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POTENTIAL FOR INFRASTRUCTURE IMPROVEMENTS IN ALASKA

To truly evaluate the potential infrastructure needs and benefits relating to the North Slope in Alaska, it is crucial to appreciate the short and long-term resource potential in the region. In that vein, it is also vital to consider the various projects that are in development currently as well as those projects that have the potential for production in the near term. Of course, any discussion regarding the resource recovery potential in Alaska must contemplate areas and regions that are currently unavailable for resource extraction, but that could become available for exploration and development in the future. Finally, analysis regarding the potential of oil and gas projects in Alaska must be coupled with an understanding of the nation's long term energy needs, particularly the ongoing demand for traditional energy sources in the decades to come. In other words, recommendations related to potential infrastructure improvements must be placed in the context of Alaska's resource potential and our nation's resource demands moving forward.

Significance of Industry on Economy

The oil and gas industry in Alaska is the state's largest economic driver. Economic studies by university and private economic firms have historically and consistently estimated that one-third of all jobs in Alaska are generated by the oil and gas industry. Since statehood, revenues from oil and gas through royalties, production tax, property tax, and corporate income tax have generated over \$150 billion (non-inflation adjusted) and since production from the North Slope began 40 years ago, oil and gas revenues have accounted for approximately 85% of the state's unrestricted general fund.

History of North Slope Production

Early in the 20th Century, the U.S. Geological Survey (USGS) began its first surveys of Alaska's Arctic in an endeavor to discover petroleum reserves for the U.S. Navy. Although those surveys identified some potential for hydrocarbon reserves, the logistical realities related to the severe and remote Alaskan North Slope discouraged any momentum to engage in serious exploration, and serious efforts were abandoned in favor of U.S. regions that provided easier access.

In the 1960s, private companies began to display interest in the North Slope and began to conduct their own surveys. However, many of the logistical and meteorological issues remained, which resulted in imperfect data and, for the most part, these efforts proved fruitless and were ultimately abandoned.

In the Summer of 1968, exploration efforts paid off with a discovery in Prudhoe Bay that, at the time, was estimated to contain 9.6 billion barrels of oil and 26 trillion cubic feet of natural gas, which represented the most substantial and significant reserves ever discovered in North America. Despite the massive hydrocarbon reserves, the logistical realities remained a deterrence to development, raising legitimate questions concerning how to get the oil reserved to market. Discussions began regarding the potential routes for a pipeline, where, ironically, environmentalists preferred a route that went through the coastal plain of the Arctic National Wildlife Range (ANWR) and into Northern Canada, due to the fact that ANWR "had no redeeming qualities whatsoever". Complicating matters further, during the time in which producers were considering the most prudent path for an Alaskan pipeline, Congress enacted a series of significant environmental legislation, including the Clean Air Act, Clean Water Act, Coastal Zone Management Act, Endangered Species Act, Marine Mammal Protection Act and Outer Continental Shelf Lands Act. As a result, Prudhoe Bay and the soon to be constructed Trans Alaska Pipeline System (TAPS), became the most studied, observed, regulated, and litigated project in history.

Over a decade later, following the issuance of nearly 1500 federal and state permits, oil began to flow through TAPS from Prudhoe Bay to Valdez. In the nearly forty years since, over 17 billion barrels of oil have been transported from Alaska's North Slope. It should be noted that production has already vastly exceeded original estimates. During a significant period of time, Alaskan oil effectively represented approximately a quarter of America's domestic production, peaking at over 2,000,000 barrels a day. However, production has declined greatly since its peak in 1989. In 2016, production averaged 517,000 barrels per day, which represented less than six percent of this nation's domestic supply. But, there is reason for optimism that Alaska can continue to assist this nation in meeting its energy demands for future generations. Just last year, production in Alaska increased from the previous year and this historical decline can be reversed. Although the

North Slope of Alaska has already provided billions and billions of barrels of oils, there are billions and billions more that remain untapped.

Stable and/or increased production is not only important for the industry operating on the North Slope, it is also important for the downstream side of the industry; the refining sector. Alaska has three in-state refineries, supplying gasoline and diesel for Alaska drivers as well as jet fuel for Alaska's cargo hub in Anchorage, as well as the military. For refineries to continue to invest in Alaska, they need assurance that the supply of product to refine will be available, so any significant declines are a key factor in their investment decisions which impact the State and Alaskans. If refineries did not exist in Alaska, the cost of fuel would be much great.

The remainder of this discussion focuses on that potential and the role the federal government can play in helping industry reach that potential.

Current and Potential Oil and Gas Energy Projects

The following does not represent an exhaustive break-down of each and every oil and gas project on the North Slope, but hopefully will provide enough details to provide the proper context when considering both infrastructure needs and the role the North Slope has played in meeting our nation's energy demands. The majority of the descriptions that follow represent projects that are in their infancy, which is important to consider when evaluating infrastructure needs and the long-term potential of Alaska's North Slope. However, one should not discount the role that already existing development can play moving forward. The future of oil and gas production in Alaska will be a balance of maximizing aging fields while simultaneously bringing new fields online.

The Liberty oilfield contains one of the largest potential sources of new light oil production on the North Slope, with an estimated 80-130 million barrels of recoverable oil. Development of this resource will help offset declining light oil production on the North Slope and contribute to increasing the life span and efficiency of TAPS. If the project is developed, total investment is about \$1.5 billion creating 200 construction jobs with peak production estimated to be 70,000 barrels/day from a total of five production wells. Hilcorp has filed a Development and Production Plan (DPP) with the Bureau of Ocean Energy Management for the Liberty Project. The DPP plan represents the first of many steps in the permitting process, which entails multiple approvals at the local, state and federal levels. It is difficult to predict the timelines associated with getting permit approval, but even optimistic estimates would expect it would take multiple years before the process will run its course. Once each of the necessary permits have been obtained, Hilcorp will conduct a final analysis before determining whether to proceed with the project. The Liberty project calls for the construction of a self-contained island connected to land by a subsea pipeline. Located 15 miles east of Prudhoe Bay in Foggy Island Bay, Liberty Island will sit about

six miles offshore in 19 feet of water. The area is well protected from the moving polar icepack, shielded by a belt of offshore barrier islands and covered by stable “shore-fast” sea ice in winter. The proposed island is similar to other islands that have been safely developing Alaska’s offshore resources responsibly for nearly 30 years: Endicott, Northstar, Oooguruk and Nikaitchuq. The 9.3-acre, manmade Liberty Island will take an estimated two years to construct. The island will have facilities for drilling, production, production support, utilities, camp and relief-well area. The outer perimeter of the island will be heavily reinforced using proven North Slope technology. While the island location is near shore, no permanent road or causeway will connect Liberty Island to the mainland. Personnel and equipment will be transported via helicopter or boat.

Hilcorp is also moving forward with the Moose Pad Development Project, which contemplates the construction of Moose Pad and an access road located on the west side of Milne Point Road. To support new oil production wells on Moose Pad, this \$400 million investment will include approximately 275 construction jobs to install an oil production pipeline, a small tie-in pad, and new pad infrastructure. The Moose Pad Development Project relates to the Schrader Bluff reservoir on the North Slope, which is estimated to contain 10 to 20 billion barrels of oil reserves. The proposed new pad (Moose Pad) will provide Hilcorp access to approximately 7 square miles of undeveloped oil reserves within the MPU. Initial development plans for Moose Pad will include approximately 24 new wells to be drilled using directional drilling technology for the oil production wells. To increase the amount of crude oil that can be extracted from the Schrader Bluff reservoir, the new wells will include both oil production wells and enhanced oil recovery injection wells.

In recent news, partners Repsol and Armstrong Energy made the largest U.S. onshore conventional hydrocarbons discovery in three decades. The operators have been actively exploring in Alaska since 2008 and have recently experienced consecutive discoveries on the North Slope. The discoveries are located in a prospect called Horseshoe, near the North Slope village of Nuiqsut, on the edge of Alaska’s National Petroleum Reserve, commonly referred to as Pikka. The resources currently identified in this region amount to some 1.2 billion barrels of recoverable light oil. Expectations are that first production should come online in 2021, and peak output is estimated at 120,000 bpd.

Caelus Energy is a privately held independent that currently operates the Oooguruk Unit where they produce close to 5 million barrels of oil annually. They hold close to 500,000 acres of operating and exploration leases across the North Slope. Last fall the company announced the results of their two well exploration program at Smith Bay.

Caelus and its partners estimate 6-10 billion barrels of oil in place, which makes Smith Bay one of the world’s largest oil discoveries in recent years, and the largest on Alaska’s North Slope in four decades. The Smith Bay development has the potential to provide 200,000

barrels/day of light oil to TAPS, which would increase current Alaska production by 40 percent (based on 2016 flow rates) and extend the pipeline's long-term viability by reducing the average viscosity of its oil. In addition to production, a project like Smith Bay will employ thousands of Alaskans, including North Slope residents during construction and operation and will pay billions in revenue through royalties and taxes. Make no mistake, while this project has many milestones ahead, on paper is a project of national significance. Caelus owns a 75 percent working interest ownership in 26 leases covering 117,000 acres in Smith Bay.

While the project lies in State of Alaska waters, the bay is surrounded by the National Petroleum Reserve-Alaska and is approximately 125 miles from existing oil and gas infrastructure. It is estimated that project of this size and scope could cost nearly \$10 billion dollars, including all development and drilling costs. However, there are ways that the state and federal government can assist in lowering those costs and that is through strategic infrastructure development as well as expedited permitting. Two significant items that would be an asset to the residents of the North Slope as well as to the companies seeking to produce our natural resources is the funding of an access road and bridges connecting communities and developments through the NPR-A. Truly, anything the government can do to lessen the upfront development costs and permitting time will ensure this project can come online in a reasonable manner.

In addition to Smith Bay, the company is working to bring its Nuna oil development online – truly a “shovel ready” project. The company built a 22-acre drill pad and road and is looking to install facilities and flow lines over the next few years. Oil production is forecasting to peak at approximately 20,000 barrels per day, and the current projection for the project is first oil near the end of 2018.

And lastly the company will seek to drill additional exploration wells on their eastern North slope acreage. Caelus conducted hundreds of high-resolution seismic and has 2-3 exciting prospects. In total, estimates show all of these potential Caelus Energy projects would create 2100 jobs, \$34 billion in revenue to the state of Alaska, and 2 billion barrels of oil.

Earlier this year, ConocoPhillips announced the 300 million-barrel Willow discovery from a pair of exploration wells drilled in the Greater Mooses Tooth unit in early 2016. ConocoPhillips Co. is looking at a 2023 timeline to bring its new Willow discovery into production, although, as is a reoccurring theme, permitting delays create a fair degree of uncertainty for that timeline. The Willow prospect is estimated to be capable of producing up to 100,000 barrels of oil per day, with a chance for greater potential discovery as acreage nearby yet to be explored. ConocoPhillips has indicated that it has yet to determine whether to develop the field as a satellite of the Alpine field or as a standalone field. The former would be less expensive, but would produce lower volumes over a longer period of time.

The company also acquired considerable acreage in the vicinity of the discovery in a December 2016 lease sale and commissioned a 3-D seismic survey earlier this year.

ExxonMobil has started production at its Point Thomson project, its first operated project on Alaska's North Slope. Point Thomson is located on state acreage along the Beaufort Sea, 60 miles east of Prudhoe Bay and 60 miles west of the village of Kaktovik. The facilities were designed to initially produce approximately 5,000 barrels per day of condensate and 100 million standard cubic feet per day of recycled gas. By design, the recycled gas is re-injected for potential future recovery. At peak production, the facility is designed to produce up to 10,000 barrels per day of natural gas condensate and 200 million cubic feet of recycled gas. The Point Thomson reservoir holds approximately eight trillion cubic feet of natural gas and associated condensate, which is considered a premium hydrocarbon similar to kerosene or diesel and represents a quarter of the known gas on the North Slope. ExxonMobil and the working-interest owners have invested approximately \$4 billion in the development of Point Thomson production facilities through 2015. About 100 Alaskan companies have contributed to the success of the project, and thousands of people worked onsite and around the state during peak construction activity.

Again, the projects detailed above are not comprehensive, nor do they describe the many energy projects that continue to provide valuable production. Nevertheless, these projects should provide some insight and excitement regarding the potential of production moving forward. It also serves to underscore that these projects have been designed and implanted in a region that, in many ways, suffers from many of the same logistical strains that have existed for decades. It underscores the discussion below that articulates the unsettling lack of basic infrastructure in the Arctic region.

Arctic OCS and ANWR

It is impossible to discuss the resource potential, or achieving true energy independence without considering the incredible assets that remain untapped in the Arctic Outer Continental Shelf (OCS) and Arctic National Wildlife Refuge (ANWR). Surveys and analysis of the region estimate that 90 billion barrels of undiscovered, technically recoverable oil and 44 billion barrels of natural gas liquids reside in the Arctic. In total, this Arctic potential represents 22% of the Earth's undiscovered oil and natural gas. In Alaska's Arctic waters, the U.S. government conservatively estimates 26 billion barrels of oil in the Chukchi and Beaufort Seas alone. Recent economic assessments have estimated the job potential from these prospects would create almost 55,000 yearly jobs across the US over the next fifty years. Arctic OCS development could generate an annual average of 35,000 jobs in Alaska, total estimated payroll of over \$70 billion, over \$15 billion in potential cumulative revenues to the State of Alaska, and over \$4 billion in estimated property tax payments to local governments, over the next half-century. However, the potential benefits of future OCS development in the Alaskan Arctic will extend well

beyond the state. As an initial matter, OCS leases generate direct revenues to the federal government. Furthermore, the corresponding and dramatic increases in economic activity born from exploration, development, and production of OCS oil and gas resources will also generate jobs, income, and additional tax revenues to the rest of the nation.

More specifically from Alaska and the North Slope Borough's perspective, there are three categories of direct revenues that would potentially accrue. First, the State of Alaska assesses and collects property taxes on any petroleum-related property located onshore as well as collecting a corporate income tax on a defined portion of income generated by any OCS activities. Alaska property tax is estimated by determining the share of total infrastructure associated with OCS production that is located on Alaska lands. It is important to note that the majority of the taxes collected is then allocated to local jurisdictions where the infrastructure is located, with the state of Alaska keeping the remainder. Second, Alaska collects corporate income tax by calculating the percentage of worldwide corporate profits attributable to activities in Alaska. Invariably, vigorous and successful OCS activity would result in an increase in worldwide profits for those companies operating in the Alaska OCS. Finally, Alaska would also receive a share of bonuses and lease revenues on federal tracts between three and six miles offshore. Of course, this discussion does not even contemplate the many other positive externalities that would be categorized as non-petroleum revenues, such as those revenues generated from non-petroleum business activity supportive of OCS development as well as household income resulting from OCS development. It is also important to consider the indirect revenues associated with Alaska OCS development, such as increasing the volume of oil in TAPS, which will, in turn, extend the life of TAPS.

In addition to considering the extensive benefits to Alaska, the federal government take associated with lease revenues in the Beaufort OCS is estimated to be nearly \$50 billion over fifty years. That amount reflects bonus bids, rental payments, and royalty payments, the latter representing the majority of the lease payments and assuming a 12.5 percent royalty rate. The estimated federal government take from lease revenues in the Chukchi OCS would also be nearly \$50 billion over the same time period. All in all, the federal government stands to obtain almost \$100 billion in revenue from the exploration and development of the Arctic OCS. These figures do not account for the corresponding increase in federal revenue associated with corporate and personal income taxes, which would also be substantial.

Although the Arctic OCS has been a primary focus for the oil and gas industry over the past decade, it is impossible to understate the potential for significant discoveries of hydrocarbon reserves in ANWR. ANWR was originally established 1960 by President Eisenhower to designate 8.9 million acres as wilderness. ANWR was greatly expanded with the passage of the Alaska National Interest Lands Conservation Act (ANILCA) in

1980. When President Carter signed ANILCA, ANWR was expanded to over 19 million acres, but there was an area along the coastal plain specifically set aside to be considered for oil and gas development, 1.5 million acres known as the “1002 area”. Because of the vast protections and wilderness designations, significant exploration in the region has been effectively prohibited, with surveys being limited to surface geological investigations, aeromagnetic surveys, and two winter seismic surveys that were conducted over thirty years ago. With one exception, no exploratory drilling has been accomplished in ANWR.

Nevertheless, there is every reason to believe that the Coastal Plain of ANWR contains massive economically recoverable oil resources. The first evidence suggesting these reserves relates to its location. Less than 70 miles to the west of ANWR’s Coastal Plain, are the main North Slope facilities and oil fields, such as the Prudhoe Bay, Lisburne, Endicott, Milne Point, and Kuparuk. As previously stated, these fields have collectively produced over 17 billion of barrels of oil, and continue to be productive today. And the new Point Thomson field in production is around 5 miles from the boundary of ANWR. Similarly, to the east of ANWR’s Coastal Plain, major discoveries have been made in Canada, near the Mackenzie River Delta and in the Beaufort Sea. However, there is more than the mere proximity to other oil and gas discoveries that supports a belief in ANWR’s resource potential. Starting in 1980, the USGS began surveying ANWR’s Coastal Plain, with initial estimates of up to 17 billion barrels of oil and 34 trillion cubic feet of natural gas. Almost a decade later, the U.S. Department of Interior, following several years of surface geological investigations, aeromagnetic surveys, and seismic surveys issued a report on the oil and gas potential of the Coastal Plain, in which it estimated that there are billions of barrels of oil to be discovered in the area. More specifically, the DOI estimated that “in-place resources” range from 4.8 billion to 29.4 billion barrels of oil, and identified twenty-six separate oil and gas prospects in the Coastal Plain that could each contain fields of 500 million barrels or more.

LNG Project

In addition to vast amounts of oil, Alaska is also home to massive amounts of natural gas. The recovery and reinjection of gas into the oil fields on the North Slope has led to billions of barrels of additional oil recovery, but the gas is basically stranded as there is currently no viable way to get the gas to market. Due to the large supply of natural gas in the Continental U.S., the state of Alaska and industry are working together on a potential LNG project to monetize the gas for Asian markets. This project is a \$45 billion infrastructure project that could be geopolitically strategic to displace Russian gas going to Asia. Currently the State of Alaska is positioned to lead this commercial effort and they are currently assessing a tolling model, preserving regulatory process and identifying financing options for a successful path forward.

EIA forecasts

Although fossil fuel consumption is often discussed in binary terms, it is important to note that for the next several decades, energy consumption in the U.S. will remain heavily dependent on hydrocarbon resources to meet demand. The U.S. Energy Information Administration's (EIA) 2017 outlook outlines the likely energy demands of our nation through 2050. Although EIA presents various scenarios moving forward that account any number of variables, it is prudent to examine those figures that represent the median outlook. With that in mind, overall U.S. energy consumption is projected to remain relatively flat, rising approximately 5% from the 2016 level by 2040 and somewhat close to its previous peak. Of course, if our nation experiences greater economic growth than anticipated, the U.S.'s energy consumption will understandably rise accordingly. Based on EIA models, natural gas use is likely to increase more than any other fuel sources in terms of quantity of energy consumed, led by demand from the industrial and electric power sectors. In general, petroleum consumption projects to remain relatively flat as increases in energy efficiency offset growth in the transportation and industrial activity measures. More specifically, crude oil production projects to actually increase from current levels, then levels off around 2025 as tight oil development moves into less productive areas. Like natural gas, projected crude oil production varies considerably with assumptions about resources and technology. Ultimately, this context is offered to highlight that our nation will rely heavily on fossil fuel production and consumption for, at the very least, another generation. What remains to be seen is whether the U.S. can, over the coming years, truly achieve energy independence. Although the biggest hurdle to that endeavor remains the federal regulatory approach to oil and gas production, a beneficial infrastructure can play an important role.

Infrastructure Needs

In April 2016, the U.S. Department of Transportation released "A Ten-Year Prioritization of Infrastructure Needs in the U.S. Arctic." The report fell under the 2013 United States National Strategy for the Arctic Region and the 2014 Strategy Implementation Plan's objective to "Prepare for Increased Activity in the Maritime Domain." The report did not focus solely on the oil and gas industry, but represented a holistic analysis of the general infrastructure needs of the Alaskan Arctic, highlighting a dramatic increase in maritime traffic coupled with a marked lack of onshore infrastructure in Alaska. For example, conservative estimates predict that vessel traffic in Alaska's Arctic will more than double by 2023. A substantial portion of the report endeavored to identify key areas and potential projects that can be undertaken to improve safety and commerce in the American Arctic.

Accordingly, the report discusses a prudent path forward that can address the Arctic infrastructure gaps by identifying critical requirements. Specifically, the report identifies five core components: 1) navigable waterways, 2) physical infrastructure, 3) information

infrastructure, 4) response services, and 5) vessels. Although these “gaps” are often discussed in the context of marine traffic, progress in these areas would also invariably serve to support oil and gas development, both onshore and offshore. The report offers a litany of recommendations, many of which are more pressing than others. Some of the recommendations are as follows: designating an American Arctic port of refuge at Port Clarence; working with stakeholders to coordinate research efforts and de-conflict research within commercial and subsistence use areas; placing hydrography and charting of the U.S. maritime Arctic among the highest priority requirements for agency execution; improving weather, water, and climate predictions to an equivalent level of service comparable to what is provided to the rest of the nation; supporting development of a Pan-Arctic response equipment database; and sharing information for continued development of guidelines for oil spill response in the Arctic.

These efforts dovetail into the fundamental question of how federal infrastructure can be implanted in a manner that offers assistance to existing and future oil and gas energy projects. Industry does not desire federal infrastructure projects that would serve to merely subsidize a particular energy project. Rather, efforts should be focused on identifying infrastructure projects that have multiple benefits to multiple stakeholders. Working together with these stakeholders, infrastructure corridors could be identified and federal agencies could work together to not only provide funding for potential projects, but could assist projects through permitting and regulatory cooperation. Additionally, better information infrastructure would serve to aid industry, but also local communities, and other aspects of the public and private sector. Similarly, a strategically placed road or common carrier pipeline could benefit multiple oil and gas operators while also offering benefits to local communities and people. Put bluntly, the North Slope in Alaska is in need of basic infrastructure projects that can and will meet the most basic needs of Alaskan communities. Of course, this will lead to tangential benefits to industry, but candidly, it is the uncertainty, costs, and delays associated with the federal regulatory rubric that undermines the role that the North Slope can play in meeting our nation’s energy needs.