



Netherlands Enterprise Agency

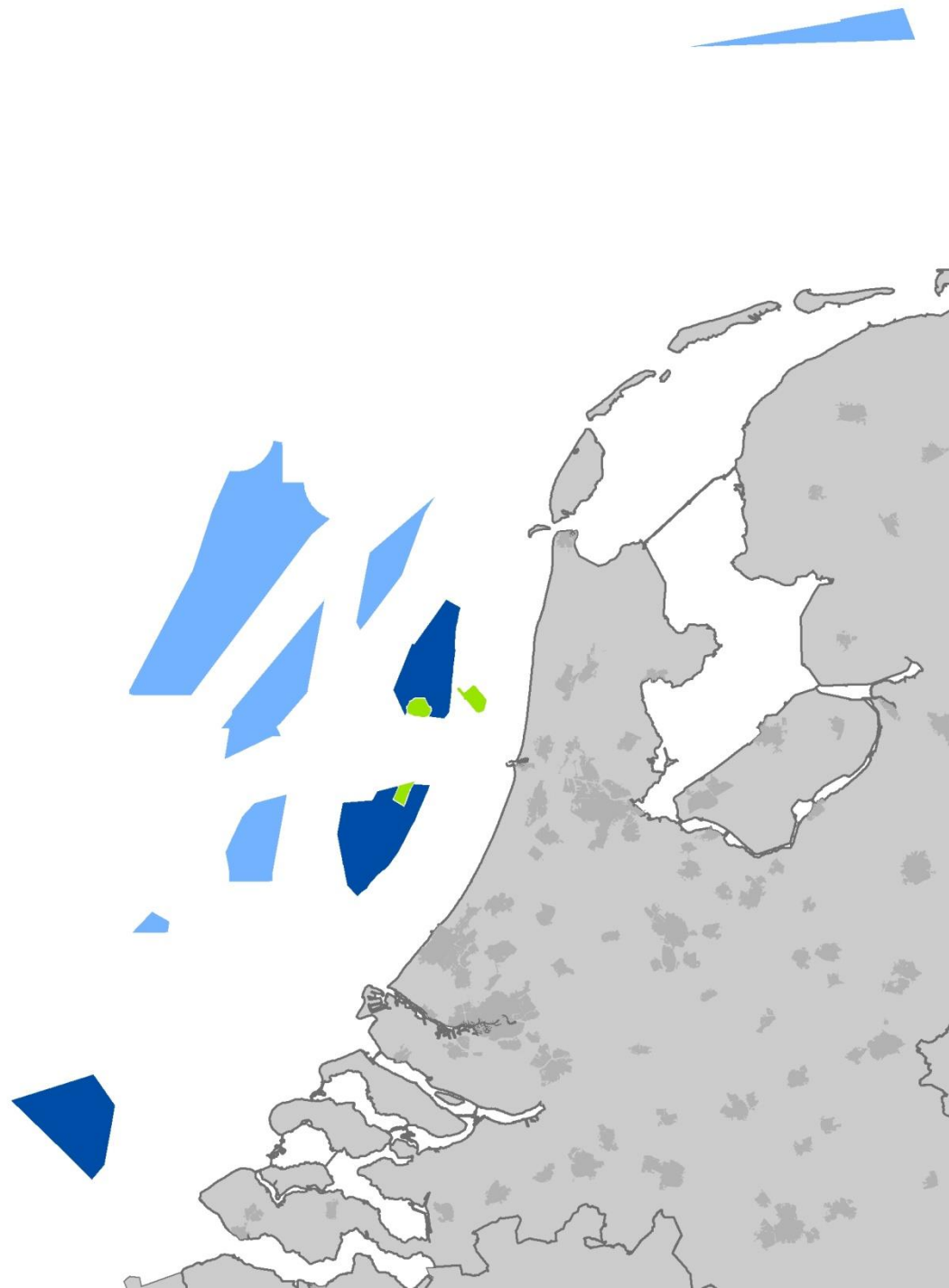
Roadmap towards 4,500 MW offshore wind power

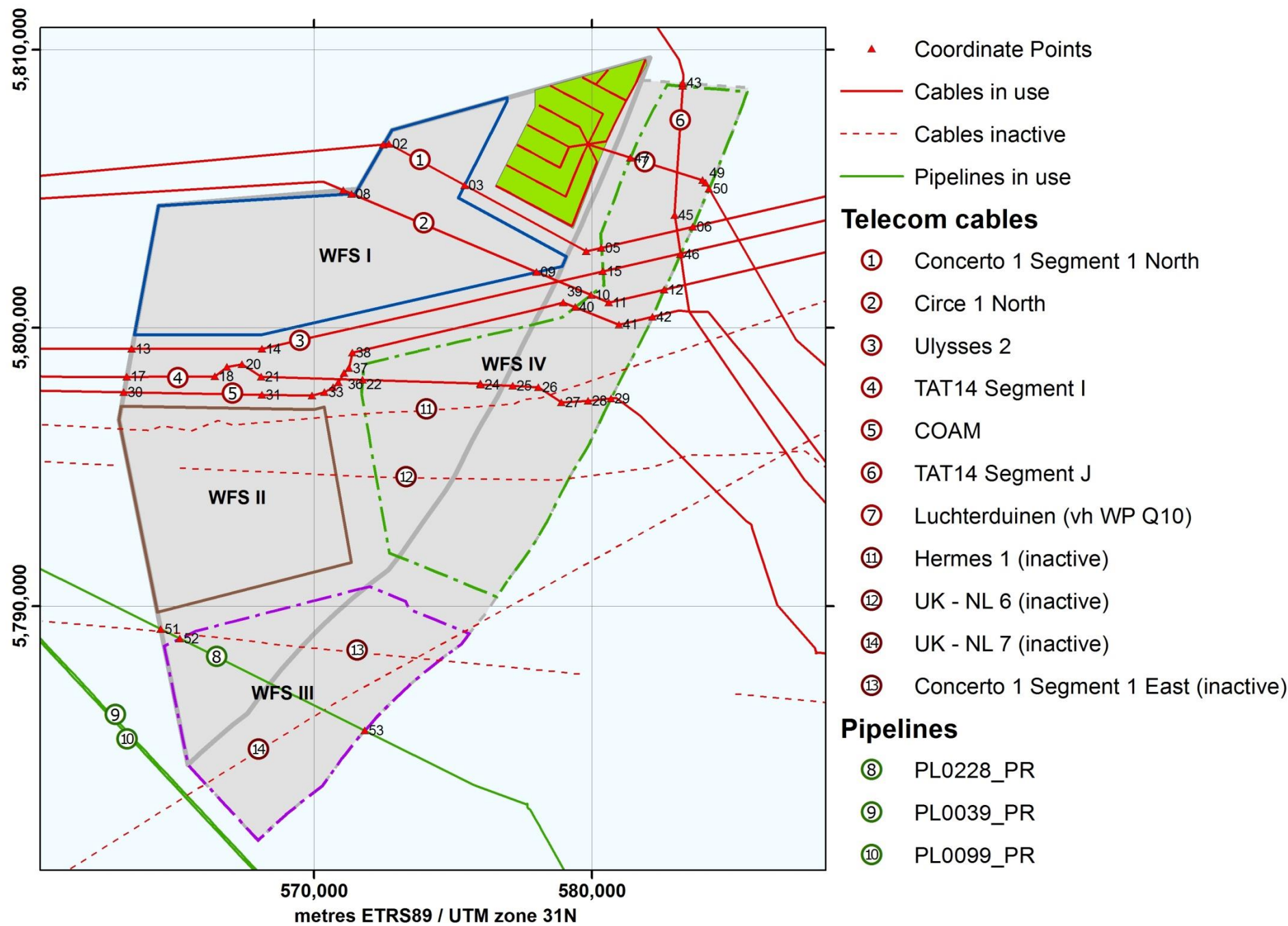
Site Investigations & Interface Studies

Ruud de Bruijne

18th April 2017, Maritime Museum Rotterdam

>> Sustainable. Agricultural.
Innovative. International.





Obstructions

Archaeology

Archaeological
desk study

UXO

UXO risk
assessment

Soil

Geology

Geological
desk study

Seabed

Wind & Water

Wind resource

Metocean

Geophysical site investigation

Metocean campaign

Archaeological
assessment

Geotechnical site
investigation

Morphology
study

Wind resource
assessment

Metocean
desk study

Turbine layout

Installation
procedures

Foundation and cable design

Yield assessment

Turbine,
foundation and
cable design



SI Hollandse Kust - Planning

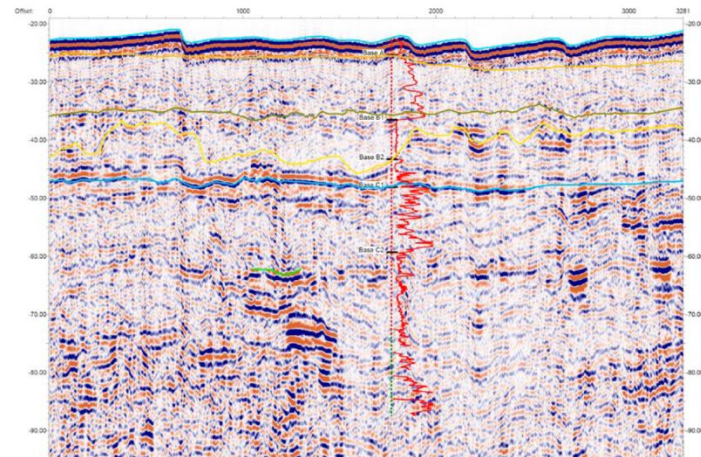
- **Hollandse Kust (zuid) WFS I & II**
 - Base scope completed
 - Extras due in Q2/Q3 2017:
 - > scour study
 - > update Metocean Desk Study & Wind Resource Assessment
- **Hollandse Kust (zuid) WFS III & IV**
 - Geotechnical reporting due Q2 2017
 - Other studies: completed
- **Hollandse Kust (noord) WFS V**
 - Investigations started, due in 2018





Site investigations HKZ WFS I & II

- **Geotechnical**
 - BH plan based on PCPTs results
 - No boreholes post-tender phase
 - More cyclic lab tests





Site investigations HKZ WFS I & II

Conclusion

Geotechnical

Based on PCPTs results

This comprehensive geotechnical campaign was defined as a joint effort between multiple parties and reviewed by DNV GL with the objective to reduce the need for boreholes in later stages of development. With a proper CPT calibration and additional CPTs at each planned turbine location it is likely that additional boreholes may be omitted.

However, it is the responsibility of the designer to make the final decision, if additional boreholes can be omitted to enable an economic and safe foundation design.

DNV GL – Report No. CR-SC-DNVGL-SE-0190-02453-1_Geotechnical – www.dnvgl.com

STATEMENT OF COMPLIANCE

Statement No.:
SC-DNVGL-SE-0190-02664-0

Issued
2017-03-21

Issued for:

Site Conditions Assessment of Wind Farm Zone Hollandse Kust (zuid) (WFS I and WFS II)

Comprising:

Wind Turbines, Substation and Power Cables

Specified in Annex 1

Issued to:

Netherlands Enterprise Agency

Croeselaan 15
3521 BJ Utrecht
The Netherlands

According to:

DNVGL-SE-0190:2015-12 Project certification of wind power plants


Based on the documents:
CR-SC-DNVGL-SE-0190-02664-2

Certification Report, dated 2017-03-21

Changes of the site conditions are to be approved by DNV GL.

Hamburg, 2017-03-21

For DNV GL Renewables Certification


J.V. Fabio Pollicino
Service Line Leader Project Certification

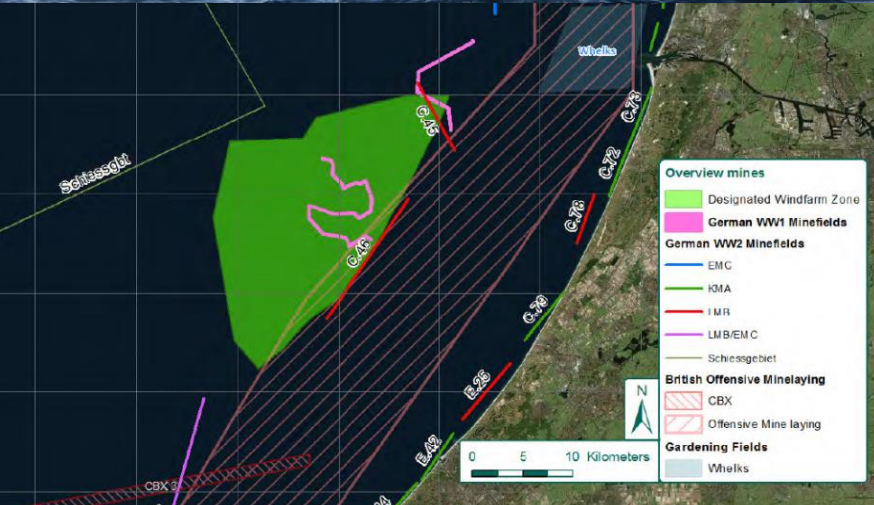


By DAKKS according DIN EN ISO/IEC 17065
accredited Certification Body for products. The
accreditation is valid for the fields of certification
listed in the certificate.

Hellerup, 2017-03-21

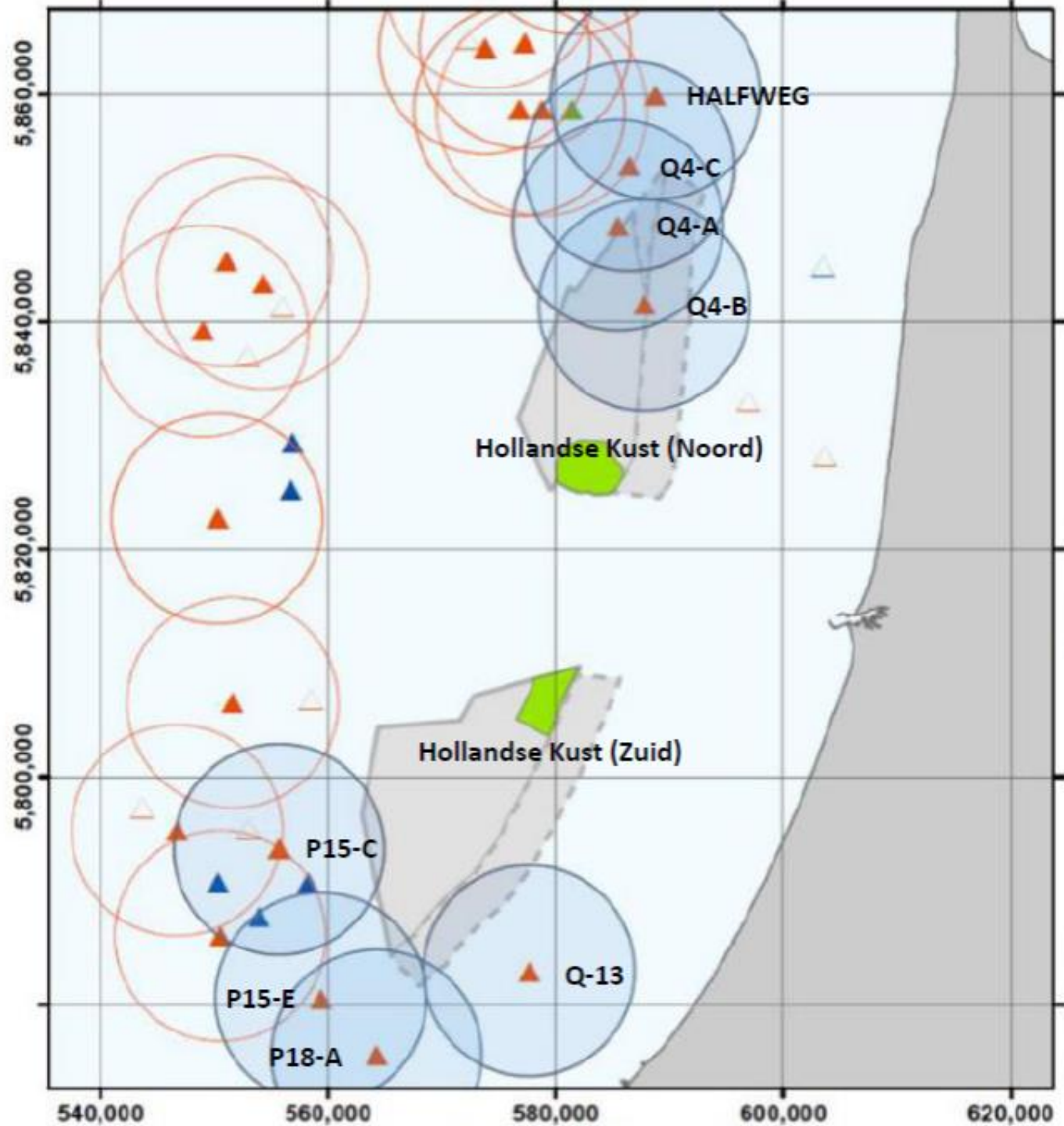
For DNV GL Renewables Certification


Erik Asp
Project Manager



Site investigations HKZ

- **Metocean campaign**
 - 2 Buoys for redundancy
 - April 2017: 9 months data, >97% availability
 - Validation of all measurements
 - Campaign to be continued till January 2018
- **Metocean Desk study and Wind Resource Assessment**
 - Update planned July 2017 based on in situ measured data
- **UXO**
 - Assessment type of ordnance added





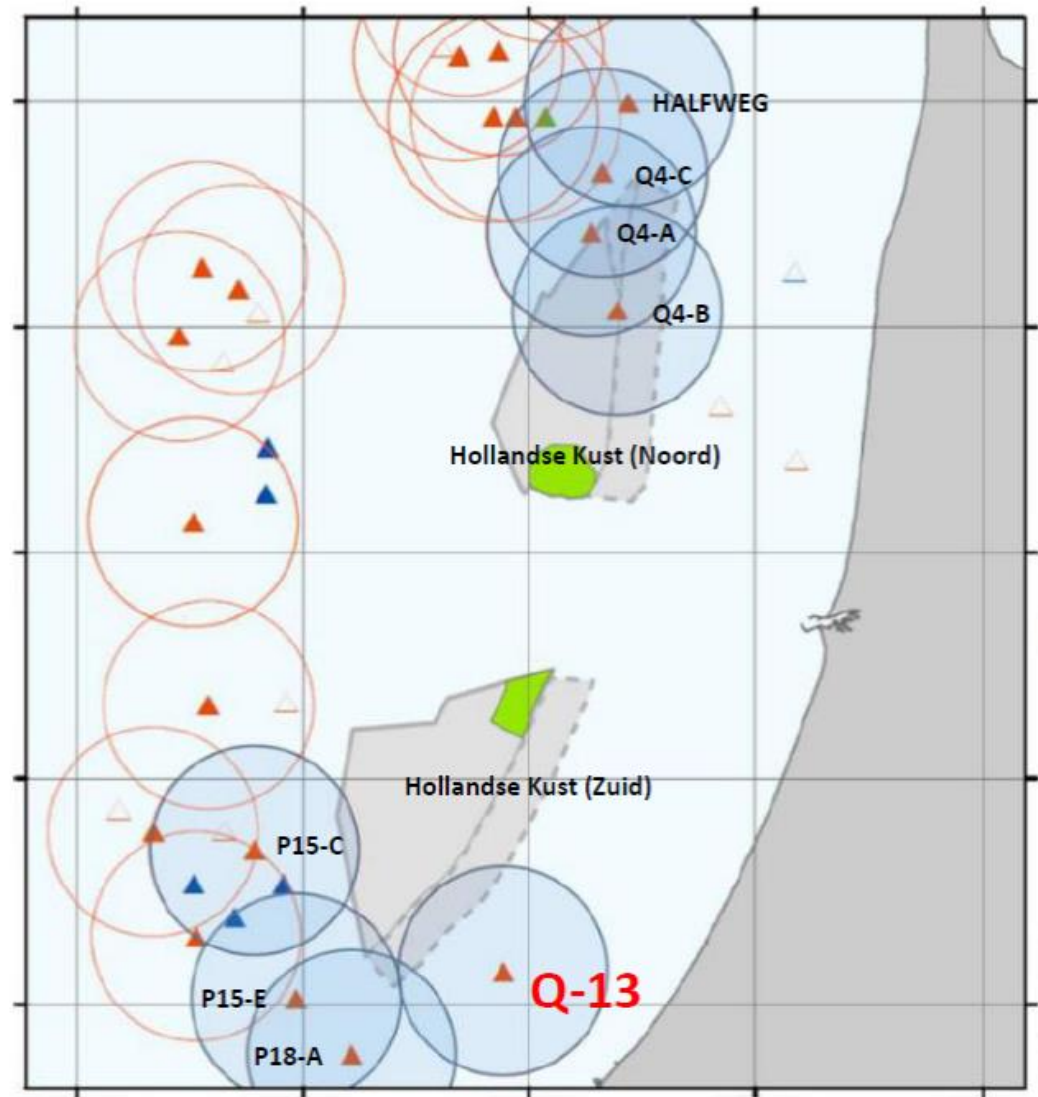
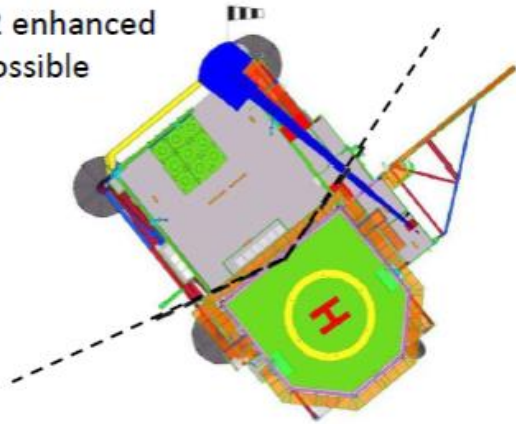
Interface: helicopter accessibility

- Study by TO70;
expert support OutSmart
- Steering committee includes
Ministries of EA; I&E; ILT; Nogepe
and helicopter operators
- Aim:
 - General guidelines
 - Dedicated solutions
Hollandse Kust Wind Farm Zone
- Due Q2 2017



Q13

Class 2 enhanced
possible



Q13 (IMC / ARA / Departure)

Legend

Windfarm zone

Buffer 1NM

Anchorage

Maritime separation zone

Maritime routes

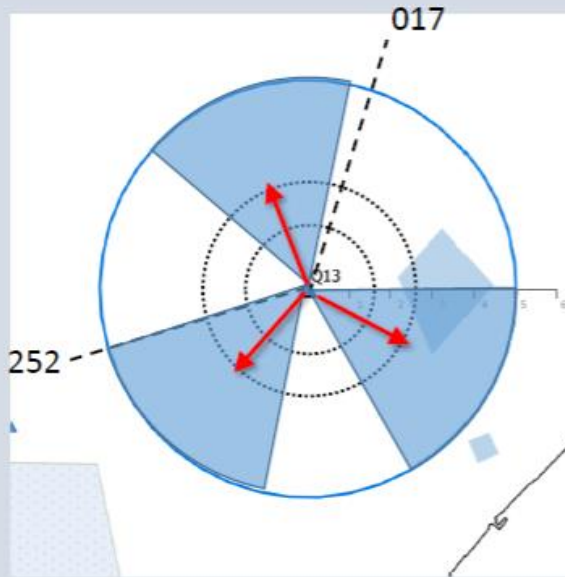
HTZ

Oilrig outside windfarm zone

Oilrig within windfarm zone

Oilrig asymmetry

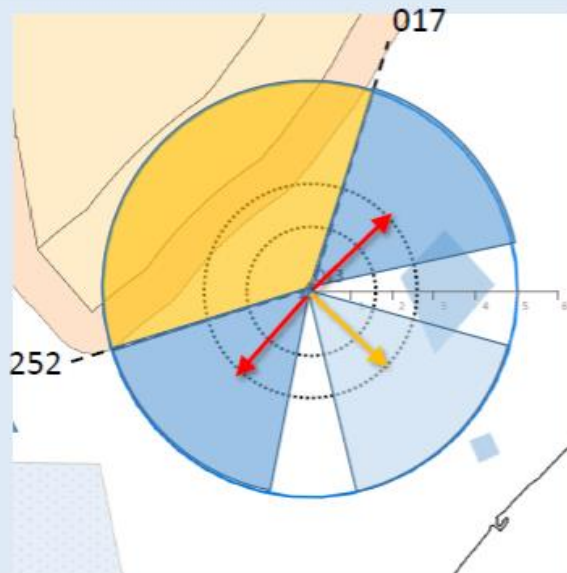
Baseline



3 x D

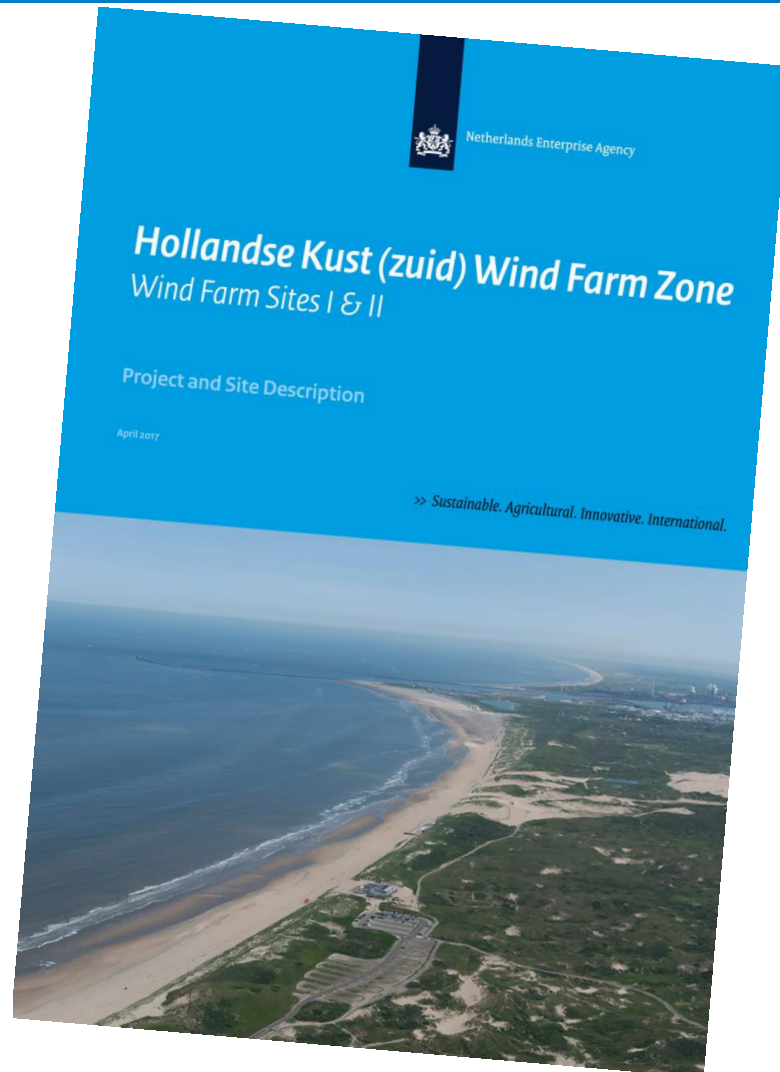
$\geq 99\%$?

Windpark



2 x D + 1

90-99% ?



Communication

- **Website: offshorewind.rvo.nl**
Check revision log frequently!
- **Project and Site Description
Hollandse Kust (zuid) WFS I and II**
Published today
- **HKN: webinars
after Tender HKZ III & IV**

Questions? E-mail: woz@rvo.nl

