

# Dogger Bank: Developing the world's largest offshore wind farm

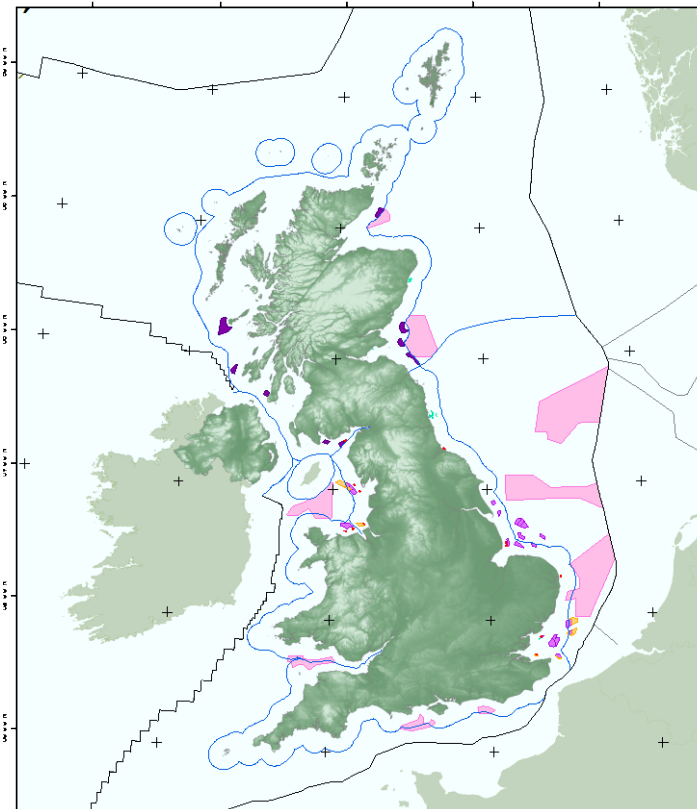
Gareth Lewis – Head of Offshore Development

Scarborough 8th October 2014



# Four leading international energy companies

- Forewind is a consortium of four leading international energy companies



- The consortium members joined forces to bid for the Dogger Bank Zone as part of The Crown Estate's third licence round for UK offshore wind farms, awarded in 2010.
- Forewind combines extensive experience of offshore project delivery and renewables development, construction, asset management and operations with UK utility expertise spanning the full electricity value chain.
- The Crown Estate is Forewind's partner in the development of Dogger Bank



# Forewind and the Dogger Bank Zone

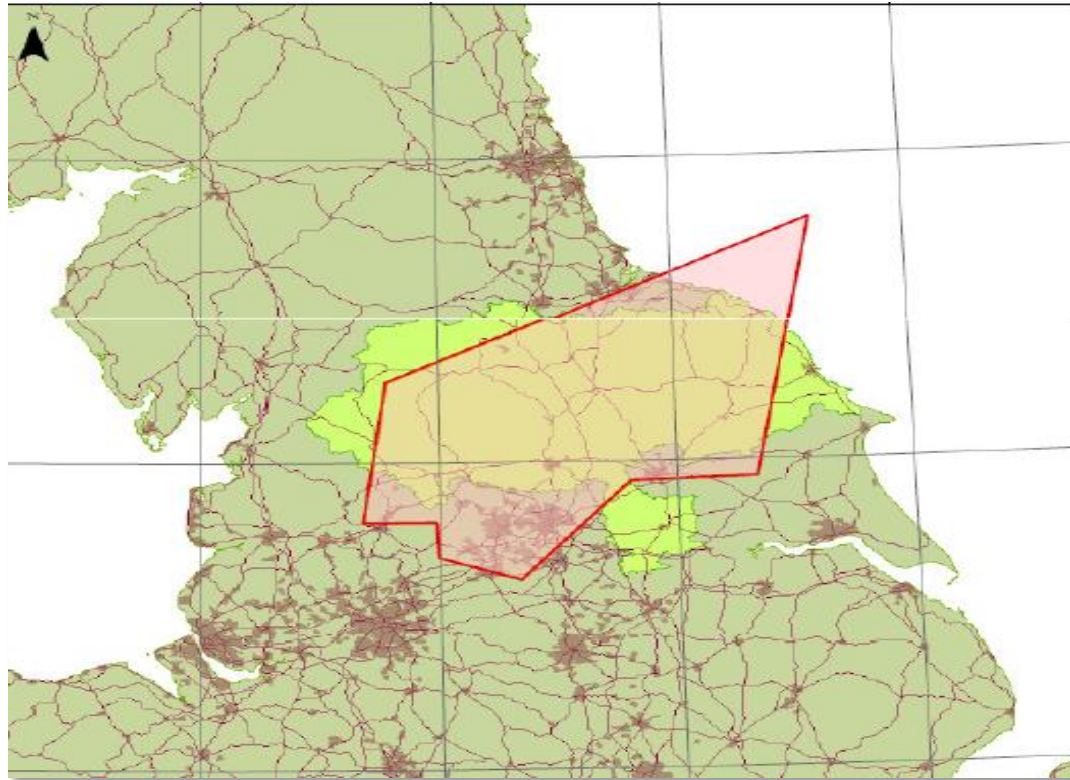
- Forewind is committed to securing all necessary consents required for the construction and development of safe, economically viable offshore wind capacity on Dogger Bank.

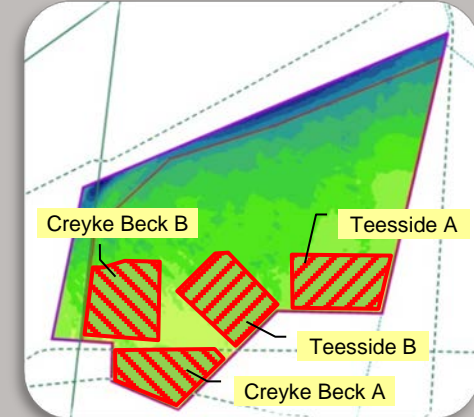
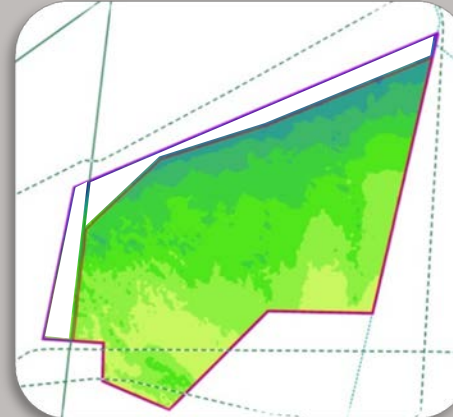
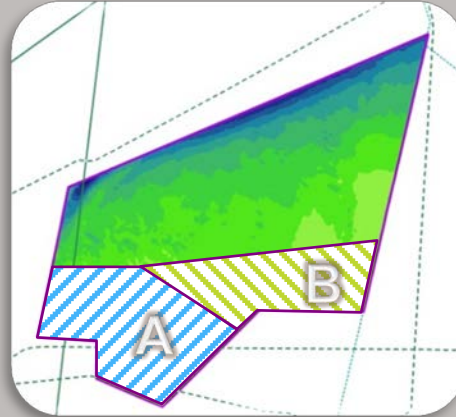
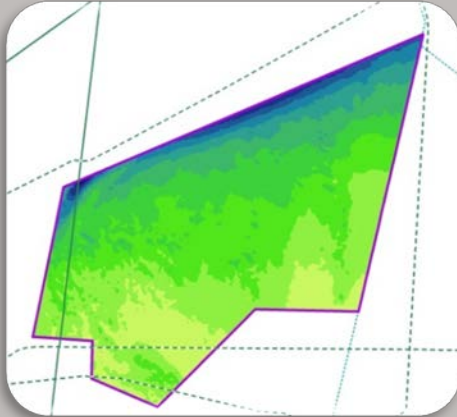


## Dogger Bank key facts:

- Capacity: Up to six 1.2 GW projects
- Area: 8660 km<sup>2</sup> - equivalent in size to North Yorkshire. Largest Round 3 zone.
- Distance: 125-290 km from shore.
- Depth: 18-63 m; approx 4GW in <30m water depth, shallow compared with other Round 3 zones.
- Wind: High wind speeds of >10 m/s average wind speed across the zone.
- History: A "dogger" was a type of Dutch fishing boat common to the North Sea in the 17<sup>th</sup> century.

# Dogger Bank Zone





## Zone

- Coarse zone-wide surveys.
- Zone appraisal workshops with stakeholders at start of programme.
- Consent “heat map” and hard constraints identified.
- Relative cost of energy crudely modelled.

## Survey tranches

- Most promising areas prioritised for detailed surveying; first area “A” then “B”.
- Onshore grid connections agreed.
- Cable routes to shore identified, starting with reconnaissance survey grids.

## Developable area

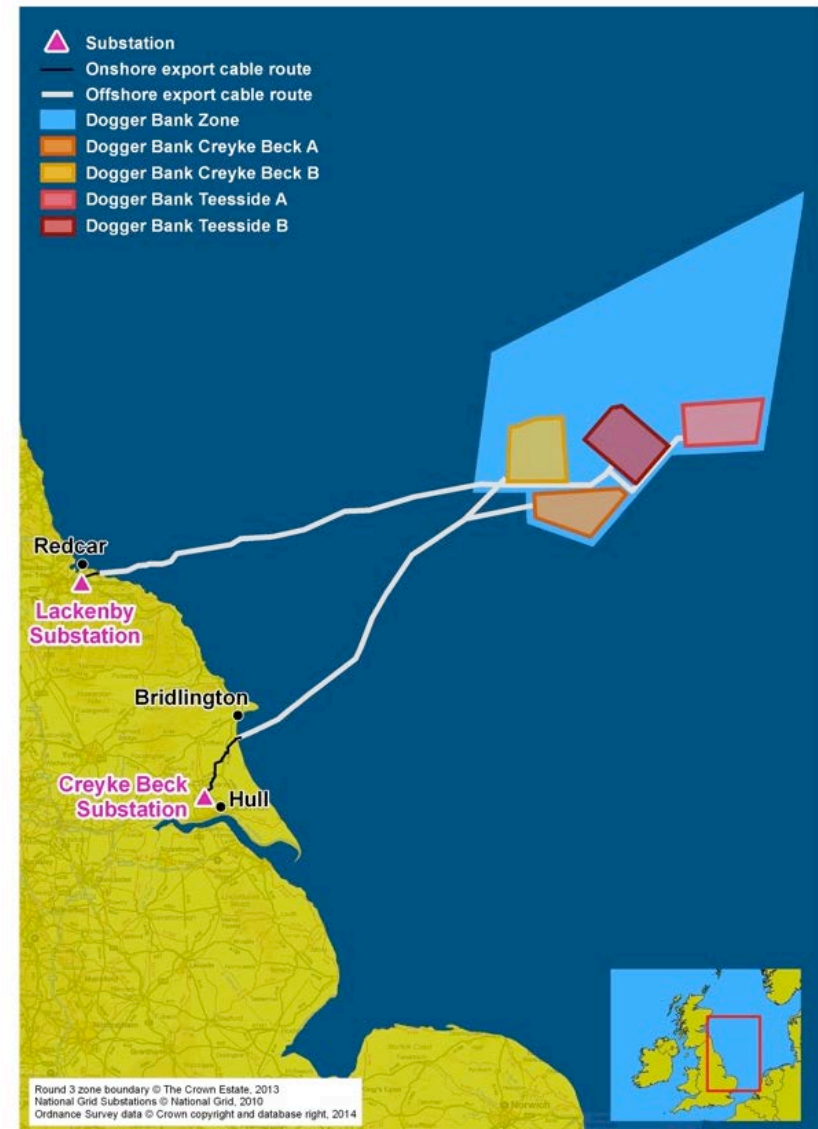
- Area of high fishing intensity, bird density, and more complicated geology to west of Zone excluded.
- Deeper water, with slope habitat to north of Zone excluded.

## Project areas

- Narrowing down from zone to tranche to specific project areas.
- Based on detailed environmental assessment and detailed wind resource modelling.
- Stakeholder engagement and consultation throughout.

# Dogger Bank project connections and timeframe

- Each Dogger Bank project will be up to 1.2GW, linked to the national grid via 1GW connections.
- Dogger Bank Creyke Beck  
Forewind's first two projects will connect at the existing Creyke Beck substation, East Riding of Yorkshire – consent decision expected February 2015.
- Dogger Bank Teesside A&B  
A further two projects will connect at the existing Lackenby substation, Teesside – consent decision expected August 2015.
- Dogger Bank Teesside C&D  
Two further projects also scheduled to connect in Teesside at the existing Tod Point substation – the application is planned for submission at least one year after Teesside A&B.
- Each 1.2GW project could generate enough green electricity to power the equivalent of almost one million British homes.

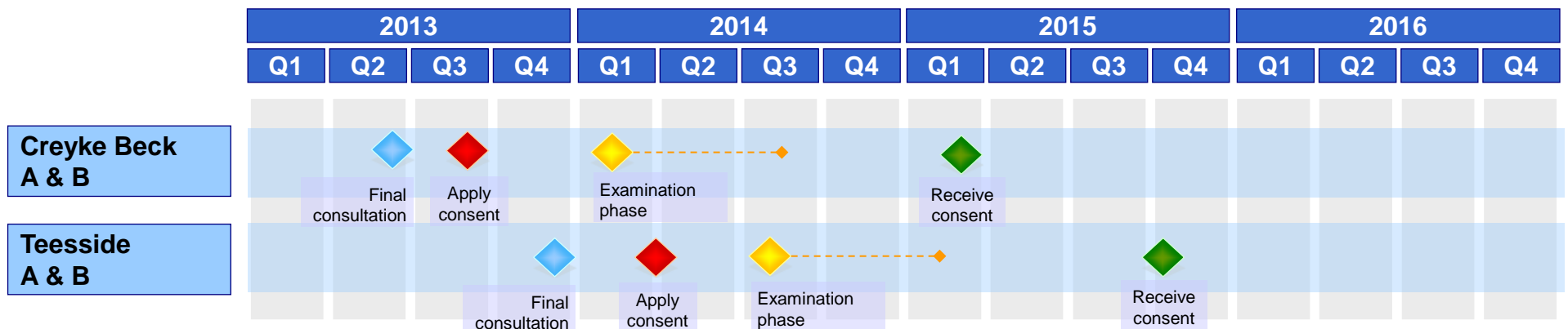


# Consenting timetable

- Each Dogger Bank project is a Nationally Significant Infrastructure Project (NSIP).
- Development Consent Order (DCO) applications include onshore and offshore aspects.
- Examined by The Planning Inspectorate.
- Determined by the relevant Secretary of State, currently Department of Energy & Climate Change (DECC).
- Stakeholder consultation, key element of development process.



*Ed Davey, Secretary of State for Energy & Climate Change*



## Ornithology & marine mammals



- Boat-based and aerial surveys - more than three years of survey data acquired.
- Boat: 2400 line km per month; totalling 40,000 km in transects.
- Aerial: several days per month, two aircraft; totalling 160,000 km in transects.

## Benthic



- Over 700 benthic survey samples acquired across Dogger Bank, over 500 from the project cable corridors.
- Campaigns included camera deployments and samples taken for faunal, chemistry and particle size analysis.

## Geophysics



- Coarse zone wide survey – 7,000 line km covering 8,660 km<sup>2</sup>.
- Detailed survey, three campaigns – over 50,000 line km (covering 4,700 km<sup>2</sup>).
- Cable corridor surveys to Yorkshire and Teesside.

## Fish



- Acquired over 850 fish samples from across Dogger Bank and nearly 300 from the project cable corridors.
- Sampling campaigns have included otter and beam trawls, sand eel dredges, potting and trammel netting.

## Geotechnical



- 84 boreholes and 174 cone penetration tests over three separate campaigns.
- Dedicated investigation of seismic anomalies.
- Sophisticated geological modelling (with British Geological Survey and Norwegian Geotechnical Institute).

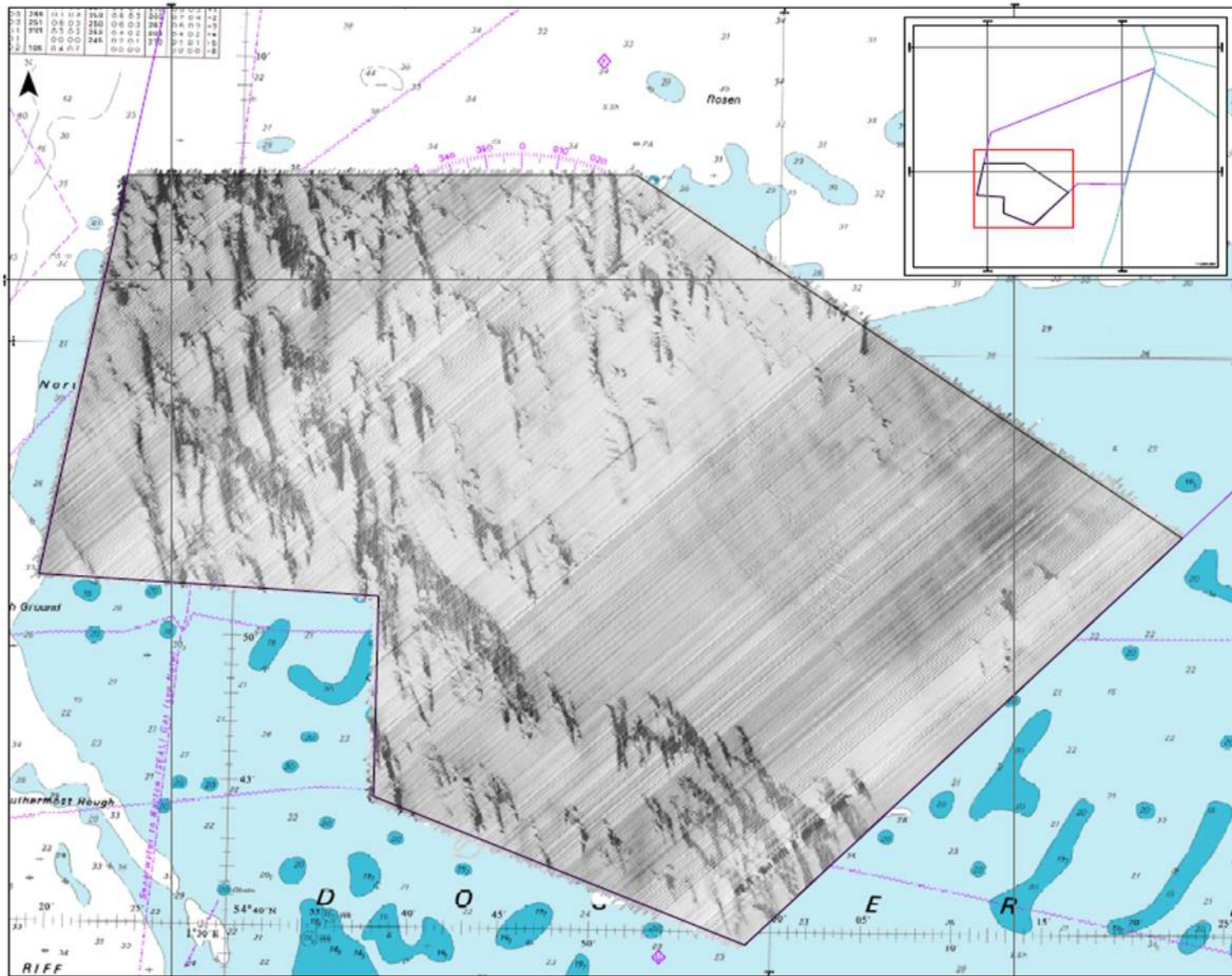
## Met ocean



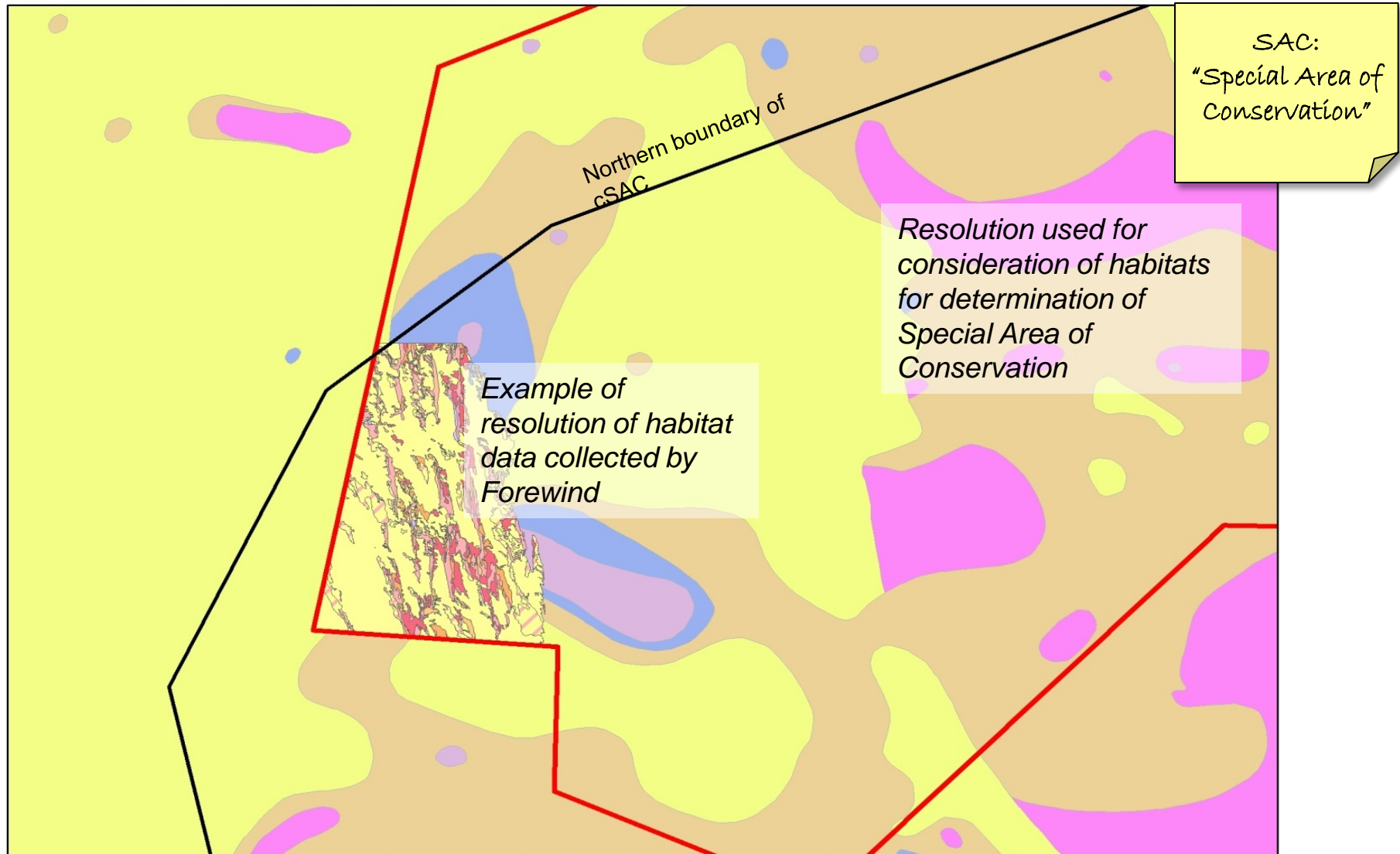
- Buoys used to acquire oceanographic and meteorological data installed 2010.
- LIDAR installed on RWE Cavendish platform, Summer 2011.
- Two met masts installed using suction installed Bucket Foundation.

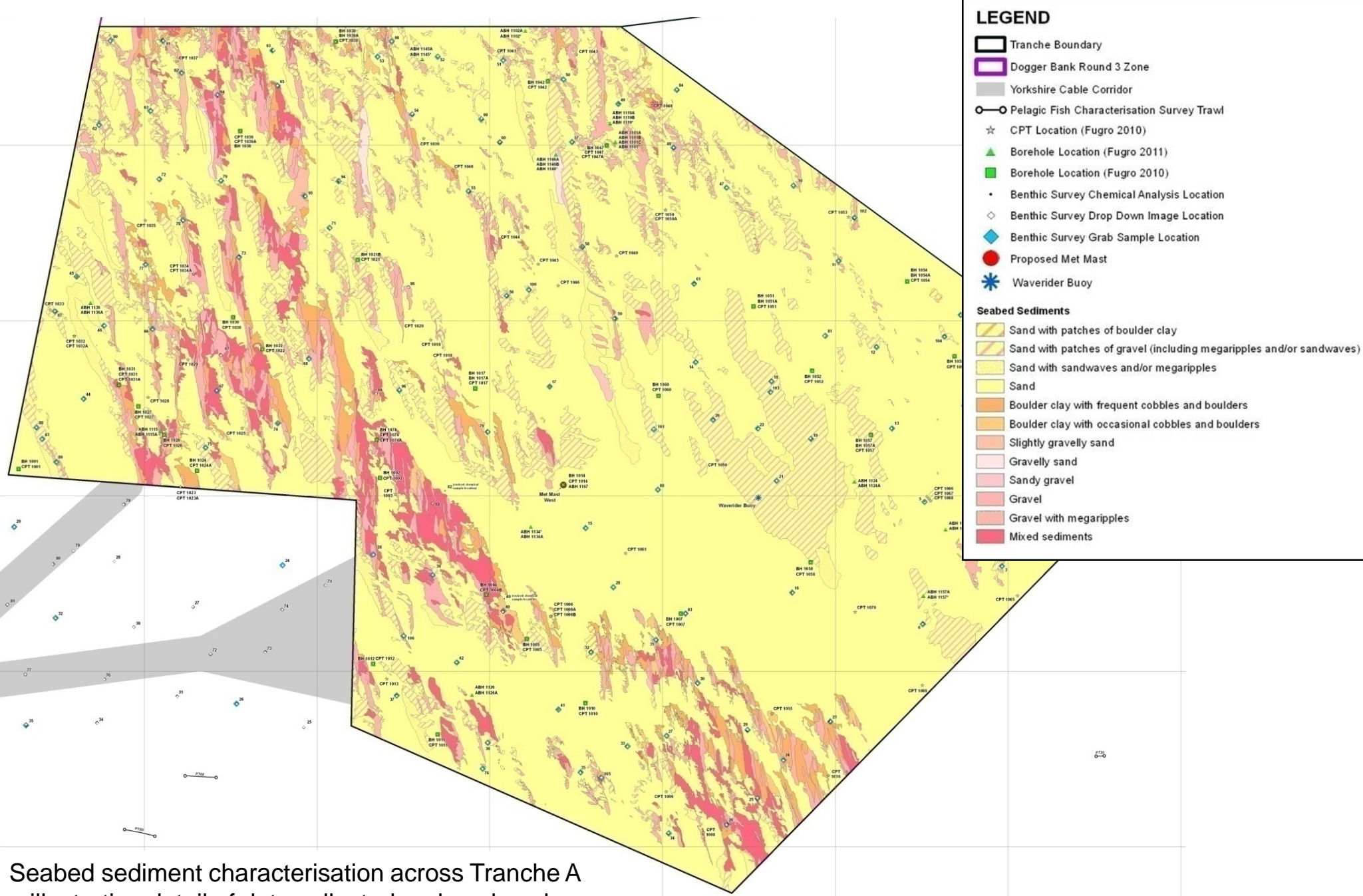


# Unparalleled data: side scan sonar



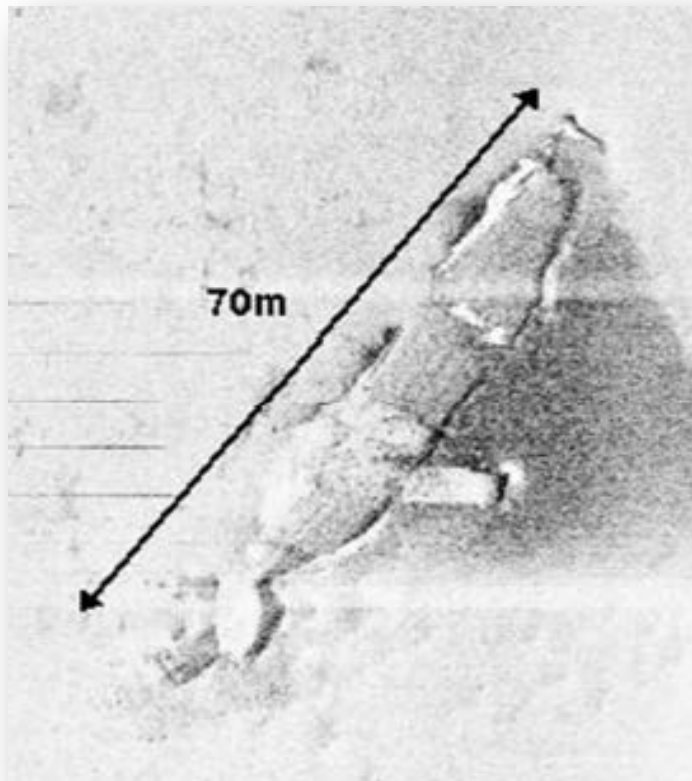
# Unparalleled data: SAC base data compared with new data



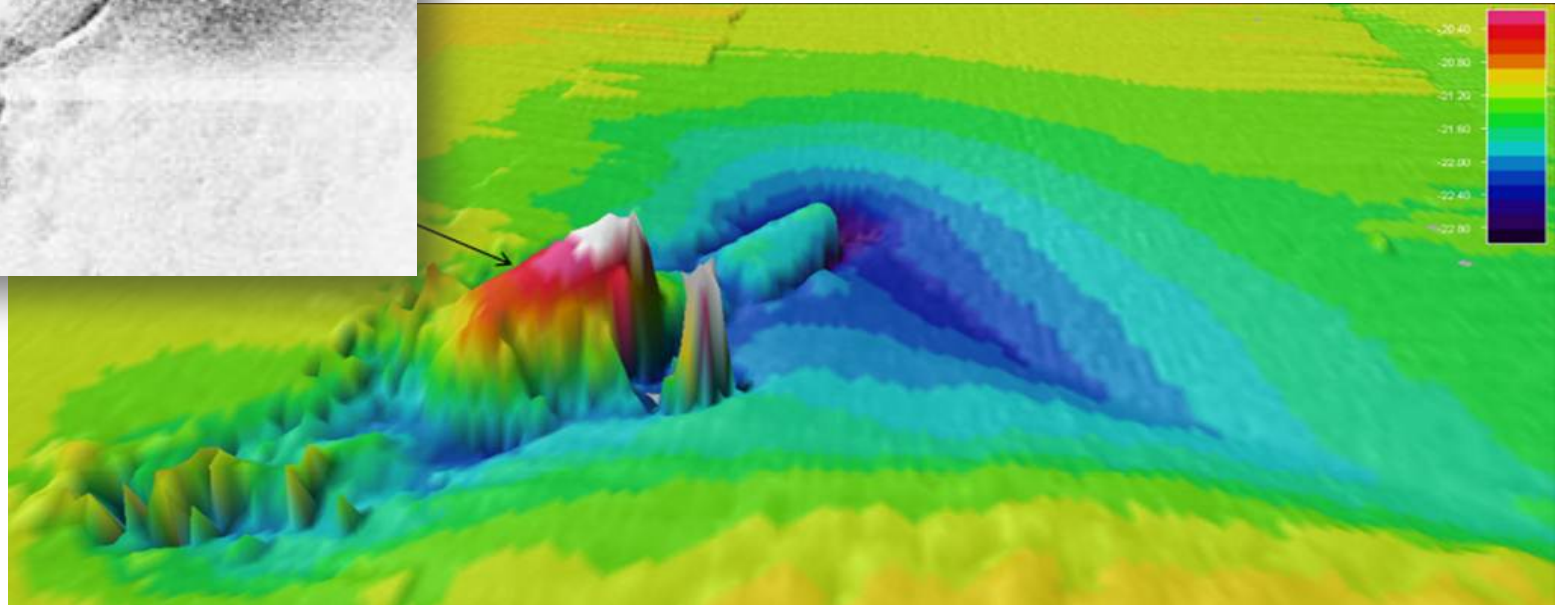


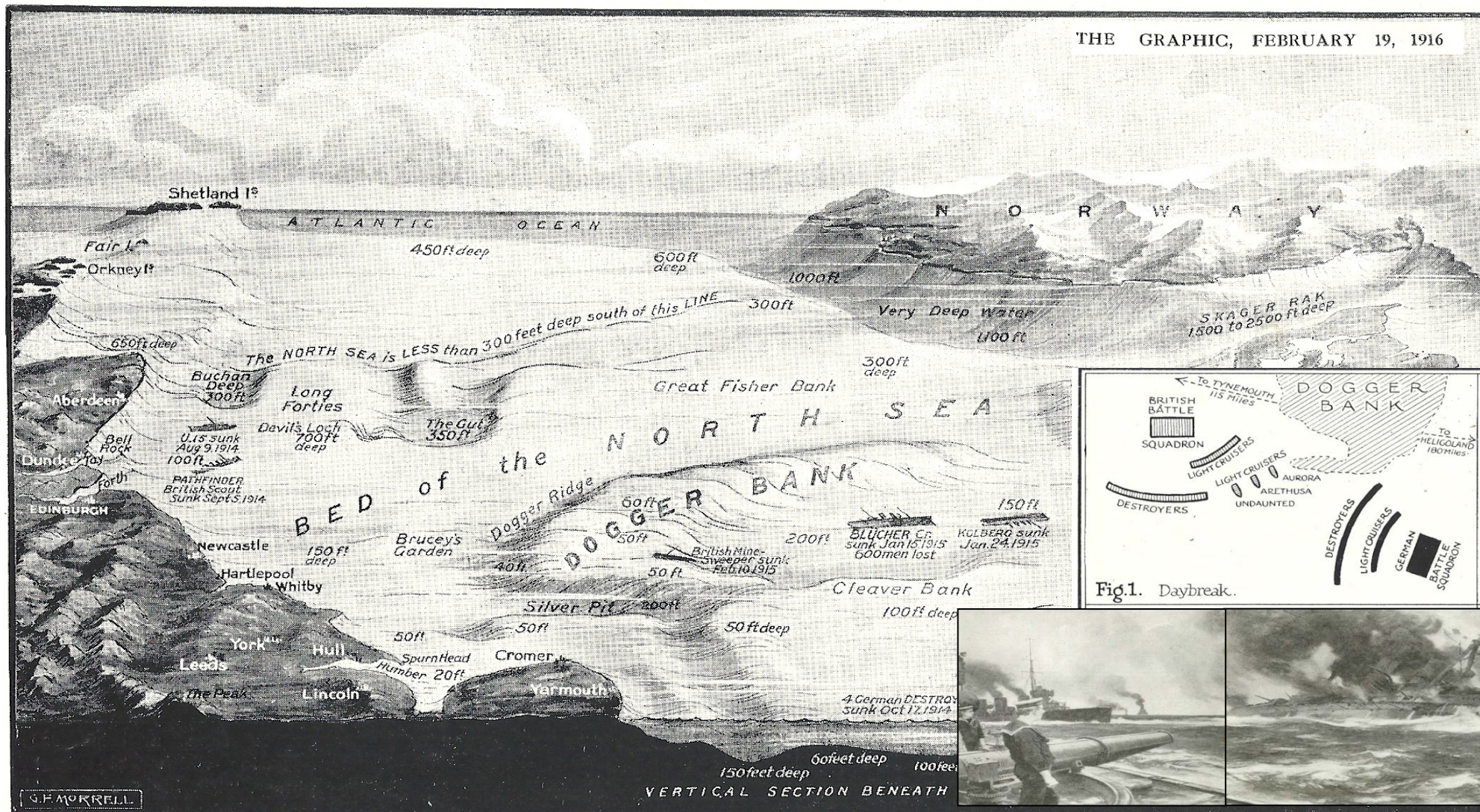
Seabed sediment characterisation across Tranche A – illustrating detail of data collected and analysed

# Unparalleled data: unidentified wrecks



*Thought to be the wreck of German submarine, U66, although diving survey this year suggests old steam ship instead.*



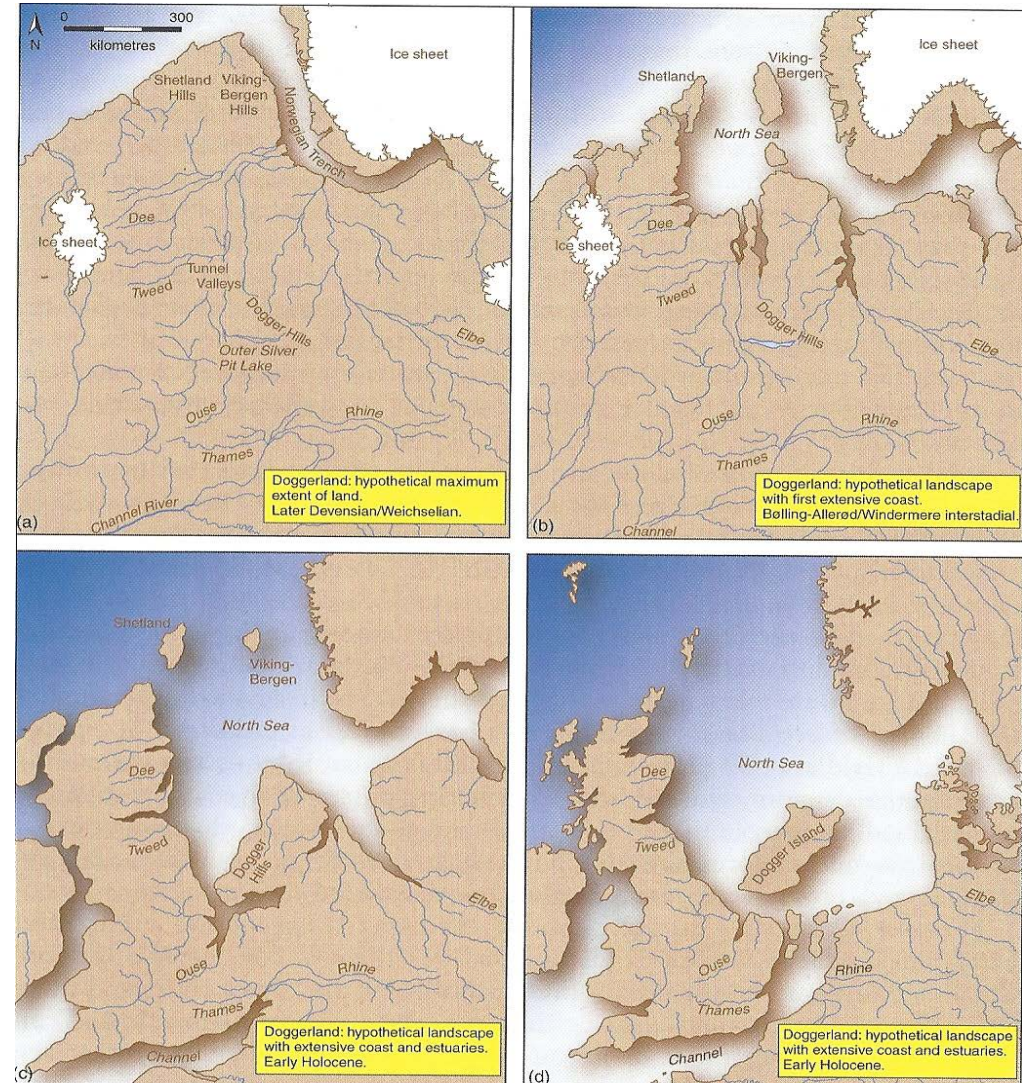
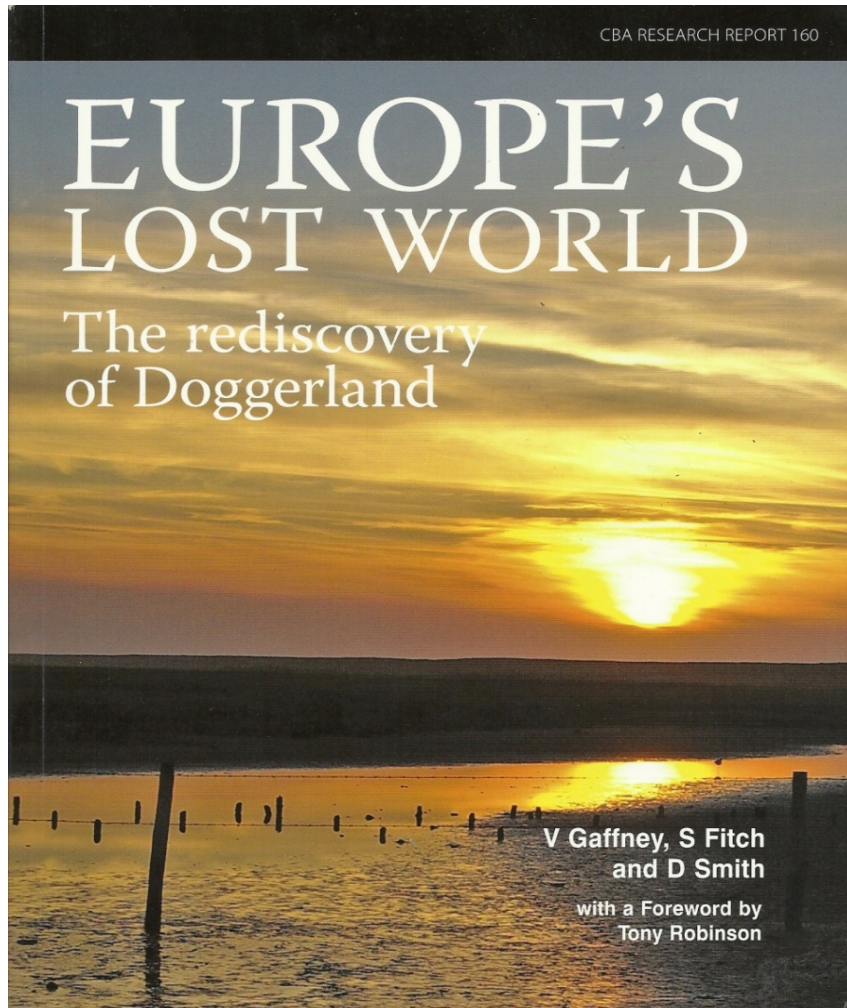


Strictly copyright.]

[Design registered.]

A pictorial plan of the bed of the North Sea, showing the submerged range of hills known as the Dogger Bank, which has figured prominently in the war.

# Dogger Bank – Atlantis of the N Sea?



# Unparalleled data: birds and marine mammals



*MV Vigilant, survey vessel (Gardline)*

- Probably the largest marine bird and mammal survey ever!
- More than 3 years surveys.
- Cutting edge high-definition aerial surveying.

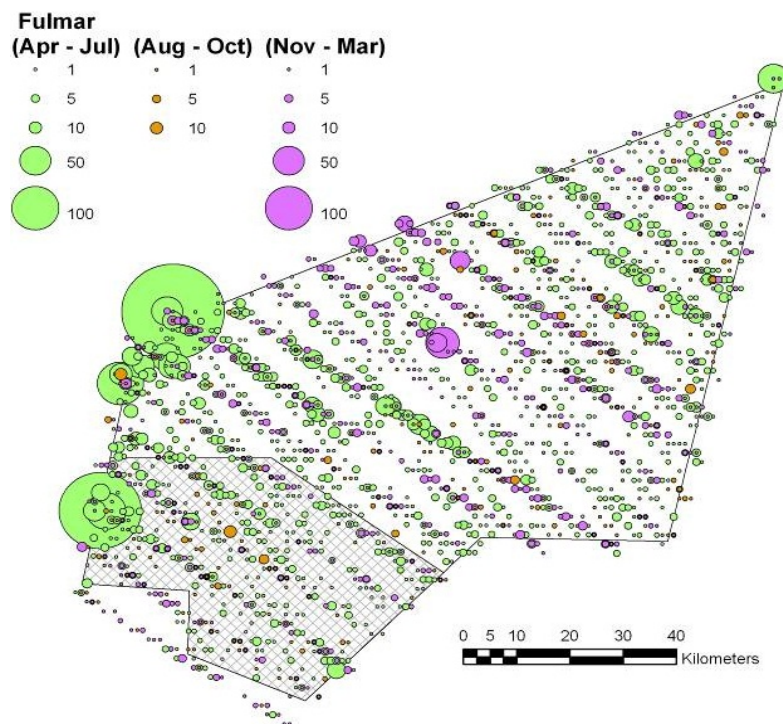


*Kittiwake, most common bird recorded*



*Forewind ornithologist on vessel*

## Example bird distribution plot:



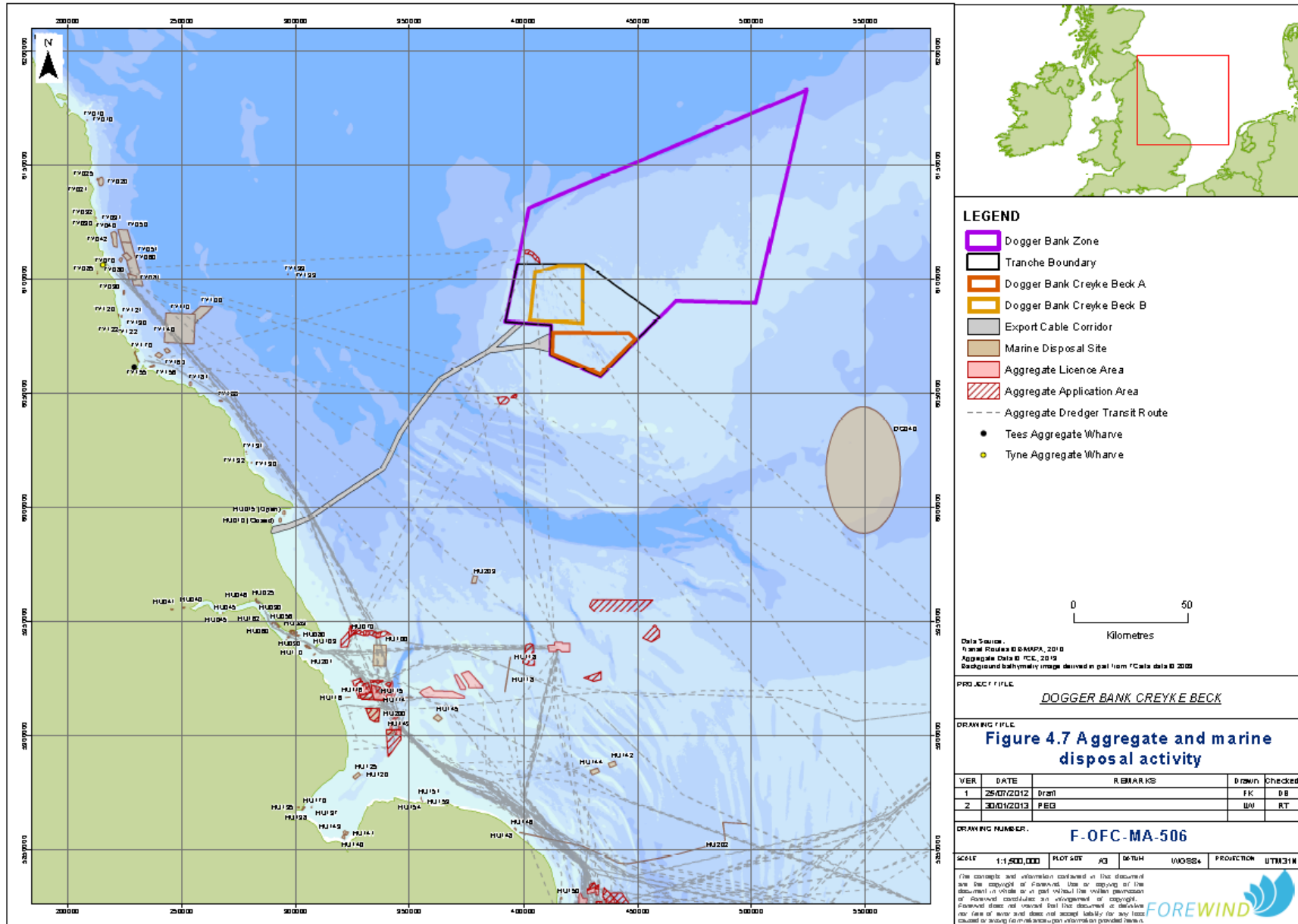
*White-beaked dolphin*



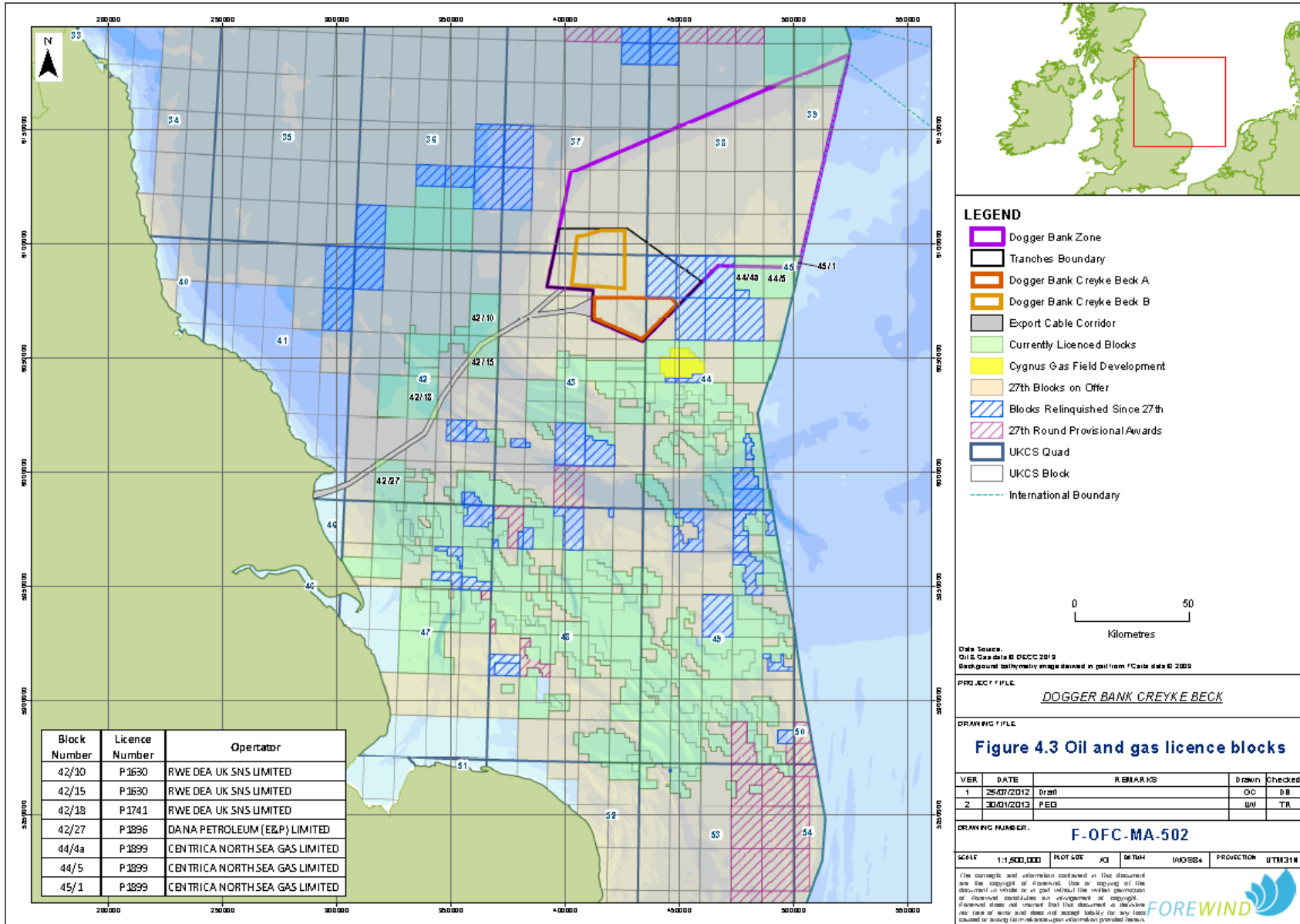
*Surveys by air (HiDef Aerial Surveying Ltd)*



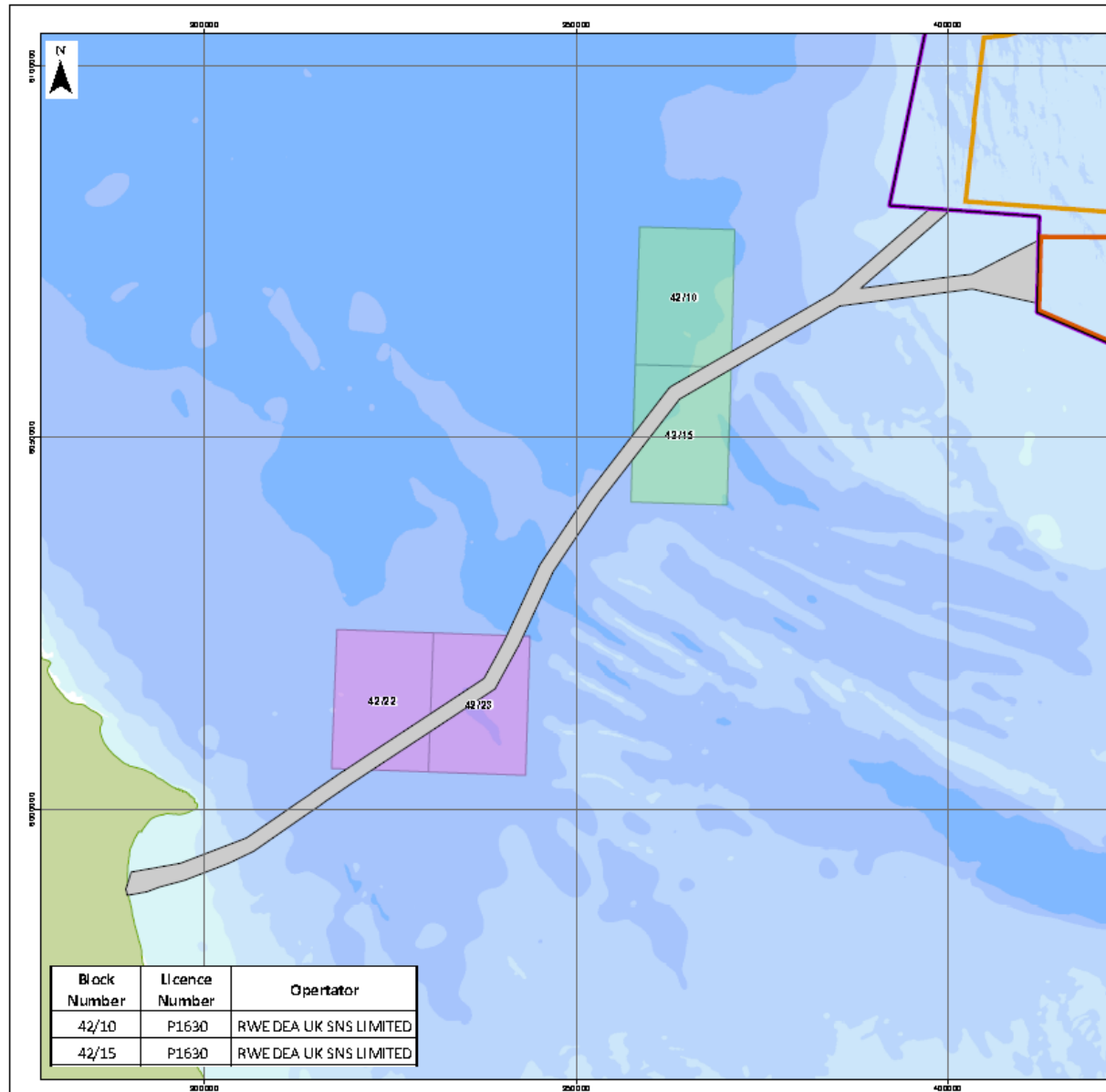
*Minke whale*







# Oil & gas interaction with cable route



Block Number	Licence Number	Operator
42/10	P1630	RWE DEA UK SNS LIMITED
42/15	P1630	RWE DEA UK SNS LIMITED



- LEGEND**
- Dogger Bank Zone
  - Tranche Boundary
  - Dogger Bank Creyke Beck A
  - Dogger Bank Creyke Beck B
  - Export Cable Corridor
  - Currently Licenced Blocks
  - Blocks Considered in HRA Screening



Data Source:  
Oil & Gas data © DECC 2013  
Background bathymetry map derived in part from ICale data © 2009

PROJECT FILE  
DOGGER BANK CREYKE BECK

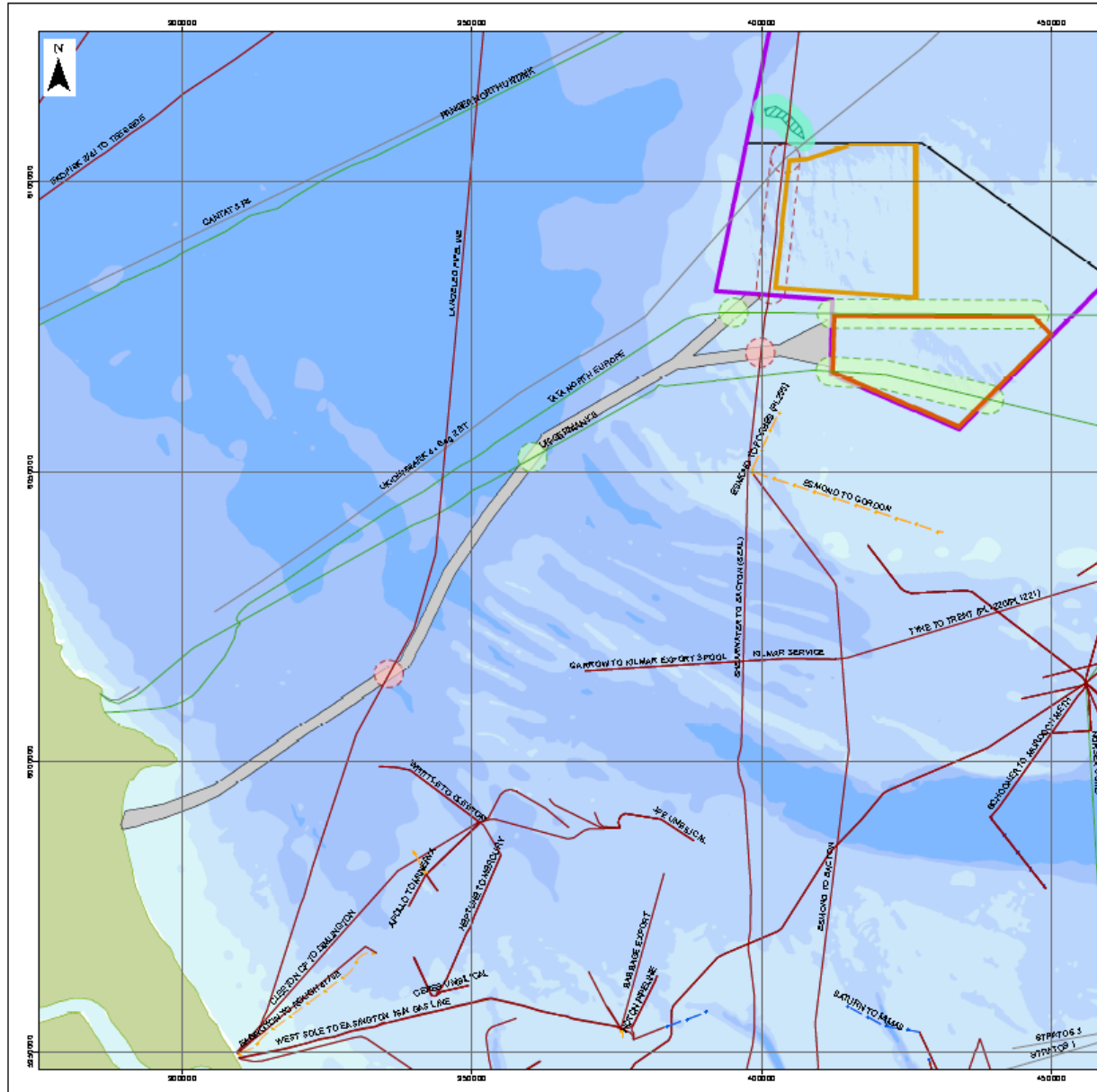
DRAWING TITLE  
**Figure 4.5 Export cable corridor interaction with oil and gas licence blocks**

VER	DATE	REMARKS	Drawn	Checked
1	30/01/2013	Draft	UN	TR
2	12/02/2013	PEB	UN	RZ

DRAWING NUMBER:  
**F-OFC-MA-504**

SCALE: 1:550,000 PLOT SIZE: A3 SOUTH UNOSG+ PROJECTION: UTM31N

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**LEGEND**

- Dogger Bank Zone
- Tranche Boundary
- Dogger Bank Crayke Beck A
- Dogger Bank Crayke Beck B
- Export Cable Corridor
- Cemex Application Area
- Cemex Application Area 2km Buffer
- Cable Crossing or Proximity
- Pipeline Crossing
- Pipeline Proximity

**Subsea Cable**

- Active
- Out of Service

**Subsea Pipeline**

- Active
- Not In Use
- Precommission
- Removed

Data Source:  
 Appleton Data © ICE, 2010  
 Cables © ECA, ICE, 2012  
 Pipelines © UK Deal 2012  
 Background bathymetry image derived in part from © Coda data © 2009

PROJECT FILE: **DOGGER BANK CRYEKE BECK**

DRAWING FILE: **Figure 4.9 Crayke Beck A and Crayke Beck B interaction with cables and pipelines**

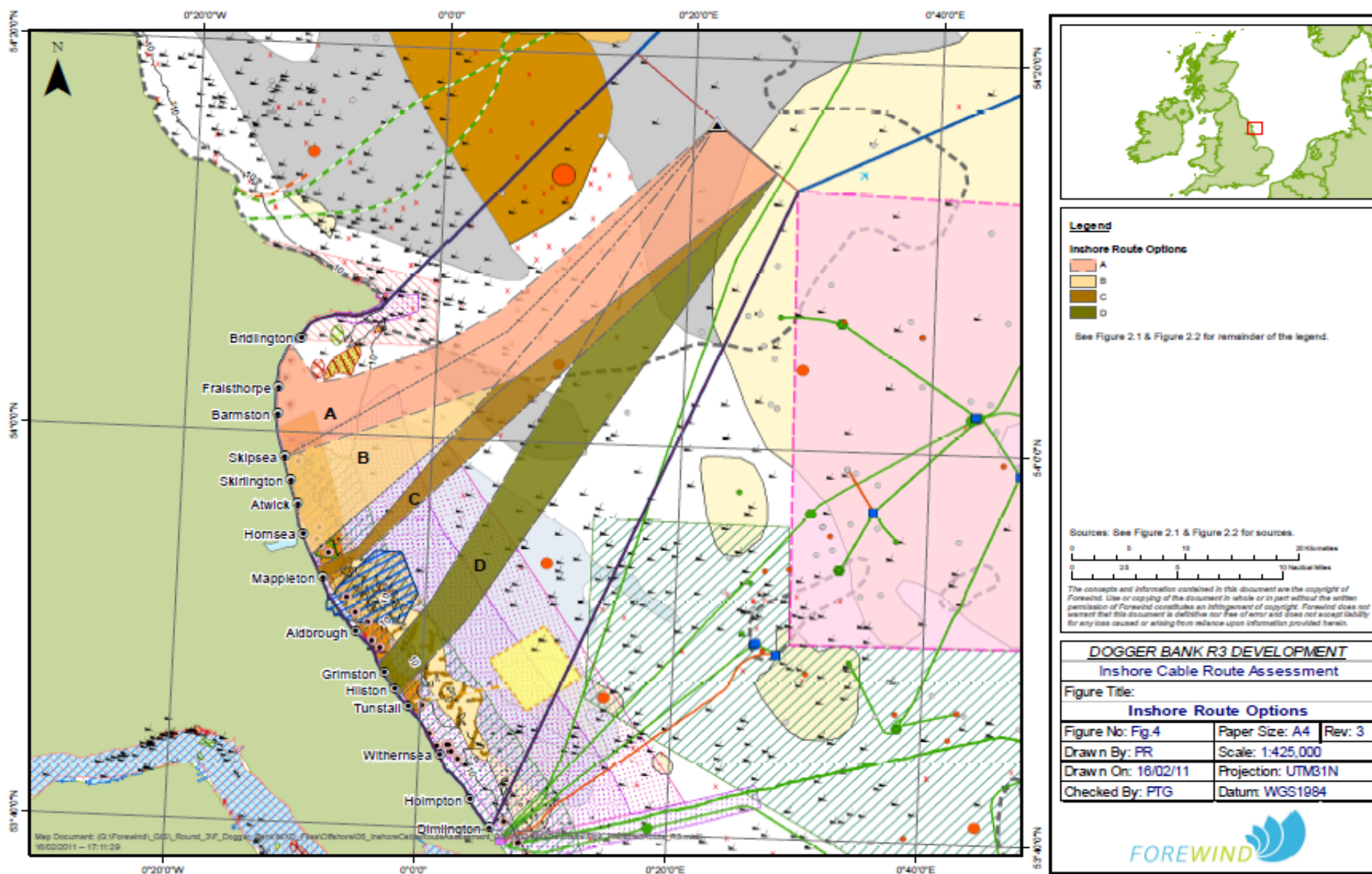
VER	DATE	REMARKS	Drawn	Checked
1	31/01/2013	Drawn	UN	RT
2	12/02/2013	FEED	UN	RZ

DRAWING NUMBER: **F-OFC-MA-508**

SCALE	1:700,000	PLOT SIZE	A3	GRID	10M	WGS84	PROJECTION	UTM31N
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# Preferred nearshore and cable landfall routes



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- Relevant aspects of the project must be described for environmental assessment.
- The consenting approach to be used by Forewind is called a “Rochdale Envelope”.
- Range of options described – final project must build within that “envelope”.
- Assess “realistic worst case” assumptions - intended to cover anything the shareholders might want to build, but not too conservative as this would increase consent risks.



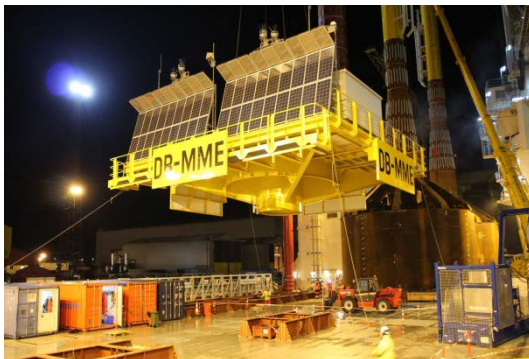
## **Project description overview:**

Offshore project components (one project):

- Capacity up to 1200MW
- Up to 200 turbines (implies minimum 6 MW per turbine)
- 1 to 4 AC collector substations
- 1 DC converter substation
- Up to 2 accommodation or helicopter platforms
- Up to 5 met masts
- Up to 10 vessel mooring buoys
- Minimum construction duration 3 years
- Maximum construction duration 6 years

Cumulative impact assumptions:

- Up to 6 projects in construction simultaneously
- Up to 12 piling rigs in operation simultaneously
- Maximum zonal construction duration 20 years



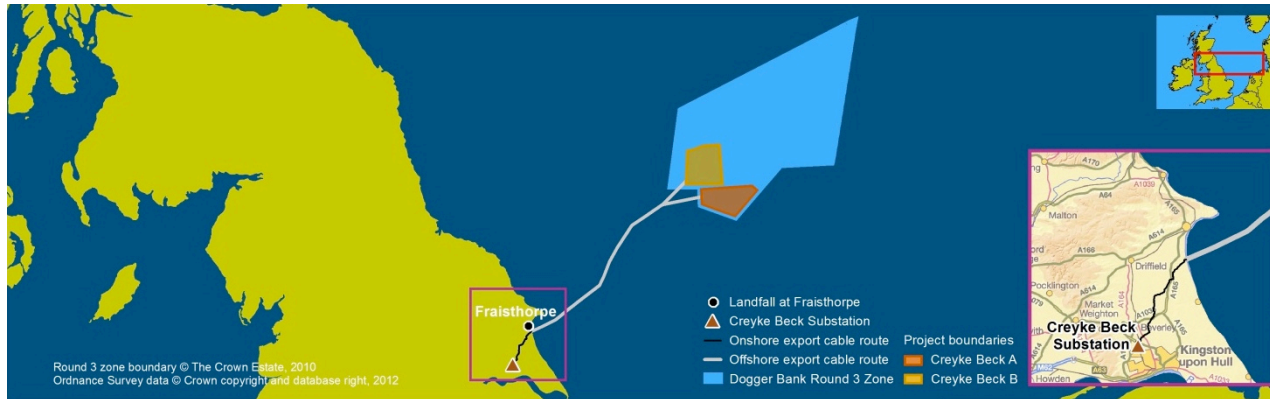
- Two met masts installed during 2013 - providing essential wind, wave, weather and other information.
- Innovative suction installed Bucket Foundation.
- Installed by Fred. Olsen United utilising the 132m jack-up vessel *MV Brave Tern*.
- Designed by Universal Foundation and installed by applying suction in the bucket, to embed it into the seabed.
- Fabricated by Harland & Wolff, Belfast.
- 93m lattice towers manoeuvred into place using a “human free” technique employing guide cones.
- Project supported by the Carbon Trust’s Offshore Wind Accelerator programme.
- Opportunity to innovate, demonstrate new methods and ultimately reduce costs and improve efficiencies industry-wide.

# Dogger Bank current status



- Forewind completed its final Dogger Bank offshore survey in October 2013, marking the end of the most extensive study of an offshore area by a wind energy developer ever undertaken.
- More than £60 million has been spent on surveys with most of the work going to UK-based contractors.
- The two meteorological masts installed in 2013 are now in operation.
- Forewind has submitted two development consent order applications totalling 4.8GW to the Planning Inspectorate, which is more than the offshore wind capacity currently in operation in the UK.
- The applications, for Dogger Bank Creyke Beck and Dogger Bank Teesside A&B, each comprise two 1.2GW wind farm projects.
- These four Dogger Bank projects alone could create more than 4500 new jobs and generate an additional £1.6 billion\* for the UK economy.

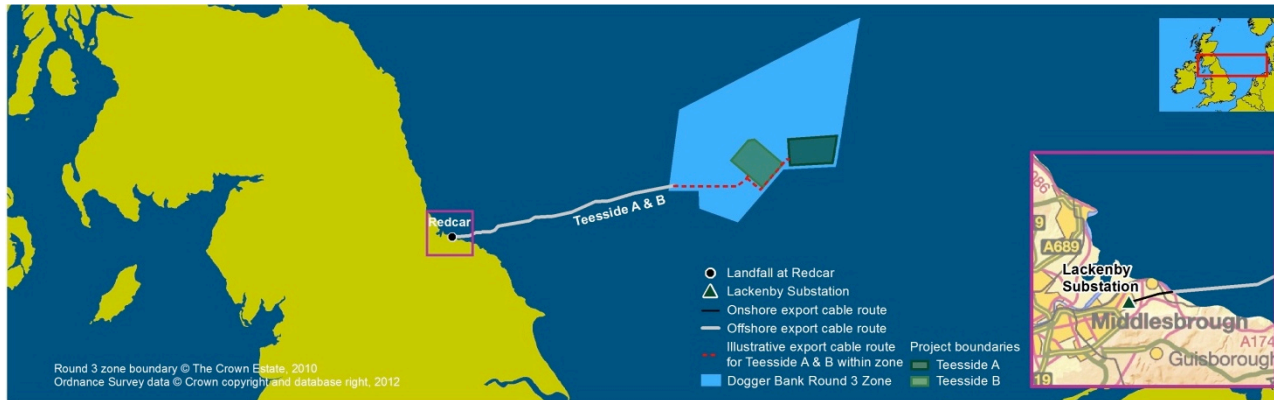
\* This figure represents Gross Value Add (GVA) or the contribution to the economy of each individual producer, industry or sector.



- Development consent order was submitted at the end of August 2013.
- Accepted for examination at the end of September.
- Section 56 consultation and Habitats Regulations Assessment consultation undertaken in late 2013.
- Relevant representations received.
- Examination phase started in February 2014 and concluded August 2014.
- Consent anticipated by 18<sup>th</sup> February 2015

Date	Activity
Q4 2011	First stage of statutory consultation
2011 - 2012	Environmental surveys and reporting continued
Q2 2013	Second stage of statutory consultation
Q3 2013	Application submitted and accepted for examination
Q1 2014	Six month examination phase starts
Q1 2015	Consent decision anticipated
2015 onwards	Pre-construction, construction and operation





Date	Activity
Q2 2012	First stage of statutory consultation
2012 - 2013	Environmental surveys and reporting continued
Q4 2013	Second stage of statutory consultation
Q1 2014	Application submitted
Q2 2014	Application accepted for examination
Q3 2014	Six month examination phase started
Q3 2015	Consent decision anticipated
2015 onwards	Pre-construction, construction and operation

- Lessons from Dogger Bank Creyke Beck project incorporated.
- Development consent order application submitted at end-March 2014.
- Application accepted for examination in April.
- Section 56 consultation completed and Statements of Common Ground prepared.
- Examination started, due to finish February 2015.
- Consent anticipated August 2015.



- Forewind exists to achieve development consent for Dogger Bank projects. Our expertise is taking projects through this early phase.
- Despite the tough economic climate, in partnership with the Crown Estate, shareholders have to date already invested almost £90m developing the Zone.
- Each individual Dogger Bank project will require a massive investment.
- Forewind's shareholder companies will take the role of lead operators, guiding individual projects once consent is received, to financial close and then into construction and operation.
- Britain is a world leader in offshore wind, but the future will depend in part on Government energy policy and partly on cost reductions.
- Forewind is playing its part by making sure we plan and consent the most viable projects we can for Dogger Bank – projects that will be safe, have low environmental impact, and are economic.