Gaffney Cline

Independent Review of Petrophysical Interpretation and Volumetrics for the Zechstein Reservoirs, Devil’s Hole Horst Prospect, UK Continental Shelf

Prepared for

North Sea Natural Resources Limited

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Gaffney Cline

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Dear Niels,

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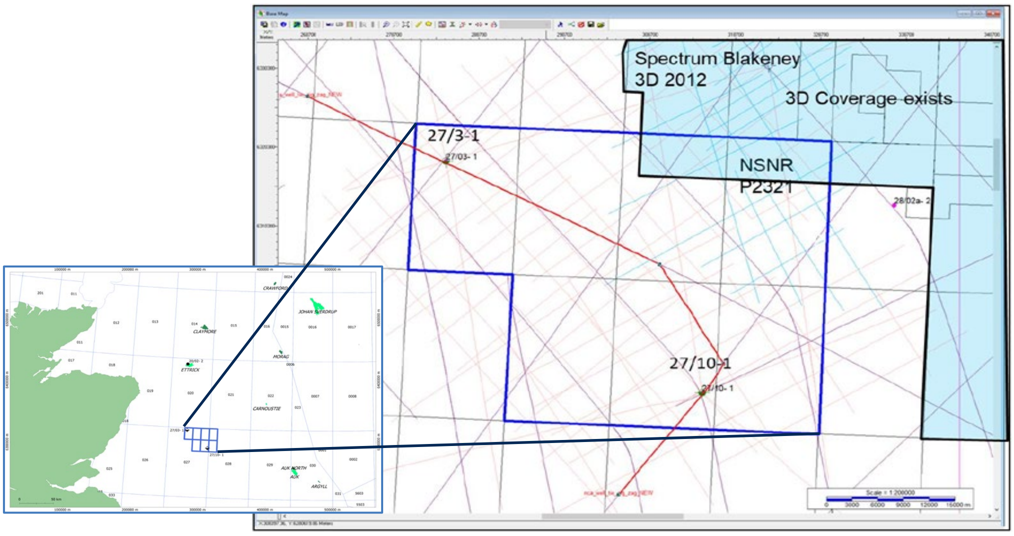
Introduction

As part of the UKCS 29th Offshore Licensing Round, North Sea Natural Resources Ltd. (NSNRL) was awarded licence P2321 comprising seven blocks (27/3, 27/4, 27/5, 27/9, 27/10, 28/1 & 28/6) on the Mid North Sea High. NSNRL holds a 100% interest in the license. Figure 1 shows the location of the two legacy wells located on the licence (27/3-1 (drilled in 1967) and 27/10-1 (drilled in 1970)).

Figure 1: P2321 Licence Location, Wells and Seismic Coverage



Source: NSNRL

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Based on the existing well and seismic data, NSNRL has identified the Devil's Hole Horst prospect, which comprises several stacked reservoir targets (Leads) in multiple Zechstein dolomites, as well as in Jurassic and Devonian sandstones. GaffneyCline previously performed an independent review of the Prospective Resource estimates for each of the Leads identified by NSNRL in December 2019, as well as a petrophysical review of 27/10-1 in October, 2019. NSNRL have requested another review of the Z1/Z2 Carbonate reservoir based on a new porosity interpretation, and therefore water saturation interpretation, as well as updated maps, with re-calculated gross and net rock volumes.

A review of the provided petrophysical re-interpretation of the 27/3-1 and 27/10-1 well logs over the Zechstein Z1/Z2 interval was conducted by GaffneyCline and an independent interpretation performed to provide updated petrophysical rock properties for input into the updated volumetric estimates.

Resource estimates have been prepared in accordance with the SPE Petroleum Resource Management System (PRMS) Definitions and Guidelines (as updated in 2018).

This report relates specifically and solely to the subject matter as defined in the scope of work (SOW), as set out herein, and is conditional upon the specified assumptions. The report must be considered in its entirety and must only be used for the purpose for which it is intended.

Summary and Conclusions

- GaffneyCline performed an independent petrophysical analysis on the Z1/Z2 Carbonates in the 27/3-1 and 27/10-1, based on the premise of an updated porosity interpretation from NSNRL, based on the acoustic and neutron logs, as well as the Rate of Penetration (ROP) log, along with core analysis porosity-permeability data from the Zechstein reservoir in the 20/2-2 well (Ettrick field).

- It is GaffneyCline's opinion that the use of the acoustic log over nuclear log methods is not the most appropriate method, due to the acoustic log being sensitive only to the primary porosity, whereas density and neutron logs see the total porosity. Nuclear porosity devices measure total porosity and respond to pores of all sizes, whereas acoustic logs (or rather transit time) are not/minimally affected by vugs/fractures as the acoustic wave will find a faster path around them. Therefore acoustic porosity is a measure of the primary (matrix) porosity, with secondary porosity often overlooked.

- GaffneyCline's new interpretation is based on use of the density log, but incorporating a higher grain density than used previously (using the core grain density measurements from well 20/2-2). This higher grain density is likely due to the presence of anhydrite nodules within the formation at the Ettrick well. This results in a slightly higher porosity. However, as the amount of anhydrite present within the 27/3-1 and 27/10-1 wells is unknown due a lack of core data and cuttings descriptions, GaffneyCline has only used this interpretation, as well as the updated Sw in the high case volumetric estimate.

- Although different methodologies have been used, the petrophysical results of NSNRL and GaffneyCline are similar in the 27/3-1 well, although there is still a difference of opinion as to the presence of hydrocarbons in 27/10-1. GaffneyCline interpret this well to be water-bearing, but accept that there is uncertainty.

- There is a thin, but more porous interval in the 27/10-1 well, in both the Z2 and at the top of Z1 that shows a marked decrease in resistivity. These more porous intervals are sandwiched between the tighter formation. Where the high resistivity occurs at the top of Z1 coincides with a relatively high density and fast acoustic response as well as a slower ROP indicating a tighter interval. The more porous, thin interval corresponds with a decreasing resistivity, similar to that in the clearly water-bearing part of the reservoir, however, due to the vertical resolution of the deep resistivity tool it reads slightly higher, with the resulting erroneously calculated hydrocarbon saturation.

- Correlation to the Ettrick field (20/2-2) shows similar good reservoir quality to 27/10-1, however, the resistivity responses in the two wells are very different and does not support hydrocarbon presence in 27/10-1.

- The major uncertainties of the Zechstein Z1/Z2 prospect are in part due to the lack of correlation between the two wells, no core or formation pressure data to calibrate the petrophysical properties and provide insight on the oil-water contact and the 2D seismic spacing not being sufficient to rely upon for confident future drilling on the structure.

- It is GaffneyCline's opinion that the estimates of total recoverable hydrocarbon liquid volumes in the Z1/Z2 reservoir, as of 31st May 2020, summarised in Table 1, are reasonable, the Resources classification and categorization as Prospective Resources is appropriate and consistent with the definitions and guidelines for Resources.

Table 1: Gross Oil Prospective Resources for Licence P2321 (Devil's Hole Horst)

Lead/Reservoir	Oil Prospective Resources (MMstb)				Pg
	Low	Best	High	Mean	
Zechstein Z1/Z2	122	404	1,081	**531**	0.34

Notes:

1. Gross Prospective Resources are 100% of the on-block volumes estimated to be recoverable from the Leads in the event that a discovery is made and subsequently developed.
2. The estimated quantities of petroleum that may potentially be recovered by the application of a future development project(s) relate to undiscovered accumulations. These estimates have both an associated risk of discovery (Pg) and a risk of development (Pd). Further exploration appraisal and evaluation is required to determine the existence of a significant quantity of potentially moveable hydrocarbons.
3. The volumes reported here are "Unrisked" in the sense that the Pg has not been applied to the designated volumes within this assessment.
4. Leads are features that are not sufficiently well defined to be drillable, and need further work and/or data.
5. The Pg reported here represents an indicative estimate of the probability that drilling the Lead would result in a discovery, which would warrant the re-classification of those volumes as a Contingent Resource.
6. It is inappropriate to aggregate Prospective Resources without due consideration of the different levels of risk associated with each Lead and the potential dependencies between them.

Discussion

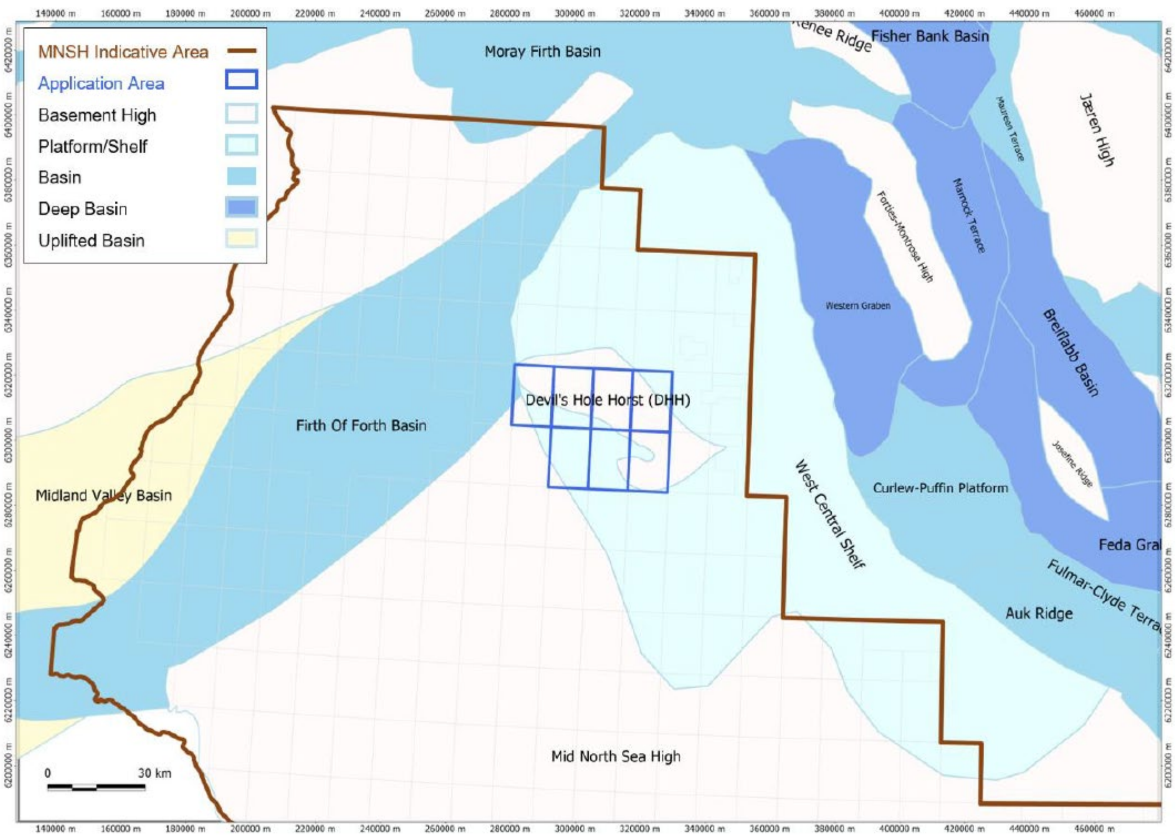
1 Database

Well data available to NSNRL included logs, core and well reports from the two wells drilled within the licence area and from 8 other key OGA released wells from the surrounding area (20/20-2, 20/12-3, 26/4-1, 26/7-1, 26/8-1. 26/12-1, 26-14-1 and 28/12-1).

2 Regional Geology and Petroleum System

The licence area is situated on the Mid North Sea High (MNSH), some 70 km to the west of the prolific oil and gas province of the West Central Graben of the UKCS, and also some 30 km to the west of the West Central Shelf (Figure 2 and Figure 3). The present day structural framework is a result of prolonged extension from the Carboniferous to the Early Cretaceous, coupled with thermal subsidence during the Cretaceous and Tertiary.

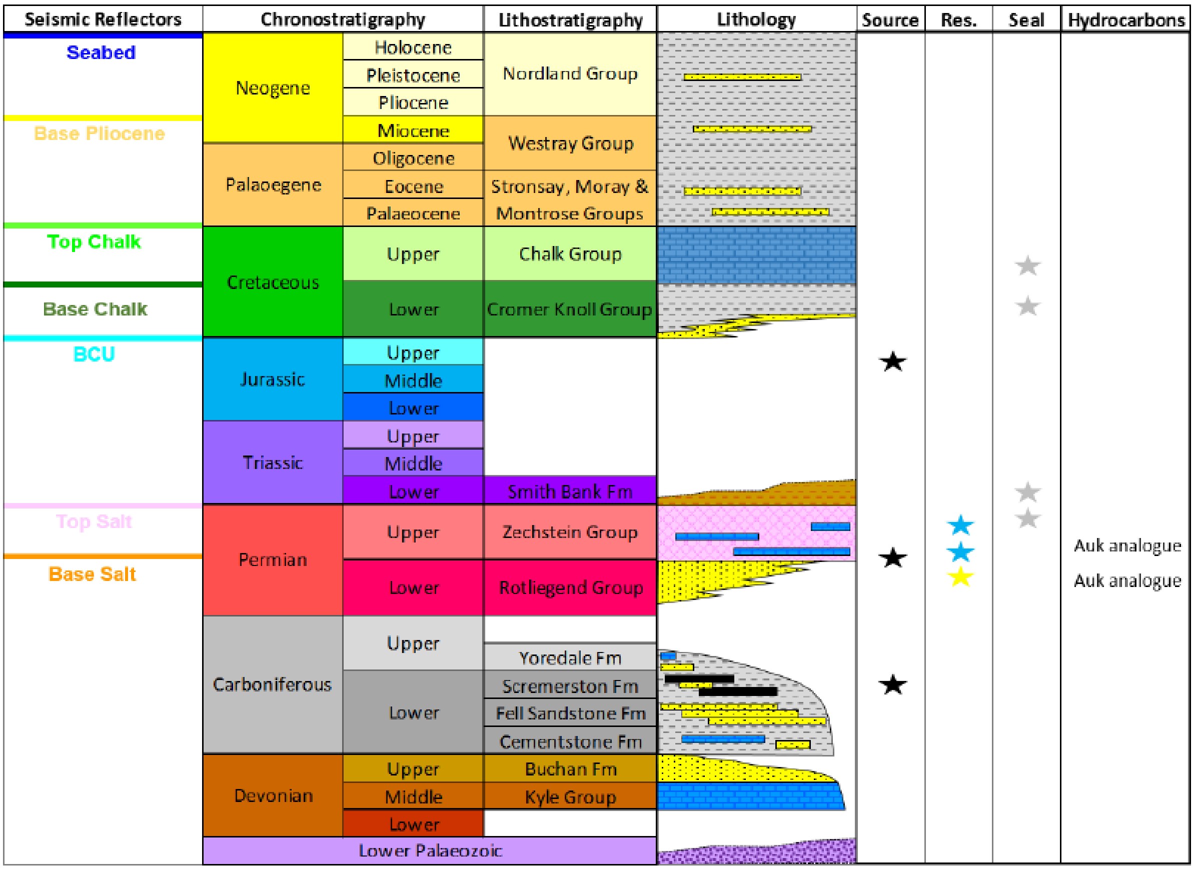
Figure 2: Devil's Hole Horst Structural Setting



Source: NSRL Licence Application

The Devil's Hole Horst is believed to have originated during the Variscan orogeny in the Late Carboniferous to Early Permian, at the time of general uplift of the MNSH. Lower Palaeozoic basement is penetrated in both wells beneath later Devonian clastic sediments and Permian Zechstein deposits. No Carboniferous sequences have been penetrated over the horst.

Figure 3: Stratigraphic Column for License Area showing Petroleum System Elements



Source: NSNRL License Application (GaffneyCline modified)

2.1 Source Rocks

Following the award of the P2321 license NSNRL has commissioned a Fluid Inclusion Stratigraphy (FIS) and regional petroleum geochemistry study (Integrated Geochemical Interpretation Ltd, 2019) to identify and type the hydrocarbon fluids in the DHH area. Cuttings and core samples from the two wells, 27/3-1 and 27/10-1, were analyzed for FIS screening for the potential presence of hydrocarbon fluids. Additionally, petroleum inclusions were extracted for biomarker analyses from one interval of the Zechstein Z2 Dolomite in 27/3-1 and from one interval from the Zechstein Z1 Dolomite in 27/10-1.

A regional petroleum geochemistry study of the area surrounding the DHH was performed based on full analysis of 23 oil and gas condensate samples from wells in the area in order to identify the main oil families in the region and for typing, by oil-oil correlation, of the DHH petroleum fluid inclusions.

In well 27/10-1, the FIS study identified a proximity to wet gas in the Permian Zechstein Z2 Dolomite and to liquid petroleum in the Z1 Dolomite interval. In well 27/3-1, the FIS study also found evidence of some amount of oil charge in the Permian Z2 Dolomite interval, and several intervals of proximity to wet gas were detected in Devonian sand formations, in which separate charges of thermogenic gas are suspected.

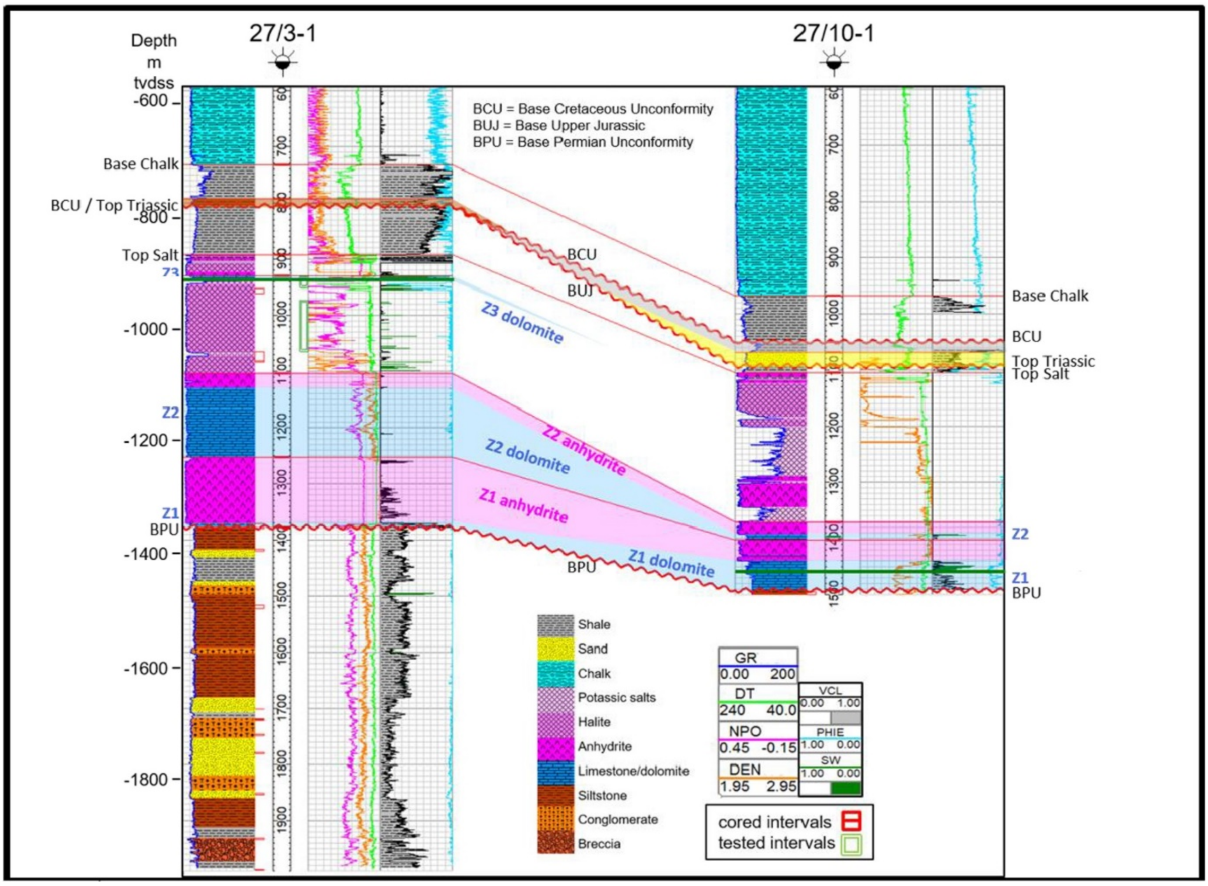
The regional petroleum geochemistry study identifies the petroleum encountered in Permian Dolomite intervals of the DHH to have been sourced from the Upper Jurassic Kimmeridge Clay Formation (KCF), with the kitchen probably located in the East Central Graben. However, the authors also hypothesize that the thermogenic gas in the Devonian sands in 27/3-1 might be charged from Carboniferous sources (presumed from the Forth Approaches Basin to the north)

In the Z1 Dolomite reservoir of well 27/10-1, the slightly more sulphur-rich character of the fluid suggests that it might contain some contributions from a more restricted facies in the KCF kitchen. The occurrence of hydrocarbon gases consistent with KCF sources in Z3 Permian Dolomite intervals of well 26/4-1, which is located west of the DHH in the Forth Approaches Basin, supports evidence for the occurrence of petroleum that has migrated laterally from Central Graben kitchens into Permian reservoirs of the DHH in the Mid North Sea High.

2.2 Reservoirs

The main reservoir targets consist of Z1 and Z2 carbonate, mainly dolomite, intervals within the Permian age Zechstein Group sequences and the shallower good quality Upper Jurassic age sands. Secondary targets are the thin Z3 dolomite and deeper Devonian age sandstones. These four target reservoirs are shown in a well correlation between the 27/3-1 and 27/10-1 wells (Figure 4).

Figure 4: DHH 27/3-1 and 27/10-1 Well Correlation



Source: NSNRL Information Memorandum

2.3 Seals

Zechstein evaporate sequences (Salt and Anhydrite) provide top and base seals for the Zechstein carbonates.

2.4 Traps

The Zechstein targets (Z3 and Z1/Z2) include combined structural and combined structural/stratigraphic traps with structural components comprising four-way dip closure as well as horst blocks, which rely on fault closure. Lateral facies changes in the Zechstein evaporates/carbonates provide the potential for stratigraphic trapping as demonstrated by the difficulty in correlating reservoir intervals between the 27/3-1 and 27/10-1 wells and in the variable quality in reservoir properties.

2.5 Charge/Timing

An Oil Migration study *"Modelling of the Petroleum Systems of the Devil's Hole Horst, Mid North Sea High (Quadrant 27, UKCS)"* (Integrated Geochemical Interpretation Ltd., 2019) commissioned by NSNRL has reported the following key findings:

- It postulates "...*that pre-Zechstein carrier beds have been charged with petroleum expelled from Upper Jurassic source intervals where they are juxtaposed at main rift-bounding faults."*
- It *"predicts that Upper Jurassic source intervals have only reached oil-window maturities in the West Central Graben areas, excluding the hypothesis that oil inclusions in Permian dolomites in wells 27/3-1 and 27/10-1 in the DHH could have been expelled from incipient local generation at any time."*
- Several simple migration scenarios assuming a strong top-seal of 500 m (for Zechstein evaporites) and a 20 m thick pre-Zechstein carrier bed are reported. The model predicted that…
    - *If minor migration losses of 5 MMboe km^{-2} are assumed, the model predicts an oil charge of over 11 Billion Bbl in the DHH, which is forecasted to have been charged essentially since the late Cenozoic.*
    - *…the model still predicts a total oil charge of over 1.7 Billion Bbl for unrealistically large migration losses of 80 MMboe km^{-2}*.

However, the report also identified two main risk factors for the DHH petroleum system:

- *"Charging of pre-Zechstein carrier beds with KCF petroleum at the graben-platform contact."*
- *"Non-interrupted migration of the hydrocarbon fluids towards the culminating DHH area".*

Although the study is encouraging, there are still a number of risk factors that would need to be addressed before the charge model for all the structures mapped over the DHH can be validated.

3 Petrophysics

A review and independent petrophysical interpretation has been performed over the Z1/Z2 reservoirs in 27/3-1 and 27/10-1, based on an updated interpretation provided by NSNRL, as well as additional data from the Ettrick field (20/2-2 well).

3.1 Data Available

NSNRL provided GaffneyCline with wireline log data in .LAS format for both wells. Data included Gamma Ray, Caliper, Compressional Acoustic, Bulk Density, Deep Resistivity (Induction and Laterolog), micro-resistivity and 16" Short Normal Resistivity. Mud and composite logs were also provided in .pdf format along with biostratigraphy and micropalaeontology reports and a more recent fluid inclusion study. Existing interpretations were made available in .LAS format with these containing information on apparent water resistivity (Rwa), mud filtrate resistivity (Rmf) and formation temperature. Core data and reports were also made available from the 20/2-2 well, which may be analogous to the DHH wells at the Zechstein. All log analyses were performed in Schlumberger's Techlog software, the effective porosity system was selected as the basis for quantitative log analysis so as to be comparable to existing interpretations. Water saturations have been calculated using the Archie model.

3.2 Lithology

In the 27/10-1 well, the Z1 Dolomite interval immediately overlies the Devonian Red Sandstone, with approximately 120 ft of anhydrite above, with 35 ft of the Z2 dolomite present, overlain by another anhydritic interval some 70 ft thick.

In 27/3-1, Z1 is not present. The Z2 interval is some 400 ft thick, overlain by over 600 ft of evaporites.

As implied by the formation name, the dominant lithology of the reservoir of interest is dolomite. Mud log descriptions confirm this, along with varying amounts of both limestone and anhydrite as well as argillaceous material, which appears to be more prevalent at the base of the unit.

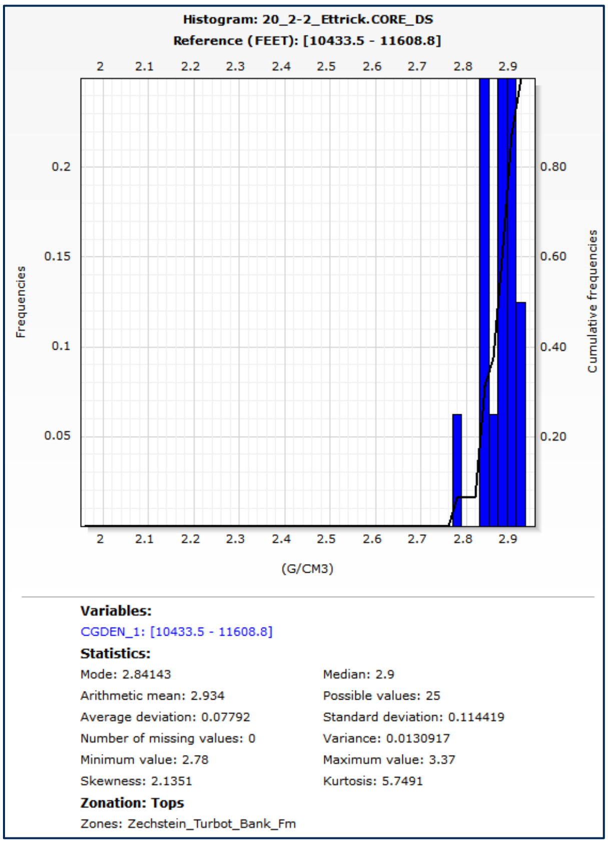
Core data from the Ettrick field (20/2-2) reveals a relatively high degree of anhydrite nodules within the main dolomite framework, with high measured core grain densities, but with reasonable/good porosity and permeability values.

3.3 Formation Evaluation

GaffneyCline derived a Volume of Shale (Vsh) curve from the Gamma Ray log by picking a shale line and a clean line through the dolomite intervals, using the linear Vsh equation. Although shale content is not particularly high through either of the reservoir intervals, existing interpretations were made in the effective porosity (PHIE) system, therefore GaffneyCline followed a similar approach so that the results could be directly comparable.

An estimation of PHIE was calculated using the bulk density log, with grain matrix values derived from the core analysis data in 20/2-2 (Figure 5) and shale end-points derived from histogram analysis estimates from the lithology descriptions and from cuttings in the mud log. A higher than usual grain density (for dolomite) is required in the Ettrick well to better calibrate the density-derived porosity to the measured core porosity. As the amount of anhydrite is more uncertain in the DHH wells, due to the lack of core data, GaffneyCline consider this interpretation as a high case scenario. No core data is available over the reservoir interval in either well to be able to calibrate porosity, however, results were similar to the new interpretations provided by NSNRL, with average PHIE of ranging from around 0.06 p.u to 0.16 p.u. across the two wells.

Figure 5: Core Grain Density Histogram – 20/2-2 Ettrick

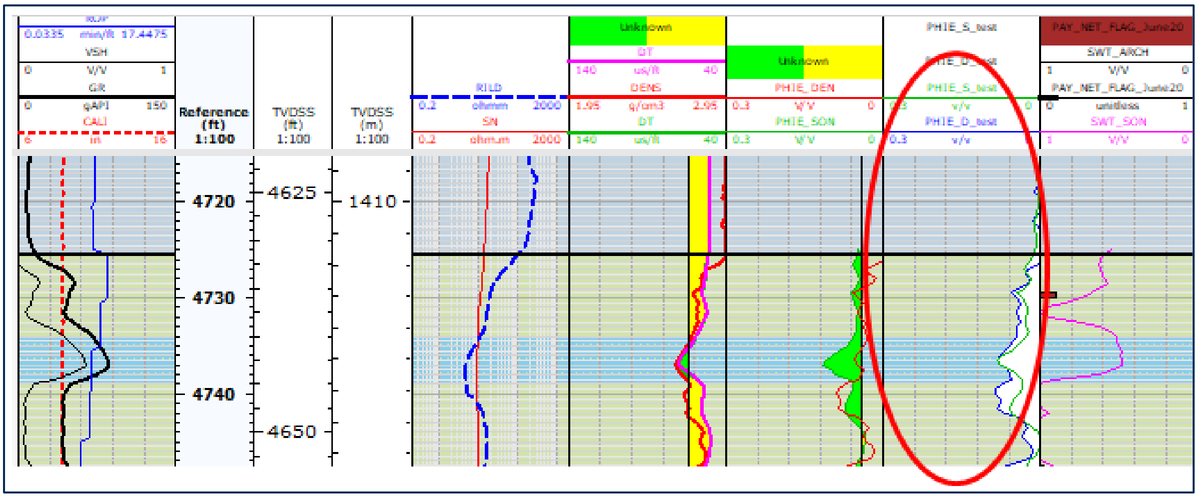


Secondary porosity is likely to be present throughout the Z1/Z2 reservoirs, with the presence of vugs observed in core data at Ettrick. The density log measures the total porosity of the rock and responds to all pore sizes, whereas the acoustic log only measures the primary porosity, as the acoustic wave will find a faster path around such pores. Acoustic porosity is generally lower than that estimated from density especially through the Z1, showing further indications of secondary porosity (in the form of vugs).

GaffneyCline calculated water saturation using the Archie model. No electrical properties (Archie m and n) have been measured, therefore assumptions must be made and m and n were set to 2.0 for the purpose of this analysis, however, it is likely true values will deviate from this value due to changes in the dominant pore-type through the dolomite reservoir as well as any changes in the microstructure. The deep resistivity logs were used along with an re-estimation of water resistivity based on the high case porosity interpretation ,made through Pickett plot analysis, where Rwa = 0.09 ohm.m at reservoir temperature, which equates to a formation water salinity of approximately 40 kppm NaCl eqv. This compares to a water salinity of approximately 180 kppm NaCl eqv. used for the base case analysis. This appears to be in agreement with the Rwa curve provided by NSNRL. An oil-down-to (ODT) is observed in 27/3-1 at approximately 4,020 ft TVDss (1,226 m TVDss). Generally, high water saturations are calculated throughout the intervals of interest, with average water saturations > 0.5 v/v. The high case porosity interpretation results in some hydrocarbon saturation being calculated in the Z2 reservoir in 27/10-1 and this is included within GaffneyCline's range of uncertainty.

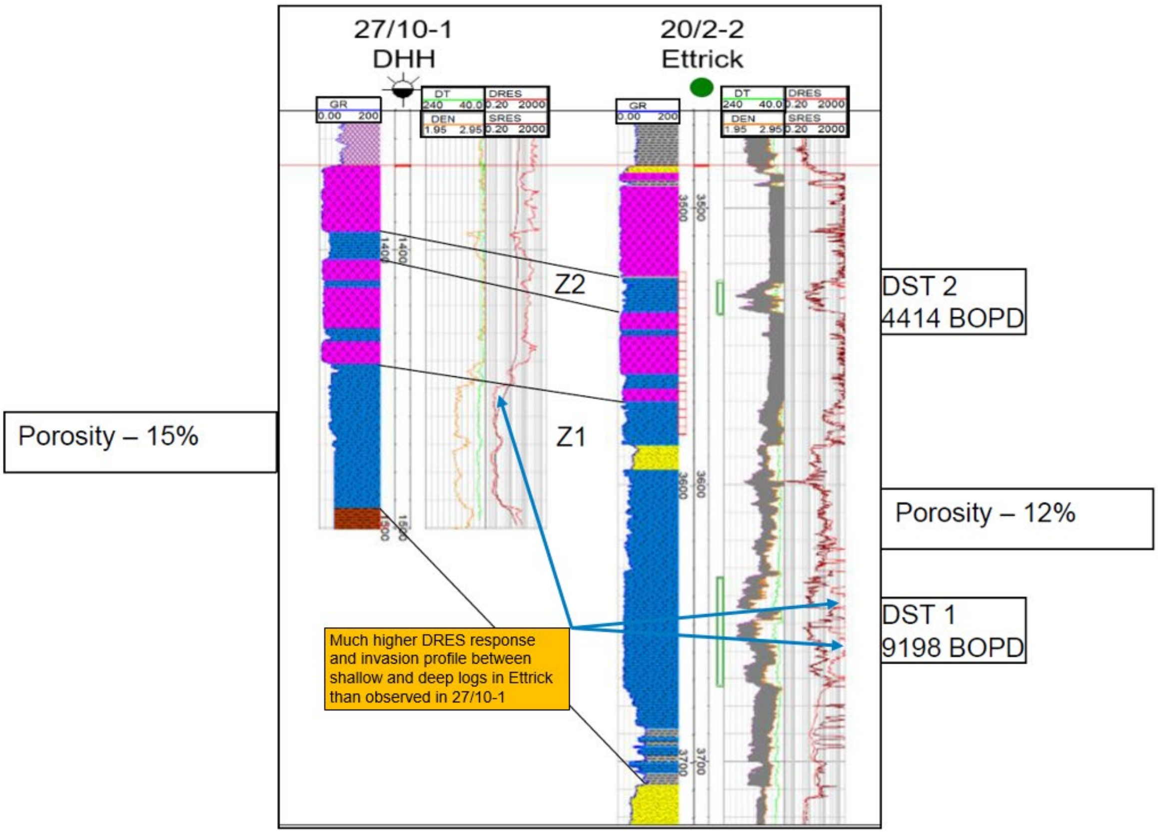
NSNRL interpret an OWC in the Z1 interval in this well at 1,416 m TVDss, based on the crossover of the sonic and density-derived porosities. The density and compressional acoustic logs in the Z1 interval read slightly higher densities and faster acoustic responses in the uppermost part of the section, which, whilst only discrete differences, do not indicate a lighter fluid being observed in this zone and therefore further supports the observation that this interval is likely to be water-bearing. If a slower (higher) travel time is used in the estimation of sonic porosity to allow for the presence of anhydrite within the formation, this reduces the sonic porosity to similar values calculated by the density log method and the observed porosity crossover is removed (Figure 6 – track 8 – PHIE_S (green), PHIE_D (blue)). The resistivity response does not align with that of an oil-bearing interval, with the shallow resistivity (SN (red) – track 5) reading higher than the deep resistivity (RILD (blue) – track 5) log in the apparently more porous zone, which is indicative of a water-bearing interval. The change in both the acoustic and the density response is more likely to be lithological, where it is coincident with a marked increase in the gamma ray log (GR (bold black) – track 1). NSNRL state that the possible OWC is supported in the seismic mapping with a large closure at a similar depth and the fluid inclusions that show high levels of oil inclusions. However, the high levels of oil inclusions continue into the obvious water-bearing zone below and GaffneyCline considers it more likely that hydrocarbons have migrated through this interval. NSNRL state these deeper fluid inclusions suggest a palaeo and deeper contact implying the structure has tilted to the east during the Tertiary Central Graben sedimentation and subsidence. This could cause structure to tilt to the east as the Top and Base Chalk depth structure map shows and for the OWC to move upwards. GaffneyCline do not see enough evidence to support this concept at this stage.

Figure 6: Alternative Sonic Porosity Interpretation in Z1, 27/10-1



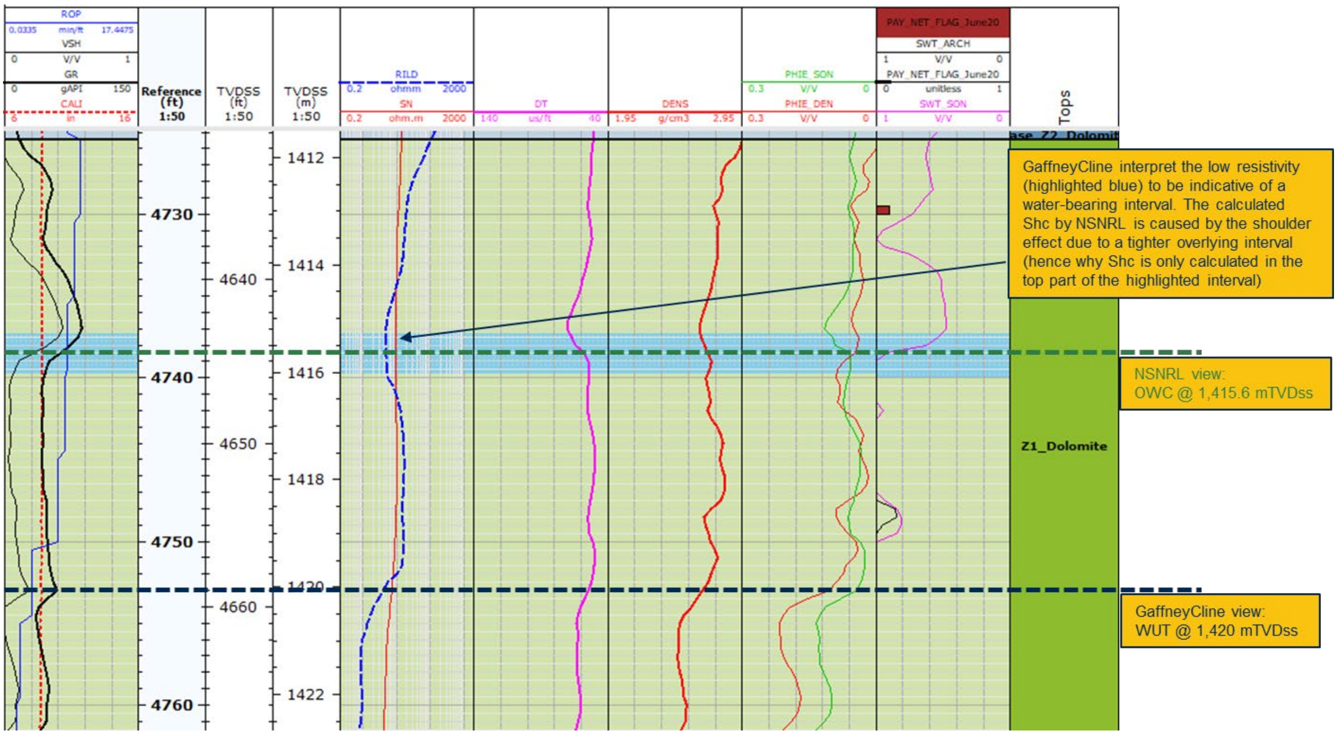
Comparisons of the Z1 interval between 27/10-1 and the producing Ettrick field (20/2-2) have previously been made by NSNRL, however, it is noted that the resistivity responses are significantly different, with values of ~200 ohm.m observed in the reservoir intervals of the Ettrick well (Figure 7).

Figure 7: Zechstein Well Correlation (adapted from "DHH Presentation")



The Z1 interval in 27/10-1 is still interpreted as being water-bearing, with a confident water-up-to (WUT) of 4,659 ft TVDss (1,420 m TVDss) (Figure 8) which GaffneyCline has used for the High Case GRV estimation, with the ODT observed in the 27/3-1 used in the Low Case. NSNRL interpret an OWC in this interval, however GaffneyCline do not see enough evidence for this and interpret the hydrocarbon saturation calculated by NSNRL as likely to be a result of shoulder effects on the deep resistivity log.

Figure 8: Differing Fluid Observations in Z1, 27/10-1



The resulting petrophysical sums and averages from the high case interpretation are shown in Table 2. CPI's of the two wells are shown in Figure 9 and Figure 10.

Table 2: Petrophysical Sums and Averages, Z1/Z2 Reservoir

HIGH CASE RES: PHIE ≥ 0.04 PAY: PHIE ≥ 0.04 and Sw ≤ 0.70												
Well	Zones	Flag Name	Top ft MD	Bottom ft MD	Gross ft	Net ft	Net to Gross v/v	BVW v/v	POR-TH ft	HCPOR-TH ft	Av_PHIE v/v	Av_Sw v/v
27_03-1	Z1-Z2_Dolomite	RES	3708.00	4132.00	424.00	129.50	0.31	0.04	7.93	2.10	0.06	0.74
27_03-1	Z1-Z2_Dolomite	PAY	3708.00	4132.00	424.00	34.50	0.08	0.03	2.15	0.99	0.06	0.54
27_10-1	Z2_Dolomite	RES	4570.66	4604.44	33.78	30.00	0.89	0.05	2.42	0.83	0.08	0.66
27_10-1	Z2_Dolomite	PAY	4570.66	4604.44	33.78	18.50	0.55	0.05	1.60	0.68	0.09	0.57
27_10-1	Z1_Dolomite	RES	4725.44	4898.00	172.56	147.00	0.85	0.16	23.45	0.11	0.16	1.00
27_10-1	Z1_Dolomite	PAY	4725.44	4898.00	172.56	0.00	0.00	-	-	-	-	-

Figure 9: 27/3-1 CPI

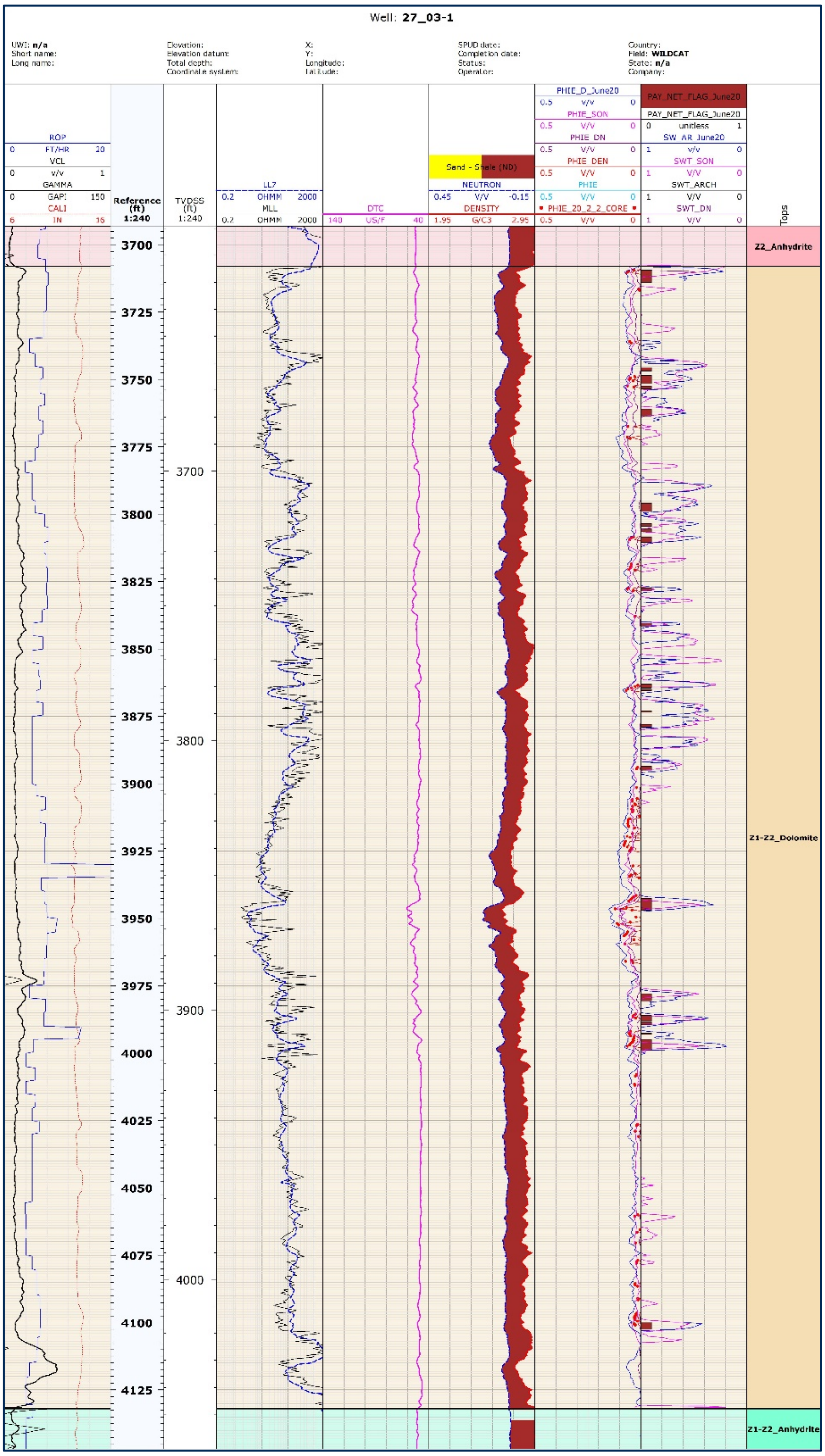
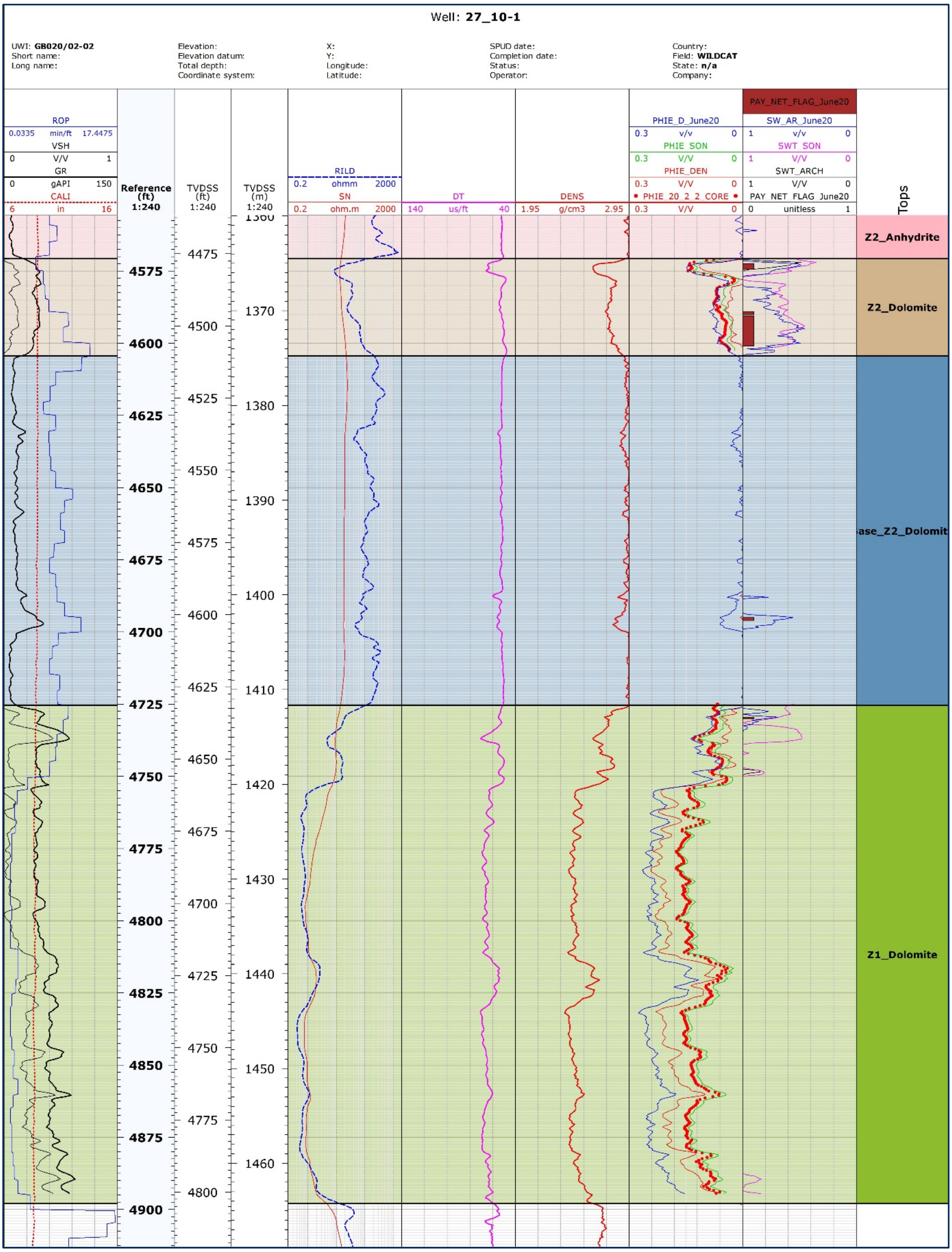


Figure 10: 27/10-1 CPI



4 Devil's Hole Horst Resource Estimates

NSNRL has identified four Leads within the P2321 license, which comprise reservoir target intervals in Jurassic sands, Zechstein dolomites and Devonian sands.

GaffneyCline has previously provided estimates of in-place and recoverable oil volumes in December 2019 for each of the four leads. This updated report is focussed solely on the Zechstein Z1/Z2 lead.

A Monte Carlo model was used to estimate the in-place and Prospective Resources for the Z1/Z2 Lead. Input to the Monte Carlo model was based on the reservoir maps previously provided by NSNRL with hydrocarbon extents revised by GaffneyCline in consideration of the structural and stratigraphic controls relating to the Lead. The map and details of the limits used by GaffneyCline to estimate the Low and High case Gross Rock Volumes (GRVs) are provided in the description of the lead in the following section. Reservoir parameters were based on those previously provided by NSNRL adjusted, where necessary to reflect GaffneyCline's review/interpretation of the well log data provided for the two wells on the license. Details of the input GRV and reservoir parameter distributions are provided in Appendix III.

GaffneyCline has also estimated a Pg based on the chance of finding the estimated hydrocarbon volumes that can flow to surface. The calculation of the Pg uses a matrix approach for each of five factors:

- Trap and Seal;
- Reservoir presence and quality;
- Hydrocarbon source (presence, quality, maturity and migration);
- Geological timing; and
- Play factor.

The overall Pg is estimated by the multiplication of the specific values from each of the five factors. The Pg estimate helps to provide a numerical ranking system for the leads and highlights the most significant risks associated with each lead. This allows for the identification of areas where more data, analysis or a better understanding may help to de-risk a lead. The Z1/Z2 Lead has been assessed with a Moderate Pg.

4.1 Permian (Z1/Z2) Dolomite Lead

The Permian Z1/Z2 Dolomite Lead is a structural trap, combining 3-way dip and fault closure. The crest of the structure is located at -3,480 ft TVDss. The Z1 dolomite is present in 27/10-1 where it is ~170 feet thick with a high Net/Gross (~85%) and has good reservoir porosity (~15%) but is water wet; Z1 is not present in the up-dip 27/3-1 well. The Z2 interval is some 400 feet thick in 27/3-1 but is tight with relatively low porosity (<7%). It is correlated between the two wells but thins to the east to a net thickness of only about 30 feet in the 27/10-1 well. Reservoir properties are better in this well with average porosity of about 10%. New analysis of the well logs suggests that the interval is hydrocarbon filled, with high water saturations estimated (>50%).

The individual dolomite intervals cannot be reliably mapped using the 2D seismic data. To define the Lead, NSNRL has used the combined interval from the top of the Z2 Anhydrite to the base of the Zechstein, which is co-incident with the Base Permian Unconformity (see Figure 4). The interval comprises a thick sequence of Zechstein Salt, Anhydrite and carbonates with the dolomite intervals (representing 15 – 51% of the interval) interspersed within the mainly salt facies providing the main reservoirs. Net/Gross of the unit is consequently low (~10%) and individual dolomite intervals may not be laterally continuous.

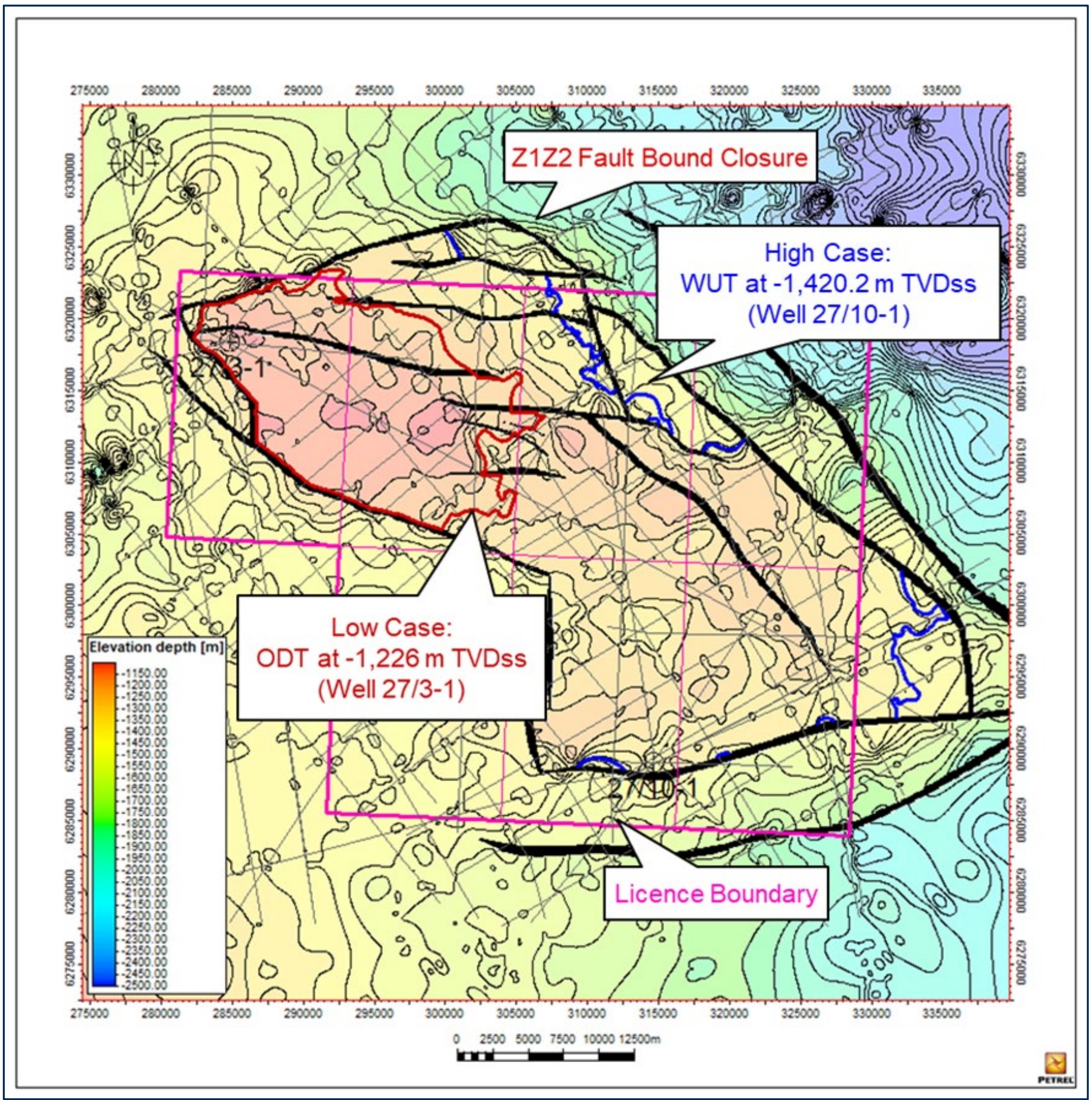
The water-up-to (WUT) depth in well 27/10-1 at -4,659 ft (-1,420 m) TVDss was used to define the maximum closure to the northeast of the structure; closure in the south, north and west is provided by faults. The low case closure has been redefined by the ODT observed in 27/3-1 (Figure 11).

A depth structure map of the top Z1/Z2 interval, including extent of the tilted fault block, as well as the limits used for the Low and High Case GRV estimates, is shown in Figure 10. Reservoir properties used in the Monte Carlo model were based on results from GaffneyCline's review of the 27/3-1 and 27/10-1 well logs. GaffneyCline's estimates of oil in place for the Z1/Z2 Lead are summarised in Table 3, detailed parameters used as input to the Monte Carlo model are given in Appendix III.

The crestal Well 27/3-1 encountered a tight Z1/Z2 interval. As such, the main subsurface risks are reservoir quality as well as continuity. Another key risk is trap effectiveness and leakage along fault planes.

GaffneyCline's estimate of Pg is provided in Table 4.

Figure 11: Top Z1/Z2 Depth Structure Map



Source: GaffneyCline *based on digital data provided by NSNRL*

Table 3: GaffneyCline Estimate of Oil In-Place Volumes for Zechstein Z1/Z2 Lead

	Oil In-Place (MMstb)		
Lead/Reservoir	**P90**	**P50**	**P10**
Zechstein Z1/Z2	870	2,448	5,888

Table 4: GaffneyCline Estimate of Pg for Z1/Z2 Dolomite Lead

Migration	Reservoir	Trap	Seal	Play	Pg
0.80	0.75	0.75	0.75	1.0	0.34

4.2 Prospective Resources

GaffneyCline has performed an updated independent volumetric estimate of the Prospective Resources and assessed the Geological Chance of Success (Pg) of the Z1/Z2 lead identified by NSNRL in the offshore UK North Sea license P2321.

GaffneyCline has reviewed data and interpretations provided by NSNRL in order to provide an independent assessment of Prospective Resources and Pg using an audit approach.

In its review GaffneyCline has determined the identified structure should be classified as a Lead as interpretation refinement is ongoing and a new 3D seismic survey is planned to be shot as part of the work commitments on the block before any drilling commitment is progressed.

It is GaffneyCline's opinion that the estimates of total recoverable hydrocarbon liquid volumes, as of 31st May 2020, are as summarised in Table 5.

Table 5: GaffneyCline Estimate of Prospective Resources for the Z1/Z2 Reservoir, Licence P2321 (Devil's Hole Horst)

Lead/Reservoir	Oil Prospective Resources (MMstb)				Pg
	Low	Best	High	Mean	
Z1/Z2 Dolomite	122	404	1,081	**531**	0.34

Notes:

1. Gross Prospective Resources are 100% of the on-block volumes estimated to be recoverable from the Leads in the event that a discovery is made and subsequently developed.
2. The estimated quantities of petroleum that may potentially be recovered by the application of a future development project(s) relate to undiscovered accumulations. These estimates have both an associated risk of discovery (Pg) and a risk of development (chance of a commercial development). Further exploration appraisal and evaluation is required to determine the existence of a significant quantity of potentially moveable hydrocarbons.
3. The volumes reported here are "Unrisked" in the sense that the Pg factor has not been applied to the designated volumes within this assessment.
4. Leads are features that are not sufficiently well defined to be drillable, and need further work and/or data.
5. The Pg reported here represents an indicative estimate of the probability that drilling the Lead would result in a discovery, which would warrant the re-classification of those volumes as a Contingent Resource.
6. It is inappropriate to aggregate Prospective Resources without due consideration of the different levels of risk associated with each Lead and the potential dependencies between them.

Basis of Opinion

This document reflects GaffneyCline's informed professional judgment based on accepted standards of professional investigation and, as applicable, the data and information provided by the Client, the limited scope of engagement, and the time permitted to conduct the evaluation.

In line with those accepted standards, this document does not in any way constitute or make a guarantee or prediction of results, and no warranty is implied or expressed that actual outcome will conform to the outcomes presented herein. GaffneyCline has not independently verified any information provided by, or at the direction of, the Client, and/or obtained from other sources (e.g., public domain), and has accepted the accuracy and completeness of this data. GaffneyCline has no reason to believe that any material facts have been withheld, but does not warrant that its inquiries have revealed all of the matters that a more extensive examination might otherwise disclose.

The opinions expressed herein are subject to and fully qualified by the generally accepted uncertainties associated with the interpretation of geoscience and engineering data and do not reflect the totality of circumstances, scenarios and information that could potentially affect decisions made by the report's recipients and/or actual results. The opinions and statements contained in this report are made in good faith and in the belief that such opinions and statements are representative of prevailing physical and economic circumstances.

In the preparation of this report, GaffneyCline has used definitions contained within the Petroleum Resources Management System (PRMS), which was approved by the Society of Petroleum Engineers, the World Petroleum Council, the American Association of Petroleum Geologists, the Society of Petroleum Evaluation Engineers, the Society of Exploration Geophysicists, the Society of Petrophysicists and Well Log Analysts, and the European Association of Geoscientists and Engineers in June 2018 (see Appendix II).

There are numerous uncertainties inherent in estimating reserves and resources, and in projecting future production, development expenditures, operating expenses and cash flows. Oil and gas resources assessments must be recognized as a subjective process of estimating subsurface accumulations of oil and gas that cannot be measured in an exact way. Estimates of oil and gas resources prepared by other parties may differ, perhaps materially, from those contained within this report.

The accuracy of any resource estimate is a function of the quality of the available data and of engineering and geological interpretation. Results of drilling, testing and production that post-date the preparation of the estimates may justify revisions, some or all of which may be material. Accordingly, resource estimates are often different from the quantities of oil and gas that are ultimately recovered, and the timing and cost of those volumes that are recovered may vary from that assumed.

Oil and condensate volumes are reported in millions (10^6) of barrels at stock tank conditions (MMstb). Standard conditions are defined as 14.7 psia and 60°F.

GaffneyCline's review involved reviewing pertinent facts, interpretations and assumptions made by NSNRL or others in preparing estimates of resources. GaffneyCline performed procedures necessary to enable it to render an opinion on the appropriateness of the methodologies employed, adequacy and quality of the data relied on, depth and thoroughness of the resources estimation process, classification and categorization of resources appropriate to the relevant definitions used, and reasonableness of the estimates.

GaffneyCline prepared an independent assessment of the resources based on data and interpretations provided by NSNRL.

Definition of Reserves and Resources

Reserves are those quantities of petroleum that are anticipated to be commercially recoverable by application of development projects to known accumulations from a given date forward under defined conditions. Reserves must further satisfy four criteria, based on the development project(s) applied: discovered, recoverable, commercial and remaining (as of the evaluation date).

Reserves are further categorized in accordance with the level of certainty associated with the estimates and may be sub-classified based on project maturity and/or characterized by development and production status. All categories of reserves volumes quoted herein have been derived within the context of an economic limit test (ELT) assessment (pre-tax and exclusive of accumulated depreciation amounts) prior to any net present value (NPV) analysis.

Contingent Resources are those quantities of petroleum estimated, as of a given date, to be potentially recoverable from known accumulations, but the applied project(s) are not yet considered mature enough for commercial development because of one or more contingencies. Contingent Resources may include, for example, projects for which there are currently no evident viable markets, or where commercial recovery is dependent on technology under development, or where evaluation of the accumulation is insufficient to clearly assess commerciality. Contingent Resources are further categorized in accordance with the level of certainty associated with the estimates and may be sub-classified based on project maturity and/or characterized by their economic status.

It must be appreciated that the Contingent Resources reported herein are unrisked in terms of economic uncertainty and commerciality. There is no certainty that it will be commercially viable to produce any portion of the Contingent Resources. Once discovered, the chance that the accumulation will be commercially developed is referred to as the “chance of development” (per PRMS).

Prospective Resources are those quantities of petroleum that are estimated, as of a given date, to be potentially recoverable from undiscovered accumulations by application of future development projects. Prospective Resources have both an associated “chance of discovery” and a “chance of development” (per PRMS). Prospective Resources are further subdivided in accordance with the level of certainty associated with recoverable estimates, assuming their discovery and development, and may be sub-classified based on project maturity.

There is no certainty that any portion of the Prospective Resources will be discovered. If discovered, there is no certainty that it will be commercially viable to produce any portion of the resources. Prospective Resource volumes are presented as unrisked.

This report has been prepared based on GaffneyCline’s understanding of the effects of petroleum legislation and other regulations that currently apply to these properties. However, GaffneyCline is not in a position to attest to property title or rights, conditions of these rights (including environmental and abandonment obligations), or any necessary licenses and consents (including planning permission, financial interest relationships, or encumbrances thereon for any part of the appraised properties).

Qualifications

In performing this study, GaffneyCline is not aware that any conflict of interest has existed. As an independent consultancy, GaffneyCline is providing impartial technical, commercial, and strategic advice within the energy sector. GaffneyCline's remuneration was not in any way contingent on the contents of this report.

In the preparation of this document, GaffneyCline has maintained, and continues to maintain, a strict independent consultant-client relationship with NSNRL. Furthermore, the management and employees of GaffneyCline have no interest in any of the assets evaluated or related with the analysis performed, as part of this report.

Staff members who prepared this report hold appropriate professional and educational qualifications and have the necessary levels of experience and expertise to perform the work.

Notice

This document is confidential and has been prepared for the exclusive use of the Client or parties named herein. It may not be distributed or made available, in whole or in part, to any other company or person without the prior knowledge and written consent of GaffneyCline. No person or company other than those for whom it is intended may directly or indirectly rely upon its contents. GaffneyCline is acting in an advisory capacity only and, to the fullest extent permitted by law, disclaims all liability for actions or losses derived from any actual or purported reliance on this document (or any other statements or opinions of GaffneyCline) by the Client or by any other person or entity.

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It has been a pleasure preparing this Independent Review of Petrophysical Interpretation and Volumetrics for the Zechstein Reservoirs, Devil's Hole Horst Prospect, UK Continental Shelf for North Sea Natural Resources Limited. Please contact the undersigned if you have any questions.

Yours sincerely,

Gaffney, Cline & Associates Limited

Project Manager
Philip Gibbons – Senior Consultant, Petrophysics

Reviewed by
Stephen Lane – Technical Director

Appendices

Appendix I	Glossary
Appendix II	PRMS Reserves Definitions
Appendix III	Monte Carlo Volumetric Estimation Input Parameters and Results

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Appendix I
Glossary

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GLOSSARY

Standard Oil Industry Terms and Abbreviations

ABEX	Abandonment expenditure
ACQ	Annual contract quantity
API	American Petroleum Institute
°API	Degrees API (a measure of oil density)
AAPG	American Association of Petroleum Geologists
AVO	Amplitude versus offset
B	Billion (10^9)
Bbl	Barrels
/Bbl	Per barrel
BBbl	Billion barrels
bcpd	Barrels of condensate per day
BHP	Bottom hole pressure
blpd	Barrels of liquid per day
Bm^3	Billion cubic metres
boe	Barrels of oil equivalent
boepd	Barrels of oil equivalent per day
BOP	Blow out preventer
bopd	Barrels oil per day
bpd	Barrels per day
Bscf or Bcf	Billion standard cubic feet
Bscfd or Bcfd	Billion standard cubic feet per day
BS&W	Bottom sediment and water
BTU	British thermal units
bwpd	Barrels of water per day
°C	Degrees Celsius
CAPEX	Capital expenditure
CBM	Coal bed methane
cf	Standard cubic feet
cfd	Standard cubic feet per day
CIIP	Condensate initially in place
CGR	Condensate to gas ratio
cm	Centimetres
CMM	Coal mine methane
CO_2	Carbon dioxide
cP	Centipoise (a measure of viscosity)
CSG	Coal seam gas
CT	Corporation tax
DCQ	Daily contract quantity
Dev	Developed
DHI	Direct hydrocarbon indicator

DST	Drill stem test
E&A	Exploration & appraisal
E&P	Exploration and production
EBIT	Earnings before interest and tax
EBITDA	Earnings before interest, tax, depreciation and amortisation
EI	Entitlement interest
EIA	Environmental impact assessment
ELT	Economic limit test
EMV	Expected monetary value
EOR	Enhanced oil recovery
ESP	Electrical submersible pump
EUR	Estimated ultimate recovery
€ / EUR	Euro
°F	Degrees Fahrenheit
FDP	Field development plan
FEED	Front end engineering and design
FPSO	Floating production, storage and offloading vessel
FSO	Floating storage and offloading vessel
ft	Foot/feet
g	Gram
g/cc	Grams per cubic centimetre
G&A	General and administrative costs
GBP	Pounds Sterling
GDT	Gas down to
GIIP	Gas initially in place
GJ	Gigajoules (one billion Joules)
GOC	Gas oil contact
GOR	Gas oil ratio
GRV	Gross rock volume
GTL	Gas to liquids
GWC	Gas water contact
HCIIP	Hydrocarbons initially in place
HDT	Hydrocarbons down to
HSE	Health, Safety and Environment
HUT	Hydrocarbons up to
H_2S	Hydrogen sulphide
IOR	Improved oil recovery
IRR	Internal rate of return
J	Joule (Metric measurement of energy; 1 kilojoule = 0.9478 BTU)
KB	Kelly bushing
kJ	Kilojoules (one thousand Joules)
km	Kilometres
km^2	Square kilometres

kPa	Kilopascal (one thousands Pascals)
kW	Kilowatt
kWh	Kilowatt hour
LKG	Lowest known gas
LKH	Lowest known hydrocarbons
LKO	Lowest known oil
LNG	Liquefied natural gas
LPG	Liquefied petroleum gas
LTI	Lost time injury
LWD	Logging while drilling
m	Metres
M	Thousand
m^3	Cubic metres
MBbl	Thousands of barrels
Mbopd	Thousands of barrels of oil per day
Mcf or Mscf	Thousand standard cubic feet
MCM	Management committee meeting
m^3d	Cubic metres per day
mD	Millidarcies (a measure of rock permeability)
MD	Measured depth
MDT	Modular dynamic tester (a wireline logging tool)
Mean	Arithmetic average of a set of numbers
Median	Middle value in a set of values
mg/l	milligrams per litre
MJ	Megajoules (one million Joules)
Mm^3	Thousand cubic metres
Mm^3d	Thousand cubic metres per day
MM	Million
MMBbl	Millions of barrels
MMBTU	Millions of British Thermal Units
MMcf or MMscf	Million standard cubic feet
Mode	Value that exists most frequently in a set of values = most likely
Mcfd or Mscfd	Thousand standard cubic feet per day
MMcfd or MMscfd	Million standard cubic feet per day
MW	Megawatt
MWD	Measuring while drilling
MWh	Megawatt hour
mya	Million years ago
n/a	Not applicable
NGL	Natural gas liquids
N_2	Nitrogen
NOK	Norwegian krone
NPV	Net Present Value

NPV10	Net Present Value at 10% annual discount rate
NTG	Net to gross ratio
OBM	Oil based mud
OCM	Operating committee meeting
ODT	Oil down to
OPEX	Operating expenditure
OWC	Oil water contact
p.a.	Per annum
Pa	Pascal (metric measurement of pressure)
P&A	Plugged and abandoned
PD	Proved developed
PDP	Proved developed producing
%	Percentage
Pg	Geological chance of success
PI	Productivity index
PJ	Petajoules (10^{15} Joules)
ppm	Parts per million
PRMS	Petroleum Resources Management System
PSC / PSA	Production sharing contract / Production sharing agreement
PSDM	Post stack depth migration
psi	Pounds per square inch
psia	Pounds per square inch absolute
psig	Pounds per square inch gauge
PUD	Proved undeveloped
PVT	Pressure volume temperature
P10	Value with a 10% probability of being exceeded
P50	Value with a 50% probability of being exceeded
P90	Value with a 90% probability of being exceeded
RF	Recovery factor
RFT	Repeat formation tester (a wireline logging tool)
RT	Rotary table
RUB	Russian Rouble
R_w	Resistivity of water
SCAL	Special core analysis
scf	Standard cubic feet
scfd	Standard cubic feet per day
S_o	Oil saturation
SPE	Society of Petroleum Engineers
SPEE	Society of Petroleum Evaluation Engineers
SRP	Sucker rod pump
ss	Subsea
ST	Side track
stb	Stock tank barrel

STOIIP	Stock tank oil initially in place
S_w	Water saturation
t	Tonnes
TD	Total depth
te	Tonnes equivalent
THP	Tubing head pressure
TJ	Terajoules (10^{12} Joules)
Tscf or Tcf	Trillion standard cubic feet
TCM	Technical committee meeting
TOC	Total organic carbon
TOP	Take or pay
tpd	Tonnes per day
TVD	True vertical depth
TVDss	True vertical depth subsea
Undev	Undeveloped
USGS	United States Geological Survey
US$	United States Dollar
VAT	Value added tax
VSP	Vertical seismic profiling
WC	Water cut
WI	Working interest
WPC	World Petroleum Council
WTI	West Texas Intermediate
wt%	Weight percent
WUT	Water up to
1C	Low estimate of Contingent Resources
2C	Best estimate of Contingent Resource
3C	High estimate of Contingent Resources
2D	Two dimensional
3D	Three dimensional
4D	Four dimensional (time lapse)
1H13	First half (6 months) of 2013 (example of date)
1P	Proved Reserves
2P	Proved plus Probable Reserves
3P	Proved plus Probable plus Possible Reserves
2Q14	Second quarter (3 months) of 2014 (example of date)

Appendix II
PRMS Reserves Definition

**Society of Petroleum Engineers, World Petroleum Council,
American Association of Petroleum Geologists, Society of Petroleum Evaluation Engineers,
Society of Exploration Geophysicists, Society of Petrophysicists and Well Log Analysts,
and European Association of Geoscientists & Engineers**

Petroleum Resources Management System

Definitions and Guidelines ([1])

(Revised June 2018)

Table 1—Recoverable Resources Classes and Sub-Classes

Class/Sub-Class	Definition	Guidelines
Reserves	Reserves are those quantities of petroleum anticipated to be commercially recoverable by application of development projects to known accumulations from a given date forward under defined conditions.	Reserves must satisfy four criteria: discovered, recoverable, commercial, and remaining based on the development project(s) applied. Reserves are further categorized in accordance with the level of certainty associated with the estimates and may be sub-classified based on project maturity and/or characterized by the development and production status. To be included in the Reserves class, a project must be sufficiently defined to establish its commercial viability (see Section 2.1.2, Determination of Commerciality). This includes the requirement that there is evidence of firm intention to proceed with development within a reasonable time-frame. A reasonable time-frame for the initiation of development depends on the specific circumstances and varies according to the scope of the project. While five years is recommended as a benchmark, a longer time-frame could be applied where, for example, development of an economic project is deferred at the option of the producer for, among other things, market-related reasons or to meet contractual or strategic objectives. In all cases, the justification for classification as Reserves should be clearly documented. To be included in the Reserves class, there must be a high confidence in the commercial maturity and economic producibility of the reservoir as supported by actual production or formation tests. In certain cases, Reserves may be assigned on the basis of well logs and/or core analysis that indicate that the subject reservoir is hydrocarbon-bearing and is analogous to reservoirs in the same area that are producing or have demonstrated the ability to produce on formation tests.
On Production	The development project is currently producing or capable of producing and selling petroleum to market.	The key criterion is that the project is receiving income from sales, rather than that the approved development project is necessarily complete. Includes Developed Producing Reserves. The project decision gate is the decision to initiate or continue economic production from the project.

[1] These Definitions and Guidelines are extracted from the full Petroleum Resources Management System (revised June 2018) document.

Class/Sub-Class	Definition	Guidelines
Approved for Development	All necessary approvals have been obtained, capital funds have been committed, and implementation of the development project is ready to begin or is under way.	At this point, it must be certain that the development project is going ahead. The project must not be subject to any contingencies, such as outstanding regulatory approvals or sales contracts. Forecast capital expenditures should be included in the reporting entity's current or following year's approved budget. The project decision gate is the decision to start investing capital in the construction of production facilities and/or drilling development wells.
Justified for Development	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.	To move to this level of project maturity, and hence have Reserves associated with it, the development project must be commercially viable at the time of reporting (see Section 2.1.2, Determination of Commerciality) and the specific circumstances of the project. All participating entities have agreed and there is evidence of a committed project (firm intention to proceed with development within a reasonable time-frame}) There must be no known contingencies that could preclude the development from proceeding (see Reserves class). The project decision gate is the decision by the reporting entity and its partners, if any, that the project has reached a level of technical and commercial maturity sufficient to justify proceeding with development at that point in time.
Contingent Resources	Those quantities of petroleum estimated, as of a given date, to be potentially recoverable from known accumulations by application of development projects, but which are not currently considered to be commercially recoverable owing to one or more contingencies.	Contingent Resources may include, for example, projects for which there are currently no viable markets, where commercial recovery is dependent on technology under development, where evaluation of the accumulation is insufficient to clearly assess commerciality, where the development plan is not yet approved, or where regulatory or social acceptance issues may exist. Contingent Resources are further categorized in accordance with the level of certainty associated with the estimates and may be sub-classified based on project maturity and/or characterized by the economic status.
Development Pending	A discovered accumulation where project activities are ongoing to justify commercial development in the foreseeable future.	The project is seen to have reasonable potential for eventual commercial development, to the extent that further data acquisition (e.g., drilling, seismic data) and/or evaluations are currently ongoing with a view to confirming that the project is commercially viable and providing the basis for selection of an appropriate development plan. The critical contingencies have been identified and are reasonably expected to be resolved within a reasonable time-frame. Note that disappointing appraisal/evaluation results could lead to a reclassification of the project to On Hold or Not Viable status. The project decision gate is the decision to undertake further data acquisition and/or studies designed to move the project to a level of technical and commercial maturity at which a decision can be made to proceed with development and production.

Class/Sub-Class	Definition	Guidelines
Development on Hold	A discovered accumulation where project activities are on hold and/or where justification as a commercial development may be subject to significant delay.	The project is seen to have potential for commercial development. Development may be subject to a significant time delay. Note that a change in circumstances, such that there is no longer a probable chance that a critical contingency can be removed in the foreseeable future, could lead to a reclassification of the project to Not Viable status. The project decision gate is the decision to either proceed with additional evaluation designed to clarify the potential for eventual commercial development or to temporarily suspend or delay further activities pending resolution of external contingencies.
Development Unclarified	A discovered accumulation where project activities are under evaluation and where justification as a commercial development is unknown based on available information.	The project is seen to have potential for eventual commercial development, but further appraisal/evaluation activities are ongoing to clarify the potential for eventual commercial development. This sub-class requires active appraisal or evaluation and should not be maintained without a plan for future evaluation. The sub-class should reflect the actions required to move a project toward commercial maturity and economic production.
Development Not Viable	A discovered accumulation for which there are no current plans to develop or to acquire additional data at the time because of limited production potential.	The project is not seen to have potential for eventual commercial development at the time of reporting, but the theoretically recoverable quantities are recorded so that the potential opportunity will be recognized in the event of a major change in technology or commercial conditions. The project decision gate is the decision not to undertake further data acquisition or studies on the project for the foreseeable future.
Prospective Resources	Those quantities of petroleum that are estimated, as of a given date, to be potentially recoverable from undiscovered accumulations.	Potential accumulations are evaluated according to the chance of geologic discovery and, assuming a discovery, the estimated quantities that would be recoverable under defined development projects. It is recognized that the development programs will be of significantly less detail and depend more heavily on analog developments in the earlier phases of exploration.
Prospect	A project associated with a potential accumulation that is sufficiently well defined to represent a viable drilling target.	Project activities are focused on assessing the chance of geologic discovery and, assuming discovery, the range of potential recoverable quantities under a commercial development program.
Lead	A project associated with a potential accumulation that is currently poorly defined and requires more data acquisition and/or evaluation to be classified as a Prospect.	Project activities are focused on acquiring additional data and/or undertaking further evaluation designed to confirm whether or not the Lead can be matured into a Prospect. Such evaluation includes the assessment of the chance of geologic discovery and, assuming discovery, the range of potential recovery under feasible development scenarios.
Play	A project associated with a prospective trend of potential prospects, but that requires more data acquisition and/or evaluation to define specific Leads or Prospects.	Project activities are focused on acquiring additional data and/or undertaking further evaluation designed to define specific Leads or Prospects for more detailed analysis of their chance of geologic discovery and, assuming discovery, the range of potential recovery under hypothetical development scenarios.

Table 2—Reserves Status Definitions and Guidelines

Status	Definition	Guidelines
Developed Reserves	Expected quantities to be recovered from existing wells and facilities.	Reserves are considered developed only after the necessary equipment has been installed, or when the costs to do so are relatively minor compared to the cost of a well. Where required facilities become unavailable, it may be necessary to reclassify Developed Reserves as Undeveloped. Developed Reserves may be further sub-classified as Producing or Non-producing.
Developed Producing Reserves	Expected quantities to be recovered from completion intervals that are open and producing at the effective date of the estimate.	Improved recovery Reserves are considered producing only after the improved recovery project is in operation.
Developed Non-Producing Reserves	Shut-in and behind-pipe Reserves.	Shut-in Reserves are expected to be recovered from (1) completion intervals that are open at the time of the estimate but which have not yet started producing, (2) wells which were shut-in for market conditions or pipeline connections, or (3) wells not capable of production for mechanical reasons. Behind-pipe Reserves are expected to be recovered from zones in existing wells that will require additional completion work or future re-completion before start of production with minor cost to access these reserves. In all cases, production can be initiated or restored with relatively low expenditure compared to the cost of drilling a new well.
Undeveloped Reserves	Quantities expected to be recovered through future significant investments.	Undeveloped Reserves are to be produced (1) from new wells on undrilled acreage in known accumulations, (2) from deepening existing wells to a different (but known) reservoir, (3) from infill wells that will increase recovery, or (4) where a relatively large expenditure (e.g., when compared to the cost of drilling a new well) is required to (a) recomplete an existing well or (b) install production or transportation facilities for primary or improved recovery projects.

Table 3—Reserves Category Definitions and Guidelines

Category	Definition	Guidelines
Proved Reserves	Those quantities of petroleum that, by analysis of geoscience and engineering data, can be estimated with reasonable certainty to be commercially recoverable from a given date forward from known reservoirs and under defined economic conditions, operating methods, and government regulations.	If deterministic methods are used, the term "reasonable certainty" is intended to express a high degree of confidence that the quantities will be recovered. If probabilistic methods are used, there should be at least a 90% probability (P90) that the quantities actually recovered will equal or exceed the estimate. The area of the reservoir considered as Proved includes (1) the area delineated by drilling and defined by fluid contacts, if any, and (2) adjacent undrilled portions of the reservoir that can reasonably be judged as continuous with it and commercially productive on the basis of available geoscience and engineering data. In the absence of data on fluid contacts, Proved quantities in a reservoir are limited by the LKH as seen in a well penetration unless otherwise indicated by definitive geoscience, engineering, or performance data. Such definitive information may include pressure gradient analysis and seismic indicators. Seismic data alone may not be sufficient to define fluid contacts for Proved. Reserves in undeveloped locations may be classified as Proved provided that: A. The locations are in undrilled areas of the reservoir that can be judged with reasonable certainty to be commercially mature and economically productive. B. Interpretations of available geoscience and engineering data indicate with reasonable certainty that the objective formation is laterally continuous with drilled Proved locations. For Proved Reserves, the recovery efficiency applied to these reservoirs should be defined based on a range of possibilities supported by analogs and sound engineering judgment considering the characteristics of the Proved area and the applied development program.
Probable Reserves	Those additional Reserves that analysis of geoscience and engineering data indicates are less likely to be recovered than Proved Reserves but more certain to be recovered than Possible Reserves.	It is equally likely that actual remaining quantities recovered will be greater than or less than the sum of the estimated Proved plus Probable Reserves (2P). In this context, when probabilistic methods are used, there should be at least a 50% probability that the actual quantities recovered will equal or exceed the 2P estimate. Probable Reserves may be assigned to areas of a reservoir adjacent to Proved where data control or interpretations of available data are less certain. The interpreted reservoir continuity may not meet the reasonable certainty criteria. Probable estimates also include incremental recoveries associated with project recovery efficiencies beyond that assumed for Proved.

Category	Definition	Guidelines
Possible Reserves	Those additional reserves that analysis of geoscience and engineering data indicates are less likely to be recoverable than Probable Reserves.	The total quantities ultimately recovered from the project have a low probability to exceed the sum of Proved plus Probable plus Possible (3P), which is equivalent to the high-estimate scenario. When probabilistic methods are used, there should be at least a 10% probability (P10) that the actual quantities recovered will equal or exceed the 3P estimate. Possible Reserves may be assigned to areas of a reservoir adjacent to Probable where data control and interpretations of available data are progressively less certain. Frequently, this may be in areas where geoscience and engineering data are unable to clearly define the area and vertical reservoir limits of economic production from the reservoir by a defined, commercially mature project. Possible estimates also include incremental quantities associated with project recovery efficiencies beyond that assumed for Probable.
Probable and Possible Reserves	See above for separate criteria for Probable Reserves and Possible Reserves.	The 2P and 3P estimates may be based on reasonable alternative technical interpretations within the reservoir and/ or subject project that are clearly documented, including comparisons to results in successful similar projects. In conventional accumulations, Probable and/or Possible Reserves may be assigned where geoscience and engineering data identify directly adjacent portions of a reservoir within the same accumulation that may be separated from Proved areas by minor faulting or other geological discontinuities and have not been penetrated by a wellbore but are interpreted to be in communication with the known (Proved) reservoir. Probable or Possible Reserves may be assigned to areas that are structurally higher than the Proved area. Possible (and in some cases, Probable) Reserves may be assigned to areas that are structurally lower than the adjacent Proved or 2P area. Caution should be exercised in assigning Reserves to adjacent reservoirs isolated by major, potentially sealing faults until this reservoir is penetrated and evaluated as commercially mature and economically productive. Justification for assigning Reserves in such cases should be clearly documented. Reserves should not be assigned to areas that are clearly separated from a known accumulation by non-productive reservoir (i.e., absence of reservoir, structurally low reservoir, or negative test results); such areas may contain Prospective Resources. In conventional accumulations, where drilling has defined a highest known oil elevation and there exists the potential for an associated gas cap, Proved Reserves of oil should only be assigned in the structurally higher portions of the reservoir if there is reasonable certainty that such portions are initially above bubble point pressure based on documented engineering analyses. Reservoir portions that do not meet this certainty may be assigned as Probable and Possible oil and/or gas based on reservoir fluid properties and pressure gradient interpretations.

Figure 1.1—RESOURCES CLASSIFICATION FRAMEWORK

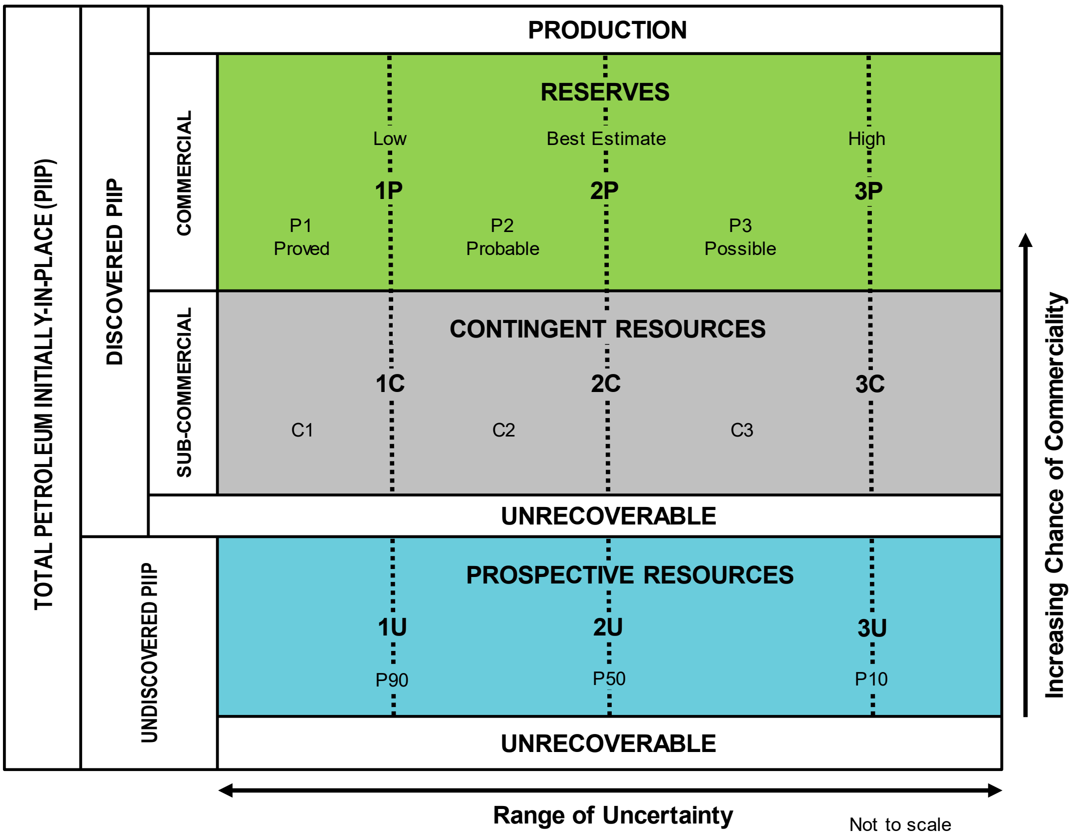
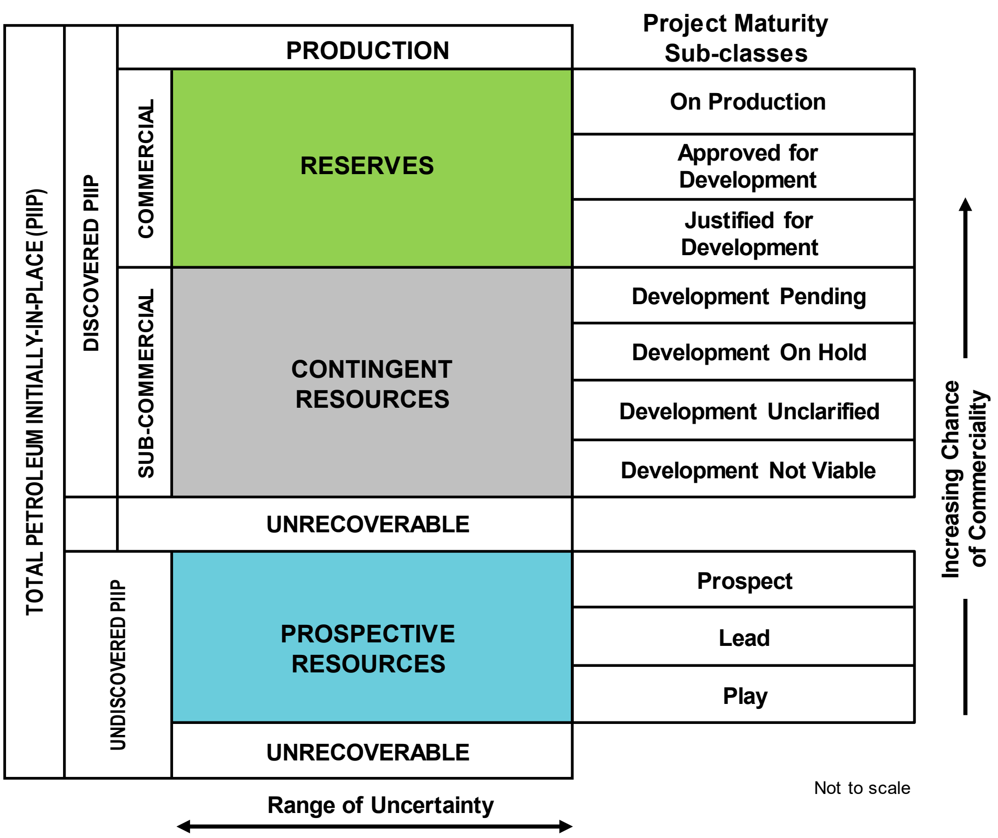


Figure 2.1—SUB-CLASSES BASED ON PROJECT MATURITY



Appendix III
Monte Carlo Volumetric Estimation Input Parameters and Results

North Sea Natural Resources Limited
22 July 2020

Zechstein Z1/Z2 Lead
Monte Carlo Volumetric Estimation

Parameter	Units	Low	Mid	High	Distribution
Area					
GRV Limits	mss	-1,226.0		-1420.2	
Gross Rock Volume	MM m3	17,464	39,490	125,216	Lognormal
Net to Gross	v/v	0.100	0.250	0.400	Normal
Porosity	v/v	0.050	0.100	0.150	Normal
Hydrocarbon Saturation	v/v	0.451	0.530	0.610	Normal
Formation Volume Factor	Bo	0.864	0.909	0.955	Triangular
Fill Factor	v/v	0.85	0.90	0.95	Triangular
Recovery Factor	v/v	0.10	0.20	0.25	Normal
Probabilistic Results		**P90**	**P50**	**P10**	**Mean**
IN-PLACE VOLUME	MMBbl	870	2,448	5,888	**3,037**
ESTIMATED ULTIMATE RECOVERABLE	MMBbl	122	404	1,081	**531**