



UNECE Ad Hoc Group of Experts on Harmonization of Fossil Energy and Mineral Resources Terminology, 5th Session

“Applying the UNFC Classifications on the producing German oil field Mittelplate – A case study”

UNECE Ad Hoc Group of Experts on Harmonization of
Fossil Energy and Mineral Resources Terminology
Fifth Session, 15-16 April 2008

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Geneve, April 15th – 16th, 2008

Overview

- Objective
- Introduction
- General Information on Mittelplate oilfield
 - Infrastructure
 - Reservoir
 - Development
- Mittelplate reserves evaluation
 - RWE Dea system (comparable to SPE)
 - UN system
 - Workout variations in categories (no consideration of volumes)
- Conclusion



Objective ...

- ... is to apply the new UNFC-System on an existing reservoir and to check, if (in this particular case “Mittelplate”)
 - the system is applicable
 - the system is compatible with the RWE Dea/PRMS-System
 - the system “generates new reserves” or if existing accumulations are excluded

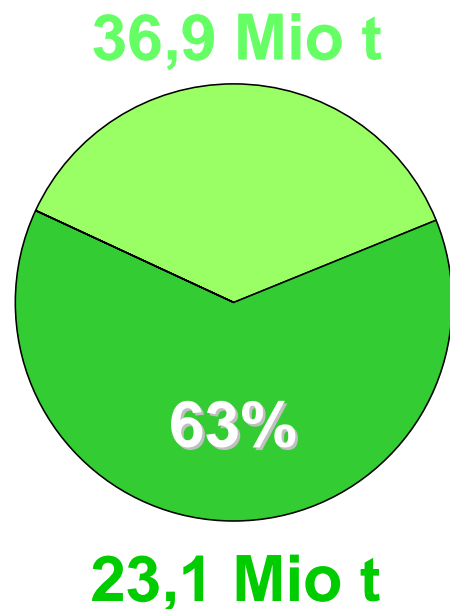
- ... is not to compare volumes or quantities of the outcome of UNFC-System with RWE Dea/PRMS-System

Introduction

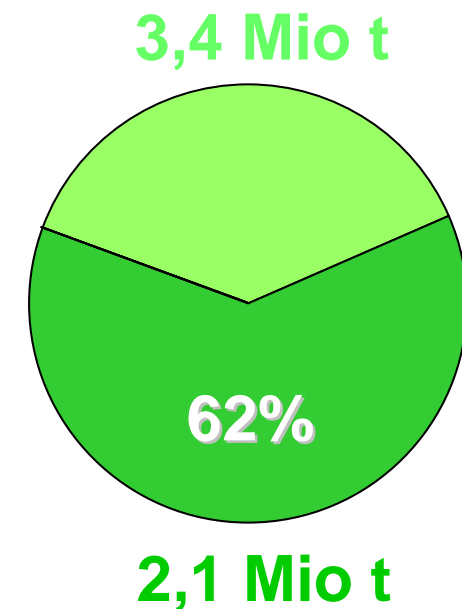
The importance of the Mittelplate field for Germany's Oil Reserves

Reserves 31. 12. 2007

Production 2007



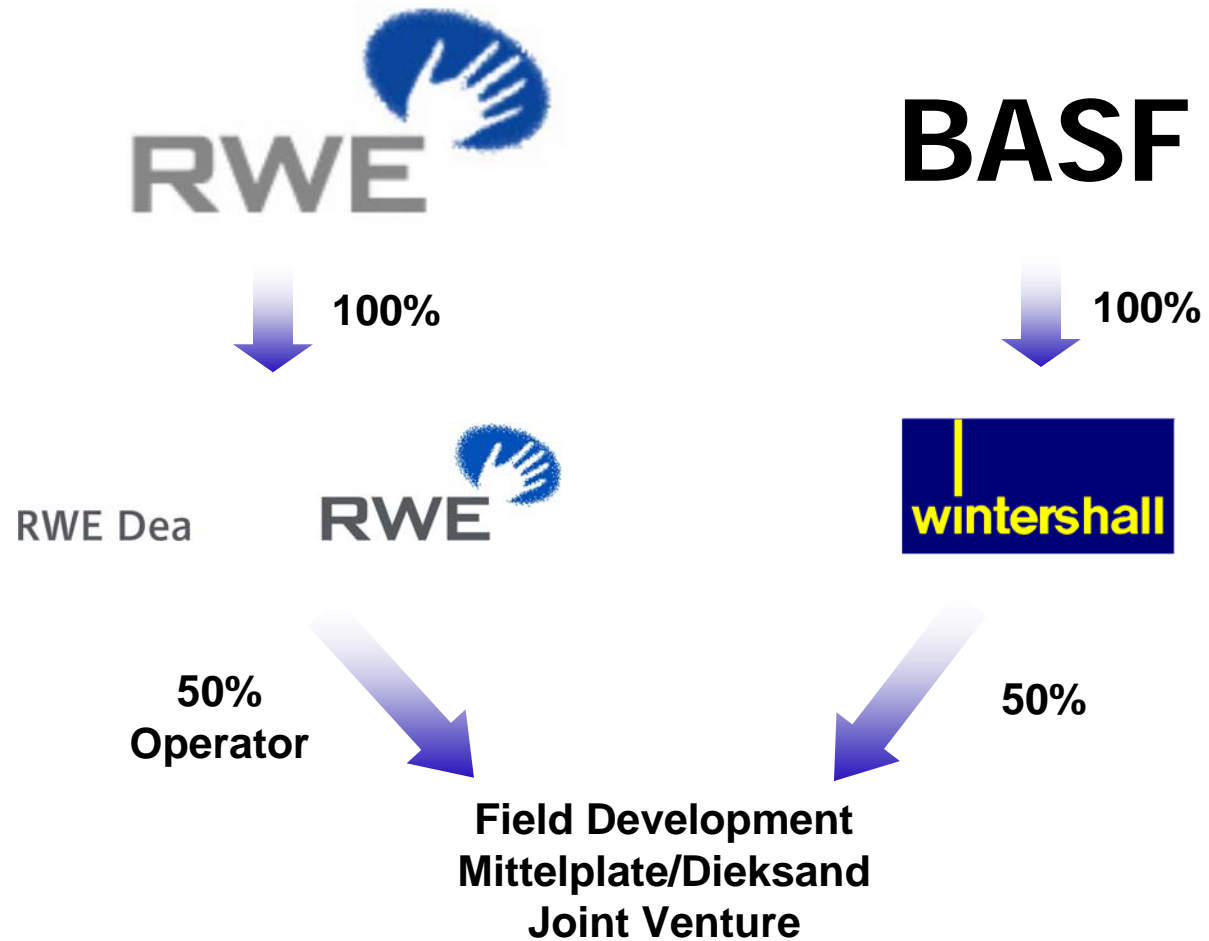
Germany



Mittelplate

Introcuction

Mittelplate Joint Venture



Introduction

Mittelplate Island



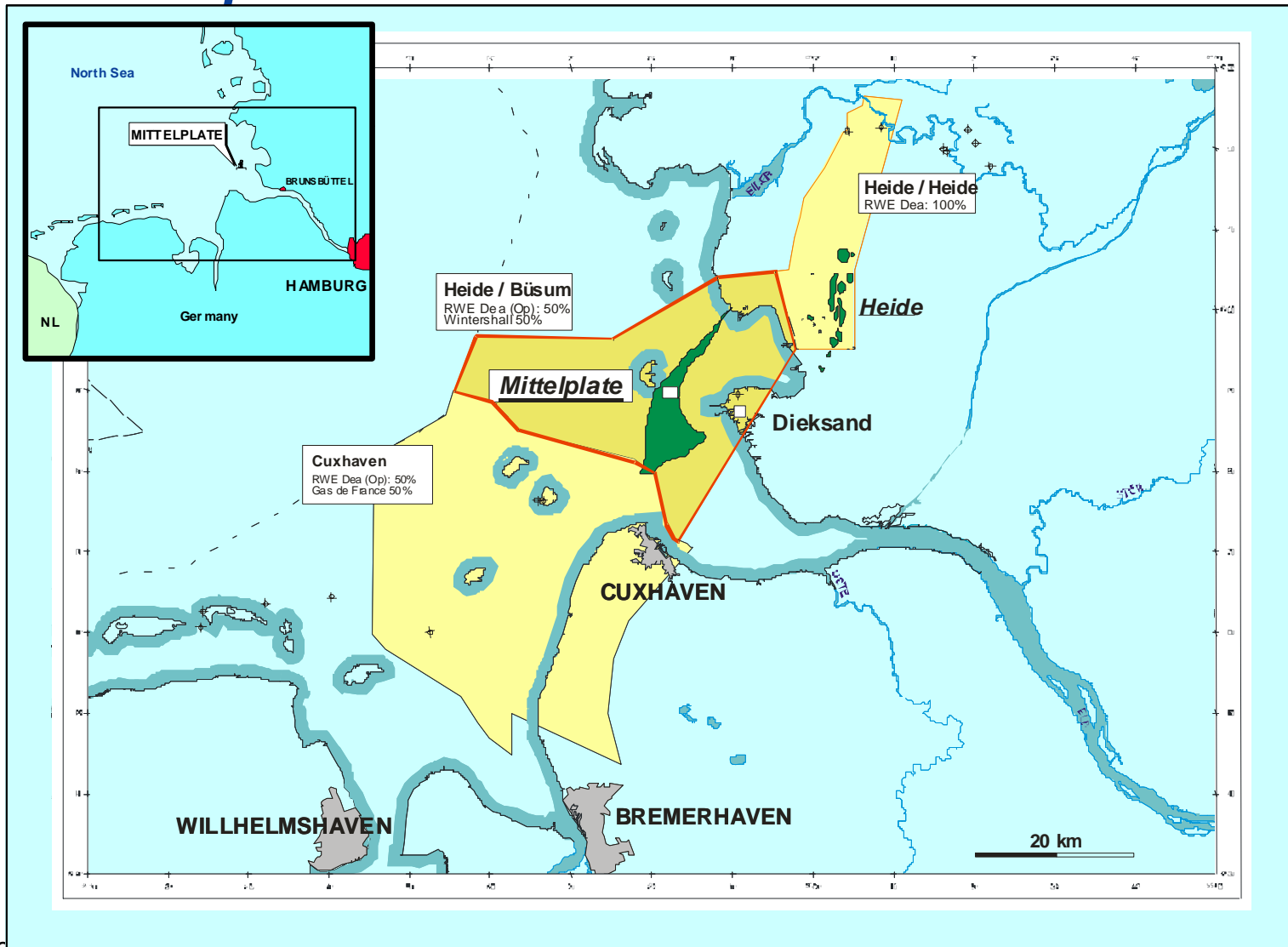
RWE Dea



Artificial Island Mittelplate A

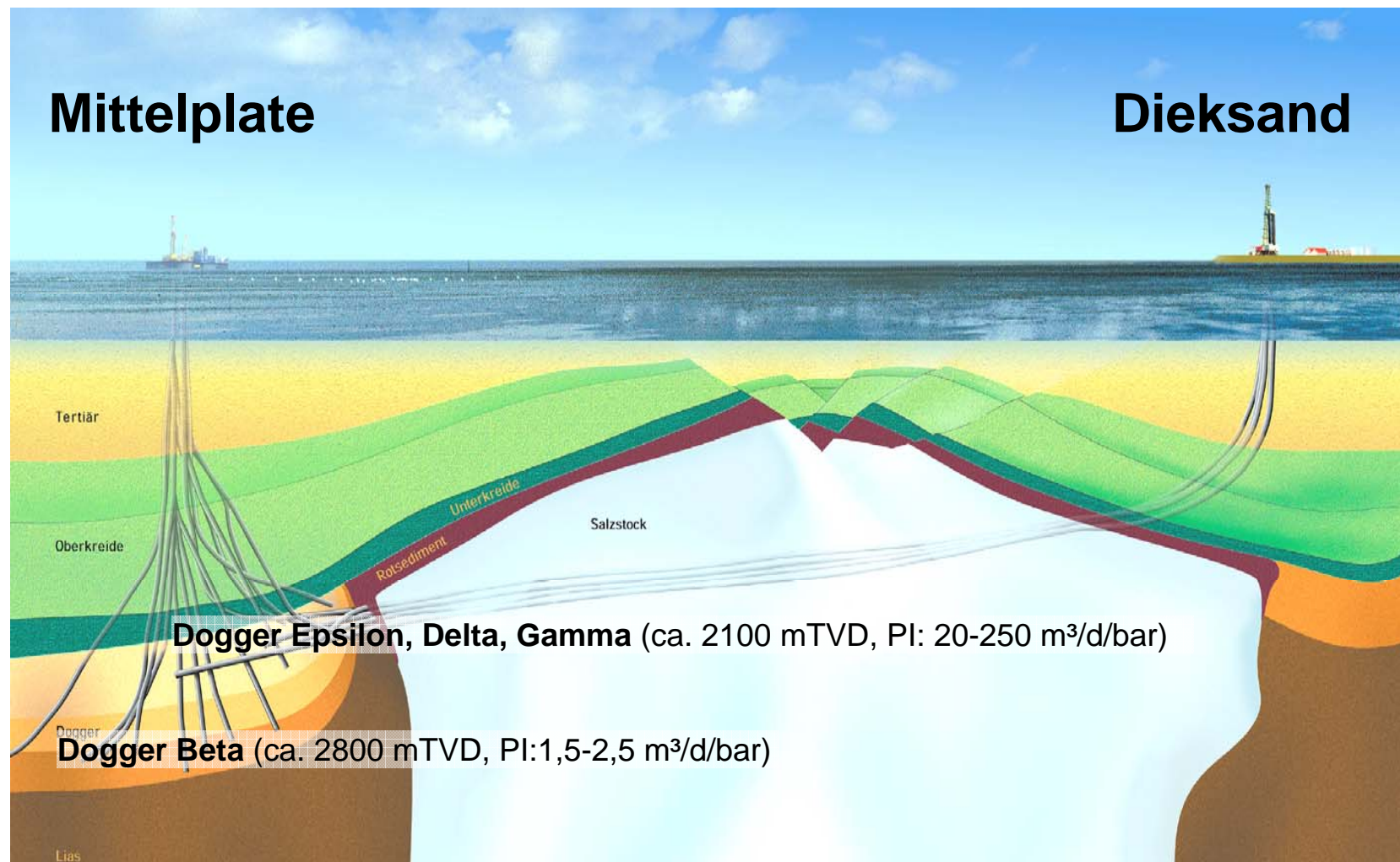
Introduction

Location Map



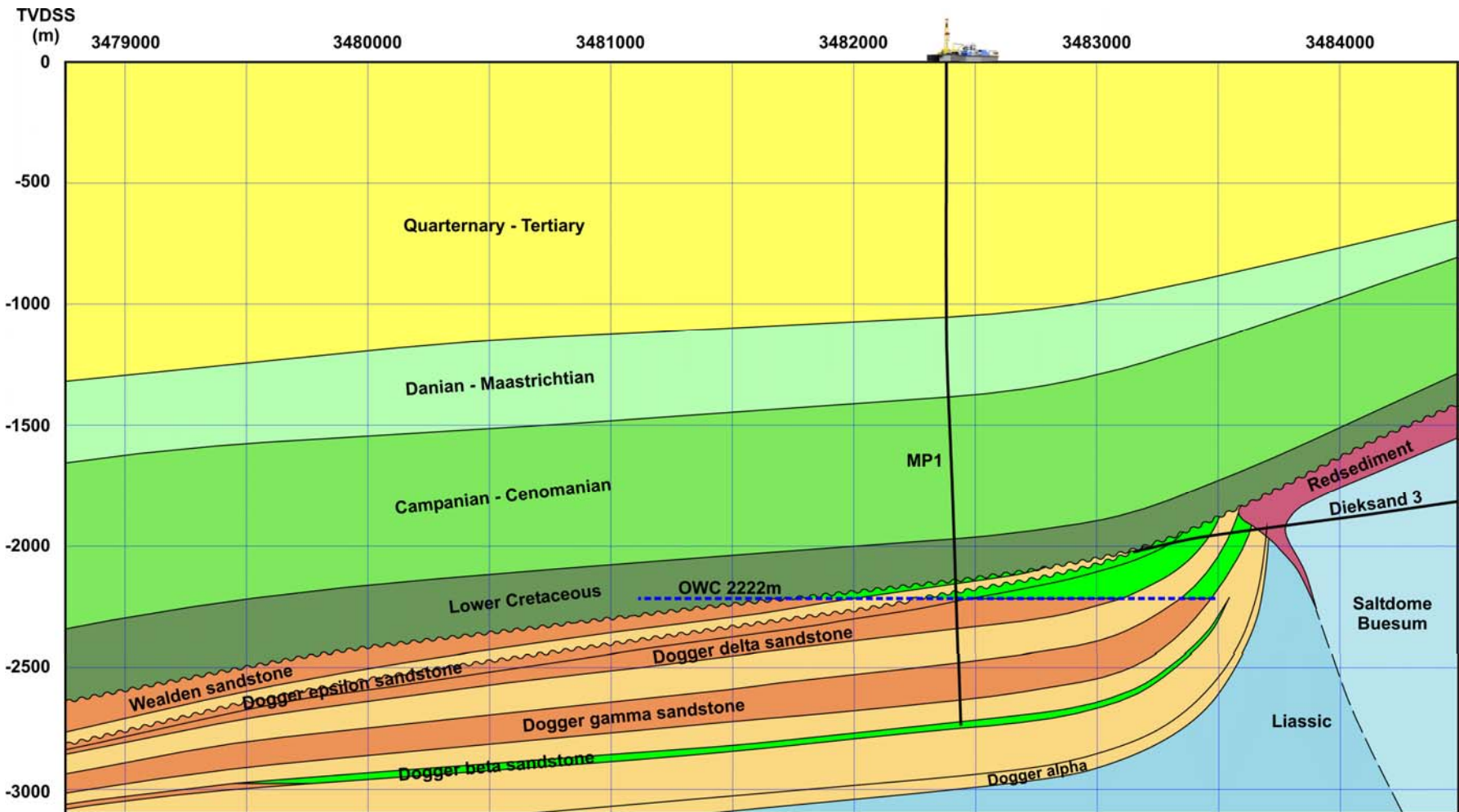
Oilfield Mittelplate

Geological Cross Section (W-E)



Oilfield Mittelplate

Geological Cross Section (W-E) - details



RWE Dea Resource Classification System

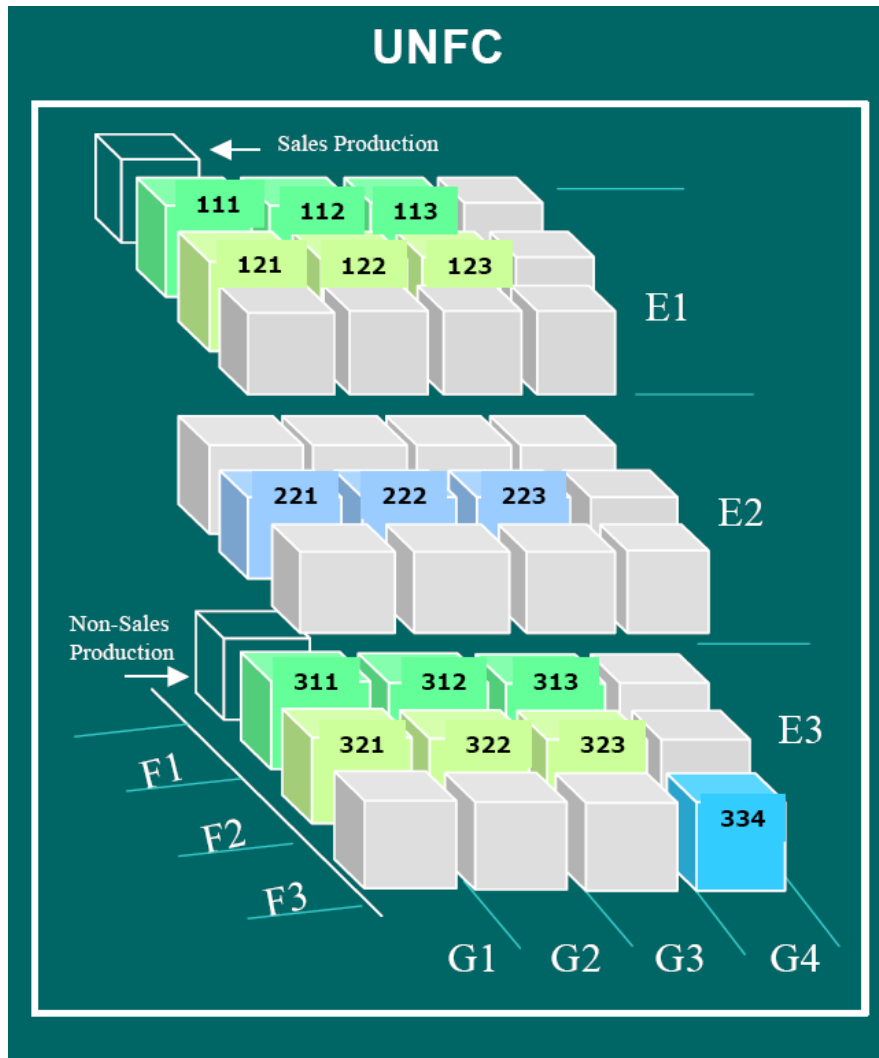


TOTAL PETROLEUM-INITIALLY-IN-PLACE	DISCOVERED PETROLEUM-INITIALLY-IN-PLACE	COMMERCIAL	PRODUCTION			PROJECT STATUS		PROJECT MATURITY ↑ HIGHER RISK	
			RESERVES			On Production	C1		LOWER RISK
			PROVED	PROVED plus PROBABLE	PROVED plus PROBABLE plus POSSIBLE	Approved for Development	C2		
				Justified for Development	C3				
	DISCOVERED PETROLEUM-INITIALLY-IN-PLACE	SUB-COMMERCIAL	CONTINGENT RESOURCES						PROJECT MATURITY ↑ HIGHER RISK
			LOW ESTIMATE	BEST ESTIMATE	HIGH ESTIMATE	Development Pending	S1		
			UNRECOVERABLE			Development on Hold	S2		
	UNDISCOVERED PETROLEUM-INITIALLY-IN-PLACE	INITIALLY-IN-PLACE	PROSPECTIVE RESOURCES						HIGHER RISK
			LOW ESTIMATE	BEST ESTIMATE	HIGH ESTIMATE	Prospect	E1		
			UNRECOVERABLE			Lead	E2		
UNRECOVERABLE									
← RANGE OF UNCERTAINTY →									

Alternative System

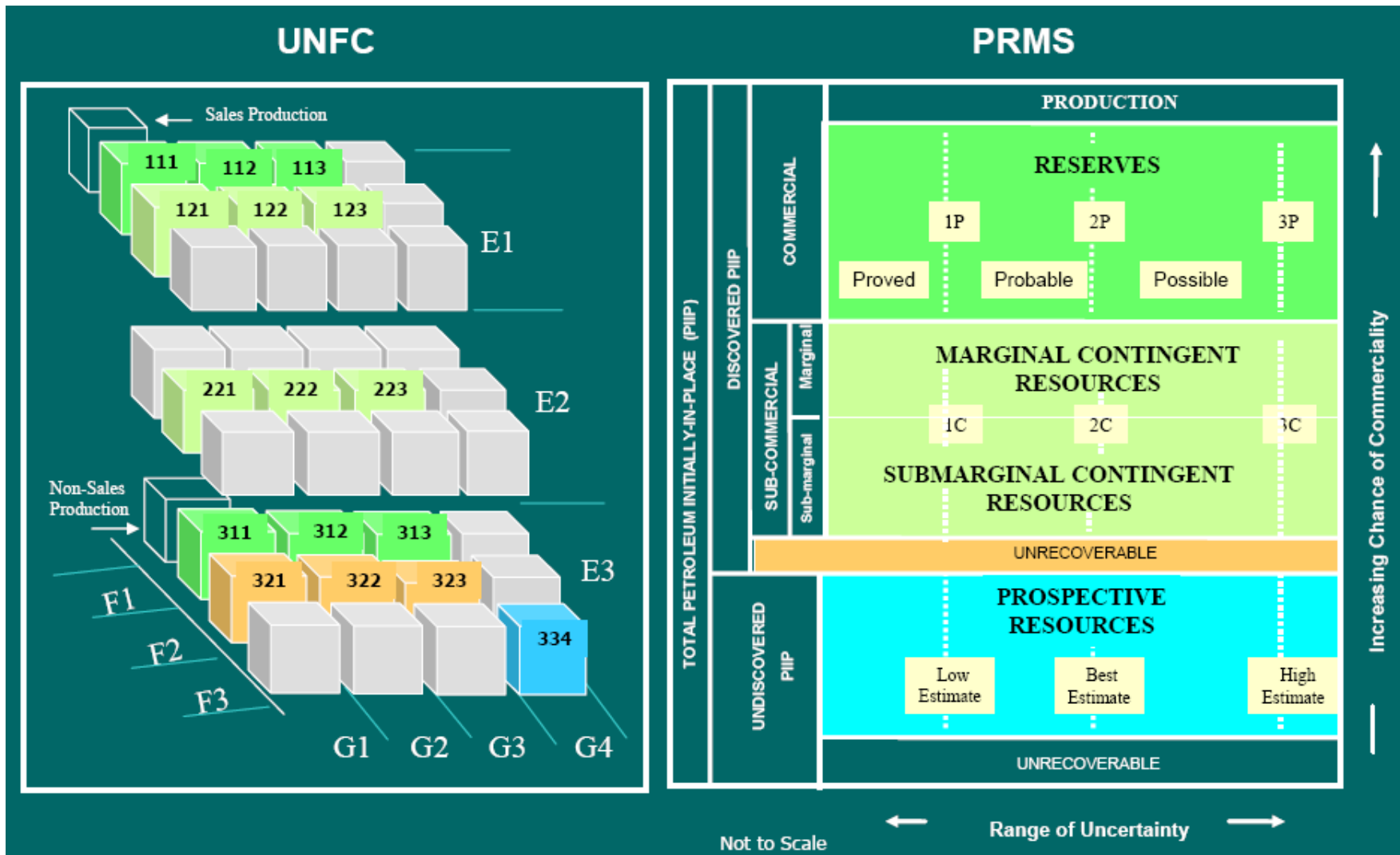


UNFC Classification



- **E axis = Economic and commercial viability**
 - E1 – economic
 - E2 – potentially economic
 - E3 – intrinsically economic
- **F axis = Field project status and feasibility**
 - F1 – justified
 - F2 – contingent
 - F3 – undefined
- **G axis = Geological knowledge**
 - G1 – reasonably assured
 - G2 – estimated
 - G3 – inferred
 - G4 - potential

Aligning PRMS-UNFC Classification Matrices*



*Source: "Mapping of the UNFC to the SPE PRMS", John Etherington, presented to AHGE, Fourth Session, 17-19 October 2007, Geneva

Proposed UNFC E-Axis Definitions



E1	Extraction and sales is economically viable.
E1.1	Extraction and sales is economically viable on the basis of realistic assumptions of future market conditions.
E1.2	Extraction and sale is economic in spite of current adverse market conditions that are expected to be of a short-term nature if long-term forecasts remain economic. Extraction that is deemed to be economic as a consequence of subsidies also falls into this sub-category.
E2	Economic extraction has not been fully demonstrated.
E2.1	Extraction has not yet been fully demonstrated to be economic, but on the basis of realistic assumptions of future market conditions, it is more likely than not that economic extraction may take place in the foreseeable future.
E2.2	Extraction is not economic on the basis of realistic assumptions of future market conditions, and eventual economic extraction would require a substantially higher commodity price to render it economic.
E3	Extraction is of a non-commercial nature, it is not economic to extract or economic viability has not yet been determined.
E3.1	Extraction without sale.
E3.2	Economic viability has not yet been determined.
E3.3	Estimated quantities that are in-situ, but where there is currently considered to be no potential for eventual economic extraction.

Proposed UNFC F-Axis Definitions

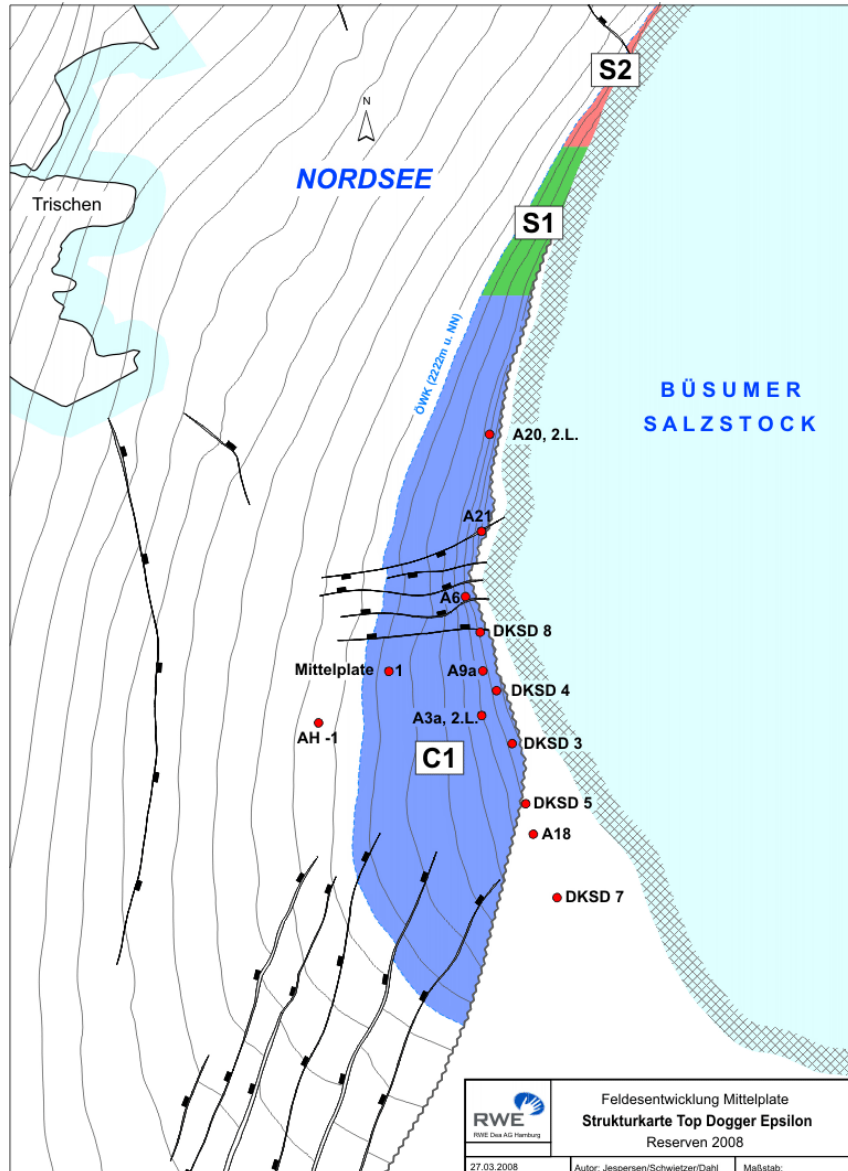


F1	A project that has been demonstrated to be technically and commercially feasible and it is justified to assume that the project will be implemented.
F1.1	The project is currently extracting
F1.2	All necessary approvals have been obtained, capital funds have been committed, and implementation of the development project is under way.
F1.3	Implementation of the development project is justified on the basis of reasonable forecast commercial conditions at the time of reporting, and there are reasonable expectations that all necessary approvals/contracts will be obtained and commitments made.
F2	A development project that has not yet been demonstrated to be technically and/or commercially feasible and its implementation its not yet justified to assure that the project will be implemented.
F2.1	Project activities are ongoing to justify commercial development in the foreseeable future.
F2.2	Project activities are on hold and/or justification of development may be subject to significant delay. .
F2.3	There are no current plans to develop or to acquire additional data at the time due to limited potential.
F2.4	No technically and/or commercially feasible extraction project is currently defined.
F3	Project evaluation is incomplete or lacks sufficient definition to establish technical and commercial feasibility
F3.1	Prospect
F3.2	Lead
F3.3	Play
F3.4	Undiscovered/Unrecoverable

Proposed UNFC G-Axis Definitions

G1	Quantities associated with a known deposit that can be estimated with a high level of confidence.
G2	Quantities associated with a known deposit that can be estimated with a reasonable level of confidence.
G3	Quantities associated with a known deposit that can be estimated with a low level of confidence.
G4	Estimated quantities associated with a potential, but not yet confirmed, deposit or accumulation.
G4.1	Quantities associated with an undiscovered deposit that can be estimated with a high level of confidence.
G4.2	Quantities associated with an undiscovered deposit that can be estimated with a reasonable level of confidence.
G4.3	Quantities associated with an undiscovered deposit that can be estimated with a low level of confidence.

Mittelplate Dogger epsilon

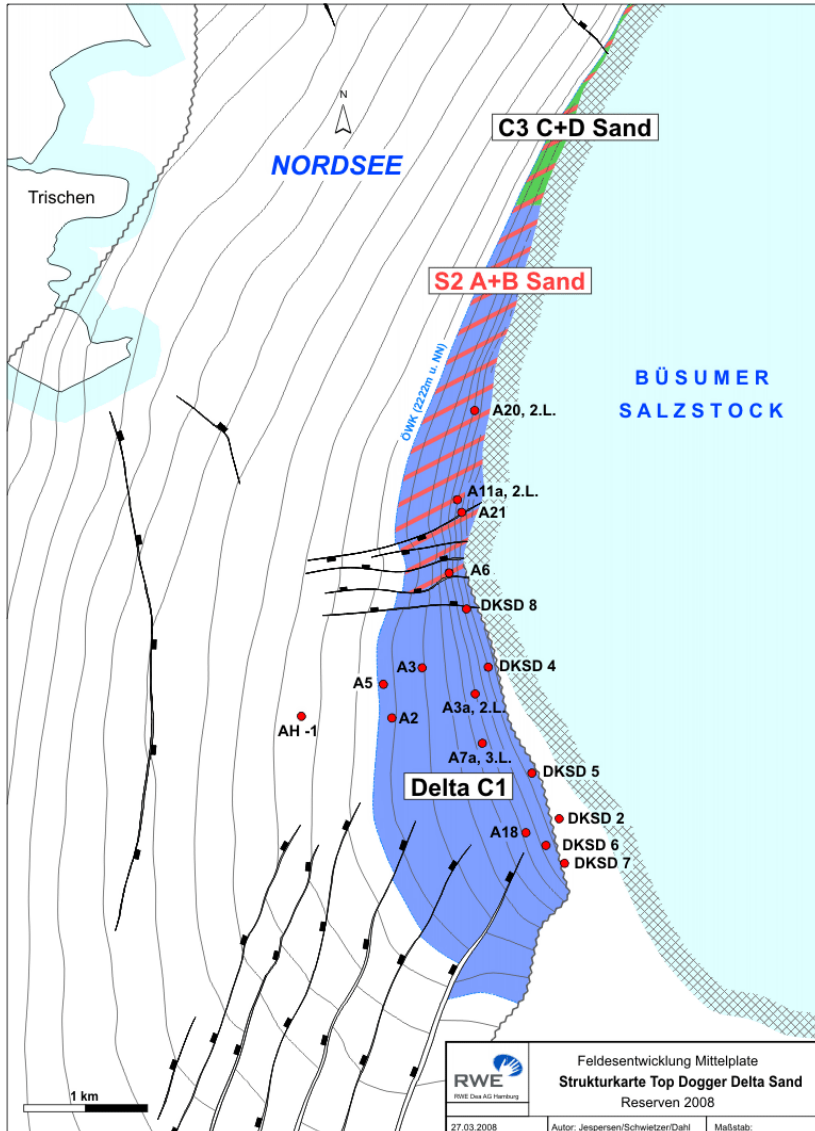


C1	P90	P50	P10
E1.1	F1.1.1.1	G1	G2 G3

S1	P90	P50	P10
E2.1	F2.2	G1	G2 G3

S2	P90	P50	P10
E2.2	F2.4	G1	G2 G3

Mittelplate Dogger delta

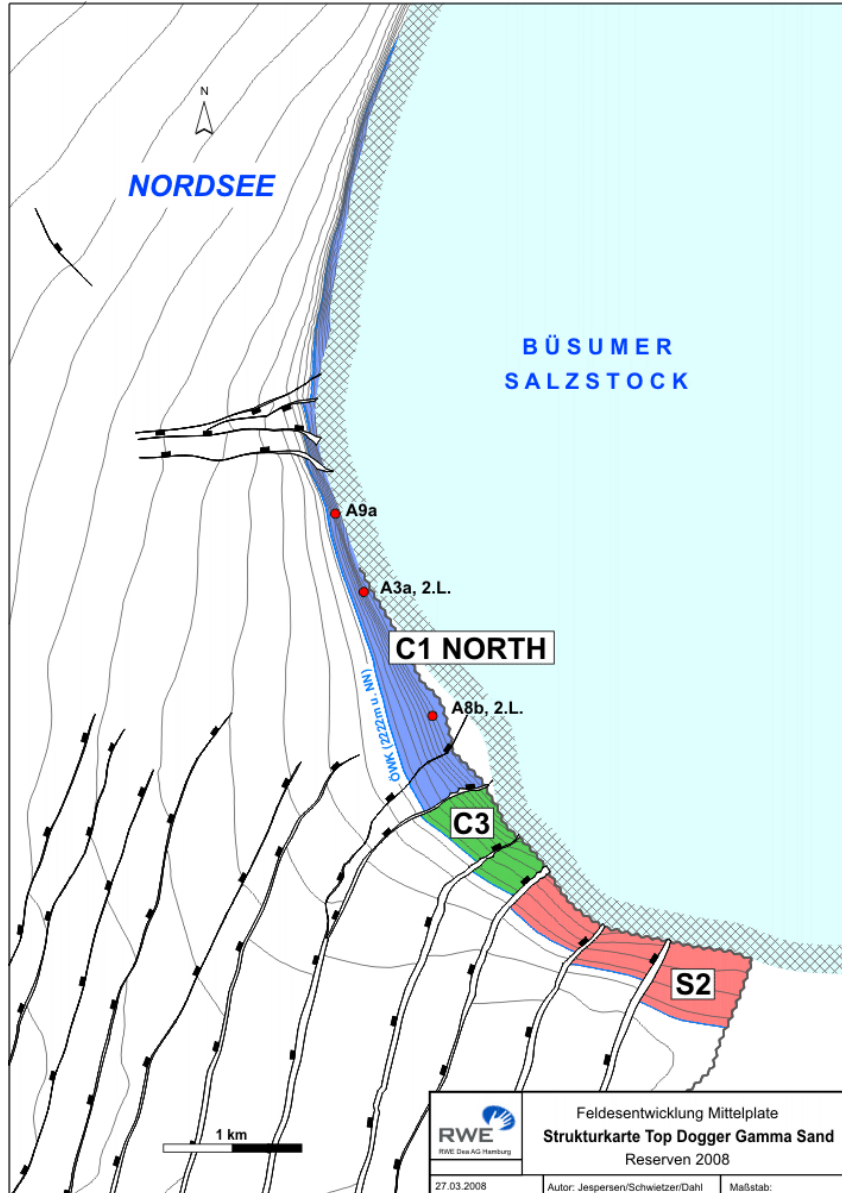


C1	P90	P50	P10
E1.1	F1.1.1.1	G1	G2 G3

C3 C+D North	P90	P50	P10
E2.1	F2.1	G1	G2 G3

S2 A+B	P90	P50	P10
E2.2	F2.3	G1	G2 G3

Mittelplate Dogger gamma



C1 North	P90	P50	P10
E1.1	F1.1.1.1	G1	G2 G3

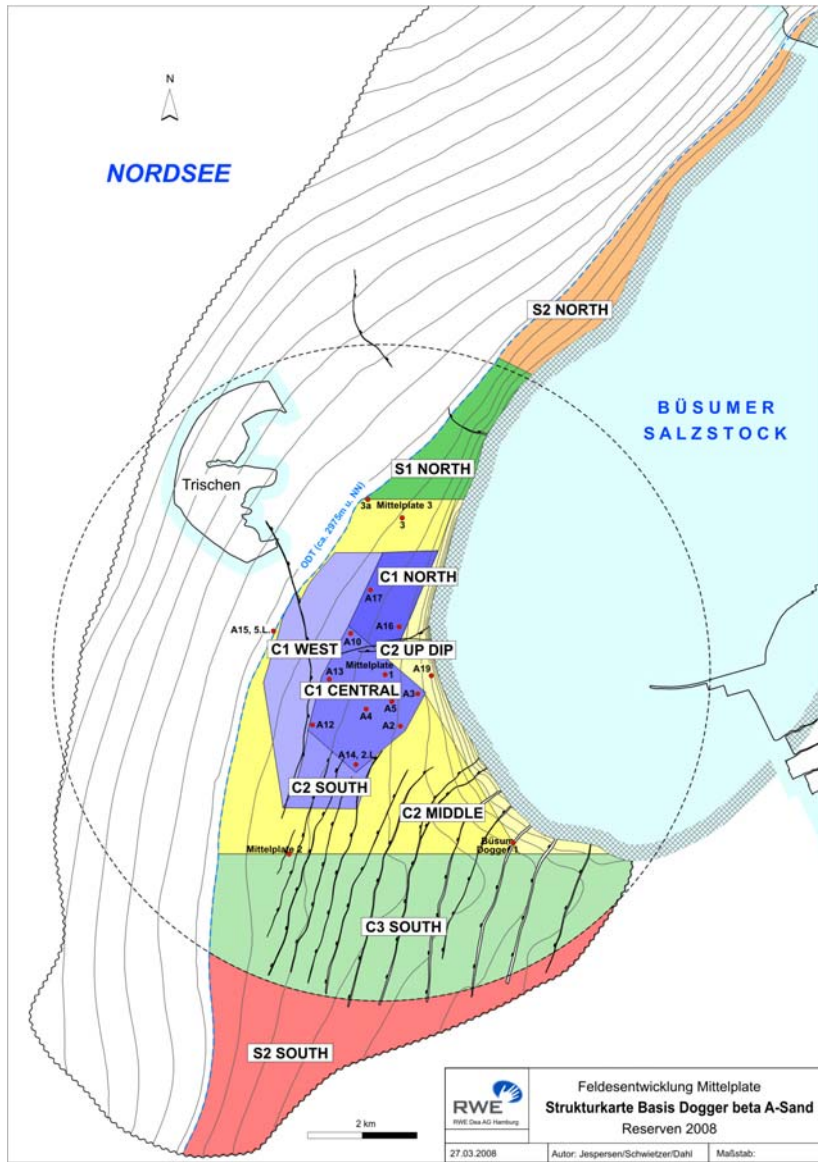
C3	P90	P50	P10
E1.1	F2.1	G1	G2 G3

S2	P90	P50	P10
E2.2	F2.3	G1	G2 G3

RWE Dea

Links to E F G

Mittelplate Dogger beta



C1 Central	P90	P50	P10
E1.1 F1.1.1.1	G1	G2	G3

C1 North	P90	P50	P10
E1.1 F1.1.1.1	G1	G2	G3

C1 West	P90	P50	P10
E1.1 F1.1.1.1	G1	G2	G3

C2 South	P90	P50	P10
E1.1 F1.2.2	G1	G2	G3

C2 UP & Middle	P90	P50	P10
E1.1 F1.2.2	G1	G2	G3

C3 South	P90	P50	P10
E1.1 F1.3.2	G1	G2	G3

S1 North	P90	P50	P10
E1.2 F2.1	G1	G2	G3

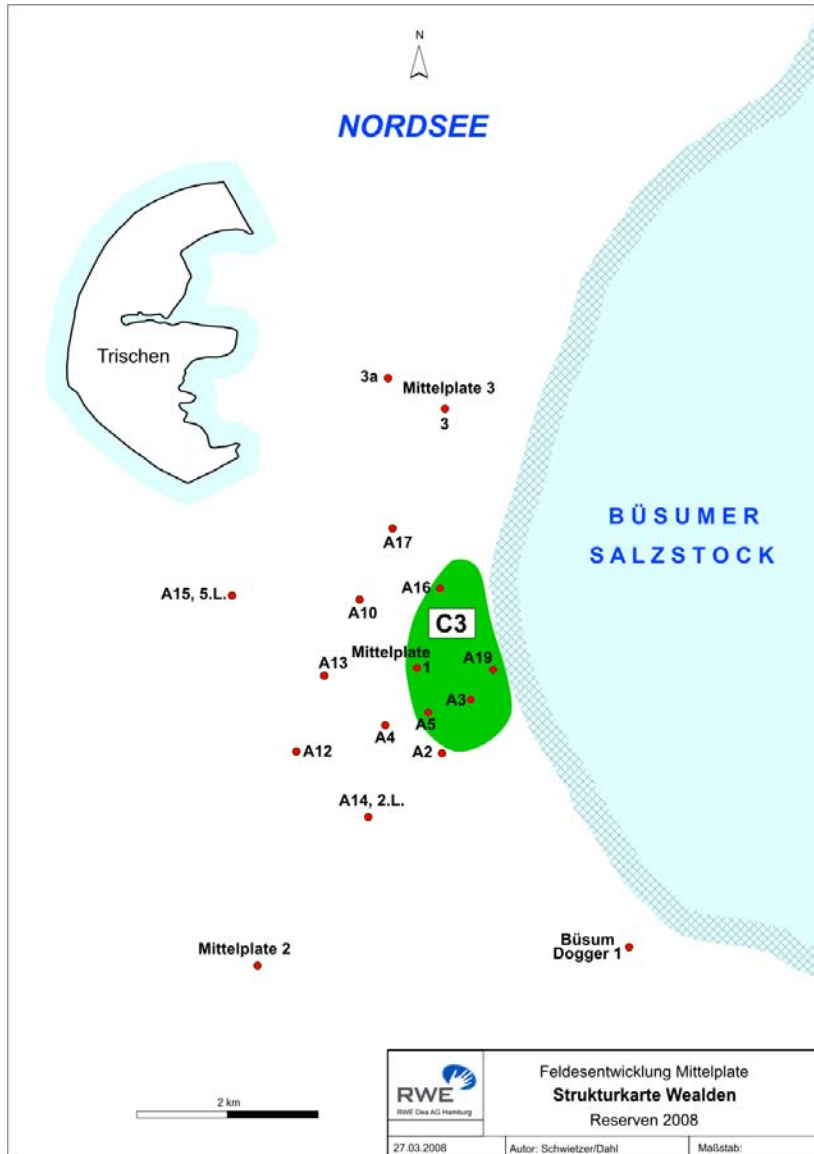
S2 South	P90	P50	P10
E1.1 F2.2	G1	G2	G3

S2 North	P90	P50	P10
E2.2 F2.4	G1	G2	G3

RWE Dea

Links to E F G

Mittelplate Wealden

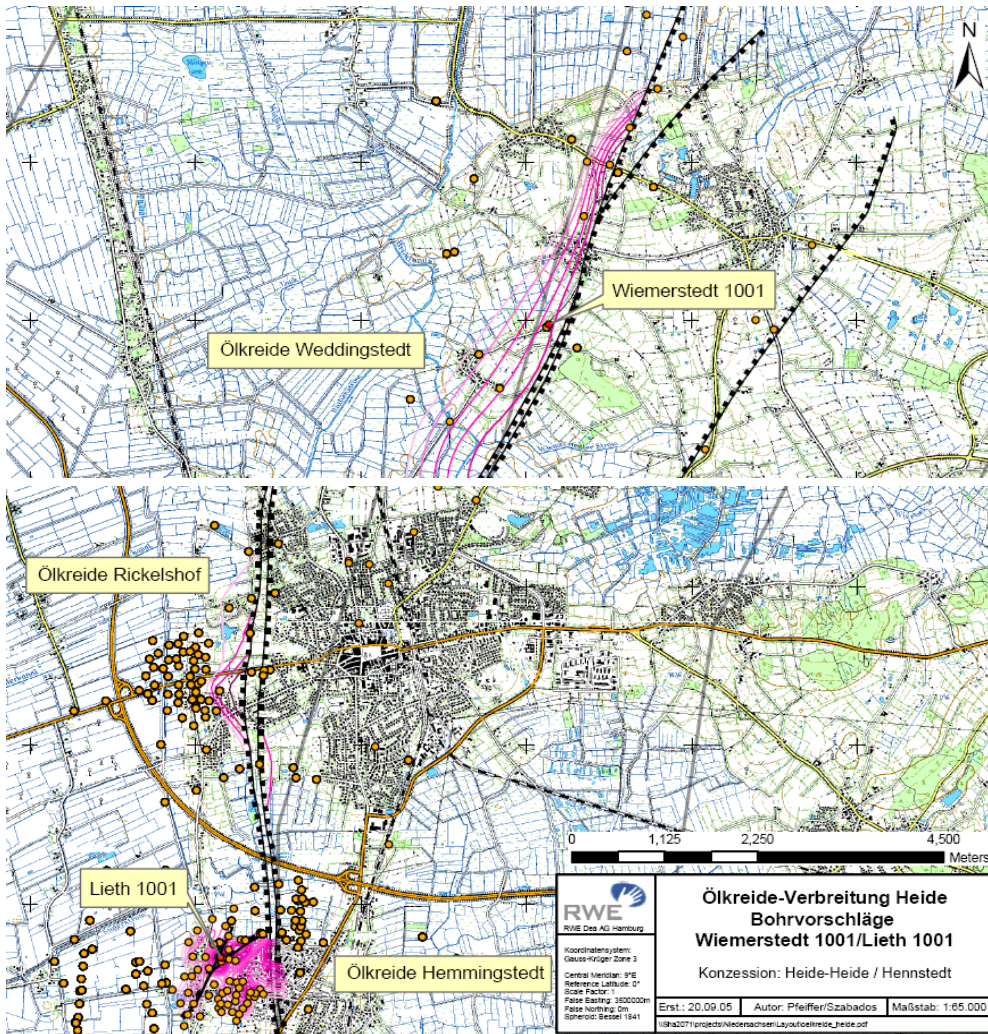


C3	P90	P50	P10
E1.1	F1.3.2	G1	G2
		G3	

RWE Dea

Links to E F G

Heide Chalk



Weddingstedt	P90	P50	P10
E3.3	F2.4	G1	G2
		G1	G3

Hemmingstedt	P90	P50	P10
E3.3	F2.4	G1	G2
		G1	G3

Core Material from Heide Chalk

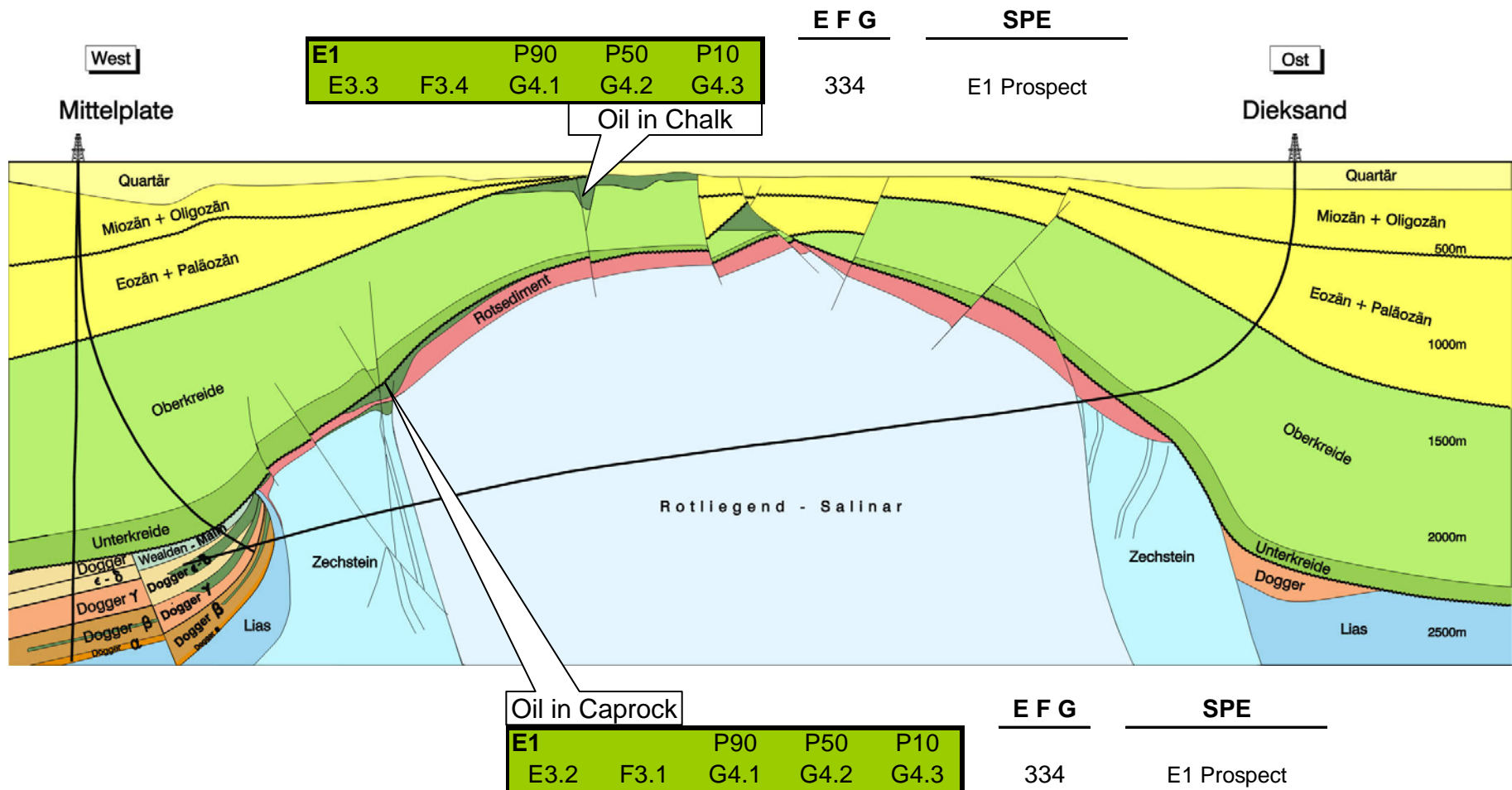


Mining of Oil sands in Heide



Oilfield Mittelplate

Geological Cross Section (W-E) - details



Conclusions

- If a proper classification based on SPE PRMS is available, transforming the results into the UNFC-System is possible without much effort
- Different Reserves status in SPE PRMS not discriminated by 3-digit UN code
 - information loss e.g. in beta by using 3-digit UN code
- Using subclasses, UNFC has more breakdowns, classification can be done more exactly
 - e.g. Contingent Resources (S2) in beta not distinguished in SPE PRMS but have different categories in UNFC
- UNFC covers accumulations which are not considered in SPE PRMS
 - Heide Chalk not accounted in SPE PRMS but in UNFC
- Generally spoken, reserves remain reserves and resources remain resources
- Except the additional accumulation, volumes seem not be affected and therefore are similar in both systems

**“Applying the UNFC Classifications on the producing
German oil field Mittelplate – A case study”**

Thank you for your attention!

PRMS-UNFC Detailed Mapping*



Fundamental Characterization	PRMS Resources Classes	PRMS Sub-Classes	UNFC E axis	UNFC F axis	UNFC G axis		
					1P/1C low est	2P/2C best est	3P/3C high est
DISCOVERED AND COMMERCIALY RECOVERABLE	RESERVES	On Production	1.1 or 1.2	1.1	1	1+2	1+2+3
		Approved for Development	1.1 or 1.2	1.2	1	1+2	1+2+3
		Justified for Development	1.1 or 1.2	1.3	1	1+2	1+2+3
DISCOVERED AND NOT COMMERCIALY RECOVERABLE	CONTINGENT RESOURCES	Development Pending	1.1 or 2.1	2.1	1	1+2	1+2+3
		Development Unclarified or on Hold	3.2 or 1.1 or 2.1	2.2	1	1+2	1+2+3
		Development not Viable	2.2	2.3	1	1+2	1+2+3
	Unrecoverable		3.3	2.4	1	1+2	1+2+3
UNDISCOVERED	PROSPECTIVE RESOURCES	Prospect	3.2	3.1	4.1	4.1+4.2	4.1+4.2+4.3
		Lead	3.2	3.2	4.1	4.1+4.2	4.1+4.2+4.3
		Play	3.2	3.3	4.1	4.1+4.2	4.1+4.2+4.3
	Unrecoverable		3.3	3.4	4.1	4.1+4.2	4.1+4.2+4.3

*Source: "Mapping of the UNFC to the SPE PRMS", John Etherington, presented to AHGE, Fourth Session, 17-19 October 2007, Geneva

UNFC Codification for Developed and Undeveloped Reserves

F-Axis Sub-Codes



Fundamental Characterization	PRMS Class	PRMS Sub-Classes	UNFC F axis			UNFC G axis		
			Developed		Undeveloped	1P	2P	3P
			Producing	Non-Producing				
DISCOVERED AND COMMERCIALY RECOVERABLE	RESERVES	On Production	1.1.1.1	1.1.1.2	1.1.2	1	1+2	1+2+3
		Approved for Development	NA	1.2.1.2	1.2.2	1	1+2	1+2+3
		Justified for Development	NA	NA	1.3.2	1	1+2	1+2+3

*Source: "Mapping of the UNFC to the SPE PRMS", John Etherington, presented to AHGE, Fourth Session, 17-19 October 2007, Geneva

PRMS-UNFC DETAILED MAPPING

Defining Developed/Undeveloped Using F-axis Sub-codes

Fundamental Characterization	PRMS Class	PRMS Sub-Classes	UNFC F axis			UNFC G axis		
			Developed		Undeveloped	1P	2P	3P
			Producing	Non-Producing				
DISCOVERED AND COMMERCIALY RECOVERABLE	RESERVES	On Production	1.1.1.1	1.1.1.2	1.1.2	1	1+2	1+2+3
		Approved for Development	NA	1.2.1.2	1.2.2	1	1+2	1+2+3
		Justified for Development	NA	NA	1.3.2	1	1+2	1+2+3

(new codes)

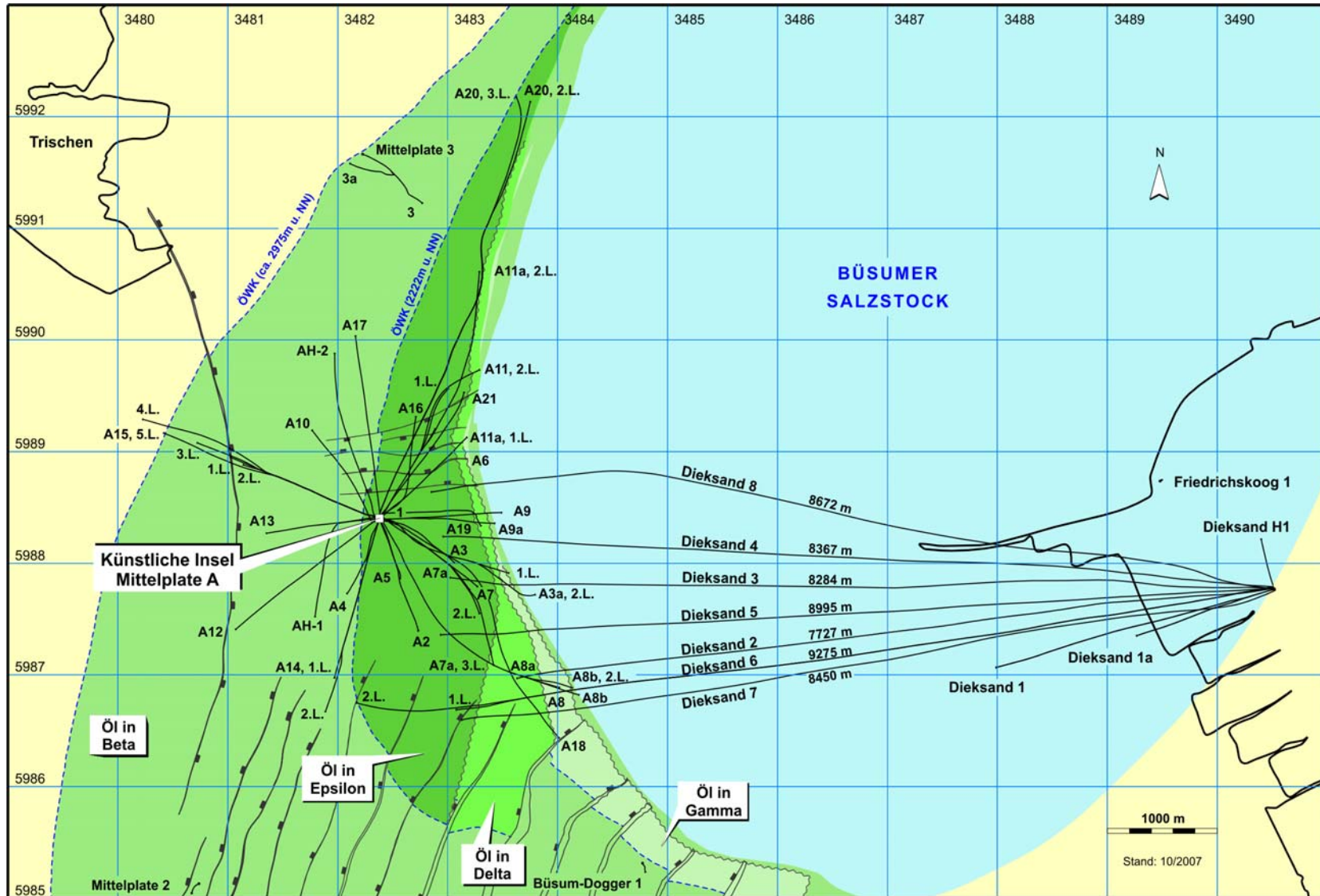
(using scenario terms)

NOTES:

Developed/Undeveloped is an allocation of quantities based on operational and funding status of associated projects and may not align with maturity sub-classes.

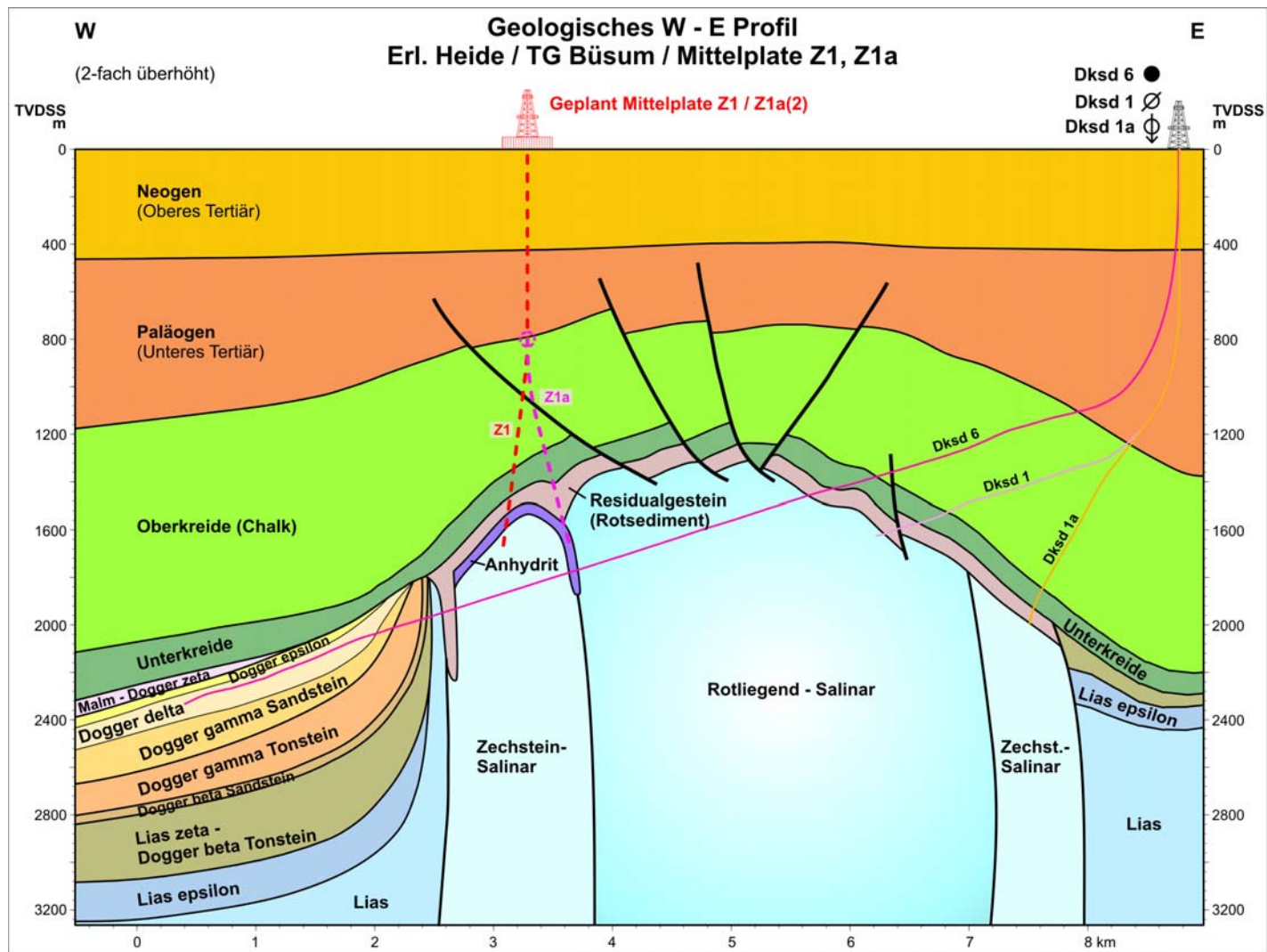
Each allocation has an range of estimated sales quantities *(even Developed Producing has a range of estimated recoveries)*.

Overview



Oilfield Mittelplate

Geological Cross Section (W-E) - details

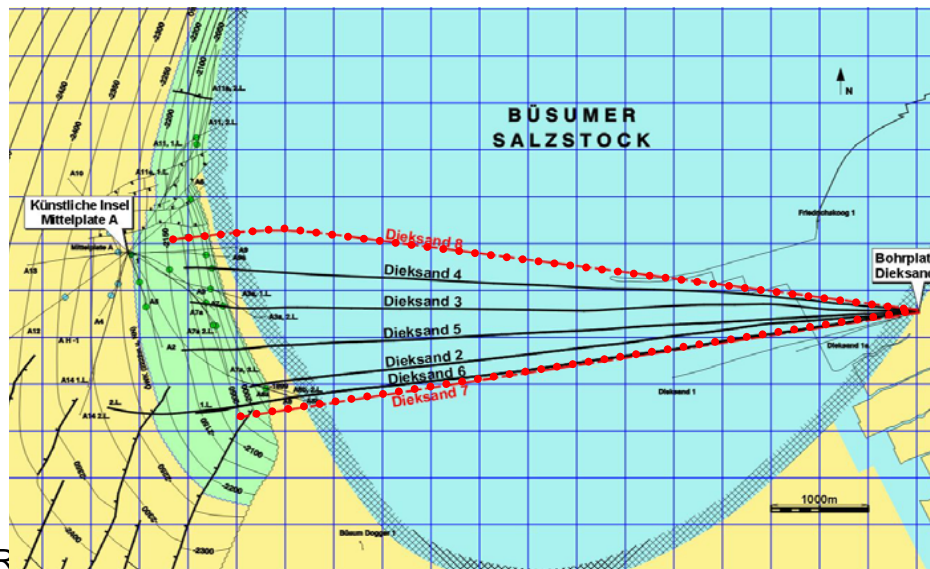


Field Development Concept

Mittelplate Island



- Development of Dogger Beta Sandstone downdip
- 44 slots available
- 13 producers/5 injectors (beta, gamma, delta, epsilon)
- additional wells planned up to 7,000 m MD
- current production 3,200 t/d

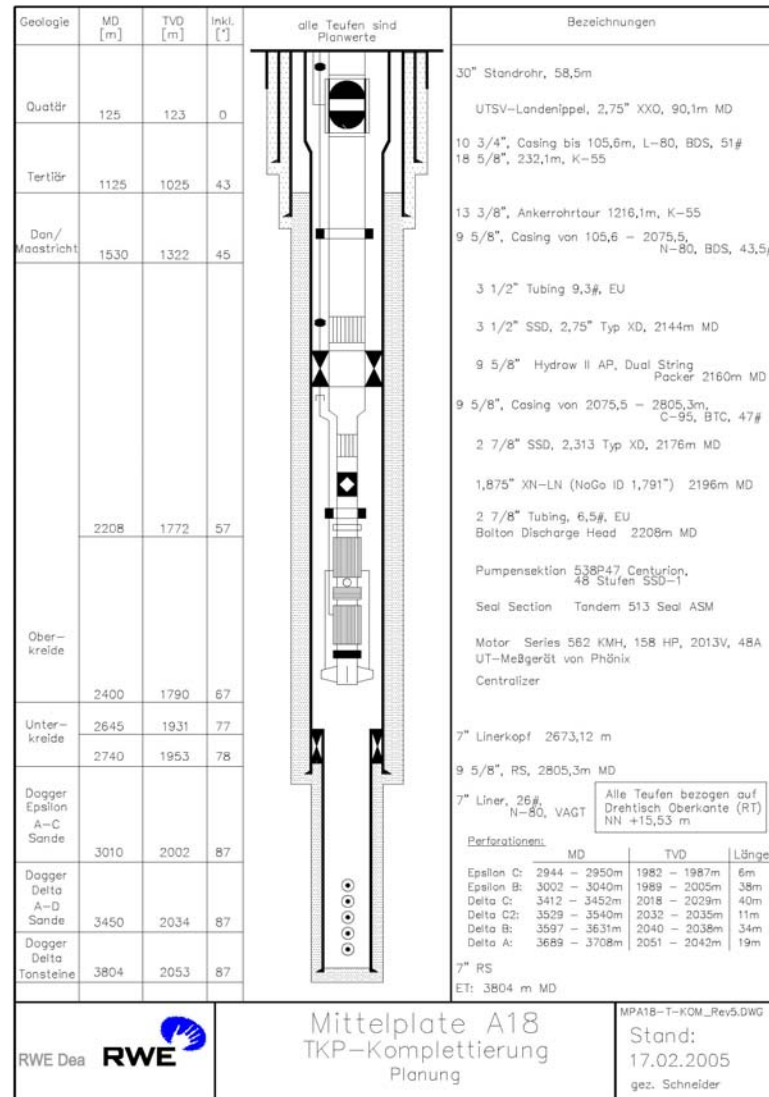


Dieksand Land Location

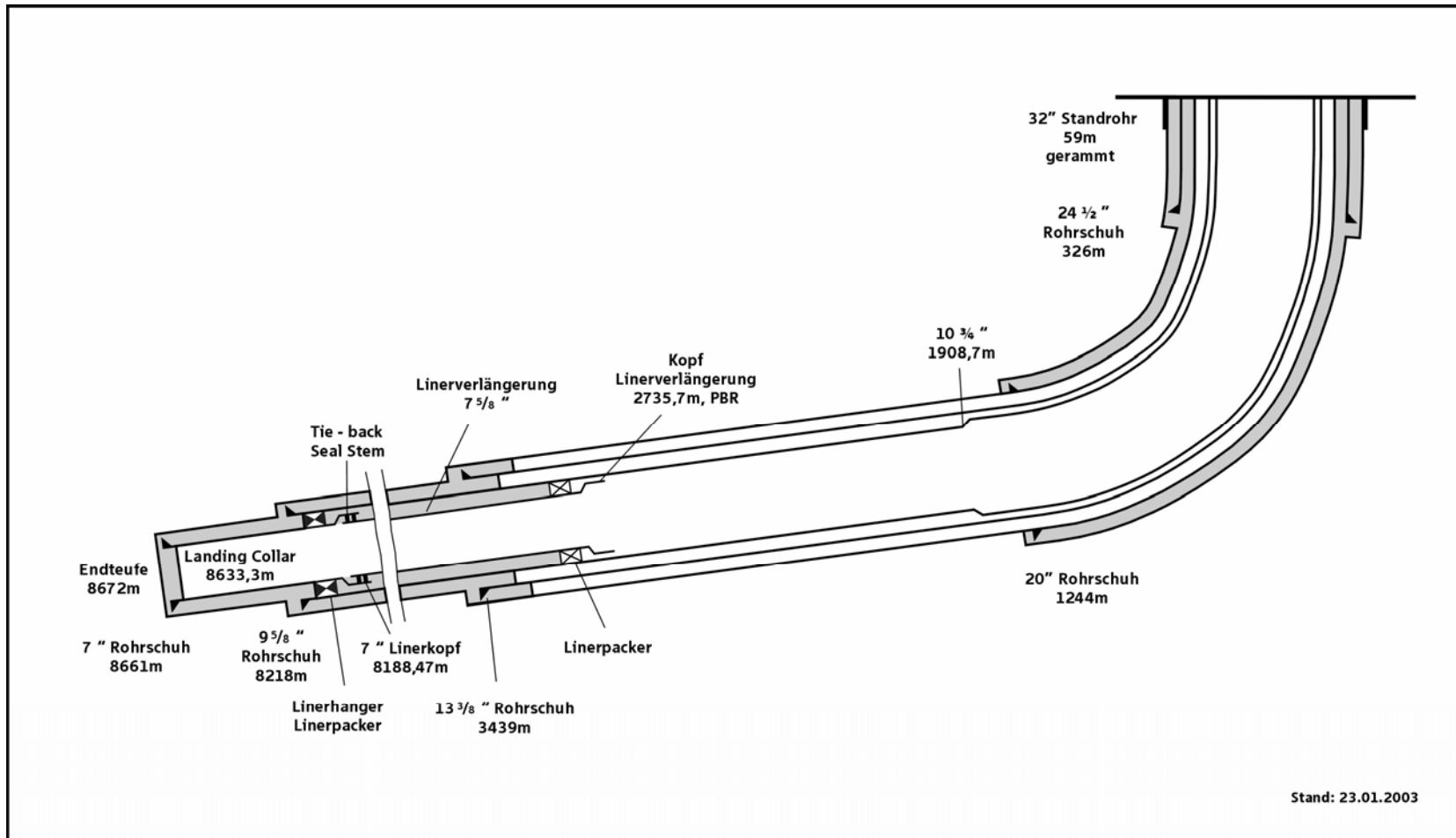
- Development of updip sandstones with ERD wells up to 10,000 m MD
- 6 wells under production as of April 2005 (1 w/o)
- current production 3,400 t/d

Mittelplate A18

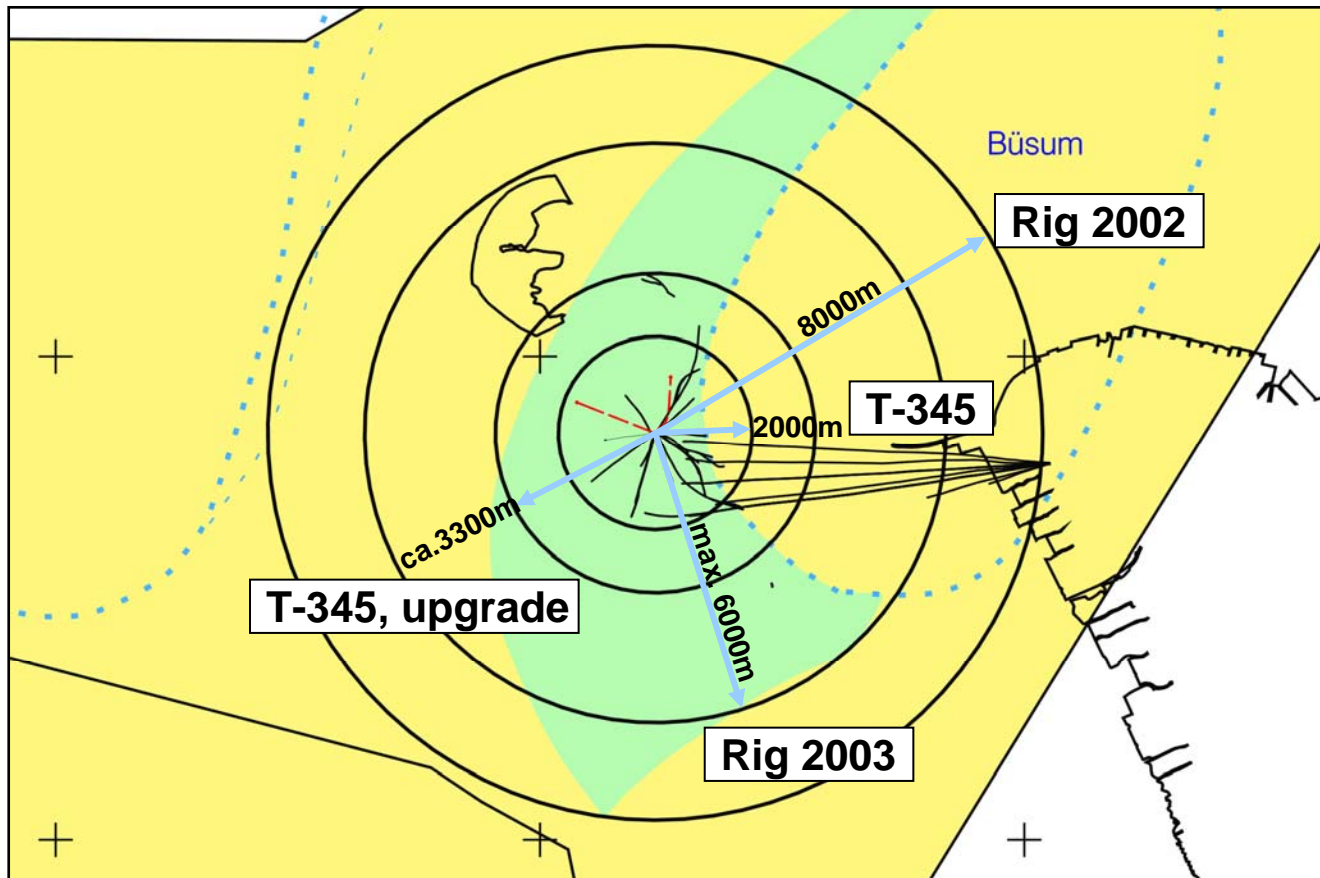
Completion (Delta/Epsilon)



Dieksand 8 Casing Design



Capacity of Drilling Rig

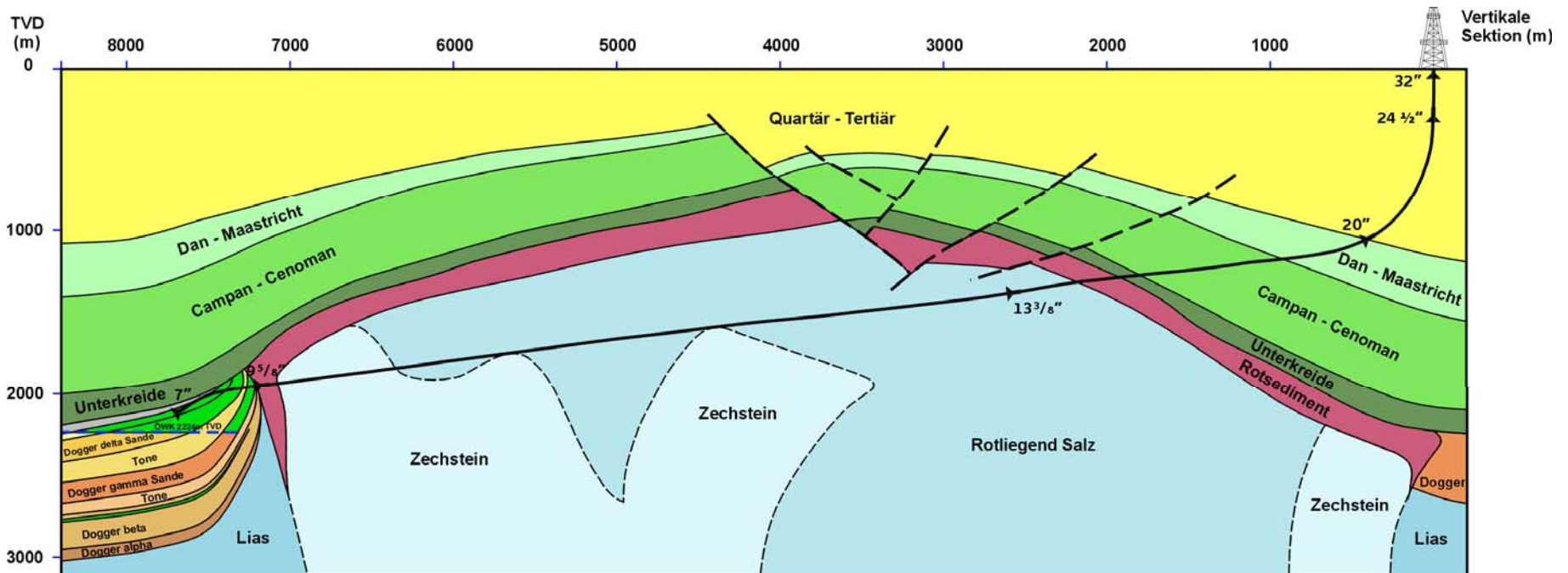


***Rig Replacement will Provide Better Conditions for Drilling & Access
Additional Reserves/Resources***

Allows Future Rig Upgrading and Application of New Techniques

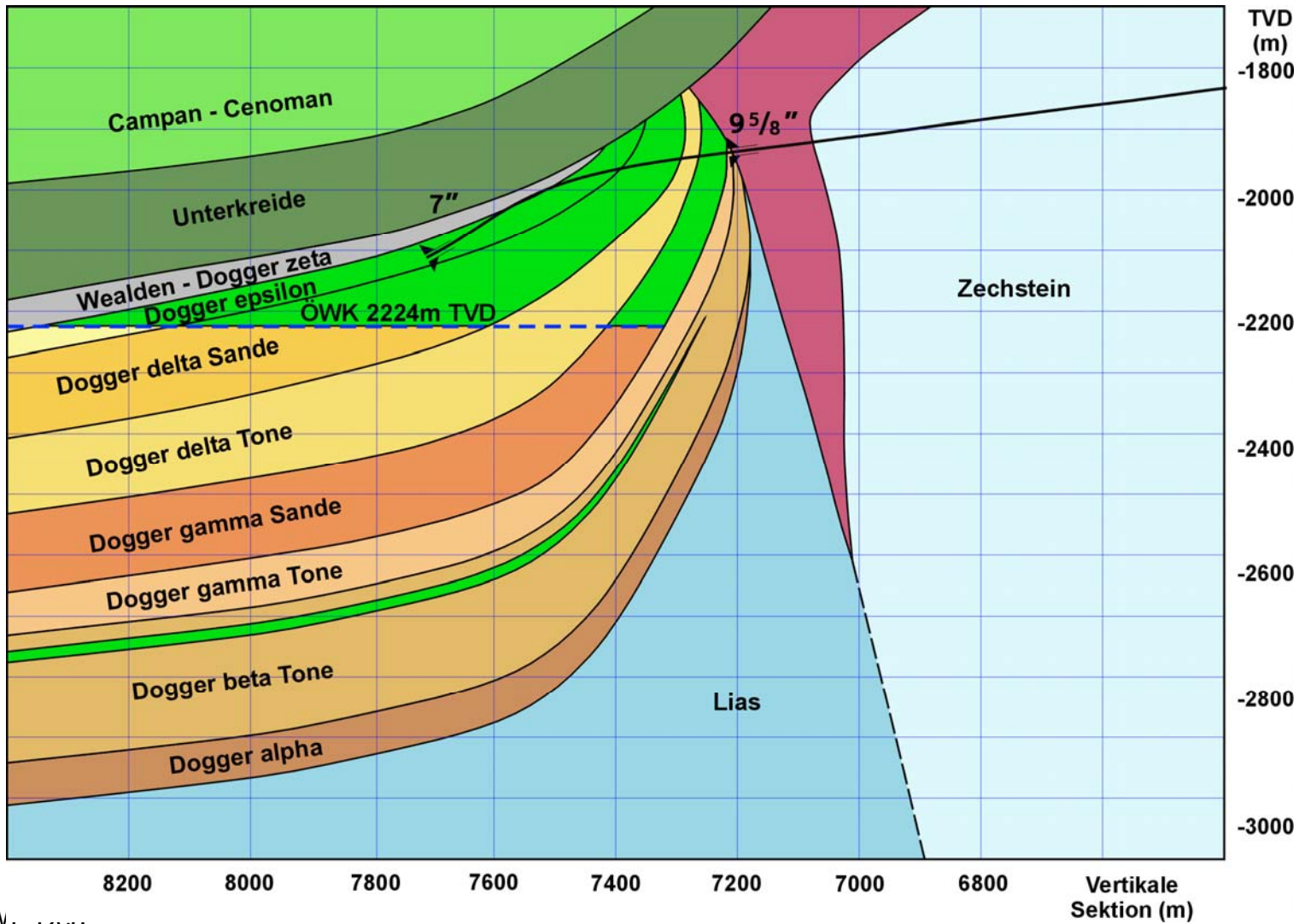
Field Development Mittelplate

Profile Dieksand 8

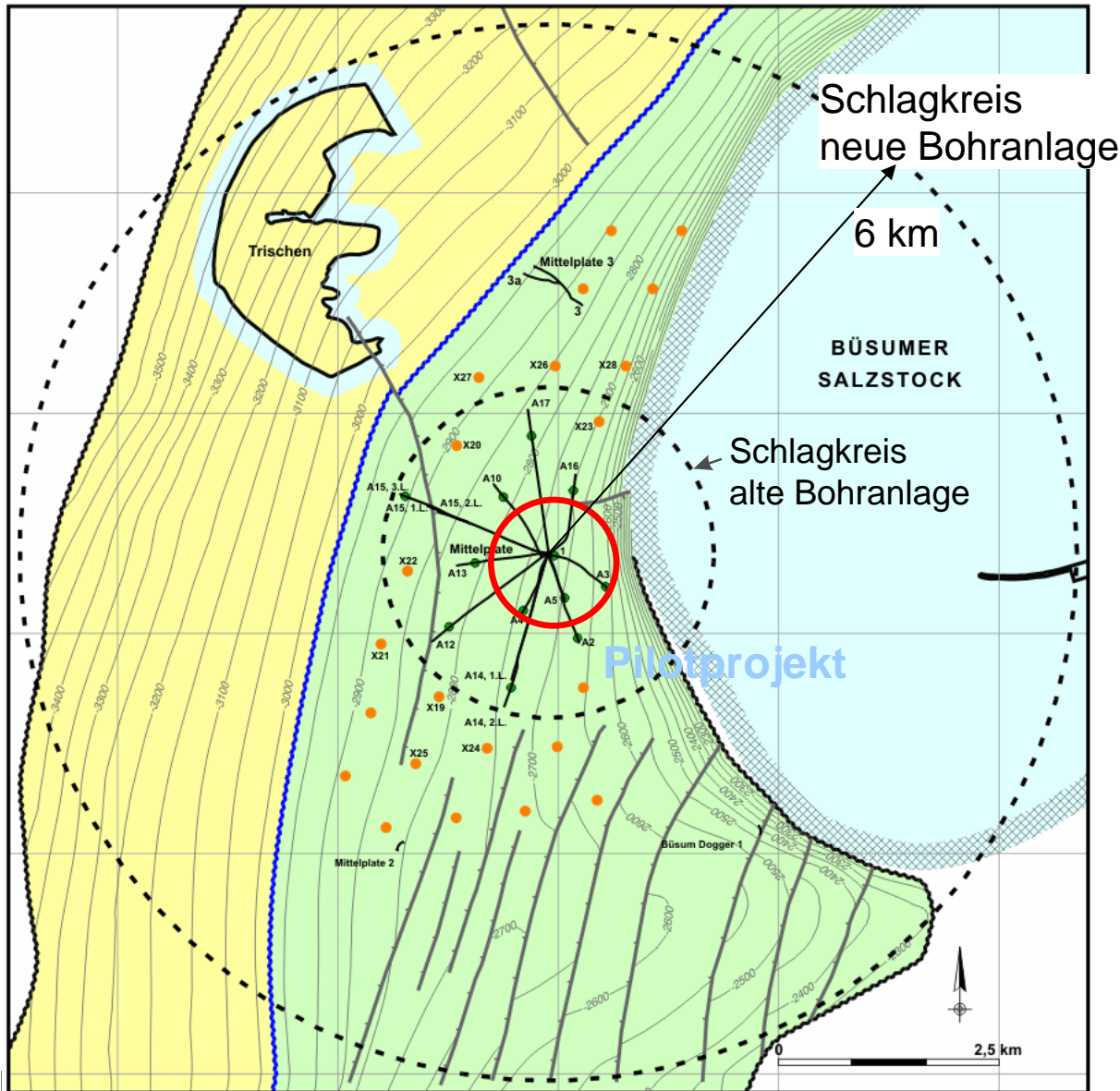


Field Development Mittelplate

Profile Dieksand 8



Reservoir Dogger Beta



Artificial Island Mittelplate



Artificial Island Mittelplate



Mittelplate/Dieksand Reservoir Parameters

Dogger beta

Porosity: 22 - 25 %
 Permeability: 200 - 2000 mD
 Net-Pay 5 - 17 m
 Depth (TVDSS): 2400 - 2975 m
 OOIP: 55 Mio t

Dogger gamma

Porosity: 22 - 25 %
 Permeability: 50 - 500 mD
 Net-Pay 30 - 50 m
 Depth (TVDSS): 1900 - 2222 m
 OOIP: 8 Mio t

Dogger delta

Porosity: 22 - 25 %
 Permeability: 2000 - 10000 mD
 Net-Pay 40 - 60 m
 Depth (TVDSS): 1900 - 2222 m
 OOIP: 26 Mio t

Dogger epsilon

Porosity: 22 - 25 %
 Permeability: 2000 - 10000 mD
 Net-Pay 20 - 30 m
 Depth (TVDSS): 1900 - 2222 m
 OOIP: 14 Mio t

Top 20 Extended Reach Wells

Platz	Horizontale Abweichung [m]	Mess Teufe [m]	Vertikal Teufe [m]	Auftraggeber	Bohrung	Feld	Lokation
1	10728	11278	1637	BP	M-16Z	Wytch Farm	UK Land
2	10585	11184	1657	TotalFinaElf	CN-1	Ara	Argentinien
3	10114	10658	1605	BP	M-11Y	Wytch Farm	UK Land
4	8938	9557	1795	BP	M-14	Wytch Farm	UK Land
5	8434	9275	2335	RWE Dea	Dieksand 6	Mittelplate	Deutschland
6	8306	9278	2896	Woodside	GWA-18	Goodwyn	Australien
7	8181	8687	1498	TotalFinaElf	CS-1	Kaus	Argentinien
8	8146	8995	2191	RWE Dea	Dieksand 5	Mittelplate	Deutschland
9	8062	9236	2985	ConocoPhillips	24-3 A-14	Xijiang	China
10	8028	8715	1605	BP	M-5	Wytch Farm	UK Land
11	7974	8530	1616	TotalFinaElf	AS-3	Ara	Argentinien
12	7967	8892	1633	BP	M-15	Wytch Farm	UK Land
13	7853	9327	2770	Norsk Hydro	30/6-C-26A	Oseberg	Norwegen
14	7793	8672	2112	RWE Dea	Dieksand 8	Mittelplate	Deutschland
15	7679	8193	1503	TotalFinaElf	CS-2	Kaus	Argentinien
16	7652	8303	1656	BP	M-9Z	Wytch Farm	UK Land
17	7645	9032	2156	Maersk	MFF-19C	Dan	Dänemark
18	7571	8367	2072	RWE Dea	Dieksand 4	Mittelplate	Deutschland
19	7566	8686	2847	ConocoPhillips	24-3 A-17	Xijiang	China
20	7513	8611	2831	ConocoPhillips	24-3 A-18 st3	Xijiang	China
21	7505	8450	2122	RWE Dea	Dieksand 7	Mittelplate	Deutschland
22	7495	8284	2058	RWE Dea	Dieksand 3	Mittelplate	Deutschland
29	6938	7727	2019	RWE Dea	Dieksand 2	Mittelplate	Deutschland