

**Final Findings and Determination**

**For**

**Nuna Development**

**Royalty Modification**

**Application**

**Commissioner of the Department of Natural Resources**

**APPROVAL**

**OF MODIFICATION OF ROYALTY**

**FOR LEASES:**

**ADLs 355038, 355039, 390434, 390697, and 392158**

**January 20, 2015**

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## **I. BACKGROUND**

On July 1, 2014, Caelus Natural Resources Alaska, LLC (Caelus) as operator of the Oooguruk Unit and 100% interest owner in leases corresponding to the onshore Nuna development submitted an application to the Commissioner of the State of Alaska Department of Natural Resources (DNR) for modification of royalty under AS 38.05.180(j)(1)(B). This Final Findings and Determination responds to the royalty modification application as required under AS 38.05.180(j)(8).

### **A. Procedure**

On October 28, 2014, DNR issued a Preliminary Findings and Determination to respond to Caelus's royalty modification application. DNR invited the public to comment on the preliminary decision for 30 days ending December 12, 2014. On December 2, 2014, DNR presented its preliminary findings to the Legislative Budget & Audit Committee of the Alaska State Legislature. See Attachment 1. The Commissioner publishes this Final Findings and Determination after taking into consideration comments received during the public comment period. The Commissioner attaches a summary of the public comments with responses to this Final Findings and Determination. See Attachment 2. In accordance with AS 38.05.180(j)(11)(D), and with the Applicant's consent, DNR will amend the applicant's lease(s) or unitization agreement(s) consistent with this Final Findings and Determination. Pursuant to AS 38.05.180(j)(11)(B), the Commissioner's Final Findings and Determination regarding a royalty reduction is final and not appealable to the court.

## **II. SUMMARY OF CAELUS'S APPLICATION FOR ROYALTY MODIFICATION**

Caelus has applied for royalty modification on 11 leases involved in the Nuna development. Four of these leases (ADL 355036, ADL 355037, ADL 355038, and ADL 355039) contain a 30% net profit share and a 12.5% royalty, while seven of these leases (ADL 390434, ADL 390697, ADL 390505, ADL 390506, ADL 392113, ADL 392157, and ADL 392158) have a 16.6667% royalty rate. The application was made under AS 38.05.180(j)(1)(B) asserting royalty modifications were warranted to prolong the life of an oil field or pool as per barrel or barrel equivalent costs increase sufficient to make future production no longer economically feasible. The Torok formation is currently producing from the Oooguruk offshore island facilities and therefore does not qualify for modification under AS 38.05.180(j)(1)(A) (royalty modification for a field or pool that has not "previously produced oil or gas for sale"). The Nuna development is an onshore facility targeting Torok reserves which cannot be recovered without new onshore facilities, wells, and flowlines. The Caelus application requested a fixed, flat, 5% royalty until the Nuna Development project reached payout. After payout, the base royalty would annually increase by 1.875% for four years when the original base royalties would be returned to their respective un-modified rates.

**A. Lease summary**

The Division of Oil and Gas (Division) issued ADLs 355036, 355037, 355038, and 355039, effective August 1, 1983, on Competitive Oil and Gas Lease Form No. DMEM-4-83 (NET PROFIT SHARE)(REVISED May 5, 1983) DNR 10-1113, with a primary term of ten years. These leases provided for a 12.5% fixed royalty rate and 30% net profit share for the State. These four leases were committed to the Kuukpik Unit, which terminated effective June 1, 2001. Prior to lease term expiration, a well was drilled on each lease, and the wells were certified as capable of producing in paying quantities, thereby extending the leases' primary terms indefinitely. As a result of several assignments of working and royalty interest shares, Caelus owns a 70% working interest in these leases, while ENI Petroleum US, LLC owns the other 30%. For production from Nuna, Caelus has a 100% working interest.

On February 1, 2006, DNR agreed to provide royalty modification for production from the Kuparuk and Nuiqsut formations that produced into these four NPSLs, among others. The royalty rate for these NPSLs was set at five percent until ADL 355036 went into payout; after payout, the royalty rates on these four leases would increase over four years to the 12.5% lease rate.

The Division issued ADLs 390434, 390697, 390505, and 390506 with a 16.66667% fixed royalty and a seven-year primary term in 2004 and 2005. In the Second Expansion of the Oooguruk Unit, the leases were committed to the Oooguruk Unit effective March 11, 2011. ADLs 392113, 392157, and 392158 were issued in 2012 with a primary term of 10 years and a fixed royalty of 16.66667%. As a result of several assignments of working and royalty interest shares, Caelus has a 100% working interest in these leases.

The Oooguruk Unit was expanded to include a Torok Participating Area in 2011. Currently, the Torok Participating Area (PA) consists of three leases: ADLs 355036, 355037, and 355038. The Nuna development would access Torok resources to the south from an on-shore drill pad. The Nuna Torok resource comes from five leases: ADLs 355038, 355039, 390434, 390697, and 392158.

**B. Project development history**

The Oooguruk-Torok Oil reservoir lies offshore in the Beaufort Sea and onshore in the Colville River Delta. In March of 2010, a production well, OST-45 was drilled from the Offshore Drillsite (ODS) and began producing. The following year, in March of 2011, an injection well, ODS-46i, was drilled. DNR approved the Torok PA on June 24, 2011. Another production well, ODS-39, was drilled in January of 2012. ODS-45 was shut-in in May of 2014 due to a failed electric submersible pump. Although Torok has produced around 725,000 barrels of oil, only one production well, ODS-39, producing at 200 barrels per day, and one injector (ODS-46), are in operation.

In 2012, Pioneer Natural Resources Alaska, Inc. (Pioneer) drilled the Nuna-1 well to test the southern part of Torok formation, a portion of the reservoir that would only be accessible from an on-shore well-pad. In 2013, Pioneer drilled an offset well, NDST-2. These wells were drilled from on-shore and to access and evaluate the southern part of the Torok formation.

### **III. SUMMARY OF ROYALTY MODIFICATION AUTHORITIES AS 38.05.180(j)(1)(A), (2), (3), (4)(A), & (5)**

#### **A. Royalty modification criteria authority**

1. AS 38.05.180(j)(1)(B) provides the DNR Commissioner the authority to provide for modification of royalty to unitized or individual leases. AS 38.05.180(j)(2) provides that the Commissioner may not grant a royalty modification unless the lessee or lessees requesting the royalty modification make a clear and convincing showing that
  - a. The modification is necessary to prolong the economic life of an oil or gas field or pool as per barrel or barrel equivalent costs increase or as the price of oil or gas decreases, and the increase or decrease is sufficient to make future production no longer economically feasible, and
  - b. A modification of royalty is in the best interests of the State.

#### **B. Royalty modification terms guidance**

1. Under AS 38.05.180(j)(3) the royalty modification terms must provide for an increase or decrease or other modification of the State's royalty share by a sliding scale royalty or other mechanism that shall be based on a change in the price of oil or gas and may also be based on other relevant factors such as a change in production rate, projected ultimate recovery, development costs, and operating costs.
2. Under AS 38.05.180(j)(4)(B) a modification to royalty may not be granted for the field or pool if the royalty modification would result in a royalty rate of less than three percent in amount or value of the production removed or sold from a lease or leases covering the field or pool.
3. Under AS 38.05 180(j)(5) a royalty reduction must include an explicit condition that the royalty reduction is not assignable without the prior written approval, which may not be unreasonably withheld, by the Commissioner. The Commissioner shall, in the preliminary and final findings and determinations, set out the conditions under which the royalty reduction may be assigned and may not grant a royalty reduction without an explicit condition that the royalty reduction is not transferable.

#### **IV. SUMMARY OF STATE'S ROYALTY MODIFICATION TERMS AND CONDITIONS**

##### **A. Royalty modification criteria applied**

Caelus's application for royalty modification on ADLs 355038, 355039, 390434, 390697, 392158 meets the requirements for consideration under AS 38.05.180(j)(1)(B). Caelus has paid the filing fee and submitted a complete application for the royalty modification, including financial and technical data that meet the requirements of 11 AAC 88.105, 11 AAC 83.185, 11 AAC 05.010(a)(10)(H), and AS 38.05.180(j)(6).

The lessee requesting the change has made a clear and convincing showing that a modification of royalty meets the requirements of 38.05.180(j)(1)(B), and is in the best interests of the state.

##### **B. Royalty modification terms**

1. 5% royalty rate in effect beginning at first production of the Torok Formation as developed from the Nuna Development facilities. ADLs associated with this modification are ADLs 355038, 355039, 390434, 390697, and 392158.
2. The Nuna royalty reduction will remain in effect until Caelus has achieved a cumulative Gross Revenue Target (GRT) of \$1.25 billion associated with gross production and netback wellhead pricing associated with Torok production from the Nuna facilities. Gross Production is defined as sales volume of oil from Torok Nuna with a fixed 6% backout associated with CPAI Kuparuk; netback wellhead pricing is equal to the wellhead pricing used for Oooguruk production. On an annual basis gross revenue cannot be negative.
3. If Caelus presents sufficient evidence that 80% or more of its Nuna Project workforce, including contractors and subcontractors, is comprised of Alaska residents, the fixed 6% backout associated with CPAI Kuparuk will increase to a fixed 8% for the month in which the local hire percentage is at least 80%. The Alaska resident hire percentage will be calculated monthly; Caelus will submit local hire employment statistics when it files monthly royalty reports. In order for the fixed backout rate to increase to 8%, Caelus must present sufficient evidence to the commissioner that Caelus has achieved the 80% local hire level as described in this section.
4. Upon reaching the GRT the original, un-modified, royalty terms will be re-established.
5. The Nuna Development Project must be sanctioned by March 31, 2015. If project sanction documents and Authorizations for Expenditures (AFE) are not provided to DNR



before March 31, 2015, the Nuna royalty modification is automatically rescinded and the original royalty terms will be in effect.

6. The Nuna royalty modification is rescinded if “facilities capex” (to include surface equipment, flowline bundle, drilling, etc.) is not initiated by September 30, 2015 and does not amount to at least \$260 million by September 30, 2017.
7. The Nuna royalty modification is rescinded if sustained production from the Nuna drillsite from Torok does not commence by September 30, 2017.
8. The NPSL accounting practices for 11 AAC 83.201 – 11 AAC 83.295 remain in full force and effect.
9. This royalty modification is not assignable without prior written approval, which may not be unreasonably withheld by the Commissioner. The Commissioner will approve a transfer of the royalty modification unless he or she makes a written finding that the transfer would adversely affect the best interests of the State or does not comply with applicable regulations.
10. Prior to commencement of sustained commercial production, Caelus shall deliver to DNR a non-confidential, detailed written project summary that includes, but is not limited to, planned development activities, well designs, well fracture stimulation designs, waterflood recovery designs and production rate projections. The DNR Commissioner shall determine whether the summary provides sufficient detail; if it does not, the Commissioner will require Caelus to augment the summary. The Nuna royalty modification is rescinded if Caelus does not deliver the written project summary prior to sustained commercial production with sufficient detail.
11. If Caelus sells, assigns or in any other way transfers the ownership of any of the leases subject to the Nuna royalty modification decision, before providing either the project summary detailed in Section IV.B.10, or updated project summary detailed in Section IV.B.12 of this Final Findings and Determination, the Nuna royalty modification is rescinded.
12. Twenty four months following the commencement of sustained commercial production from Nuna Drill Site 1, Caelus shall deliver to DNR an updated, non-confidential written project summary similar in form and content to a Society of Petroleum Engineers (SPE) paper that includes, but is not limited to, development activities, construction costs, well designs and costs, fracture stimulation designs and costs, waterflood recovery designs and future development plans and rate projections. The purpose of this summary will be to



share the project learnings with DNR and the North Slope operators free of charge to better understand the challenges and successes of developing similar geologic formations to promote continued development of the State's resources. The DNR Commissioner shall determine whether the summary provides sufficient detail; if it does not, the Commissioner will require Caelus to augment the summary. If, after an opportunity to update the summary, Caelus has not made the summary sufficiently detailed, this royalty modification is rescinded.

13. For the Nuna Project, Caelus is encouraged to employ Alaska residents, contract with Alaska businesses and to locally manufacture and construct modules and other facilities for its Nuna Development Project.

## **V. DISCUSSION OF ROYALTY MODIFICATION CRITERIA**

### **A. Leases are eligible for consideration**

Caelus applied for royalty modification for 11 leases. However, only five of these leases are anticipated to include production from the Nuna development. For that reason, only leases with ADLs 355038, 355039, 390434, 390697, and 392158 should be considered for royalty modification.

### **B. Interpretation of AS 38.05.180(j)(1)(B)**

Under AS 38.05.180(j)(1)(B) royalty modification must be necessary to prolong the economic life of the field. Here, Caelus proposes making an investment to add reserves and thereby extend the Torok formation's economic life. To determine if royalty modification is necessary, DNR must first determine whether the reserves added by the proposed investment would prolong the economic life of the field or pool, and also whether the investment is economically feasible in the absence of royalty modification. The showing by the applicant that royalty modification is necessary must be made by clear and convincing evidence pursuant to AS 38.05.180(j)(2).

DNR determined that the resources to be produced from the Nuna drillsite cannot be produced from the ODS because of the lack of connectivity between the resource accessible from the ODS and the resource accessible from the Nuna drillsite. See Section VI below. The "field or pool" to be prolonged here is the Torok formation, not simply the current facilities at ODS producing oil from the Torok formation.

As an initial matter, in determining economic feasibility, DNR takes note that Caelus has represented to DNR that it would not do the project without royalty relief. DNR thoroughly examined the economics of the project and determined, based on required return parameters, that the investment by Caelus is not economically feasible without royalty modification.

### **C. Financial modeling review**

Caelus was required to provide detailed information allowing DNR to comprehensively evaluate the economics of the Nuna project. First, Caelus provided an economic model of its Nuna development. Caelus also provided other documents that detailed the basis for their cost and production assumptions. DNR checked model inputs against cost and production assumptions reflected in these documents. DNR also reviewed the formulas used to capture the costs and benefits of the project. Upon request, Caelus provided additional and updated information to incorporate into the model.

DNR carefully reviewed this model, and revised this model in a number of ways. First, DNR revised the model to allow for a stochastic rather than deterministic analysis of project economics. In this revision, DNR made extensive changes to model inputs and functionality. Second, DNR revised the model to facilitate display of the incremental economics to Caelus of the Nuna project. DNR reviewed and disaggregated by lease the modeling of the Net Profit Share leases. DNR added potential federal income tax impacts on project returns to the investors and closely reviewed the model's treatment of production tax for Nuna. Finally, DNR added the ability to look at a variety of different royalty modification mechanisms and their respective impacts on Caelus' and the State's revenue streams.

### **D. Stochastic modeling approach**

The Caelus model used one set of assumptions for price, costs, and production in deriving a project return; each of these assumptions is uncertain. Instead of looking at just one possible set of values for key input variables - for price, production, and costs - DNR revised the model to include a full range of possible outcomes. DNR revised the model Caelus provided so that it could use @Risk proprietary software to run the simulations and generate charts, graphs and reports used in the analysis. Statistical distributions for each of the primary input variables were established. DNR questioned Caelus about the certainty regarding its projected capital costs, both for drilling and facilities, and based on Caelus' response DNR formulated a distribution of likely capital costs. DNR also formulated a distribution of average oil prices that attempted to capture the possibility that oil price could be much higher or lower than expected. See Figure 1 below. DNR used a PERT distribution<sup>1</sup> to capture uncertainty in the average oil price over time. In a previous royalty modification analysis, DNR used a mean-reverting random walk method to generate multiple price paths.<sup>2</sup> Similarly, DNR had evaluated, with assistance from the Department of Revenue (DOR), a "jump diffusion", mean-reverting, model that would have the

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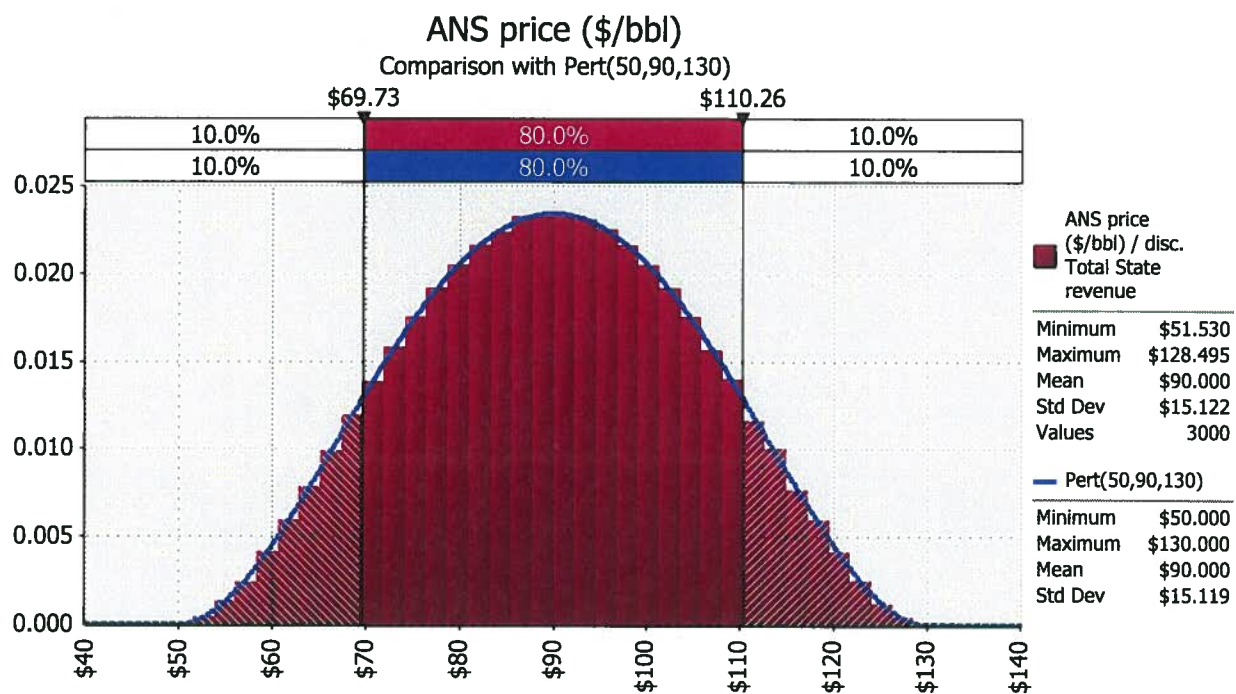
<sup>1</sup> The beta-PERT or PERT distribution compared to the triangular distribution in that both are fitted based on three values: a minimum, a mode, and a maximum value. Unlike a triangular distribution, a PERT distribution is rounded, and with relatively more values around the most likely value versus the two extreme values. See Palisade PowerPoint by Javier Ordonez, entitled "Using @Risk in Cost Risk Analysis", for description of the distribution.

<sup>2</sup> See "Final Finding and Determination for Nikaitchuq Development Royalty Modification Application", January 11, 2008 at pages 15-16 for a description of DNR's price model.

Alaska North Slope (ANS) price distribution differ each year.<sup>3</sup> These types of price models generate a more realistic price path, which is important when evaluating specific year cash flows or constraints on capital due to timing. However, when simply evaluating the life-cycle economics of a project, the volatility of price changes between years is averaged out over time and model iterations. Due to the assumed normality of the price distributions, and the aggregation of the time series into a single value, DNR determined that the simplifying use of an average price over time would not misrepresent the total value, especially in the central tendency summary statistics being relied on in this analysis.

Figure 1 below shows the range of ANS prices considered (on the X-axis) and the probability a given run would select a price within a two dollar range (each bar measured against the Y-axis). For a given “run”, the @Risk software would randomly choose a price using this price distribution. Using the model, DNR would evaluate the project assuming prices were in the \$50 to \$60 per barrel range; other times DNR would evaluate the project assuming prices were in the \$120 to \$130 per barrel range.

**Figure 1.**



In addition to the distributions for capital costs and oil prices, DNR incorporated a distribution of recoverable reserves including 1P (proven), 2P (proven + probable) and 3P (proven + probable + possible) in order to fully assess the economics of the full range of possible outcomes rather than

<sup>3</sup> DOR Fall 2014 Revenue Sources Book at pages 30 to 31.

just that of the most conservative reserve potential.<sup>4</sup> With this forecasted production, water and gas production were forecast to determine how facility sharing fees and back-out<sup>5</sup> projections could vary.

In addition to revising the model to look at a wider variety of oil prices, DNR revised the model to use in-house TAPS tariff projections rather than the forecasts provided by Caelus.

DNR identified a number of downside reservoir risks in its review of Caelus's technical work that had not been incorporated into the reserve estimates. See Section VI below. For this reason, DNR incorporated a "failure leg" in its analysis, or a 10% probability that the project yielded very low reserves. On the other hand, for the "success leg," DNR allowed reserves at their highest possible point to exceed the high, 3P case, by more than 50%.

These inputs (price, costs, production) vary, and in doing so, yield a range of possible cash flows. Each of these future cash flows can be expressed as a net present value by discounting to the current period. The discount rate used typically is a firm's "cost of capital".<sup>6</sup>

As an output, DNR looked at a probability distribution of each run's Net Present Value (NPV). It is helpful to view the probability distribution with some summary statistics. DNR derives the EMV (Expected Monetary Value) or average by taking each NPV and weighting it by its probability, then taking these products and adding them. DNR also examined the median (often called the p50 run) by looking at the NPV of the run where it is equally likely that a given run will have an NPV greater than or lesser than that run's NPV. The median allows DNR to estimate the extent to which high NPV runs skew the EMV upward.

#### **E. Incremental economics**

Caelus already operates the Offshore Drill Site (ODS) in the Oooguruk Unit. To understand the economics of the Nuna project, DNR took the difference between revenue streams generated assuming Nuna went forward, and subtracted revenue streams assuming ODS operations only went forward. This approach allows DNR to identify ways in which Nuna production might extend the life of shared facilities (the Onshore Tie-in Pad (OTP) and gathering lines) between Nuna and ODS.

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<sup>4</sup> Caelus requested that certain information be held confidential per AS 38.05.035(a)(9). Estimates of reserves, production, and costs are held confidential by DNR at the royalty modification applicant's request.

<sup>5</sup> Nuna production will be processed at Kuparuk River Unit facilities. These facilities are limited in the amount of gas/water they can handle. The gas/water produced with Nuna oil will take up capacity that could otherwise be used to allow for more oil production from KRU fields. These fields' oil is thereby "backed out" by Nuna oil. To compensate KRU owners for this backout, a percentage of Nuna oil is provided to the KRU owners. To estimate this percentage, Caelus and DNR had to estimate gas and water production from Nuna. This production also gives rise to facility sharing fees based on KRU operating costs.

<sup>6</sup> See page 97 of Paul Newendorp and John Schuyler's "Decision Analysis for Petroleum Exploration," and Section V.J for a discussion of the discount rate used.



**F. Net Profit Share impacts**

DNR requested that Caelus tie Nuna production to particular leases, and Caelus provided DNR with estimated tract factors or the estimated allocations of Nuna production to individual leases. There are three leases with 16.66667% royalty rates, and two with 12.5% royalty rates. The two 12.5% royalty rate leases, ADLs 355038 and 355039, are Net Profit Share Leases. A substantial percentage of total Nuna production will be allocated to these two leases. In addition to their fixed rate royalty of 12.5%, these leases contain a 30 percent net profit share. Under the assumptions used, the net profit share payments accounts for over 25% of the State's revenue from the project. Given their importance, DNR took care to estimate when these leases would start paying a net profit share.

Net Profit Share Leases provide the State with a share of the operating cash flow once the lease has reached payout, or when revenue from the lease has paid back costs to develop the lease with interest. The development costs, or all capital expenditures, are tracked in a development account that accrues interest. Once production begins, a production revenue account tracks net operating revenue or revenue minus operating costs and taxes and royalty payments. Net revenue from the production revenue account pays down the balance in the development account. Once it has done so, payout occurs, and net revenue is split 30% to the State and 70% to the lessee. The State will receive on average almost \$400 million NPV3 value from these net profit share payments.

**G. Federal income tax impacts**

The revenue at Nuna will generate federal tax payments. The incidence of this tax burden will differ based on the type of business entity involved (a "C-corp" vs. "S-corp" or LLC), but the income tax benefits and burdens will impact an investor that isn't tax-exempt. DNR modeled the federal income tax impact on returns because an investment in oil and gas carry with it certain income tax benefits (IDC (intangible drilling costs), accelerated depreciation) that Caelus will likely monetize.

**H. Production tax impacts**

DNR carefully reviewed how Caelus modeled the production tax impacts of the Nuna project. Like all Oooguruk production, Nuna production will receive a 20% gross value reduction (GVR). Coupled with upfront tax credit and tax shield benefits from the Nuna investment, the GVR pushes the expected value of production tax revenue from the Nuna project slightly negative. Both DNR and Caelus incorporated these production tax incentives into the economic modeling. The production tax assumptions were the same whether royalty modification was granted or not.

**I. Different royalty modification mechanisms**

DNR modified the economic model to investigate the impact of different types of royalty modification on Caelus and the State. DNR examined different forms of oil price based royalty relief where the royalty rate decreased as the oil price declined. In addition, DNR examined the impact of a royalty modification based on time, on NPSL payout, and on the annual or cumulative gross revenue. Once DNR determined that royalty modification was justified, DNR sought to provide the royalty modification that provided the relief necessary to make the project economic while minimizing the risk to the State that the relief would be larger than necessary.

**J. The appropriate hurdle or discount rate**

In the past, DNR has used a 15% nominal discount rate to estimate value to a company. In doing so, DNR relied upon sources such as the former federal agency Minerals Management Service, which set 15% as the default and the highest discount rate to be used in calculating a project's NPV (see MMS's Appendix I to NTL No. 2002-N02, Guidelines for the Application, Review, Approval, and Administration of the Deep Water Royalty Relief Program for Pre-Act leases and post-2000 leases, February 2002. Other experts have even recommended a higher hurdle rate as being appropriate. Dr. Anthony Finizza, a consultant with Econ One Research, Inc., believed that oil and gas projects require between 15% and 20% to get approved. See Presentation on Alaska Gas Pipeline Project to Alaska State Legislative Budget and Audit Committee, August 31, 2005, entitled "Investment Decision-Making by Oil and Gas Companies."

Because the discount rate is meant to incorporate the opportunity cost facing the company in making a project decision, the cost of borrowing capital is important to the determination of an appropriate discount rate. DNR considered Caelus's need to obtain financing for the project in the capital markets due to lack of internal capital. These markets typically require greater rates of return to compensate for the increased risk of default. Given the higher cost of capital from private equity markets, DNR found it reasonable to increase the discount rate and evaluate the investment using a 17.5% real rate of return.

**K. Nuna is not economically feasible without royalty modification**

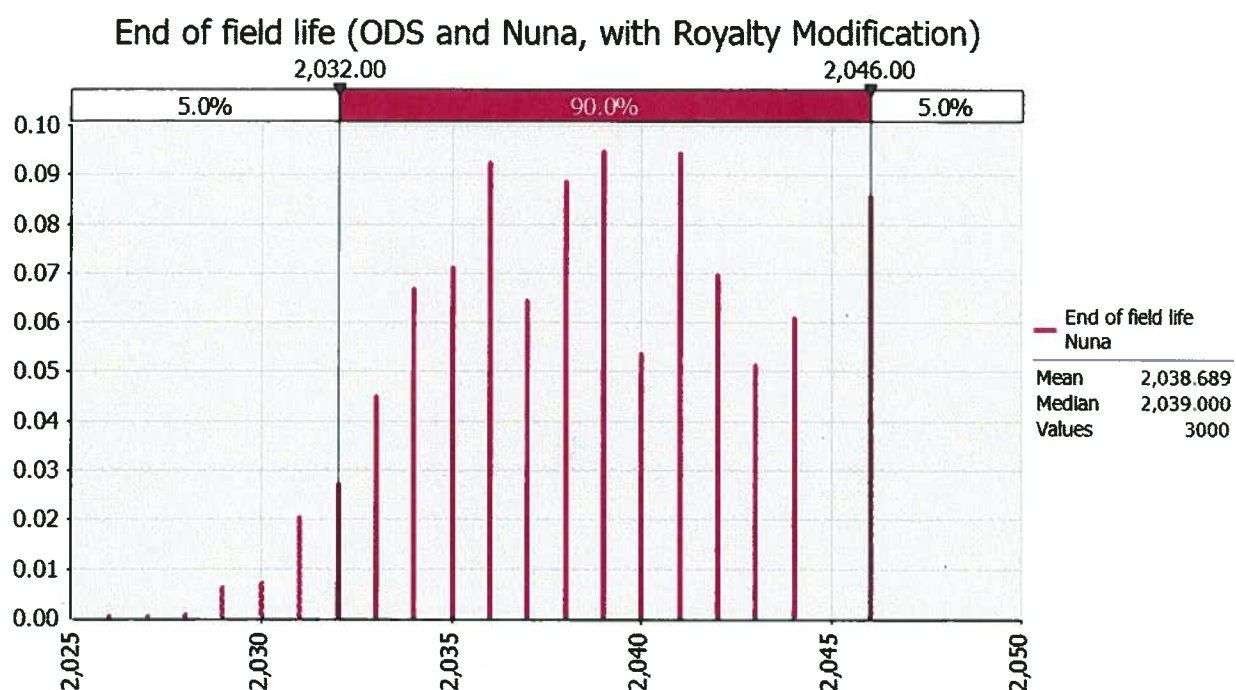
Using its modeling assumptions outline above, DNR determined that the Nuna development would lose money in at least 50% of the model runs without royalty modification using either a 15% or 17.5% hurdle rate. High prices and/or reserves cases generated very good economic returns to the company. These outlier cases pulled the EMV to slightly positive values using a 15% hurdle rate, but were not enough to pull the EMV positive at 17.5%. Based on these mediocre economic results relative to the risk of loss, Caelus has made a clear and convincing case that without royalty modification the investment in the Nuna project is uneconomic.

**L. The Nuna development will prolong field life of the Torok formation**

The ODS-Torok formation is on life support but isn't in danger of imminent shut-in. The Torok field has produced over 750,000 barrels since 2010 from three producers and one injector drilled from the offshore ODS. Only one producer and one injector are active now, and ODS-Torok production has declined to around 200 barrels a day. No new wells are planned to be drilled into the Torok reservoir from ODS. The currently producing Torok well may only produce for another five to ten years.

The proposed Nuna Development will significantly extend the life of the Torok formation. The end of field life for Nuna on average is 2038, with the Nuna development almost certainly producing longer than 2032. See Figure 2 below.

**Figure 2.**



#### **M. Royalty modification mechanism adopted**

Since oil production levels and price impact revenue, the timing of the benefits conferred by this royalty modification depends on oil prices and production levels. DNR decided not to use an NPSL-based royalty modification because the DNR did not want the State to assume the risk of a cost overrun. The focus was on supporting the project by recognizing there are factors not specifically in the operator's control and balancing the value of royalty reduction on those.

DNR considered providing royalty modification based on oil price, with lower oil prices triggering a lower royalty rate. Such a mechanism, however, does not vary if production is lower or greater than previously thought. Further, the State would assume a lot of risk if oil prices declined - a time when the State could likely use the additional revenue.



DNR chose to focus on a cumulative, gross revenue target. This provides Caelus with certainty as to the benefits it receives, while also eliminating the risk and administrative burden of an NPSL-based remedy. Gross revenue is measured as the sales price netted back to the lease, less a fixed amount of backout. It is not net of upstream costs, so the State does not assume the risk of cost overruns.

Under AS 38.05.180(j)(7)(A)&(B), DNR has the option of contracting with an independent consultant to provide additional analysis of a royalty modification application. The value of the contract is limited to \$150,000.00, to be paid by the applicant. DNR did not contract with an outside consultant for the analysis of this application.

## **VI. GEOLOGY OF THE TOROK FORMATION AND NUNA INTERVAL**

Geological, geophysical, and engineering data submitted in support of the original application for formation of the Oooguruk Torok Participating Area included structure, isopach, net-to-gross and net sand maps, well logs, cross sections, seismic cross sections, formation tops, and confidential geological, engineering, and well production test analyses for the Torok interval. Additional technical data was submitted in support of the operator's royalty modification application. Division of Oil and Gas geologists, geophysicists, and engineers reviewed this data along with other public and confidential data to characterize the reservoir and likely production behavior.

The Torok Formation is a regional, time transgressive unit of Albian to Cenomanian age. It comprises deepwater turbidite and sediment gravity flow strata deposited outboard of the marine shelf in slope, toe-of-slope, and basin floor settings. The formation is a complex succession of interbedded mudstone, siltstone, and sandstone that records complex interaction of deposition, sedimentation, subsidence, sea-level changes, and erosion along a series of shelf margins that prograded generally eastward, filling much of the Colville foreland basin during mid-Cretaceous time. Non-reservoir lithologies (shale, mudstone, and siltstone) make up the majority of the formation; sandstone-bearing packages capable of forming commercial reservoirs are secondary, and are mainly concentrated in the lower part of the formation.

The Torok reservoir within the Oooguruk Unit occurs in the Nuna interval (informal name, also referred to as Moraine by other operators). The reservoir is located on an eastward dipping homocline, and the estimated one billion barrels of oil in place accumulated in a combination structural-stratigraphic trap. There are several minor northwest trending normal faults in the area and a northwest trending down-to-the-east fault represented by the operator as bounding the reservoir to the northeast between the Kalubik 1 and Colville Delta 2 wells. East of this major fault the Torok is wet. The oil water contact is uncertain, but is constrained by 1) an oil-down-to of -5150' TVDSS (tested in the Colville Delta No. 3 well) and 2) a highest known water of -5212' TVDSS (calculated from MDT measurements in the Ivik No. 1 exploratory well, located approximately 2 miles northeast of the Kalubik No. 1 well).

The Nuna interval is generally around 250 feet thick in the area accessible from the current Offshore Drill Site (ODS), increasing to almost 350 feet thick in the area proposed for the new Nuna development. Like the other producing Torok reservoir (Nanuq PA in the Colville River Unit), Nuna represents toe-of-slope and basin floor fan sandstone deposits. The thickest and most prospective portion of the reservoir lies south of the existing Oooguruk Torok PA, close to the Nuna 1 and NDST-2 wells, in the area proposed for the new Nuna development and within drilling reach of the onshore Nuna Drill Site (NDS).

Seismic data provide no clear evidence of mappable faults that might isolate the proposed Nuna development area from the existing Torok PA. However, it would not be feasible to drain the Nuna area from the Offshore Drill Site (ODS) due to the 15,000 – 30,000 foot horizontal map distance and insufficient connectivity across the reservoir between these areas. Some composite sand packages greater than 35-40 feet can be recognized and possibly mapped with 3-D seismic, but these packages are an amalgamation of much thinner beds, the thickest and cleanest sands on the order of 10 feet thick, likely representing channel sandstones, which were deposited preferentially near the middle of the reservoir interval. Most of the reservoir volume is interpreted to consist of levee, overbank, and thin sheet sands. Core and log data from the Kalubik #2 well from the Nuna interval clearly indicate the predominance of interbedded thin-bedded sandstones and mudstones ranging from 0.1 to 2.0 feet thick. The individual sands, though thin to very thin bedded, yield measurements of 15-21% porosity and 1-20 mD permeability. The best reservoir properties occur in the channel facies, with 22-26% porosity and 20-100 mD permeability. The limiting factor on reservoir performance is not the porosity and permeability of the individual sand layers, but more likely, the fact that these sands are thin, interbedded in subequal proportion with essentially impermeable mudstone, and are probably laterally discontinuous as flow units across distances of more than a few hundred feet to a few thousand feet.

## **VII. RESERVOIR UNCERTAINTY**

While the reservoir appears less compartmentalized than Badami, similar to Badami it consists mostly of very thin-bedded to laminated sandstone-siltstone-shale turbidites and is expected to have multiple discontinuous sand bodies, with potential challenges to primary and secondary recovery mechanisms.

Secondary recovery from water flooding is planned, but no data exist to provide a good prediction of recovery efficiency. Water and gas have been injected in ODST 46i, however, mechanical integrity problems curtailed gas injection and when water injection resumed it was at a lower rate. Injection has been sporadic but to date there is no evidence of water breakthrough or impact on liquid production rate in either of the two nearby producer wells, casting doubt on any predictions of waterflood sweep effectiveness. There is no assurance that waterflooding will effectively sweep the reservoir, making estimates of ultimate recovery very uncertain.

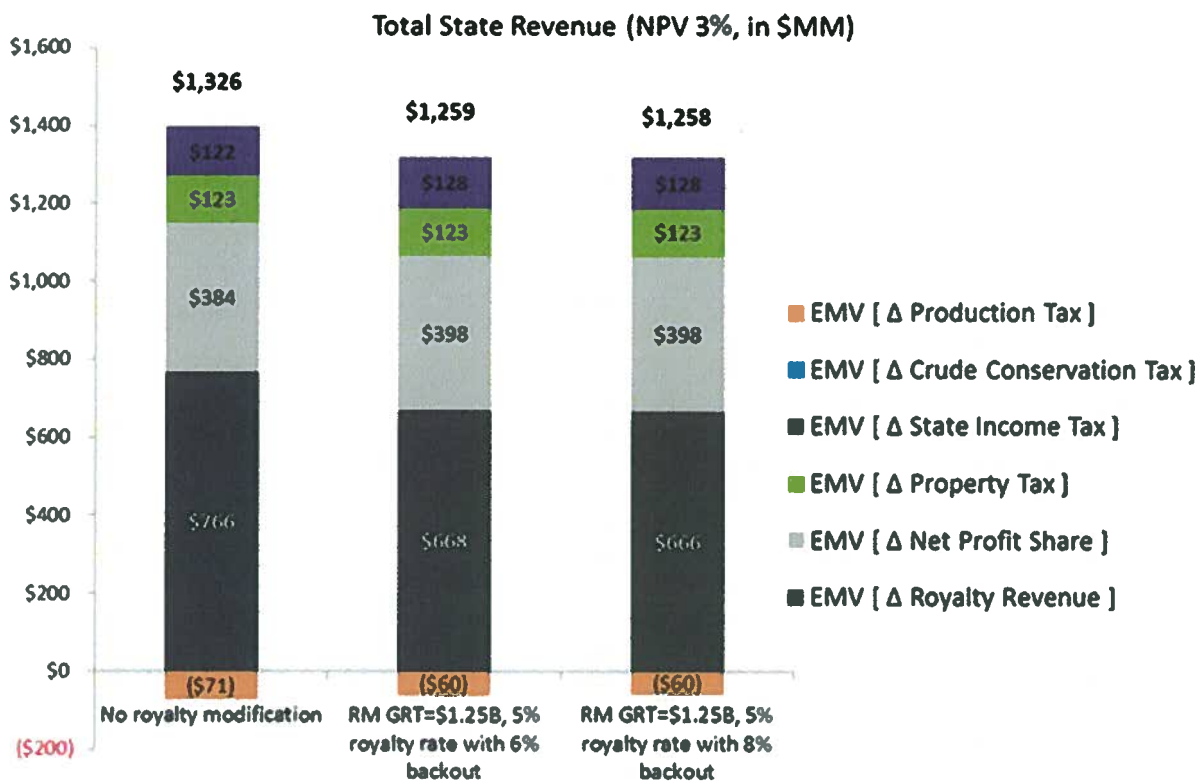
In addition to uncertainty in the effectiveness of secondary recovery through waterflood, there is uncertainty regarding hydraulic fracturing effectiveness. The operator has successfully completed some of the more recent Oooguruk wells using multi-stage fracturing technology, but it is unknown whether this stimulation approach will be able to consistently generate and sustain propped fractures across the increased reservoir thickness in the heart of the field, to allow for optimal completions draining the entire reservoir volume throughout the Nuna development area.

## VIII. THE ROYALTY MODIFICATION IS IN THE BEST INTERESTS OF THE STATE

### A. State economically benefits from Nuna project commencing sooner

Analysis of the economics of the Nuna project indicates that without modification of the royalty rate, the project economics would not provide sufficient return for Caelus to pursue the development. See Section V above. With royalty modification, the project economics improve, which should enable Caelus to develop the project and the State to receive revenues from severance tax, property tax, possibly corporate income tax, Hazard Surcharge, royalty, and net profit share payments.

Figure 3.



If, contrary to our finding, Caelus would have done the project without royalty modification, then the modeled impact to the State of providing a gross revenue target based royalty modification will vary depending on the granularity with which the DNR models the year the cumulative gross revenue exceeds the gross revenue target. Normally, the DNR models cash flows on an annual basis. If the year cumulative revenue exceeds the gross revenue target the royalty rate reverts to the higher royalty rate for the entire year, then the impact to the State is \$44 million EMV3. If cumulative revenue is measured on a monthly basis, and the royalty rate reverts to the higher lease rate in the month (rather than the year) cumulative revenue exceeds the gross revenue target, then the modeled impact to the State is \$66 million (with 8% rather than 6% back-out, \$68 million) EMV3. With annual revenue in the hundreds of millions of dollars, an intra-year period modelled with the lower 5% royalty rate will show a higher State revenue impact.

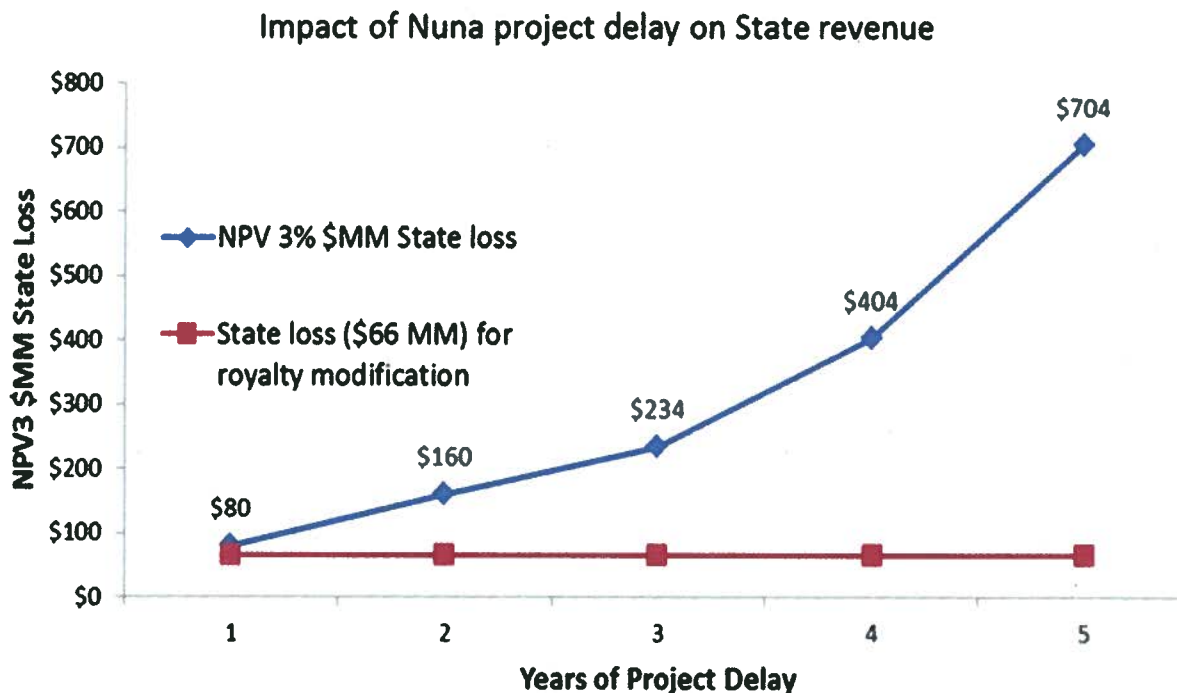
A substantial benefit the State receives from a royalty modification agreement is that Caelus is committed to develop the project soon. Various deadlines make royalty relief conditional on sanctioning the project within the next three months, and proceeding to first production in 2017. If the State denied Caelus's application for royalty modification, Caelus stated it would not develop the project. If Caelus does not move forward with the project, Nuna development would at best be delayed for a few years as the State struggled with Caelus or a subsequent lessee to go forward with the project under the existing lease terms. Even if DNR succeeded in expeditiously replacing or prompting Caelus to develop Nuna without royalty modification, the State risks a much greater loss in net present value<sup>7</sup> if the project were delayed than it risks in providing royalty modification unnecessarily. See Figure 4 below.

A delay in commencing production from the Nuna Project would be harmful to the State. The sooner Nuna development and production commences, the sooner the State begins receiving revenue and the interest that will accrue from that revenue. Also, the individual's preference for money today versus at some distant time has an analog in society's interest in the provision of government services (roads, schools, etc.) today versus at some distant time.

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<sup>7</sup> The State's loss from delay is a function of the time value of money, rising TAPS costs, and time-sensitive components of the backout calculation.

Figure 4.



#### B. Sharing of information

Caelus is confident it has developed the key to developing challenging reservoirs like the Torok formation. It has a development program that consists of multi-stage fracs of not only producing wells, but also injection wells. Similar fields could benefit from what Caelus learns in attempting to develop the Torok formation. Caelus has committed to sharing information about the Nuna development with other parties interested in North Slope development, prompting more well-informed investment in the State's oil and gas resources. DNR will ensure that the information is sufficiently detailed to provide real assistance to other prospective developers of challenging reservoirs.

#### C. Environmental, social, and cultural impacts

DNR develops lease stipulations through the lease sale process to mitigate the potential environmental, social and cultural impacts from oil and gas activity. The leases that are proposed to be granted royalty modification contain many stipulations designed to protect the environment and address any outstanding concerns regarding impacts to the area's fish and wildlife species and to habitat and subsistence activities. They address the protection of primary waterfowl areas, site restoration, construction of pipelines, seasonal restrictions on operations, public access to, or use of the leased lands, and avoidance of seismic hazards. The granting of



royalty modification will not result in additional restrictions or limitations on access to surface lands or to public and navigable waters.

The leases comprising the Nuna development have provisions requiring the lessee to undertake a program to encourage the employment of Alaskans. Caelus has already maintained many Pioneer Natural Resources employees after the asset transfer. The Nuna development should help to improve the employment picture in Alaska.

For the Nuna Project, Caelus is encouraged to:

- a. Employ Alaska residents and contract with Alaska businesses to the extent they are qualified, available and competitive;
- b. Use, as far as is practicable, job centers and associated services operated by the State Department of Labor and Workforce Development;
- c. Advertise for available positions locally and use, as far as practicable, Alaska job service organizations to notify the Alaska public; and
- d. Work with the State Department of Labor and Workforce Development and other organizations to provide training.

The goal of at least 80% Alaska resident hire addresses several State needs, including developing and maintaining a skilled and experienced oil and gas industry workforce. The State has a need to develop a skilled workforce for potential future projects in Alaska that may utilize innovative technology and techniques like those Caelus intends to use in the Nuna Project. Additionally, the local hire option addresses the declining percentage of Alaska residents employed in the oil and gas industry workforce at a time when oil and gas industry jobs in Alaska are increasing.<sup>8</sup> In turn, local spending by resident employees may help reduce the loss to the State by the royalty reduction.

The approval of the royalty modification has no environmental impact itself. The Commissioner's approval of the royalty modification is an administrative action, which by itself does not convey any authority to conduct operations on the leases, within the development area, unit or participating area. Caelus must still obtain approval of a Unit Plan of Operations and various permits from state agencies before initiating activities.

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<sup>8</sup> See Alaska Department of Labor and Workforce Development report titled, *Residency of Alaska Workers*, published January 2014; available at: <http://laborstats.alaska.gov/reshire/nonres.pdf>.

**IX. FINAL FINDINGS AND DETERMINATION**

After detailed consideration where all the materials presented by the applicant were reviewed and incorporated into our analysis, DNR has determined that Caelus meets the necessary requirements and that royalty modification for the Nuna Development Project is warranted under the terms established in Section IV of this Final Finding and Determination.



Marty Rutherford

Acting Commissioner



Date

cc: Paul Decker, Acting Director, Division of Oil and Gas

Alex Nouvakhov, Senior Commercial Analyst, Division of Oil and Gas

Martin Schultz, Department of Law