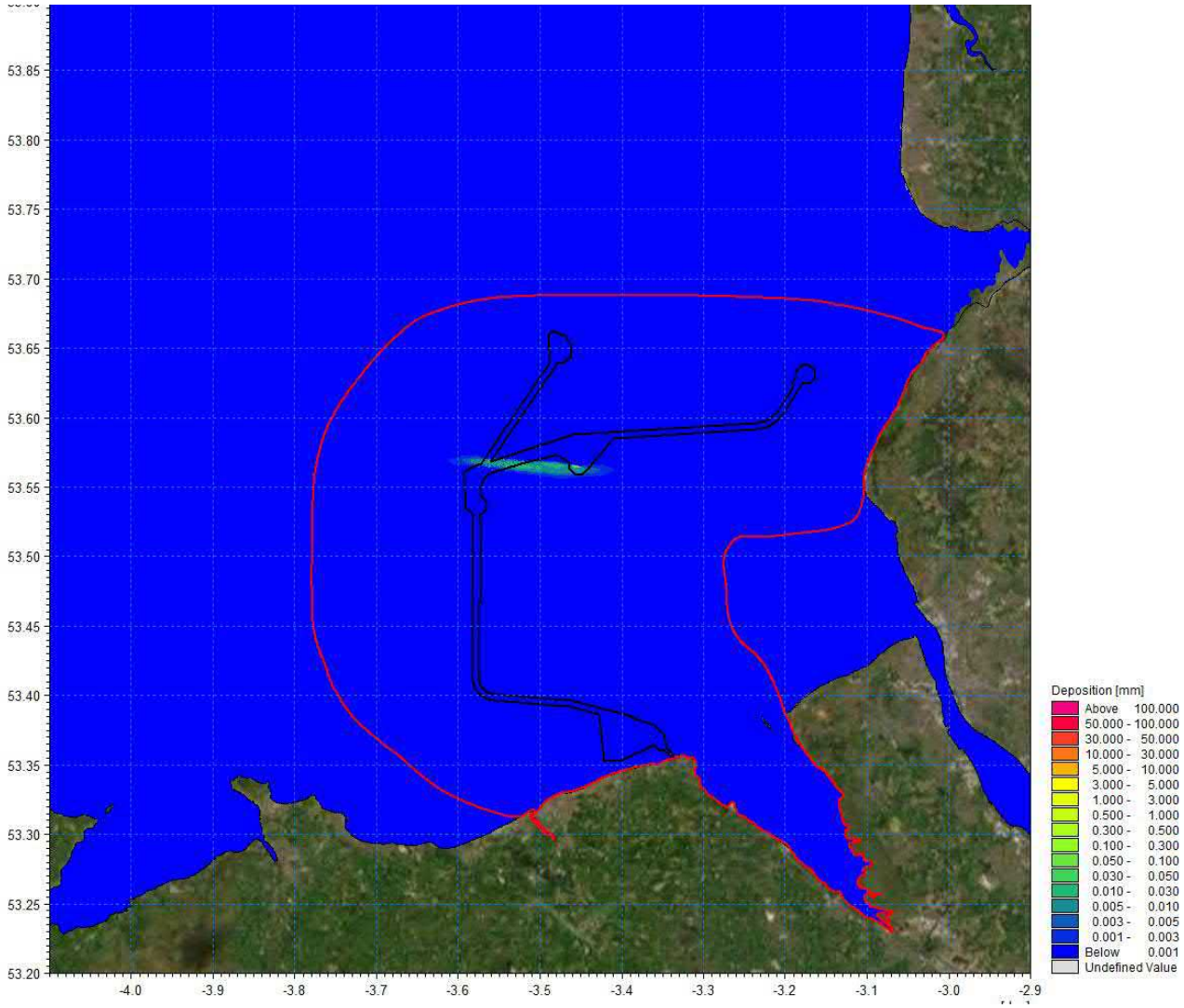


Figure 1.77: Sedimentation one day after cessation of drilling - Hamilton Main.

1.7.2.2 Hamilton North

The sediment composition at the Hamilton North location is comprised of predominantly sandy sediment with a sediment grading as follows which was implemented in the simulation:

- Gravel: 0.2%
- Coarse sand: 20.3%
- Medium sand: 59.7%
- Fine sand: 17.7%
- Very fine sand/mud: 2.1%.

Suspended sediment plumes are presented for Hamilton North in Figure 1.78 and Figure 1.79. SSC concentrations remain similar to those of Hamilton Main, with a similar sized maximum plume *c*.8km east and west, with slightly more dispersion north and south (*c*.2km from the drill site). Maximum suspended sediment concentrations are limited to 500mg/l in the direct vicinity of the drill site and are generally less than 5mg/l across the rest of the plume envelope. Mean concentrations around the drill site are <30mg/l and further from the source <0.3mg/l.

Maximum and mean sedimentation during the drilling phase is presented in Figure 1.80 and Figure 1.81. As with Hamilton Main the coarse sediment released directly at the seafloor during drilling remains by the drill site, with maximum deposition values of *c*.100mm within c.50m of the site. Mean sedimentation across the drill site is for the most part contained in a *c.*500m radius from the drill site and is limited to <0.1mm. Again, upon examining sedimentation a day after cessation of drilling activities, as shown in Figure 1.82, it is clear that much of the fine drilling mud remains suspended for a more prolonged period. The figure clearly shows how sediment is deposited along the tidal ellipse, with coarser sediment falling at the drill site and drilling muds dispersed to settle further from the source.

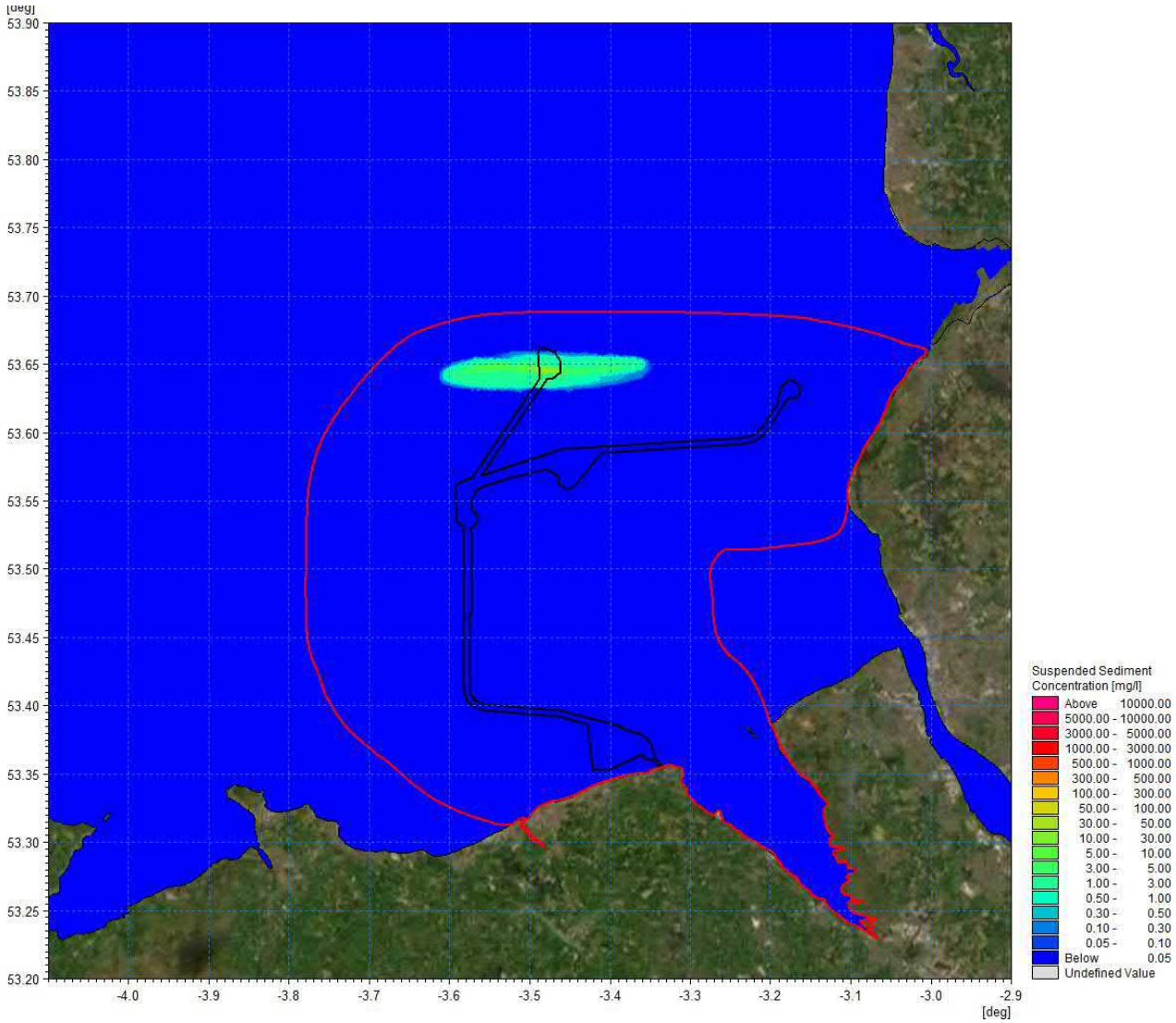


Figure 1.78: Maximum suspended sediment concentration over drilling phase - Hamilton North.

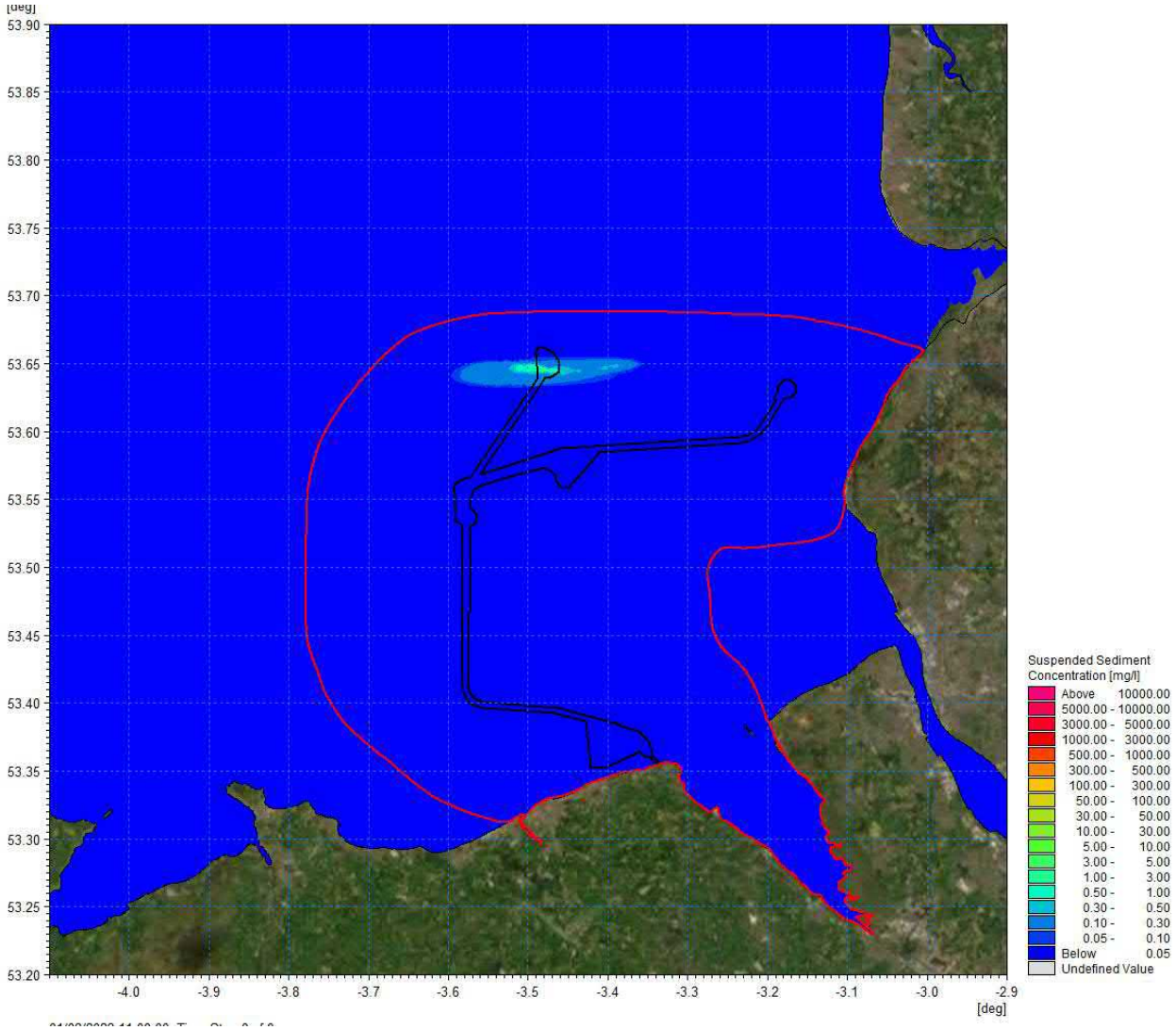


Figure 1.79: Average suspended sediment concentration over drilling phase - Hamilton North.

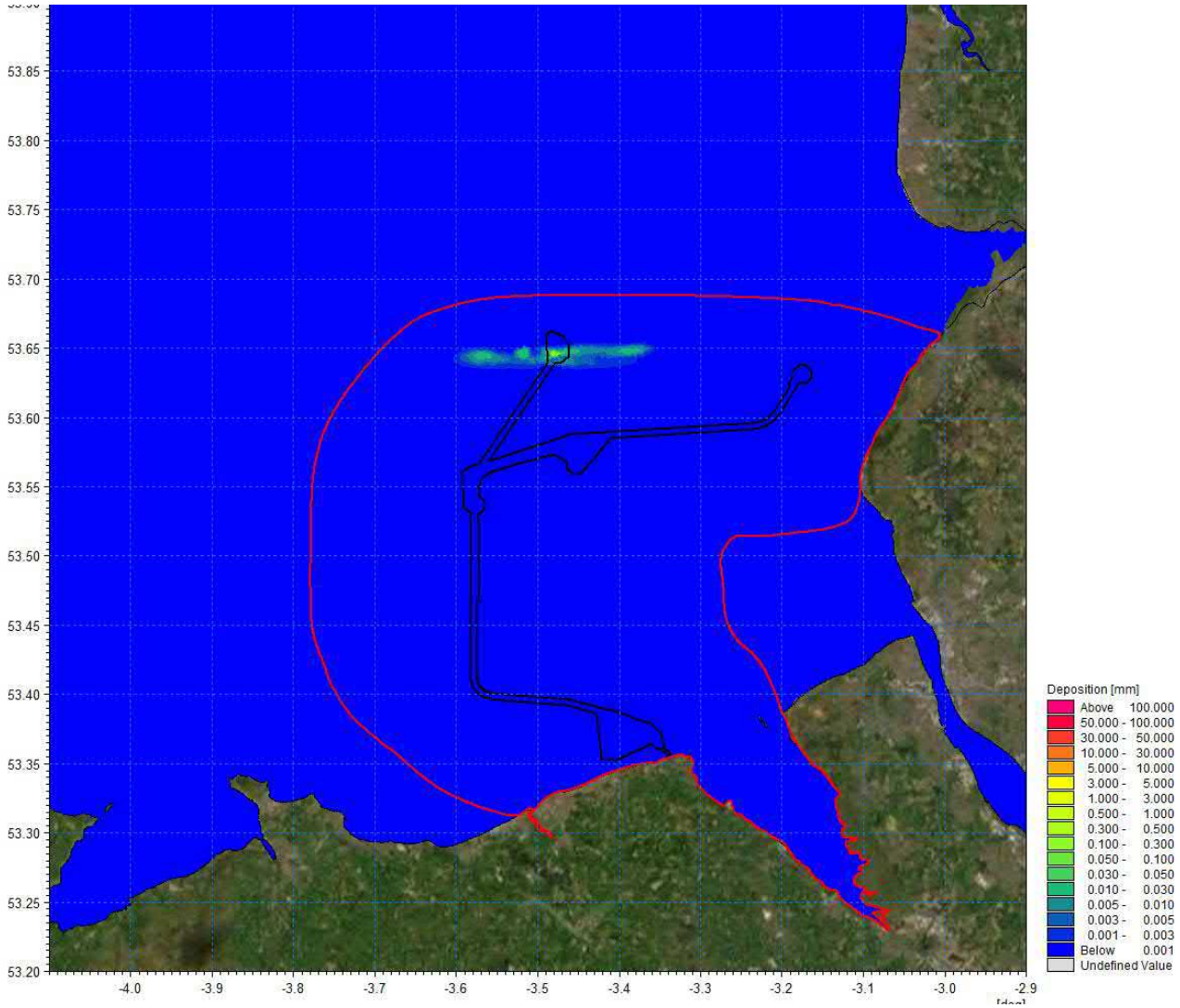


Figure 1.80: Maximum sedimentation over drilling phase - Hamilton North.

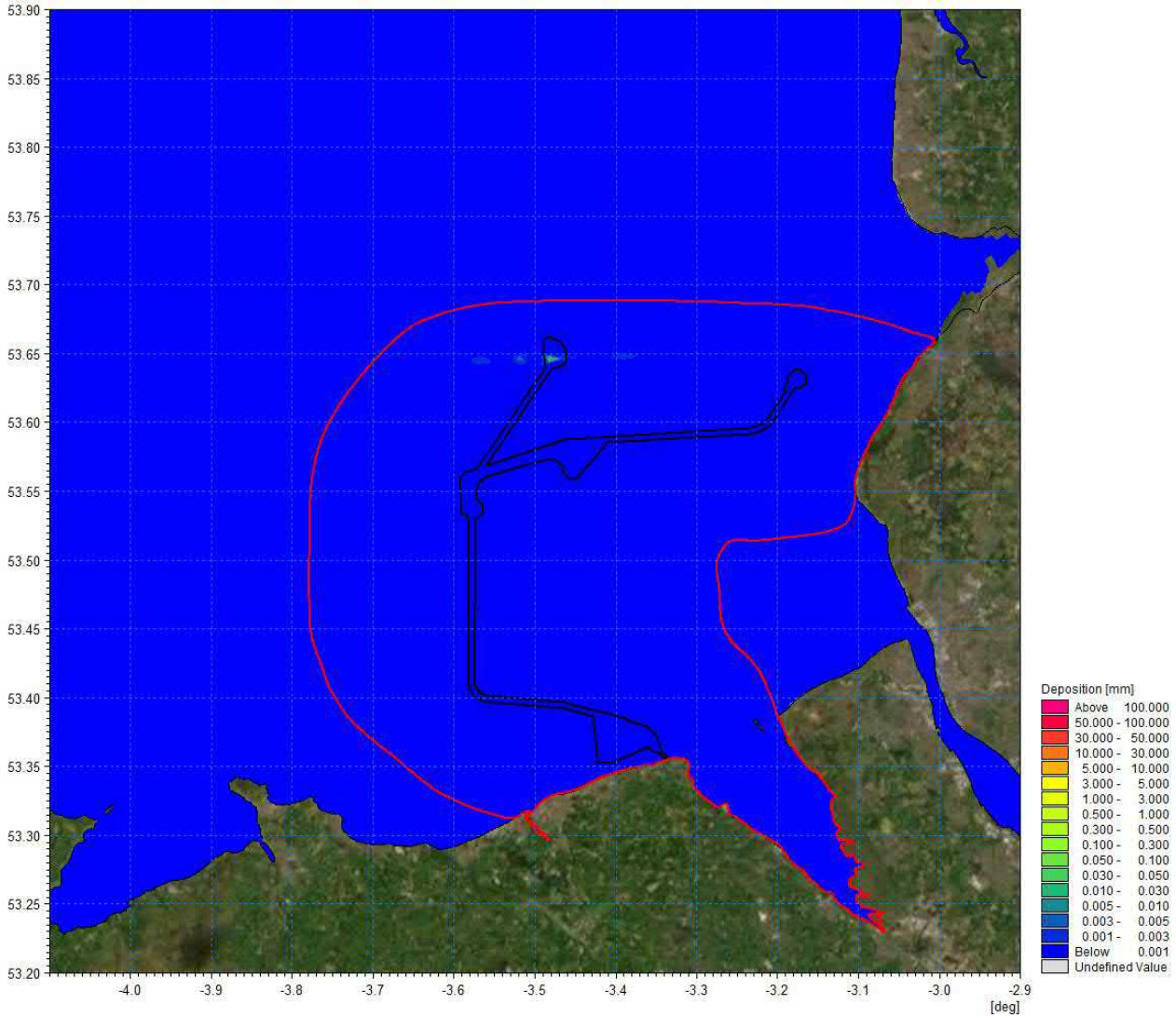


Figure 1.81: Average sedimentation over drilling phase - Hamilton North.

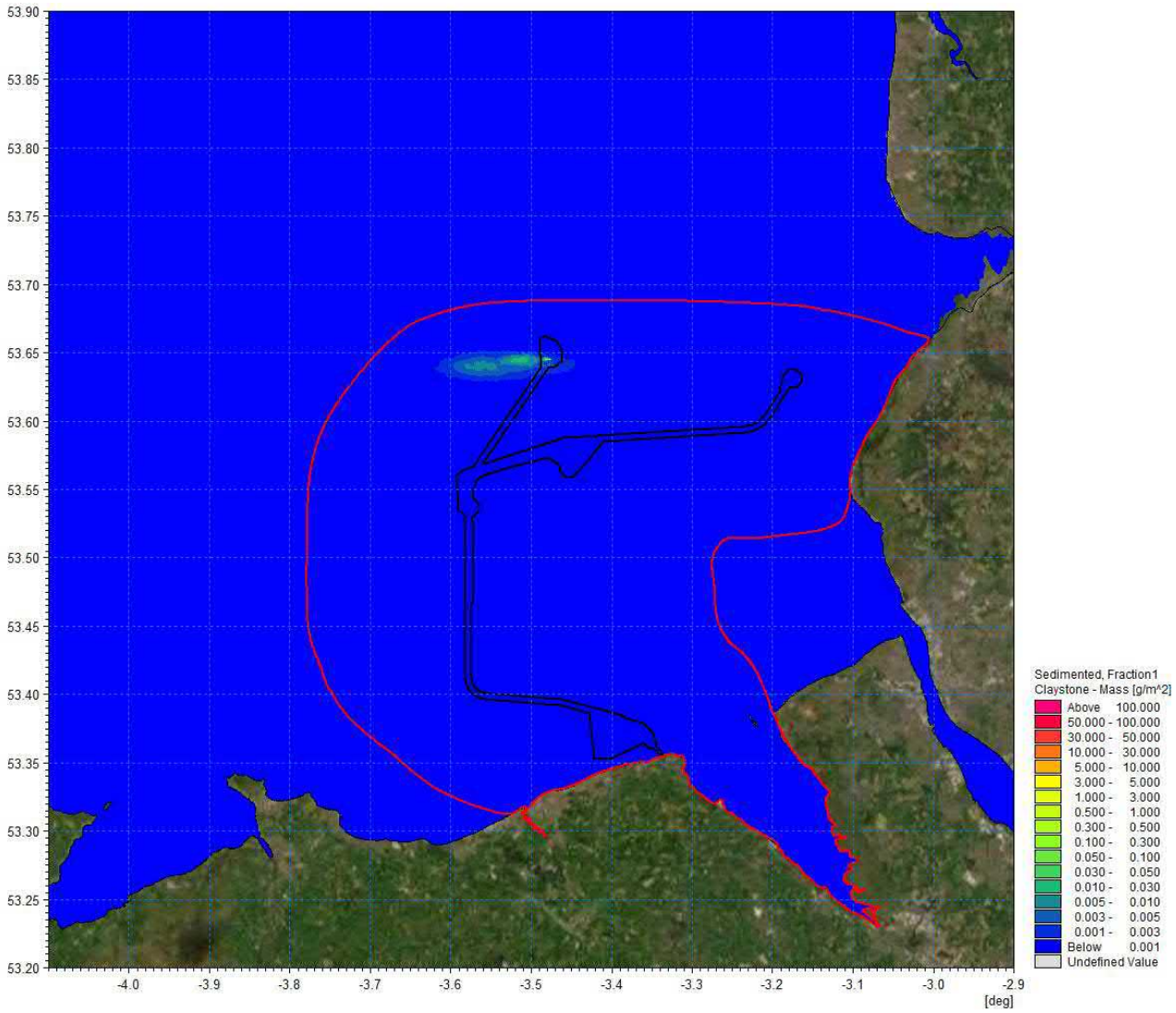


Figure 1.82: Sedimentation one day after cessation of drilling - Hamilton North.

1.7.3 Cable installation

The third aspect of the construction phase is cable installation between OPs and the onshore terminal Point of Ayr (POA). For the maximum design scenario in terms of release of sediment into the water column, cables were assumed to be trenched. A number of trenching techniques may be suited to the ground conditions; however, it was assumed within the modelling that a trench of material of the maximum depth presented in the Proposed Development description outlined in Volume 1, Chapter 3: Proposed Development Description of the ES was mobilised into the lower water column as a result of the burial process, in line with the Business Enterprise and Regulatory Reform (BERR) guidelines (BERR, 2008). In reality the installation technique implemented may result in less sediment being mobilised and the maximum depth may not always be achieved with a corresponding reduction in the amount of material disturbed.

Similar to the sandwave clearance and drill cuttings, the model simulations used the sediment grading determined from the site-specific grab sample sediment data. The same approach used for seabed preparation was again utilised for cable installation, with both the MT and PT modules used. Two representative sample routes were modelled. The MT module was used for modelling of the nearshore cabling from the POA to Douglas OP, whereas further offshore to characterise cabling from Douglas OP to Lennox, the PT module was used.

Trenching rates can vary widely depending on the bed material and equipment used; typically, rates are between 25m/h and 780m/h. For the simulation, a relatively high rate of 450m/h was used over an extensive sample route ensuring that material was released at all tidal states over a number of tides and ensuring initial concentrations were not underestimated.

1.7.3.1 POA to Douglas

The POA to Douglas cable trenching route was examined using numerical modelling. Two cables will be trenched along the same route therefore one cable installation operation was simulated over the range of conditions and is reflective of the outcome of each of the installations. The simulation assumed a trenching rate of 450m/h, and that installation began from onshore and continued offshore. Each trench was 3m at the surface extending to a depth of 3m (i.e., the greatest burial depth proposed), with a triangular profile. The operation took approximately 3 days to complete, encompassing a range of tidal conditions. Figure 1.83 shows the modelled route from POA to Douglas, running from the onshore terminal to the offshore platform in open sea. The sediment grading characteristics along the route were derived from the PSA grab sample locations, with the grading interpolated along the route between data points.

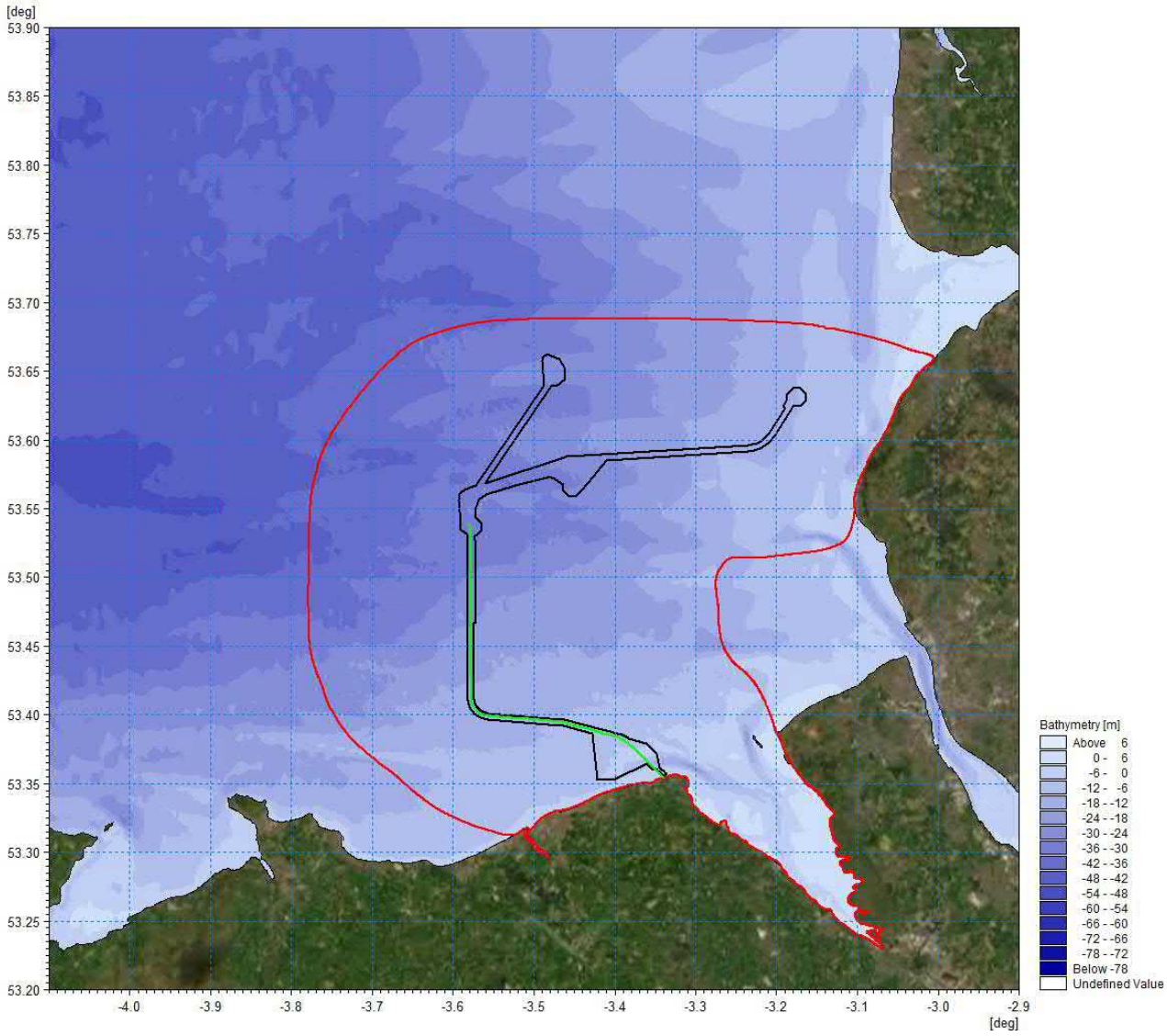


Figure 1.83: Modelled POA to Douglas trenching route.

The model results presented follow the same format as those for the seabed preparation and drill cuttings described in the previous sections. Figure 1.94 shows the maximum suspended sediment concentration over

the course of the trenching phase, plume may extent up to 15km to the west, exiting the physical processes study area by *c*.1km. However, they do so at background levels i.e. <1mg/l. It is clear that the sediment is dispersed on subsequent tides as the plume envelope illustrates the flood and ebb tidal excursions as trenching progresses offshore. Localised maximum suspended sediment concentrations are seen along the cable route south of the Douglas OP are generally <10,000mg/l. However, SSC increases rapidly over the very shallow drying area of West Hoyle Bank which, with maximum values in excess of 300,000mg/l, peaking at *c*.640,000mg/l. Average suspended sediments, as shown in Figure 1.85, follow a similar pattern, with concentrations along the route having mean values of <1,000mg/l, the largest of which occur over West Hoyle Bank where water depth is very limited.

As was evident in the previous operations, the material settles during slack water and then is re-suspended to form a secondary plume which becomes amalgamated. This is further illustrated in Figure 1.94 and Figure 1.96, showing maximum sedimentation and sedimentation one day after cessation of trenching activities at slack water. Maximum sedimentation occurs within *c*.30m of the cable route and is limited to <300mm with peak deposition of *c*.175mm. Average sedimentation, as is shown in Figure 1.95, is greatest at the location of the trenching and may be up to c.160mm in depth where the coarser material has settled within close proximity.

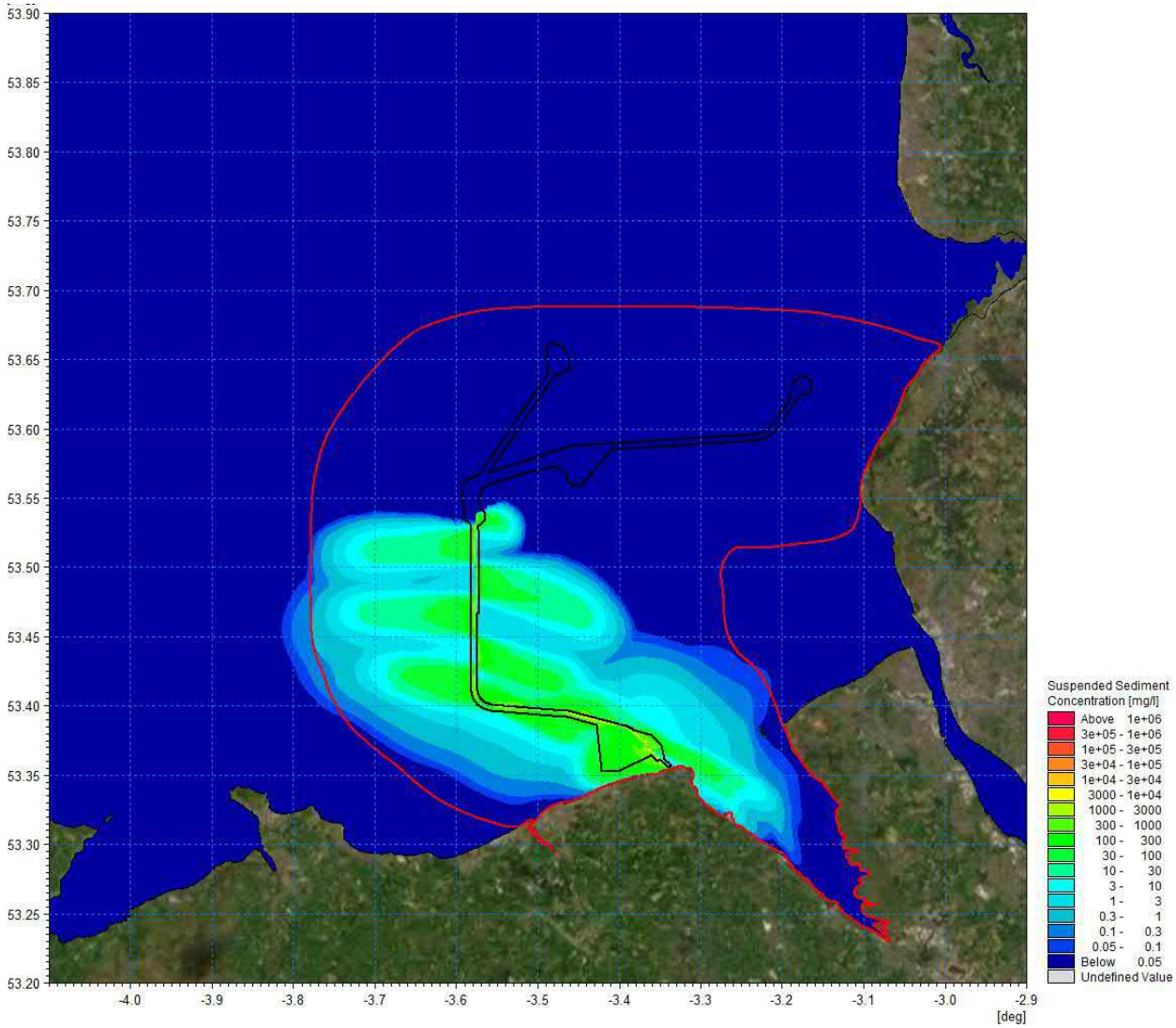


Figure 1.84: Maximum suspended sediment concentration over trenching phase - POA to Douglas.

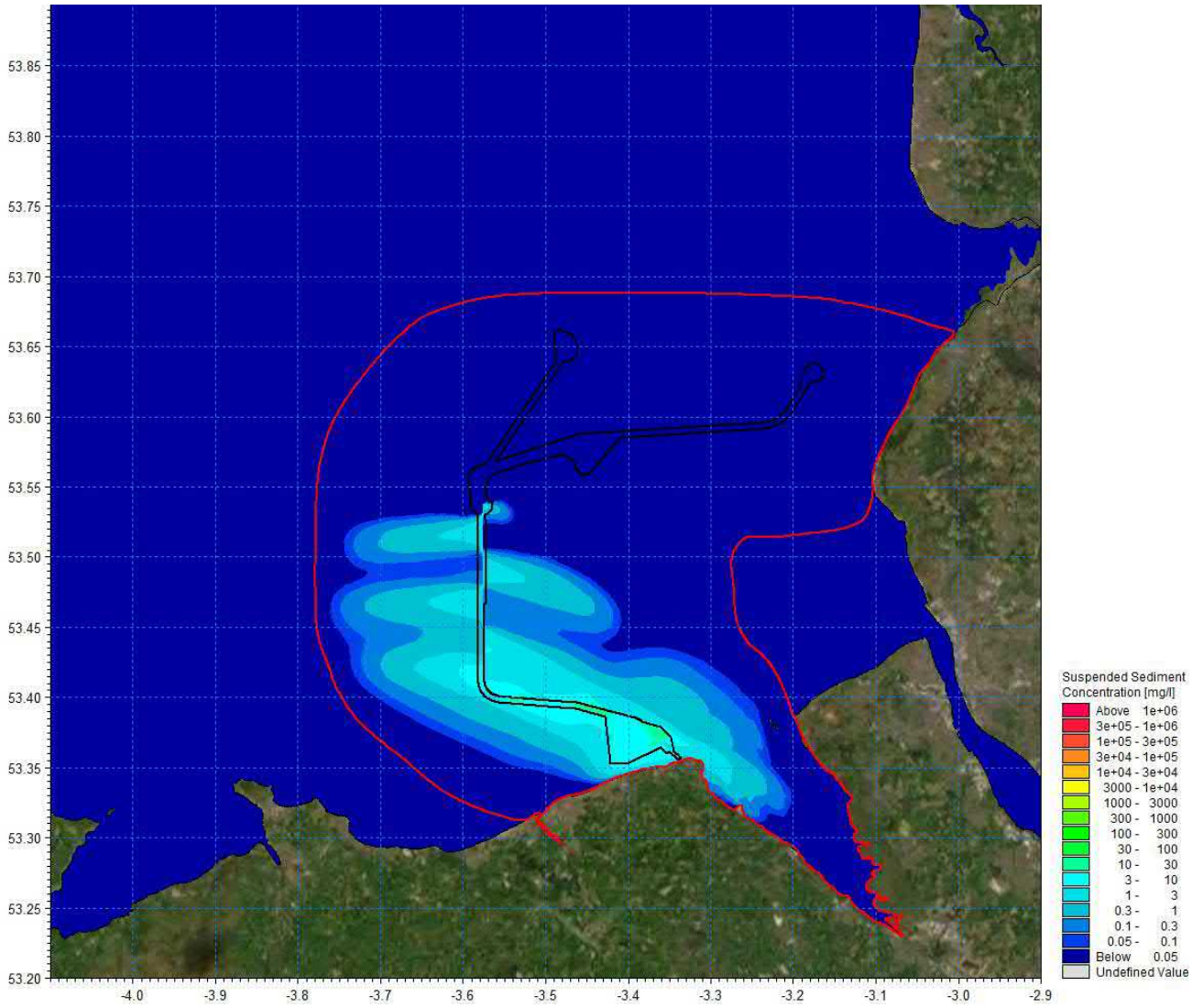


Figure 1.85: Average suspended sediment concentration over trenching phase - POA to Douglas.

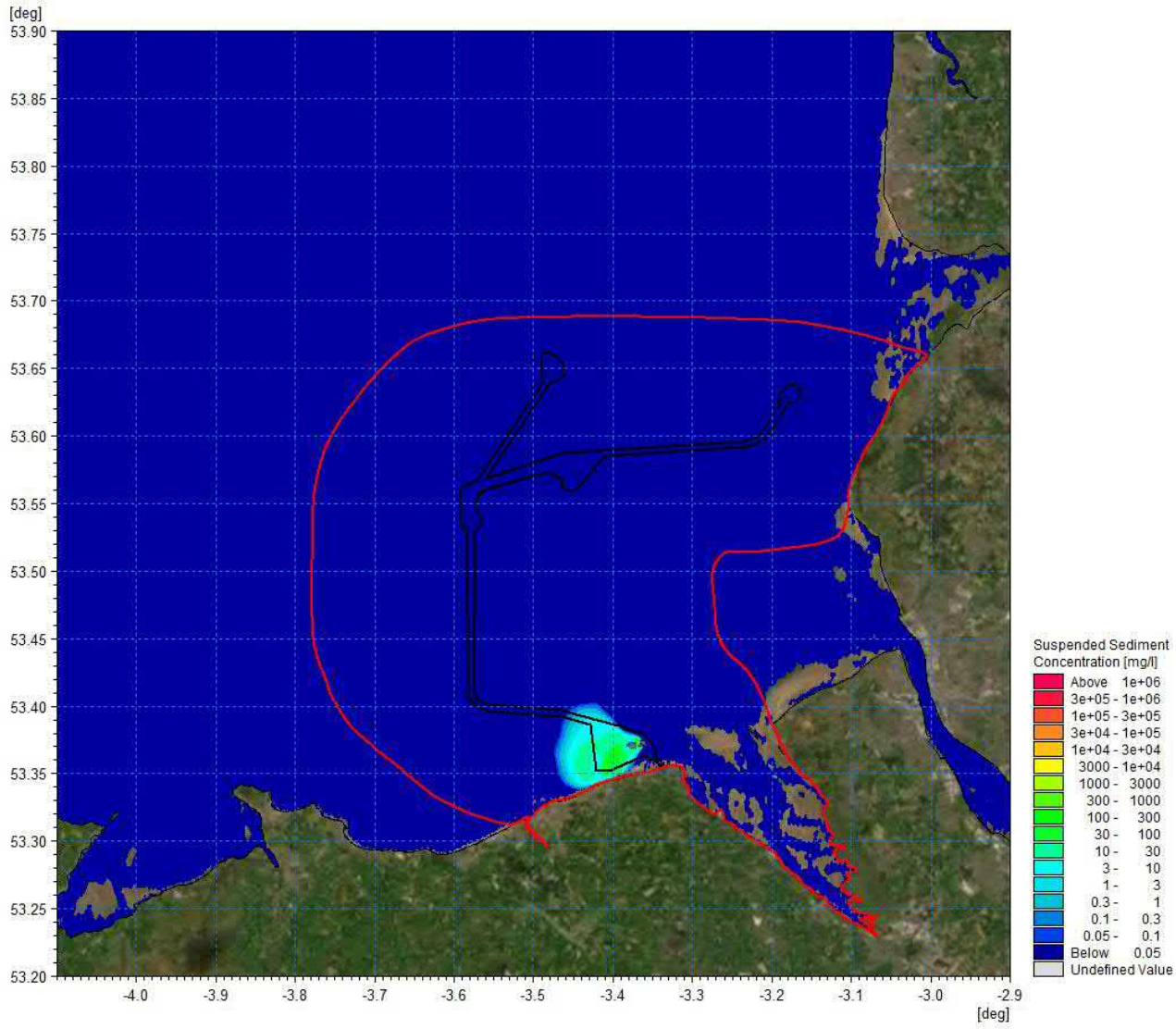


Figure 1.86: Suspended sediment concentration day 1 ebb - POA to Douglas.

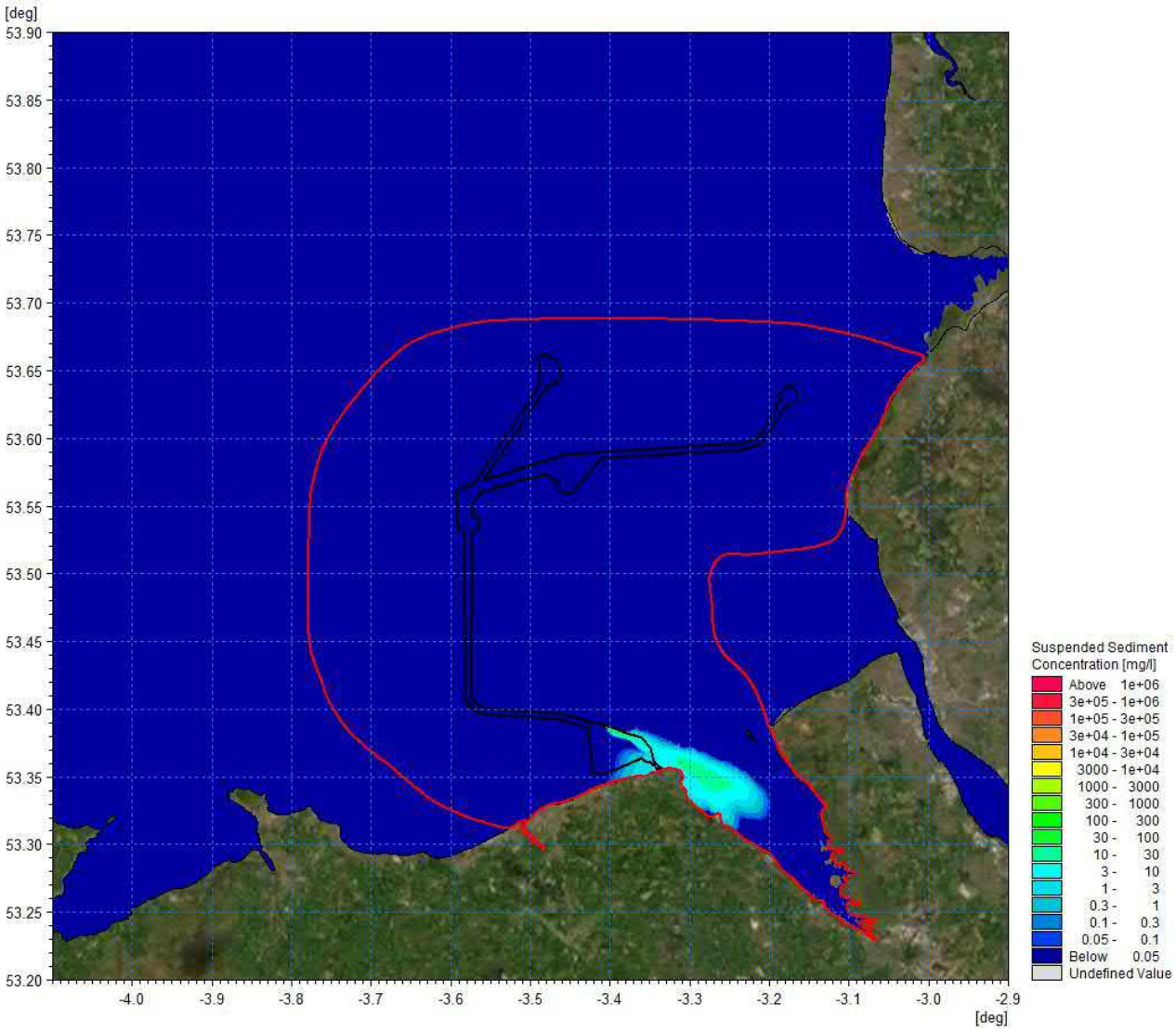


Figure 1.87: Suspended sediment concentration day 1 flood - POA to Douglas.

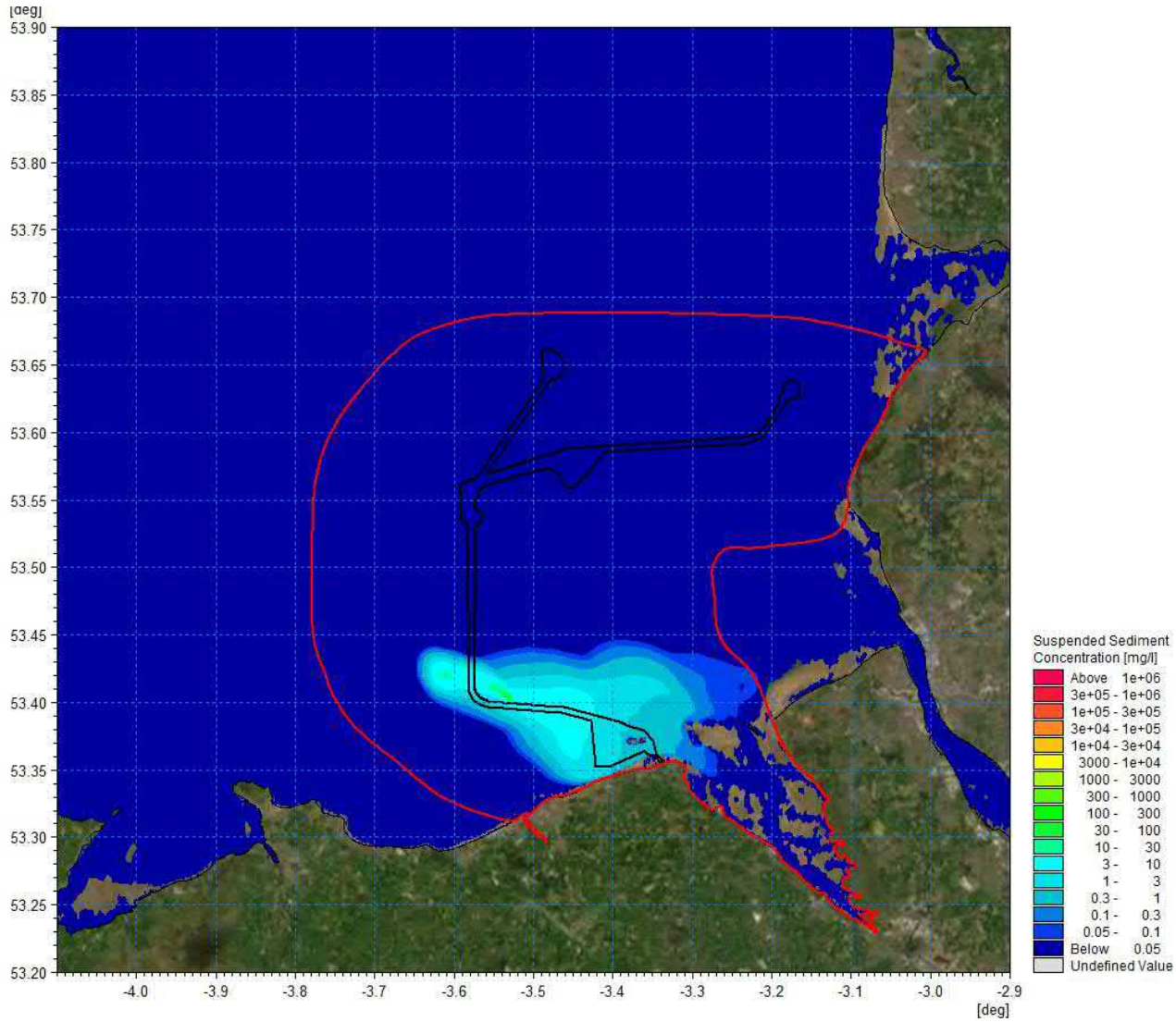


Figure 1.88: Suspended sediment concentration day 2 ebb - POA to Douglas.

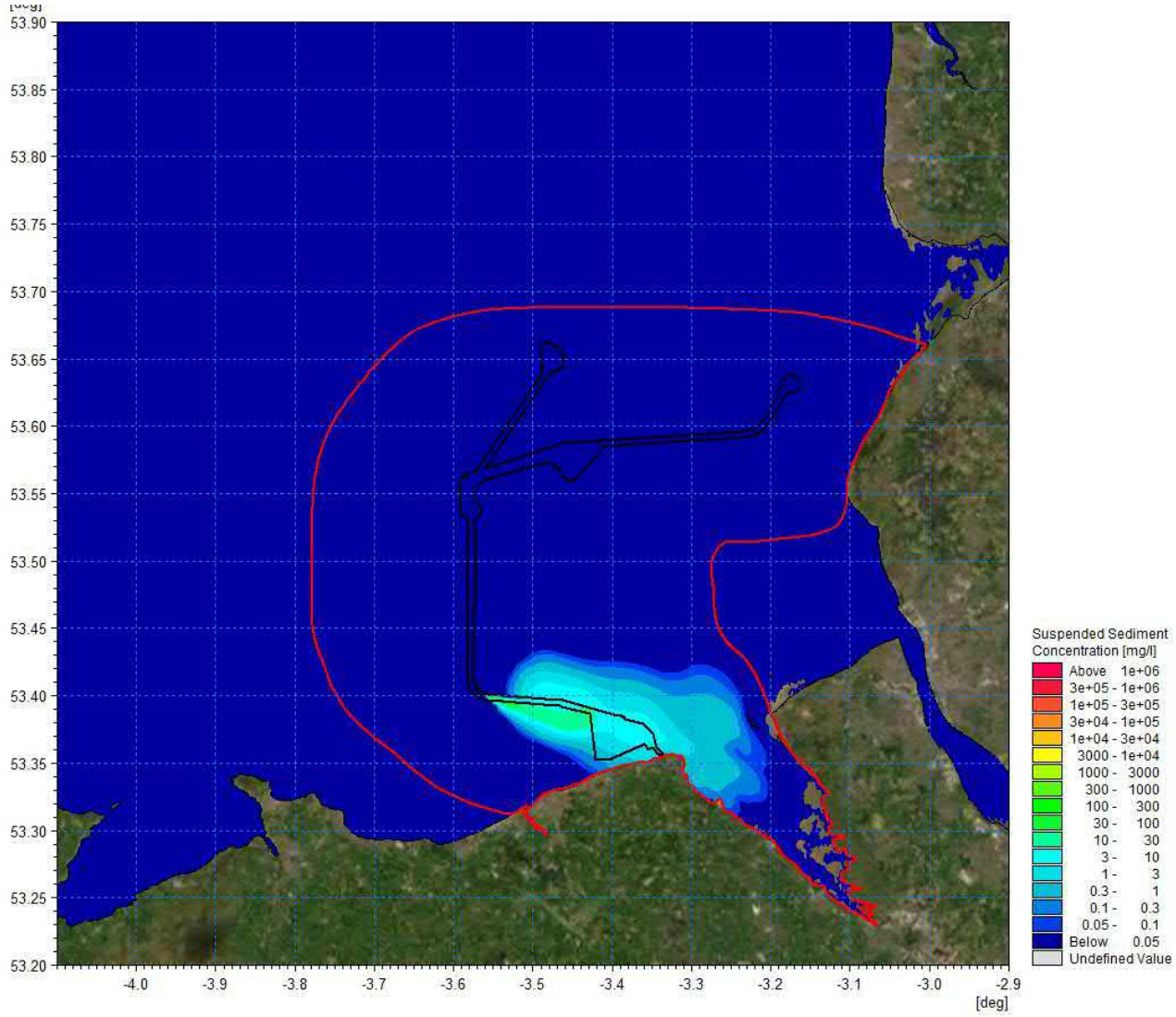


Figure 1.89: Suspended sediment concentration day 2 flood - POA to Douglas.

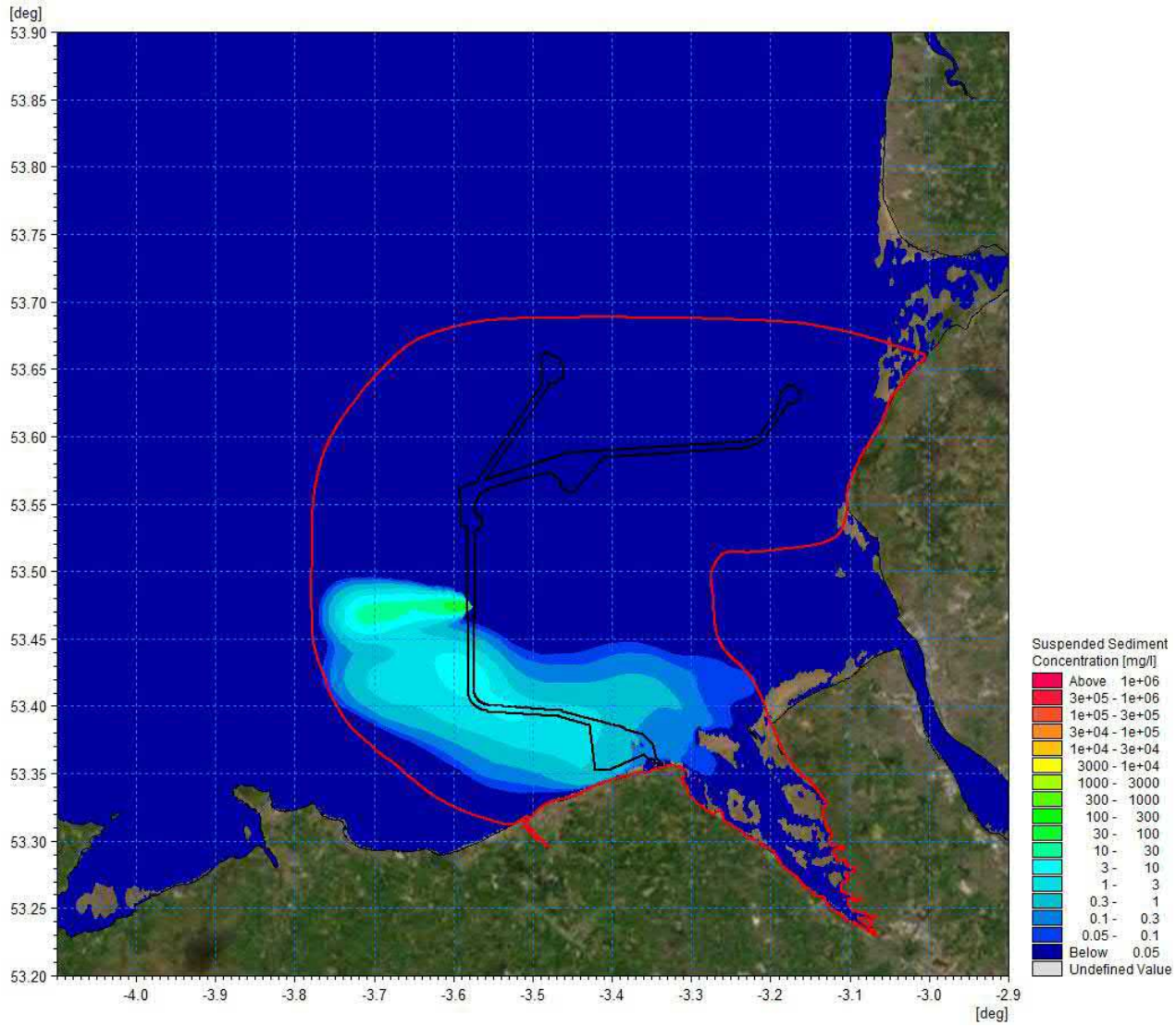


Figure 1.90: Suspended sediment concentration day 3 ebb - POA to Douglas.

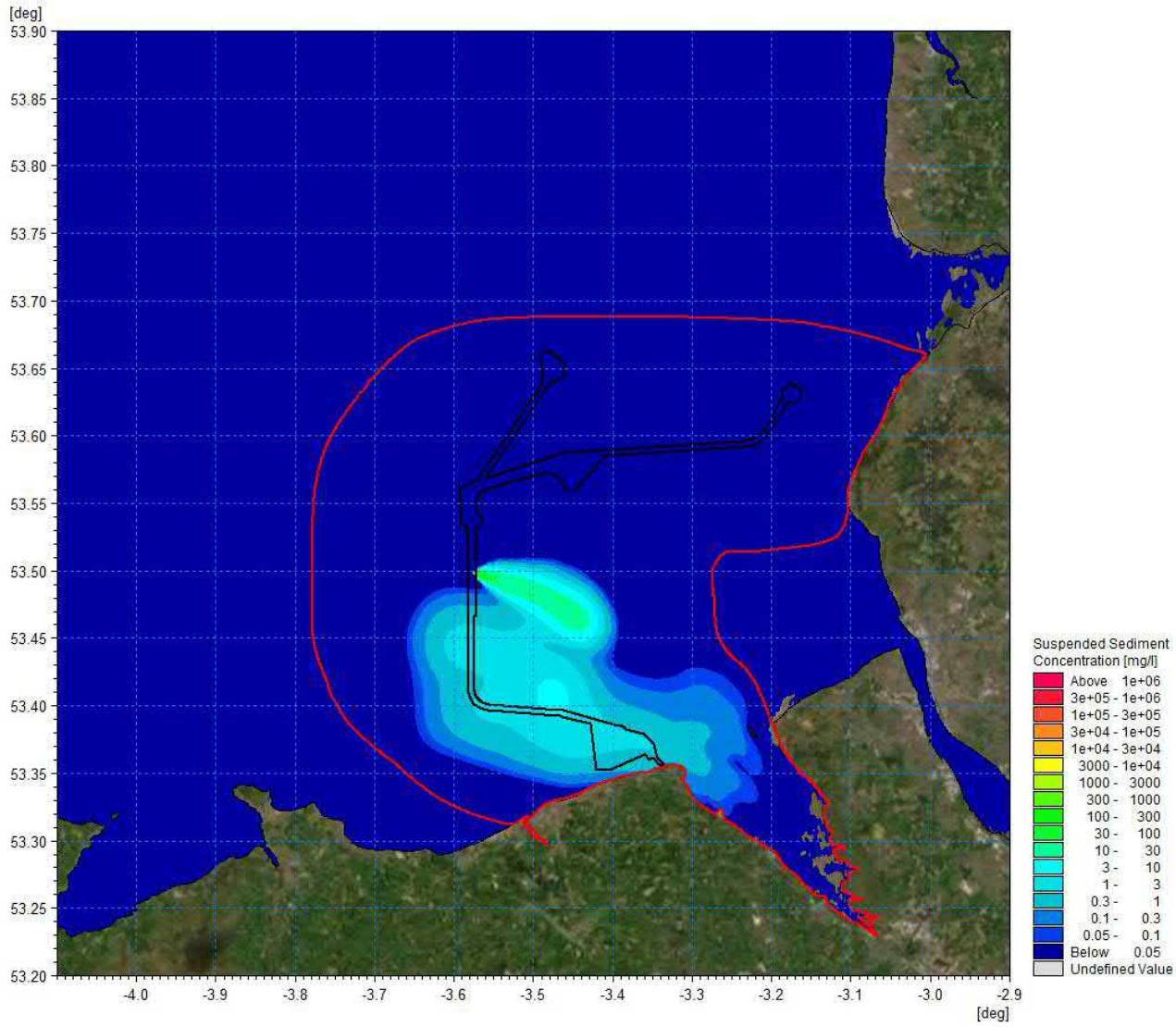


Figure 1.91: Suspended sediment concentration day 3 flood - POA to Douglas.

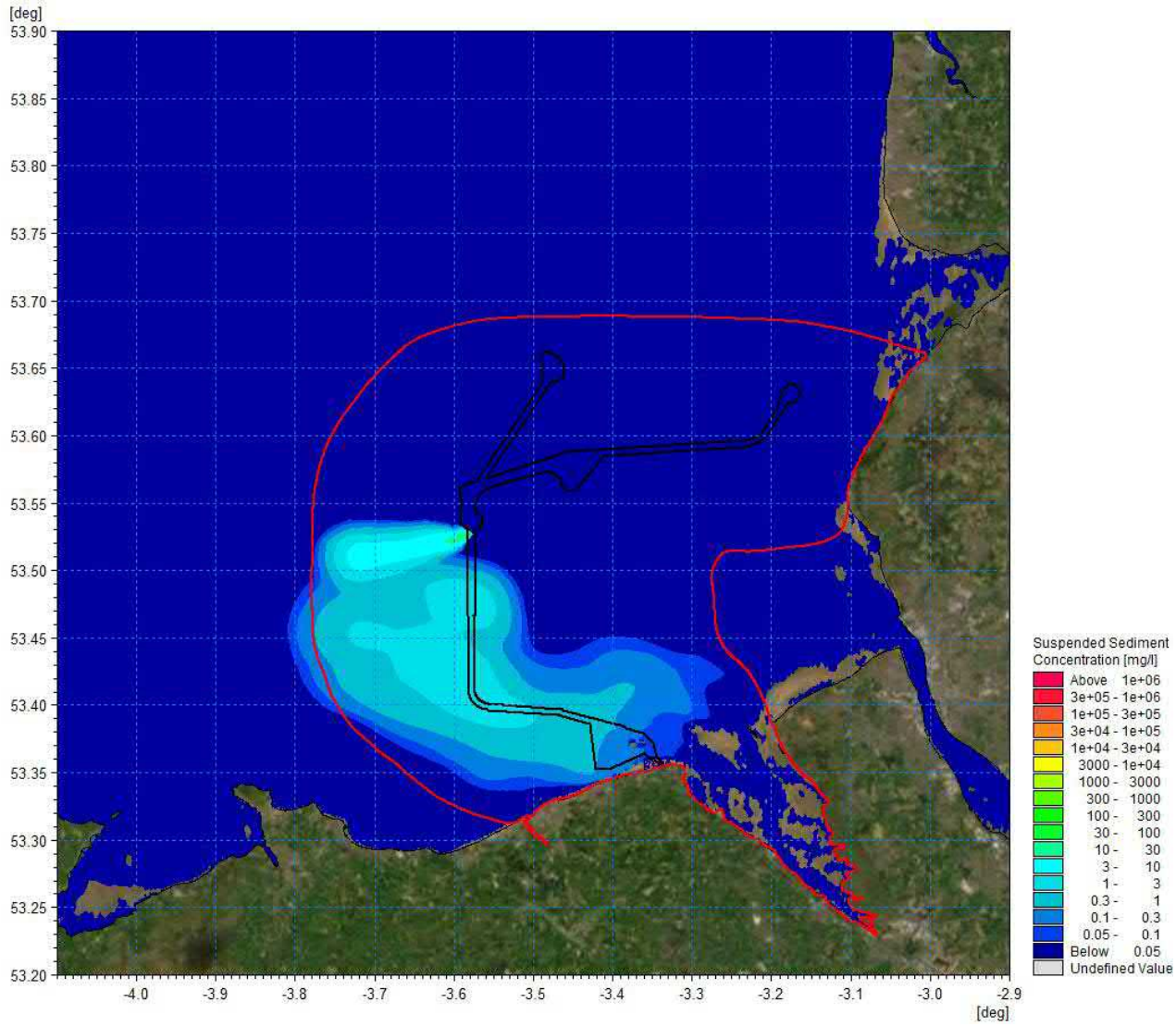


Figure 1.92: Suspended sediment concentration day 4 ebb - POA to Douglas.

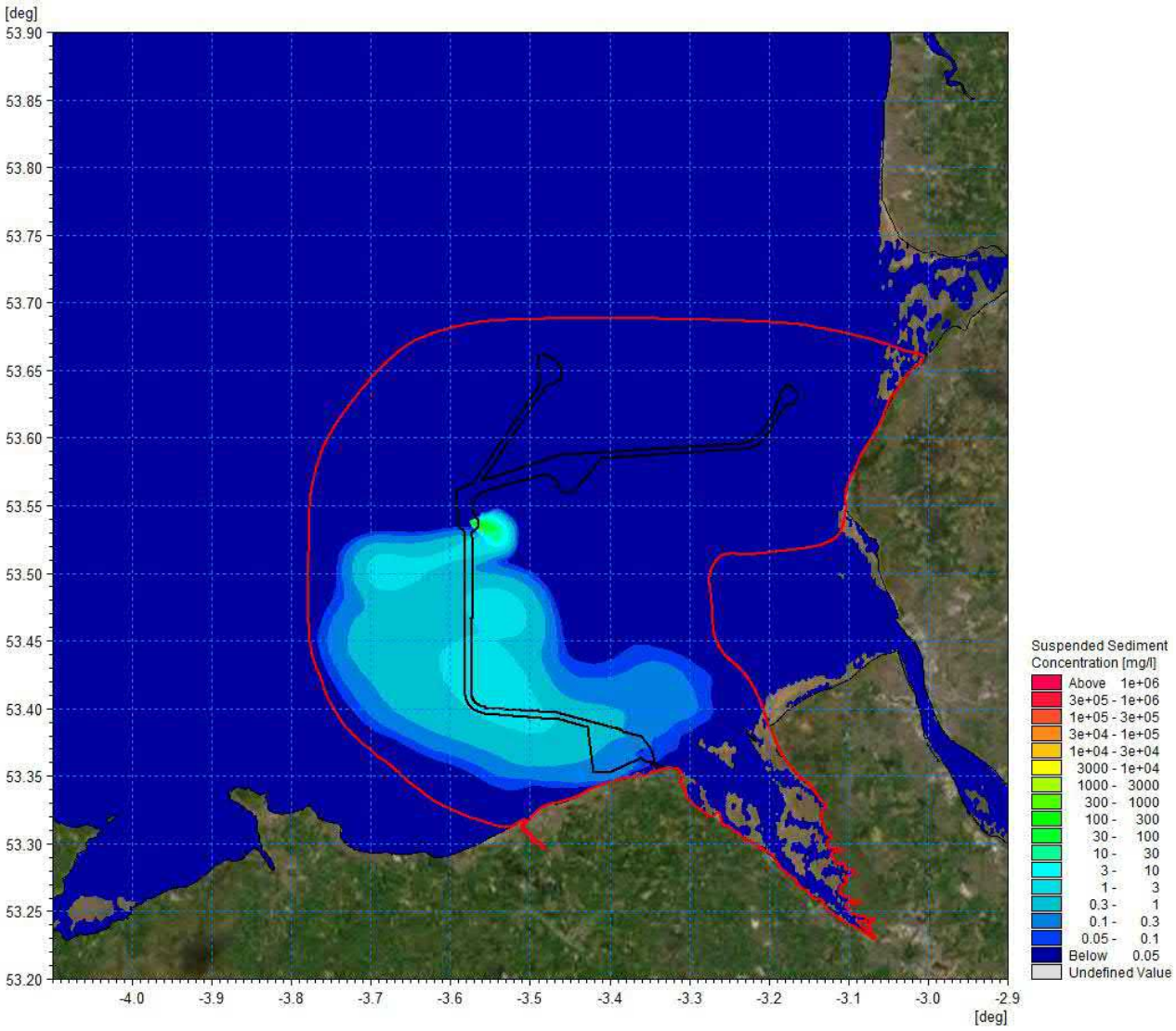


Figure 1.93: Suspended sediment concentration day 4 flood - POA to Douglas.

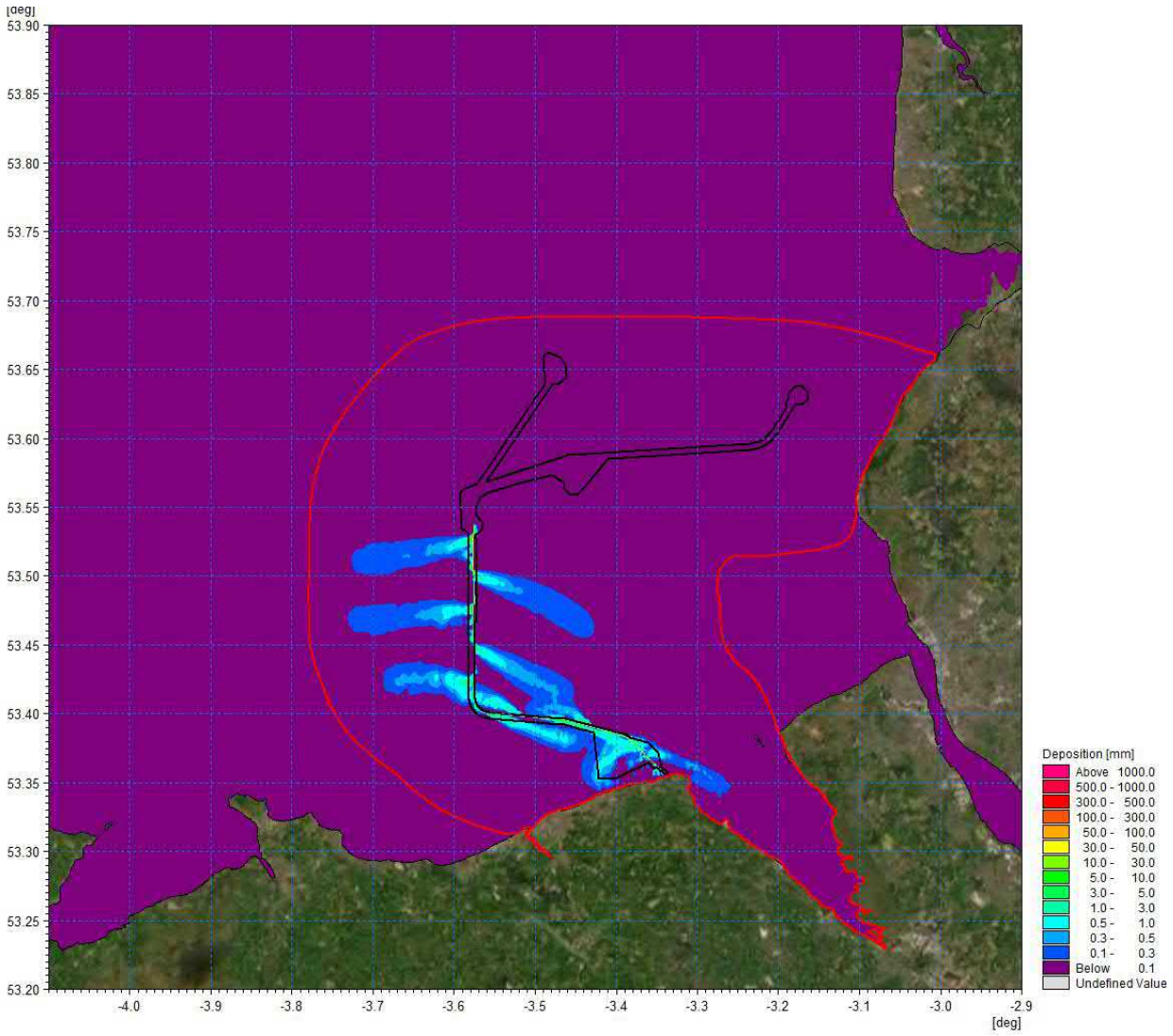


Figure 1.94: Maximum sedimentation over trenching phase – POA to Douglas.

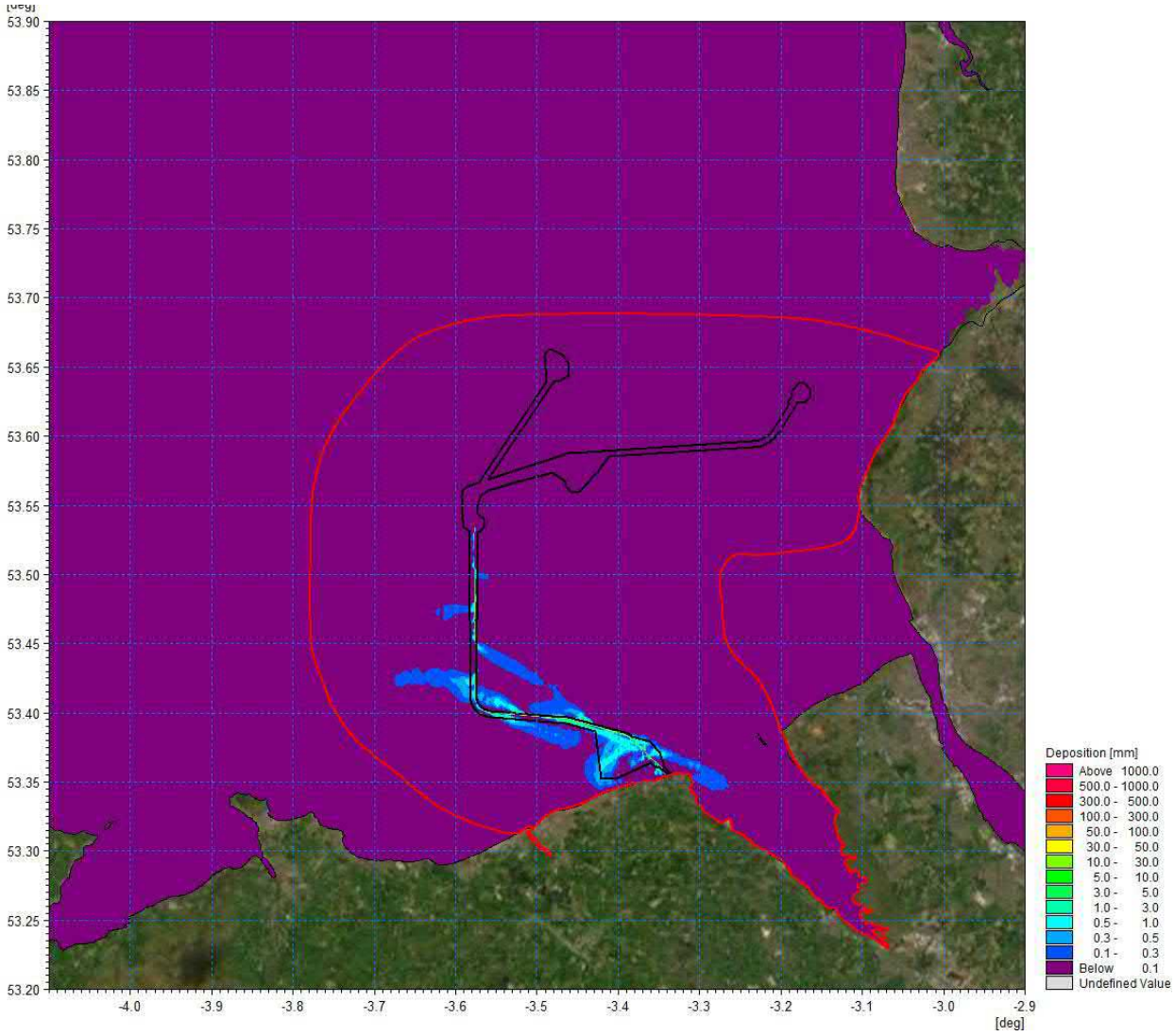


Figure 1.95: Average sedimentation over trenching phase – POA to Douglas.

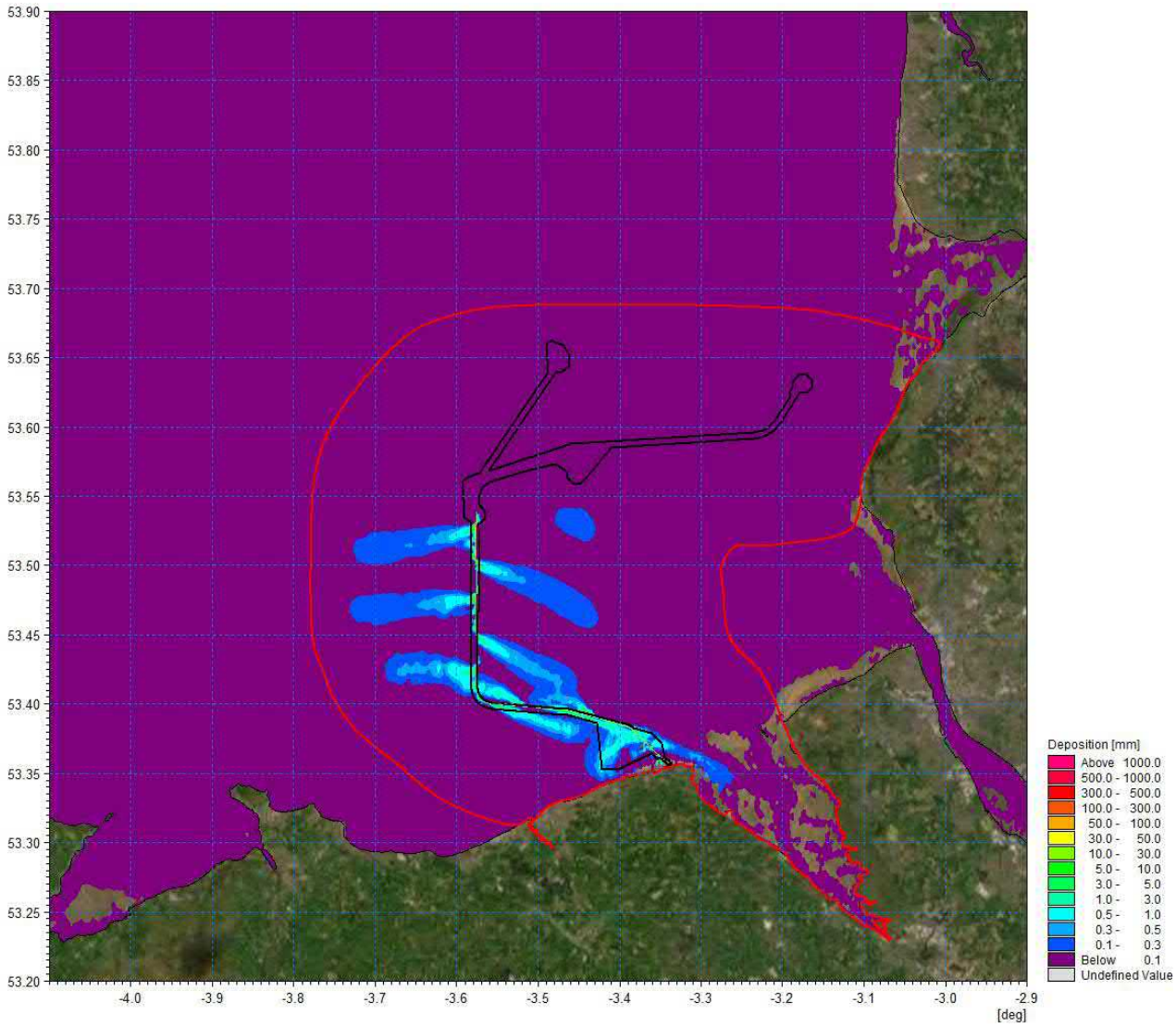


Figure 1.96: Sedimentation one day after cessation of trenching – POA to Douglas.

1.7.3.2 Douglas to Lennox

As with the POA to Douglas, the Douglas to Lennox cable trenching route was examined using numerical modelling. The simulation again assumed trenching rate of 450m/h and that each trench was 3m at the surface extending to a depth of 3m (i.e., the greatest burial depth proposed), with a triangular profile. The operation similarly took approximately 3 days to complete, encompassing a range of tidal conditions. Figure 1.97 shows the modelled route from the Douglas OP to Lennox OP. The sediment grading characteristics along the route were derived from the PSA grab sample locations, with the grading interpolated along the route between data points.

Figure 1.98 presenting the maximum suspended sediment concentration over the course of the trenching phase, 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*.50m the trenching route, with values in excess of 300g/l, and peak values of *c*.70g/l at the location at which trenching is undertaken. Average suspended sediments, as shown in Figure 1.99, are described with concentrations as having mean values of <1,000mg/l in close proximity to the trenching, and mean SSC of <10mg/l outside of the development area. It is at these near background values that the plume may on occasion extend beyond the physical processes study area to the west by up to *c*.1,500m. Maximum sedimentation during the trenching phase also occurs along the cable route within *c*.50m, however even so

deposition is limited to <50cm (peak of *c*.32cm), average values along the route as shown in Figure 1.109 are further limited to <10cm. It is noted that the trenching activities are in alignment with the axis of tidal flow. Sedimentation one day following the cessation of trenching activities is shown in Figure 1.110, which at its northern extent around the Lennox OP, further demonstrates the settlement along tidal ellipsis during slack water.

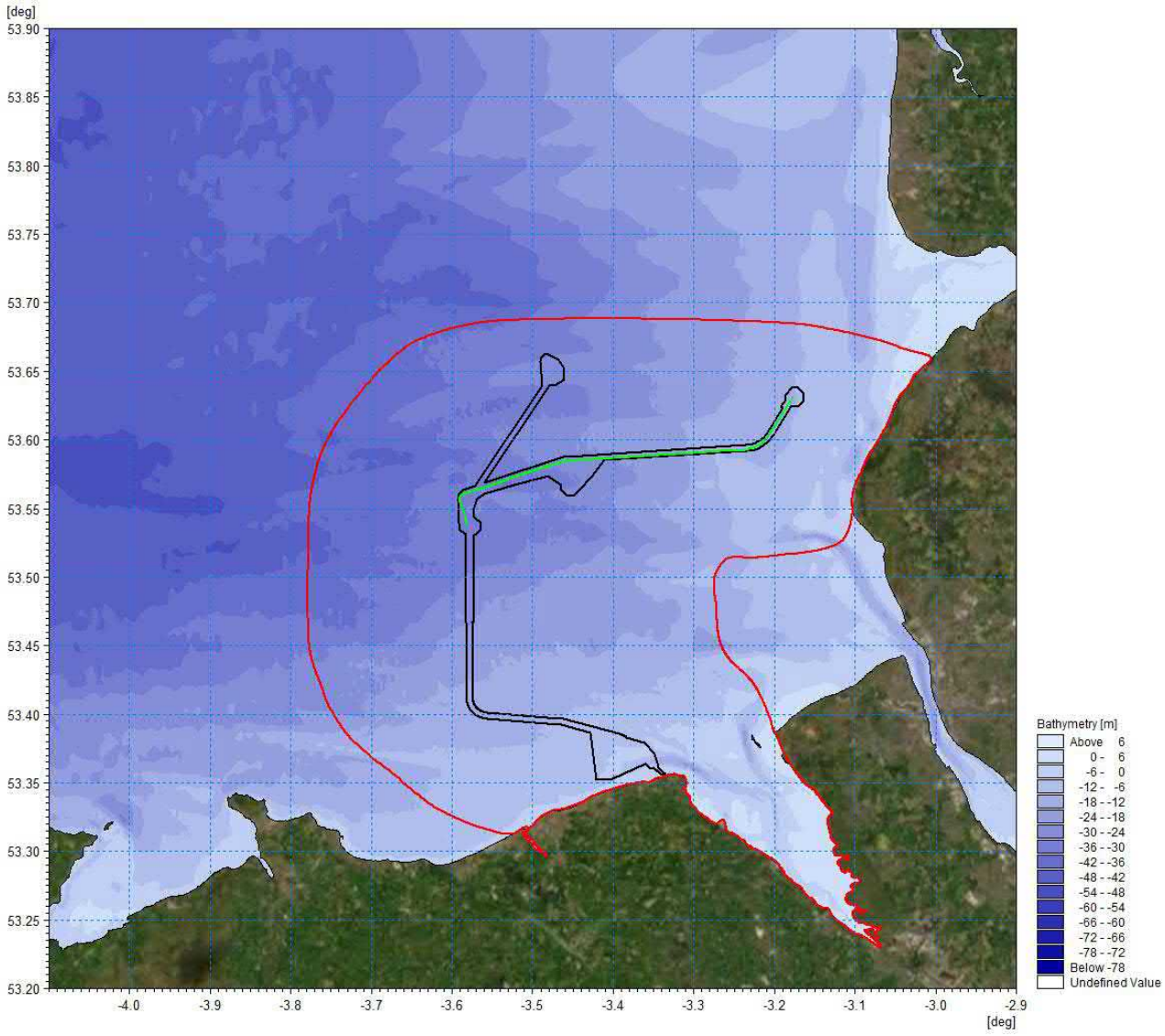


Figure 1.97: Modelled Douglas to Lennox trenching route.

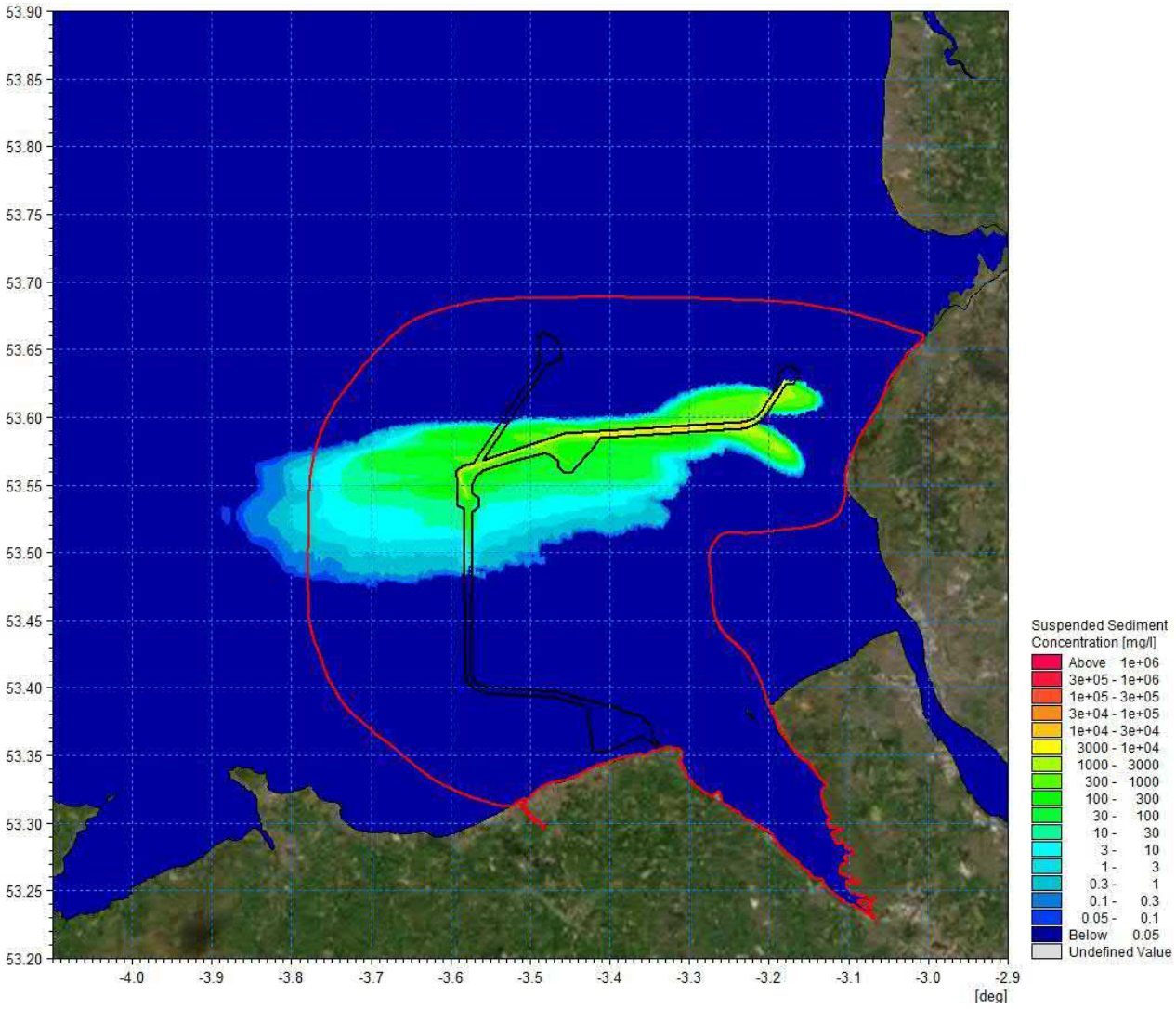


Figure 1.98: Maximum suspended sediment concentration over trenching phase – Douglas to Lennox.

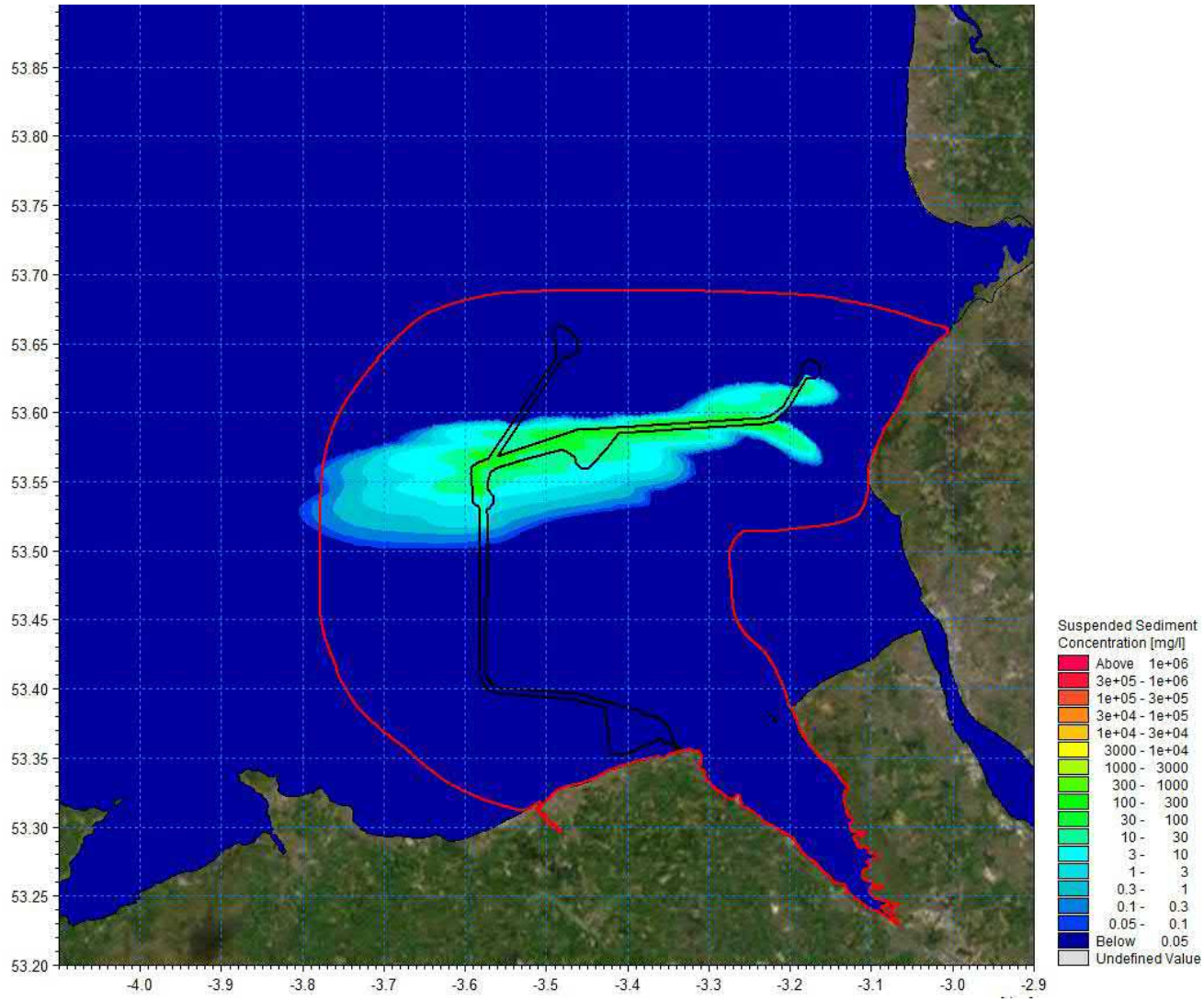


Figure 1.99: Average suspended sediment concentration over trenching phase – Douglas to Lennox.

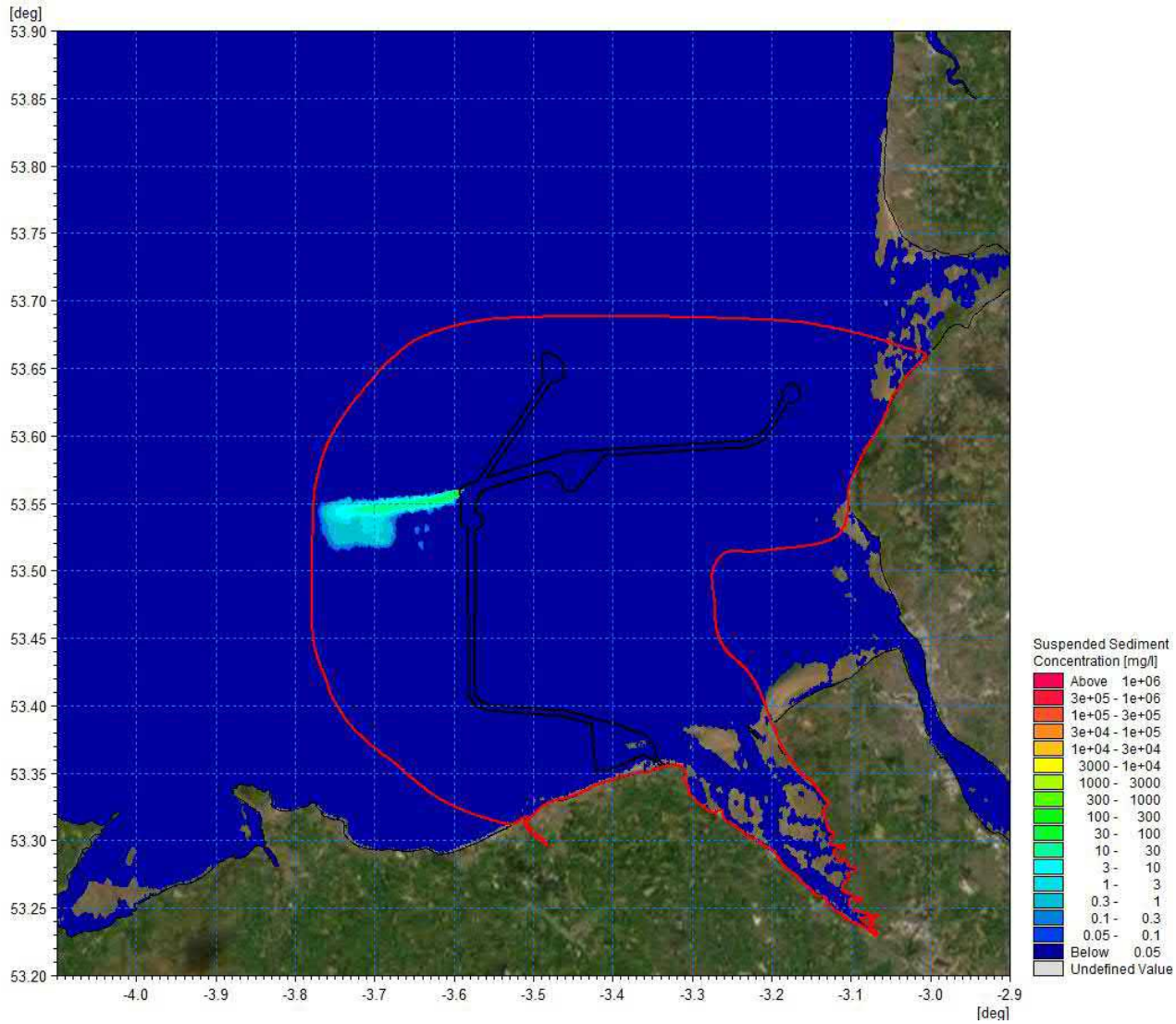


Figure 1.100: Suspended sediment concentration day 1 ebb – Douglas to Lennox.

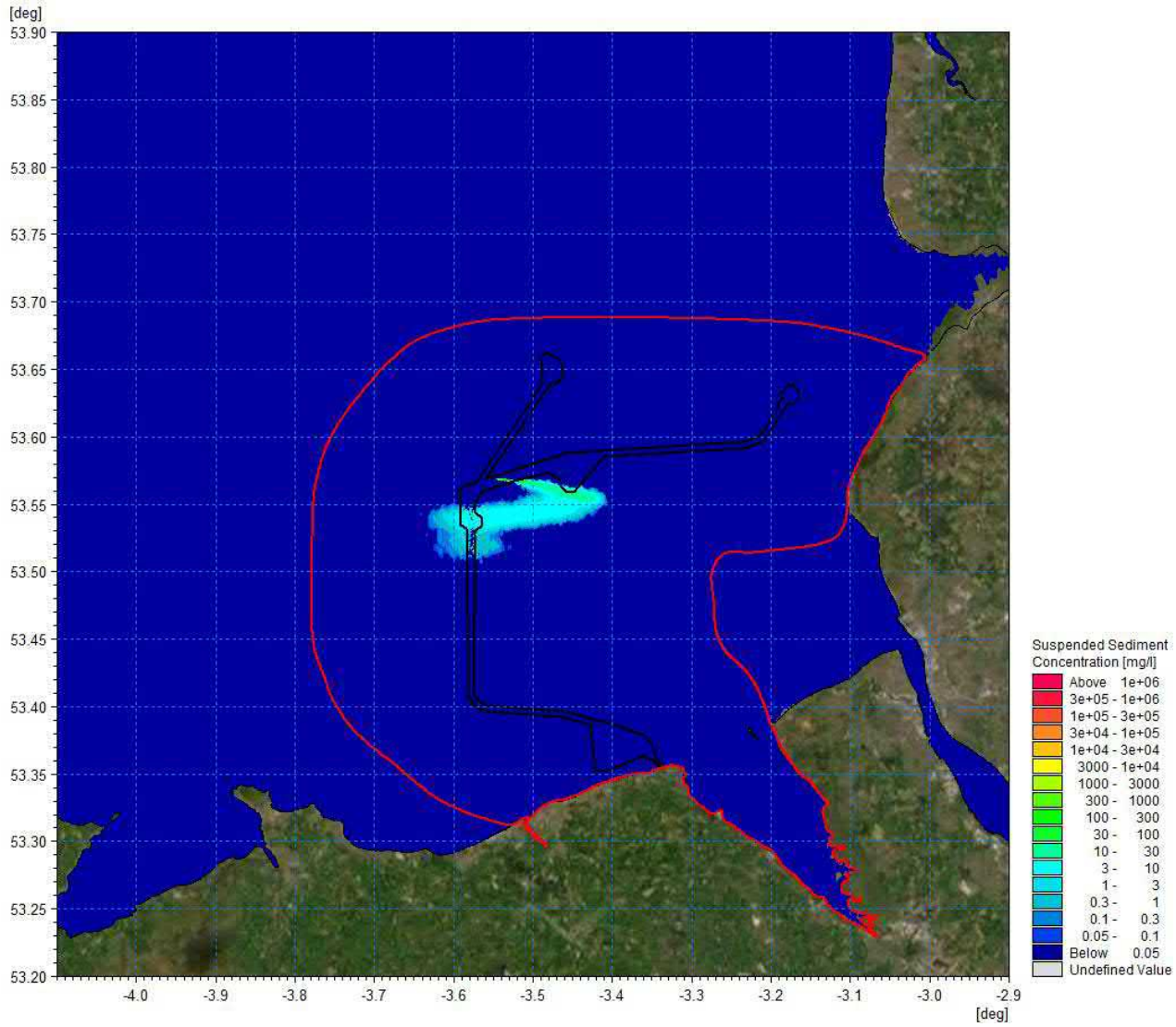


Figure 1.101: Suspended sediment concentration day 1 flood – Douglas to Lennox.

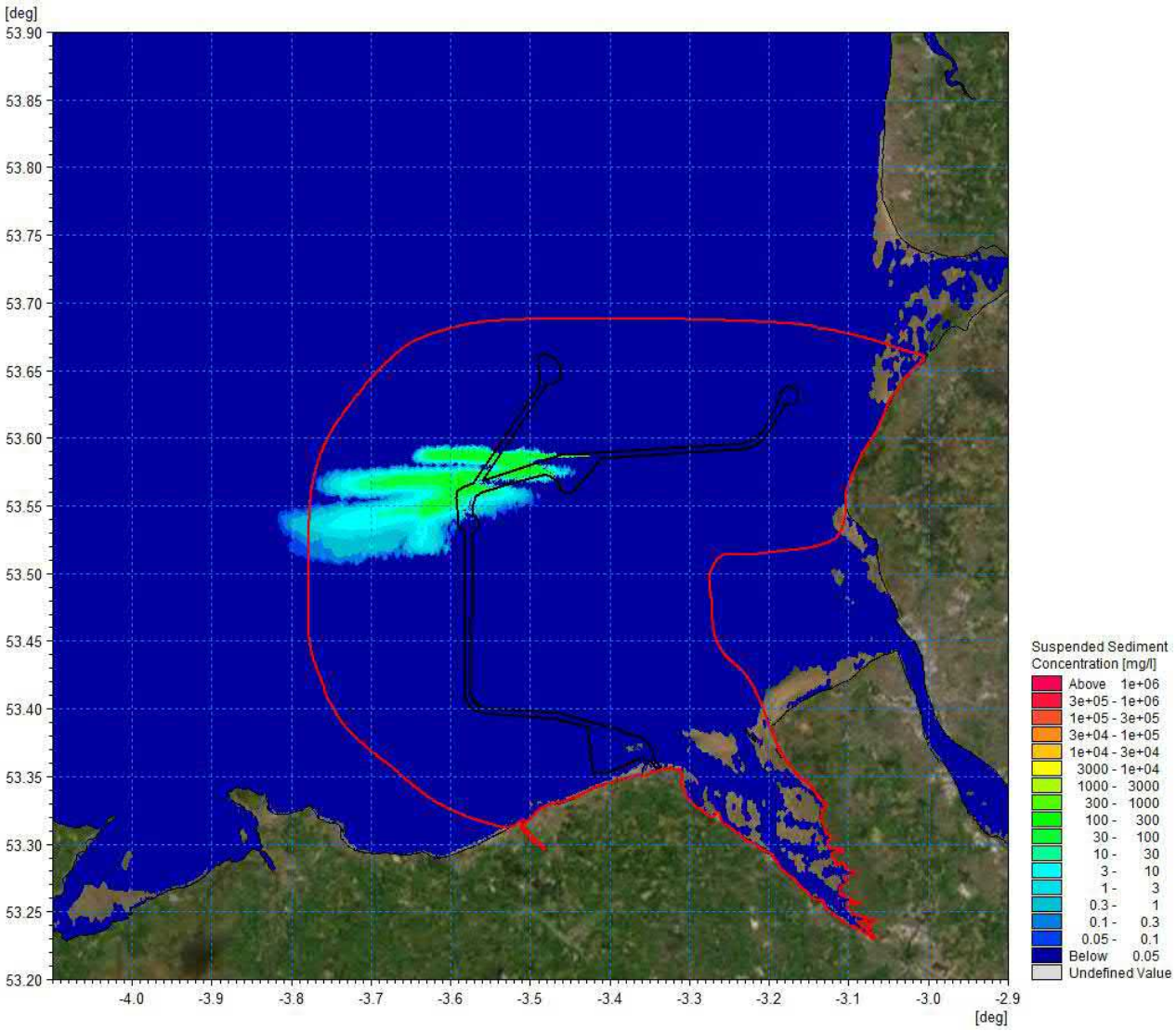


Figure 1.102: Suspended sediment concentration day 2 ebb – Douglas to Lennox.

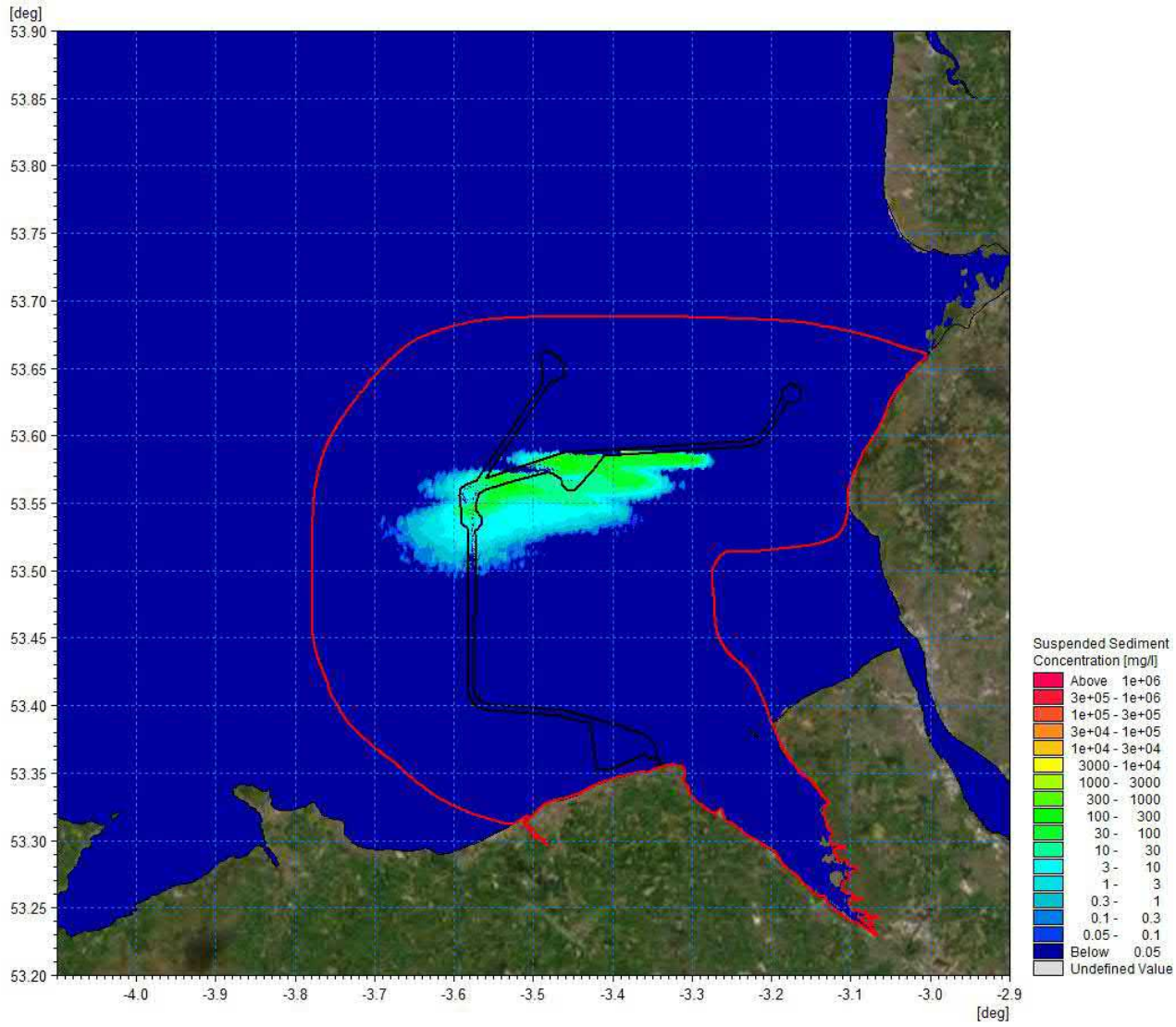


Figure 1.103: Suspended sediment concentration day 2 flood – Douglas to Lennox.

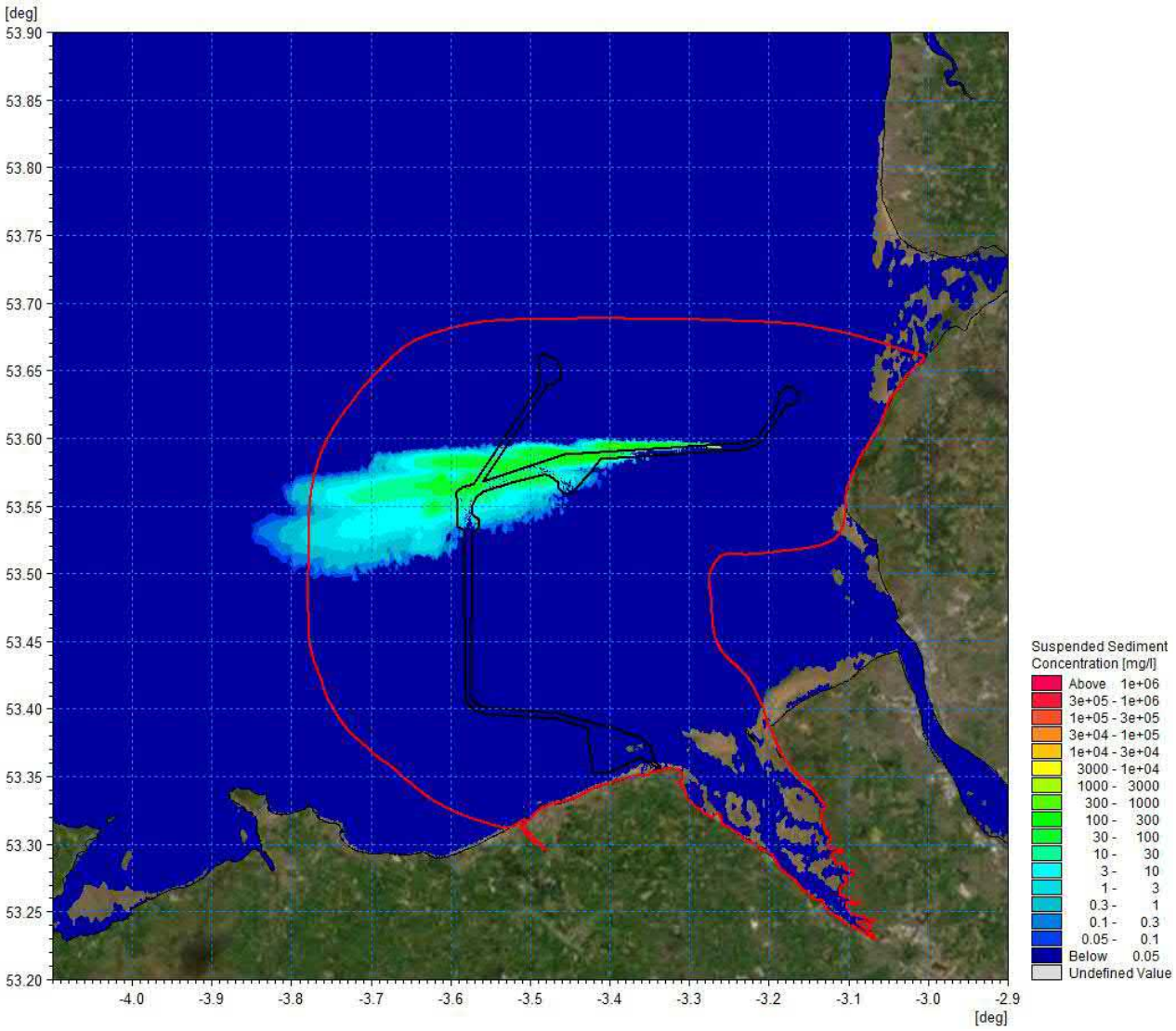


Figure 1.104: Suspended sediment concentration day 3 ebb – Douglas to Lennox.

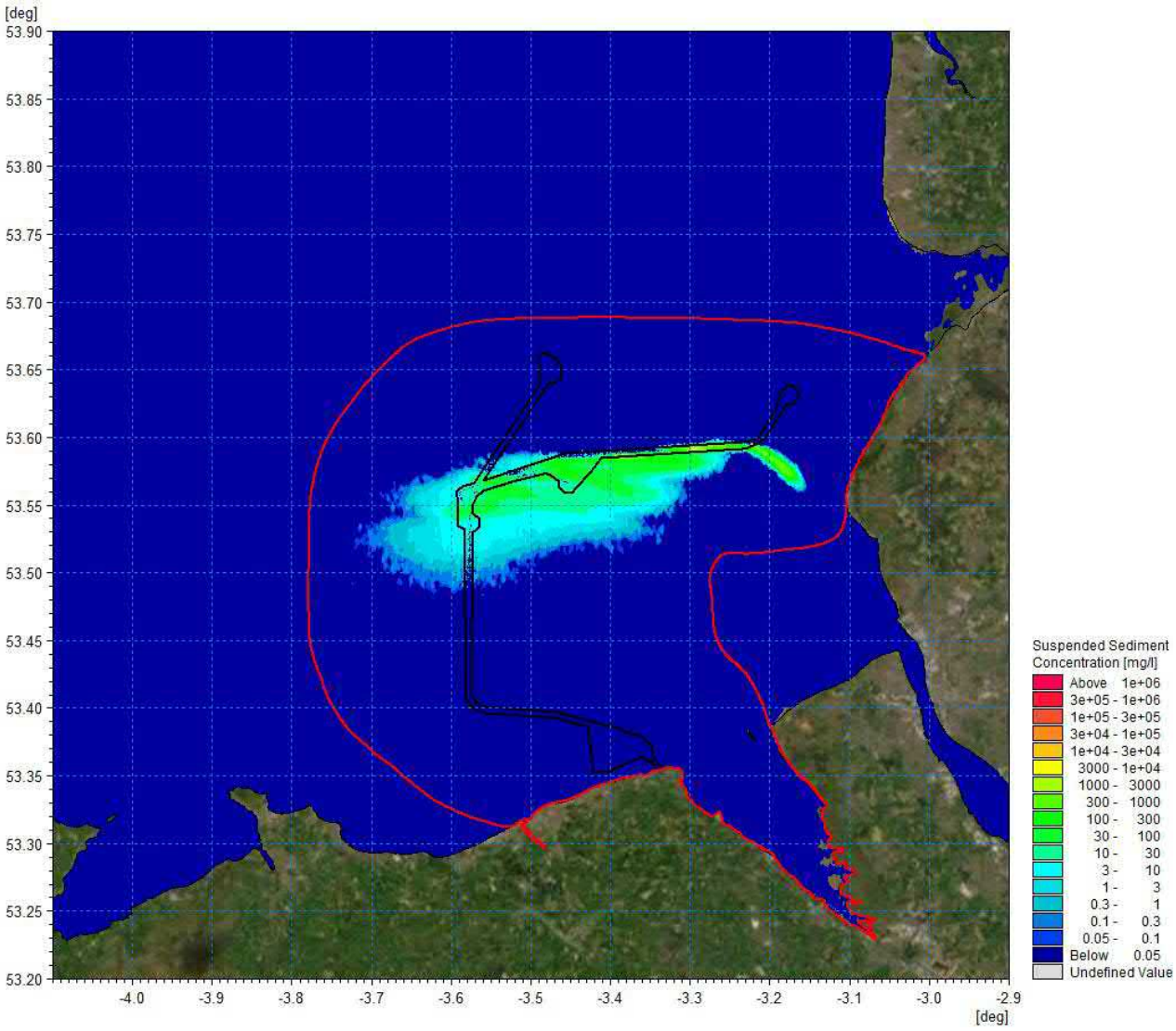


Figure 1.105: Suspended sediment concentration day 3 flood – Douglas to Lennox.

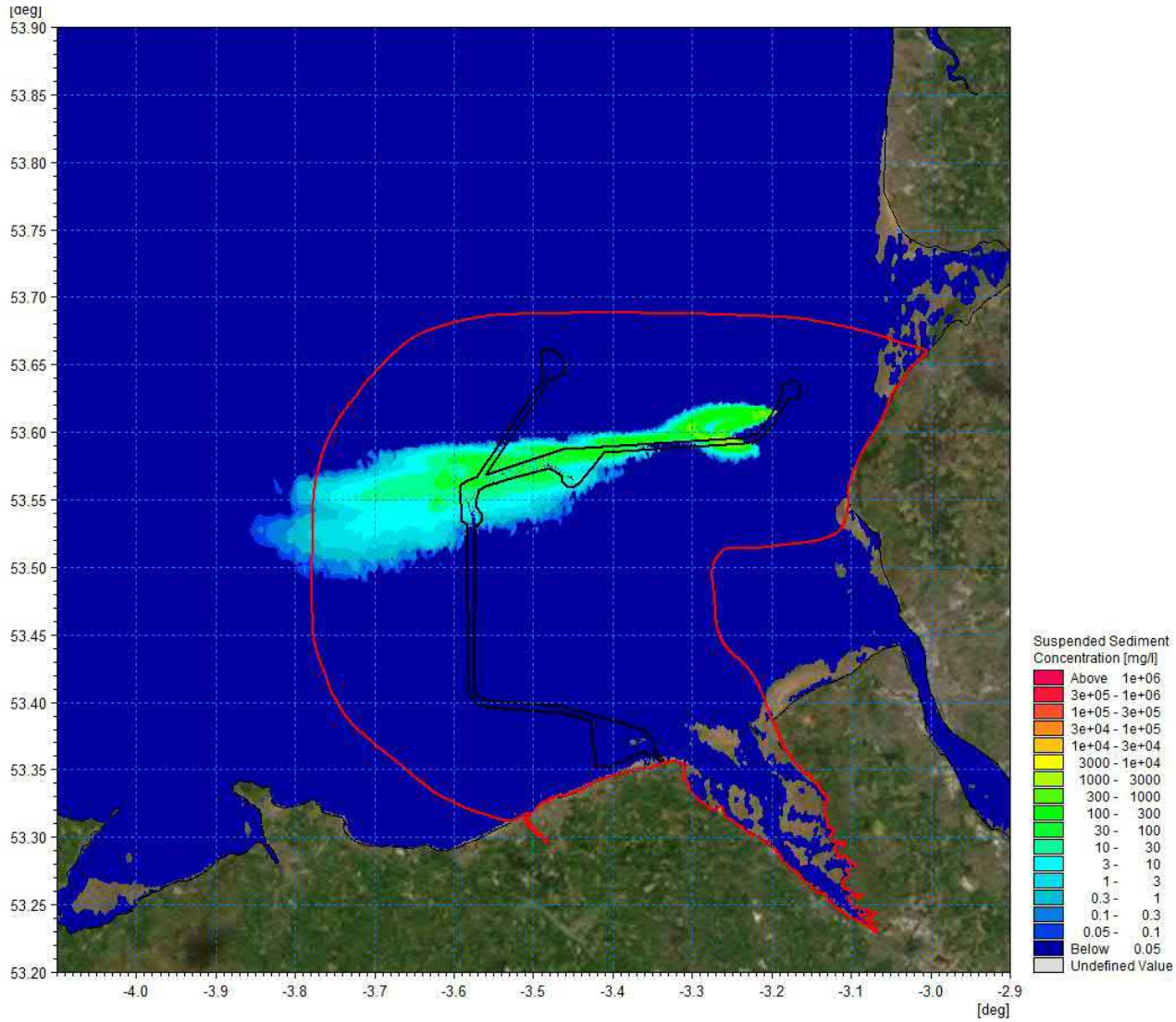


Figure 1.106: Suspended sediment concentration day 4 ebb – Douglas to Lennox.

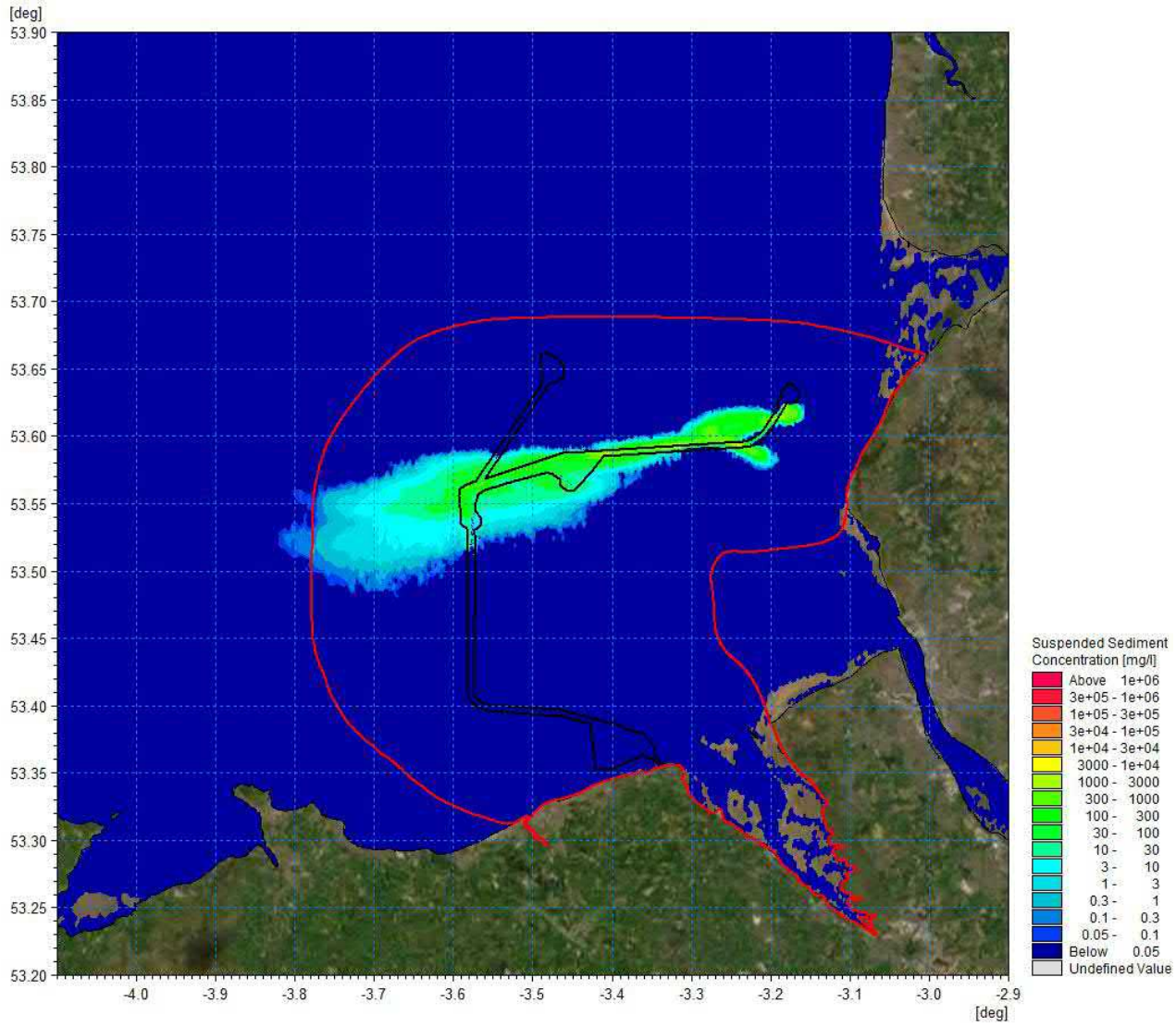


Figure 1.107: Suspended sediment concentration day 4 flood – Douglas to Lennox.

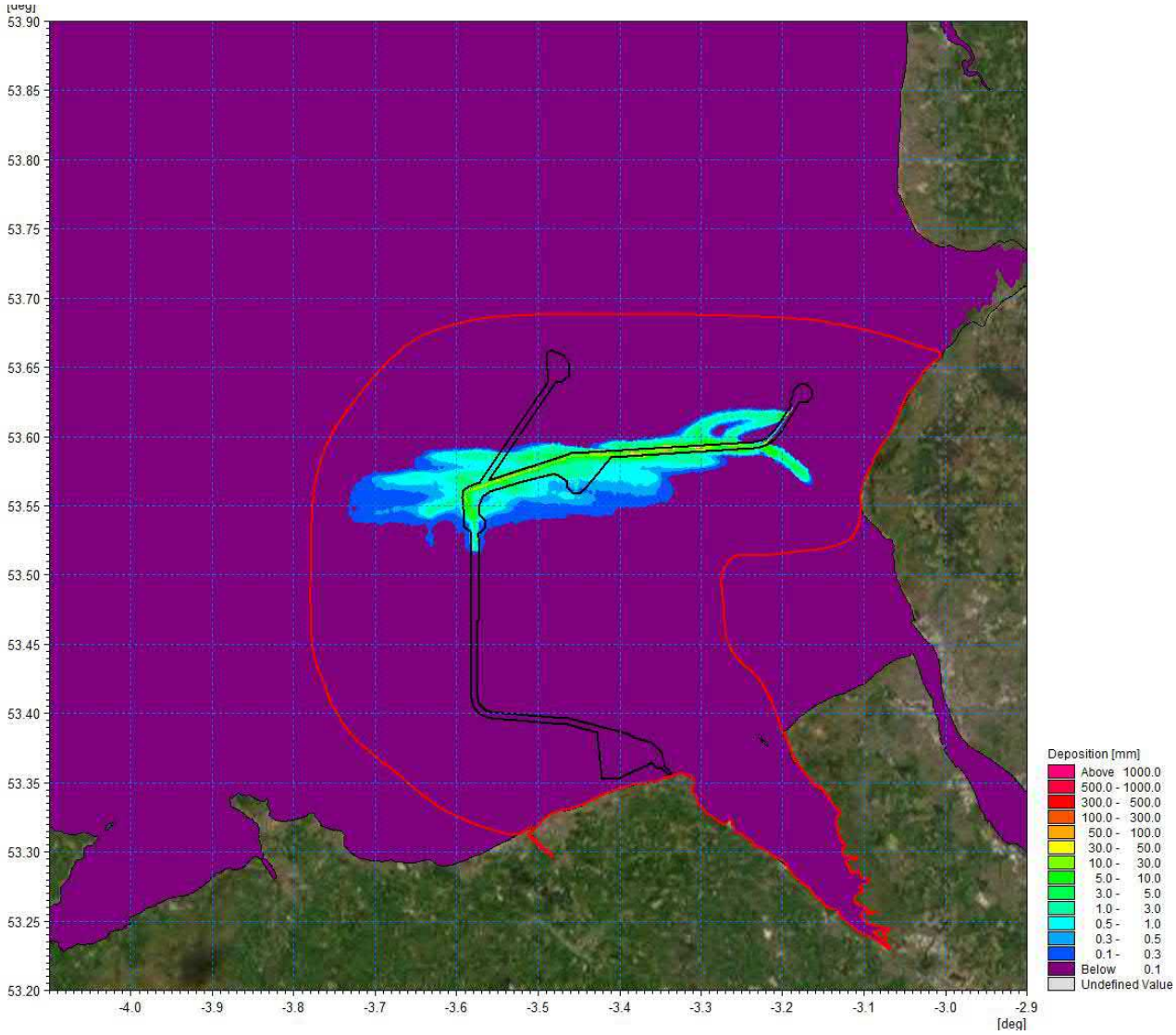


Figure 1.108: Maximum sedimentation over trenching phase – Douglas to Lennox.

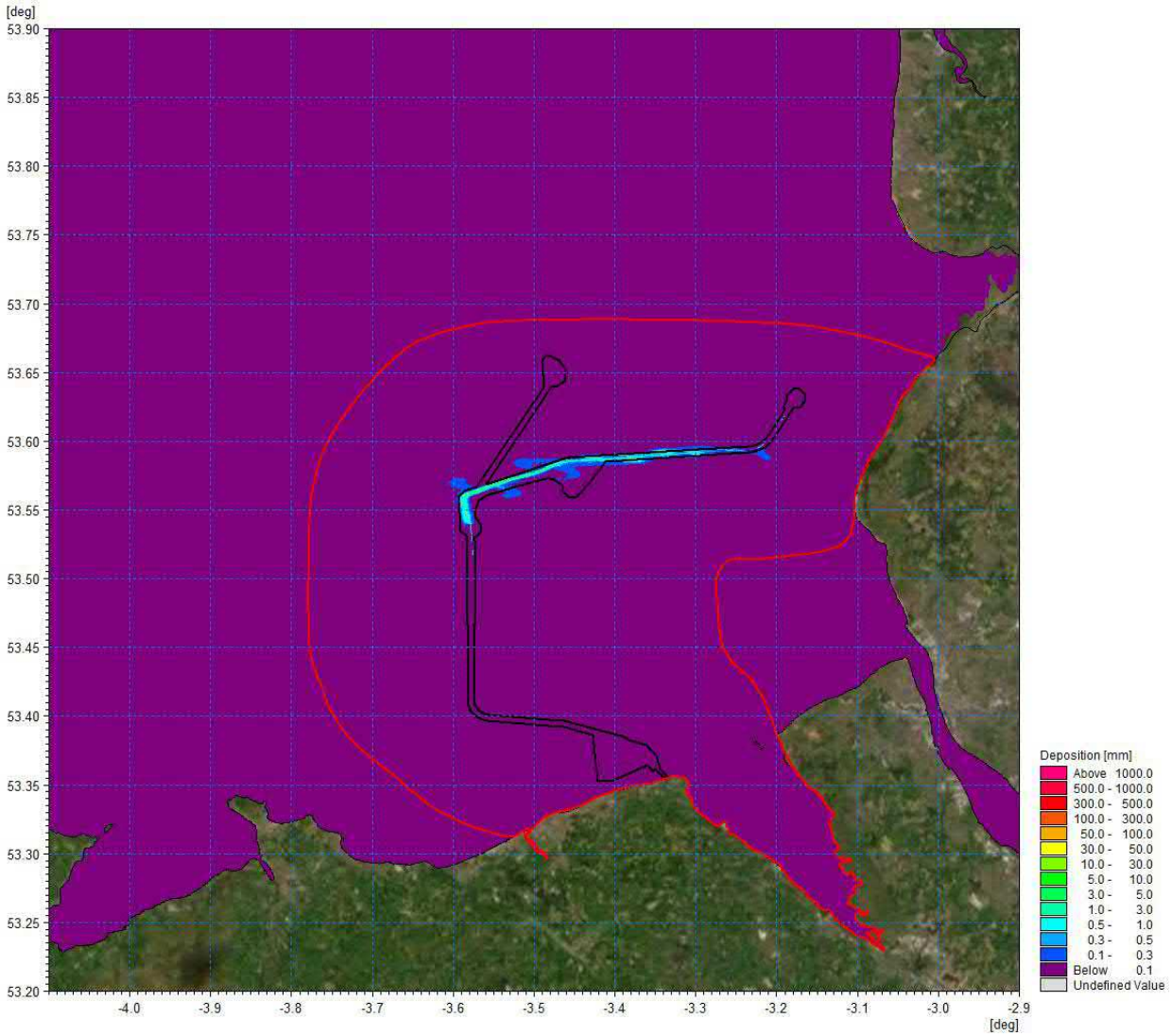


Figure 1.109: Average sedimentation over trenching phase – Douglas to Lennox.

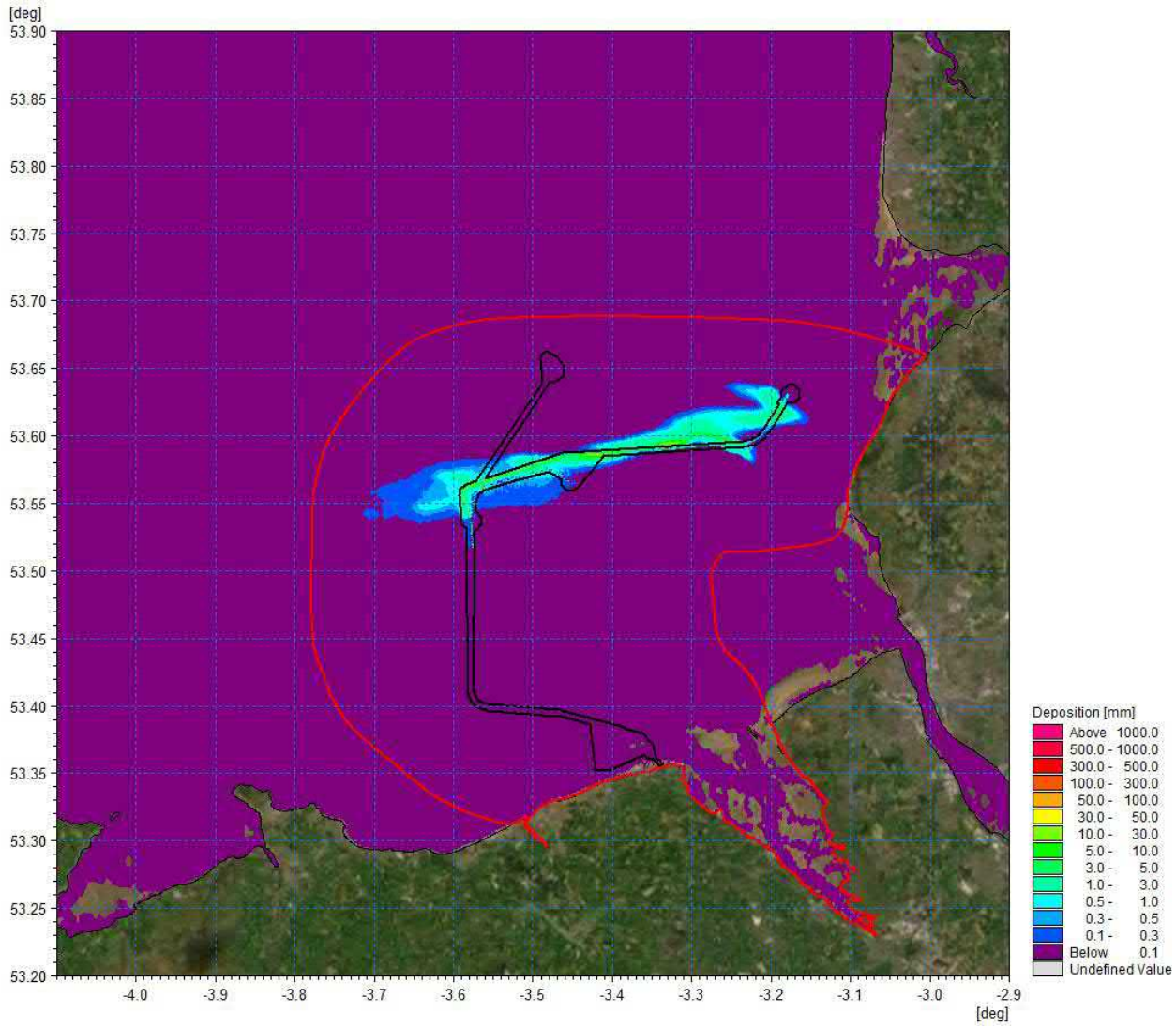


Figure 1.110: Sedimentation one day after cessation of trenching – Douglas to Lennox.

1.8 Summary

A numerical modelling study was undertaken to inform and qualify the potential impacts of the Proposed Development on physical processes. This report has outlined the baseline characteristics of the region in terms of physical processes. This includes tidal current, wave climate and sediment transport under both calm and storm conditions. Numerical modelling has been used to quantify the changes in physical processes, predominantly suspended sediment concentrations, due to seabed preparation activities, the drilling of new monitoring wells, and laying of cables.

Suspended sediment plumes for seabed preparation activities were quantified. In all cases, the material released was native to the bed sediments and, although there are periods of increased turbidity, the material was retained in the sediment cell and would be subsequently assimilated into the existing sediment transport regime. Suspended sediments may reach into the estuary during cable trenching from POA to Douglas, but generally do so at background levels, i.e., 30mg/l.

Both SSC and deposition related to the drill cutting releases were further limited than the seabed preparation and cable installation activities both spatially and in magnitude. With sedimentation restrained to negligible levels across the drill site and along the tidal ellipse.

During cable installation sediment again showed it was retained within the Solway Firth sediment cell and is again incorporated into the sediment transport regime. Sedimentation occurs predominantly during slack water, and is then again resuspended to form a secondary plume.

2 REFERENCES

ABPmer, 2008. *WEBvision - Renwables (wave).* [Online]
Available at: https://www.renewables-atlas.info/explore-the-atlas/
[Accessed February 2023].

ABPmer, 2018. *ABPmer Data Explorer.* [Online]
Available at: https://www.seastates.net/explore-data/
[Accessed February 2023].

BERR, 2008. *Review of Cabling Techniques and Envrionmental Effects applicable to the Offshore Windfarm Industry. Technical Report, Department for Business Enterprise and Regulatory Reform (BERR), in association with Defra,* s.l.: s.n.

BGS, 2023. *BGS Maps Portal.* [Online]
Available at: https://www.bgs.ac.uk/information-hub/bgs-maps-portal/
[Accessed February 2023].

BODC, 2023. *UK Tide Gauge Network.* [Online]
Available at: https://www.bodc.ac.uk/data/hosted_data_systems/sea_level/uk_tide_gauge_network/
[Accessed February 2023].

CEFAS, 2016. *Suspended Sediment Climatologies around the UK,* s.l.: s.n.

DEFRA, 2022. *Bathymetry and SSSI information.* [Online]
Available at: https://environment.data.gov.uk/DefraDataDownload
[Accessed February 2023].

ECMWF, 2022. *Long term win and wave datasets.* [Online].

EMODnet , 2022. *EMODnet Geology.* [Online]
Available at: https://emodnet.ec.europa.eu/en/geology
[Accessed February 2023].

EMODnet, 2020. *EMODnet Map Viewer.* [Online]
Available at: https://emodnet.ec.europa.eu/geoviewer/
[Accessed February 2023].

EMU, 2013. *Irish Sea Zone, Hydrodynamic measurement campaign October 2010- October 2012. Report issued to Centrica Energy Renewable Investments.,* s.l.: s.n.

Fugro, 2016. *BBW02 North Wave Buoy Documentation Report and BBW02 South Wave Buoy Documentation Report,* s.l.: s.n.

GEMS, 2011. *Metocean data collection, Ormonde wind farm project. Report prepared for Offshore Design Engineering Ltd Document number: GSL10108-FIN-001-01,* s.l.: s.n.

Haigh, I. D. et al., 2015. *A user-friendly database of coastal flooding in the United Kingdom from 1915–2014. Scientific data, 2(1), pp.1-13,* s.l.: s.n.

Howarth, M. J., 2005. *Hydrography of the Irish Sea, SEA6 Technical Report, POL Internal document 174,* s.l.: s.n.

INFOMAR, 2023. *Seabed mapping data Geological Survey Ireland (GSI) and Marine Institute..* [Online]
Available at: https://www.infomar.ie/
[Accessed February 2023].

Marine Data Exchange, 2023. *Marine Data Exchange Portal.* [Online]
Available at: https://www.marinedataexchange.co.uk/search
[Accessed January 2023].

MEDIN, 2021. *Bathymetry data.* [Online]
Available at: https://portal.medin.org.uk/portal/start.php
[Accessed February 2023].

Mellet, C. et al., 2015. *Geology of the seabed and shallow subsurface: The Irish Sea. British Geological Survey Comissioned Report CR/15/057 52pp,* s.l.: s.n.

National Network of Regional Coastal Monitoring Programmes, 2022. *Metocean data.* [Online]
Available at: https://coastalmonitoring.org/cco/
[Accessed February 2023].

NOAA, 2022. *Metocean data portal.* [Online]
Available at: https://www.dhigroup.com/data-portals/metocean-data-portal
[Accessed February 2023].

Ocean Ecology , 2022. *Hynet Carbon Capture Storage and Decomissioning Benthic Survey Report 2022,* s.l.: s.n.

RPS, 2018. *Tide and Storm Surge Forecast for the Coast of Ireland ,* s.l.: s.n.

RPS, 2022. *Liverpool Bay CCS Ltd. HYNET CARBON DIOXIDE TRANSPORTATION AND STORAGE PROJECT - OFFSHORE. EIA SCOPING REPORT.,* s.l.: s.n.

RPS, 2022. *Mona Offshore Wind Project Generation Assets Preliminary Environmental Information Report (PEIR) - Technical Report,* s.l.: s.n.

RPS, 2022. *Morgan Offshore Wind Project Generation Assets Preliminary Environmental Information Report (PEIR) - Technical Report,* s.l.: s.n.

The Environment Agency, 2022. *National LiDAR Programme - LiDAR data.* [Online]
Available at: https://data.gov.uk
[Accessed February 2023].

Whitehouse, R. J., Sutherland, J. & O'Brien, D., 2006. *Seabed scour assessment for offshore windfarm. Proceedings Third International Conference on Scour and Erosion.* Gouda, s.n.

APPENDIX B - SOIL TEMPERATURE ANALYSIS – P908 ONSHORE PIPELINE (EXTENDED) – WOOD 2023

Soil Temperature Analysis – P908 Onshore Pipeline (Extended)

Prepared for:	Eni UK
Doc Ref:	809424-00-FA-REP-0001-000
Rev:	A
Date:	April 2023

Technical Report

wood.

Client
Eni UK
Document Title
Soil Temperature Analysis – P908 Onshore Pipeline (Extended)

Wood Reference Number	Client Reference Number (if applicable)
809424-00-FA-REP-0001-000	

Contact

Hooman Haghighi, Business Manager
hooman.haghighi@woodplc.com
Tel: +44 (0)1224 347445

Wood
Sir Ian Wood House
Hareness Road
Altens Industrial Estate
Aberdeen AB12 3LE
Scotland, UK

Tel +44 (0)1224 851000
www.woodplc.com

Revision	Date	Reason for Issue	Prepared	Checked	Approved
A	18/04/23	For Review	RR/CC	RR	HH

Revision History (Optional)		
Revision	**Date**	**Comments**
A	18/04/2023	For Review

HOLDS		
No.	**Section**	**Comment**

Signatory Legend		
Revision	**Role**	**Comments**
A	Prepared	Rishav Raj, Lead Flow Assurance Engineer Christian Chauvet, Flow Assurance and CFD SME
	Checked	Rishav Raj, Lead Flow Assurance Engineer
	Approved	Hooman Haghighi, Energy Transition Manager

Table of Contents

List of Figures

List of Tables

1.0 Introduction

1.1 Overview

Eni UK has identified a risk of adverse impacts resulting from potentially increased temperatures along CO_2 pipelines (due to CO_2 compression requirements – gas phase state).

To mitigate the risk, an assessment of the soil temperature contours at specific segments of the CO_2 pipelines that overlap with sensitive environmental areas would be required. The current study considers the onshore section, i.e. P908 of CO_2 pipeline. The key areas of interest (highlighted in yellow) as advised by Eni UK [Ref. 1] are presented in Figure 1.1 and are as below:

1. Near the Warren Farm
2. Near Dunes
3. Near the Beach

The soil temperature contours would inform the Environmental Impact Assessment (EIA) and ecology team of any buffering zone around the pipeline that could be impacted by the temperature change in order to inform the assessment of impacts to be reported during the EIA process.

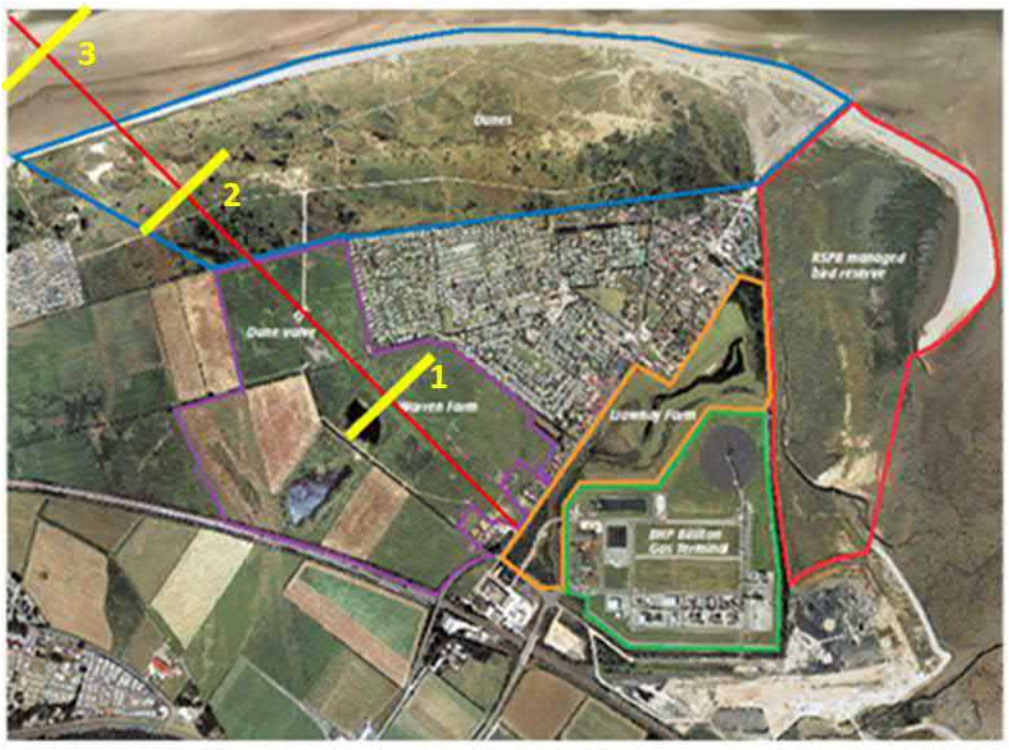


Figure 1.1 Satellite view of P908 pipeline and surrounding

.

1.1.1 Objectives

The objectives of the soil temperature analysis are:

- Perform steady state simulations in OLGA to estimate the temperature profile across the soil layer at key locations identified on P908 pipeline.
- Perform simulations using Computational Fluid Dynamics (CFD) to further assess the impact of soil temperature on ambient (air and water).

1.2 Abbreviations

CFD	Computational Fluid Dynamics
EIA	Environmental Investigation Agency
k-ω SST	k-omega Shear Stress Transport
PVT	Pressure Volume Temperature

2.0 Basis

The following sections summarise the basis of analysis for the soil temperature study, compiled from several documentations provided by Eni UK. This data set was used to define the inputs to the OLGA and CFD modelling.

2.1 P908 Pipeline Properties

The key parameters for modelling of onshore pipeline were obtained from supplied OLGA model [Ref. 1], list of input data used from supplied OLGA model are presented below:

- Pipeline Diameter and Thickness
- Pipeline Insulation Details and Properties
- Material Properties
- Pipeline Bathymetry

The soil burial depth was assumed, as worst case, to be constant as 1 m in the supplied OLGA model, which was updated for the purpose of current study and was based on latest survey data supplied by Eni UK [Ref. 1 & 2]. Figure 2.1 presents the profile for P908 pipeline, it can be observed that the soil layer varies throughout the onshore pipeline (represented by blue dotted line), average burial depth was estimated for different sections of the pipeline to capture a realistic soil burial in the model. The updated values for soil burial depth in OLGA model is presented in Table 2.1.

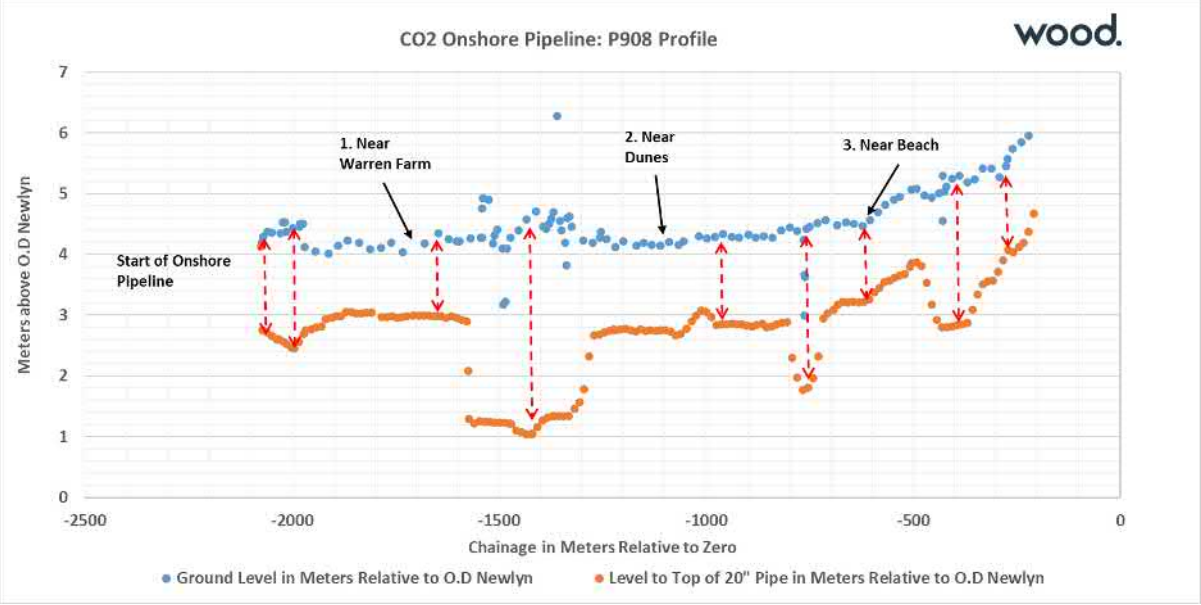


Figure 2.1 CO_2 Onshore Pipeline Profile

It should be noted that the first 250 m of onshore pipeline (downstream of gas compressor) is above the ground (unburied). The above ground piping was added to the supplied OLGA model [Ref. 1] and similar pipeline material and wall properties were assumed for the above ground piping as the rest of onshore pipeline.

Table 2.1: Updated Soil Burial Depth for Onshore Pipeline

Pipe Length [m]	Average Burial Depth [m]
0 to 250	0 [Above Ground]
250 to 360	1.71
360 to 460	2.37
460 to 740	1.35
740 to 810	2.44
810 to 1300	1.46
1300 to 1600	3.23
1600 to 1970	1.19
1970 to 2045	1.95
2045 to 2100	1.66

2.2 Key Locations

Key locations were advised by Eni UK [Ref. 1] and distances of key locations from onshore plant are presented in Table 2.2. It should be noted that temperature profile is unlikely to change within few meters of the points considered on the onshore pipeline and the objective of selecting the points in Table 2.2 was to obtain a fair representation of key locations.

Table 2.2: Key Location Considerations

S.No.[2]	Location	Distance from Onshore Plant [m]
1	Near Warren Farm	400
2	Near Dunes	1000
3	Near Beach	1500

Note:

1. The distances presented in table above do not include the 250 m piping which is above the ground.
2. Refer to Figure 1.1 for details of locations on satellite image.

2.3 Ambient Conditions

Ambient Conditions for the onshore pipeline was obtained from the offshore new pipeline design requirement document [Ref. 3] and is presented in Table 2.3. Simulations were performed for both summer and winter ambient conditions, further details on modelling of ambient conditions have been presented in section 4.1.

Table 2.3: Ambient Data

Ambient Medium	Temperature [°C]	
	Summer	Winter
Sea water (Depth 0-5 m)	17	3
Sea water (Depth 25-30 m)	13	5.9
Air (Onshore/Offshore)	27	2.5
Onshore Soil	18	4

Note:

1. Temperatures for Sea water (Depth 0-5 m) was used in the cases performed with tides on the onshore pipeline section after the Dunes.
2. Onshore Soil temperature was used while setting up the mesh in the model, simulations were then performed to estimate the impact on soil temperature due to hot CO_2 fluid in the pipeline.

2.4 Wind Profile

The standard logarithmic equation for wind profile was used as the equations shown in Figure 2.2 below:

$$U(z) = U(H) \cdot \left(1 + \frac{\ln\left(\frac{z}{H}\right)}{\ln\left(\frac{H}{z_0}\right)} \right)$$

with U(H): Velocity at reference height
H: Reference height
z_0: Roughness parameter
z: Altitude above groud

Figure 2.2 Standard Wind Profile Equation

It should be noted that for altitude below the ground roughness parameters, the profile was not defined. Hence the natural convection conditions were assumed for the simulations where the atmosphere was explicitly simulated. Those assumptions were considered as conservative in terms of temperature in the atmosphere.

2.5 Boundary Conditions

The following boundary conditions were applied to the current study:

- Inlet Flowrate: 150 kg/s
- Temperature at Onshore Pipeline Inlet: 50°C, Sensitivity with 60°C
- Pressure at Douglas Manifold: 46 bara

2.6 Material Properties

The material properties were obtained from supplied OLGA model and is presented in Table 2.4.

Table 2.4: Material Properties

Material	Capacity (J/kg-K)	Conductivity (W/m-K)	Density (Kg/m^3)
Carbon Steel	434	45	7832
3LPP	1000	0.22	900
CTE	950.0	0.19	1335
FBE	1700.0	0.3	1450
Concrete	1000	1.13	3040
Sand[1]	800	2.5	1280
Formation	1257	3	2100
Onshore Soil	880	1.3	1800

Note:

1. The conductivity of sand was assumed to be 2.5 W/m-K to account for wet sand near the beach.

2.7 Software

OLGA, version 2019.1, was used for simulating the thermo-hydraulic and FEMTherm bundles in the current study.

The CFD software ANSYS CFX 2020 R2 was used to carried out the detailed analyses including the air flow above the ground.

3.0 Methodology

3.1 OLGA FEMTherm Modelling

FEMTherm bundles were created in OLGA near the key locations as described in section 2.2. The key properties of FEMTherm bundle have been presented below:

- A rectangular bundle was created at each key location with a height of 20 m (20 m below the soil) and width of 20 m as shown in Figure 3.1.
- A mesh fineness grid parameter of 128 was used in the study. It should be noted that tuning of individual mesh around the pipeline is not possible in FEMTherm and default sizes have been used in the study.
- Temperatures were plotted at various locations such as soil surface level, 0.1 m and 1 m below soil surface, along with bulk fluid temperature.
- The location near the beach and after the dunes (highlighted as number 3 in Figure 1.1), was simulated with both air and water as ambient to capture the intertidal scenario.

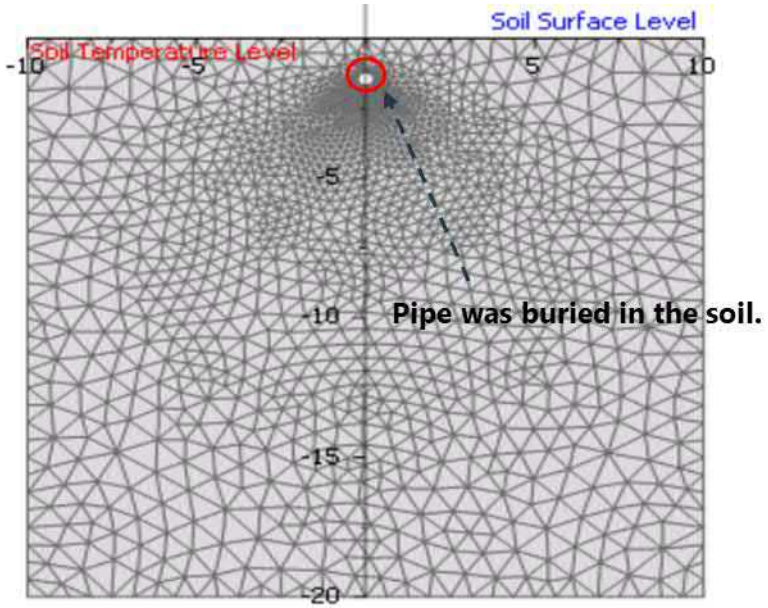


Figure 3.1 FEMTherm Bundle modelled in OLGA at each key location of P908 pipeline

3.2 CFD Modelling

The CFD modelling approach was similar to FEmTherm approach, but it offers more possibilities of refinement of the model, which allows a more accurate solution.

A 2D section of the pipe was considered. A computational domain of 20 m was considered on each side and below the pipe to apply the boundary conditions. This was deemed sufficient to avoid any boundary effects. The domain within the atmosphere was extended 10 m above the ground. Soil temperature boundary conditions were applied at the bottom of the domain while adiabatic (no heat flux) was applied on the side of the soil domain. For the air domain as natural convection conditions were considered, only the temperature of the air was applied at the top

of the domain. Air was free to flow from the sides. Figure 3.2 shows the extent of the computational domain and the mesh refinement considered to capture accurately the temperature profile. The turbulent structures generated by the natural convection above the ground were captured using the k-ω SST turbulent model. Results from the OLGA modelling were used as fluid temperature on the pipe walls.

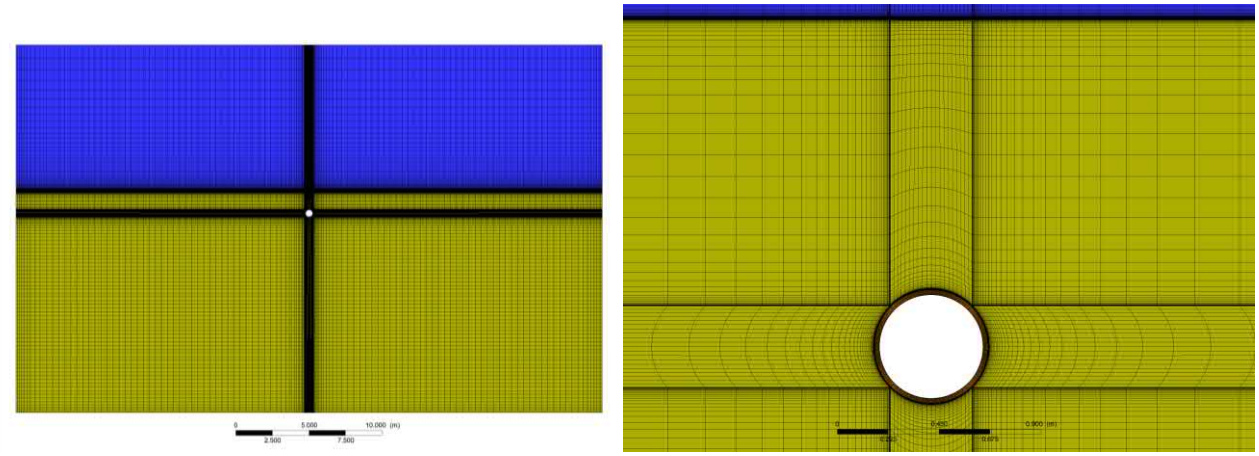


Figure 3.2 CFD Model Domain and Mesh

4.0 Results

4.1 OLGA FEMTherm Analysis: Base Case

The steady state simulations were carried out for both summer and winter ambient conditions and considering the impact of tides near the beach on P908 onshore pipeline. Pipeline inlet temperature of 50°C was assumed for base case scenario. Following scenarios were performed as part of current analysis:

1. Summer ambient condition without Tide
2. Summer ambient condition with Tide
3. Winter ambient condition without Tide
4. Winter ambient condition with Tide

For scenarios performed with tides, water was added as an ambient over the FEMTherm bundle and conductivity of wet sand (2.5 W/m-K) was used in heat transfer calculations. Tide, modelled as sea water in OLGA was extended to cover entire sand area after the Dunes. Simulations were also performed for scenarios without tide and air was modelled as ambient for entire onshore pipeline P908. Key results of steady state OLGA simulations have been presented in sections below.

4.1.1 Summer Case without Tide

As described in section 4.1 above, for summer case without tide, P908 pipeline was modelled with air as ambient for entire length of onshore pipeline. Air temperature of 27°C was used in the model. To assess the impact of fluid (CO_2 rich fluid) temperature on surrounding soil, FEMTherm bundles were added at desired locations (refer to section 2.2).

Figure 4.1 presents the pressure and temperature profile over the length of onshore pipeline. An inlet pressure of 72.3 bara was observed for onshore pipe, while fluid temperature at end of onshore pipeline was noted as 47.7°C, based on 50°C inlet temperature.

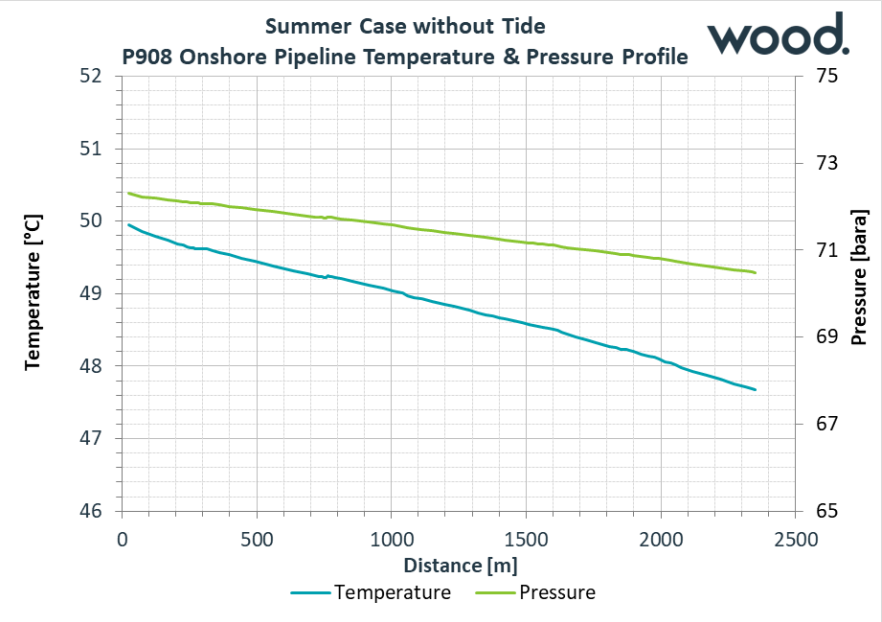


Figure 4.1: Pressure and Temperature Profile of P908 pipeline; Summer without Tide

Temperature trends were generated for various depths of soil in the FEMTherm analysis, i.e. at key locations impact of fluid temperature on soil layer just above it was trended in OLGA. Temperature of soil was recorded at surface, 0.1 m below the soil surface and 1 m below the soil surface. Figure 4.2, Figure 4.3 and Figure 4.4 illustrates the steady state temperature trend at various depths of soil for key locations. The distances shown in figures below is from the centre of pipe section anlaysed with FEMTherm bundle.

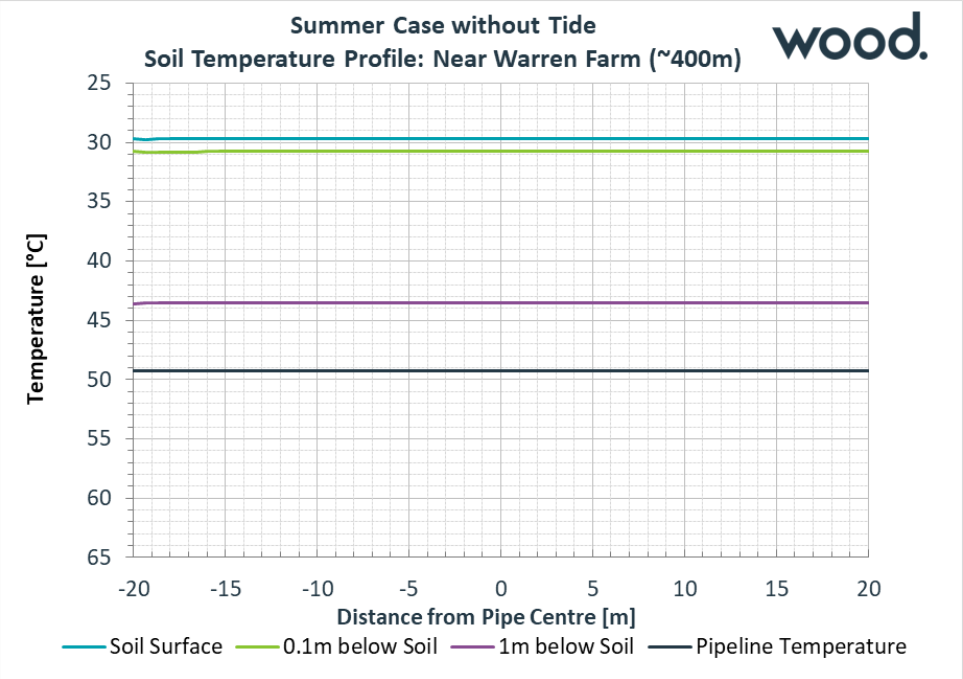


Figure 4.2: Soil temperature trend near Warren Farm; Summer without Tide

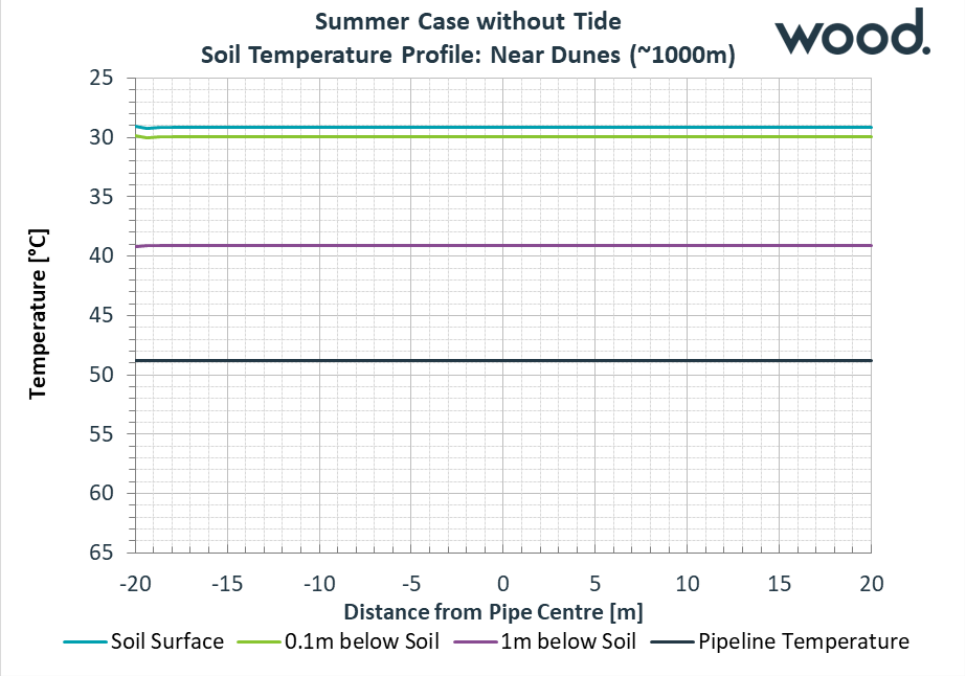


Figure 4.3: Soil temperature trend near Dunes; Summer without Tide

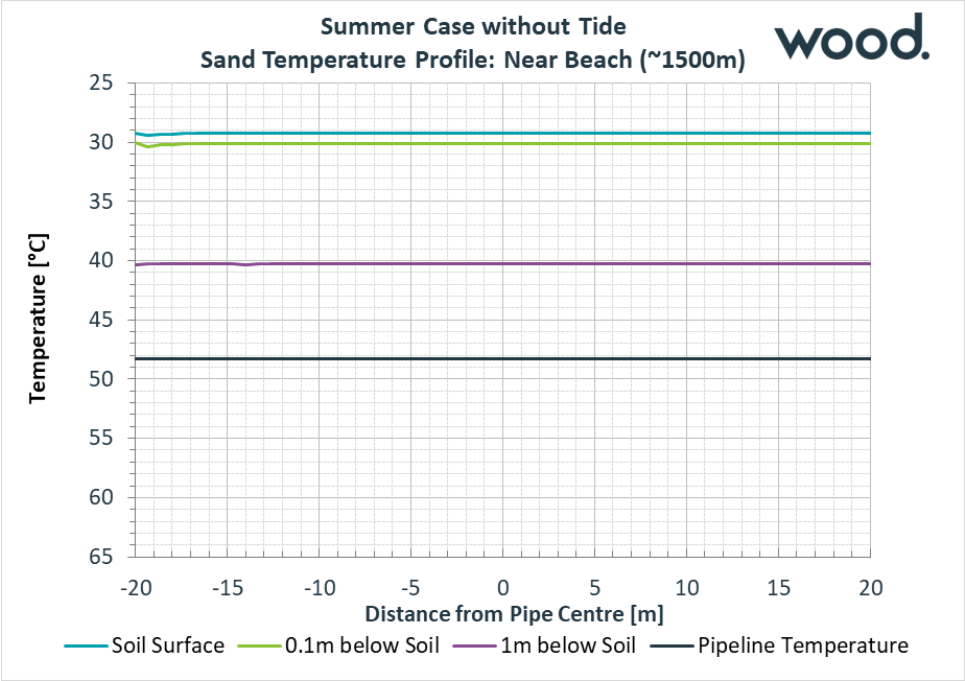


Figure 4.4: Soil temperature trend near Beach; Summer without Tide

It can be observed in Figure 4.2, Figure 4.3 and Figure 4.4, that there was a big difference in soil temperature (less than 30°C) near the surface and soil temperature (~ 40°C) close to pipeline. OLGA simulations resulted in soil surface temperature closure to ambient air temperature of 27°C and impact of hot pipeline was not found to be significant on surrounding soil and sand.

4.1.2 Summer Case with Tide

Summer case with tide was modelled with air as ambient up to the Dunes and with water over the sand after the Dunes, i.e. first 1650 m (including 250m piping above ground) of the onshore pipe was modelled with air, while rest of the pipe was modelled with water as ambient.

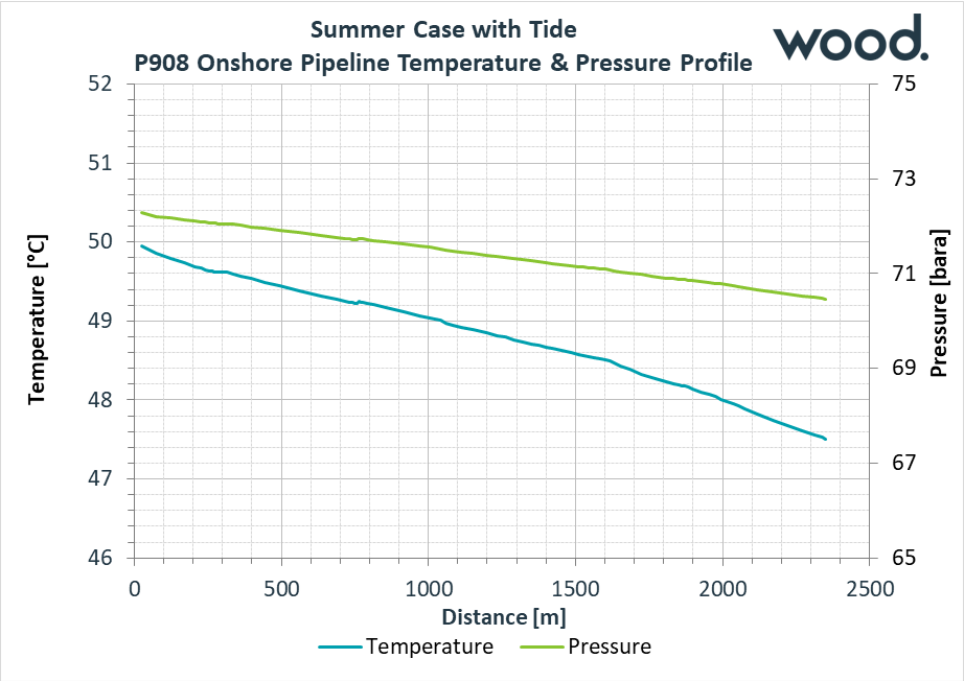


Figure 4.5: Pressure and Temperature Profile of P908 pipeline; Summer with Tide

An air temperature of 27°C and water temperature of 17°C was used for the case as per Table 2.3. It can be observed from Figure 4.5 that there is a slightly greater fall in fluid temperature inside the pipeline for last 700 m section (modelled with tide). However, the impact of tide on fluid temperature and pressure profile in the onshore pipeline was not significant when compared to the case without tide. The inlet pressure observed for the case with tide, was 72.3 bara and temperature at end of onshore pipeline was 47.5°C, which is 0.2°C lower than the case without tide.

As expected, there was negligible change in the soil temperature results for the location near Warren farm (Figure 4.6) and Dunes(Figure 4.7), when compared with previous case without tide. Figure 4.8 presents the trend of sand temperature near the beach and clear effect of sea water can be seen on the temperature of sand as much lower sand temperatures were observed when compared to previous case without tide. It was found that temperature of sand near the surface was very close to the sea water temperature and impact of hot fluid inside the pipeline was not significant.

Cases with and without tide were also performed with winter as ambient and similar trends were observed as for summer cases. Plots for winter cases have been presented in the APPENDIX 7.1.

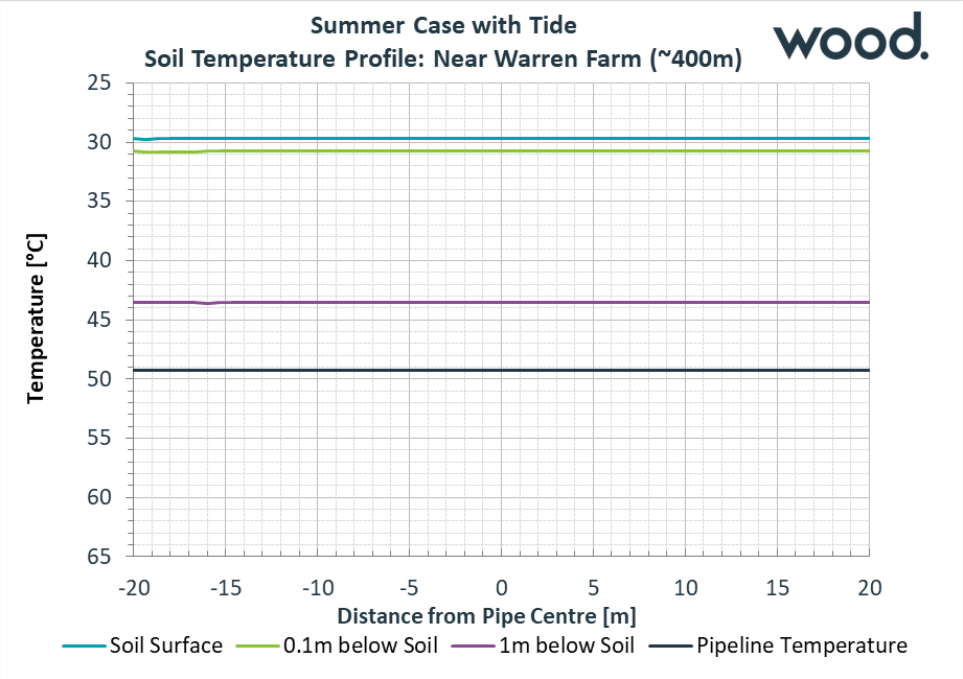


Figure 4.6: Soil temperature trend near Warren Farm; Summer with Tide

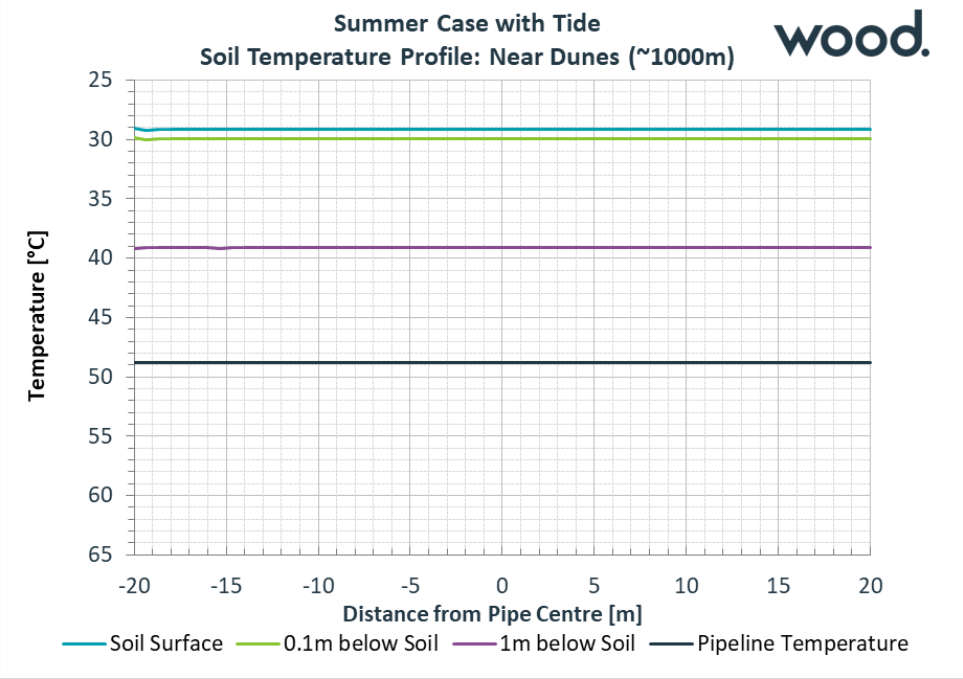


Figure 4.7: Soil temperature trend near Dunes; Summer with Tide

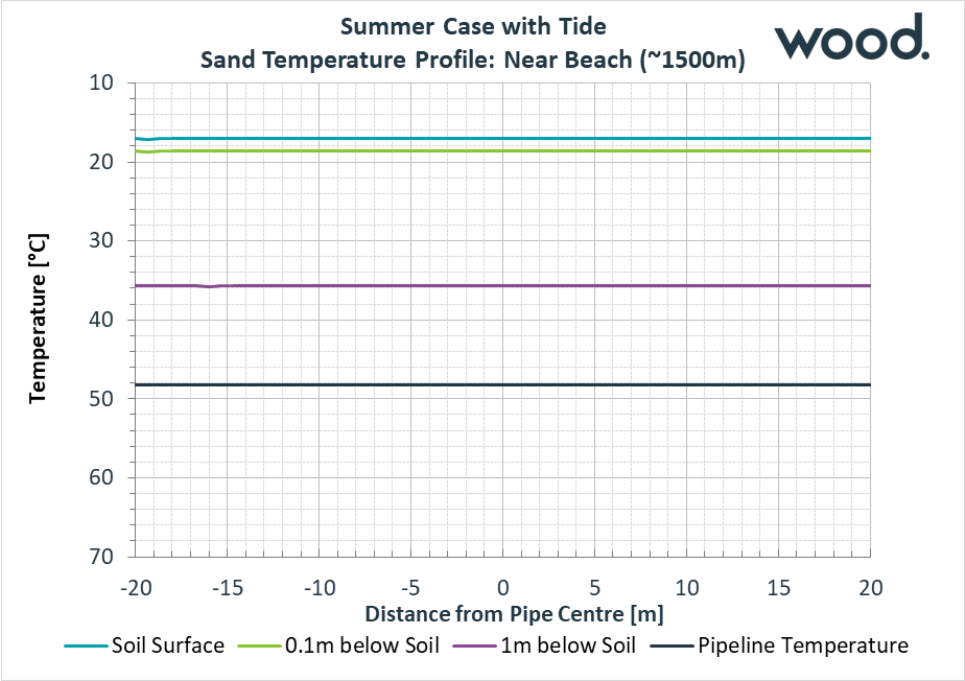


Figure 4.8: Soil temperature trend near Beach; Summer with Tide

4.2 OLGA FEMTherm Results Summary: Base Case

The key findings of OLGA FEMTherm analysis have been presented in Table 4.1. The results from OLGA study were further used to develop CFD models for detailed assessment of the impact of hot fluid temperature inside the onshore pipeline on ambient.

It can be observed in Table 4.1 that temperature near soil surface is warmer at beach when compared to Dunes, for cases without tide, which is due to higher conductivity of wet sand (2.5 W/m-K) as compared to lower conductivity of onshore soil (1.3 W/m-K). Temperature at sand surface near the beach was significantly lower when impact of tide was considered in the simulation.

Table 4.1: OLGA FEMTherm Steady State Results– Pipeline Inlet of 50°C

S.No.	Case	Tide	Location	Fluid Temperature	Temperature of Soil/Sand 1m below surface	Temperature of Soil/Sand 0.1m below surface
				°C	°C	°C
1	Summer	No	Warren Farm	49.3	43.6	30.8
			Dunes	48.8	39.0	29.9
			Beach	48.3	40.2	30.1
2	Summer	Yes	Warren Farm	49.3	43.6	30.8
			Dunes	48.8	39.0	29.9
			Beach	48.3	35.6	18.6
3	Winter	No	Warren Farm	48.9	37.3	10.6
			Dunes	48.3	28.4	8.8
			Beach	47.6	30.8	9.3
4	Winter	Yes	Warren Farm	48.9	37.3	10.6
			Dunes	48.3	28.4	8.8
			Beach	47.6	29.6	5.3

4.3 OLGA FEMTherm Results Summary: Sensitivity at 60°C

A sensitivity was also performed in OLGA to analyse the impact of higher fluid inlet temperature of 60°C, similar FEMTherm approach was applied to sensitivity cases, and key results obtained are summarised in Table 4.2 below.

Table 4.2: OLGA FEMTherm Steady State Results – Pipeline Inlet of 60°C

S.No.	Case	Tide	Location	Fluid Temperature	Temperature of Soil/Sand 1m below surface	Temperature of Soil/Sand 0.1m below surface
				°C	°C	°C
1	Summer	No	Warren Farm	59.1	50.9	32.5
			Dunes	58.4	44.5	31.3
			Beach	57.8	46.2	31.6
2	Summer	Yes	Warren Farm	59.1	50.9	32.5
			Dunes	58.4	44.5	31.3
			Beach	57.8	41.3	19.1
3	Winter	No	Warren Farm	58.7	44.5	12.2
			Dunes	57.8	33.7	10.1
			Beach	57	36.8	10.8
4	Winter	Yes	Warren Farm	58.7	44.5	12.2
			Dunes	57.8	33.7	10.1
			Beach	57	35.1	5.7

4.4 CFD Results

4.4.1 Base Case Results

Further analysis was carried out in CFD to analyse the impact on ambient air and sea water temperature, CFD offers more possibilities of refinement of the model when compared to FEMTherm approach, which allows a more accurate solution.

Two sections have been selected for the detailed CFD analysis, one for the warren farm with a burial depth of 1,19 m and one for the tidal area with a burial depth of 1.35 m. It should be noted that all the CFD simulations in the tidal area were carried out without the presence of water i.e. air only.

For the warren farm location, the soil thermal conductivity was assumed at 1.3 W/m-K while it was assumed at 2.5 W/m-K for the tidal area.

The fluid temperature was taken from the OLGA modelling,

Table 4.3: CFD Cases

S.No.	Case	Location	Fluid Temperature
			°C
1	Summer	Warren Farm	49.3
2	Winter	Warren Farm	48.9
3	Summer	Beach	48.3
4	Winter	Beach	47.6

Figure 4.9 to Figure 4.11 show the temperature profile across the computational domain and at different levels above and below ground. The soil temperature presented was the reference temperature from Table 2.3 used as far field boundary conditions for the simulations. The figures also provide a comparison with the undisturbed profile respectively for the warren farm summer case. Due to the natural convection happening in the atmosphere, the profile of temperature was always fluctuating. However, the results indicated that a temperature up to 13°C above the expected temperature could be observed on the ground immediately above the pipe. The results also indicated that 0.5 m, no significant effect could be observed.

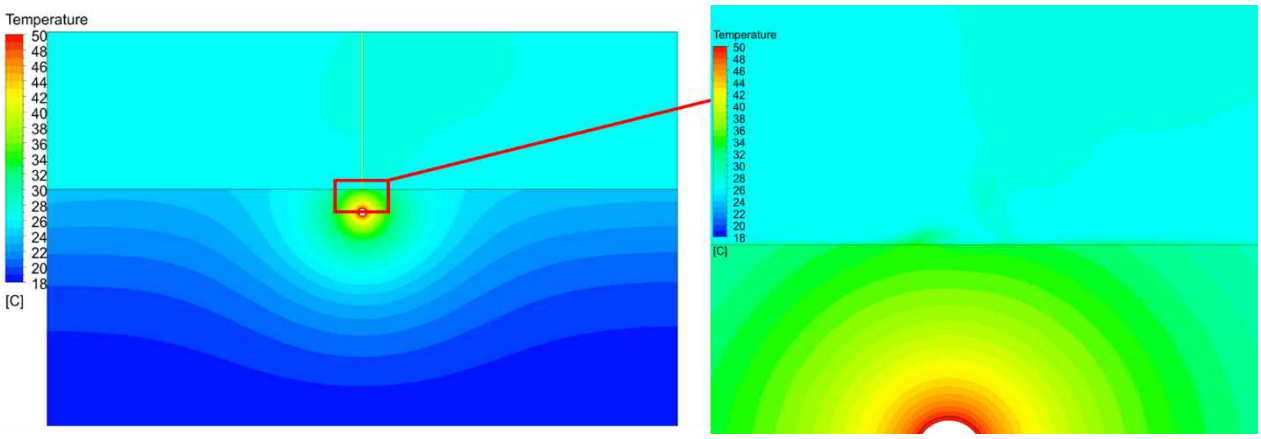


Figure 4.9: Soil and Atmosphere Temperature Contour Plots – Warren Farm – Summer

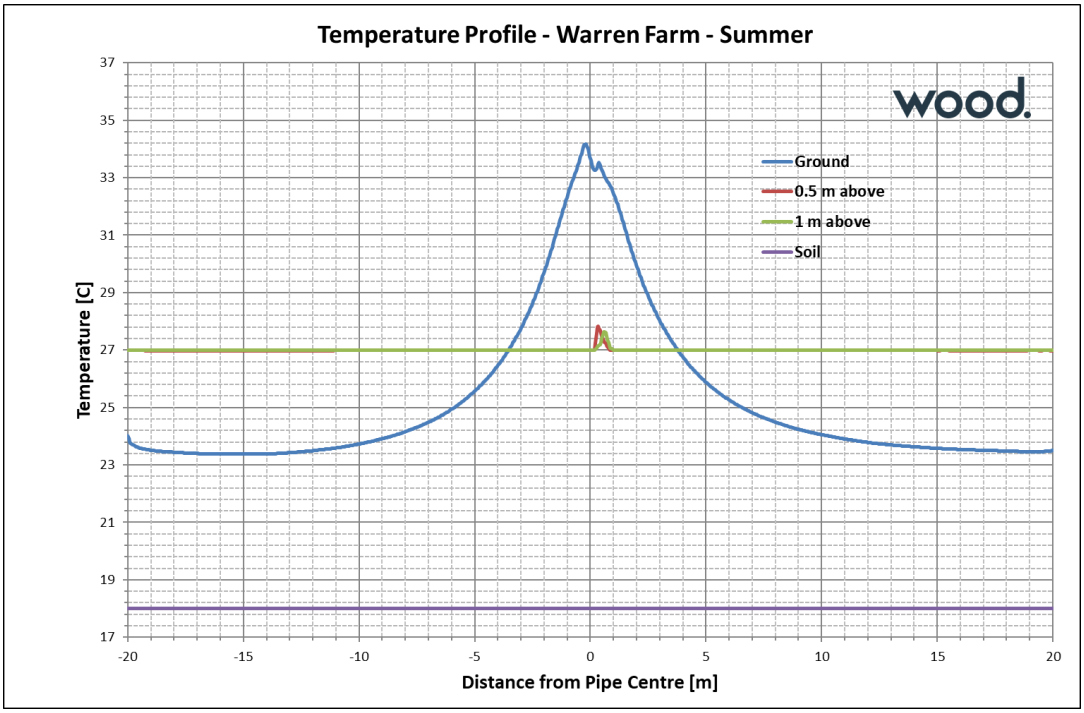


Figure 4.10: Soil and Atmosphere Temperature Profile – Warren Farm - Summer

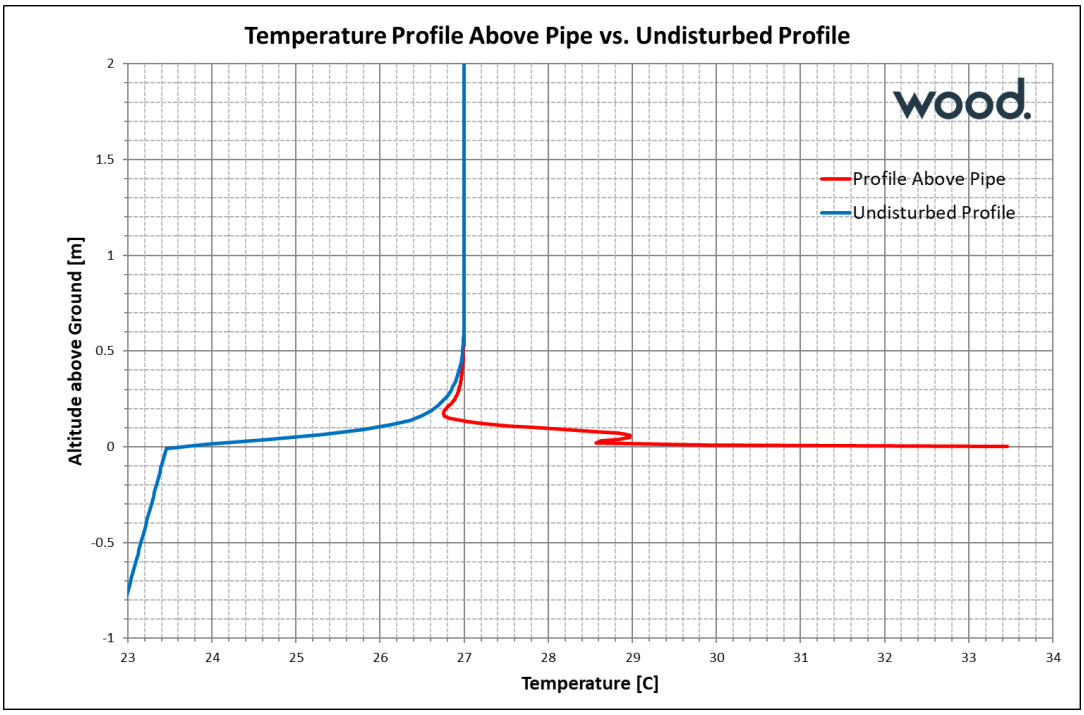


Figure 4.11: Soil and Atmosphere Temperature Vertical Profile – Warren Farm - Summer

Figure 4.12 to Figure 4.14 show the temperature profile across the computational domain and at different levels above and below ground. The soil temperature presented was the reference temperature from Table 2.3 used as far field boundary conditions for the simulations. The figures also provide a comparison with the undisturbed profile respectively for the warren farm winter case. Similar results as described for the summer case, a temperature up to 13°C above the expected temperature could be observed on the ground immediately above the pipe. The results also indicated that 0.5 m, no significant effect could be observed.

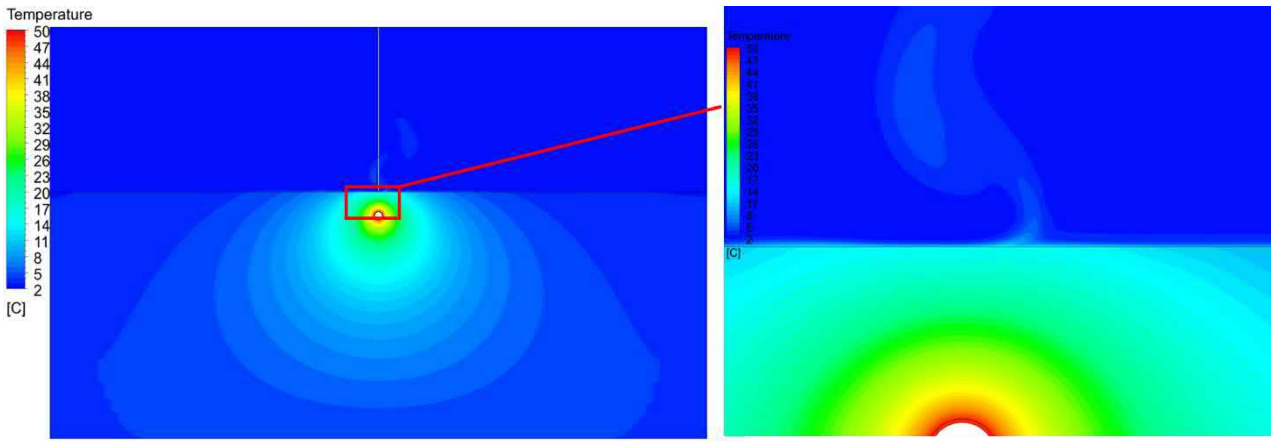


Figure 4.12: Soil and Atmosphere temperature Contour Plots – Warren Farm - Winter

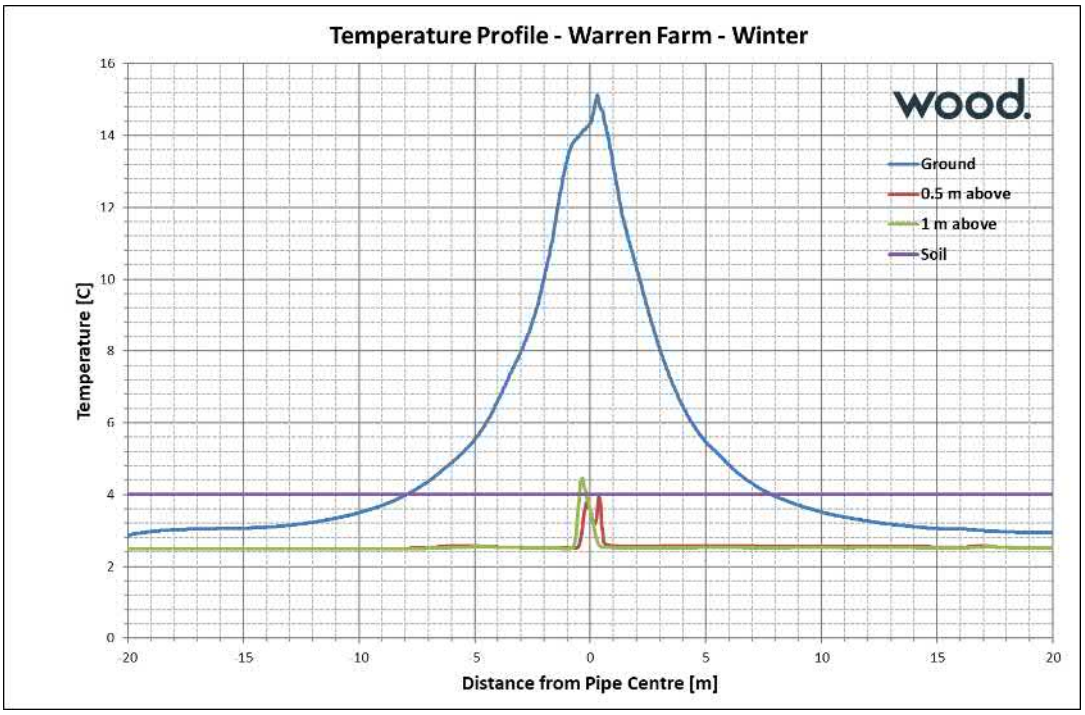


Figure 4.13: Soil and Atmosphere Temperature Profile – Warren Farm - Winter

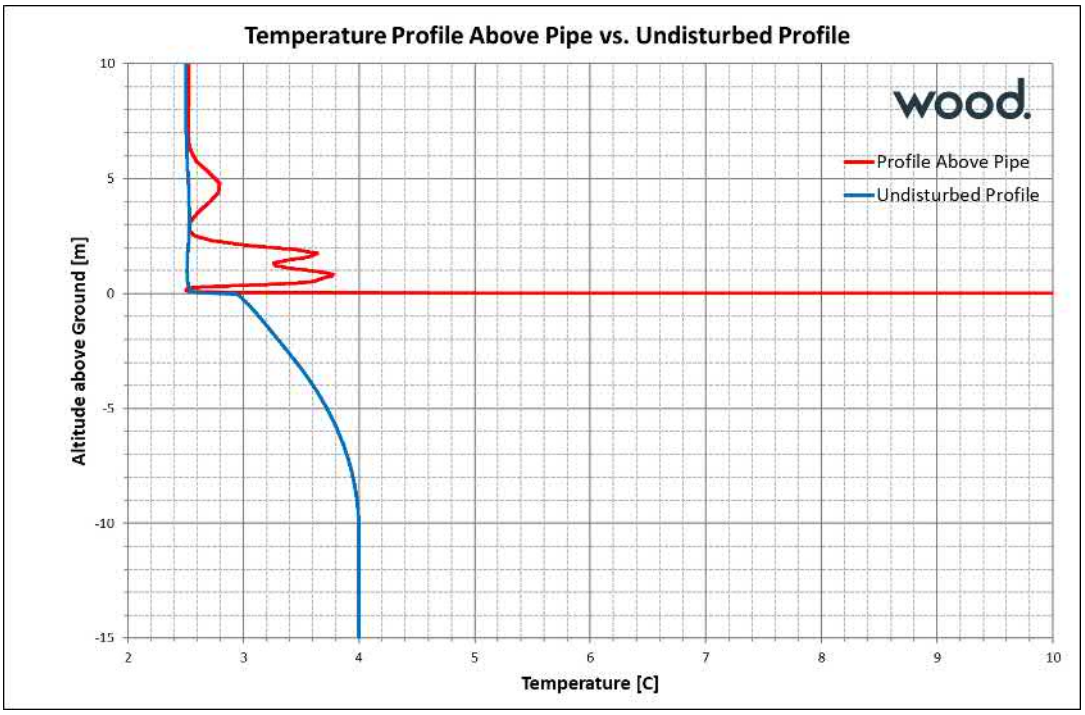


Figure 4.14: Soil and Atmosphere Temperature Vertical Profile – Warren Farm - Winter

Figure 4.15 to Figure 4.17 show the temperature profile across the computational domain and at different levels above and below ground. The figures also provide a comparison with the undisturbed profile respectively for the tidal area summer case. Although the fluid temperature was lower than for the warren farm case and the pipe n=burial deeper, the soil temperature was higher due to the higher thermal conductivity of the sand. The peak

soil temperature was observed to be 3°C higher.

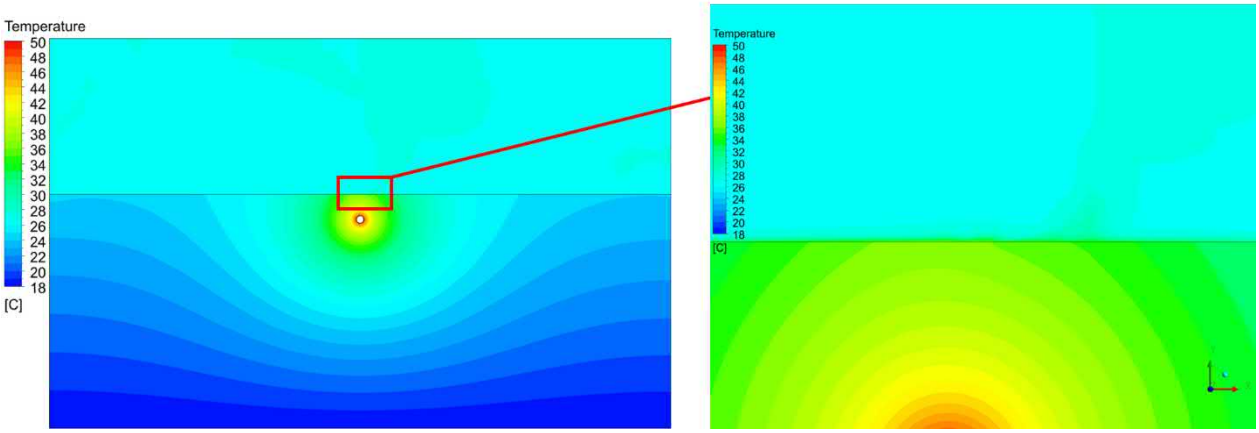


Figure 4.15: Soil and Atmosphere temperature Contour Plots – Near Beach - Summer

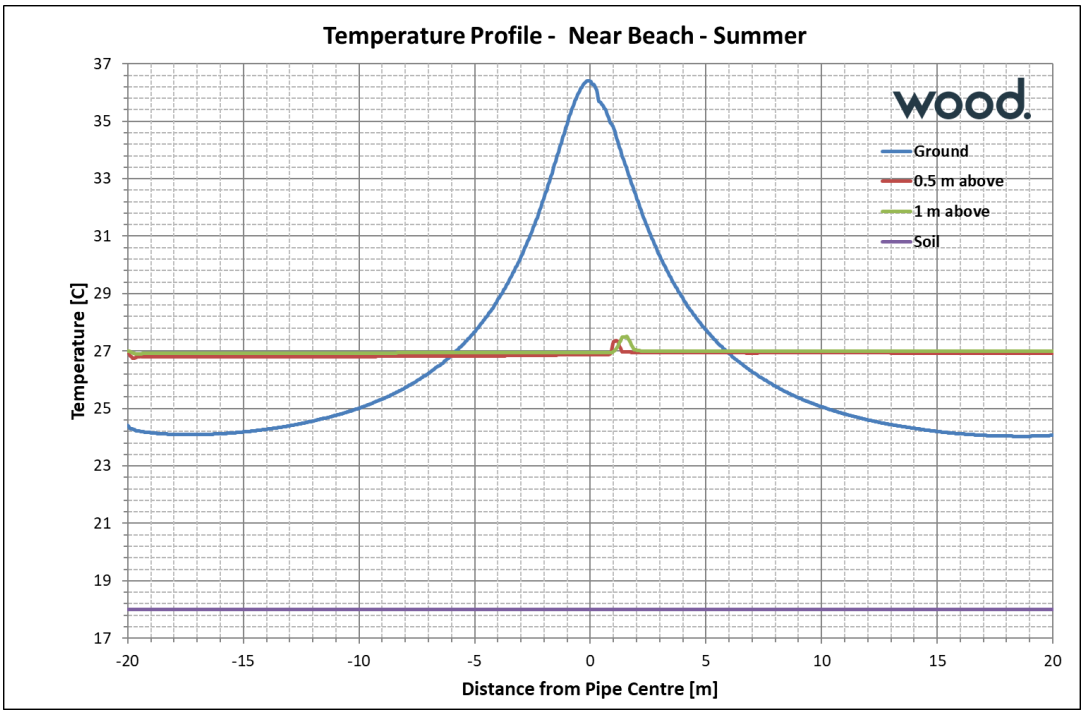


Figure 4.16: Soil and Atmosphere Temperature Profile – Near Beach - Summer

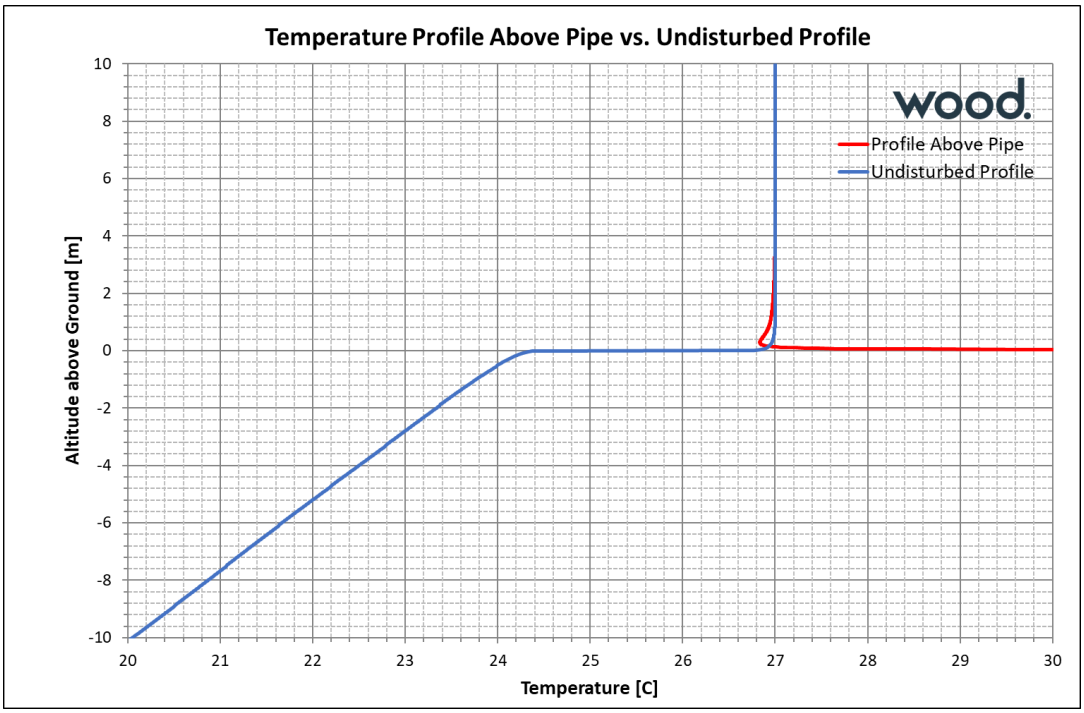


Figure 4.17: Soil and Atmosphere Temperature Vertical Profile – Near Beach - Summer

Figure 4.18 to Figure 4.20 show the temperature profile across the computational domain and at different levels above and below ground. The figures also provide a comparison with the undisturbed profile respectively for the tidal area winter case. Similar conclusions as for the summer case, the ground temperature was observed 3°C higher compared to the warren farm case despite the lower fluid temperature and higher burial depth.

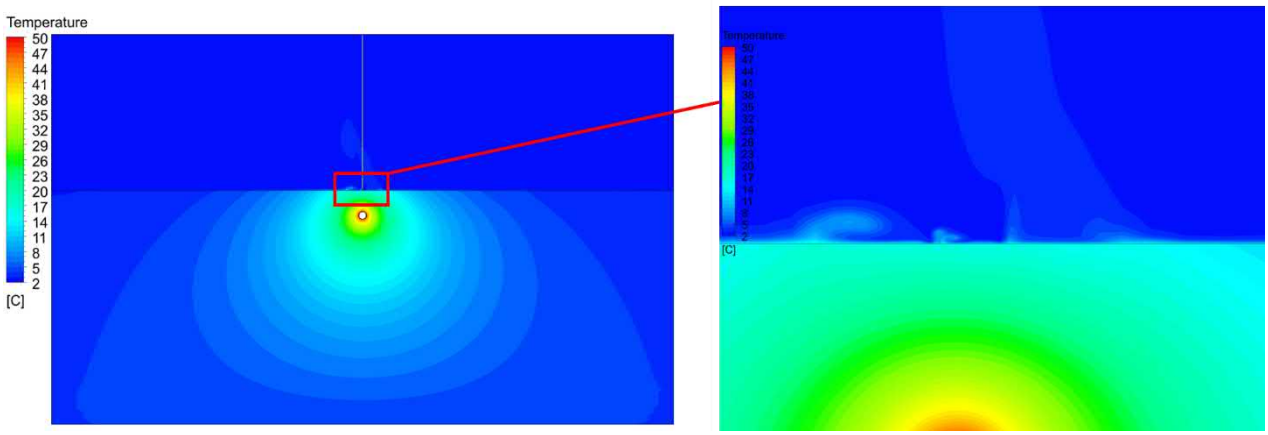


Figure 4.18: Soil and Atmosphere temperature Contour Plots – Near Beach - Winter

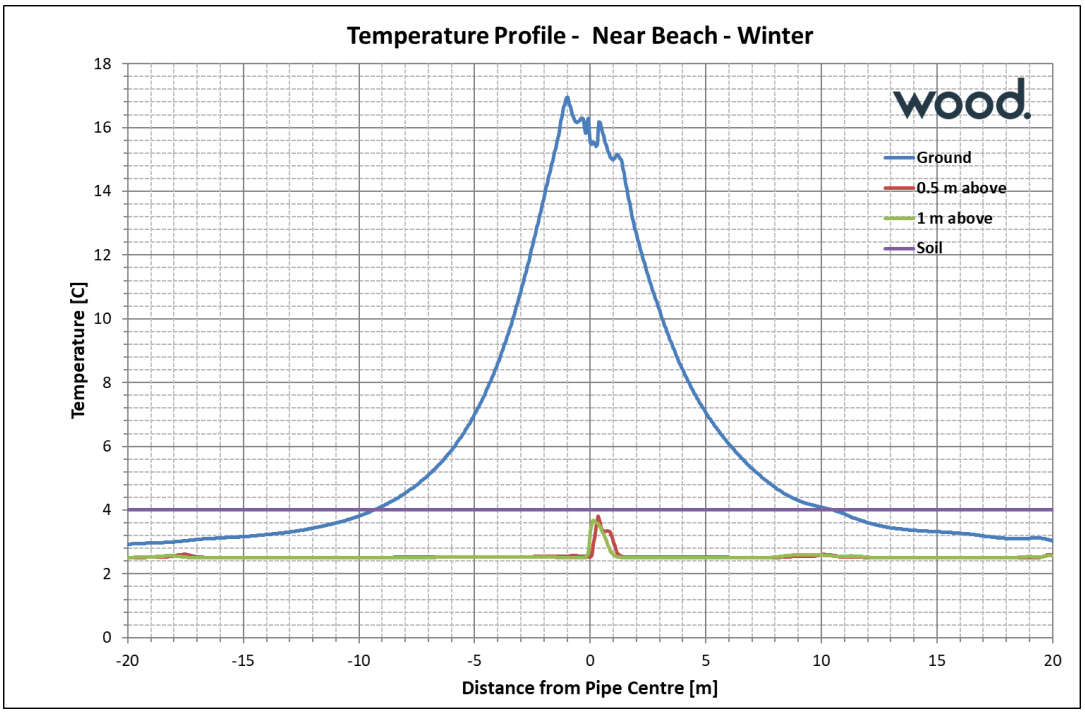


Figure 4.19: Soil and Atmosphere temperature Contour Plots – Near beach - Winter

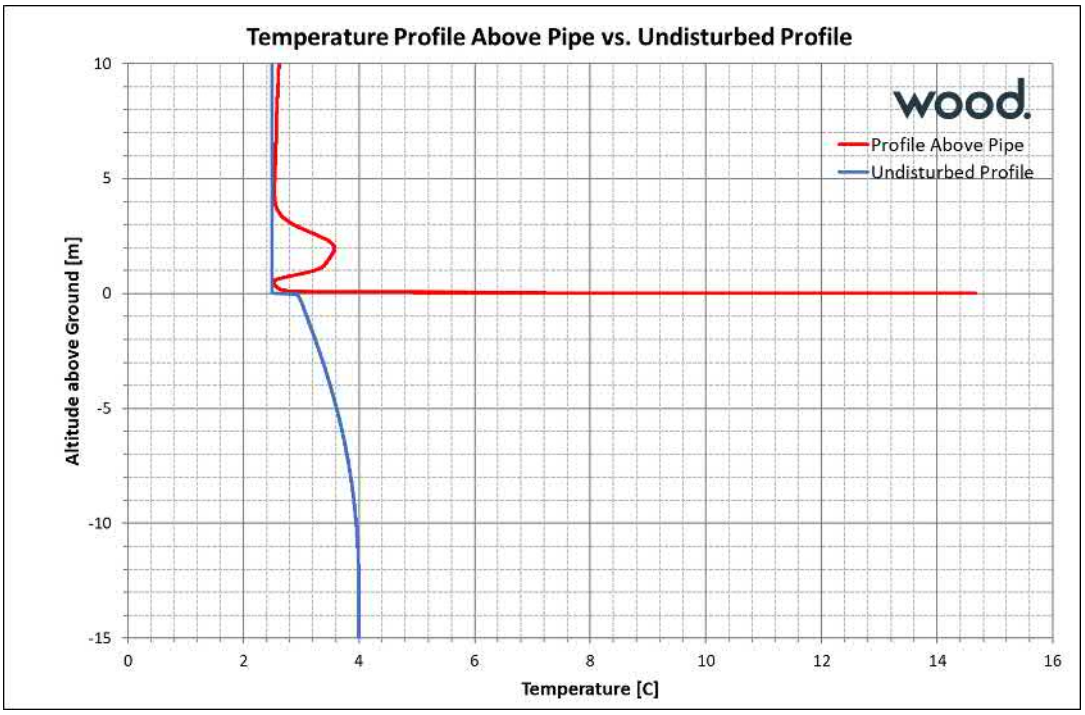


Figure 4.20: Soil and Atmosphere Temperature Vertical Profile – Near beach - Winter

4.4.2 Sensitivity at 60°C

This section focuses on the CFD results for the sensitivity case for the initial fluid temperature at 60°C.

In addition of the 2 sections previously considered, a third section representing the dune area has been considered in this phase of the work. Based on the dune profile provided and shown in Figure 4.21 a 3D model of the 200 m profile circled in red was built and shown in Figure 4.22.

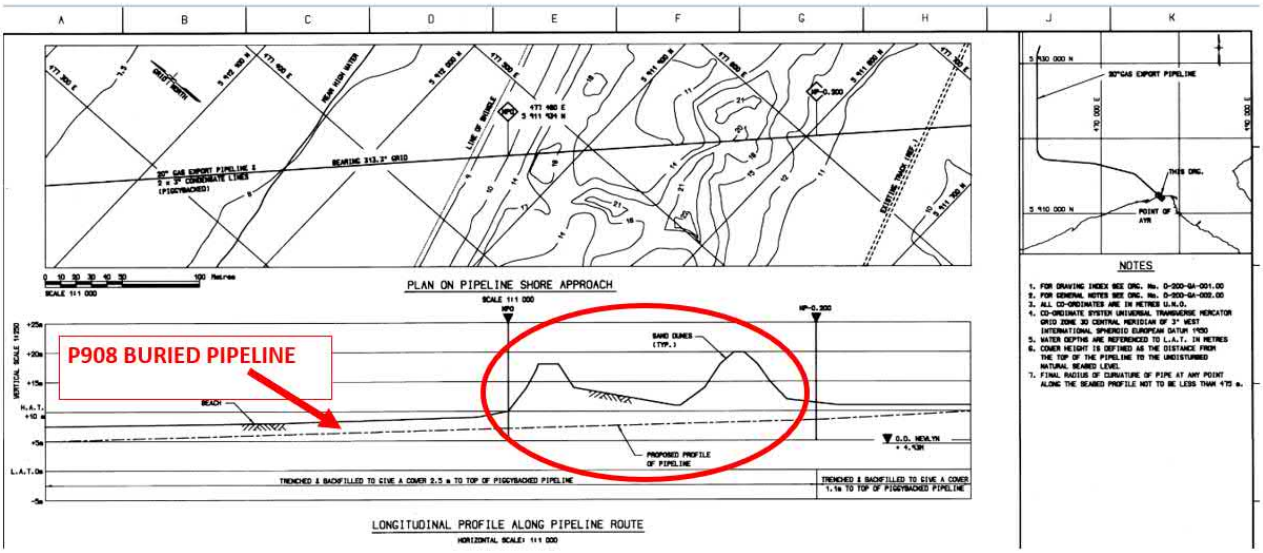


Figure 4.21: Dune Profile

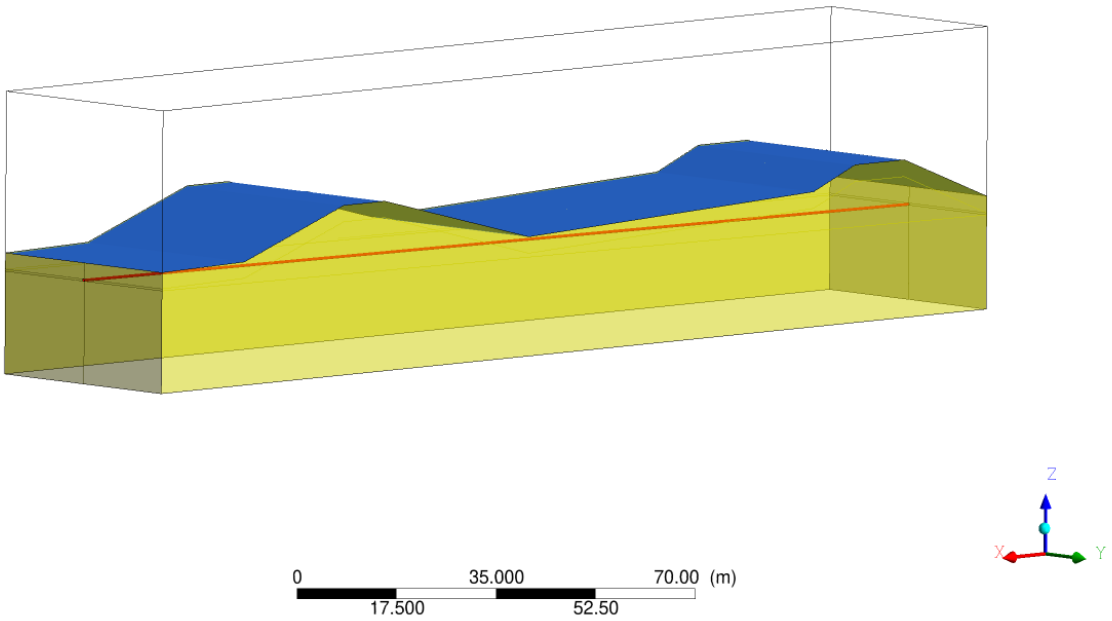


Figure 4.22: Dune CFD Model

For the warren farm location, the soil thermal conductivity was assumed at 1.3 W/m-K while it was assumed at 2.5 W/m-K for the tidal and dune area.

The fluid temperature was taken from the OLGA modelling,

Table 4.4: CFD Cases

S.No.	Case	Location	Fluid Temperature
			°C
1	Summer	Warren Farm	59.1
2	Winter	Warren Farm	58.7
3	Summer	Beach	57.8
4	Winter	Beach	57.0
5	Summer	Dunes	58.4
6	Winter	Dunes	57.8

Figure 4.23 to Figure 4.34 show the results of the CFD analysis for the Warren farm and the beach area in a similar format as per the previous section.

The conclusions are similar in terms of overall behaviour, but the soil temperature increased significantly due to the higher fluid temperature. For none of the scenarios considered, the temperature at 0.5 m or 1 m above the ground was affected by the presence of the pipe.

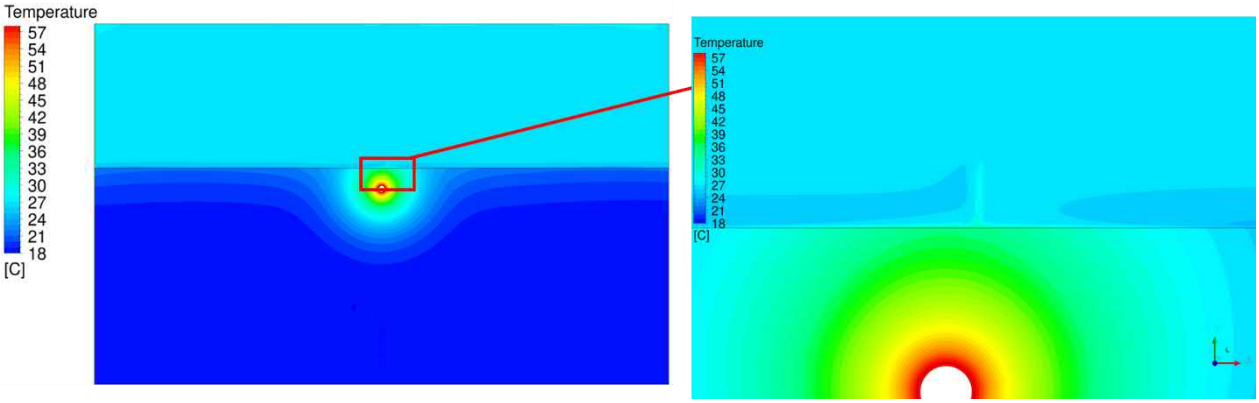


Figure 4.23: Soil and Atmosphere Temperature Contour Plots – Warren Farm - Summer

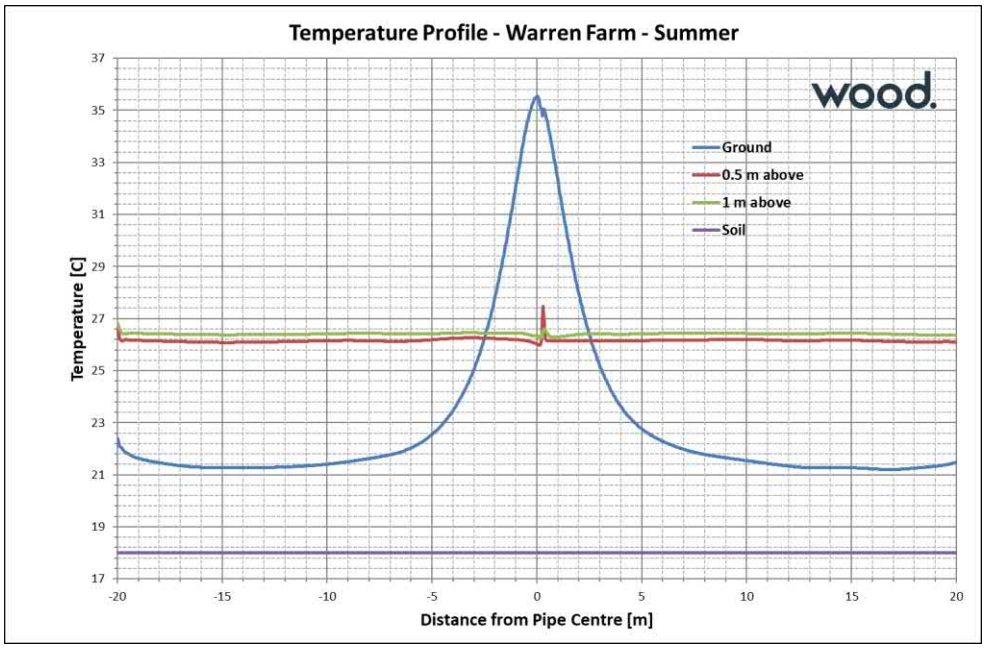


Figure 4.24: Soil and Atmosphere Temperature Profile – Warren Farm - Summer

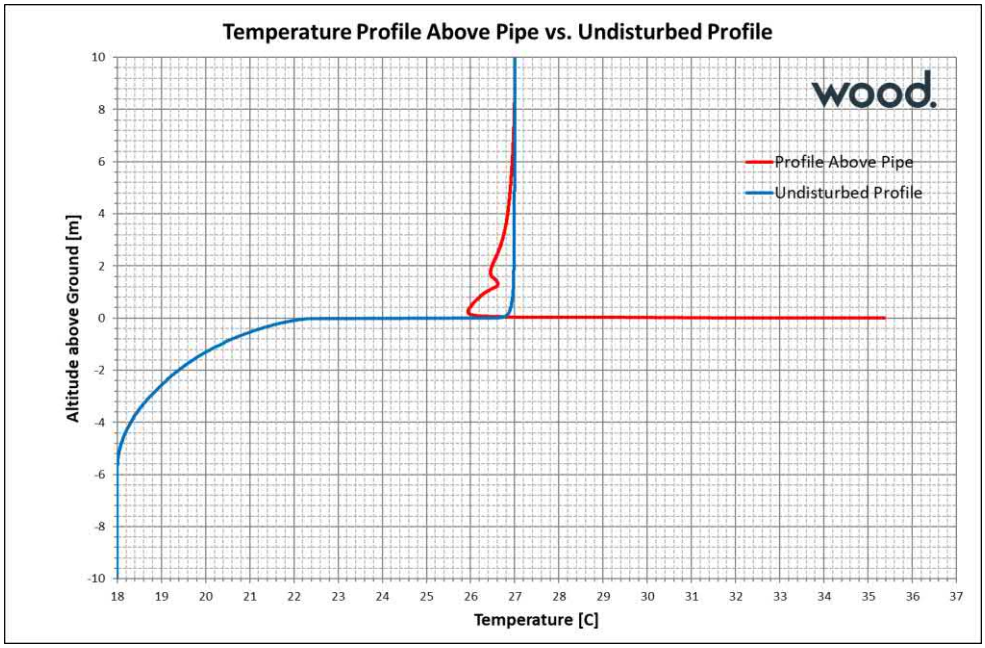


Figure 4.25: Soil and Atmosphere Temperature Vertical Profile – Warren Farm - Summer

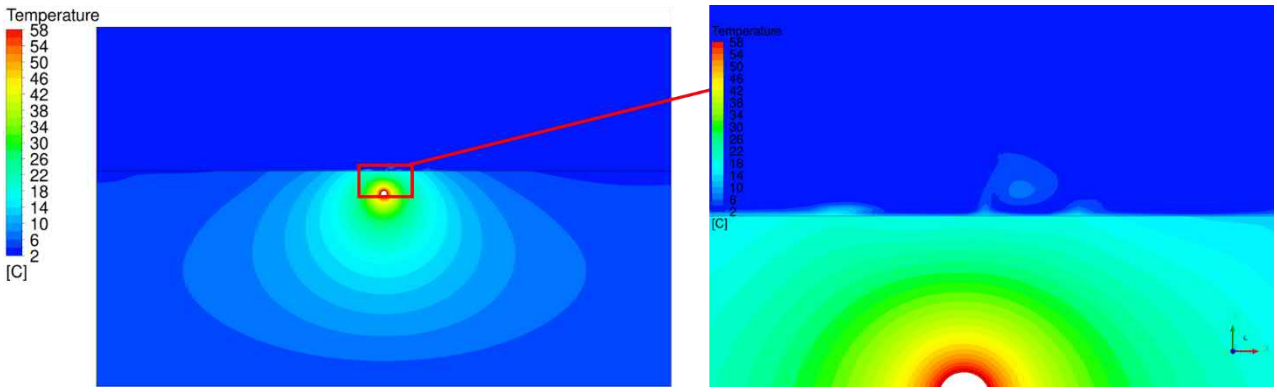


Figure 4.26: Soil and Atmosphere Temperature Contour Plots – Warren Farm - Winter

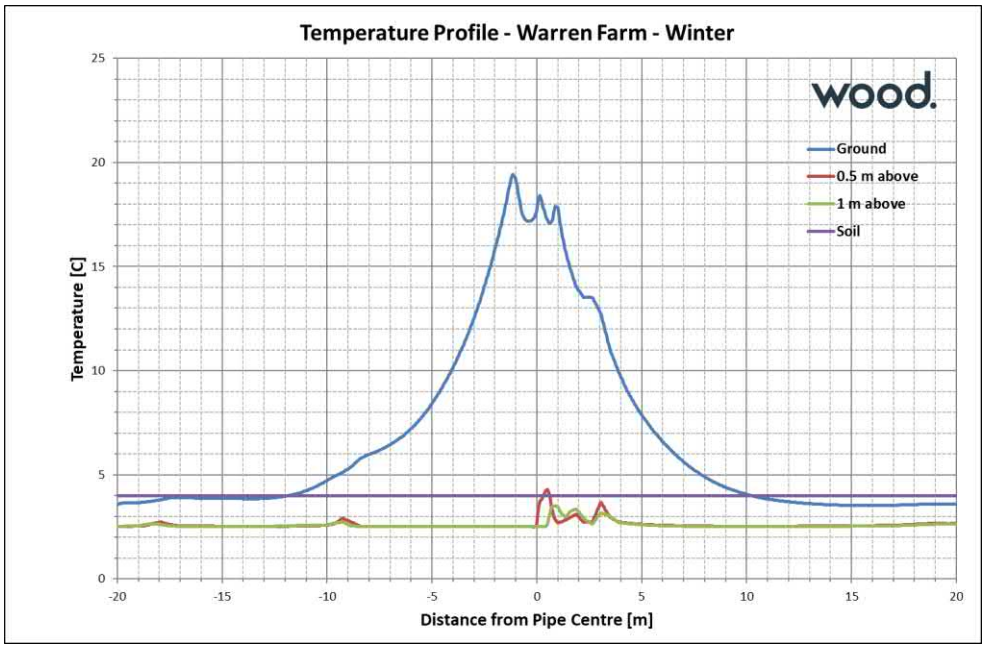


Figure 4.27: Soil and Atmosphere Temperature Profile – Warren Farm - Winter

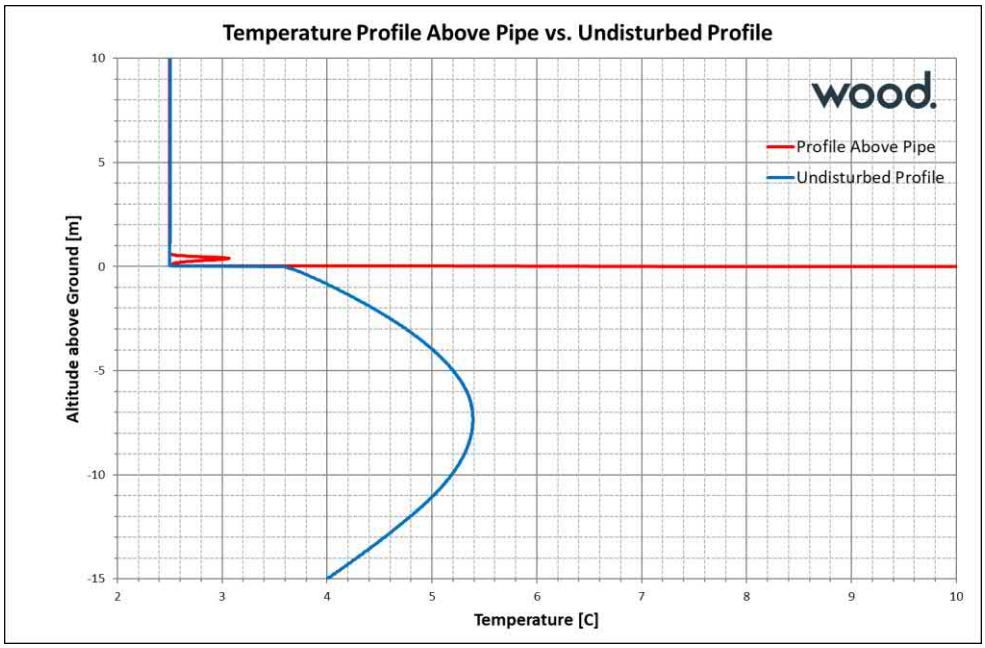


Figure 4.28: Soil and Atmosphere Temperature Vertical Profile – Warren Farm - Winter

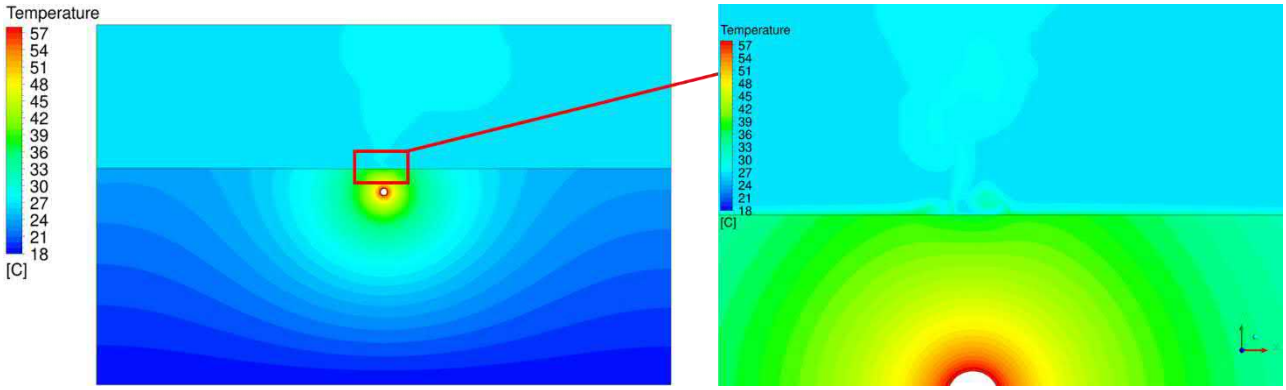


Figure 4.29: Soil and Atmosphere Temperature Contour Plots – Near Beach - Summer

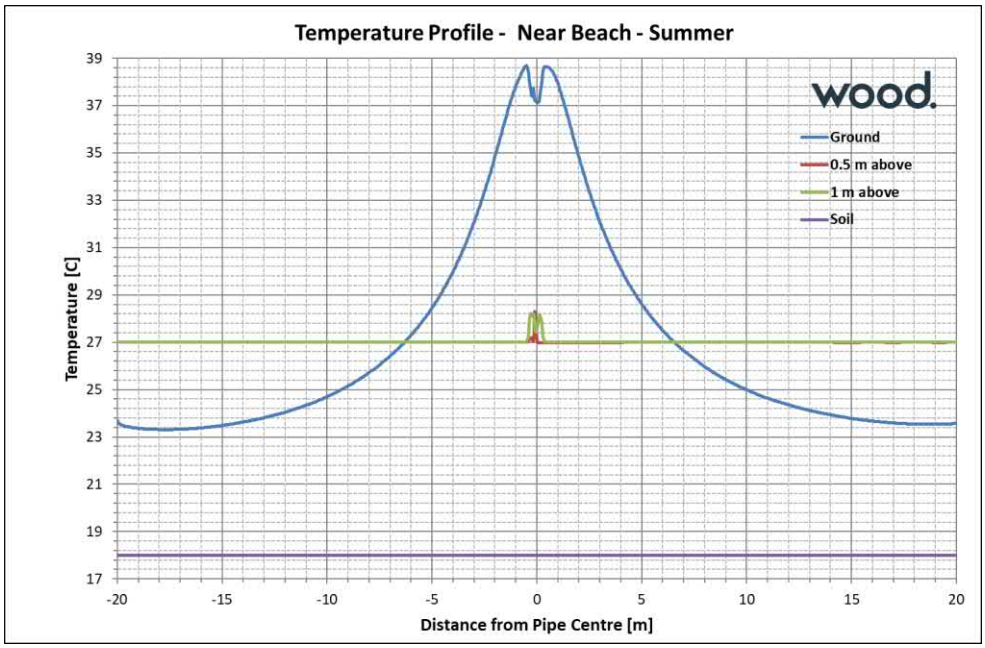


Figure 4.30: Soil and Atmosphere Temperature Profile – Near Beach - Summer

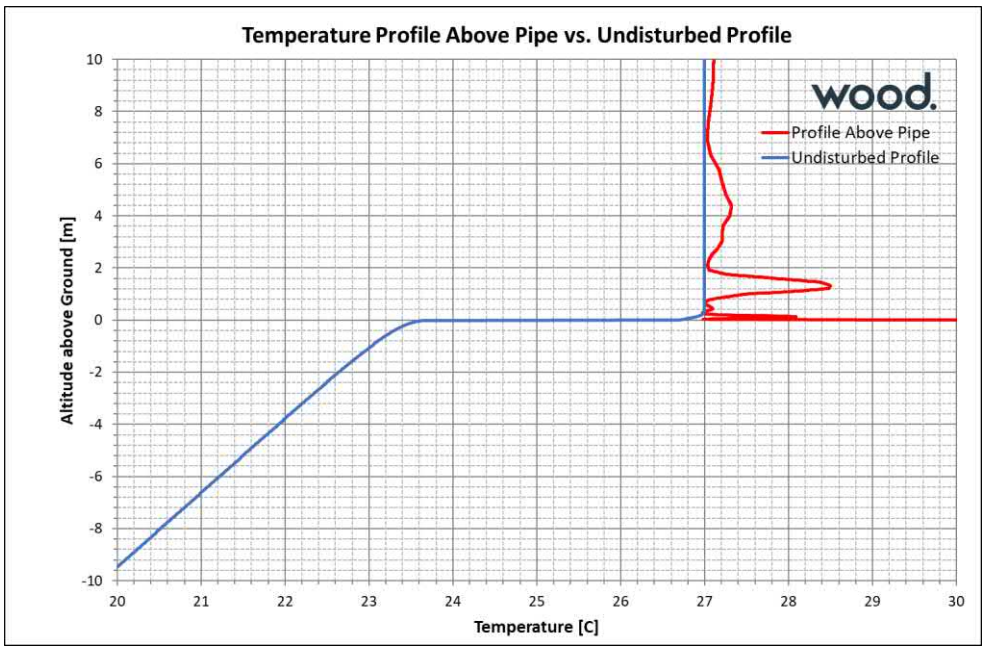


Figure 4.31: Soil and Atmosphere Temperature Vertical Profile – Near Beach - Summer

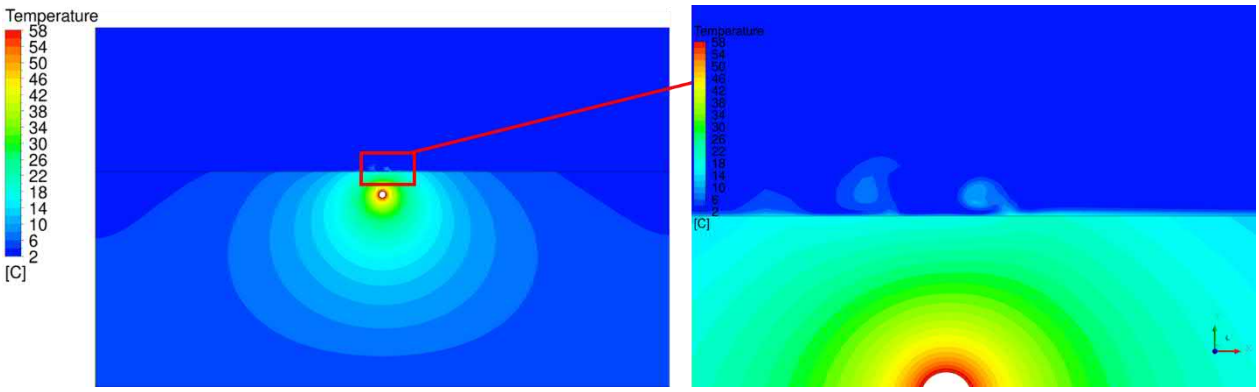


Figure 4.32: Soil and Atmosphere Temperature Contour Plots – Near Beach - Winter

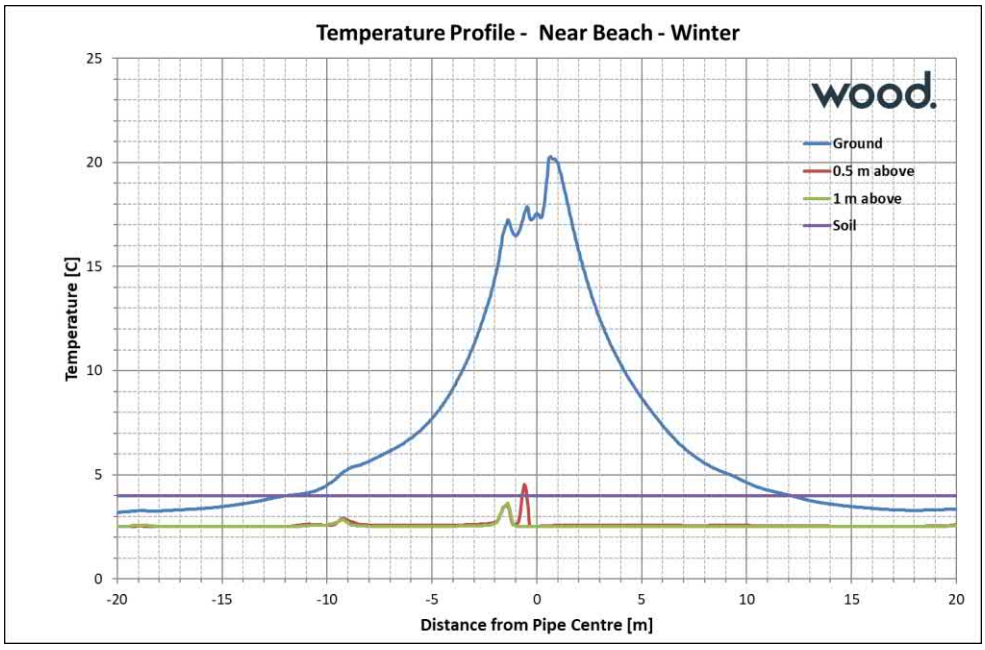


Figure 4.33: Soil and Atmosphere Temperature Profile – Near Beach - Winter

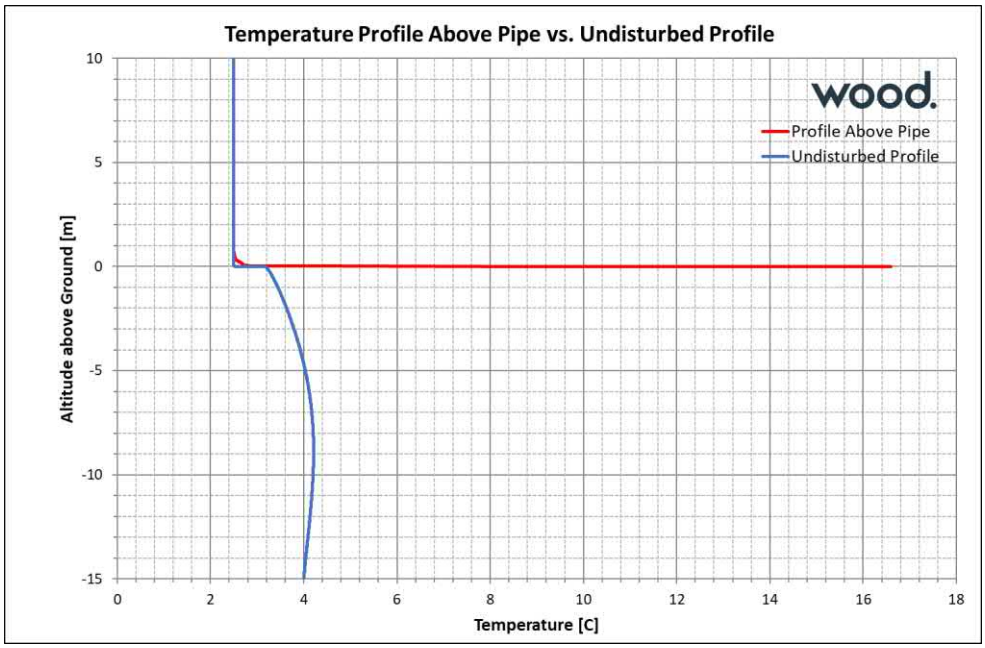


Figure 4.34: Soil and Atmosphere Temperature Vertical Profile – Near Beach - Winter

Figure 4.35 to Figure 4.40 show the temperature profiles of the dune area for summer and winter conditions.

Due to the increased soil layer above the pipe, the effect on the warm pipe in terms of ground temperature was minimal compared to the other locations with a ground temperature only 2°C above ambient for the summer conditions and 5°C above ambient for the winter conditions.

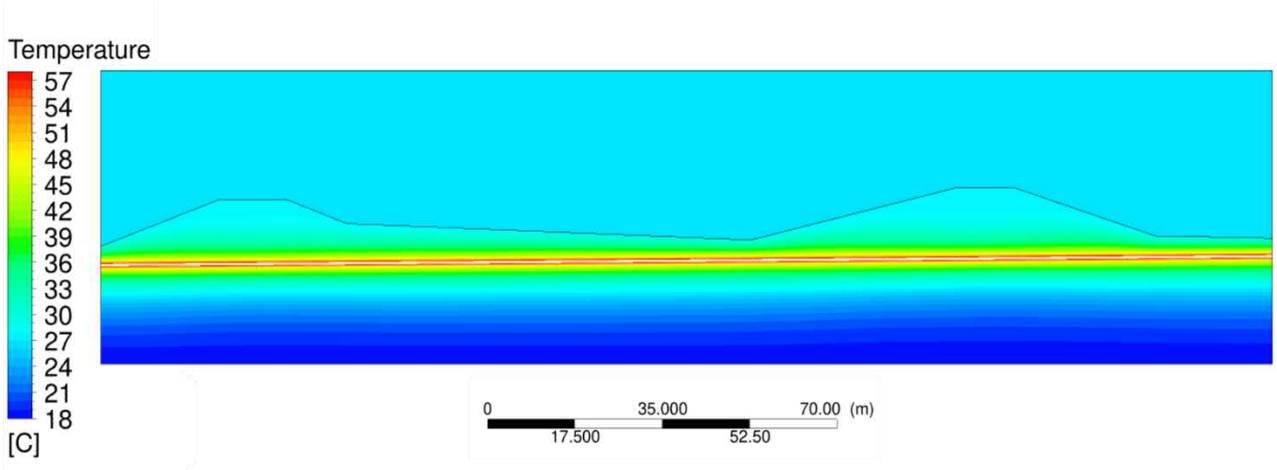


Figure 4.35: Soil and Atmosphere Temperature Contour Plots – Dunes - Summer

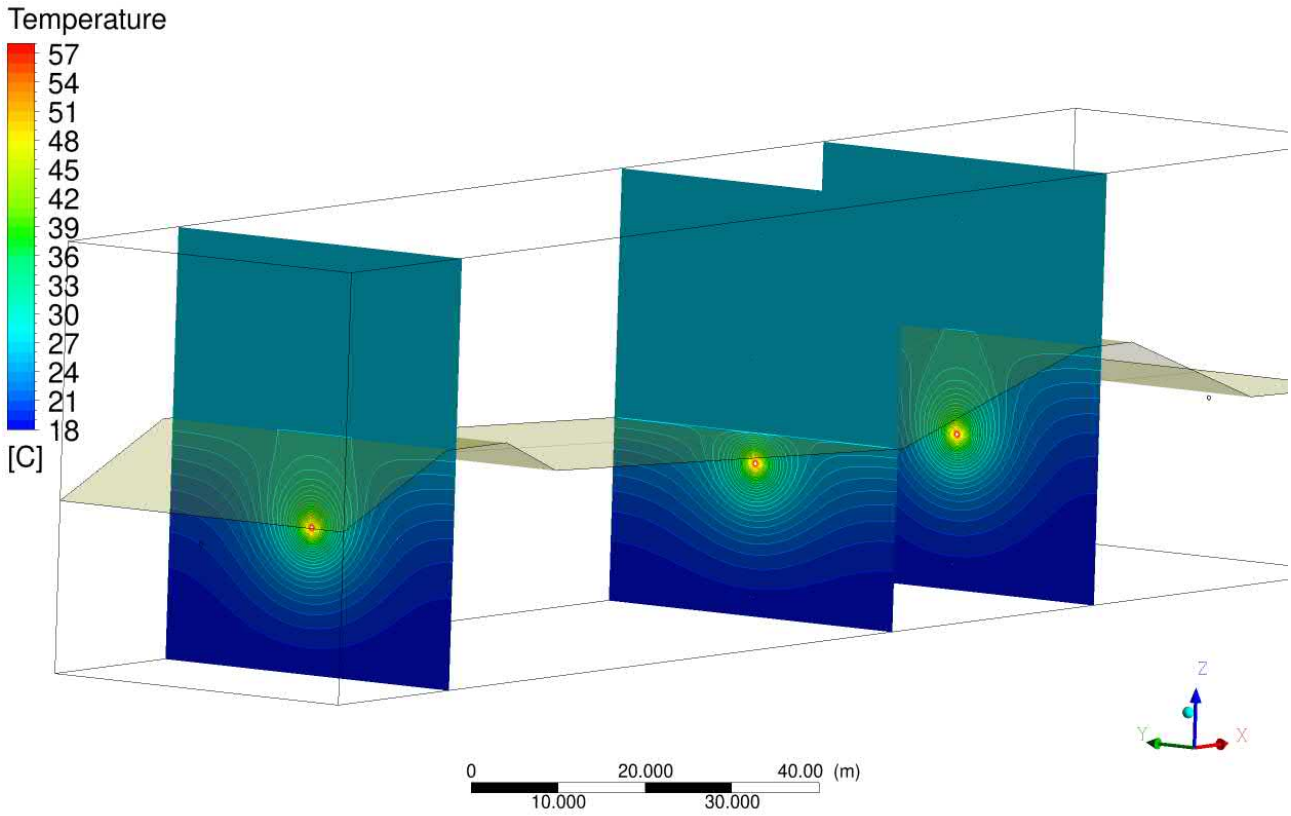


Figure 4.36: Soil and Atmosphere Temperature Vertical Contour Plots – Dunes - Summer

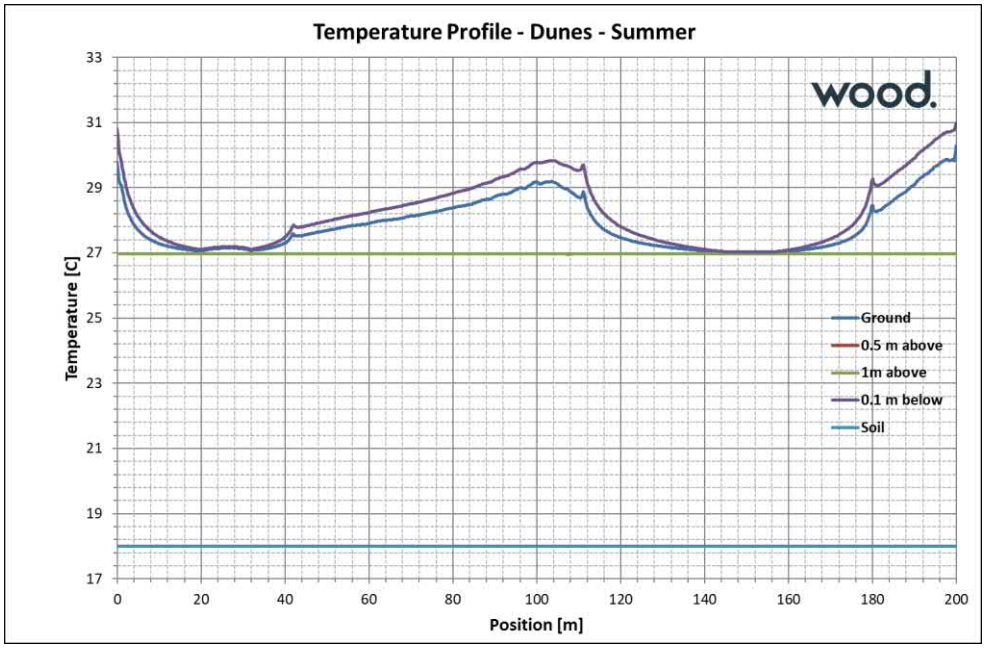


Figure 4.37: Soil and Atmosphere Temperature Profile – Dunes – Summer

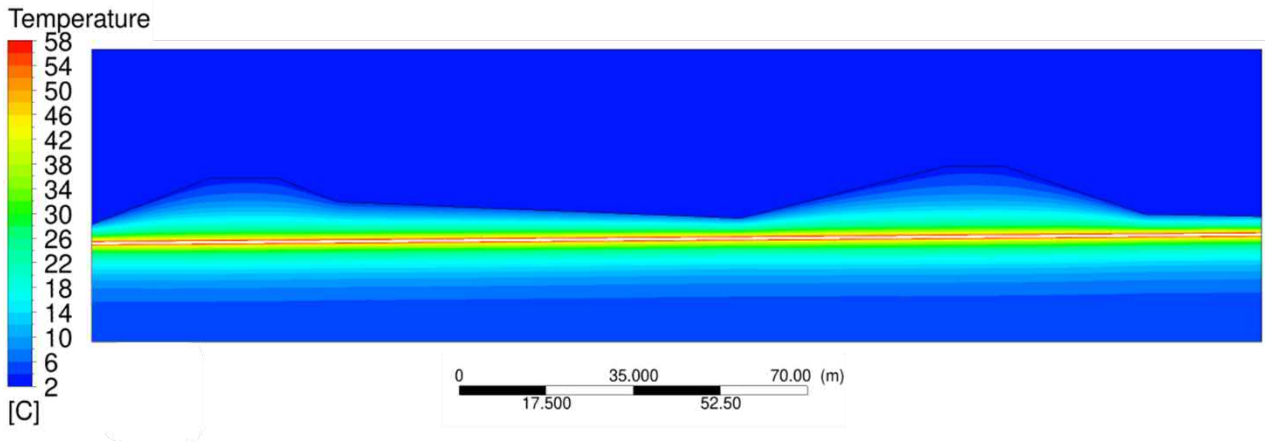


Figure 4.38: Soil and Atmosphere Temperature Contour Plots – Dunes - Winter

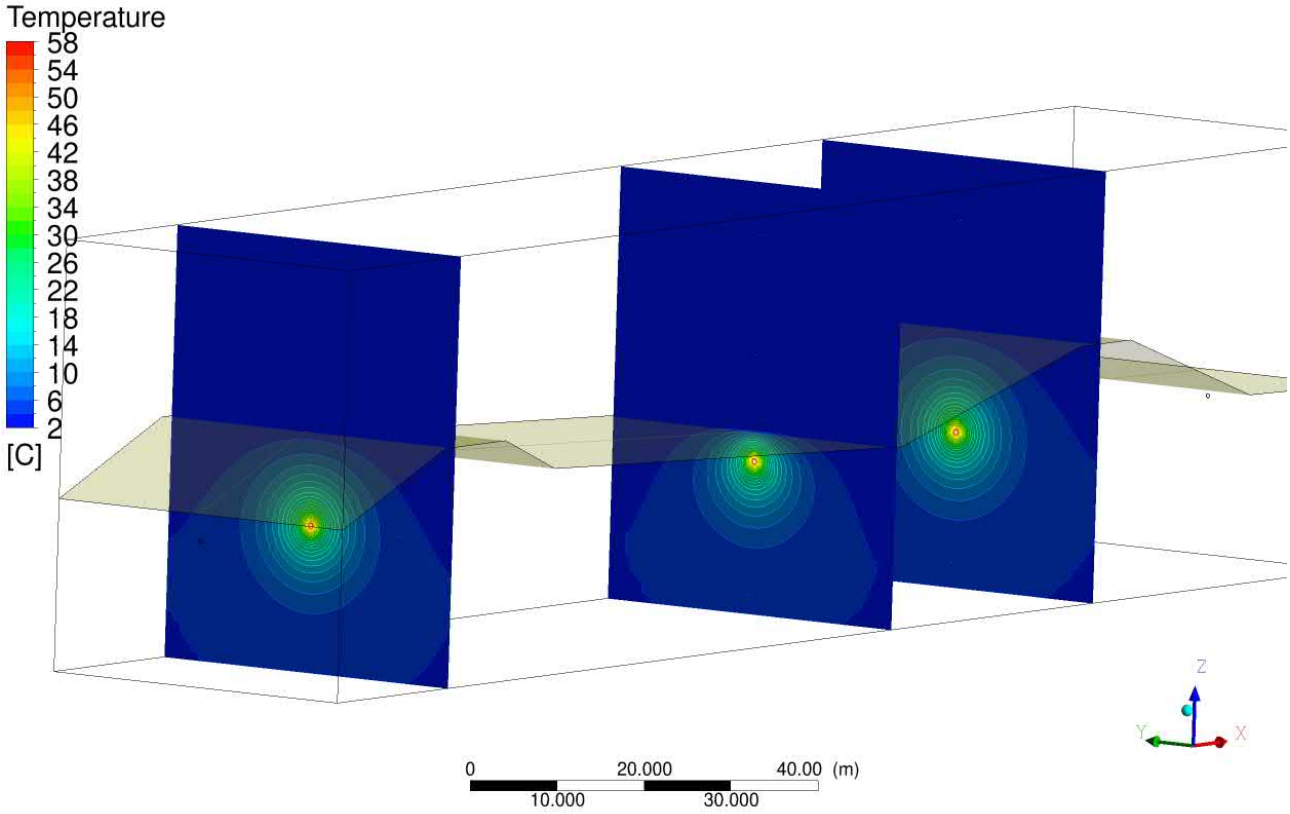


Figure 4.39: Soil and Atmosphere Temperature Vertical Contour Plots – Dunes - Winter

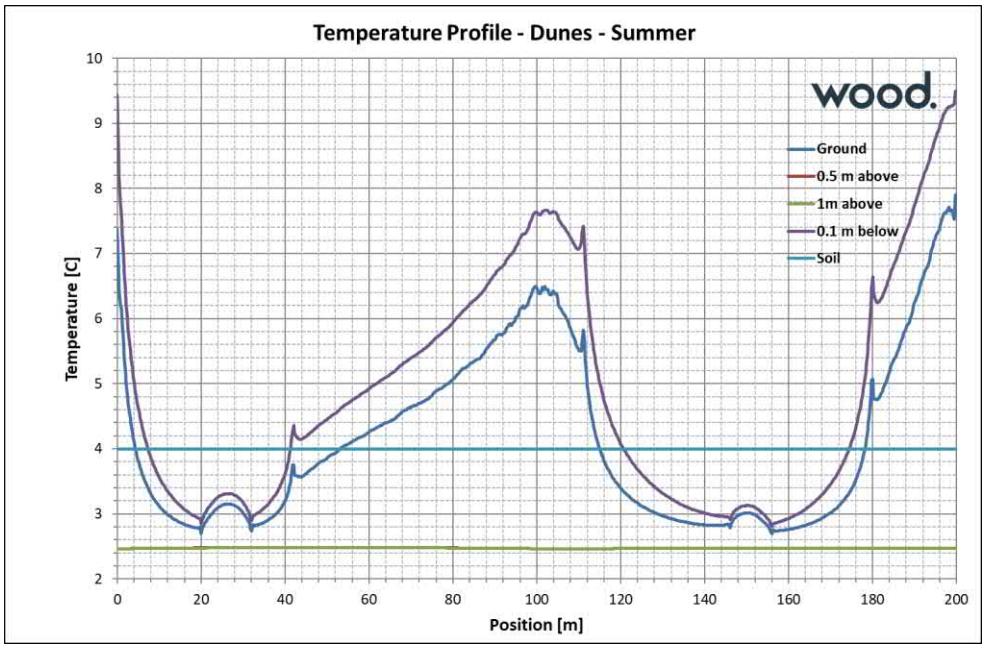


Figure 4.40: Soil and Atmosphere Temperature Profile – Dunes - Winter

5.0 Conclusions and Recommendations

5.1 Conclusions

The following conclusions are drawn from this analysis.

- Based on the analysis performed using FEMTherm approach, it was concluded that the impact of hot fluid temperature inside the pipeline was not significant on soil/sand temperature near the surface, for any of the scenarios assessed, which is due to low thermal conductivity of soil and sand. FEMTherm analysis showed that pipeline had minimal impact on change in temperature of soil/sand after a distance of ~1 m from top of pipe.
- For cases performed without tide, temperature near the surface was found to be warmer at beach when compared to Dunes, which is due to higher conductivity of wet sand (2.5 W/m-K) as compared to lower conductivity of onshore soil (1.3 W/m-K). Impact of sea water was critical near the beach, for cases where tide was considered in the simulation, as lower surface temperature was observed at beach as a result of low temperature of sea water.
- Cases performed with higher fluid inlet temperature of 60°C showed similar trends as was observed with 50°C case, there was slight increase in soil temperature near the surface when fluid with higher temperature was used in the pipeline. The average increase in soil temperature was around 1.3°C, the maximum difference was observed at Warren Farm during summer, when soil temperature near surface increased by 1.7°C compared to base case scenario of 50°C pipeline inlet temperature.
- The results of the detailed CFD analysis showed the same trend as the OLGA FEMTherm results, for the Warren farm area. However, results between OLGA and CFD cannot be directly compared for the Near Beach area as the OLGA simulations assumed the beach being covered with water (for cases with tide), while the CFD assumed low tide conditions.
- From the CFD results, it could be observed that the band of soil of 10 m on each side of the pipe was affected by the presence of hot fluid inside the pipe, in terms of temperature. It could also be noted that effect of temperature was not significant beyond 0.5 m above the ground surface.

6.0 References

1. Email from Cislaghi Raffaella [Raffaella.Cislaghi@eni.com] to Hooman Haghighi [Hooman.Haghighi@woodplc.com], "Hynet CCS – soil temp profiling + key location selection", Date: 03/11/2022, 5:26 pm
2. Email from Cislaghi Raffaella [Raffaella.Cislaghi@eni.com] to Rishav Raj [Rishav.Raj@woodplc.com], "Hynet CCS – soil temp profiling + key location selection", Date: 03/18/2022, 3:49 pm
3. Offshore New Pipeline Design Requirement, 1023DSBSRA84001, Rev 00, Date: 02/03/2022

-o0o-

7.0 APPENDIX

7.1 Plots for Winter Case

7.1.1 Winter Case without Tide

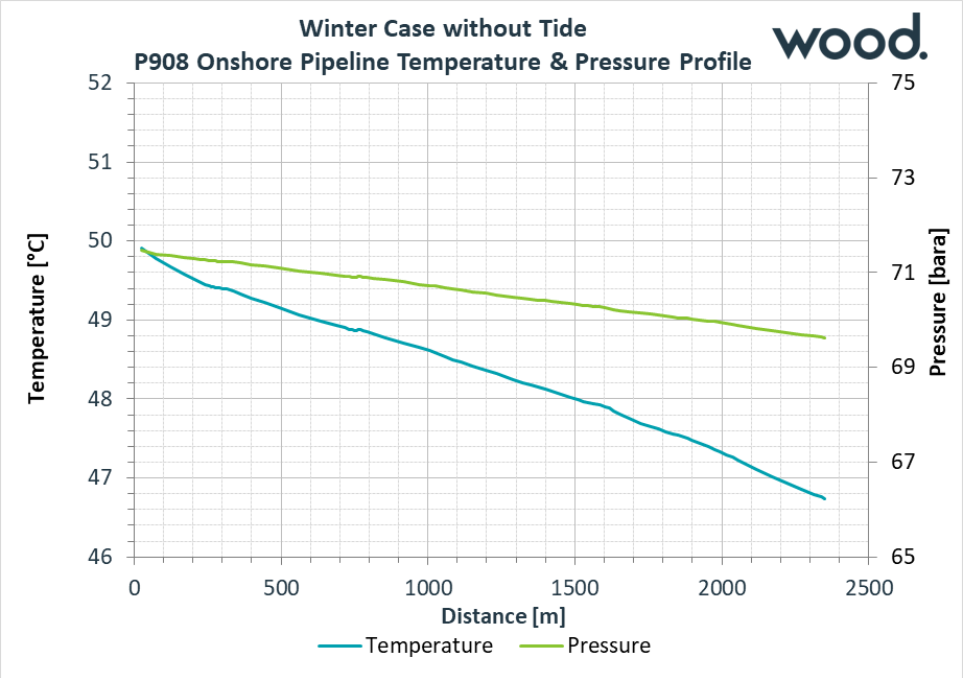


Figure 7.1: Pressure and Temperature Profile of P908 pipeline; Winter without Tide

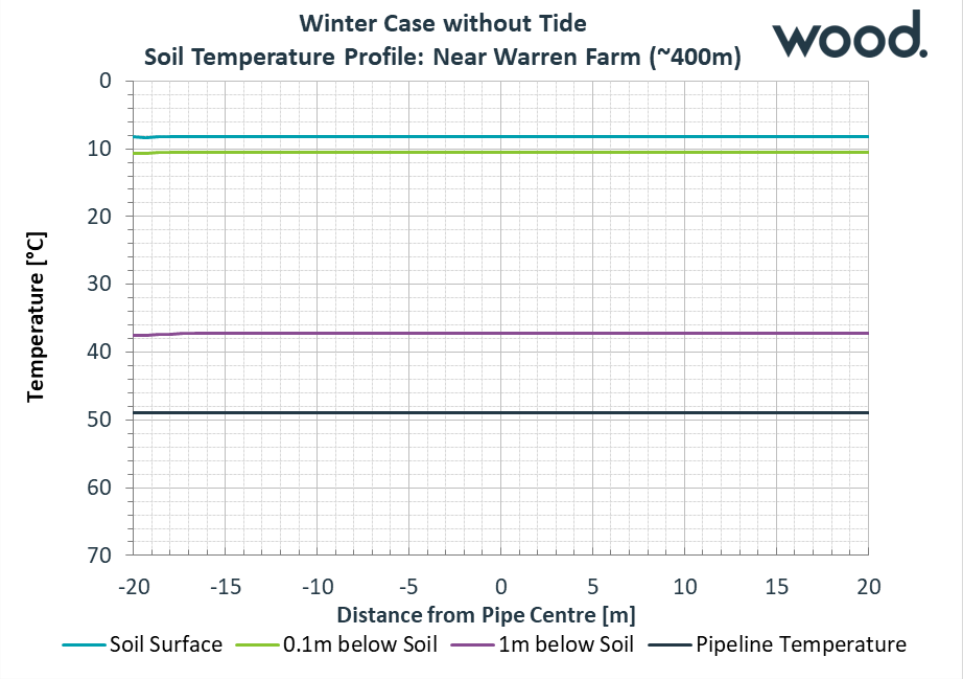


Figure 7.2: Soil temperature trend near Warren Farm; Winter without Tide

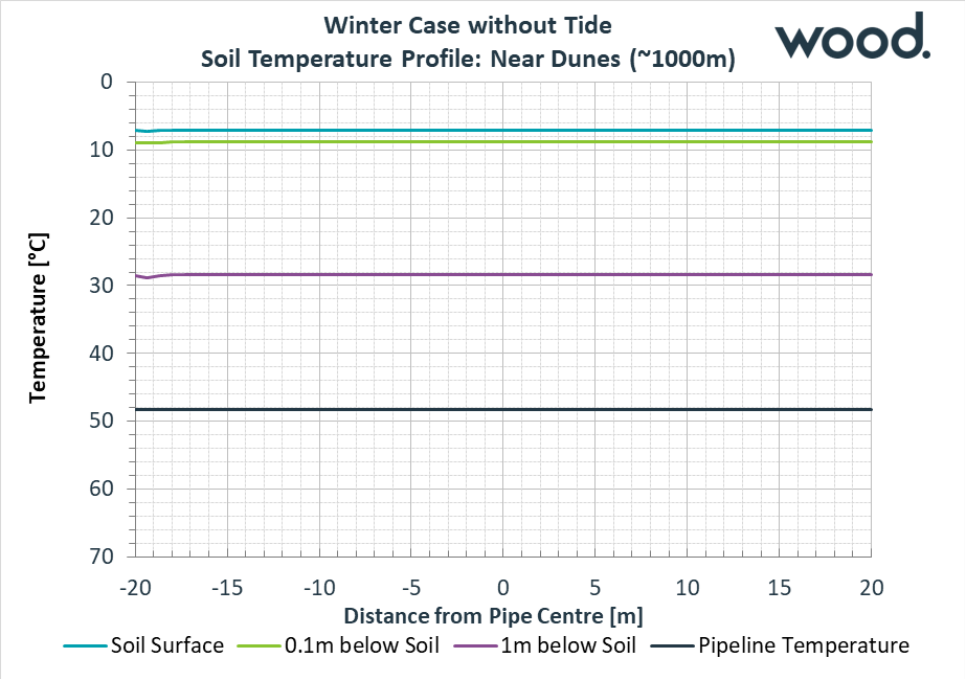


Figure 7.3: Soil temperature trend near Dunes; Winter without Tide

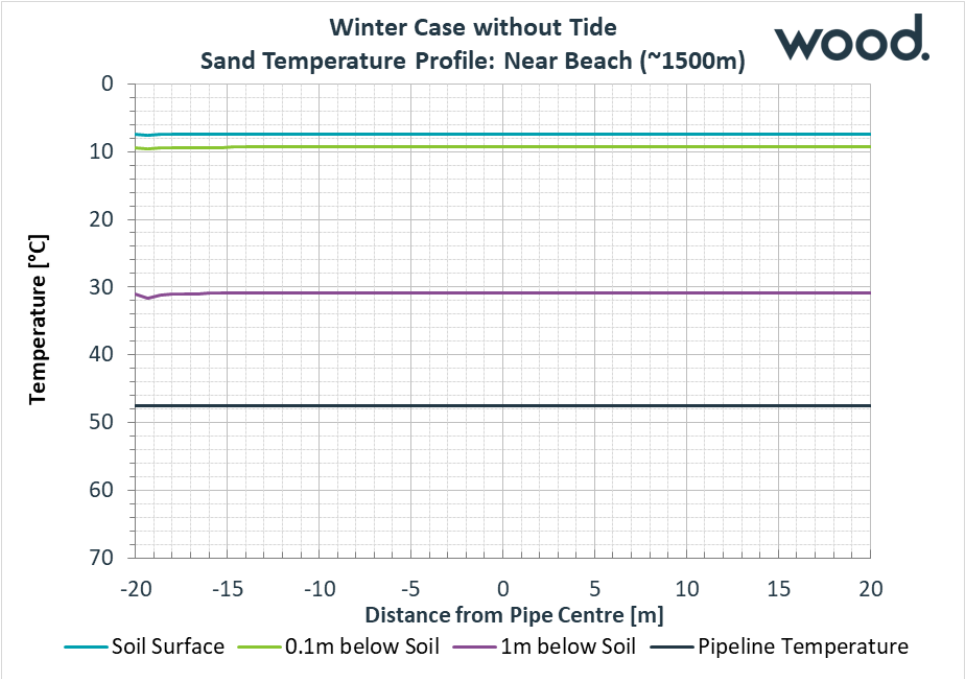


Figure 7.4: Sand temperature trend near Beach; Winter without Tide

7.1.2 Winter Case with Tide

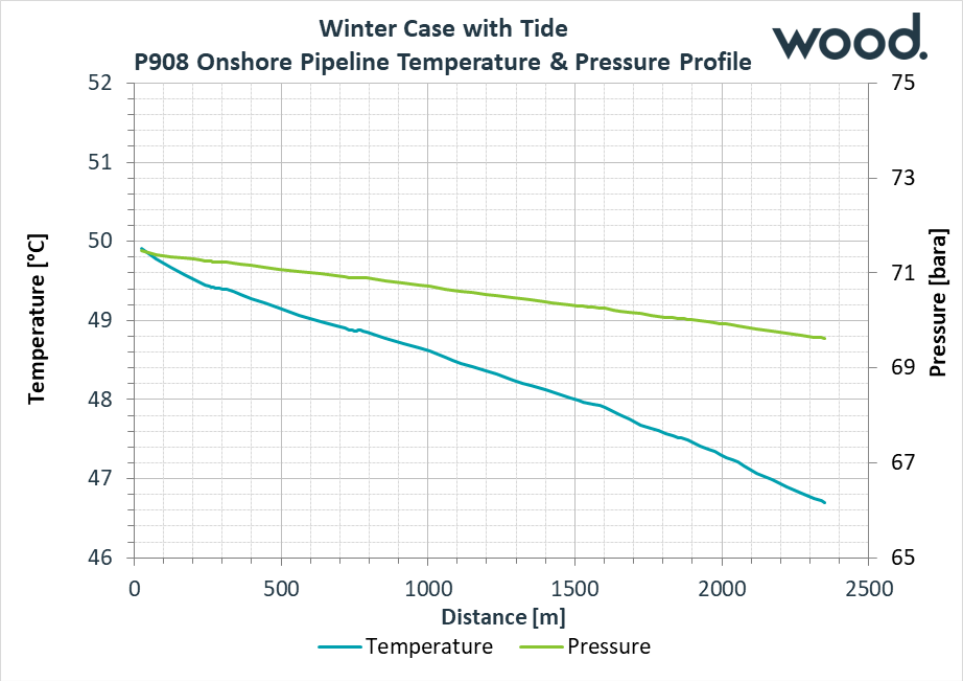


Figure 7.5: Pressure and Temperature Profile of P908 pipeline; Winter with Tide

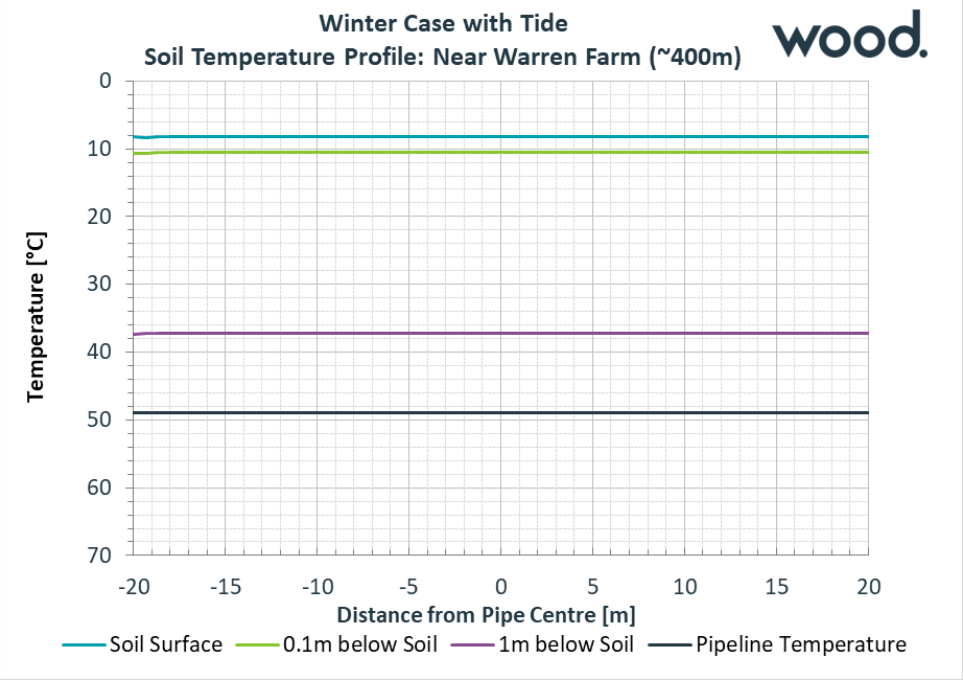


Figure 7.6: Soil temperature trend near Warren Farm; Winter with Tide

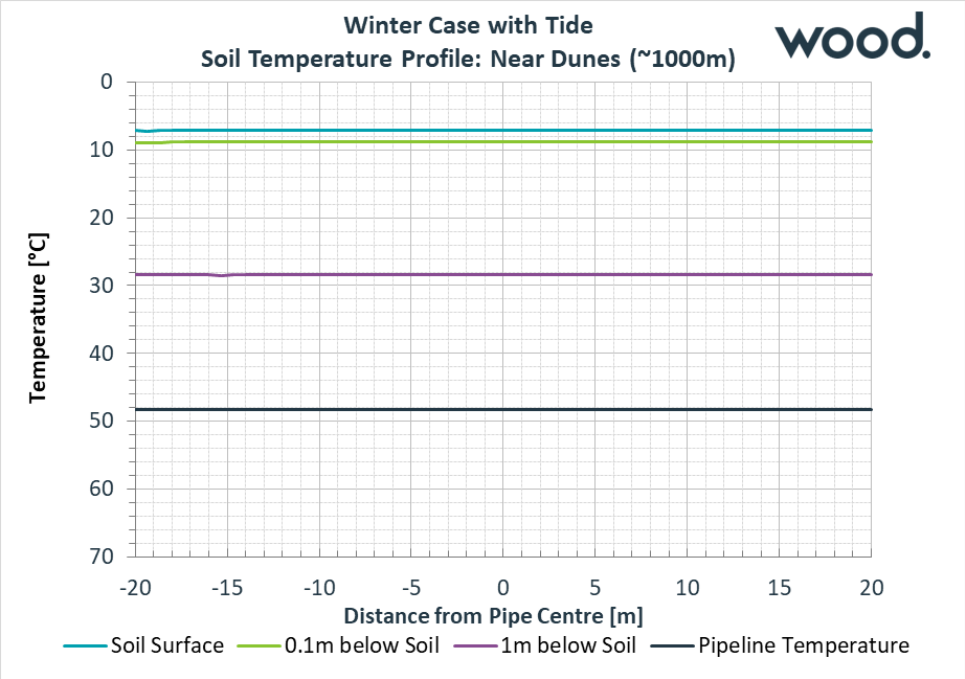


Figure 7.7: Soil temperature trend near Dunes; Winter with Tide

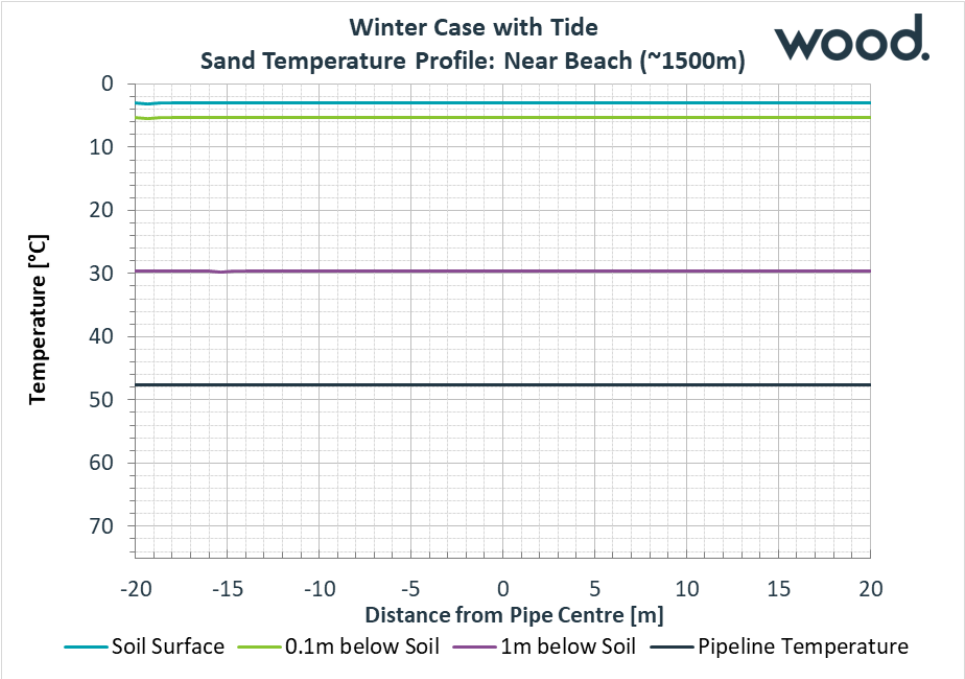


Figure 7.8: Sand temperature trend near Beach; Winter with Tide

HyNet North West

TECHNICAL NOTE – Water

DATE:	01 August 2023	**CONFIDENTIALITY:**	Public
SUBJECT:	Water		
PROJECT:	HyNet TCPA – PoA Terminal and Foreshore Works	**AUTHOR:**	OB
CHECKED:	VM	**APPROVED:**	SB

1. INTRODUCTION

1.1. PURPOSE OF THIS DOCUMENT

1.1.1. This document has been prepared on behalf of Liverpool Bay CCS Limited ('the Applicant'), who intends to construct new, and modify existing infrastructure associated with underground natural gas pipelines and equipment within the Point of Ayr (PoA) Terminal in Flintshire to operate with carbon dioxide (known hereafter as the 'Town and Country Planning Act (TCPA) Proposed Development'). Two separate full Planning Applications were submitted to Flintshire County Council (FCC), one for the three Block Valve Stations (BVS) located along the route of the existing natural gas pipeline (ref. FUL/000633/23), and the other for the PoA Terminal and Foreshore Works (ref. FUL/000246/23), with this document providing clarifications on the PoA Terminal and Foreshore Works application. This document provides the Applicant's response to Natural Resources Wales (NRW).

1.1.2. NRW has provided a statutory consultation response following a review of the Environmental Statement (ES), Flood Consequences Assessment (FCA) and Water Framework Directive (WFD) report submitted as part of the Planning Application for the PoA Terminal and Foreshore Works (ref: FuL/000246/23). Many of these comments relate to requests for clarifications on details of the FCA relating to:

- The TCPA Proposed Development lifespan, which affects the assessment length of the FCA.
- The assessment of the impact on flood risk elsewhere.
- Flood risk mitigation measures implemented as part of the design of the PoA Terminal.

1.1.3. As a result of NRW's response, a meeting was held on the 28th of June, between NRW, WSP UK Ltd (flood risk assessor) and Axis (planner) to agree the nature of the information and level of detail required to satisfy the clarifications that NRW had requested. A copy of the meeting minutes is presented within **Appendix A NRW Meeting Minutes**.

1.1.4. This document provides the Applicant's direct response to each of NRW's comments relating to water in **Table 2.1**. The intention is for this document to clarify the ES, FCA and WFD reports, providing additional clarity to support the information previously submitted.

1.2. THE TCPA PROPOSED DEVELOPMENT

1.2.1. The TCPA Proposed Development will form part of the wider HyNet North West Project (the 'Project'). The Project is an innovative low carbon hydrogen and carbon capture, transport and storage project that will unlock a low carbon economy for the North West of England and North Wales and put the region at the forefront of the UK's drive to net zero. The details of the project can be found in the main TCPA documentation. The TCPA Proposed Development is solely for the carbon dioxide capture and transport segment of the wider Project.

1.2.2. The TCPA Proposed Development comprises the construction (including the removal and / or replacement of existing equipment, known as 'disinvestment'), operation, and decommissioning of the PoA Terminal and associated infrastructure, and the construction of three BVSs.

1.2.3. The modification to the existing PoA Terminal includes removing (disinvestment) redundant natural gas infrastructure that cannot be used with carbon dioxide and installing new plant and equipment (such as a carbon dioxide compression system), so the PoA Terminal can function with carbon dioxide. The Foreshore Works includes removing the existing Shut Down Valve which is installed on the Foreshore Pipeline (west of the PoA Terminal), using the existing PoA to Douglas Pipeline to transport carbon dioxide for safe storage in Liverpool Bay and the installation of electric power cables and fibre optic cables (the Foreshore Cables).

1.2.4. A full description of the Proposed Development is detailed in **Chapter 3 – Description of the TCPA Proposed Development (Document Reference T.4.2.3)** of the ES.

2. APPLICANT'S RESPONSE

2.1.1. **Table 2.1** details the comments from NRW following review of the ES, FCA and WFD reports submitted as part of the Planning Application for the PoA Terminal and Foreshore Works (ref: FUL/000246/23). The Applicant's responses to these comments are also provided.

Table 2.1 – Natural Resources Wales

Comment Reference		Section	NRW Comment	Response
Flood Risk				
1	2.5a	FCA	Your Authority should assure itself that the FCA assesses flood risks over the "agreed" lifetime of development. We have previously questioned the 25-year lifetime referred to within the FCA. The FCA does not refer to any correspondence between the applicant and your Authority confirming that this is a suitable lifetime of development. We would advise that a development lifetime of 75 years should typically be applied for such development proposals.	The 25-year development lifespan of the PoA Terminal is linked to the estimated time it would take for the CO2 reservoir to fill up. The current 25-year lifespan estimate is driven by the current supply model based on a set number of upstream emitters. The Applicant has discussed the approach to the permitted lifetime of the proposed development with Flintshire County Council (FCC) following the meeting with NRW on the 28th June. FCC has confirmed if planning permission were to be granted it would be time limited by virtue of a planning condition. FCC await NRW's consultation response before confirming the time limit, but it is anticipated the condition would limit the operational life of the facility to 25 years following commissioning of the facility. The Applicant agrees that this is acceptable and in accordance with the assessment provided in the Environmental Statement. Should the facility need to operate beyond this period it would be subject to an application to vary the terms of this. Any such application

				would need to be accompanied by updated assessments which would enable FCC to determine the effects of a longer operational time period, this would include impacts in relation to flood risk.
2	2.5	FCA	The FCA should fully assess, for the agreed development lifetime, the flood depths and flood hazards across the site during the design flood event, which is the 0.5% annual probability tidal event, including allowance for climate change and breach of the existing flood defences. We note that paragraphs 5.4.10 and 5.4.12 of the FCA have considered the 75-year lifetime of development breach scenarios. The FCA shows that for the Talacre breach location, flood depths at the terminal would be in the region of 1.1m. Your Authority should note that only a mean figure has been presented, whereas we advise that a maximum flood depth should be used. When maximum depths are considered, flood depths at the site could be in the region of 2.2m. The site is therefore considered to be at significant risk of flooding. Whilst we acknowledge that the FCA considers a longer lifetime of development than is proposed (on the basis your Authority agrees to a 25-year lifetime of development) the 75-year assessment is the best available information available at this time to inform your consideration of the application.	Please see **Item 2** in **Appendix A NRW Meeting Minutes**. It was agreed with NRW that this comment was intended for FCC rather than for the Applicant to address. In order to aid FCC in their review, NRW has advised that the 2.2m flood depth is used for the assessment as this is the best available modelled information for the 75-year event, whilst acknowledging that the 2.2m depth used in the assessment would be an overestimate as the design life is currently 25 years. The Applicant notes that the maximum flood depth from the modelling information available for the 75-year breach scenario applies to areas of existing low spots within the red line boundary due to the presence of local ditches and land drainage assets which are outside of the developable areas, hence the maximum flood depth of 2.2m noted in those localised areas.

3	2.5b	FCA	The assessment of the impact on flood risk elsewhere (for the PoA Terminal development) is not currently sufficient. The impact of the development proposed in the tidal floodplain should be investigated in more detail, as we do not consider it appropriate to assume that the impact would be negligible. The FCA should explain the nature and scale of any changes in development footprints and potential impacts this could have on displacement of tidal floodwaters in a breach event.	A qualitative approach in the FCA was taken based on the assumption that present day and obsolete equipment located on the PoA Terminal site, which will be disinvested, and the new equipment installed, will result in a net loss of footprint does not differ greatly. At NRW's request, the Applicant has provided volumetric calculations as a response to this comment. The calculations were performed from the finished "at grade" level up to the mean height of 1.1m above the ground level to determine the change in volume take-up of equipment on site. This is an approximation based on a mean flood depth of 1.1m. The maximum flood depth on site is associated with the surrounding ditches and not in the developable area. The maximum on site depth based on current modelled data for events exceeding the current envisaged development lifespan is approximately 2.2m (which includes 75 years of projected sea level rise). The volumetric calculations provided are for solid buildings such as office buildings, plinths and pillars located above ground, and not for the suspended pipework, as agreed with NRW (See **Section 3** in **Appendix A NRW Meeting Minutes**). The volume presently taken up (baseline) on the PoA Terminal site by solid structures is approximately 3,000m^3. After the site is upgraded to accept CO_2 (post development) the volume taken up by the new site configuration will be approximately 1,600m^3. This will result in an approximate net gain of tidal flood storage volume of 1,400m^3 on site and will not increase flood risk on the site and elsewhere.

				A summary of the calculations is shown in **Appendix B Volumetric Calculations**.
4	2.5c	FCA	In respect to flood risk mitigation, the measures proposed are limited to the implementation of an updated flood plan. There is also no reference to any further mitigation measures in Table 7-12 of Chapter 7 Climate Resilience of the ES. Given the nature of the development (redevelopment of a site with an existing less vulnerable land use) and the potential flood risk at the site, we would expect further measures to be implemented to provide flood risk betterment compared to current conditions. The FCA does not comment on whether the new structures on the site can be raised compared to the previous structures, or if any flood resilience/resistance measures can be implemented. We advise that the FCA is updated to comment on this and advise whether any further mitigation measures can be implemented.	The site will be mostly formed of pre-manufactured kit placed on concrete plinths. The Applicant can confirm the following flood resilience/resistance measures haven been/will be implemented into the design to mitigate against fluvial, groundwater and surface water flooding risks: • All paved areas have been raised 150mm from the finish grade level. All plinths for structures/equipment supports and foundations are 200mm above the HPP (Highest Point of Paving). • All foundations and paving slabs have been designed assuming that the groundwater level is at grade. Therefore, the risk of buoyancy due to flooding is considered. • All areas will be served by a surface water drainage network. The flood/ drainage calculation has been undertaken conservatively to consider: 1 in 100 years storm event plus 40% climate change event, assuming 10% open areas (not connected to drainage system).
	Water Framework Directive			
5	3.5	Total footprint of works	We note that in Table 4-3, the activities (foreshore works and Point of Ayr works) have been considered separately within the WFD compliance assessment and as such, there is no assessment of the total footprint of the works on each transitional or coastal water body. We advise that	Please see comment reference 3 within this table.

			the total footprint of works on each water body should be calculated and made available to provide evidence for your WFD compliance assessment.	
6	3.6	Accidental spills	Furthermore, within Tables 4-5 and 4-14, it has not been identified that there is the potential to release Environmental Quality Standards Directive (EQSD) chemicals. We consider that there is a risk of accidental spills, and these should be considered in the context of the WFD.	The risk of any accidental spills would be managed through the CEMP with measures in place to protect the water environment. Construction phase impacts have been considered within the assessment with appropriate construction mitigation in place to manage risk.
7	3.9	Sediment mobilisation during trenching	Table 4-14 states that trenching will take place in the foreshore and that it will be complete within one tidal cycle, and as such there is no risk for sediment mobilisation which could pass on risk to other receptors (e.g., *Mytilus edulis*, Table 5-3). We advise that you seek evidence to confirm the feasibility of this and clarity on contingency measures if this is not achievable.	The preference would be for the construction to take place within a dry working environment when the tide is out. However, it cannot be guaranteed that the cable installation across the inter-tidal area would only be carried out in dry conditions at low tide. There are many factors that would influence the timing that cannot be guaranteed at this time. However, if the cable can be buried during low tide conditions, then the 'self-burial' of the cable using the identified techniques, would mean that the beach profile would be returned to baseline conditions, and the risk of sediment mobilisation would remain as under baseline conditions. Notwithstanding, preliminary results from the sediment dispersion numerical modelling, carried out for the offshore EIA, indicate that suspended sediment plumes from cable installation activities showed that while there are periods of increased turbidity, the suspended material is retained in the sediment cell and would be subsequently assimilated into the existing sediment transport regime. It also showed that suspended sediments may reach into the Dee estuary during cable installation, but generally do so at background levels, i.e., 30mg/l. The preliminary numerical

				modelling also indicates that the maximum sedimentation occurs within c.30m of the cable route and is limited to <300mm with peak deposition of c.175mm.
8	3.10	Sediment resuspension and smothering	It is specified in Tables 4-14 and 5-3 that the CEMP will deal with any issues relating to *Mytilus edulis*. We advise that you seek confirmation that the potential for sediment resuspension and subsequent smothering has been considered.	Please see comment response 7 within this table.
	Contamination			
9	5.1	Detailed CEMP	We advise that the detailed CEMP should outline a risk assessment methodology for how unexpected contamination would be dealt with. Other risks may consist of unusually high groundwater and high seepage rates, potentially of contaminated groundwater. The detailed CEMP should therefore provide a methodology for managing such risks.	The Applicant will advise the Construction Contractor to include a risk assessment methodology for how unexpected contamination will be dealt with within the detailed CEMP.
10	5.2	Detailed CEMP	We note that groundwater within the Point of Ayr area is within a few metres of the ground surface and becomes shallower towards the coast. The groundwater is likely to be saline and under a tidal influence. However, the spatial extent of the saline intrusion and tidal influence does not appear to have been defined. We therefore advise that this information should be provided in the detailed CEMP.	The Applicant will advise the Construction Contractor to take account of the spatial extent of the saline intrusion and tidal influence of groundwater within the detailed CEMP.
11	5.3	Detailed CEMP	Groundwater levels at the BVSs have not been determined although the information	Groundwater monitoring at BVSs to gather information about groundwater (e.g., groundwater levels, seasonal variation etc.) is

			in paragraphs 1.2.36 and 1.2.37 of Appendix 18.1 Assessment of Likely Effects suggests that they may be a few metres below the ground surface in these locations. However, it is unknown when the Trial Pits were excavated and hence whether the conditions reported are for drier periods of the year. Wet winters may increase groundwater levels in shallow aquifers and superficial deposits although levels would also be influenced by the degree to which rainfall can recharge into the local ground. We therefore advise that clarification is provided about this in the detailed CEMP.	included under REAC entry T-WR-035 which will provide the basis for the detailed CEMP.
12	5.4	Detailed CEMP	Figure 18.3: Groundwater Dependent Terrestrial Ecosystems shows the extent of GWDTE in the vicinity of the PoA area. A risk assessment to determine the nature of interaction with the GWDTE arising from the construction and operation of the upgraded PoA area does not appear to have been completed. We therefore advise that the following information should be provided in the detailed CEMP: • the sequencing and duration of particular tasks and phases required to deliver the particular infrastructure for the project such as the works required to upgrade the PoA terminal, and the works	An assessment of the nature of interaction with the GWDTE (part of the Gronant Dune and Talacre Warren SSSI) in the vicinity of the PoA area is presented in **Appendix 18.1 Assessment of Likely Effects (Document Reference: T.4.3.18.1)**, paragraphs 1.2.43 to 1.2.52 (construction phase) and paragraphs 1.2.66 to 1.2.70 (operational phase). Recommendations to include mitigations for these effects in the detailed CEMP are included in paragraph 1.3.3. The Applicant will advise the Construction Contractor to take account of the additional information requested on sequencing and duration of the works, ground profile and interaction with GWDTE within the detailed CEMP.

			associated with the foreshore and cabling. • clarification about how much the current ground profile at the PoA Terminal and BVSs would need to be altered including the excavation, treatment if necessary and reuse/removal of Made Ground, in order for the PoA Terminal to be prepared for construction such as for the piled foundations or the proposed cabling. • the degree to which GWDTE would be interacted with by the proposed works should be assessed in detail. The assessment should be based on a Preliminary Construction Plan which would then be amended as more detail is made available as to how the proposed engineering works would be performed.	
13	5.5	Detailed CEMP	We note that a Groundwater Management and Monitoring Plan (GWMMP) would be implemented alongside the detailed CEMP. We advise that the scope of this plan should include consideration of dewatering impacts to the Gronant Dunes and Talacre Warren SSSI and we would wish to be a named party for consultation on this document at	The Applicant will advise the Construction Contractor to include consideration of dewatering impacts to the Gronant Dunes and Talacre Warren SSSI in the GWMMP and detailed CEMP.

			the Discharge of Condition stage. The proposed GWMMP should be informed by the detailed CEMP.	
	Water Quality			
14	7.1	General	We note that a 10m³ containment sump will be present to contain spillages of any drilling fluid and a plant-friendly alternative to bentonite would be used during HDD. HDD drilling fluids should be managed to ensure that there is no potential for interaction with water courses. Measures to achieve this should be described in the detailed CEMP, including the process for decommissioning any temporary containment sumps.	The Applicant will advise the Construction Contractor to include measures to protect water quality from HDD drilling fluids within the detailed CEMP.
15	7.2	General	We note that pollution, sediment mobilisation and sewage management referred to in ES Chapter 18 (para. 18.8.1) would be addressed via the detailed CEMP. While we agree with the water quality aspects of the Outline CEMP, we note that the detailed CEMP would include a sediment management plan and a surface water monitoring and management plan. We would therefore wish to be a named party for consultation on the detailed CEMP during the Discharge of Condition stage.	The Applicant has noted this advice.

APPENDIX A NRW MEETING MINUTES

HyNet North West

AGENDA & MEETING NOTES

PROJECT NUMBER	EN070007	**MEETING DATE**	28 June 2023
PROJECT NAME	CO2 Pipeline TCPA	**VENUE**	Teams
APPLICANT	Liverpool Bay CCS Limited	**RECORDED BY**	
MEETING SUBJECT	NRW response on Flood Consequences Assessment		

PRESENT	Christopher Jones, Rhys Hughes, Chris Taylor, Stefan Boss, Rachael Chambers, Vic Mohun, Ovidiu Bucur, Andrew Russell
APOLOGIES	
DISTRIBUTION	As above plus: Akshat Vipin
CONFIDENTIALITY	**Internal**

AGENDA

1. Design lifetime
2. Maximum flood depth
3. Demonstrating flood risk elsewhere
4. Flood risk mitigation

ITEM	SUBJECT	ACTION	DUE
1.	**Design lifetime** AR: explained the background of the 25 year design life of the proposed development at POA Terminal is linked to the estimated time it will take for the CO2 reservoirs to fill. It is driven by the supply of CO2 being generated from the hydrogen plant and the other upstream emitters. This background has also been explained to Flintshire County Council (FCC) who have agreed to add a condition to the planning application about limiting the operation of the proposed development for that time period. If the time period for the operation of the facility needs to be extended a S73 will be required in the future; at that point the applicant would re-assess flood risk accordingly. RH: Agreed if FCC confirm a 25 year design life condition, which would be from the point of commissioning, is acceptable to them then NRW will proceed on that basis, although note that 75 years is the standard they would normally work to if the permission if not time limited by condition. NRW would like to see confirmation of the agreement with FCC. RH: Confirmed that the FCA would not need to be updated, any further information can be supplied within a letter.	**AR**	
2.	**Maximum flood depth**		

	VM: explained that the mean flood depth within the FCA was 1.1m, but the initial response from NRW was to update this to the maximum flood depth of 2.2m and questioned, particularly in light of the agreed 25 year design life, what the reasoning behind the 2.2m max. flood depth would be used. RH: Confirmed that NRW's response on this was just to highlight that the FCA outputs are overestimating the risk by using the 75 years level and this is more of a point for FCC to consider than for the Applicant to address. RH confirmed that there is no need to complete any additional modelling. AR: requested that NRW please reiterate that this is an acknowledgement to FCC. RH: confirmed that it would be useful to update the information to use the 2.2m max. flood depth but with the explanation that there is a disconnect between that and the 25 years basis for design life. The 2.2m max. flood depth on site is for a breach that includes 75 years of sea level rise, instead of 25 years, the expected design life. However, there is no other data to use for 25 years and the maximum should be used rather than the mean. Besides, an overestimate is better than an underestimate. Therefore, using the 2.2m is an appropriate basis for the assessment. CJ: confirmed that the Applicants response should include some information explaining the discussion with NRW around this. The format of the response can be in a letter.	**VM/OB/AR**	
3.	**Demonstrating flood risk elsewhere** VM: Explained the qualitative approach taken in the FCA, that the proposed development is a replacement so any flood risk over the area would be similar, and due to the short lifetime of the development wouldn't differ greatly from the existing. RH: This section in the FCA is very brief and NRW would like to see some more information on the thought process to support the position taken that the impact would be negligible. Requested if data for the proposed footprint vs existing footprint could be provided to support this. VM: Confirmed the Applicant can prepare some statistics for the before and after footprints to justify the proposed approach, including that no further modelling is required. RH: Confirmed that evidence would be welcomed and no further modelling is expected. Ovi: Asked if buildings should only be included, i.e. suspended pipes would be omitted?	**VM/OB**	

	RH: Yes only need to include solid structures e.g small buildings, units, structures and buildings as it would be difficult to calculate the same for the pipework involved.		
4.	**Flood risk mitigation** VM: Explained that we are currently discussing further flood risk mitigation measures with the Applicant but that we wanted to confirm the level of detail with NRW. RH: Outlined that NRW is requesting information on flood risk resilience, e.g. Can new structures be raised etc.? This can be standard flood risk resilience measures but there might be specific measures for certain aspects of the development, e.g. the sub-station. VM: Questioned that betterment would not necessarily be provided within a tidal area. E.g. if we replace a building should we improve the building by increasing the floor height? AR: Explained that most of the equipment will be pre-manufactured kit on concrete plinths. We can check if the concrete plinths will be installed at 300mm above ground level. VM: Questioned if the information supplied by the Applicant should include information about providing flood resilience rather than pure "betterment"? RH: Confirmed that the betterment requested related to providing enhanced mitigation measures and resilience measures to the proposed facility compared to the existing infrastructure on the site, rather than providing flood risk improvements elsewhere off the site. Further demonstration of flood resilience information would be acceptable to NRW. VM: Confirmed that a list of flood resilience measures for the site could be supplied, after agreement with the Applicant, and questioned how this further information should be sent to NRW, i.e. should it be in an addendum to the FCA or a letter? RH: confirmed no preference so a letter containing this and the above points would be acceptable.	**VM/OB**	

APPENDIX B VOLUMETRIC CALCULATIONS

New Installations (Added)		Existing Installations (Removed)	
Description	**Volume Occupied to 1.1 m, m^3**	**Description**	**Volume Occupied to 1.1 m, m^3**
Receiving Area	105.5	Inlet Facilities & Cooling	-829.8
Filter and Metering	370.6	Process Units	-1061.7
Nitrogen	20.2	Utility Units	-835.6
Compression Train 1	168.1	Flare	-73.7
Compression Train 2	168.1	Fire Water	-180
Compression Train 3	168.1		
E-W Piperack and Drums	300.5		
Vent	3		
Diesel Generator	98.5		
MV/LV Substation	180		
Total New	**1582.6**	**Total Existing**	**-2980.8**
	Net Change Total	**-1398.2 m^2**	