

**APPROVAL IN PART OF THE APPLICATION TO  
FORM THE QUGRUK UNIT**

Findings and Decision of the Director,  
Division of Oil and Gas Under a Delegation of Authority  
from the Commissioner,  
Department of Natural Resources, State of Alaska

**JANUARY 26, 2012**

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## I. INTRODUCTION AND DECISION SUMMARY

The State of Alaska (State), Department of Natural Resources (DNR), Division of Oil and Gas (Division) received the Application for the Formation of the Qugruk Unit (Application) September 21, 2011, from Repsol E&P USA Inc. (Repsol), as the proposed Qugruk Unit Operator. By email dated September 28, 2011, the Division provided Repsol notice that the Application was incomplete, and requested further information from Repsol in order for the Application to be complete under 11 AAC 83.306 (1) - (6). Repsol submitted the requested confidential and public information and the Application was deemed complete on October 24, 2011. The Division gave notice of the proposed Qugruk Unit under 11 AAC 83.311 on October 25, 2011. The public comment period closed on November 28, 2011. No comments were received.

The Division finds that the approval of the Application, as modified by this decision, promotes conservation of all natural resources, promotes the prevention of economic and physical waste, and provides for the protection of all parties of interest, including the State. Of the 49 leases proposed for inclusion in the Qugruk Unit, six are approved for inclusion in the Qugruk Unit (see Attachments 4 and 5, Approved Qugruk Unit Leases and Approved Qugruk Unit Boundary).

## II. APPLICATION AND LEASE SUMMARY

Repsol submitted the Application on September 21, 2011, and simultaneously paid the \$5,000.00 unit application filing fee, in accordance with 11 AAC 83.306 and 11 AAC 05.010(a)(10)(D), respectively. The Division deemed the Application incomplete on September 28, 2011 because it did not (1) include evidence that all proper parties to the unit agreement were given an invitation to join the unit; and (2) provide all of the geologic and other data and information requested by DNR. Repsol submitted the requested information and data; the Division deemed the Application complete on October 24, 2011. The Application includes Exhibit A (Attachment 1), a table legally describing the proposed unit area, its leases, and ownership interests; Exhibit B (Attachment 2), a map of the proposed unit boundary; Exhibit G (Attachment 3), the Initial Plan of Exploration (POE); evidence that all proper parties to the unit agreement were given an invitation to join the unit; the Qugruk Unit Agreement; the Qugruk Unit Operating Agreement; and confidential technical data.

The Division published a public notice in the "*Anchorage Daily News*" on October 25, 2011, and in the "*Arctic Sounder*" on October 27, 2011, under 11 AAC 83.311. Copies of the Application and the public notice were provided to interested parties. DNR provided public notice to the North Slope Borough, the City of Barrow, the City of Nuiqsut, the Kuukpik Corporation, the Arctic Slope Regional Corporation (ASRC), the Nuiqsut Postmaster, the Barrow Postmaster, the radio station KBRW in Barrow, as well as the Alaska Department of Environmental Conservation, the Alaska Department of Fish and Game, the Alaska Oil and Gas Conservation Commissioner, and the DNR Office of Habitat, Management and Permitting. The public notices invited interested parties and members of the public to submit comments by November 28, 2011. No comments were received.

Repsol proposed 49 State of Alaska leases for inclusion in the Qugruk Unit comprising approximately 98,852 acres, as described in Attachments 1 and 2. All but six of the leases are held by Repsol E&P USA Inc., 70.00%, 70 & 148, LLC, 22.50%, and GMT Exploration Company, LLC 7.50% (Repsol, 70, and GMT). Two of the leases are held by ConocoPhillips Alaska, Inc. 78%, and Anadarko, 22%. One is held 100% by Pioneer Natural Resources Alaska, Inc. And one is held 50% by Paul Craig and 50% by Peter G. Zamarello. Two of the leases are as yet unleased state acreage which were successfully bid upon by Repsol and will be issued during 2012. All of the leases provide for a 16.66667% royalty share.

Of the 49 leases, 47 were issued with a five year primary term (five year leases). Thirty four of the five year leases were issued from the BS2008 or NS 2008 lease sale, effective September 1, 2009, lease form DOG 200604, and expiring August 31, 2014; seven were issued from the BS 2007 or NS 2007 lease sale effective August 1 2008, lease form DOG 200604AS, and expiring July 31, 2013; five of the leases were issued from the B2006A lease sale, effective September 1, 2007, lease form DOG 200604, and expiring August 31, 2012. One lease was issued from the BS 2006 sale on form DOG 200204(REV 10/23), effective March 1, 2007, and expiring February 29, 2012. Two of the leases were issued with a seven year primary term, one from the BS 2010 lease sale effective October 1, 2010, form DOG 200604(REV32009), and expiring September 30, 2017, and one from the NS 2009 sale, effective July 1, 2010, expiring June 30, 1017. Six of the leases contain jointly managed State/ASRC acreage; ASRC acreage comprises approximately 4.24% percent of the entire proposed unit area.

Repsol's complete application includes four leases not held by Repsol, 70, and GMT. The only parties who have ratified the proposed Qugruk Unit Agreement and the Operating Agreement are Repsol, 70, and GMT. The Working Interest Owners (WIOs) of the two leases held by ConocoPhillips Alaska, Inc. 78%, and Anadarko, 22%, ADLs 391401 and 391304, the lease held 100% by Pioneer Natural Resources Alaska, Inc., ADL 391459, and the lease held 50% by Paul Craig and 50% by Peter G. Zamarello, ADL 390852, have been invited to join the proposed Qugruk Unit, but they have not ratified the proposed Qugruk Unit Agreement and the proposed Qugruk Unit Operating Agreement.

### **III. DISCUSSION OF DECISION CRITERIA**

A unit may be formed to conserve the natural resources of all or a part of an oil or gas pool, field, or like area when determined and certified to be necessary or advisable in the public interest (AS 38.05.180(p)). Conservation of the natural resources of all or part of an oil or gas pool, field or like area means maximizing the efficient recovery of oil and gas and minimizing the adverse impacts on the surface and other resources. 11 AAC 83.395(1).

The DNR Commissioner (Commissioner) reviews applications related to units under 11 AAC 83.303-11 AAC 83.395. By memorandum dated December 21, 1998, the Commissioner delegated this authority to the Director of the Division of Oil and Gas (Director). The Commissioner will approve a proposed unit upon a finding that it will (1) promote conservation of all natural resources, including all or part of an oil or gas pool, field, or like area; (2) promote the prevention of economic and physical waste; and (3) provide for the protection of all parties of interest including the State. 11 AAC 83.303(a).

In evaluating these three criteria, the Commissioner will consider (1) the environmental costs and benefits of unitized exploration or development; (2) the geological and engineering characteristics of the potential hydrocarbon accumulation or reservoir proposed for unitization; (3) prior exploration activities in the proposed unit area; (4) the applicant's plans for exploration or development of the unit area; (5) the economic costs and benefits to the State; and (6) any other relevant factors, including measures to mitigate impacts identified above, the Commissioner determines necessary or advisable to protect the public interest. 11 AAC 83.303(b).

A discussion of the subsection (b) criteria, as they apply to the Application, is set out directly below, followed by a discussion of the subsection (a) criteria.

**A. Decision Criteria considered under 11 AAC 83.303(b)**

**1. Environmental Costs and Benefits**

The proposed Qugruk Unit lies within the Colville Delta and shallow waters of Harrison Bay, north and west of the Oooguruk Unit, and north and east of the Colville River Unit. The northern limit boundary of the proposed unit is defined by the boundary between State waters and the Federal Outer Continental Shelf waters. This area is habitat for various mammals, waterfowl, and fish. Area residents may use this area for subsistence hunting and fishing. Oil and gas activity in the proposed unit area may affect some wildlife habitat and some subsistence activity. In approving sale of these leases, DNR has already determined that oil and gas activity in this area best serves the interests of the State.

When specific oil and gas activities are proposed, DNR will determine whether those particular activities, given mitigation measures to lessen or avoid adverse impacts, best serve the interests of the State. Here, however, approval of the unitization of any of the proposed Qugruk Unit leases does not authorize any on-the-ground activity. Thus this approval does not itself impact the environment. A plan of operation must be approved before any operation is conducted on a lease or in a unit, and that approval process involves assessment of the 11 AAC 83.303 criteria, including environmental costs and benefits. DNR develops lease stipulations through the lease sale process to mitigate the potential environmental impacts from oil and gas activity, and may impose additional mitigation measures when approving a plan of operation. Potential effects on the environment are also analyzed when permits to conduct exploration or development in the unit area are reviewed.

Thus approving this unit does not create any environmental costs or benefits to consider. The environmental costs and benefits of oil and gas activities on the unit will be examined when DNR considers any proposed plan of operation.

## **2. Geologic and Engineering Characteristics and Prior Exploration Activities**

### **Introduction**

Geologic, geophysical and engineering data submitted by Repsol to the Division in support of the application to form the Qugruk Unit included: well logs and published analyses from wells within the proposed unit and surrounding area, geologic cross sections, proprietary petrophysical analysis, and mapped horizons and interpretations of proprietary seismic data. All proprietary data and interpretations will be held confidential in accordance with AS 38.05.035(a)(8)(C).

As part of the application, Repsol submitted a 1 year forecast of planned unit activities. This initial Plan of Exploration (POE) consisted of four exploration wells to be drilled within the unit during the 2012 winter drilling season. The wells are targeted to delineate and test identified accumulations and prospective intervals within the Jurassic-age Kingak Formation, Lower Cretaceous-age Kuparuk River Formation, and Upper Cretaceous-age (Brookian sourced) Torok Formation and Nanushuk Group.

### **Prior Exploration Activities**

The area surrounding the proposed unit has undergone numerous phases of exploration beginning in the 1960's during the period which resulted in discovery of the giant Prudhoe Bay and Kuparuk oil fields. Since then, numerous other oil fields have been discovered in the area surrounding the proposed unit and are now in various stages of development and production. The Colville River Unit, which is adjacent to the southern and western boundary of the proposed unit, has established production from the Nechelik and Alpine sands of the Jurassic age Kingak Formation, the Kuparuk C sand of the Cretaceous age Kuparuk River Formation, Brookian sourced Nanuq sands of the Torok Formation and Qannik sand within the Nanushuk Group. The Ooguruk Unit, adjacent to the southern and eastern boundaries of the proposed unit produces from the Nuiqsut sand within the Kingak Formation, the Kuparuk C sand, and the Moraine sand within the Torok Formation.

Six prior exploration wells have been drilled within the boundaries of the proposed unit.

The Colville Delta State #1 well was drilled by Gulf Oil Corporation in 1970 to a total depth of 9,299' measured depth (MD), just penetrating the top of the Mississippian Endicott Group, in SE ¼ Sec. 9, T13N, R6E, Umiat Meridian (U.M.). Mudlog oil shows were noted in the Tuluvak Formation, the Cretaceous Nanushuk Group, the Sag River Sandstone, the Ivishak Sandstone and the Lisburne Group. Two of the show intervals were tested. The first test was of the Ivishak which recovered 114 barrels per day (BPD) of muddy formation water with a trace of oil. The second zone tested was a silty/sandy interval near the top of the Nanushuk Group. The zone would not flow and only .06 barrels of 20.8 degree Ametrican Petroleum Institute gravity (20.8° API) oil and water were recovered during reverse out. None of the untested show intervals appear productive based on wireline logs. In the Jurassic Kingak Formation, the Nuiqsut sand was not present due to erosion by the Lower Cretaceous Unconformity (LCU), and the older Nechelik sand appears to be composed of predominately shale and not of reservoir quality. Based upon wireline logs, the stratigraphically older J-2 interval of the Kingak Shale

appears to have been encountered in a depositionally distal setting and primarily consists of non-reservoir siltstone.

In 1986 Amerada Hess drilled the Colville Delta #25-1 to a depth of 6,871' MD, about 100' below the base of the Jurassic Nuiqsut interval in the SE ¼ Sec. 25, T13N, R6E, U. M. This well tested oil in the Nuiqsut interval and flowed at an average rate of 159 barrels of 25 ° API oil with a Gas Oil Ratio (GOR) of 200 to 835 Standard Cubic Feet per Stock Tank Barrel (SCF/STB). In addition to the Nuiqsut interval, approximately 21 feet true vertical thickness (tvt) of hydrocarbon-bearing Kuparuk C sand was encountered in the well but was not tested. Based upon wireline logs the upper 15 feet of the interval appears to contain abundant secondary siderite cement.

The Colville Delta #25-1 well was drilled approximately three miles southwest of the Colville Delta wells #1 and 1A wells drilled by Texaco in 1985 which encountered and tested hydrocarbon-bearing sands within the Jurassic Nuiqsut interval. Three separate intervals were tested within the Nuiqsut in the Colville Delta #1 well. The lower interval of the Nuiqsut tested at a rate of 31 BPD of 22.7° API oil. It was then acidized and produced at a calculated rate of 25 to 100 barrels of oil per day (BOPD) on nitrogen lift. The middle zone of the Nuiqsut produced at a rate calculated of 30 BPD of 17.7° API oil on nitrogen lift. The upper portion of the Nuiqsut has the best sand development and tested at rates of 373 to 1075 BPD of 25° API oil with a GOR of 400-500 SCF/STB after fracture treatment. A sidetrack, the Colville Delta #1A was also drilled in 1985 through the Nuiqsut interval in order to acquire whole core of the Nuiqsut sand. Porosities measured from the core within the Nuiqsut interval ranged from approximately 8 – 17% and averaged 11.3%. Permeability varied greatly, ranging from less than 0.1 to 122 (1 sample) millidarcies (md), with an average of approximately 1.5 md.

In 1986 Texaco followed up the Nuiqsut discovery by drilling the Colville Delta #2 and Colville Delta #3 wells. In the Colville Delta #2 well, the Nuiqsut interval (6,235-6,411' MD) was perforated over a 178 foot interval and after two fracture treatments flowed at a rate of 200 to 800 BOPD. The Moraine sand interval of the Cretaceous Torok Formation was also tested and flowed 44 barrels of water with a trace of oil. The Colville Delta #3 was drilled to the base of the Nuiqsut sand for a total depth of 6,800'. The Nuiqsut sand was tested and flowed 290 BOPD after fracture treatment. The Moraine sand was also tested in in Colville Delta #3 and flowed 235 barrels of 16-20° API oil after fracture treatment. The Texaco Colville Delta #1, 2, and 3 wells and Amerada Hess Colville #25-1 well were certified as capable of production in paying quantities from the Jurassic Nuiqsut sand on October 14, 1991. Both the Jurassic Nuiqsut sand and the shallower Cretaceous-age Moraine sand in the Torok Formation first encountered and tested by Texaco in the Colville Delta wells are now under development and in production within the Ooguruk Unit.

In 1993 Arco drilled four wells within the proposed unit: Kuukpik #3, Till #1, the Colville River #1 and Colville River #1 PB1. All of the Arco wells were drilled to the upper Kingak Shale except the Colville River PB1 which was drilled to the Kuparuk C interval.

The Kuukpik #3 well was drilled to a total depth of 6,880' MD in the SW ¼ Sec. 22, T13N, R6E, U. M. Drill Stem Tests (DSTs) were attempted over four prospective intervals, the Nuiqsut sand,

Kuparuk C sand, lower Torok Formation, and the Tuluvak Formation. The Nuiqsut interval (6,293-6,495' MD) was perforated and tested (DST #1) between 6,340-6,405' MD and had a final calculated average flowing rate on nitrogen lift of 24 BOPD after fracture treatment. The Kuparuk C (6,233-6,251' MD) was perforated and tested (DST #2) between 6,234-6,249' MD and had a final average calculated flow rate of 20 BPD of 23° API oil also on nitrogen lift. Based upon the results of the tests, the well was certified as capable of producing oil in paying quantities in the Kuparuk C and Nuiqsut sands on April 14, 1993. DST #3 was over a 56 foot thick sand in the lower Torok Formation perforated between 5,663-5,718' MD which flowed 90 barrels of water per day (BWPD) on nitrogen lift. DST #4 over a 26' thick sand in the Tuluvak Formation perforated between 2,682-2,710' MD flowed intermittently on nitrogen lift an unspecified amount of an oil, water and mud mixture. The oil gravity was approximately 21°API. Conventional cores were acquired in the Nuiqsut sand between 6,310-6,370' MD and in the Kuparuk C sand between 6,207-6,225' MD.

The Till #1 well was drilled to a total measured depth of 6,975' in the SW ¼, Sec. 10, T12N, R6E, U. M., The Nuiqsut interval was encountered between approximately 6,592-6,830' MD. The Nuiqsut in this well is fairly well-developed, consisting of inter-bedded siltstone, very fine-grained sandstone, and claystone based on analysis of cuttings samples reported from the mudlogs. Good hydrocarbon shows were reported in the mudlogs, but porosity and permeability is estimated to be poor. No tests were attempted in this well. No other zones of particular interest were present in the Till #1 well.

The Colville River #1 well was drilled in 1993 by ARCO, in NW ¼ Sec. 17, T11N, R6E, U.M., in the southwest portion of the proposed unit, just outside the northwest portion of the Kachemach Unit. The well drilled to a total depth of 7,300' MD, -7,7254' Sub-Sea True Vertical Depth (sstvd). The original objective for the well was the Cretaceous-age sands within the Kuparuk Formation, which were unsuccessful. Weak oil shows were present up-hole, in thinly inter-bedded sandstone, siltstone, and shale in the basal portion of the Torok Formation. No production tests were attempted. The well was then deepened to penetrate Jurassic-age strata in the Kingak Formation where it encountered inter-bedded very fine- to fine-grained sandstone and siltstone. Cuttings from this interval displayed weak to fair oil shows in the form of sample and cut fluorescence. The Nuiqsut interval appears to be positionally distal at this location and does not appear to be of reservoir quality based upon wireline logs. No cores or production tests were attempted in this portion of the well.

Seismic coverage in the proposed Unit area consists of both 2D and 3D seismic data. Proprietary 3D seismic exists over a large portion of the proposed Unit; however, the primary 3D seismic surveys licensed and interpreted that cover the proposed Unit are the Fiord 3D (2000), Kalubik 3D (1997), and Big Island 3D (2007). In addition, variably spaced 2D seismic lines (approximately 0.5 to 2 mile line spacing) acquired during the 1970s to 1990s were used in areas of no 3D seismic coverage. The existing seismic data allows detailed mapping of fault patterns, truncation of individual Jurassic sands by the LCU, and amplitude anomalies associated with sands.

## **Geological and Engineering Characteristics**

The primary objectives identified by Repsol for the proposed unit are sands within the upper portion of the Jurassic Kingak Formation, the Cretaceous Kuparuk C sand and several sands within the Cretaceous Nanushuk Group. The sands within the Kingak Shale are, in ascending order, two sands within the J-2 interval informally termed the Cervelo and Judy Creek sands, the Nechelik sand, the Nuiqsut sand and the Alpine A and C sands. The sands within the Nanushuk Group are informally termed in ascending order the Nanushuk 1, Nanushuk 2 or Qannik Sand, Nanushuk 6 and Nanushuk 7.

### **Jurassic Potential**

The depositional setting, geometry and characteristics of the Nechelik, Nuiqsut and Alpine sands are well defined from numerous well penetrations, abundant core data from where these sands are being developed, and existing seismic data. Currently the Nechelik, Alpine A and Alpine C sands are producing from the Jurassic Kingak Formation in the Colville River Unit to the west of the proposed Unit. The Kingak Nuiqsut sand is productive in the Oooguruk Unit located to the east of the proposed Unit. Within the existing fields, all the zones being developed are done so using horizontal producing and injection wells. The oil gravity for the Nuiqsut sand at Oooguruk is typically in the low to mid-20° API range. In the Colville River Unit, the Nechelik oil gravity ranges from approximately 28° to 30° API while the oil in the Alpine sands are generally around 40° API.

Within the proposed unit area, both the Colville Delta #25-1 and Kuukpik #3 wells have produced oil from successful DSTs of the Jurassic Nuiqsut sands. The Colville Delta well produced 25 ° API oil at a calculated rate of 159 BOPD with a GOR of 200 to 835 SCF/STB. The Kuukpik #3 had a final calculated average flowing rate from the Nuiqsut sand of 24 BOPD while on nitrogen lift after fracture treatment. Based upon these tests, both wells were previously certified as capable of producing in paying quantities by the Division. The calculated rates of these wells are generally less than those from other wells tested within the Nuiqsut sand located to the northeast in the Oooguruk Unit where the Nuiqsut interval is now under development. This may represent a general decrease in reservoir quality to the southwest as the sand becomes more distal, or may represent inadequate testing or stimulation to overcome formation damage due to drilling. The low permeability of the Nuiqsut sands makes it a very challenging reservoir to develop. Further delineation drilling and testing is needed to determine the commercial viability and producible area of the Nuiqsut sand identified by the existing wells and present in the proposed unit area.

Few well penetrations exist for the older prospective J-2 Judy Creek interval, while the J-2 Cervelo interval has not been penetrated by any wells, so their characteristics are based heavily on interpretation of existing seismic data and analogy to the other productive Jurassic sands.

The Nechelik, Nuiqsut, and Alpine A sands are interpreted to represent high-stand systems tracts within the Kingak Shale that were deposited in a lower shoreface setting on a shallow marine shelf that prograded from the north to the south. The resulting geometries are lobate-shaped sand

bodies that are elongated in a roughly east-west orientation along depositional strike. Based upon seismic interpretation, the older prospective Judy Creek interval is inferred to represent an older high-stand deposit. The Alpine C sand is interpreted as a transgressive shoreface system that represents a reworking of the underlying Alpine A sand. By analogy, the older prospective Cervelo interval is also thought to have been deposited as part of a transgressive systems tract and as a result, is expected to develop similar, relatively narrow, linear sand bodies with a west to east strike orientation.

Structure at the Jurassic stratigraphic level in the proposed unit area consists of a broad southeast plunging anticline. Several prominent northwest-southeast trending normal faults are present in the proposed unit area. These faults tend to have a down to the southwest offset in the western part of the area and a down to the northeast offset in the eastern part. A younger set of normal faults with a more northerly trend is also present, particularly in the eastern part of the proposed unit. The trapping mechanism for the sands is interpreted to be predominately stratigraphic with the sands pinching out or shaling out in the downdip (distal) direction and erosional truncation by the LCU in the northern updip (proximal) direction. To date, the Nuiqsut sand is the only interval of the Jurassic Kingak Formation that has successfully tested hydrocarbons within the proposed unit area. No water leg has been observed within these Jurassic sands.

### **Kuparuk Potential**

The Kuparuk C sand is one of the major reservoirs on the North Slope with a long history of production from numerous fields, most notably within the Kuparuk River Unit (KRU) located southeast of the proposed unit. The sands were deposited on a shallow marine shelf in paleotopographic lows that formed primarily as a result of late Jurassic and Cretaceous aged rift faulting. This depositional setting results in dramatically variable sand thicknesses and aerial extent of individual sand bodies. The sands were deposited directly above the LCU, one of the major unconformities on the North Slope. The sand in the Kuparuk C interval is believed to be primarily sourced from erosion of older subcropping sands below the LCU. Within the KRU, erosion and re-working of the underlying aurally pervasive Kuparuk A sands provided much of the source sediments. Outside the KRU, distribution of Kuparuk C sands is much more irregular. Local accumulations are typically present where increased thickness of sand has been preserved on the down-thrown side of faults or in other paleotopographic lows.

Numerous smaller accumulations such as these have been discovered and developed outside the KRU in the area surrounding the proposed Qugruk Unit. Currently Kuparuk C sands are in production within the Ooguruk Unit and two separate accumulations in the Colville River Unit. Additional Kuparuk C sand accumulations are currently being delineated prior to production in the recently formed South Miluveach, Tofkat, and Placer Units.

Within the proposed Qugruk Unit, The Kuukpik #3 and Colville Delta #25-1 wells encountered 15-20' tvf of hydrocarbon-bearing Kuparuk C sand. This interval was tested and certified as capable of producing in the Kuukpik #3 well where it tested at a calculated flow rate of approximately 20 BOPD. The Kuparuk C sand was not tested in Colville Delta #25-1.

The Kuparuk C sands also have a complicated diagenetic history with the degree of secondary siderite cementation and glauconite being the primary control on reservoir quality. Because of this, porosity and permeability can vary greatly in the C sand. Core data reveals that porosity can range from 8% to 30% and permeability can range from less than 0.1 md to over 3,000 md. In areas with less cementation the Kuparuk C sand has demonstrated the capability to produce at very high rates from relatively thin sands.

Structure at the Kuparuk / LCU stratigraphic level consists of an extremely large, roughly circular, four-way closure known as the Colville High. The proposed unit area is located on the northwest flank of the structure but is still nearly entirely within the area of closure. The down to the northeast faults previously described primarily affect deposition of the Kuparuk C sands but occasionally offset and isolate local accumulations of the sand. The trapping mechanism from a regional perspective is thought to be primarily structural with stratigraphy controlling the distribution of reservoir presence.

Repsol integrated available subsurface control from well data with various seismic attributes to predict the presence of Kuparuk C sand within the proposed unit. Seismic data was primarily used to define areas of potential accommodation on the LCU, detailed LCU subcrops, and direct sand detection using seismic amplitudes. Kuparuk C sands are generally high impedance sands that may produce a strong peak amplitude anomaly above the LCU when the sand is present. However, due to interference effects of underlying subcropping strata, and the limits of seismic data to resolve thin sands below a "tuning thickness" of approximately 50 feet, the amplitude patterns can be complex and sometimes misleading. This can be further complicated by the common presence of dense secondary siderite cement which can give a strong amplitude signature, but result in significantly diminished reservoir quality.

### **Nanushuk Potential**

The Nanushuk Group comprises a series of shallow marine, top-set sands deposited as part of an eastward prograding, subaqueous delta complex. Individual sands occur as thin, elongate deposits that can extend for 10 to 20 miles north-south along depositional strike. Limited core data indicates that the sands where present, are lithic sandstones consisting primarily of quartz, chert and clay with minor amounts of potassium and plagioclase feldspar. The sands are generally very fine to fine grained and well-sorted to very well-sorted.

Structure at the stratigraphic level of the Nanushuk sands consists of a broad, east plunging anticline. Structural dips within the proposed unit and the Colville River Unit are very shallow, generally less than 1 degree. The trapping mechanism appears to be dominantly stratigraphic with the sands pinching out or onlapping up-dip to the west and shaling out depositionally down-dip to the east.

Within the Colville River Unit located south of the western portion of the proposed unit, one zone of the Nanushuk Group, the Qannik sand, is currently being developed with 6 producing wells and 3 injection wells. The oil ranges from 27° to 32° API gravity, with a viscosity of about 2 centipoise and a solution GOR of approximately 404 SCF/STB. The initial reservoir pressure was approximately 1,865 psia. A gas-oil contact is has been identified within the Qannik sand at

a depth of approximately 4,000' sstvd. To date the Qannik sand is the only sand that has been tested or developed within the Nanushuk Group.

Within the proposed Qugruk Unit area, Repsol has subdivided the Cretaceous Nanushuk Group into nine individual zones that they have informally termed the Nanushuk 0 through Nanushuk 8. Based upon their subdivision, the Qannik sand that is being developed in the CRU is equivalent to the Nanushuk 2. Based on interpretation of available seismic data and regional subsurface mapping, Repsol believes the Nanushuk 1, Nanushuk 2 (Qannik sand), Nanushuk 6 and Nanushuk 7 sands are prospective within the western portion of the proposed unit. To date, no prior wells drilled within the proposed unit area have conclusively demonstrated the productivity of the Nanushuk interval.

In 2001 Conoco Phillips drilled the Nigliq #1 and #1A wells approximately 1 ½ miles south of the proposed unit in Sec. 2, T12N, R4E, U. M. The primary objective for these wells was to delineate the Jurassic Nechelik sands within the CRU. As a secondary objective three sands encountered in the wells within the Nanushuk Group were evaluated with wireline logs and rotary sidewall cores. In the Nigliq #1A well the three sands present between approximately 4,250-4,800' MD correlate to the Nanushuk 1, 2, and 6 zones as defined by Repsol. All three zones had good hydrocarbon shows reported in the mudlogs. Porosity measured from rotary sidewall cores range from 16% to 28% and permeability ranges from approximately 0.1 to 27 md. The Nanushuk interval was not tested in either the Nigliq #1 or #1A well. The closest producing Qannik well is CRU CD2-468 located approximately 4.7 miles south of the proposed unit boundary in the SW ¼, Sec. 23, T12N, R4E U. M. Since January 2009 this well has produced approximately 420,000 barrels of oil. As part of their application Repsol proposes to drill an exploration well located in Sec. 15, T13, R4E, U. M. to evaluate and test the Nanushuk sands. This well will be approximately 7.5 miles north of the CRU CD2-468 well.

## **Conclusion**

Repsol provided the Division a comprehensive interpretation and analysis of the available data in support of the application to form the Qugruk Unit. Through careful analyses Repsol has identified numerous high quality prospective targets over a large area in multiple stratigraphic intervals which will need to be drilled in order to prove-up, which they propose to do in part during the proposed initial unit plan.

The ultimate purpose for forming a unit is to protect the correlative rights of all parties, prevent waste and ensure greater ultimate recovery during development and production of a pool or reservoir which has been discovered by drilling and evaluated by testing. Unitization is not necessary to conduct exploration activities which could be carried out under the terms of an existing lease.

Repsol, through technical information and data provided in the application has established that producible hydrocarbons have been demonstrated in a portion of the proposed unit area through drilling and testing of a well. Both the previously drilled Kuupik #3 and Colville Delta #25-1 wells produced limited quantities of oil during testing from the Nuiqsut sand in the Jurassic Kingak Formation, as well as the Cretaceous Kuparuk C sand in the Kuupik #3 well. The unit

plan provided by Repsol commits to the drilling of additional wells to delineate and determine the commercial viability of these accumulations for further development and also evaluate additional identified prospects.

Unitizing the leases is not necessary to conduct the delineation and exploration activities proposed in the initial unit plan. The proposed activities would not be conducted any differently as a unit than as individual leases.

### 3. Plans for Exploration and Development

Repsol, as proposed unit operator, submitted a proposed Plan of Exploration (POE), Exhibit G, Attachment 3, and met with the Division for a technical presentation on June 14, 2011. Repsol proposed the following activities in the POE:

#### Drilling Program

Currently, four exploration wells are planned for the proposed Qugruk Unit. All four wells will be drilled during the 2012 Winter Drilling Season. The planned locations for each of these exploration wells are depicted upon the confidential displays submitted to the Division in support of the proposed Qugruk Unit application. The intended bottom-hole locations and depths are set forth below. Repsol, 70, and GMT reserve the right to modify the order in which these wells are to be drilled. Following drilling of the first well, the location and drilling depth of subsequent wells may be adjusted pursuant to the results of the prior wells.

Well Name	Bottomhole Location	Depth
1st Exploration Well	Qugruk No. 1 Sec 28, T13N, R6E	7,100' TVD*
2nd Exploration Well	Qugruk No. 2 Sec 25, T13N, R5E	7,000' TVD
3rd Exploration Well	Qugruk No. 3 Sec 31, T12N, R6E	7,150' TVD
4th Exploration Well	Qugruk No. 4 Sec 15, T13N, R4E	8,300' TVD

\* True Vertical Depth (TVD)

Since the submittal of the Application, Repsol has secured the rigs necessary for this proposed drilling program. Repsol has also received drilling permits for these activities from the North Slope Borough, except that Repsol agreed to withdraw its permit request for the Qugruk No. 3 well and to not have more than three rigs working at one time.

Repsol, 70, and GMT offered to establish a substantial cash bond ("Bond") in favor of the DNR. As proposed, the Bond would remain with DNR until the first exploration well of the proposed unit is spud, at which time the DNR will release said Bond to Repsol as operator of the unit. To date, Repsol, 70, and GMT have ratified the proposed Qugruk Unit Agreement, the operating agreement, and, as WIOs, have agreed to the termination of the unit if the first well is not drilled

during the drilling season of 2011/2012. No other parties have yet ratified the unit agreement or the operating agreement.

Further discussion with Repsol resulted in a revision to the terms of the proposed POE as follows:

Repsol has agreed to terminate the unit in the absence of any drilling, to terminate the unit if it fails to drill, test, plug and abandon the Qugruk No. 4 well, and to post a \$20,000,000.00 bond to support its commitment to drill, test, plug and abandon the Qugruk No. 4 well. Specifically,

- A. Repsol shall drill, test, and plug and abandon the Qugruk No. 4 well by June 30, 2012.
- B. Repsol agrees that if no well is drilled within the Qugruk unit by June 30, 2012, the unit will terminate.
- C. Repsol will furnish a bond in the amount of \$20,000,000.00 in the favor of DNR. If the Qugruk No. 4 is not drilled, tested and plugged and abandoned by June 30, 2012, the bond will be retained by DNR. If the Qugruk No. 4 well is drilled, tested and plugged and abandoned by June 30, 2012, DNR will return the bond to Repsol.

This revised POE insures that the Approved Qugruk Unit (Attachments 4 and 5) will be drilled and tested prior to lease expiration, or the unit will terminate. Unitization is not necessary to conduct exploration activities which could be carried out under the terms of an existing lease. The State benefits from the greater ultimate recovery which results from development and production of a pool or reservoir which has been discovered by drilling and evaluated by testing.

#### **4. The Economic Costs and Benefits to the State**

The POE does not propose activity that would necessarily result in greater economic benefit to the state if the leases were unitized than if the activities were conducted on a lease-by-lease basis. The activities proposed by Repsol do not result in production sooner than if the same activities (drilling) were conducted on a lease-by-lease basis. Accordingly, unitization at this stage may offer no benefit to the state.

Unitizing the leases listed in Attachment 4 does, however, encourage development, which in turn benefits the State economically. Unitized development under the unit agreement provides for development of all of the leases, thus increasing the likelihood of development over development conducted on a lease by lease basis.

Meanwhile, the costs to the State are minimal. Should Repsol not drill the Qugruk No. 4 well, the unit will terminate prior to lease expiration. The leases will be available for the next lease sale and the State might receive bonus bids. Unitizing these leases under the conditions of this decision creates minimal cost to the State from bonus bids the State might receive from re-leasing expiring leases if no well is drilled at Qugruk.

## **5. Other Relevant Factors**

Repsol has agreed to terminate the unit in the absence of any drilling, to terminate the unit if it fails to drill, test, plug and abandon the Qugruk No. 4 well, and to post a \$20,000,000.00 bond to support its commitment to drill, test, plug and abandon the Qugruk No. 4 well. Specifically, the Qugruk No. 4 commitment is as follows:

- A. Repsol shall drill, test, and plug and abandon the Qugruk No. 4 well by June 30, 2012.
- B. Repsol agrees that if no well is drilled within the Qugruk unit by June 30, 2012, the unit will terminate.
- C. Repsol will furnish a bond in the amount of \$20,000,000.00 in the favor of DNR. If the Qugruk No. 4 is not drilled, tested and plugged and abandoned by June 30, 2012, the bond will be retained by DNR. If the Qugruk No. 4 is drilled, tested and plugged and abandoned by June 30, 2012, DNR will return the bond to Repsol.

Unitizing the leases is not necessary to conduct the delineation and exploration activities proposed in the initial unit plan. The proposed activities would not be conducted any differently as a unit than as individual leases. However, approval of the Qugruk Unit, conditioned by the Qugruk No. 4 commitment, protects the public interest by insuring that the leases will be drilled prior to unitization and that failure to fulfill the Qugruk No. 4 commitment will result in unit termination and the DNR will retain the \$20,000,000 bond.

## **B. Decision Criteria under 11 AAC 83.303(a)**

### **1. Promote the Conservation of All Natural Resources**

A unit may be formed under AS 38.05.180(p) “[t]o conserve the natural resources of all or a part of an oil or gas pool, field, or like area.” Conservation of the natural resources of all or part of an oil or gas pool, field or like area means maximizing the efficient recovery of oil and gas and minimizing the adverse impacts on the surface and other resources. 11 AAC 83.395(9). The unitization of oil and gas reservoirs and the formation of unit areas to develop hydrocarbon-bearing reservoirs are well-accepted means of hydrocarbon conservation. Unitization, with development occurring under the terms of a unit agreement, can promote efficient evaluation and development of the State’s resources, and minimize impacts to the area’s cultural, biological, and environmental resources.

Repsol has agreed that if the Qugruk No. 4 well commitment is not fulfilled, the unit shall terminate. Approval of the Qugruk Unit under this condition promotes the conservation of all natural resources because the unit will continue only if the well is drilled, tested, and plugged and abandoned. After Repsol drills Qugruk No. 4, development will proceed as unitized development under a POE and POD which will promote conservation of oil and gas resources by maximizing more efficient recovery than if these particular leases were developed individually on a lease-by-lease basis. Unitized development for these leases will also impact less surface acreage than development on a lease-by-lease basis, thus reducing the potential adverse impacts to land, fish, and wildlife.

## **2. The Prevention of Economic and Physical Waste**

Unitization prevents economic and physical waste by eliminating redundant expenditures for a given level of production, and by avoiding loss of ultimate recovery with the adoption of a unified reservoir management plan. Reducing costs and environmental impacts through unitized operations will expedite development of any reserves and will promote greater ultimate recovery of any oil and gas from the unit area. This will increase and extend the State's income stream from production taxes and royalties.

## **3. The Protection of All Parties of Interest, Including the State**

The State's best interest is to encourage assessment of oil and gas resources while minimizing adverse impacts of exploration, development, production, and transportation activities. AS 38.05.180(a)(2). The State also has an interest in protecting the public interest. The people of Alaska have an interest in the development of the State's oil and gas resources to maximize the economic and physical recovery of the resources, maximizing competition, and maximizing use of Alaska's human resources. AS 38.05.180(a)(1). Approval of the unit and management under future plans of operation and annually approved plans of development will provide for continued review and approval of Repsol's plans to develop the Qugruk Unit in a manner which will maximize economic and physical recovery. The existing lease mitigation measures, as well as additional mitigation measures that DNR may impose with future plans of operation, and DNR's future review of plans of operation and plans of development all minimize the potential adverse impacts of exploration and development on this unit. Combining interests and operating under the terms of the unit agreement and operating agreement assures each individual WIO an equitable allocation of costs and revenues commensurate with the resources of its leases.

Approval of the unit area, although not technically supported, but based upon Repsol's commitments for the Qugruk No. 4, to post a bond, and to terminate the approved unit area if the Qugruk No. 4 commitments are not fulfilled by June 30, 2012, would protect the State's interest by assuring the State will receive the benefit of the unit area being drilled prior to lease expiration.

The Division approves the Application in part, as provided for in this decision. The approved Qugruk Unit includes six leases held by Repsol E&P USA Inc., 70.00%, 70 & 148, LLC, 22.50%, and GMT Exploration Company, LLC 7.50%, Attachments 4 and 5. The State is the sole royalty owner for all of the leases except for ADL 391164, where ASRC holds 4.26% of Section 27 and 0.21% of Section 28. The lease is jointly owned with ASRC and management of those interests is governed by the 1991 Settlement Agreement between ASRC and the State of Alaska, as amended. ADL 391164 is comprised of two sections and will be segregated by section into two leases due to the differing ASRC royalty ownership. Section 28 will be assigned the ADL 392206 as shown in Attachment 4. All of the leases in the unit area provide a 16.66667% royalty rate. The unit area comprises approximately 12,065 acres.

Conditions providing for unit termination in the event that Repsol fails to fulfill the Qugruk No. 4 well commitment by June 30, 2012 protect the State's interest in both exploration and development and in leasing its land. Four of the unit area leases would have expired on August

31, 2012 if not extended by unitization. The State will forego revenue in the form of bonus bids by including these leases in the Qugruk Unit. If Repsol fails to fulfill the Qugruk No. 4 well commitments by June 30, 2012, however, the unit will terminate on that date. In that case, ADLs 391160, 391161, 391162, and 391164 would expire August 31, 2012, and the acreage would be available at the next lease sale. These conditions protect the State's interest.

In addition, to partially offset any potential loss of lease sale bonus bids on this acreage, the State is increasing the lease rentals for these three leases as authorized under AS 38.05.180(m). ("Upon extension, the commissioner may increase lease rentals so long as the increased rental rate does not exceed 150 percent of the rate for the preceding year.") The rental rate for ADLs 391160, 391161, 391162, and 391164 will increase from \$3.00 per acre to \$4.50 per acre effective August 31, 2012. Rental is payable in advance, and continues until income to the State from royalty exceeds rental income to the State for that year. AS 38.05.180(n).

The unit approval protects the economic interests of the WIOs and the royalty owner. The Qugruk Unit promotes the State's economic interests because hydrocarbon recovery will be maximized and additional production-based revenue will be derived from the increased production. Diligent exploration and development under a single approved unit plan without the complications of competing leasehold interests promotes the State's interest. The operating agreement provides for accurate reporting and record keeping, State approval of plans of exploration and development and operating procedures, royalty settlement, in-kind taking, and emergency storage of oil and gas, all of which will further the State's interest.

#### **IV. FINDINGS AND DECISION**

##### **A. The Conservation of All Natural Resources**

1. Formation of the Qugruk Unit will provide for exploration and development of the leases under the unit agreement and will maximize the efficient recovery of oil and gas and minimize the adverse impacts on the surface and other resources, including hydrocarbons, gravel, sand, water, wetlands, and valuable habitat.
2. The unitized development and operation of the leases in the unit will reduce the amount of land and fish and wildlife habitat that would otherwise be disrupted by individual lease development. This reduction in environmental impacts and preservation of subsistence access is in the State and public interest.
3. There is potential for environmental impacts associated with reservoir development. All unit development must proceed according to an approved plan of development. Additionally, before undertaking any specific operations, the Unit Operator must submit a unit Plan of Operation to the Division and other appropriate state and local agencies for review and approval. The lessees may not commence any drilling or development operations until all agencies have granted the required permits and plan approvals. DNR may condition its approval of a unit Plan of Operation and other permits on performance of mitigation measures in addition to those in the lease sale approval and the Agreement,

if necessary or appropriate. Compliance with mitigation measures will minimize, reduce, or completely avoid adverse environmental impacts.

**B. The Prevention of Economic and Physical Waste**

1. Repsol submitted confidential geological, geophysical and engineering data to the Division in support of the Application. As conditioned by this decision, DNR finds that formation of the Qugruk Unit will prevent economic and physical waste.

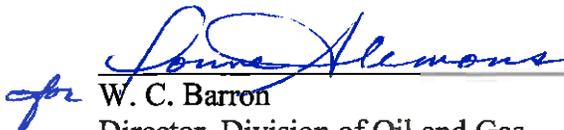
**C. The Protection of All Parties in Interest, Including the State**

1. The unit formation as approved protects all parties in interest including the State, both as a sovereign, with its best interest in assessing oil and gas resources while minimizing adverse impacts, and in its role protecting the people of Alaska, who have an interest in the development of the State's oil and gas resources to maximize the economic and physical recovery of the resources. AS 38.05.180(a).
2. Repsol provided evidence of reasonable effort to obtain joinder of any proper party to the Agreement.
3. Repsol holds sufficient interest in the unit area to give reasonably effective control of operations.
4. The unit formation as approved meets the requirements of 11 AAC 83.303.
5. The Division complied with the public notice requirements of 11 AAC 83.311.
6. The unit formation will not diminish access to public and navigable waters beyond those limitations (if any) imposed by law or already contained in the oil and gas leases covered by this decision.
7. The unit agreement provides for additional expansions and contractions of the unit areas in the future, as warranted by data obtained by exploration or otherwise. The unit agreement thereby protects the public interest, the rights of the parties, and the correlative rights of adjacent landowners.
8. Within 60 days of the issuance of this decision, the working interest owners will sign and submit a new Qugruk Unit Agreement using the Multiple Royalty Owner Unit Agreement form dated March 2011 with Exhibits A, B, and G, revised to comport with this decision.

9. The POE for the Qugruk Unit is approved until September 30, 2012 as follows:
  - A. Repsol shall drill, test, and plug and abandon the Qugruk No. 4 well by June 30, 2012.
  - B. Repsol agrees that if no well is drilled within the Qugruk unit by June 30, 2012, the unit will terminate.
  - C. Repsol will furnish a bond in the amount of \$20,000,000.00 in the favor of DNR. If the Qugruk No. 4 is not drilled, tested and plugged and abandoned by June 30, 2012, the bond will be retained by DNR. If the Qugruk No. 4 is drilled, tested and plugged and abandoned by June 30, 2012, DNR will return the bond to Repsol.
10. Repsol will establish the \$20,000,000.00 bond on or before February 15, 2012.
11. The rental rate for ADLs 391160, 391161, 391162, and 391164 will increase from \$3.00 per acre to \$4.50 per acre effective August 31, 2012. The rental rate increase is a permanent amendment to the lease rental rate, regardless of whether the lease remains committed to the unit.
12. ADL 391164 will be segregated into two one section leases, Section 28 will be assigned ADL 392206, which will have the same terms and conditions as the parent lease (ADL 391164).

For the reasons discussed in this Findings and Decision, I hereby approve formation of the unit subject to the conditions set out in this decision, effective January 26, 2012.

A person affected by this decision may appeal it, in accordance with 11 AAC 02. Any appeal must be received within 20 calendar days after the date of "issuance" of this decision, as defined in 11 AAC 02.040(c) and (d) and may be mailed or delivered to Daniel S. Sullivan, Commissioner, Department of Natural Resources, 550 W. 7th Avenue, Suite 1400, Anchorage, Alaska 99501; faxed to 1-907-269-8918, or sent by electronic mail to [dnr.appeals@alaska.gov](mailto:dnr.appeals@alaska.gov). This decision takes effect immediately. An eligible person must first appeal this decision in accordance with 11 AAC 02 before appealing this decision to Superior Court. A copy of 11 AAC 02 may be obtained from any regional information office of the Department of Natural Resources.

  
\_\_\_\_\_  
W. C. Barron  
Director, Division of Oil and Gas

  
\_\_\_\_\_  
Date

**V. LIST OF ATTACHMENTS**

1. Exhibit A, Proposed Qugruk Unit
2. Exhibit B, Map of the Proposed Qugruk Unit Boundary
3. Exhibit G, Proposed Initial Plan of Exploration
4. Approved Qugruk Unit Leases
5. Map of the Approved Qugruk Unit Boundary

**ATTACHMENT 1: Proposed Qugruk Unit Exhibit A**

EXHIBIT A  
TO THE QUGRUK UNIT AGREEMENT DATED SEPTEMBER 13, 2011

Unit Tract #	Lessor & Lease No	Working Interest Owner	Working Interest	Effectiva Date	Description	Acreage	Royalty	ORR Burden
1	State of AK ADL 391382	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2009	Tract: 388  T. 014N., R. 008E., Umiat Meridian, Alaska.  Section 17, Protracted, All, 640.00 acres; Section 18, Protracted, All, 614.00 acres; Section 20, Unsurveyed, All tide and submerged lands, 614.08 acres;  T. 014N., R. 008E., Tract A, Umiat Meridian, Alaska.  Section 20, Unsurveyed, All uplands, 25.92 acres;	1894.00	16.66667%	William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lysio 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furin 0.10000% GMT Exploration Company LLC 0.83333%
2	State of AK ADL 391383	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2009	Tract 403  T. 014N., R. 007E., Umiat Meridian, Alaska.  Section 1, Protracted, All, 640.00 acres; Section 2, Protracted, All tide and submerged lands lying shoreward of line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 552.72 acres; Section 11, Protracted, All, 640.00 acres; Section 12, Protracted, All, 640.00 acres;  T. 015N., R. 007E., Umiat Meridian, Alaska.  Section 35, Protracted, All tide and submerged lands lying shoreward of line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 5.14 acres; Section 36, Protracted, All tide and submerged lands lying shoreward of line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 125.01 acres;	2602.87	16.66667%	William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lysio 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furin 0.10000% GMT Exploration Company LLC 0.83333%

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3	State of AK ADL 391384	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2009	Tract: 404  T. 014N., R. 007E., Umiat Meridian, Alaska  Section 3, Protracted, All tide and submerged lands lying shoreward of line fixed by coordinates found in Exhibit A of the Final Decree In U.S. v. Alaska, No. 84 Original, 148.72 acres; Section 9, Protracted, All tide and submerged lands lying shoreward of line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 92.66 acres; Section 10, Protracted, All tide and submerged lands lying shoreward of line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 611.95 acres;	853.33	16.66667%	William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lyslo 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furin 0.10000% GMT Exploration Company LLC 0.83333%
4	State of AK ADL 391385	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2009	Tract: 405  T. 014N., R. 007E., Umiat Meridian, Alaska.  Section 13, Protracted, All, 640.00 acres; Section 14, Protracted, All, 640.00 acres;	1280.00	16.66667%	William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lyslo 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furin 0.10000% GMT Exploration Company LLC 0.83333%
5	State of AK ADL 391386	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2009	Tract 406  T. 014N., R. 007E., Umiat Meridian, Alaska.  Section 15, Protracted, All, 640.00 acres; Section 16, Protracted, All tide and submerged lands lying shoreward of line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 376.76 acres;	1016.76	16.66667%	William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lyslo 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furin 0.10000% GMT Exploration Company LLC 0.83333%

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6	State of AK ADL 390852	Paul L Craig Pete: G. Zamareilo	50% 50%	3/1/2007	Tract BS2006-407  T. 14 N., R. 7 E., Umiat Meridian, Alaska.  Section 17, Protracted, All tide and submerged lands shoreward of the line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 86.12 acres; Section 18, Protracted, All tide and submerged lands shoreward of the line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 24.82 acres;	110.94	16.66667%	0.000000%
7	State of AK ADL 391565	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	10/1/2010	Tract 407  T. 014 N., R. 007 E., Umiat Meridian, Alaska.  Section 19, Protracted, All tide and submerged lands shoreward of the line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 608.11 acres; Section 20, Protracted, All, 640.00 acres;	1248.11	16.66667%	William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lyslo 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furlin 0.10000% GMT Exploration Company LLC 0.83333%
8	State of AK ADL 391389	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2009	Tract 415  T. 014N., R. 006E., Umiat Meridian, Alaska  Section 23, Protracted, All tide and submerged lands lying shoreward of line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 355.93 acres; Section 24, Protracted, All tide and submerged lands lying shoreward of line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 531.81 acres; Section 25, Protracted, All, 640.00 acres; Section 26, Protracted, All, 640.00 acres; Section 35, Protracted, All, 640.00 acres; Section 36, Protracted, All, 640.00 acres;	3447.74	16.66667%	William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lyslo 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furlin 0.10000% GMT Exploration Company LLC 0.83333%

EXHIBIT A  
TO THE QUGRUK UNIT AGREEMENT DATED SEPTEMBER 13, 2011

9	State of AK ADL 391390	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2009	<p>Tract: 416</p> <p>T. 014N., R. 006E., Umiat Meridian, Alaska.</p> <p>Section 21, Protracted, All tide and submerged lands lying shoreward of line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 182.78 acres;</p> <p>Section 22, Protracted, All tide and submerged lands lying shoreward of line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 243.53 acres;</p> <p>Section 27, Protracted, All, 640.00 acres;</p> <p>Section 28, Protracted, All, 640.00 acres;</p> <p>Section 33, Protracted, All, 640.00 acres;</p> <p>Section 34, Protracted, All, 640.00 acres;</p>	2986.31	16.66667%	<p>William D. Armstrong 1.92500%</p> <p>Edgar Kerr 0.10000%</p> <p>Jesse V. Sommer 0.10000%</p> <p>Jeffery A. Lysio 0.10000%</p> <p>Edward S. Smida 0.06250%</p> <p>Edward Y. Teng 0.06250%</p> <p>Colby VanDenburg 0.02500%</p> <p>Patricia M. Reed 0.02500%</p> <p>Mathew X. Furin 0.10000%</p> <p>GMT Exploration Company LLC 0.83333%</p>
10	State of AK ADL 391391	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2009	<p>Tract: 417</p> <p>T. 014N., R. 006E., Umiat Meridian, Alaska.</p> <p>Section 19, Protracted, All tide and submerged lands lying shoreward of line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 119.16 acres;</p> <p>Section 20, Protracted, All tide and submerged lands lying shoreward of line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 140.56 acres;</p> <p>Section 29, Protracted, All, 640.00 acres;</p> <p>Section 30, Protracted, All, 620.00 acres;</p> <p>Section 31, Protracted, All, 623.00 acres;</p> <p>Section 32, Protracted, All, 640.00 acres;</p>	2782.72	16.66667%	<p>William D. Armstrong 1.92500%</p> <p>Edgar Kerr 0.10000%</p> <p>Jesse V. Sommer 0.10000%</p> <p>Jeffery A. Lysio 0.10000%</p> <p>Edward S. Smida 0.06250%</p> <p>Edward Y. Teng 0.06250%</p> <p>Colby VanDenburg 0.02500%</p> <p>Patricia M. Reed 0.02500%</p> <p>Mathew X. Furin 0.10000%</p> <p>GMT Exploration Company LLC 0.83333%</p>

EXHIBIT A  
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11	State of AK ADL 391395	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2009	<p>Tract 426</p> <p>T. 014N., R. 005E., Umiat Meridian, Alaska.</p> <p>Section 24, Protracted, All tide and submerged lands lying shoreward of line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 13.71 acres;</p> <p>Section 25, Protracted, All tide and submerged lands lying shoreward of line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 635.35 acres;</p> <p>Section 26, Protracted, All tide and submerged lands lying shoreward of line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 594.15 acres;</p> <p>Section 35, Protracted, All, 540.00 acres;</p> <p>Section 36, Protracted, All, 640.00 acres;</p>	2523.21	16.66667%	<p>William D. Armstrong 1.92500%</p> <p>Edgar Kerr 0.10000%</p> <p>Jesse V. Sommer 0.10000%</p> <p>Jeffery A. Lyslo 0.10000%</p> <p>Edward S. Smida 0.06250%</p> <p>Edward Y. Teng 0.06250%</p> <p>Colby VanDenburg 0.02500%</p> <p>Patricia M. Reed 0.02500%</p> <p>Mathew X. Furlin 0.10000%</p> <p>GMT Exploration Company LLC 0.83333%</p>
12	State of AK ADL 391396	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2009	<p>Tract 427</p> <p>T. 014N., R. 005E., Umiat Meridian, Alaska.</p> <p>Section 27, Protracted, All tide and submerged lands lying shoreward of line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 454.10 acres;</p> <p>Section 28, Protracted, All tide and submerged lands lying shoreward of line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 117.54 acres;</p> <p>Section 32, Protracted, All tide and submerged lands lying shoreward of line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 142.55 acres;</p> <p>Section 33, Protracted, All tide and submerged lands lying shoreward of line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 613.59 acres;</p> <p>Section 34, Protracted, All, 640.00 acres;</p>	1967.78	16.66667%	<p>William D. Armstrong 1.92500%</p> <p>Edgar Kerr 0.10000%</p> <p>Jesse V. Sommer 0.10000%</p> <p>Jeffery A. Lyslo 0.10000%</p> <p>Edward S. Smida 0.06250%</p> <p>Edward Y. Teng 0.06250%</p> <p>Colby VanDenburg 0.02500%</p> <p>Patricia M. Reed 0.02500%</p> <p>Mathew X. Furlin 0.10000%</p> <p>GMT Exploration Company LLC 0.83333%</p>

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13	State of AK ADL 391566	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	10/1/2010	<p>Tract 411</p> <p>T. 013 N., R. 006 E., Umiat Meridian, Alaska.</p> <p>Section 1, Unsurveyed, All tide and submerged lands, 617.37 acres; Section 2, Unsurveyed, All tide and submerged lands, 635.75 acres; Section 11, Unsurveyed, All tide and submerged lands, 150.22 acres; Section 12, Unsurveyed, All tide and submerged lands, 179.17 acres;</p> <p>T. 013 N., R. 006 E., Tract A, Umiat Meridian, Alaska.</p> <p>Section 1, Unsurveyed, All uplands, 22.63 acres; Section 2, Unsurveyed, All uplands, 4.25 acres; Section 11, Unsurveyed, All uplands, 489.78 acres; Section 12, Unsurveyed, All uplands, 460.83 acres;</p>	2560.00	16.66667%	<p>William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lyslo 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furin 0.10000% GMT Exploration Company LLC 0.83333%</p>
14	State of AK ADL 391303	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	8/1/2008	<p>Tract 412</p> <p>T. 13N., R. 6E., Umiat Meridian, Alaska.</p> <p>Section 3, Unsurveyed, All tide and submerged lands, 633.28 acres; Section 4, Protracted, All, 640.00 acres; Section 9, Unsurveyed, All tide and submerged lands, 156.70 acres; Section 10, Unsurveyed, All tide and submerged lands, 168.45 acres;</p> <p>T. 13N., R. 6E., Tract A, Umiat Meridian, Alaska.</p> <p>Section 3, Unsurveyed, All uplands, 6.72 acres; Section 9, Unsurveyed, All uplands, 483.30 acres; Section 10, Unsurveyed, All uplands, 471.55 acres;</p>	2560.00	16.66667%	<p>William D. Armstrong 0.76808% Edgar Kerr 0.03990% Jesse V. Sommer 0.03990% Jeffery A. Lyslo 0.03990% Edward S. Smida 0.02494% Edward Y. Teng 0.02494% Colby VanDenburg 0.00998% Patricia M. Reed 0.00998% Mathew X. Furin 0.03990% GMT Exploration Company LLC 0.33250% Andrew J. Bachner 1.80000% Keith C. Forsgren 0.20000%</p>

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15	State of AK ADL 391387	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2009	Tract: 413  T. 013N., R. 006E., Umiat Meridian, Alaska.  Section 5, Protracted, All, 640.00 acres; Section 6, Protracted, All, 625.00 acres; Section 7, Unsurveyed, All tide and submerged lands, 151.64 acres; Section 8, Unsurveyed, All tide and submerged lands, 284.19 acres;  T. 013N., R. 006E., Tract A, Umiat Meridian, Alaska.  Section 7, Unsurveyed, All uplands, 476.36 acres; Section 8, Unsurveyed, All uplands, 355.81 acres;	2533.00	16.66667%	William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lyslo 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furin 0.10000% GMT Exploration Company LLC 0.83333%
16	State of AK ADL 391392	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2009	Tract 418  T. 013N., R. 005E., Tract A, Umiat Meridian, Alaska.  Section 11, Unsurveyed, All uplands, including the bed of the Elaktoveach Channel, 205.54 acres; Section 12, Unsurveyed, All uplands, including the bed of the Elaktoveach Channel, 426.42 acres;  T. 013N., R. 005E., Umiat Meridian, Alaska.  Section 1, Protracted, All, 640.00 acres; Section 2, Protracted, All, 640.00 acres; Section 11, Unsurveyed, All tide and submerged lands, 434.46 acres; Section 12, Unsurveyed, All tide and submerged lands, 213.58 acres;	2560.00	16.66667%	William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lyslo 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furin 0.10000% GMT Exploration Company LLC 0.83333%
17	State of AK ADL 391393	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2009	Tract 419  T. 013N., R. 005E., Umiat Meridian, Alaska.  Section 3, Protracted, All, 640.00 acres; Section 4, Protracted, All, 640.00 acres;	1280.00	16.66667%	William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lyslo 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furin 0.10000% GMT Exploration Company LLC 0.83333%

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18	State of AK ADL 391160	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2007	<p>Tract B52006A-420 T. 13 N., R. 5 E., Umiat Meridian, Alaska.</p> <p>Section 5, Protracted, All tide and submerged lands shoreward of the line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, listed as "State Acreage" on Alaska's Seward Boundary Diagram approved by the State on April 15, 1996, 595.54 acres;</p> <p>Section 6, Protracted, All tide and submerged lands shoreward of the line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, listed as "State Acreage" on Alaska's Seward Boundary Diagram approved by the State on April 15, 1996, 432.35 acres;</p> <p>Section 7, Protracted, All tide and submerged lands shoreward of the line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 628.00 acres;</p> <p>Section 8, Protracted, All tide and submerged lands shoreward of the line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 640.00 acres;</p>	2295.89	16.66667%	<p>Pingo Oil &amp; Gas, L.P. 0.50000%</p> <p>AVCG, LLC 1.70833%</p> <p>Bow Valley Alaska Co. 0.16667%</p> <p>TG World Energy, Inc. 0.62500%</p> <p>Ramshorn Investments 0.33333%</p>
19	State of AK ADL 391397	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2009	<p>Tract 432 T. 013N., R. 004E., Umiat Meridian, Alaska.</p> <p>Section 1, Protracted, All tide and submerged lands lying shoreward of line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 249.39 acres;</p> <p>Section 2, Protracted, All tide and submerged lands lying shoreward of line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 31.53 acres;</p> <p>Section 11, Protracted, All tide and submerged lands lying shoreward of line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 600.30 acres;</p> <p>Section 12, Protracted, All, 640.00 acres;</p>	1521.22	16.66667%	<p>William D. Armstrong 1.92500%</p> <p>Edgar Kerr 0.10000%</p> <p>Jesse V. Sommer 0.10000%</p> <p>Jeffery A. Lyslo 0.10000%</p> <p>Edward S. Smida 0.06250%</p> <p>Edward Y. Teng 0.06250%</p> <p>Colby VanDenburg 0.02500%</p> <p>Patricia M. Reed 0.02500%</p> <p>Mathew X. Furin 0.10000%</p> <p>GMT Exploration Company LLC 0.83333%</p>

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20	State of AK ADL 391398	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2009	<p>Tract 433</p> <p>T. 013N., R. 004E., Umiat Meridian, Alaska.</p> <p>Section 3, Protracted, All tide and submerged lands shoreward of the line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 122.50 acres;</p> <p>Section 4, Protracted, All tide and submerged lands shoreward of the line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 448.61 acres;</p> <p>Section 9, Protracted, All tide and submerged lands shoreward of the line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 640.00 acres;</p> <p>Section 10, Protracted, All tide and submerged lands shoreward of the line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 636.88 acres;</p>	1847.99	16.66667%	<p>William D. Armstrong 1.92500%</p> <p>Edgar Kerr 0.10000%</p> <p>Jesse V. Sommer 0.10000%</p> <p>Jeffery A. Lyslo 0.10000%</p> <p>Edward S. Smida 0.06250%</p> <p>Edward Y. Teng 0.06250%</p> <p>Colby VanDenburg 0.02500%</p> <p>Patricia M. Reed 0.02500%</p> <p>Mathew X. Furin 0.10000%</p> <p>GMT Exploration Company LLC 0.83333%</p>
21	State of AK ADL 391399	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2009	<p>Tract 434</p> <p>T. 013N., R. 004E., Umiat Meridian, Alaska.</p> <p>Section 5, Protracted, All tide and submerged lands shoreward of the line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 638.84 acres;</p> <p>Section 6, Protracted, All tide and submerged lands shoreward of the line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 625.00 acres;</p> <p>Section 7, Protracted, All tide and submerged lands shoreward of the line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 527.77 acres;</p> <p>Section 8, Protracted, All tide and submerged lands shoreward of the line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 640.00 acres;</p> <p>T. 014N., R. 004E., Umiat Meridian, Alaska.</p> <p>Section 31, Protracted, All tide and submerged lands shoreward of the line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 448.56 acres;</p> <p>Section 32, Protracted, All tide and submerged lands shoreward of the line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 138.55 acres;</p>	3118.72	16.66667%	<p>William D. Armstrong 1.92500%</p> <p>Edgar Kerr 0.10000%</p> <p>Jesse V. Sommer 0.10000%</p> <p>Jeffery A. Lyslo 0.10000%</p> <p>Edward S. Smida 0.06250%</p> <p>Edward Y. Teng 0.06250%</p> <p>Colby VanDenburg 0.02500%</p> <p>Patricia M. Reed 0.02500%</p> <p>Mathew X. Furin 0.10000%</p> <p>GMT Exploration Company LLC 0.83333%</p>

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22	State of AK ADL 391400	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2009	Tract 437  T. 013N., R. 004E., Umiat Meridian, Alaska.  Section 17, Protracted, All tide and submerged lands, 640.00 acres; Section 18, Protracted, All tide and submerged lands shoreward of the line fixed by coordinates found in Exhibit A of the Final Decree in U.S. v. Alaska, No. 84 Original, 630.00 acres; Section 19, Protracted, All tide and submerged lands, 633.00 acres; Section 20, Protracted, All tide and submerged lands, 640.00 acres;	2543.00	16.66667%	William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lyslo 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furin 0.10000% GMT Exploration Company LLC 0.83333%
23	State of AK ADL 391162	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2007	Tract B52006A-436  T. 13 N., R. 4 E., Umiat Meridian, Alaska.  Section 15, Protracted, All, 640.00 acres; Section 16, Protracted, All, 640.00 acres; Section 21, Protracted, All, 640.00 acres; Section 22, Protracted, All, 640.00 acres;	2560.00	16.66667%	Pingo Oil & Gas, L.P. 0.50000% AVCG, LLC 1.70833% Bow Valley Alaska Co. 0.16667% TG World Energy, Inc. 0.62500% Ramshorn Investments 0.33333%
24	State of AK ADL 391161	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2007	Tract B52006A-435  T. 13 N., R. 4 E., Umiat Meridian, Alaska.  Section 13, Protracted, All, 640.00 acres; Section 14, Protracted, All, 640.00 acres; Section 23, Protracted, All, 640.00 acres; Section 24, Protracted, All, 640.00 acres;	2560.00	16.66667%	Pingo Oil & Gas, L.P. 0.50000% AVCG, LLC 1.70833% Bow Valley Alaska Co. 0.16667% TG World Energy, Inc. 0.62500% Ramshorn Investments 0.33333%
25	State of AK ADL 391394	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2009	Tract: 421  T. 013N., R. 005E., Umiat Meridian, Alaska.  Section 14, Unsurveyed, All tide and submerged lands, 163.42 acres;  T. 013N., R. 005E., Tract A, Umiat Meridian, Alaska.  Section 13, Unsurveyed, All uplands, including the bed of the Elaktoveach Channel, 640.00 acres; Section 14, Unsurveyed, All uplands, 476.58 acres; Section 23, Unsurveyed, All, 640.00 acres; Section 24, Unsurveyed, All, 640.00 acres;	2560.00	16.66667%	William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lyslo 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furin 0.10000% GMT Exploration Company LLC 0.83333%

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26	State of AK ADL 391458	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	6/1/2009	Tract 1210  T. 013N., R. 006E., Tract A, Umiat Meridian, Alaska.  Section 17, Surveyed by protraction, All, 640.00 acres; Section 18, Surveyed by protraction, All, including the bed of the Elaktoveach Channel, 631.00 acres; Section 19, Surveyed by protraction, All, including the bed of the Elaktoveach Channel, 633.00 acres; Section 20, Surveyed by protraction, All, including the beds of the Elaktoveach Channel and the Colville River, 640.00 acres;	2544.00	16.66667%	William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lyslo 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furin 0.10000% GMT Exploration Company LLC 0.83333%
27	State of AK ADL 391457	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	6/1/2009	Tract 1209  T. 013N., R. 006E., Tract A, Umiat Meridian, Alaska.  Section 15, Surveyed by protraction, All, including the bed of the Colville River, 640.00 acres; Section 16, Surveyed by protraction, All, including the bed of the Colville River, 640.00 acres; Section 21, Surveyed by protraction, All, including the bed of the Colville River, 640.00 acres; Section 22, Surveyed by protraction, All, including the bed of the Colville River, 640.00 acres;	2560.00	16.66667%	William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lyslo 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furin 0.10000% GMT Exploration Company LLC 0.83333%
28	State of AK ADL 391388	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2009	Tract: 414  T. 013N., R. 006E., Umiat Meridian, Alaska.  Section 13, Surveyed by Protraction, All including the beds of the Colville River and the Kupigruak Channel, 640.00 acres; Section 14, Surveyed by Protraction, All including the bed of the Colville River, 640.00 acres; Section 23, Surveyed by Protraction, All including the bed of the Colville River, 640.00 acres; Section 24, Surveyed by Protraction, All including the beds of the Colville River and the Kupigruak Channel, 640.00 acres;	2560.00	16.66667%	William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lyslo 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furin 0.10000% GMT Exploration Company LLC 0.83333%

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29	State of AK ADL 391459	Pioneer Natural Resources Alaska, Inc.	100%	5/1/2009	Tract 1211  T. 013N., R. 006E., Tract B, Umiat Meridian, Alaska.  Section 25, Unsurveyed, All, including that portion of ASLS 88-37 Lot 1 within Section 25 and the beds of the Colville River and Kupigruak Channel, 640.00 acres; Section 26, Unsurveyed, All, including the bed of the Colville River, 640.00 acres; Section 35, Unsurveyed, All, including the bed of the Colville River, 640.00 acres; Section 36, Unsurveyed, All, including that portion of ASLS 88-37 Lot 1 within Section 36 and the bed of the Kupigruak Channel, 640.00 acres;	2560.00	16.66667%	0.000000%
30	State of AK ADL 391460	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	6/1/2009	Tract 1212  T. 013N., R. 006E., Tract A, Umiat Meridian, Alaska.  Section 27, Surveyed by protraction, All, including the beds of the Colville River and the unnamed lake, 640.00 acres; Section 28, Surveyed by protraction, All, including the bed of the Colville River, 640.00 acres; Section 33, Surveyed by protraction, All, including the beds of the Colville River and the unnamed lake, 640.00 acres; Section 34, Surveyed by protraction, All, including the bed of the Colville River, 640.00 acres;	2560.00	16.66667%	William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lyslo 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furin 0.10000% GMT Exploration Company LLC 0.83333%
31	State of AK ADL 391461	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	6/1/2009	Tract 1213  T. 013N., R. 006E., Tract A, Umiat Meridian, Alaska.  Section 29, Surveyed by protraction, All, including the beds of the Colville River and the Elaktoveach Channel, 640.00 acres; Section 30, Surveyed by protraction, All, including the bed of the Elaktoveach Channel, 636.00 acres; Section 31, Surveyed by protraction, All, including the beds of the Elaktoveach Channel and the unnamed lake, 639.00 acres; Section 32, Surveyed by protraction, All, including the beds of the Colville River and the Elaktoveach Channel, 640.00 acres;	2555.00	16.66667%	William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lyslo 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furin 0.10000% GMT Exploration Company LLC 0.83333%

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32	State of AK ADL 391456	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	6/1/2009	Tract 1208  T. 013N., R. 005E., Tract A, Umiat Meridian, Alaska.  Section 25, Unsurveyed, All, including the beds of all meanderable waterbodies, 640.00 acres;	640.00	16.66667%	William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lyslo 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furin 0.10000% GMT Exploration Company LLC 0.83333%
33	State of AK ADL 391401	ConocoPhillips Alaska, Inc. Anadarko Petroleum Co.	78.00% 22.00%	9/1/2009	Tract 438  T. 013N., R. 004E., Umiat Meridian, Alaska.  Section 26, Unsurveyed, All tide and submerged lands, 595.97 acres,	595.97	16.66667%	0.0000000%
34	State of AK ADL 391163	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2007	Tract BS2006A-438 T. 13 N., R. 4 E., Tract A, Umiat Meridian, Alaska.  Section 26, Unsurveyed, All uplands, 44.03 acres;	44.03	16.66667%	Pingo Oil & Gas, L.P. 0.50000% AVCG, LLC 1.70833% Bow Valley Alaska Co. 0.16667% TG World Energy, Inc. 0.62500% Ramshorn Investments 0.33333%
35	State of AK ADL 391164	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2007	Tract BS2006A-439 T. 13 N., R. 4 E., Umiat Meridian, Alaska.  Section 27, Protracted, All, 610.29 acres; Section 28, Protracted, All, 603.49 acres;  T. 13 N., R. 4 E., Tract A, Umiat Meridian, Alaska.  Section 27, Unsurveyed, All uplands, 29.71 acres; Section 28, Unsurveyed, All uplands, 36.51 acres;	1280.00	16.66667%	Pingo Oil & Gas, L.P. 0.50000% AVCG, LLC 1.70833% Bow Valley Alaska Co. 0.16667% TG World Energy, Inc. 0.62500% Ramshorn Investments 0.33333%

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36	State of AK ADL 391304	ConocoPhillips Alaska, Inc. Anadarko Petroleum Co.	78.00% 22.00%	8/1/2008	Tract 440 T. 13N., R. 4E., Umiat Meridian, Alaska.  Section 29, Protracted, All, 640.00 acres; Section 30, Protracted, All, 636.00 acres; Section 31, Protracted, All, 639.00 acres; Section 32, Unsurveyed, All tide and submerged lands, 495.00 acres;  T. 13N., R. 4E., Tract A, Umiat Meridian, Alaska.  Section 32, Surveyed, All uplands, including the bed of the Colville River, 145.00 acres;	2555.00	16.66667%	0.000000%
37	State of AK ADL 391451	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	6/1/2009	Tract 1147 T. 012N., R. 006E., Umiat Meridian, Alaska.  Section 5, Surveyed by protraction, All, 640.00 acres; Section 6, Surveyed by protraction, All, 577.00 acres; Section 7, Surveyed by protraction, All, 580.00 acres; Section 8, Surveyed by protraction, All, 640.00 acres;	2437.00	16.66667%	William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lyslo 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furin 0.10000% GMT Exploration Company LLC 0.83333%
38	State of AK ADL 391450	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	6/1/2009	Tract 1146 T. 012N., R. 006E., Umiat Meridian, Alaska.  Section 3, Surveyed by protraction, All, 640.00 acres; Section 4, Surveyed by protraction, All, 640.00 acres; Section 9, Surveyed by protraction, All, 640.00 acres;	1920.00	16.66667%	William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lyslo 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furin 0.10000% GMT Exploration Company LLC 0.83333%
39	OPEN	OPEN	100.00%	-	T. 012 N., R 006E., Umiat Meridian, Alaska Section 1, All Section 2, All	1280.00	-	-
40	OPEN	OPEN	100.00%	-	T. 012 N., R 006E., Umiat Meridian, Alaska Section 10, All Section 11, All	1280.00	-	-

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41	State of AK ADL 391449	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	6/1/2009	Tract 1145  T. 012N., R. 006E., Umiat Meridian, Alaska.  Section 12, Surveyed by protraction, All, including the beds of the Colville River and Kupigruak Channel and excluding U.S. Survey 9124, 638.13 acres;  U.S. Survey. That portion of U.S. Survey 9124 located in Section 12, 1.87 acres;	640.00	16.66667%	William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lyslo 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furin 0.10000% GMT Exploration Company LLC 0.83333%
42	State of AK ADL 391452	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	6/1/2009	Tract 1148  T. 012N., R. 006E., Umiat Meridian, Alaska.  Section 13, Surveyed by protraction, All, 640.00 acres; Section 14, Surveyed by protraction, All, 640.00 acres; Section 23, Surveyed by protraction, All, 640.00 acres; Section 24, Surveyed by protraction, All, 640.00 acres;	2560.00	16.66667%	William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lyslo 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furin 0.10000% GMT Exploration Company LLC 0.83333%
43	State of AK ADL 391453	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	6/1/2009	Tract 1149  T. 012N., R. 006E., Umiat Meridian, Alaska.  Section 15, Surveyed by protraction, All, 640.00 acres; Section 16, Surveyed by protraction, All, 640.00 acres; Section 21, Surveyed by protraction, All, 640.00 acres; Section 22, Surveyed by protraction, All, 640.00 acres;	2560.00	16.66667%	William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lyslo 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furin 0.10000% GMT Exploration Company LLC 0.83333%

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44	State of AK ADL 391454	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	6/1/2009	Tract 1150  T. 012N., R. 006E., Umiat Meridian, Alaska.  Section 17, Surveyed by protraction, All, 640.00 acres; Section 18, Surveyed by protraction, All, 583.00 acres; Section 19, Surveyed by protraction, All, 585.00 acres; Section 20, Surveyed by protraction, All, 640.00 acres;	2448.00	16.66667%	William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lyslo 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furin 0.10000% GMT Exploration Company LLC 0.83333%
45	State of AK ADL 391455	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	6/1/2009	Tract 1153  T. 012N., R. 006E., Umiat Meridian, Alaska.  Section 29, Surveyed by protraction, All, 640.00 acres; Section 30, Surveyed by protraction, All, 588.00 acres; Section 31, Surveyed by protraction, All, 591.00 acres; Section 32, Surveyed by protraction, All, 640.00 acres;	2459.00	16.66667%	William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lyslo 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furin 0.10000% GMT Exploration Company LLC 0.83333%
46	State of AK ADL 391322	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	8/1/2008	Tract 1152  T. 012N., R. 006E., Umiat Meridian, Alaska.  Section 27, Surveyed by Protraction, All including the bed of the Colville River, 640.00 acres; Section 28, Surveyed by Protraction, All including the bed of the Colville River, 640.00 acres; Section 33, Surveyed by Protraction, All including the bed of the Colville River, 640.00 acres; Section 34, Surveyed by Protraction, All, 640.00 acres;	2560.00	16.66667%	William D. Armstrong 0.36443% Edgar Kerr 0.05010% Jesse V. Sommer 0.05010% Jeffery A. Lyslo 0.05010% Edward S. Smida 0.03131% Edward Y. Teng 0.03131% Colby VanDenburg 0.01253% Patricia M. Reed 0.01253% Mathew X. Furin 0.05010% GMT Exploration Company LLC 0.41750% AVCG, LLC 1.66333%

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TO THE QUGRUK UNIT AGREEMENT DATED SEPTEMBER 13, 2011

47	State of AK ADL 391553	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	7/1/2010	Tract 1151  T. 012N., R. 006E., Umiat Meridian, Alaska.  Section 25, Surveyed by Protraction, All, including the bed of the Miluweach River, 640.00 acres; Section 26, Surveyed by Protraction, All, including the bed of the Colville River, 640.00 acres; Section 35, Surveyed by Protraction, All, 640.00 acres; Section 36, Surveyed by Protraction, All, including the bed of the Miluweach River, 640.00 acres;	2560.00	16.66667%	William D. Armstrong 1.92500% Edgar Kerr 0.10000% Jesse V. Sommer 0.10000% Jeffery A. Lysio 0.10000% Edward S. Smida 0.06250% Edward Y. Teng 0.06250% Colby VanDenburg 0.02500% Patricia M. Reed 0.02500% Mathew X. Furrin 0.10000% GMT Exploration Company LLC 0.83333%
48	State of AK ADL 391445	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	6/1/2009	Tract 1048  T. 011N., R. 006E., Umiat Meridian, Alaska.  Section 5, Surveyed by protraction, All, including the beds of all meanderable waterbodies, 640.00 acres; Section 6, Surveyed by protraction, All, including the bed of the Colville River and all meanderable waterbodies, 599.00 acres; Section 7, Surveyed by protraction, All, including the bed of the Colville River and all meanderable waterbodies, 596.00 acres; Section 8, Surveyed by protraction, All, including the beds of all meanderable waterbodies, 640.00 acres;	2469.00	16.66667%	William D. Armstrong 0.96443% Edgar Kerr 0.05010% Jesse V. Sommer 0.05010% Jeffery A. Lysio 0.05010% Edward S. Smida 0.03131% Edward Y. Teng 0.03131% Colby VanDenburg 0.01253% Patricia M. Reed 0.01253% Mathew X. Furrin 0.05010% GMT Exploration Company LLC 0.41750% AVCG, LLC 1.66333%
49	State of AK ADL 391320	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	8/1/2008	Tract 1051  T. 011N., R. 006E., Umiat Meridian, Alaska.  Section 17, Surveyed by Protraction, All including the bed of the Kachemach River, 640.00 acres; Section 18, Surveyed by Protraction, All including the bed of the Kachemach River, 599.00 acres; Section 19, Surveyed by Protraction, All including the bed of the Kachemach River, 601.00 acres; Section 20, Surveyed by Protraction, All including the bed of the Kachemach River, 640.00 acres;	2480.00	16.66667%	William D. Armstrong 0.96443% Edgar Kerr 0.05010% Jesse V. Sommer 0.05010% Jeffery A. Lysio 0.05010% Edward S. Smida 0.03131% Edward Y. Teng 0.03131% Colby VanDenburg 0.01253% Patricia M. Reed 0.01253% Mathew X. Furrin 0.05010% GMT Exploration Company LLC 0.41750% AVCG, LLC 1.66333%

**ATTACHMENT 2: Proposed Qugruk Unit Exhibit B**



**ATTACHMENT 3: Proposed Qugruk Unit Exhibit G**

Exhibit "G"

Attached to and made a part of that certain QUGRUK Unit Agreement  
dated effective September 13, 2011

RECEIVED

SEP 21 2011

INITIAL PLAN OF EXPLORATION

COLVILLE RIVER DELTA, ALASKA

DIVISION OF  
OIL AND GAS

Outlined below is the initial Plan of Exploration for the proposed Qugruk Unit. The proposed Unit will encompass 98,851.59 acres of State land within the Colville Delta and shallow waters of Harrison Bay, Alaska. The proposed Unit is located between the Colville River Unit to the south and west, the Ooguruk Unit to the south and east and the proposed Placer and South Miluveach Units to the south. The northern limit of the proposed Unit is defined by the boundary between State waters and the Federal OCS. The Plan of Exploration is a 1 year forecast of planned unit exploration activities. Prospective intervals to be tested by this exploration program include but are not limited to the Cervelo, Judy Creek, Nechelik, Nuiqsut and Alpine sandstones within the Jurassic Kingak Shale, and the Cretaceous Kuparuk C sandstone (Kup "C"), Torok Formation and Nanushuk Group.

**Prior Exploration Activities**

The area surrounding the proposed Unit has been the site of numerous exploratory wells, including six wells that were drilled within the proposed Unit outline. The exploratory activity can be divided into four distinct phases with each phase dominated by different operators. Early exploration was focused on Ellesmerian structural targets, while later exploration focused on Jurassic and Cretaceous combination stratigraphic/structural traps.

The earliest exploration in the area occurred during the period that resulted in the discovery of the giant Prudhoe Bay and Kuparuk River Fields and includes one of the earliest wells drilled on State Lands on the North Slope. The Union Oil Co. of California Kookpuk #1 was drilled in 1966 to a total depth of 10,193' in Franklinian basement rocks. The well encountered weak to moderate mudlog oil shows in the Cretaceous Tuluvak Formation, the Triassic Sag River Sandstone, Shublik Formation and Ivishak Sandstone, and the Permo-Penn Lisburne Group. None of the show intervals appear productive based on wireline logs and no tests were run. In retrospect perhaps the most significant aspect of the Kookpuk #1 is that it encountered positionally distal silts and very fine sands within the Nuiqsut interval of the Jurassic Kingak Shale giving the first hint of the Jurassic potential for the area. The Gulf Oil Corp. Colville Delta State #1 was drilled next in 1970 to a total depth of 9,299', just penetrating the top of the Mississippian Endicott Group. Mudlog oil shows were noted in the Tuluvak Formation, the Cretaceous Nanushuk Group, the Sag River Sandstone, the Ivishak Sandstone and the Lisburne Group. Two of the show intervals were tested. The first test was the Ivishak which recovered 114 BPD of muddy formation water with a trace of oil. The second zone tested was a silty/sandy interval near the top of the Nanushuk Group. The zone would not flow and only .06 barrels of 20.8° API oil and water were recovered during reverse out. The zone was then acidized and swabbed dry to 3,800'. None of the untested show intervals appear productive based on wireline logs. The Nuiqsut sand was not present due to erosion by the LCU and the Nechelik sand was shaled out in the Colville Delta State #1. The J-2 interval of the Kingak Shale was encountered in a positionally distal setting and consisted primarily of siltstone, similar to the Nuiqsut interval in the Kookpuk #1 well.

The next phase of exploration in the proposed Unit area was in the early to mid-1980's and was predominantly conducted by Texaco with Sohio and Amerada Hess also drilling one well each. The Sohio Nechelik #1 was drilled in 1982 to the Lisburne Group and reached a total depth of 10,018'. Two thin sands (19' to 24' in thickness) within the Nanushuk Group, including what is now informally named the Qannik sand, appeared to have oil saturation but were not tested. The well also found approximately 60' of sand in the upper portion of the Jurassic Kingak Shale that is now informally named the Nechelik sand. Although the Nechelik sand had shows and was cored it was also not tested. None of the deeper objectives appeared to have oil saturation and no tests were conducted.

The Texaco Colville Delta #1 was drilled in 1985 to a depth of 9,457' in the Endicott Group and was the discovery well for the Nuiqsut sand interval of the Jurassic Kingak Shale. A number of zones with mudlog shows were tested. The first test was of siltstones at the top of the Endicott Group and only 1.5 barrels of mud were recovered during reverse circulation. Two tests were run in the Ivishak sands. The first was from the lower portion of the Ivishak and recovered 29 barrels of mud and water during reverse circulation. The upper Ivishak was then tested and recovered 70 barrels of water. Two tests were also run in the Sag River sandstone; the first test recovered only 2 barrels of mud during reverse circulation. The same zone was then reperforated and retested with 2 barrels of mud recovered. The Nuiqsut sand in the Colville Delta #1 has 144' of net pay and three separate intervals were tested. The lower interval of the Nuiqsut tested at a rate of 31 BPD of 22.7° API oil. It was then acidized and produced at a rate of 25 to 100 BOPD on nitrogen lift. The middle zone of the Nuiqsut produced at a rate of 30 BPD of 17.7° API oil on nitrogen lift. The upper portion of the Nuiqsut has the best sand development and tested rates of 373 to 1075 BPD of 25° API oil with a GOR of 400-500 after fracture treatment. A sidetrack, the Colville Delta #1A was also drilled in 1985 through the Nuiqsut interval in order to acquire whole core of the Nuiqsut sand.

In 1986 Texaco followed-up on the Nuiqsut discovery drilling the Colville Delta #2 and Colville Delta #3. The Colville Delta #2 was drilled to a depth of 6,800' just through the base of the Nuiqsut sand. The Nuiqsut was perforated over a 178' interval and after two fracture treatments flowed at a rate of 200 to 800 BOPD. The Moraine sand interval of the Cretaceous Torok formation was also tested and flowed 44 barrels of water with a trace of oil. The Colville Delta #3 was drilled to the base of the Nuiqsut sand for a total depth of 6,800'. The Nuiqsut sand was tested and flowed 290 BOPD after fracture treatment. The Moraine sand was also tested and flowed 235 barrels of 16-20° API oil after fracture treatment. Also in 1986 Amerada Hess drilled the Colville Delta #25-1 to a depth of 6,871', about 100' below the base of the Nuiqsut. Specific information for the Nuiqsut test is not available in the State files; however, the completion report indicates that the Nuiqsut flowed at an average rate of 159 barrels of 25° API oil with a GOR of 200 to 835 SCF/STB. A 21' thick sand with mudlog shows was encountered in the Kup "C" but was not tested.

The next phase of exploration in the area of the proposed Unit began in the early 1990's continuing through the early 2000's and was largely conducted by Arco Alaska. Starting in 1992 Arco drilled the Kalubik #1 and Fiord #1. The Kalubik #1 was drilled to a depth of 8,273' in the Ivishak and the Fiord #1 was drilled to a depth of 10,250' in the Lisburne Group; however, no significant shows were encountered in either well below the upper portion of the Kingak Shale. Three zones were tested in the Kalubik #1, the Nuiqsut, the Kup "C" and the Moraine sand. The Nuiqsut flowed 410 BPD of 19.7° API oil after fracture treatment. The Kup "C" contained 38' of sand and tested 1220 BPD of 25.5° API oil. The Moraine sand flowed 146 BW and 4.5 barrels of 17-24° API oil in a 12.5 hour period. The Fiord #1 is considered the discovery well for the Fiord Field Nechelik and Kup "C" sands. A well test of the Kuparuk "C" sand flowed 1,065 BOPD of 33° API oil. The Nechelik sand was also tested and flowed 180 BOPD of

28° API oil. The Nuiqsut sand was encountered in a positionally distal position with poor sand development and no shows reported on the mudlog. Oil shows from the Nanushuk sands were noted on the mudlog for the Fiord #1; however, poor quality wireline logs make evaluation difficult and the zone was not tested.

In 1993 Arco drilled 4 wells, the Kuukpak #3, Till #1, Colville River #1 and PB1 and Exxon drilled the Thetis Island #1. All of the Arco wells were drilled to the upper Kingak Shale except the Colville River PB1 which was drilled to the Kup "C". The Kuukpak #3 tested four zones, the Nuiqsut sand, Kup "C" sand, lower Torok Formation, and the Tuluvak Formation. The Nuiqsut had a final flowing rate on nitrogen lift of 24 BOPD after fracture treatment. The Kup "C" had a final rate of 20 BPD of 23° API oil also on nitrogen lift. Engineering analysis and petrophysical evaluation of wireline logs indicates that the tests are not indicative of true productive capability due to formation damage. A DST of a 56' thick sand in the lower Torok Formation flowed 90 BWPD on nitrogen lift and a DST of a 26' thick sand in the Tuluvak Formation flowed intermittently on nitrogen lift an unspecified amount of an oil, water and mud mixture. The oil gravity was approximately 21° API. The main zone of interest for the Till #1 and Colville River #1 is the Nuiqsut sand. The Nuiqsut is fairly well-developed in the Till #1 with 63' of net pay and good mudlog shows but was not tested. The Nuiqsut in the Colville River #1 is positionally distal and is becoming siltier with poorer mudlog shows. No other zones of particular interest were present in the Till #1, Colville River #1, or Colville River PB1 wells and no tests were run.

The Exxon Thetis Island #1 was drilled to a depth of 8,460' in the Ivishak. A DST was run over a gross interval from 6,356' to 6,450' that included two sands, the Nuiqsut with 47' of net pay and a 5' thick sand that correlates to the Jurassic Alpine "C" sand. After acidization the well flowed at an average rate of 154 BPD of 23.8° API oil. A wireline test of the Moraine sand recovered an unspecified amount of mud filtrate with a trace of oil. The Thetis #1 encountered the Jurassic J-2 interval in the most positionally updip setting of all the wells drilled to that point. The J-2 contained occasional siltstone with rare very fine-grained sandstone. There were no oil indicators, but the mudlog had a significant gas increase. No other significant show zones were encountered.

In 1994 Arco drilled the Fiord #2 to a depth of 8,400' just below the base of the Nuiqsut sand. Despite the presence of three zones of interest no tests were run. The deepest zone of interest is the Nuiqsut sand which is finer grained and has lower porosity than in wells located to the east but still has over 65' of sand and good mudlog oil shows. Calculations from wireline logs also indicate potentially movable hydrocarbons. About 150' above the Nuiqsut is a 6' sand with excellent mudlog shows that correlates to the Alpine "C" sand that is being produced at Alpine Field. Since the Fiord #2 was drilled prior to the official discovery for the Alpine Field the significance of the sand was not recognized and it was not tested. The final zone of interest is the Tuluvak Formation at a depth of 2,860' MD. Strong mudlog shows were encountered from sands at the top of the Tuluvak; however the shallow depth and colder temperatures make produceability problematic.

Arco drilled the Fiord #3 and #3A in 1995 to depths of 7,030' and 9,147' respectively. Both wells penetrated just the upper portion of the Nuiqsut sand have only partial coverage with wireline logs, precluding meaningful evaluation other than to note that the Nuiqsut had good mudlog oil shows in both wells. The Alpine sand has 20' of net pay in the Fiord #3 and 51' of net pay in the Fiord #3A with excellent mudlog oil shows in both wells. Although neither well was tested they would almost certainly be productive based on the comparison of wireline log calculations to producing wells at Alpine Field. In 2010 ConocoPhillips drilled the Colville River Unit CD 1-15 as a horizontal production test located about a half mile west of the Fiord #3A. This well is still within the confidentiality period and no information is

available. The Fiord #3 had good mudlog shows from sands in the middle and lower portions of the Torok Formation that were not tested. Although the Fiord #3A is located less than a mile away the equivalent Torok zones were not well developed and had very poor mudlog shows. The Nanushuk Group and the Tuluva Formation had very good mudlog shows in both the Fiord #3 and #3A, although they were also not tested in either well. The Tuluva Formation would have the same concerns about depth and temperature as in the Fiord #2.

The Arco Temptation #1 and #1A were drilled in 1996 to test the western extent of the Nechelik sand. The wells encountered 9' and 6' respectively of Kup "C" sand with mudlog oil shows and approximately 80' and 100' respectively of Nechelik sand with mudlog oil shows. Neither well was tested but the Temptation #1 cored the Kup "C" and Nechelik intervals. Both wells had strong mudlog oil shows throughout the Nanushuk Group with two well-developed sand benches approximately 22' to 27' each in thickness present.

In 1998 Arco's focus of exploration shifted back towards the east with the drilling of the Kalubik #2 and Kalubik #3. The Kalubik #2 was only drilled to a depth of 5,650' in the lower portion of the Torok Formation. It was drilled about a mile southwest of the Kalubik #1 in a structurally updip position to follow up on the shows encountered from the Moraine sand in that well. Good mudlog oil shows were encountered from the Moraine sand and the zone was cored but not tested. No other significant shows were encountered. The Kalubik #3 is the key well for the Jurassic J-2 interval. Drilled to a depth of 7,000' in the Kingak Shale it penetrates the J-2 interval in the most positionally updip position of any of the wells drilled in the area. The J-2 consists of thinly bedded sands and siltstones in the Kalubik #3 with mudlog oil shows throughout. At the top of the J-2 interval is a 12' thick, clean sand that we have informally named the Judy Creek sand that had very good mudlog oil shows that appears productive based on wireline log calculations. Above the J-2 interval the Nuiqsut is encountered in a position where it is nearly entirely eroded by the LCU. The Nuiqsut contains 15' of net pay with good mudlog oil shows overlain by 9' of Kup "C" sand. No zones of interest were encountered above the Kup "C" sand and no tests were run in any zones.

In 1999 Arco drilled the Fiord #4, Fiord #5 and Fiord #5PB1 wells to further delineate the Nechelik and Kup "C" sands at Fiord Field. The Fiord #4 encountered approximately 90' of oil saturated Nechelik sand that was not tested but is almost certainly productive based on comparison to wireline log calculations for known productive wells and results from MDT's. Two sand benches in the Nanushuk Group were present with thicknesses of 11' and 36' and good mudlog oil shows. Fair mudlog oil shows were encountered from silty sands in the lower portion of the Torok Formation. The Kup "C" sand was only about a foot thick. The Fiord #5 found oil saturated sand in both the Kup "C" (~15' thick) and Nechelik (~128' thick). The Nechelik sand was tested and flowed 1,400 BOPD of 29° API oil. A second test was run commingling the Nechelik sand with the Kup "C" sand. The second test flowed 2,500 BOPD of 30.5° API oil. Again, mudlog oil shows were noted throughout the Nanushuk Group with 5 sand benches present ranging in thickness from 10' to 20'. A sidetrack to the Fiord #5, the Fiord #5PB1 was drilled for the purpose of acquiring a whole core of the Nechelik sand. The Jurassic J-2 interval was not penetrated in either well and the Nuiqsut sand was not present due to erosion by the LCU. The most important wells for demonstrating the potential for the Nanushuk Group within the proposed Unit were the Nigliq #1 and #1A wells drilled in 2001. The Nechelik sand was well developed in both wells but the Kup "C" sand was not present in either well. Both wells encountered 3 benches of sand within the Nanushuk Group that were approximately 30' to 40' each in thickness and were oil saturated based on wireline logs and mudlogs. Rotary sidewall cores were taken in each of the 3 benches in the Nigliq #1A but neither well was tested. The Jurassic J-2 interval was not penetrated in either well.

The next phase of exploration in the area of the proposed Unit began in 2003 and was primarily conducted by Pioneer Exploration and Kerr McGee, both in partnership with Armstrong Alaska. Pioneer drilled the Ivik #1 to a depth of 6,943' and the Ooguruk #1 to a depth of 6,900'; about 340' and 220' below the base of the Nuiqsut sand respectively. The Nuiqsut sand had 100' of net pay in the Ivik #1 and 65' of net pay in the Ooguruk #1 with good mudlog oil shows in both wells. The Nuiqsut was tested in the Ivik #1 and flowed 1,300 BPD of 20° to 21° API oil. The Kup "C" sand was less than 4' thick in the Ivik #1 but was about 13' thick in the Ooguruk #1. A sample of 24.5° API oil was obtained from an MDT of the Kup "C" in the Ooguruk #1. The Moraine sand is present in both wells but appears to have a high water saturation based on wireline log calculations, weak mudlog oil shows and MDT results. No other zones of interest were encountered and no other tests conducted.

In 2004 ConocoPhillips drilled the Placer #1 and Placer #2. The Placer #1 was drilled to a depth of 7,761' in the Cretaceous Miluveach Shale and the Placer #2 to a depth of 9,118' in the lower portion of the Nuiqsut sand. Although the Nuiqsut in the Placer #2 is in a fairly distal depositional setting and is mainly siltstone there is over 45' of net pay near the top of the interval with good mudlog oil shows that were not tested. The Kup "C" has about 16' of sand with very good mudlog oil shows in the Placer #1 but is not present in the Placer #2. A sample of 26.8° API oil was obtained during an MDT of the Kup "C" in the Placer #1. Both wells encountered significant mudlog gas increases in a silty interval of the Nanushuk Group but had no significant oil indicators.

Kerr McGee drilled the Tuuvaq St. #1 in 2005 to a depth of 17,630' in the Ivishak Sandstone to test a deeper structure located east of the proposed Unit. The Ivishak Sandstone and the Sag River Sandstone appear "wet" based on wireline logs and mudlogs and the Jurassic J-2, Nechelik and Nuiqsut intervals have shaled out. The Cretaceous Schrader Bluff Formation had excellent mudlog shows and helped delineate the Schrader Bluff accumulation for the Nikaitchuq Unit.

The final exploratory wells drilled that have a bearing on the proposed Unit are the Iapetus #2 drilled in 2005 and the Char #1 drilled in 2008. Both wells were drilled to the upper Jurassic Kingak Shale and found oil saturated Nechelik sand and thin, (8'-11' thick) Kup "C" sand. The Char #1 tested the Nechelik sand for an average flow rate of 280 BOPD of 28° API oil on nitrogen lift and the Kup "C" sand at an average flow rate of 3,750 BOPD of 36.6° API oil. No tests were conducted in the Iapetus #2 well. The Iapetus #2 and Char #1 wells are important for delineating the western boundary of the Nanushuk sand trend with thin (less than 10' thick) poorly developed sands. As with most of the previous wells, the Jurassic J-2 interval was not penetrated in either well.

Oil shows were encountered from sands within the shallower Nanushuk Group in nearly all wells drilled during the development of the Jurassic Alpine sand in the Colville River Unit. In 2005 ConocoPhillips took a whole core of the Qannik sand in the CD2-11, an Alpine sand injection well, in order to acquire reservoir data. The following year, 2006, the CD2-404 well was drilled as a horizontal test for the Qannik sand. The well was tested through a 3,000' slotted liner for an average rate of 1,200 BOPD of 27 to 32° API oil. In 2008 the Qannik Participating Area for the Colville River Unit was approved and there are presently 6 producing wells and 3 injection wells for the Qannik sand.

#### **Geological and Engineering Characteristics**

The primary objectives for the proposed Unit are sands within the upper portion of the Jurassic Kingak Shale, the Cretaceous Kup "C" sand and several sands within the Cretaceous Nanushuk Group. The sands within the Kingak Shale are, in ascending order, two sands within the J-2 interval informally termed the Cervelo and Judy Creek sands, the Nechelik sand, the Nuiqsut sand and the Alpine "A" and "C" sands.

The sands within the Nanushuk Group are informally termed in ascending order the Nanushuk 1, Nanushuk 2 or Qannik Sand, Nanushuk 6 and Nanushuk 7.

The depositional setting, geometry and characteristics of the Nechelik, Nuiqsut and Alpine sands are well defined from numerous well penetrations, abundant core data and seismic data. Few well penetrations exist for the J-2 sands and their characteristics are based on analogy to the other Jurassic sands and seismic data. The Judy Creek, Nechelik, Nuiqsut and Alpine "A" sands represent the high-stand systems tracts of multiple fourth-order sequences within the Kingak Shale. The Alpine "C" sand is a transgressive shoreface system that represents a reworking of the underlying Alpine "A" sand. The high-stand Jurassic sands were deposited in a lower shoreface setting on a shallow marine shelf by weak traction currents and low-density turbidity flows as part of a deltaic system that prograded from the north to the south. The resulting geometries are lobate-shaped sand bodies that are elongated in a roughly east-west orientation along depositional strike. The Cervelo and Alpine "C" sands appear to have been deposited during the transgressive systems tract resulting in narrower, linear sand bodies with a west to east strike orientation.

The Jurassic sands are fine to very fine grained, transitioning to siltstone and shale in the depositionally distal direction. They are moderately to poorly sorted, with the exception of the Alpine "C" sand, and have generally been thoroughly reworked by biogenic activity. The Alpine "C" sand is well-sorted and has significantly lower shale content. The primary influence on porosity and permeability is mechanical compaction that is more advanced in the shales and shaly sands and less significant in cleaner sands. Based on core and wireline log data the porosity ranges from 8% to 18% for the Nechelik and Nuiqsut sands and from 9% to 21% for the Alpine "A" sand. Permeability ranges from <.1 md to 50 md for the Nechelik and Nuiqsut sands and from <.1 md to 60 md for the Alpine "A" sand. The Alpine "C" sand has better reservoir quality with porosity ranging from 16% to 24% and permeability ranging from .7 md to 150 md. No core data exists for the Judy Creek sand but based on logs from the Kalubik #3, the only well to encounter clean sand in the J-2 interval, the rock properties are similar to the Alpine "A" sand. The Cervelo sand is not penetrated by any wells.

Structure for the Jurassic sands in the proposed Unit area consists of a broad southeast plunging anticline. Several prominent northwest-southeast trending normal faults are present in the proposed Unit area. These faults tend to have a down to the southwest offset in the western part of the area and a down to the northeast offset in the eastern part. A younger set of normal faults with a more northerly trend is also present, particularly in the eastern part of the proposed Unit. The trapping mechanism for the sands is predominately stratigraphic with the sands pinching out or shaling out in the downdip direction and erosional truncation by the LCU in the northern updip direction. To date no water leg has been observed for any of the Jurassic sands within the proposed Unit area. Individual sands appear to be ubiquitously oil saturated with the degree of water saturation a function of reservoir quality. Seismic coverage in the proposed Unit area consists of both 2D and 3D seismic data. Proprietary 3D seismic exists over a large portion of the proposed Unit; however, the primary 3D seismic surveys successfully licensed that cover the proposed Unit are the Fiord 3D (2000), Kalubik 3D (1997), and Big Island 3D (2007). In addition, variably spaced 2D seismic lines (approximately 0.5 to 2 mile line spacing) acquired during the 1970s to 1990s were used in areas of no 3D seismic coverage. The existing seismic data allows detailed mapping of fault patterns, truncation of individual Jurassic sands by the Lower Cretaceous Unconformity (LCU), and amplitude anomalies associated with sands.

The presence of both the Alpine "A" and Alpine "C" sands have been successfully predicted using seismic data in the Colville River Unit at Alpine Field. Amplitude variation with offset (AVO) attributes calculated

on the Big Island 3D in the southern portion of the proposed Unit show the continuation of the Alpine trend west of current development in the Colville River Unit. Seismic modeling indicates the AVO attributes are consistent with the presence of at least two Alpine "C" sand bodies developed within the more continuous Alpine "A" sand in the proposed Unit.

of laterally continuous sand across the proposed Unit. In addition, subsurface control indicates thinning of the Nechelik sand to the northeast with no sand present in the Gulf Colville Delta St. #1. Seismic amplitude variations observed on the Fiord 3D confirm this observation and indicate that the Nechelik sand thins to the northeast, ultimately pinching out approximately one mile west of the Gulf Colville Delta St. #1.

The top of the J-2 interval is characterized by a high impedance (peak) event which downlaps to the south defining the J-2 sequence shelf/slope. The Judy Creek and Cervelo sands are stratigraphically separate sands; however, seismic resolution limits the individual sand responses to amplitude variations within the J-2 peak event. The thin Judy Creek sand encountered at Kalubik #3 near the LCU subcrop has a slight positive acoustic impedance contrast and a decrease in Vp/Vs ratio relative to surrounding shales. This creates decay in seismic amplitude with offset which causes the fullstack J-2 peak to dim when sufficiently thick Judy Creek sand is present. This effect indicates the Judy Creek sand is likely to be relatively high quality in the Northern portion of the proposed Unit where it has not been eroded by the LCU.

The Cervelo sand is characterized by a laterally continuous peak amplitude anomaly roughly parallel to the J-2 shelf. No penetrations of the Cervelo sand exist. Therefore, the limits and quality of the Cervelo sand are seismically defined. Limited 2D seismic pre-stack data within the Cervelo anomaly show a strong peak in the near traces with significant amplitude decay in the far traces. Seismic modeling demonstrates that this response is consistent with sufficiently thick sand similar in quality to the Nuiqsut and Nechelik sands. The observed and modeled fullstack character of this sand produces a peak amplitude anomaly which is observed on over 50 2D seismic lines and the Fiord 3D within the proposed Unit.

Currently the Nuiqsut sand is productive in the Oooguruk Unit located to the east of the proposed Unit and the Nechelik, Alpine "A" and Alpine "C" sands are producing in the Colville River Unit to the west of the proposed Unit. All the zones are being developed by horizontal laterals with alternating producing and injection wells. The oil gravity for the Nuiqsut sand is in the low to mid-20° API range, the 28° to 30° API range for the Nechelik and 40° API for the Alpine sands.

The Kup "C" sand is one of the major reservoirs on the North Slope with a long history of production from numerous fields, most notably the Kuparuk River Field located southeast of the proposed Unit. The sands were deposited on a shallow marine shelf in paleotopographic lows that formed primarily as a result of late Jurassic and Cretaceous aged rift faulting. This depositional setting results in dramatically variable sand thicknesses and aerial extent of individual sand bodies. The sands were deposited directly above the Lower Cretaceous Unconformity (LCU), one of the major unconformities on the North Slope. The sand source for the Kup "C" appears to be older subcropping sands below the LCU. The Kup "C" sands also have a complicated diagenetic history with the degree of siderite and glauconite cementation being the primary control on reservoir quality. In areas with less cementation the Kup "C" will produce at very high rates from relatively thin sands. Based on core data the porosity for the Kup "C" ranges from 8 to 30% and the permeability ranges from <.1 md to 3,000 md.

Structure at the Kup "C" level consists of an extremely large, roughly circular, four-way closure known as the Colville High. The proposed Unit lands are located on the northwest flank of the structure but are still nearly entirely within the area of closure. The down to the northeast faults previously described primarily affect deposition of the Kup "C" sands but occasionally offset the sands. The trapping mechanism from a regional perspective is primarily structural with stratigraphy controlling the distribution of reservoir presence. Based on pressure data and well tests the potential water leg would be at about the level of structural closure.

Integration of subsurface control and various seismic attributes was used to predict Kup "C" sand within the proposed Unit. Seismic data was primarily used to define areas of accommodation on the LCU, detailed LCU subcrops, and direct sand detection using seismic amplitudes. Kup "C" sands are high impedance sands that produce a strong peak amplitude anomaly above the LCU when the sand is present. Due to interference effects of underlying subcropping units, the amplitude patterns can be complex. Therefore, deviation of amplitude anomalies near subcropping units was used in combination with interval thickening due to faulting or LCU erosion and proximity to sand prone subcropping units to predict Kup "C" sand presence.

Within the area for the proposed Unit the Cretaceous Nanushuk Group is subdivided into 9 individual zones that we have informally termed the Nanushuk 0 through Nanushuk 8. The Qannik sand that is being developed in the Colville River Unit is equivalent to the Nanushuk 2. Based on seismic data and regional subsurface mapping the Nanushuk 1, Nanushuk 2 (Qannik sand), Nanushuk 6 and Nanushuk 7 sands are prospective within the proposed Unit.

The Nanushuk sands are a series of shallow marine, top-set sands deposited as part of an eastward prograding, subaqueous delta complex. Individual sands occur as thin, elongate deposits that extend for 10 to 20 miles north-south along depositional strike. Limited core data indicates that the sands are lithic sandstones consisting primarily of quartz, chert and clay with minor amounts of potassium and plagioclase feldspar. The sands are fine to very fine grained and are well-sorted to very well-sorted. Based on wireline logs and limited core data the porosity ranges from 16% to 29% and the permeability from 1 md to 100 md.

Structure for the Nanushuk sands consists of a broad, east plunging anticline. Structural dips within the proposed Unit and the Colville River Unit are very shallow, generally less than 1°. The trapping mechanism appears to be dominantly stratigraphic with the sands pinching out or onlapping up-dip to the west and shaling out depositionally down-dip to the east. An oil-water contact is observed only for the Nanushuk 0 and Nanushuk 1.

The Nanushuk interval exhibits continuous reflectivity character with minor faulting and no significant structural deviations apparent on existing seismic data. Seismic forward modeling demonstrates a strong correlation between AVO attributes and presence of reservoir quality sand. AVO attributes were calculated on a northeast oriented 2D seismic line (WKE93-17) crossing the western portion of the proposed Unit area that had available pre-stack seismic gathers. The AVO attributes calculated on this line were consistent with offset well control and confirmed the continuity of reservoir quality Nanushuk sands north of current well control spanning the western portion of the proposed Unit.

The Nanushuk 7 seismic event on the Fiord 3D contains a strike oriented amplitude anomaly depositionally updip from the Gulf Colville #1 well, which tested minor amounts of oil from a poorly developed Nanushuk 7 sand. Seismic modeling indicates this amplitude is consistent with the presence of reservoir quality Nanushuk 7 sand immediately west of the Gulf Colville #1.

The Qannik sand currently produces within the Colville River Unit located south of the proposed Unit. There are currently 6 producing wells and 3 injection wells. The oil ranges from 27° to 32° API gravity, viscosity about 2 centipoise and a solution gas-oil ratio of approximately 404 SCF/STB. The initial reservoir pressure was approximately 1865 psia. To date the Qannik sand is the only sand that has been tested within the Nanushuk Group, however reservoir properties for the other Nanushuk sands are anticipated to be similar.

**Drilling Program**

Currently, four Exploration Wells are planned for the Qugruk Unit. All four wells will be drilled during the 2012 Winter Drilling Season. The planned locations for each of these Exploration Wells are depicted upon the CONFIDENTIAL displays submitted to the Department in support of the Qugruk Unit application. The intended bottom-hole locations and depths are set forth below. The Parties reserve the right to modify the order in which these wells are to be drilled. Following drilling of the first well, the location and drilling depth of subsequent wells may be adjusted pursuant to the results of the prior wells.

	<b>Well Name</b>	<b>Bottomhole Location</b>	<b>Depth</b>
1 <sup>st</sup> Exploration Well	Qugruk No. 1	Sec 28, T13N, R6E	7,100' TVD
2 <sup>nd</sup> Exploration Well	Qugruk No. 2	Sec 25, T13N, R5E	7,000' TVD
3 <sup>rd</sup> Exploration Well	Qugruk No. 3	Sec 31, T12N, R6E	7,150' TVD
4 <sup>th</sup> Exploration Well	Qugruk No. 4	Sec 15, T13N, R4E	8,300' TVD

**ATTACHMENT 4: Approved Qugruk Unit Leases**

ADL	WIO	%	Eff. Date	Exp. Date	Form No.	Roy. Rate	Royalty Owner
ADL 391160	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2007	8/31/2012	DOG 200604	16.66667%	State 100%
ADL 391161	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2007	8/31/2012	DOG 200604	16.66667%	State 100%
ADL 391162	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2007	8/31/2012	DOG 200604	16.66667%	State 100%
ADL 391164	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2007	8/31/2012	DOG 200604	16.66667%	Section 27: State 95.74%, ASRC 4.26%
ADL 392206	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2007	8/31/2012	DOG 200604	16.66667%	Section 28: State 99.79%, ASRC 0.21%
ADL 391398	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2009	8/31/2014	DOG 200604	16.66667%	State 100%
ADL 391397	Repsol E&P USA Inc. 70 & 148, LLC GMT Exploration Company, LLC	70.00% 22.50% 7.50%	9/1/2009	8/31/2014	DOG 200604	16.66667%	State 100%

**Attachment 5:  
Approved Qugruk Unit Boundary**

