# Relinquishment Report of License PL 780

SPIRIT ENERGY

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# 1 KEY LICENSE HISTORY

PL 780 is located in block 16/1, approximately 5 km northwest of the Ivar Aasen Field on the Utsira High in the Norwegian North Sea. The license is structurally situated on the eastern margin of the Gudrun Terrace, down faulted from the fault block comprising the Ivar Aasen Field. (Fig. 1.1). The Sørvesten Prospect was drilled in 2020 and proved to be dry (Fig. 1.2).

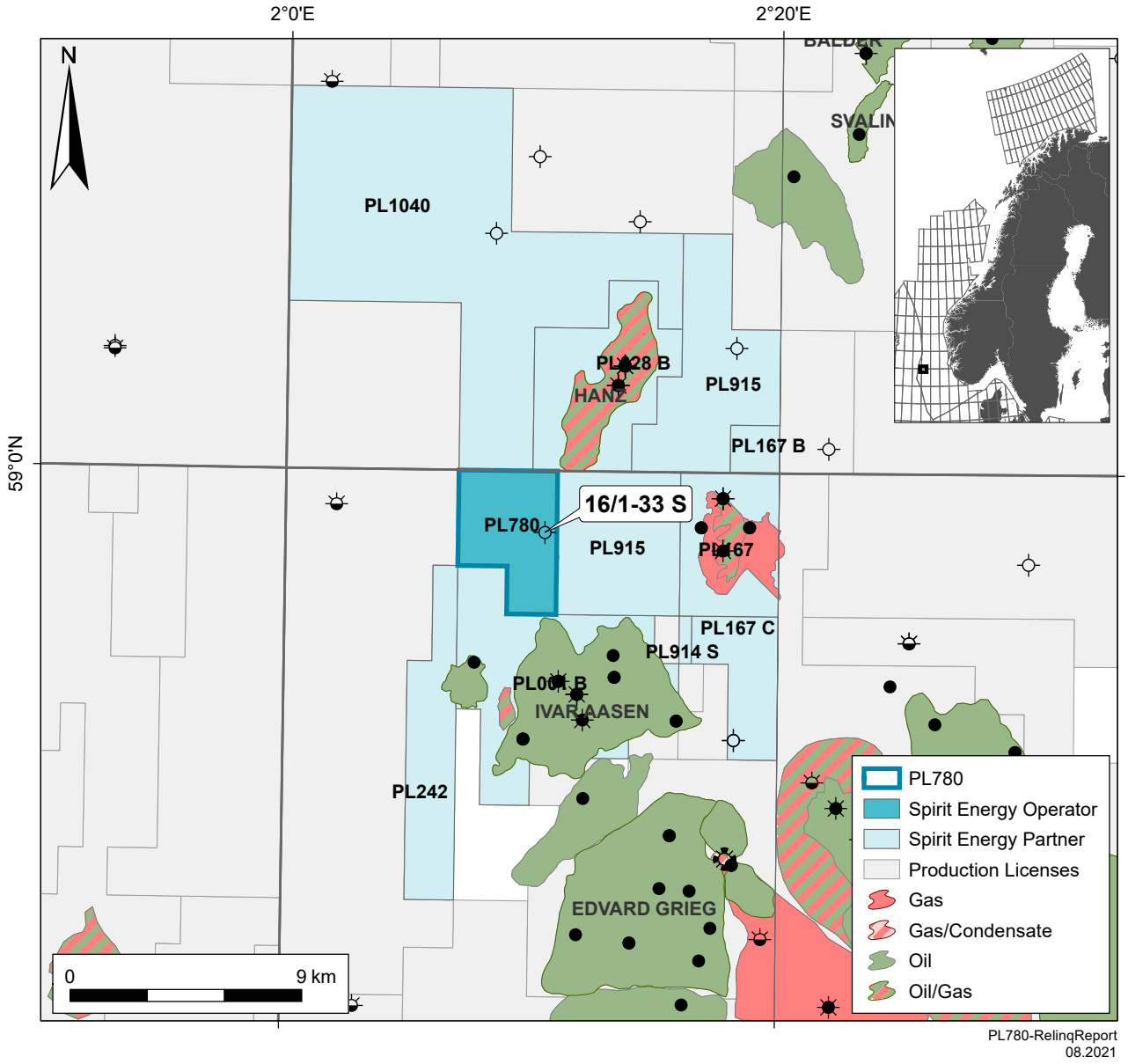


***Fig. 1.1 License Overview Map.*** *Map showing license area before relinquishment.*

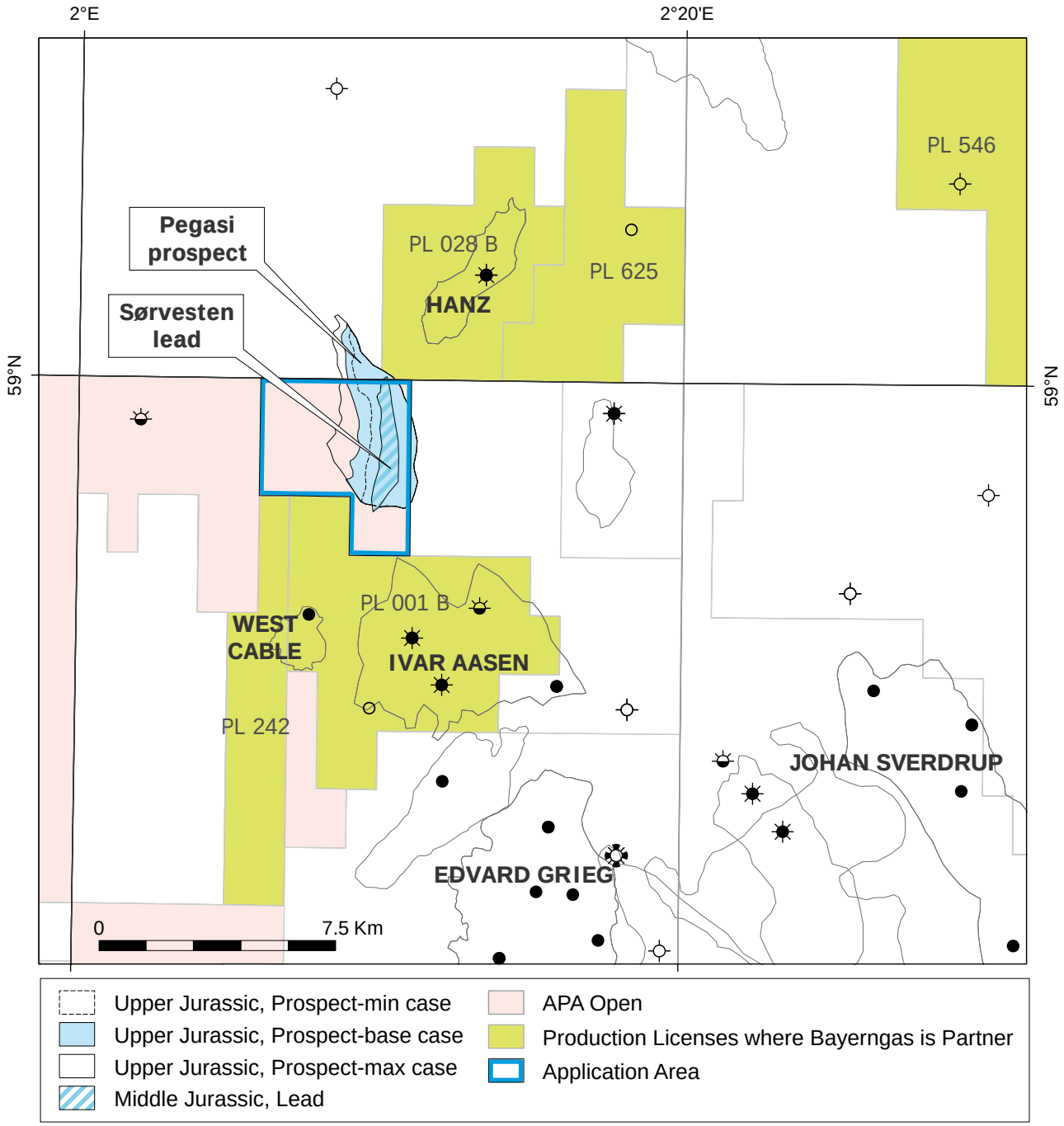


***Fig. 1.2 Prospects and Leads Summary Map, APA 2014*** *Map shows the outline of PL 780 and identified prospectivity at the time of the award in 2015 with Bayerngas as the operator.*

## Summary of Award and Participants

PL 780 was awarded 06.02.2015 as part of the APA 2014 to the following license group:

- Bayerngas Norge AS - 60% (Op)
- Suncor Energy Norge AS - 40%

The current (from 29.11.2019) license group consists of:

- Spirit Energy Norway AS - 60% (Op)
- Aker BP ASA - 40%

The voting rule is 2 parties representing minimum 50% equity.

The commitment for the initial period was to reprocess 3D seismic and was fulfilled by reprocessing of the MC3D-SVG11 3D seismic data set, giving the MC3D-SVG11BGNR15 data set. In addition, PGS Geostreamer 3D data was purchased (received early 2018). The license was granted a 1 year extension of the drill or drop decision, to February 2018, due to the delay in reprocessing of the 3D seismic data. A further 1.5 year extension resulted in a final drill or drop deadline of 6th August 2019 and the BoK deadline was also extended by 1.5 year to 6th August 2020. Following Suncor's withdrawal from the license in August 2019, prior to the drill or drop deadline, the DoD deadline was further extended; to the 6th of November, and finally the 20th December 2019 allowing establishment of a new partnership and a drill decision. With Aker BP's entry into the license, notification of drill decision was issued 26th November 2019. In February 2020 the license applied for and was granted an extension of the BoK deadline by a year to 6th August 2021. The Sørvesten exploration well 16/1-33 S was spudded 10.07.2020 and plugged and permanently abandoned 05.08.2020. Relinquishment of the license was approved by letter from MPE dated 20.09.2021 with effect 07.08.2021.

## Initial Work Obligations

At the date of award in 2015, phase 1 of the work programme included reprocessing of 3D seismic and a drill or drop (DoD) decision that was valid to 06.02.2017. As described, the DoD decision deadline was extended and the final drill decision was taken in November 2019. The work programme is summarized in Table 1.1. The work commitment, including reprocessing of a 3D survey (MC3D-SVG11BGNR15) and drilling an exploration well (16/1-33 S), has been fulfilled.

***Table 1.1 Work Programme***

| Work obligation | Decision | Task status | Expiry date | Wellbore if drilled |
|---|---|---|---|---|
| Reprocessing of 3D seismic | | Approved | | |
| | Decision to drill | Will be drilled | 06.11.2019 | |
| Drill exploration well | | Approved | | 16/1-33 S |
| | (BoK) Decision to concretize | Dropped | 06.08.2021 | |

## License Meetings

During the license period 8 MC meetings and 9 EC work meetings were held.

***Table 1.2 License Meetings***

| Date | Purpose |
|---|---|
| 16/4/2015 | EC/MC #1 |
| 4/11/2015 | EC/MC #2 |
| 17/11/2016 | EC/MC #3 |
| 19/9/2017 | EC Work Meeting - Interpretation of the Sørvesten Prospect |
| 29/11/2017 | EC/MC #4 |
| 21/9/2018 | EC Work Meeting - Prospectivity Update |
| 4/4/2019 | EC Work Meeting - Peer Review Prospect Evaluation |
| 26/6/2019 | EC/MC #5 |
| 23/09/2019 | EC Work Meeting - Sørvesten Well Planning |
| 3/12/2019 | EC/MC #6 |
| 21/01/2020 | EC Work Meeting - Data Acquisition Program |
| 19/6/2020 | EC Work Meeting - Sørvesten Operation Preparation |
| 22/4/2020 | EC Work Meeting - Well Decision Tree and DST Triggers |
| 11/6/2020 | EC Work Meeting - Sørvesten DWOP |
| 19/6/2020 | EC/MC #7 |
| 23/9/2020 | EC Work Meeting - Well Operation And Results |
| 24/11/2020 | EC/MC #8 |

## Reason for Relinquishment

The 16/1-33 S well tested the the Sørvesten Prospect, which proved to be dry. The post well evaluation of the prospectivity shows very limited further potential and no drill-candidates within the licensed acreage.

# 2 DATABASE

## 2.1 Seismic Database

All seismic interpretation for the evaluation of the license was carried out on the PGS16M04 3D survey which is generally of good quality for structural interpretation down to the Permian (Fig. 2.1).

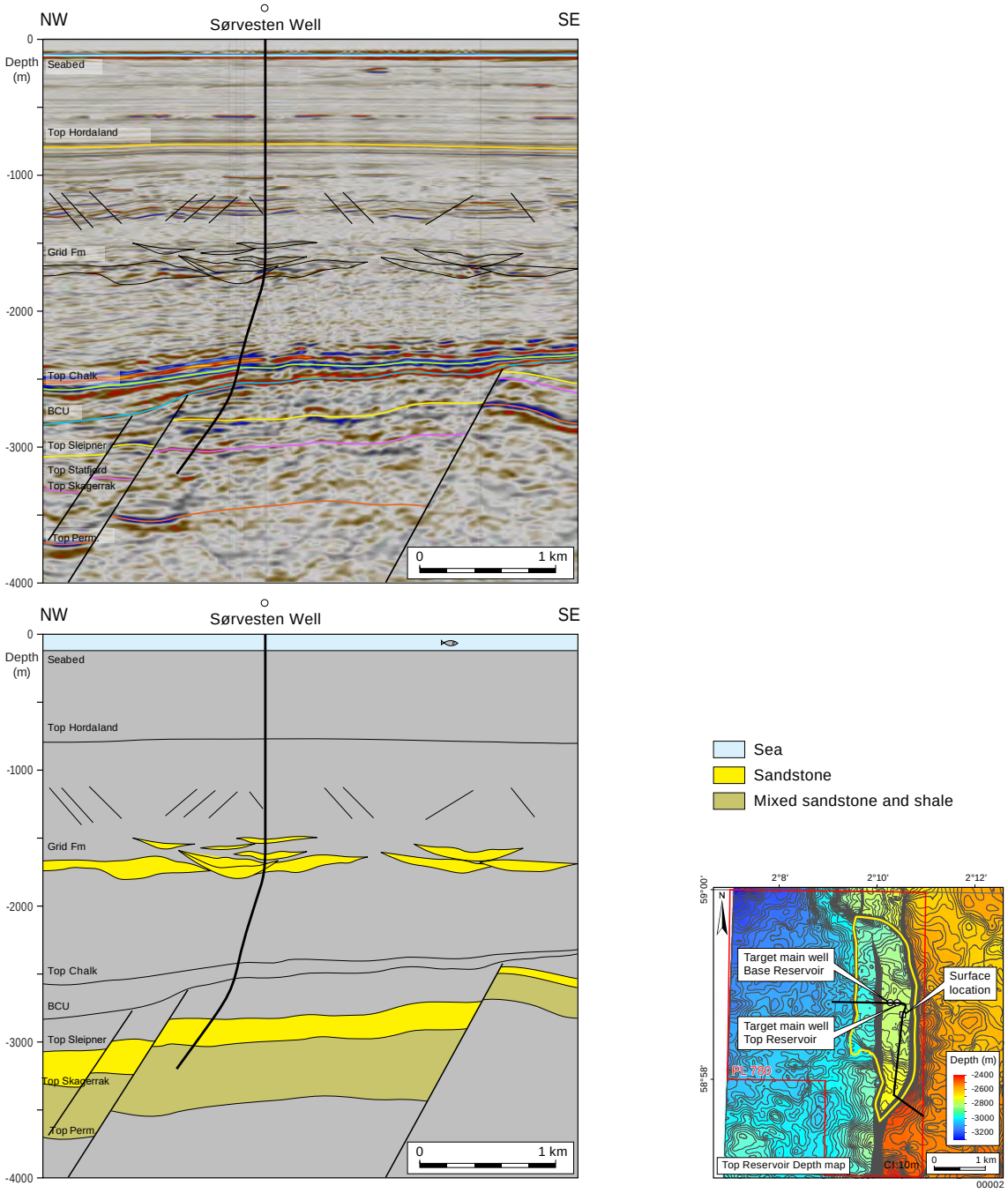


***Fig. 2.1 Seismic Section along 16/1-33 S*** *Seismic and geoseismic cross section along the drilled well path of the 16/1-33 S well and along the planned sidetrack towards the crest in the south. Line of section is shown in the index map.*

Several 3D seismic cubes are also available in the area (Fig. 2.2).

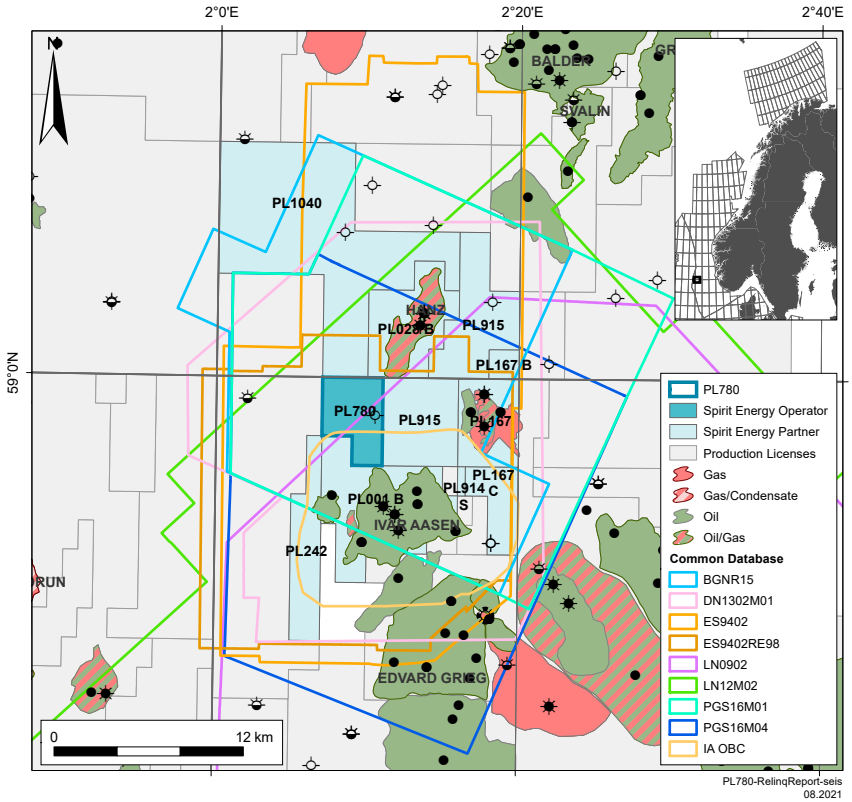


***Fig. 2.2 Common Seismic Database*** *Map showing seismic data coverage. Common database for PL780 comprises the 3D datasets BGNR15 and PGS16M04.*

The depth cube from PGS16M04 was used as the basis for the detailed assessment of the reservoir target and the pre-drill prognosis of formation tops. The actual well tops were close to prognosis with the exception of the Base Grid Sst 3 and Top Sleipner Fm. The mismatch in the Grid Fm was due to consequential errors caused by thickness variations within the Grid Fm channels. The mismatch at top Sleipner Fm is explained by the application (in the velocity model) of seismic velocities that were higher in the Jurassic Draupne Fm than the actual velocities (Fig. 2.3). The corrected Sleipner Fm pick is adjusted to the measured sonic velocities and bulk shifted 25 ms up to the soft top Sleipner reflection. No VSP operation was performed.

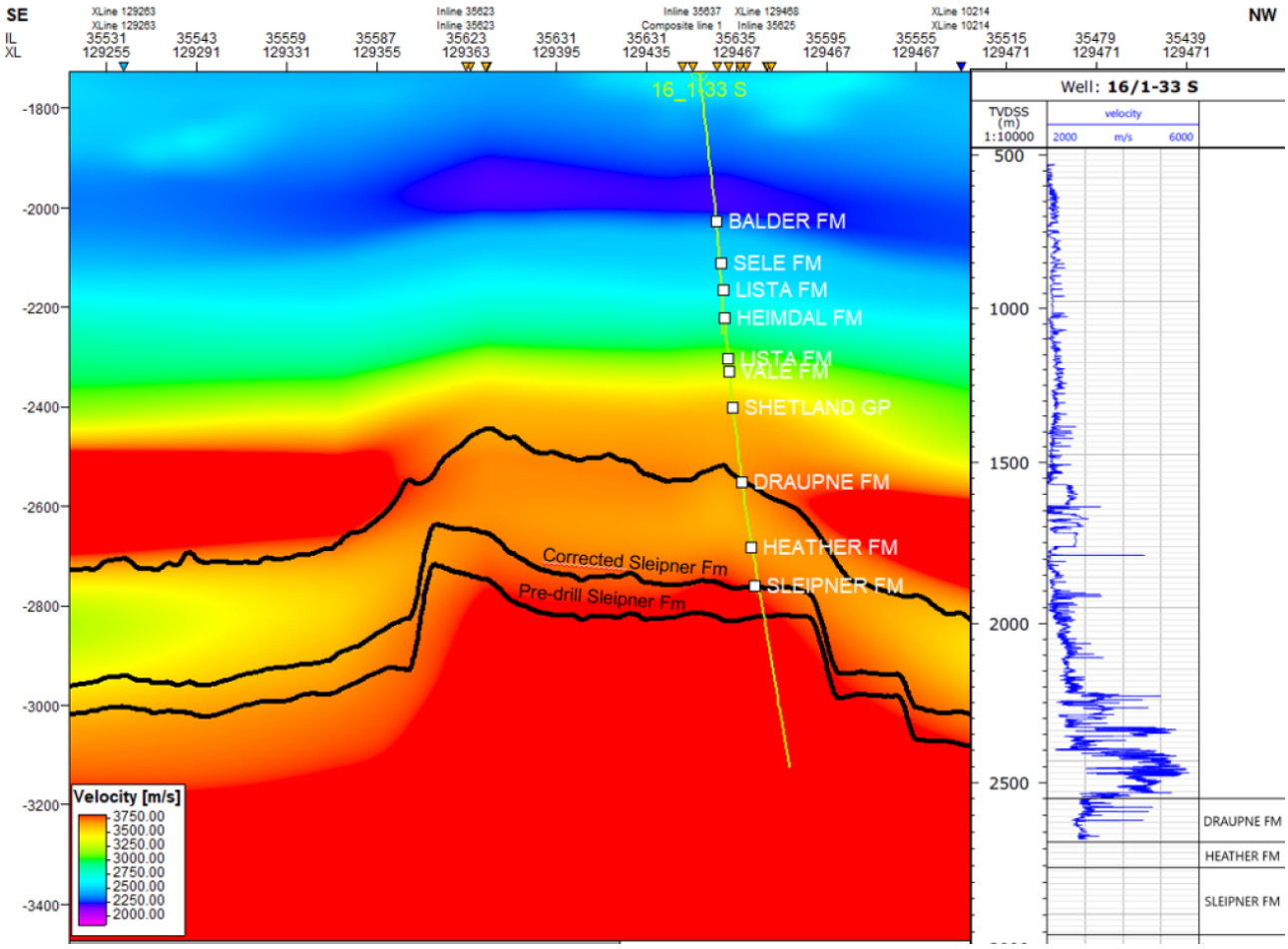


***Fig. 2.3 Sonic Velocities vs. Seismic Velocity Model.*** *Figure shows that the velocity model used in the PSDM dataset has higher velocities (>3500 m/s) than the measured sonic velocities (≈3000 m/s) in the Draupne Fm in the 12 1/4" section. The corrected Top Sleipner Fm pick is adjusted to the measured velocities. No sonic log was acquired in the 8 1/2" section.*

## 2.2 Well Database

The well database is listed in Table 2.1 and shown in Fig. 2.4. The key wells are located on the Gudrun Terrace, or in the close vicinity of the Sørvesten fault block.

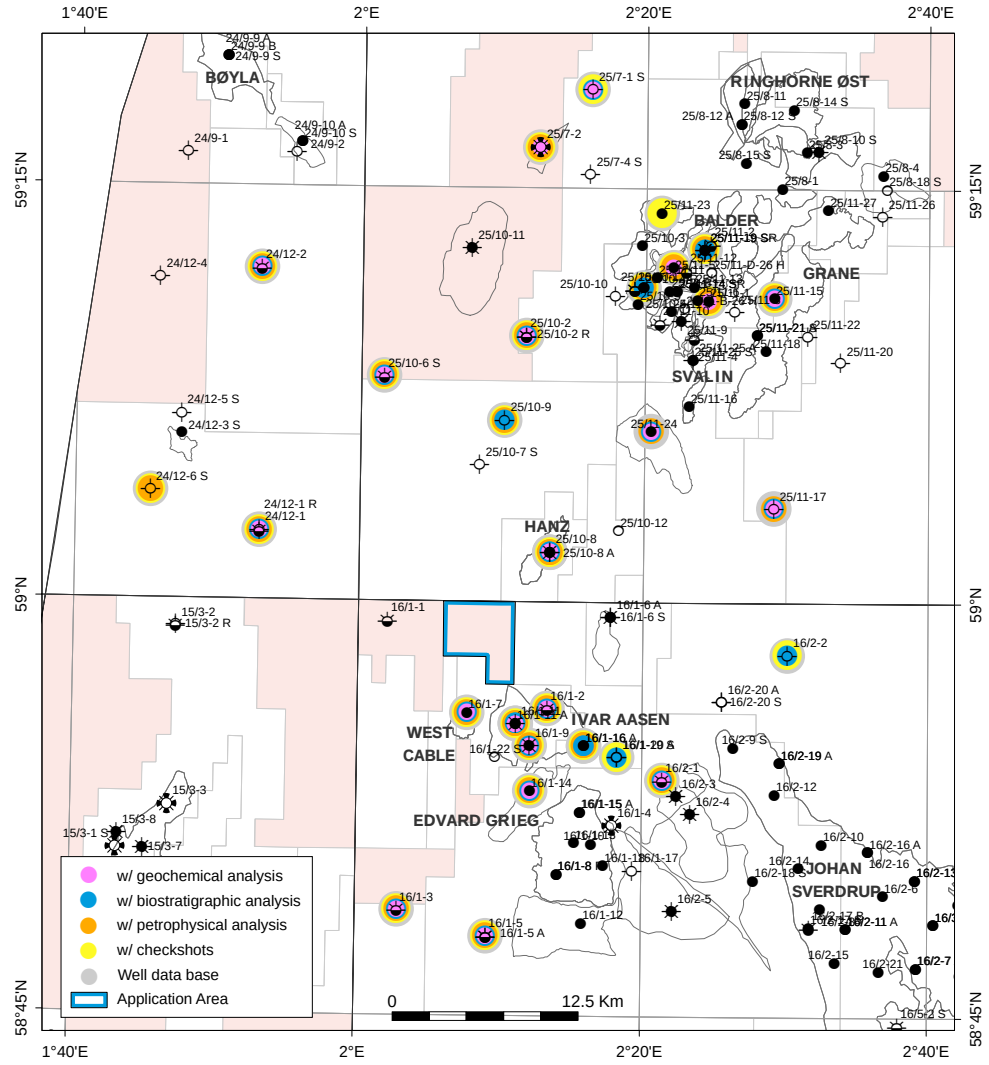


***Fig. 2.4 Well Database*** *Overview of wells used in the license evaluation. Key wells are highlighted in orange.*

***Table 2.1 Well database***

| Well | Completed | Released | TD | Operator | Status |
|---|---|---|---|---|---|
| 25/10-12 ST2 | 2015 | 2017 | Triassic | Lundin | P&A |
| 16/1-21 S | 2015 | 2017 | Late Triassic | Det Norske | P&A |
| 16/1-21 A | 2015 | 2017 | Late Triassic | Det Norske | P&A |
| 16/1-22 S | 2015 | 2017 | Late Triassic | Det Norske | P&A |
| 16/1-20 AT3 | 2013 | 2015 | Late Triassic | Wintershall | P&A |
| 16/2-20 S | 2013 | 2015 | Basement | Lundin | P&A |
| 16/1-16 A | 2013 | 2015 | Skagerrak | Wintershall | P&A |
| 16/1-16 | 2012 | 2014 | Rotligendes | Wintershall | P&A |
| 16/1-11 | 2010 | 2012 | Skagerrak | Det Norske | P&A |
| 16/1-11 A | 2010 | 2012 | Skagerrak | Det Norske | P&A |
| 16/1-14 | 2010 | 2012 | Skagerrak | Lundin | P&A |
| 24/12-6 ST2 | 2010 | 2012 | Sleipner Fm | Det Norske | P&A |
| 16/1-14 AT2 | 2010 | 2012 | Late Triassic | Lundin | P&A |
| 25/10-9 | 2009 | 2011 | Statfjord Gp | Lundin | P&A |
| 16/1-9 | 2008 | 2010 | Skagerrak | Noil En. | P&A |
| 25/11-25 A | 2008 | 2010 | Statfjord Fm | StatoilHydro | P&A |
| 25/11-24 | 2007 | 2009 | Statfjord Gp | Norsk Hydro | P&A |
| 16/1-7 | 2004 | 2006 | Skagerrak | Esso | P&A |
| 16/2-2 | 2001 | 2003 | Rødby Fm | Statoil | P&A |
| 16/1-5 | 1999 | 2001 | Basement | Det Norske | P&A |
| 25/11-23 | 1999 | 2001 | Statfjord Gp | Esso | P&A |
| 25/10-8 | 1997 | 1999 | Rotligendes | Esso | P&A |
| 25/10-8 A | 1997 | 1999 | Draupne Fm | Esso | P&A |
| 25/10-6 S | 1996 | 1998 | Sleipner Fm | Statoil | P&A |
| 25/11-19 S | 1995 | 1997 | Statfjord Gp | Esso | P&A |
| 25/11-17 | 1993 | 1995 | Basement | Norsk Hydro | P&A |
| 25/11-15 | 1991 | 1993 | Statfjord Gp | Norsk Hydro | P&A |
| 25/7-2 | 1990 | 1992 | Sleipner Fm | Conoco | P&A |
| 25/7-1 S | 1986 | 1988 | Basement | Conoco | P&A |
| 16/1-3 | 1982 | 1984 | Basement | Esso | P&A |
| 24/12-2 | 1982 | 1984 | Heather Fm | Det Norske | P&A |
| 25/10-4 R | 1981 | 1983 | Rotligendes | Esso | P&A |
| 24/12-1 R | 1978 | 1980 | Triassic | Det Norske | P&A |
| 16/1-2 | 1976 | 1978 | Basement | Esso | P&A |
| 25/11-5 | 1974 | 1976 | Triassic | Esso | P&A |
| 25/10-2 R | 1972 | 1974 | Basement | Esso | P&A |
| 16/2-1 | 1967 | 1969 | Basement | Esso | P&A |
| 25/11-1 | 1967 | 1969 | Basement | Esso | P&A |

# 3 REVIEW OF GEOLOGICAL FRAMEWORK

## Studies and Evaluations

Seismic reprocessing and special studies were undertaken to address the geological uncertainty related to reservoir quality and presence, trap risk, and, charge and migration. The results of these studies were incorporated into the maturation and final evaluation of the prospectivity within PL 780. The seismic evaluation and special studies initiated and delivered to the license are described below.

Interpretation and inversion of the reprocessed seismic data (MC3D-SVG11BGNR15) resulted in downgrading of the original Upper Jurassic Pegasi prospect to a lead, since a robust trap couldn't be mapped, and the inversion was inconclusive regarding the presence of Upper Jurassic sands. The Middle Jurassic Sørvesten lead was upgraded to prospect status, as structural interpretation supported the presence of a Middle Jurassic fault block. Seismic data conditioning was carried out in-house to further improve the seismic data quality and a well study and G&G studies were completed (incorporating data from previous external studies and in house knowledge of nearby wells). However, the evaluation of the Sørvesten trap was considered to be too immature and required further work to reach a drill or drop decision. The MC3D-SVG11BGNR15 seismic imaging of the Sørvesten fault block was sub-optimal due to residual multiple energy from the chalk group, distorting the imaging. Internal efforts to remove the noise from the seismic data were unsuccessful and Top Reservoir in the main part of the prospect was constructed based on Top Permian and a NT Triassic reflector, leading to considerable uncertainty in; the definition of top reservoir, internal geometries and the size of the fault block. In addiiton to MC3D-SVG11BGNR15, Sørvesten was evaluated on a number of different 3D seismic vintages, including LN12M02, DN1302M01and ES9402R98, but all the surveys had the same imaging problems and an application for extension of the Drill or Drop decision was therefore submitted.

To create the best possible basis for a drill or drop decision, the PL 780 partnership evaluated and acquired the new PGS Geostreamer Pure data in Q1 2018. These data gave an uplift in the imaging of the fault block and increased confidence in the interpretation of the Sørvesten trap, and allowed for a safe placement of a well. Following a prospect evaluation on the Geostreamer Pure data the decision to drill the Sørvesten prospect was made.

### Stratigraphic and Reservoir Quality Assessment

Prior to drilling of the well the possible stratigraphy, sedimentology and quality of the potential reservoir section were interpreted in-house using data available through our partnership in the Ivar Aasen area to the south-east, Hanz area to the north-east and West Cable discovery to the south. The main reservoirs were expected to be Vestland Gp and most likely Sleipner Fm. Following drilling of 16/1-33 S, a biostratigraphic analysis and interpretation was completed by Petrostrat and in addition Rockscreen, Photostrat and XRF analyses were undertaken by Stratum/Rockwash. No core was taken and all data were derived from cuttings. The biostratigraphic information, wireline logs, mud log and cuttings data were integrated to establish a stratigraphic zonation of the well. Potential reservoir section was present in Vestland Gp, Sleipner Fm as predicted with minor potential also in underlying Statfjord Gp and Skagerakk Fm sediments. The following post well geological studies were completed:

- Biostratigraphic Analysis of Well 16/1-33 S (RPS UK, now Petrostrat)
- Rockscreen cuttings photography and XRF analysis (Stratum Norge and Rockwash UK)

No sedimentological assessment was made

Basic petrophysics analysis was undertaken in house.

## Trap Risk and Sealing Capacity

The pre-drill assessment of the trap risk and sealing capacity of the Sørvesten Prospect (in 2017) were based on an in-house fault seal analysis and generation of a juxtaposition diagram for the main boundary fault of the Sørvesten Prospect. It was concluded that the top seal, comprising Heather and Draupne Fms, formed a thick section overlying the prospect and had very little sandy content in the lower part of the interval in the offset wells and would therefore be robust. The juxtaposition across the main boundary fault showed Vestland Gp reservoir in the prospect juxtaposed against Permian (probably low permeability). The sealing capacity across the fault was considered to be the main risk element for the prospect.

## Petroleum System Analysis

The basin modelling and migration assessment undertaken (by ORG) during evaluation of the prospect indicated that both Draupne and Heather Fms were potential hydrocarbon sources and could be in contact with reservoir at the Sørvesten location. A potential risk on retention was identified.

Following completion of the well geochemical analysis and interpretation were undertaken by APT and fluid inclusion analysis was undertaken by FIT with the aim of establishing the reasons for the dry well. The geochemical data (APT) indicated that there was no clear evidence of migrated hydrocarbons in any of the reservoirs. The Heather and Draupne Fms encountered in the well showed evidence of some hydrocarbon generation but little expulsion so far. The fluid inclusion (FIT) analyses found very minor evidence of hydrocarbon migration with rare oil inclusions found in one sample. The conclusion is that there was little or no hydrocarbon migration into the Sørvesten structure. The relevant studies are:

- Geochemistry Report - Well 16/1-33 S, Sørvesten Prospect (APT; Norway)
- A Stratigraphic Reconstruction of Bulk Volatile Chemistry from Fluid Inclusions in: 16/1-33 S (FIT)

## Geophysical Studies

A detailed geophysical study with fluid replacement modelling, wedge modelling, AVO modelling at wells, cross-plotting of elastic attributes and pre-stack elastic inversion was carried out in-house.

Elastic attributes for Upper Jurassic showed good separation for hydrocarbon saturated sands. Shale impedance values were however in the same range as sands, acoustic impedance could therefore not be used for lithology separation.

The Vestland Group is well represented by the wells in the area with measured shear-wave logs. AVO analysis showed that HC sands mapped into AVO class 4 with a subtle AVO effect that would be difficult to identify on seismic. Water bearing sands were generally harder than shales and with some overlap in the acoustic impedance space. Hydrocarbon bearing sands with good porosity were characterized by low acoustic impedance and Vp/Vs values, but with acoustic impedance similar to the surrounding shales. Hence, only elastic inversion could potentially separate them.

However, the pre-stack inversion results were disappointing with a noisy Vp/Vs attribute that didn't show any meaningful geological features. This could be due to residual multiples or wavelet distortion caused by the hard chalk above.

# 4 PROSPECT UPDATE

## Upper Jurassic Play

The Upper Jurassic Pegasi prospect was considered the main prospect in the the license in APA 2014. Following reprocessing, undertaken by the license to enhance the seismic imaging of the Jurassic and Triassic intervals, the Pegasi Prospect became less attractive as seismic quality was insufficient to allow differentiation of sandstones and claystones in the Upper Jurassic interval. The focus then changed to the Middle Jurassic to Triassic Sørvesten Prospect.

## Middle Jurassic to Late Triassic Play

The Sørvesten Prospect was a narrow fault block, down-thrown from the block to the east and comprising reservoirs in the Triassic Skagerrak Fm and overlying Jurassic Sleipner and possibly Hugin Fms. The Sørvesten exploration well drilled in the license proved the Sørvesten Prospect to be dry with a thick reservoir package of Sleipner Fm, Statfjord Gp and Skagerrak Fm.

## Remaining Potential

The remaining potential in the license is limited to three Jurassic leads, the up-dip potential from the Sørvesten well (Sørvesten Updip), a small, down-faulted 3-way closure to the west, Sørvesten Downdip, and in addition a small rotated fault block in the footwall of the Sørvesten, Sørøsten (Fig. 4.1). The volumetric potential is very limited with up to 5 mmboe for the updip potential and up to 2 mmboe for each of the two other leads. None of these opportunities are considered to have an attractive volume versus risk combination and none of the opportunities reach the economic threshold for a drilling candidate.

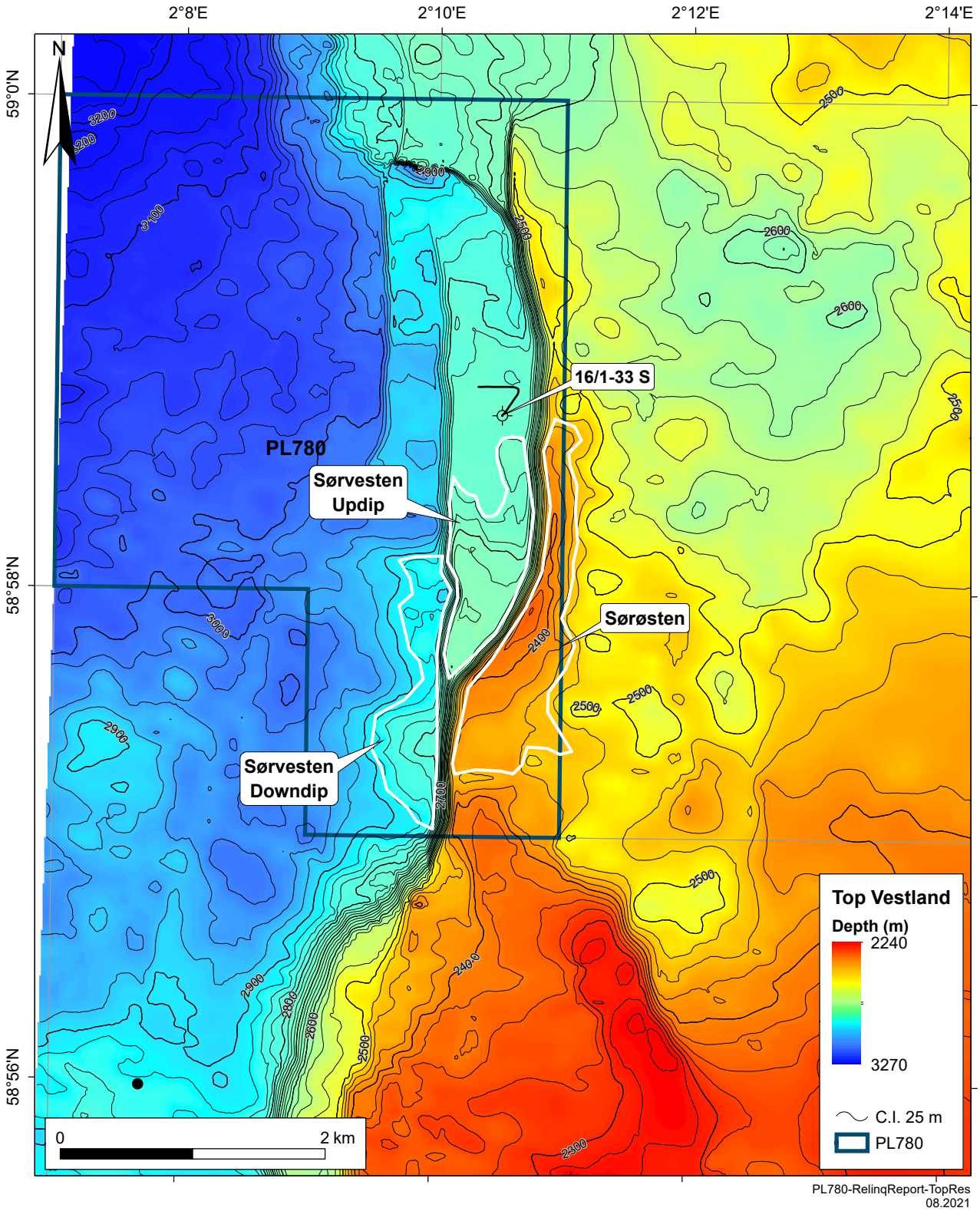


***Fig. 4.1 Remaining prospectivity in PL 780*** *Top Sleipner Fm depth map and outlines of the three remaining leads in the license, all of them with the Vestland Gp as the main reservoir. None of the leads are considered to be commercial attractive.*

# 5 TECHNICAL EVALUATIONS

A technical evaluation was performed in 2019 and addressed the different development scenarios in case of a Sørvesten discovery. The Sørvesten prospect was located 4-8 km away from Ivar Aasen and 5-10 km away from Hanz. The development plan for a P50 oil case discovery was a subsea tie-back to Ivar Aasen via the Hanz infrastructure. A 4-slot subsea template with one producer and water injector from the Hanz infrastructure is shown in Fig. 5.1.

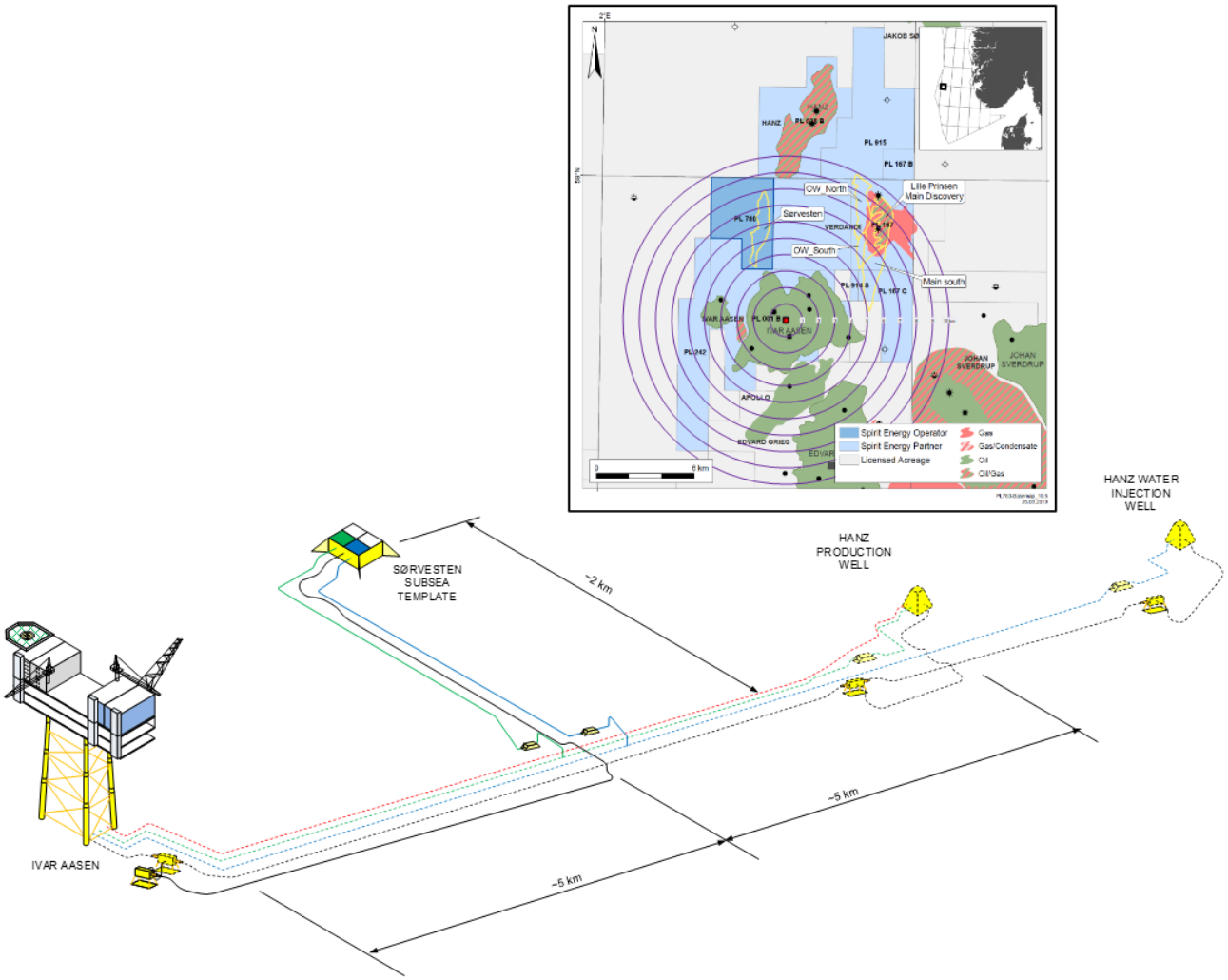


***Fig. 5.1 Sørvesten Development Scenario.***

# 6 CONCLUSIONS

The license commitments were fulfilled by reprocessing of 3D seismic data set and drilling of the Sørvesten exploration well (16/1-33 S). Based on the dry well and post-well studies the license has concluded that the remaining prospectivity in the license is not economically viable, and the license has been relinquished.

# 7 REFERENCES


**Spirit Energy, 2020:** 7321_8-2_ST2__WELL__COMPLETION_GEOLOGICAL_2021-01-05_REPORT_1