ConocoPhillips Canada Resources Corp.

Application for a Declaration of Significant Discovery for the Dodo Canyon E-76 and Mirror Lake P-20 Wells

NWT-SDD-2015-001

Office of the Regulator of Oil and Gas Operations

File No. NWT-SDD-2015-001: ConocoPhillips Canada Resources Corp., Application for a Declaration of Significant Discovery for the Dodo Canyon E-76 and Mirror Lake P-20 Wells

September 7, 2016

In THE MATTER of an application by ConocoPhillips Canada Resources Corp. made pursuant to section 27 of the *Petroleum Resources Act* S.N.W.T. 2014 c.15.

AND IN THE MATTER of the submissions of Husky Oil Operations Limited made pursuant to subsection 28(6) of the *Petroleum Resources Act* S.N.W.T. 2014 c.15. FILE NO. NWT-SDD-2015-001.

AND IN THE MATTER of the submissions of Shell Canada Energy made pursuant to subsection 28(6) of the *Petroleum Resources Act* S.N.W.T. 2014 c.15. FILE NO. NWT-SDD-2015-001.

AND IN THE MATTER of the submissions of MGM Energy made pursuant to subsection 28(6) of the *Petroleum Resources Act* S.N.W.T. 2014 c.15. FILE NO. NWT-SDD-2015-001.

TABLE OF CONTENTS

DECISION

After consideration of the evidence in this matter, the Panel declares that a significant discovery is indicated by the ConocoPhillips Canada Resources Corp. ("ConocoPhillips") Dodo Canyon E-76 ("E-76") well. The significant discovery area is composed of the sections identified in table 1 and shown on the figure 1, both in appendix 1 to this report.

What follows are the reasons for the decision to make a declaration of significant discovery.

INTRODUCTION

ConocoPhillips applied to the Regulator of Oil and Gas Operations ("regulator") of the Government of the Northwest Territories ("GNWT") for a declaration of significant discovery under section 27(1) of the *Petroleum Resources Act* S.N.W.T. 2014, c.15 ("*PRA*") on February 9, 2015, based on the E-76 and Mirror Lake P-20 ("P-20") wells.

In 2013, ConocoPhillips drilled two vertical wells under its Exploration Licence ("EL") EL 470: Loon Creek O-06 ("O-06") and Mirror Lake N-20 ("N-20"). ConocoPhillips cored, logged, and conducted diagnostic fracture injection tests in the Canol Formation at the O-06 and the N-20 wells. In 2014, ConocoPhillips drilled two horizontal wells on EL 470, the E-76 and P-20 wells, into the Canol Formation. At these wells, ConocoPhillips conducted hydraulic fracturing operations and extended formation flow tests in 2014. The E-76 well was the first of the two wells to have drilling, completions, hydraulic fracturing, and formation-flow test operations conducted.

REGULATORY FRAMEWORK

Section 27(1) of the *PRA* provides for the regulator to make a declaration of a significant discovery. A declaration of a significant discovery is a precursor to conversion of an

exploration licence to a significant discovery licence on petroleum lands within a significant discovery area.

Section 27(1) of the *PRA* states the following:

> Where a significant discovery has been made on any petroleum lands that are subject to an interest or a share in an interest held in accordance with section 22, the Regulator shall, on the application of the interest holder of the interest or the share made in the form and manner and containing such information as may be prescribed, make a written declaration of significant discovery in relation to those petroleum lands in respect of which there are reasonable grounds to believe that the significant discovery may extend.

Section 1 of the *PRA* defines "significant discovery" and "significant discovery area" as follows:

> "Significant discovery" means a discovery indicated by the first well on a geological feature that demonstrates by flow testing the existence of hydrocarbons in that feature, and having regard for geological and engineering factors, suggests the existence of an accumulation of hydrocarbons that has potential for sustained production.
>
> "Significant discovery area" means, in relation to a declaration of significant discovery made under subsection 27(1) or (2), those petroleum lands described in the declaration.

SIGNIFICANT DISCOVERY DECLARATION PROCESS

On February 9, 2015, ConocoPhillips submitted an application to the regulator for a significant discovery declaration based on the E-76 and P-20 wells, under section 27 of the *PRA*.

On February 17, 2015, the Office of the Regulator of Oil and Gas Operations ("OROGO") posted a notice requesting persons believing themselves to be directly affected by the proposed declaration to identify themselves. Husky Oil Operations Limited ("Husky"), Shell Canada Energy ("Shell"), and MGM Energy ("MGM") each

requested that they be considered a directly affected person ("DAP") for the purposes of the ConocoPhillips application.

On February 24, 2015, in accordance with section 27(7) of the *PRA*, the regulator delegated its powers over the ConocoPhillips application under s.28(2) of the *PRA* to the chief conservation officer ("CCO"), who was appointed by the regulator under section 4 of the *Oil and Gas Operations Act* S.N.W.T. 2014, c.14.

On August 4, 2015, the CCO determined that Husky, Shell, and MGM were all DAPs and issued a notice of intention to make a decision to the applicant and the DAPs under section 28(2) of the *PRA*. The notice stated that the CCO intended to declare that a significant discovery had been made on the petroleum lands specified in ConocoPhillips' application and listed in table 2.

Table 2: Lands in the significant discovery area identified in the notice of intention to make a decision

Latitude	Longitude	Sections
64° 50' N	126° 30' W	59, 60, 69, 70, 79, 80
64° 50' N	126° 45' W	9, 10, 19, 20
65° 00' N	126° 30' W	51-80
65° 00' N	126° 45' W	1-20, 22-30, 34-40, 45-50, 56-60, 66-70, 76-80
65° 00' N	127° 00' W	7-10, 18-20, 28-30, 39, 40, 50, 60
65° 10' N	126° 30' W	51-57, 60-66, 71-76
65° 10' N	126° 45' W	1-6, 11-16, 21-27, 31-38, 41-80
65° 10' N	127° 00' W	1-58
65° 20' N	126° 30' W	51-54, 61-64, 71-74
65° 20' N	126° 45' W	1-4, 11-14, 21-24, 31-33, 41-43, 51-53, 61-63, 71-73
65° 20' N	127° 00' W	1-3, 11-13, 21-23, 31, 32, 41

In accordance with the provisions of s.28(3) of the *PRA*, Husky, Shell, and MGM each requested a hearing about the CCO's intended decision.

On September 2, 2015, under section 27(7) of the *PRA*, the regulator delegated the power to hold hearings and make a decision on the ConocoPhillips application under section 28(7) of the *PRA* to a Panel ("the Panel") composed of the following individuals:

- Mr. Bradley C. Hubbard, P. Eng., of Calgary, Alberta (chair)
- Ms. Kathryn Fiess, P. Geol., of Yellowknife, Northwest Territories
- Mr. Gary Woo, P. Eng., of Calgary, Alberta

On September 18, 2015, the Panel issued a hearing order for File No. NWT-SDD-2015-001 to give notice of the hearings scheduled to accommodate Husky's, Shell's, and MGM's requests.

Written submissions related to the ConocoPhillips application were received from MGM on November 10, 2015, from Husky on November 16, 2015, and from Shell on November 18, 2015.

THE HEARINGS

Oral hearings were conducted in Yellowknife by the Panel on Husky's submissions on January 19, 2016, on MGM's submissions on January 20, 2016, and on Shell's submissions on January 21, 2016. Each hearing was conducted *in camera*, with only the party making submissions present to maintain the confidentiality of information being presented by each party in accordance with section 91 of the *PRA*. Husky, MGM, and Shell each requested reasons for the decision as provided for by section 28(7) of the *PRA*.

Husky, MGM, and Shell all agreed that a declaration of significant discovery should be made for the E-76 well, but each submitted that the significant discovery area should extend beyond the petroleum lands identified in the CCO's notice of intention to make a decision and onto lands within each of their respective exploration licences:

1. EL 494A and 494B, or collectively as EL 494 (Husky)
2. EL 474 (MGM)
3. EL 468, 469, 475, and 487 (Shell)

Participants in the hearings are listed in appendix 2.

MATERIALS CONSIDERED BY THE PANEL

ConocoPhillips' Application for a Significant Discovery Declaration

- ConocoPhillips' application for the declaration of significant discovery, including attachments, dated February 9, 2015.
- Information request no. 1, dated April 10, 2015, and ConocoPhillips' response, dated May 7, 2015.
- Letter, dated January 19, 2016, responding to the Panel's hearing order with respect to the written reasons for decision.

Documents Issued by the Chief Conservation Officer and Panel

- Notice of intention to make a decision, dated August 4, 2015.
- Hearing order for File No. NWT-SDD-2015-001, dated September 18, 2015.

Husky's DAP Submission

- Husky's DAP hearing request submission, including attachments, dated November 16, 2015.
- Information request no. 1, dated December 7, 2015, and Husky's response, dated December 18, 2015.
- Information request no. 2, dated January 6, 2016, and Husky's response, dated January 7, 2016.
- Information request no. 3, dated January 12, 2016, and Husky's response, dated January 18, 2016.
- Husky's PowerPoint presentation to the Panel, and associated exhibits, presented on January 19, 2016.
- Book of Authorities relied upon by Husky during the hearing on January 19, 2016.

MGM's DAP Submission

- MGM's DAP hearing request submission, including attachments, dated November 10, 2015.

- Information request no. 1, dated December 7, 2015, and MGM's response, dated January 5, 2016.
- Information request no. 2, dated January 6, 2016, and MGM's response, dated January 7 and January 13, 2016.
- MGM's exhibits, presented to the Panel on January 20, 2016.

Shell's DAP Submission

- Shell's DAP hearing request submission, including attachments, dated November 18, 2015.
- Information request no. 1, dated December 7, 2015, and Shell's response, dated December 18, 2015.
- Information request no. 2, dated January 6, 2016, and Shell's response, dated January 14, 2016.
- Shell's PowerPoint presentation to the Panel, and associated exhibits, presented on January 21, 2016.

ISSUES AND ANALYSIS

For the Panel to make a decision on ConocoPhillips' significant discovery application, the following determinations needed to be made:

- What geological feature is the ConocoPhillips E-76 well on?
- Is the E-76 well the first well on the geological feature that demonstrates by flow testing the existence of hydrocarbons in that feature?
- Having regard for geological and engineering factors, is the existence of an accumulation of hydrocarbons that has potential for sustained production suggested?
- Does the E-76 well indicate a significant discovery?
- What is the significant discovery area?

WHAT GEOLOGICAL FEATURE IS THE CONOCOPHILLIPS E-76 WELL ON?

In its application for declaration of a significant discovery, ConocoPhillips described the geological feature on which the E-76 and P-20 wells were drilled as the Canol Formation.

In its notice of intention to make a decision, Confidential Report File NWT-SDD-2015-001 dated July 13, 2015, the CCO concluded that the geological feature that is the subject of ConocoPhillips' significant discovery application is the Canol Formation that is present in the Mackenzie Plain syncline that traverses EL 470.

The DAPs also identified the Canol Formation as the geological feature and submitted technical evidence in support of their claims that the Canol Formation present at the E-76 and P-20 wells could be mapped as a continuous geological feature onto their proposed DAP lands.

The Canol Formation occurs within the Middle to Upper Devonian age Horn River Group. In the area of EL 470, it is underlain by the Hare Indian Formation and is overlain by an Upper-Devonian-age Imperial Formation (see figure 2, below). This formation has not yet been formally subdivided into stratigraphic members. It is an organic rich siliciclastic mudstone that was deposited in a distal shelf and slope environment, coinciding in part with Kee Scarp reef growth. In the Mackenzie Plain, the Canol Formation ranges in thickness from a few metres over full reef buildups to over 130 metres in distal basinal settings. It is a prolific source rock that sourced the Kee Scarp reef production in the Norman Wells oilfield. The depositional environment for a shale hydrocarbon source rock/reservoir often covers a large areal extent and exhibits some variability in geological properties, both laterally and vertically, that are important for its hydrocarbon potential and possibly for the feasibility of recovering the hydrocarbons. Within the region of the ConocoPhillips- and DAP-proposed significant discovery lands, the organic material in the Canol Formation is largely thermally mature for hydrocarbon generation.

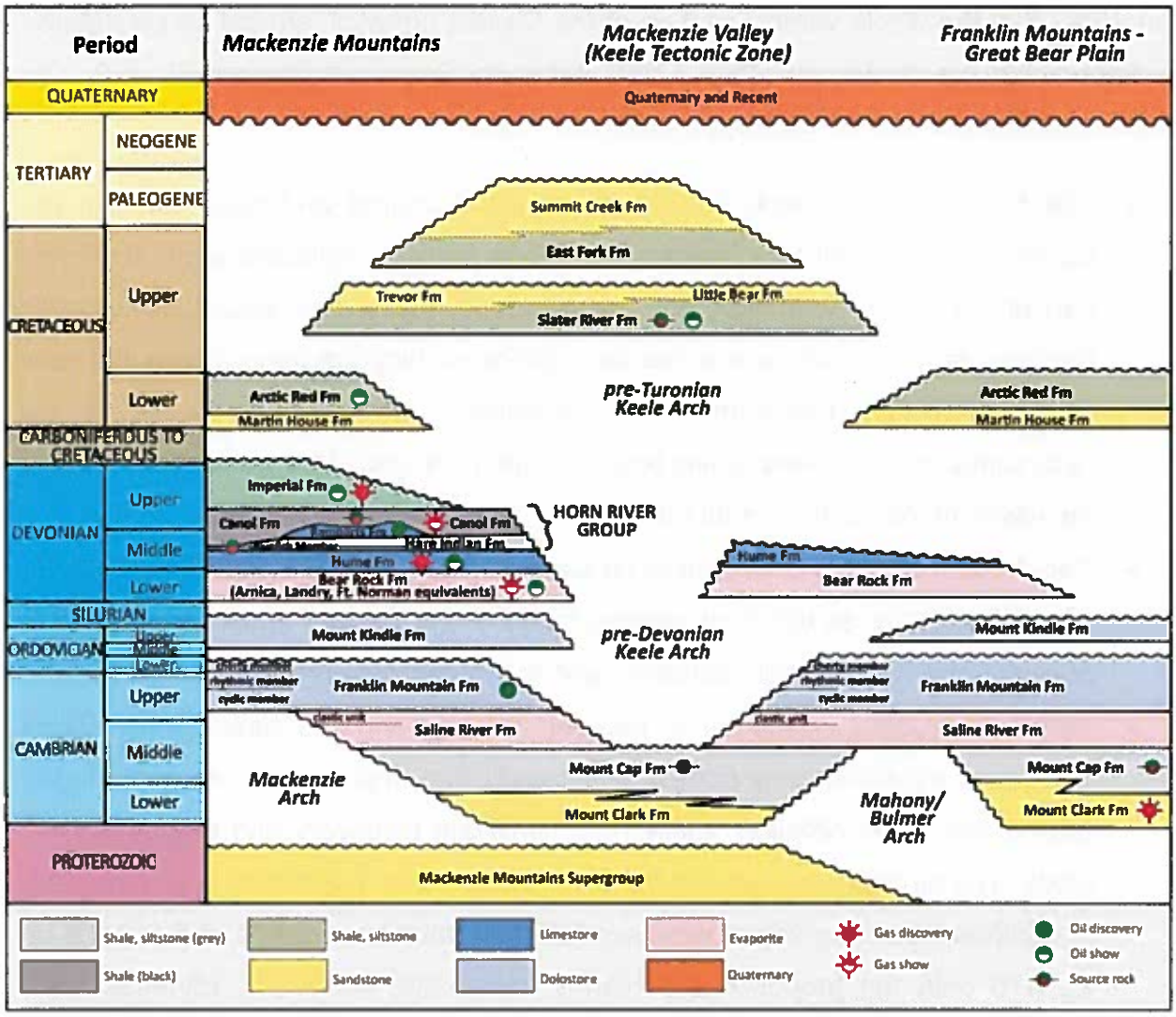

Figure 2: Stratigraphy of the Central Mackenzie Region (Pyle et al., 2014; MacLean and Cook, 1999).

In ConocoPhillips' application and in submissions made by the DAPs, the Canol Formation is variously subdivided and referred to as Lower, Middle, and Upper Canol, with distinction between these intervals based on variation in formation properties such as lithology, mineralogy, and hydrocarbon saturation, which in the Panel's view could affect whether an interval is prospective for hydrocarbon recovery or not. However, the Panel found that the basis for interpreting the various units in the Canol Formation was not consistent between parties. As the Panel notes above, the Canol Formation has not been formally subdivided into lower, middle, and upper stratigraphic units by the Northwest Territories Geological Survey. Because of these limitations, the Panel

concluded that the whole vertical section of the Canol Formation should be considered in determining the geological feature flow tested by ConocoPhillips on EL 470. The following additional factors also support this conclusion:

- The E-76 and P-20 wells were hydraulically fractured and flow tested in the Canol Formation. Although the horizontal legs of these wellbores are in the lower part of the Canol Formation at these locations, the vertical extent of hydraulic fractures is not known, nor is the contribution of hydrocarbons across the total Canol thickness. Therefore, it is inconclusive whether the source of the hydrocarbons that flowed during testing of the E-76 and P-20 wells was limited to the lower interval of the Canol Formation.
- Canol-depth well and core control on ConocoPhillips' EL 470 and on Husky's EL 494 indicate that all but the uppermost part of the Canol Formation appears to possess high hydrocarbon saturation and is thermally mature for hydrocarbons.
- Where the Canol Formation is present, the top and the base of the Canol Formation are seismically correlatable events that appear to be mapable in the area of the ConocoPhillips applied-for significant discovery and proposed DAP lands. The structure mapped at the level of the Canol Formation is a northwest-to-southeast-trending asymmetric syncline that traverses EL 470 and extends off EL 470 onto the proposed DAP lands toward the northwest, northeast, and southeast.

Based on the geological evidence in this matter, the Panel considers the Canol Formation to be the interval from 1647 to 1788 metres true vertical depth (TVD) on the O-06 well logs for a basin well and 333 to 375 metres TVD on the Esso Norman Wells E-26X well logs for an on-reef well.

To apply the *PRA* significant discovery definition and provisions to an unconventional resource play such as the Canol Formation, the Panel is of the view that the phrase "geological feature" must be interpreted within that context. The Panel finds "geological feature" to mean a set of distinct geological attributes that characterize the geological feature. Geological attributes and information relevant to describing the unconventional geological feature include the following:

- Defined stratigraphic interval
- Structural and stratigraphic reservoir continuity
- True vertical depth mapping to the top of the defined stratigraphic interval
- Area of structural closure, structure on top of stratigraphic interval with all faults and fault throws identified and quantified
- Fracture characterization (studies and imaging)
- Detailed lithology, mineralogy, porosity, and permeability (core, cuttings, and well logs)
- Reservoir weighted-average porosity
- Effective porosity, permeability, and water-saturation cutoffs
- Hydrocarbon saturation
- Gross and net pay
- Geomechanical properties, including reservoir silica and clay content
- Total organic carbon ("TOC") content and thermal maturity parameters for hydrocarbon generation

Quantification of these attributes at the significant discovery well and their variation across the Canol Formation together with mapping using well-control or seismic data, or both, will describe the extent of the geological feature under consideration for significant discovery.

For the purpose of describing the geological feature on which the E-76 and P-20 wells were drilled, the Panel considers the acceptable range in values for geological attributes associated with the geological feature to be those summarized in table 3.

Table 3: Acceptable range of values for geological attributes for the Canol Formation associated with the ConocoPhillips E-76 significant discovery and DAP lands.

Porosity (%)	> 4
Clay content (Wt %)	< 50
Silica content (Wt %)	60 to 90
Water saturation (%)	< 50
Depth range True vertical depth (m)	Possible range can be Canol Formation outcrop to 2400
Gross thickness (m)	> 10
Average TOC (Wt %)	> 2.0
Vitrinite reflectance (%)	≥ 0.6
Thermal maturity ("T_{max}") (°C)	≥ 435

IS THE E-76 WELL THE FIRST WELL ON THE GEOLOGICAL FEATURE THAT DEMONSTRATES BY FLOW TESTING THE EXISTENCE OF HYDROCARBONS IN THAT FEATURE?

ConocoPhillips applied to have a significant discovery declared on the basis of results from wells drilled on its EL 470 to test the Canol Formation. Well logs and core taken from the O-06 and N-20 wells drilled on EL 470 both indicate hydrocarbon saturation in the Canol Formation. ConocoPhillips subsequently drilled its E-76 and P-20 horizontal wells, landing the horizontal legs in the lower portion of the Canol Formation. E-76 and P-20 were hydraulically fractured. Extended flow testing conducted by ConocoPhillips on its E-76 and P-20 wells demonstrated the existence of hydrocarbons.

In the *PRA*, the definition of "significant discovery" is that it is a discovery "indicated by the **first well** on a geological feature that demonstrates by flow testing the existence of hydrocarbons in that feature and... suggests the existence of an accumulation of hydrocarbons that has the potential for sustained production." As a practical matter, the E-76 well may not be the first well to have met these criteria in the Canol Formation. Husky drilled into and flow tested the Canol Formation from two wells, Little Bear H-64 ("H-64") and Little Bear N-09 ("N-09")[1] on EL 494, which is beside ConocoPhillips' EL

[1] The H-64 and N-09 wells were drilled in 2012 and flow tested the Canol Formation in 2013.

470. The drilling and flow testing of the H-64 and N-09 wells predate the drilling and flow testing of the ConocoPhillips wells on EL470 that are the basis for ConocoPhillips' application to have a significant discovery declared. If the geological feature of the significant discovery indicated by the E-76 well on ConocoPhillips' EL 470 extends onto Husky's EL 494 as argued by Husky, the Panel must consider whether the E-76 well satisfies the criterion of the "first well on a geological feature that demonstrates... the existence of hydrocarbons in that feature." Husky provided, in its DAP submission, results from the formation flow test conducted on the N-09 well that could be considered to have demonstrated "the existence of hydrocarbons in that feature." Husky did not submit its own application for a declaration of significant discovery for the N-09 well, but it does rely on the results from that well in its argument that the significant discovery area for the E-76 well should be expanded to include parts of its EL 494. During this proceeding, no DAPs argued that the E-76 well should not be considered the first well on the geological feature that demonstrates the existence of hydrocarbons on that feature even though the N-09 well was drilled and flow tested earlier.

In the Panel's view, the definition of a "significant discovery" in the *PRA* must be read to mean the first well on a geological feature **that demonstrates to the regulator** (or its delegate or delegates) that the criteria set out in the definition have been met. To read it otherwise (that is, as the first well on the geological feature that as a matter of fact meets the criteria in the definition whether or not there has been an application for a declaration) would mean that if one interest holder drills a highly prospective well on a geological feature and, for whatever reason, does not apply for a declaration of significant discovery under section 27 of the *PRA*, then another interest holder who subsequently drills another prospective well on the same feature would be unable to make an application. Indeed, it would mean that the first interest holder (or another interest holder) could object to any application by the second interest holder under section 28 of the *PRA*. While it is true that such a scenario may be unlikely, and it is also true that the regulator, on its own motion, can by order make a declaration of significant discovery under section 27(2), such an interpretation is not consistent with the object of the *PRA*, which, among other matters, is to promote oil and gas development in the Northwest Territories and to provide those who undertake the risks

of exploration with secure tenure, such as a significant discovery licence, in appropriate circumstances.

In this case, the Panel considers that the evidence presented by ConocoPhillips for its E-76 and P-20 wells in its application constitutes the relevant evidence, regarding the first well on the geological feature, that demonstrates the existence of hydrocarbons in that feature. As E-76 was the first of those two wells to be flow tested, the Panel concludes that E-76 is the first well to demonstrate the existence of hydrocarbons on the geological feature as determined by the Panel.

HAVING REGARD FOR GEOLOGICAL AND ENGINEERING FACTORS, IS THE EXISTENCE OF AN ACCUMULATION OF HYDROCARBONS THAT HAS THE POTENTIAL FOR SUSTAINED PRODUCTION SUGGESTED?

In support of its application, ConocoPhillips submitted comprehensive geological and engineering evidence that suggests that the E-76 well tested a hydrocarbon accumulation capable of sustained production.

Geological evidence such as core porosity, permeability, hydrocarbon saturation, and geomechanical, TOC, and thermal maturity data for the Canol Formation from the O-06 and N-20 wells indicates the possible existence of an accumulation of hydrocarbons that has the potential for sustained production. Seismic evidence and well control also suggest that the geological feature and possibly the hydrocarbon accumulation present at E-76 are areally extensive.

Engineering evidence, including the extended-formation-flow test results and the produced-fluid analysis reports for the E-76 and P-20 wells submitted by ConocoPhillips in its application shows that the E-76 and P-20 wells produced hydrocarbons to surface at rates and flowing pressures for extended durations that, in the Panel's opinion, do suggest the existence of an accumulation of hydrocarbons that has potential for sustained production. ConocoPhillips also submitted production modelling results for the Canol Formation at various depths within its exploration licence to support that the hydrocarbon accumulation had potential for sustained production.

DOES THE E-76 WELL INDICATE A SIGNIFICANT DISCOVERY?

As the evidence submitted shows that the E-76 discovery satisfies the *PRA* definition of a significant discovery, the Panel concludes that a significant discovery is indicated by the E-76 well.

WHAT IS THE SIGNIFICANT DISCOVERY AREA?

Having determined that the ConocoPhillips E-76 well on EL 470 indicates a significant discovery of hydrocarbons in the Canol Formation, the Panel must make a determination of the significant discovery area in accordance with the *PRA* as being those petroleum lands on which there are reasonable grounds to believe that the significant discovery may extend. The Panel considers that the areal extent of the accumulation of hydrocarbons identified at the E-76 well as determined by the Panel's analysis of the evidence before it, establishes the boundary of the significant discovery area. Therefore, it is necessary to describe what constitutes the hydrocarbon accumulation that was discovered and flow tested at the E-76 well and that the Panel has determined to be a significant discovery. In determining the significant discovery area, the Panel assessed the following:

- The areal extent of the geological feature
- The areal extent of the E-76 well hydrocarbon accumulation
- The impact of faults on the areal extent

The Areal Extent of the Geological Feature

As discussed earlier in these reasons, the Panel has described the geological feature as the Canol Formation having the attributes shown in table 3. The DAPs' technical evidence submitted for this hearing clearly shows considerable variation in the attributes of the geological feature across the lands under consideration. The Panel has reviewed that evidence and has established what it considers to be an acceptable range for these attributes in this case. Based on its review of all technical data submitted by ConocoPhillips and the DAPs, the Panel determined the areal extent of the geological feature to be where the Canol Formation in the Mackenzie Plain asymmetric syncline exhibits all of the geological attributes within the ranges set out in table 3. In the Panel's

view, these attributes establish the potential for the presence of hydrocarbons and could suggest the potential for sustained production. With respect to kerogen thermal maturity, it is commonly accepted that the T_{max} associated with the onset of peak oil generation for amorphous organic matter types is 435°C. Evidence submitted by the DAPs demonstrates their awareness of this information. The Panel considers a T_{max} value of 435°C the minimum threshold value for this critical attribute of the Canol Formation geological feature when applying the *PRA* significant discovery provisions to this shale resource play. For this reason, the Panel determined that the areal extent of the geological feature does not include those lands where the thermal maturity of the Canol Formation as mapped by each DAP would be less than necessary for the onset of peak oil generation.

The Areal Extent of the E-76 Well Hydrocarbon Accumulation

In the Panel's assessment, for inclusion as part of the hydrocarbon accumulation that is considered a significant discovery, all parts of the hydrocarbon accumulation should meet the *PRA* significant discovery criteria of "suggests the existence of an accumulation of hydrocarbons that has potential for sustained production."

In defining the geological feature by what the Panel has described as acceptable ranges of relevant attributes based on its analysis of the DAPs' evidence, the Panel notes that on lands where the geological feature exhibits attributes that approach minimums or least favourable ends of ranges set out in table 3, the suggestion of potential for sustained production from the hydrocarbon accumulation may be weak using current technologies for drilling, completing, and hydraulic fracturing. Across some of the lands under consideration, evidence submitted indicates the Canol Formation is found at shallow depth below ground level. These areas would be expected to exhibit low initial formation pressure. The evidence submitted regarding thermal maturity mapping indicates that black oil would be the expected hydrocarbon type on some lands where the geological feature approaches the shallower end of the depth range shown in table 3. In certain areas, the geological feature is quite thin, especially compared with the Canol Formation present at the E-76 well. Some evidence indicates mineralogy of the uppermost parts of the Canol Formation may be less favourable for hydraulic fracturing

than lower parts. This evidence raises questions for the Panel in terms of feasibility of hydraulic fracturing and ability to achieve sustained hydrocarbon flow to a wellbore on some of the lands under consideration. In this regard, the Panel notes the absence of even a single well drilled to collect geological data and to flow test the prospectivity of the Canol Formation on some DAP lands. However, the Panel accepts that evidence shows that the geological feature encountered at the E-76 well and as described by the ranges of attributes set out by the Panel is continuous across the ConocoPhillips applied-for-lands and across most of the DAP proposed lands. The Panel notes that to satisfy the definition of a significant discovery, only the suggestion of potential for sustained production from the hydrocarbon accumulation is needed. Therefore, having regard for the possible development of future improved technologies to recover in-place hydrocarbons in more challenging situations, the Panel considers that those lands should not be excluded from the significant discovery area on the basis of potential challenges for achieving sustained production.

The Impact of Faults on the Areal Extent

Within the geological feature as determined by the Panel, the Panel is of the view that the area of the significant discovery indicated by the E-76 well is limited to only the area of the hydrocarbon accumulation present at the E-76 well. The accumulation, and hence the significant discovery area, may extend as far as the evidence demonstrates continuity with the E-76 well hydrocarbon accumulation. Faults in the Canol Formation may potentially impact the continuity of the hydrocarbon accumulation. Seismic and well evidence presented in ConocoPhillips' application and in DAP submissions show that the geological feature containing the hydrocarbon accumulation discovered at the E-76 well has been subjected to faulting.

The Panel is of the view that faulting that results in a vertical offset that exceeds the thickness of the hydrocarbon accumulation may represent a discontinuity or barrier to flow causing compartmentalization of the hydrocarbon accumulation. Depending on the location and lateral extent of such faulting, it may constitute the boundary or farthest limit of the E-76 well hydrocarbon accumulation. The Panel reviewed the seismic evidence to determine whether faults exist within the hydrocarbon accumulation that

compartmentalize or create discontinuities or barriers to flow. The Panel examined both the magnitude of the vertical displacement and the lateral extent of the faults. The seismic evidence indicates that faults with sufficiently large vertical displacement only exist in areas where the Canol Formation is more disturbed near the Gambill Fault Complex. The Panel determined from the DAP's seismic coverage near the Gambill Fault Complex that the lateral extent of these faults is likely not sufficient to compartmentalize or cause discontinuities or barriers to flow. The Panel concluded that there are no significant discontinuities in the hydrocarbon accumulation on ConocoPhillips' and DAPs' proposed significant discovery lands caused by faulting.

Having considered the potential of the vertical offset of faults to disrupt the continuity of the hydrocarbon accumulation, the Panel also considered DAP evidence that faults in the geological feature have created localized natural fracturing of the Canol Formation. Well logs and core- and formation-flow test results indicate that, at least in some cases, this natural fracturing has allowed water influx that would appear to hinder recovery of the hydrocarbons that are present. DAPs submitted that natural fracturing of the Canol Formation caused by faulting would be expected to be of limited extent away from these faults. The Panel accepts that this localized effect would not extend far enough away from these faults to warrant exclusion of these areas from the significant discovery area.

Based on its analysis of the impact of faults on the significant discovery area, the Panel has not excluded lands from the significant discovery area due to faulting. In this matter, the Panel concludes that the lands that comprise the geological feature, the hydrocarbon accumulation, and the significant discovery area are the same.

The Panel, based on the above assessment with regards to

- the areal extent of the geological feature,
- the areal extent of the E-76 well hydrocarbon accumulation, and
- the impact on faults on the areal extent,

finds the areal extent of the significant discovery indicated by the E-76 well to be the lands composed of the sections listed in table 1 and shown on figure 1, both in appendix 1.

CONCLUSION

The Panel reviewed the written submissions made by the DAPs and ConocoPhillips, as well as evidence presented in the DAPs' oral hearings, in order to assess whether a significant discovery was made by the E-76 well on the Canol Formation and, if so, the areal extent of such a significant discovery. To this end, determinations were made regarding the geological feature, the hydrocarbon accumulation tested at the E-76 well and its areal extent, and the potential for sustained production from the hydrocarbon accumulation. Based on this analysis, the Panel concludes that a significant discovery is indicated by the E-76 well, and the significant discovery area covers ConocoPhillips, Husky, MGM, and Shell lands as described on appendix 1, table 1, and figure 1.

Dated on September 7, 2016.

Bradley C. Hubbard, P. Eng.

Chair

Kathryn Fiess, M.Sc., P.Geo., P. Geol.

Member

Gary Woo, P. Eng.

Member

APPENDIX 1 – SIGNIFICANT DISCOVERY AREA

Table 1: Significant Discovery Area indicated by the E-76 Well

Exploration Licence	Latitude	Longitude	Sections
ConocoPhillips EL 470	64° 50' N	126° 30' W	59, 60, 69, 70, 79, 80
	64° 50' N	126° 45' W	9, 10, 19, 20
	65° 00' N	126° 30' W	51-80
	65° 00' N	126° 45' W	1-20, 22-30, 34-40, 45-50, 56-60, 66-70, 76-80
	65° 00' N	127° 00' W	7-10, 18-20, 28-30, 39, 40, 50, 60
	65° 10' N	126° 30' W	51-57, 60-66, 71-76
	65° 10' N	126° 45' W	1-6, 11-16, 21-27, 31-38, 41-80
	65° 10' N	127° 00' W	1-58
	65° 20' N	126° 30' W	51-54, 61-64, 71-74
	65° 20' N	126° 45' W	1-4, 11-14, 21-24, 31-33, 41-43, 51-53, 61-63, 71-73
	65° 20' N	127° 00' W	1-3, 11-13, 21-23, 31, 32, 41
Husky EL 494	64° 50' N	125° 45' W	70, 79, 80
	64° 50' N	126° 00' W	8-10, 17-20, 26-30, 35-40, 45-50, 54-60, 63-70, 72-80
	64° 50' N	126° 15' W	1-80
	64° 50' N	126° 30' W	1-40, 49, 50
	65° 00' N	126° 00' W	1-80
	65° 00' N	126° 15' W	1-80
	65° 00' N	126° 30' W	1-50
	65° 10' N	126° 15' W	1-80
	65° 10' N	126° 30' W	1-50
	65° 20' N	126° 15' W	51-54, 61-64, 71-74
	65° 20' N	126° 30' W	1-4, 11-14, 21-24, 31-34, 41-44
MGM/Shell EL 474	65° 00' N	125° 45' W	6, 10, 14-20, 23-30, 32-40, 41-50, 51-60, 61-70, 71-80
	65° 10' N	125° 45' W	11, 21-22, 31-33, 41-44, 51-55, 61-66, 71-76
	65° 10' N	126° 00' W	1-7, 11-17, 21-27, 31-38, 41-48, 51-58, 61-69, 71-79
Shell EL 468	65° 10' N	127° 15' W	9, 10, 15-20, 24-30, 35-40, 47-50
	65° 20' N	127° 00' W	71, 72
	65° 20' N	127° 15' W	1, 2, 11, 12, 21, 22, 31-36, 41-46, 51-56, 61-66, 73-76
	65° 20' N	127° 30' W	3-6, 14-16, 25, 26
Shell EL 469	65° 10' N	127° 00' W	59, 60, 63-70, 73-80
	65° 10' N	127° 15' W	3 E-P, 4-8, 13 N/2, 14

Exploration Licence	Latitude	Longitude	Sections
	65° 20' N	126° 45' W	25 A-L, 25 N-P, 34, 35 A-L, 44, 45 A-L, 54, 55, 64, 65, 66 B-E, 74-75, 76 A-H, 76 J-L, 76 M-N, 77 O, 77 W/2
	65° 20' N	127° 00' W	4-8, 14-19, 24-29, 33-37, 42-47, 51-57, 61-66, 73-76
	65° 20' N	127° 15' W	3-6, 13-16, 23-26
Shell/MGM EL 475	65° 20' N	127° 00' W	38, 39, 48-50, 58-60, 67-70, 77-80
	65° 20' N	127° 15' W	7-10, 17-20, 27-30, 37-40, 47-50, 57-60, 67-70, 77-80
	65° 20' N	127° 30' W	7-10, 17-20, 27-30, 37-40, 47-50, 58-60, 69, 70, 80
	65° 20' N	127° 45' W	10, 20
	65° 30' N	127° 00' W	61, 71
	65° 30' N	127° 15' W	1, 2, 11, 12, 21-23, 31-34, 41-44, 51-54, 61-64, 71-74
	65° 30' N	127° 30' W	1-4, 11-14, 21-24, 31-34, 41-44, 51-54, 61-65, 71-75
	65° 30' N	127° 45' W	1-6, 11-16, 21-26, 31-36, 41-47, 52-57, 62-67, 74-77
Shell/MGM EL 487	65° 30' N	128° 00' W	6-7

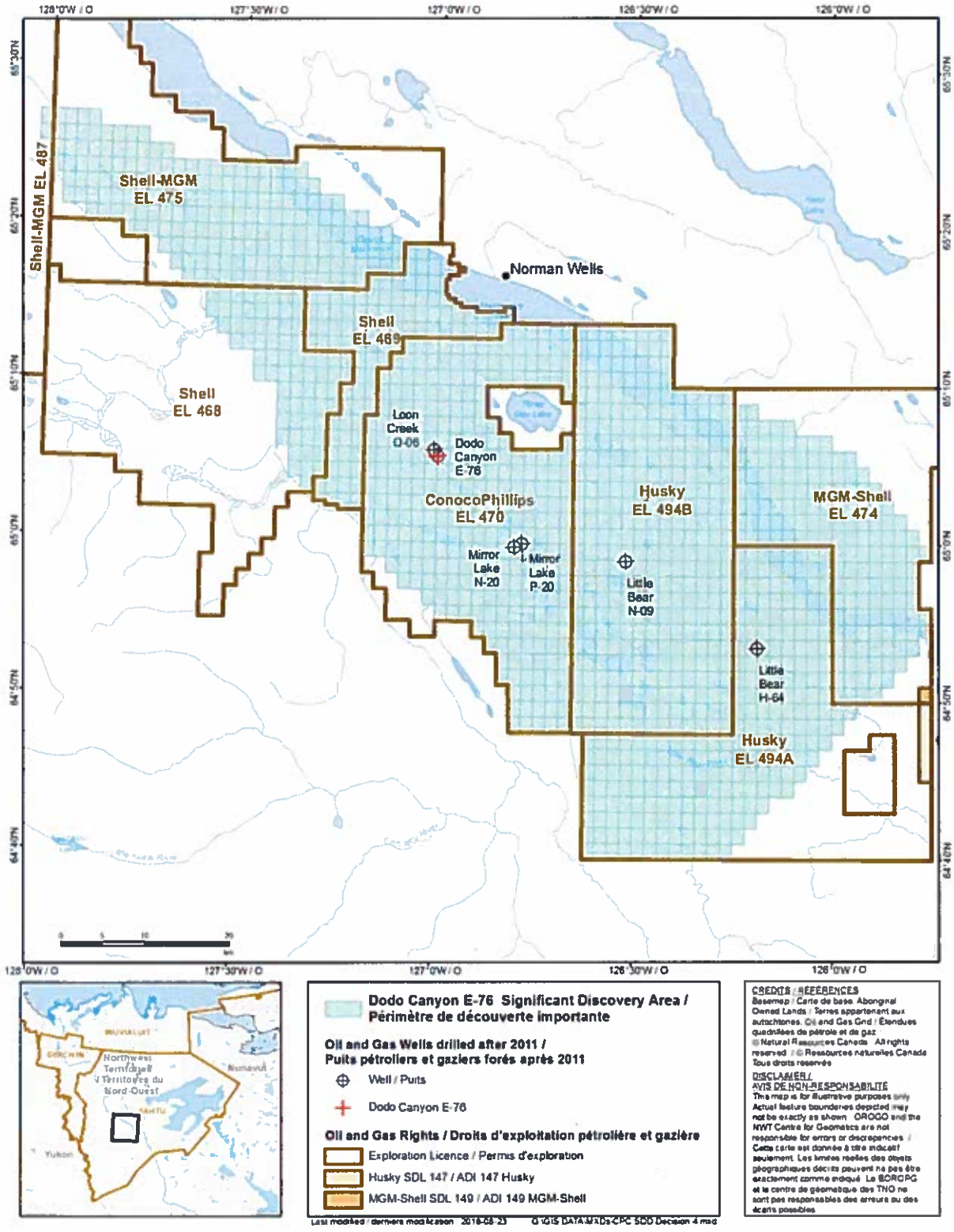

Figure 1: Significant Discovery Area

APPENDIX 2 – HEARING PARTICIPANTS

DIRECTLY AFFECTED PERSONS

Direct Affected Person (Representative)	Witnesses
Husky Oil Operations Limited (Husky) (B. J. Roth. C. Graham and G. Otto)	K. Hansen, P. Geo. G. Lewis, B.Sc. Honours Geology C. Molaro, P. Geo. J. Rhodes, P. Geoph.
MGM Energy (MGM)	L. Doyle, P. Eng. B. Kallweit, P. Geoph., P. Geol. L. Williams, P. Geo.
Shell Canada Energy (Shell) (S. Duncanson)	A. Hyde, P. Eng. P. Johnson, P. Geoph. M. Lee, P. Eng. D. Lewis, P. Geoph. G. Lynch, P. Geo.

OFFICE OF THE REGULATOR OF OIL AND GAS OPERATIONS

S. Kay, Counsel

I. Blackstock, Counsel

P. de Jong, Hearing Coordinator