April 9, 2026

SUSITNA VALLEY
GAS EXPLORATION LICENSES

Final Written Finding of the Director

Alaska Department of
NATURAL
RESOURCES
DIVISION OF OIL & GAS

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Final Written Finding of the Director

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Alaska Department of Natural Resources
Division of Oil and Gas

April 9, 2026

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Chapter One: Director’s Final Written Finding and Decision

Under AS 38.05.131–134, the State of Alaska encourages oil and gas exploration through the issuance of exploration licenses on state lands outside known hydrocarbon basins. Per AS 38.05.131(c), DNR is required to make preliminary written determinations on the state lands contemplated for "gas only" exploration licenses. After public notice and completion of the public comment period, DNR must evaluate comments timely received, then issue a final written determination. Authority for the director of Division of Oil and Gas (DO&G) to make written best interest findings and decisions was made in Alaska Department of Natural Resources (DNR) Department Order 003, Delegation of Authority Memorandum dated September 28, 2001; revised and updated on June 30, 2016 (DNR 2016a).

DO&G is offering two Susitna Valley Gas Exploration Licenses (Licenses or License Areas) to the Alaska Natural Gas Corporation (Licensee) in the Susitna Valley. The License Areas cover approximately 567,359 acres (263,983 acres in License Area 1 and 303,376 acres in License Area 2). Only lands for which the state owns the subsurface can be included in an exploration license. The Licensee applied for two licenses, because the total area applied for exceeded the statutory maximum of 500,000 acres per license (AS 38.05.132(c)(2)). This written finding considers disposing of both Susitna Valley Gas Exploration Licenses.

A. Procedural Background

The timeline for the Susitna Valley Gas Exploration License process from receipt of the applications to publication of this final finding follows:

- On May 9, 2016, DO&G issued the Final Director’s Determination of State Lands Subject to Oil and Gas Exploration Licensing for the Southcentral Region of Alaska which includes the Susitna Valley Gas License Areas (DNR 2016b). The Final Determination stated that all state-owned acreage in the Southcentral determination area will be available for oil and gas exploration licensing subject to the provisions of AS 38.05.132.
- The Final Determination was appealed on May 27, 2016, and the appeal was resolved by the DNR commissioner on December 22, 2017 (DNR 2017).
- On April 30, 2024, DO&G received two timely exploration license applications from Alaska Natural Gas Corporation. To ensure confidentiality under AS 38.05.035(a)(8), and at the applicant’s request under AS 38.05.133(e), DO&G kept confidential the name of the applicant during the notice of intent comment period.
- On August 7, 2024, DO&G published a notice of intent to evaluate the exploration license proposals, to request comments on exploration within the solicitation area from the public and other agencies, and to request competing proposals. On August 21, 2024, DO&G extended the period for public comment for an additional 30 days. Information, comments and were due by October 7, 2024.

- DO&G did not receive any competing proposals but did receive 34 timely responses to the request for agency information and the call for public comments. These comments were summarized and addressed, and new information was incorporated into the preliminary finding (Appendix A).
- On August 27, 2025, DO&G issued the preliminary written finding and request for public comments with comments due by September 30, 2025. DO&G identified the prospective licensee as Alaska Natural Gas Corporation (AS 38.05.133(f)(2)). After receiving requests for an extended comment period, on September 11, 2025, DO&G extended the comment deadline to October 30, 2025.
- DO&G received 35 written comments in response to the August 27, 2025 preliminary finding. Comments are summarized with responses in Appendix A. New issues and information received during the comment period were considered and incorporated into this finding.

B. Statement of Applicable Law

The Alaska Constitution directs the state “to encourage . . . the development of its resources by making them available for maximum use consistent with the public interest” (Alaska Constitution, Article VIII, § 1). Moreover, by statute, the people of Alaska have an interest in the development of the state’s oil and gas resources to maximize both the economic and physical recovery of the resources in addition to maximizing competition among parties seeking to explore and develop the resources (AS 38.05.180(a)). Alaska Statute 38.05.133(f) requires a written finding addressing all matters set out in AS 38.05.035(e) and (g) after considering proposals and public comment on the proposals. If the finding concludes that the state’s best interests would be served by issuing an exploration license, the finding must (1) describe the limitations, stipulations, conditions, or changes from the initiating proposal or competing proposals that are required to make the issuance of the exploration license conform to the best interests of the state, and (2) if only one proposal was submitted, identify the prospective licensee whom the commissioner finds should be issued the exploration license. The director enables the disposal of lands through the development of written findings under AS 38.05.035(e). The preparation and issuance of written findings by the director are subject to the following:

- AS 38.05.035(e)(1)(A) allows the director to establish the scope of the administrative review on which the director’s determination is based, and the scope of the written finding supporting that determination. . This statute further provides that the scope of the administrative review and finding may address only reasonably foreseeable, significant effects of the uses proposed to be authorized by the disposal.
- AS 38.05.035(e)(1)(B) allows the director to limit the scope of an administrative review and finding for a proposed disposal to a review of applicable statutes and regulations, and facts pertaining to the land, resources, property, or interest in them that the director finds are material to the written finding and are known or available to the director during the administrative review.

- AS 38.0f.035(e)(1)(B)(iii) further allows the director to limit the scope of the administrative review to issues that the director finds are material to the determination of whether the proposed disposal will best serve the interests of the state.
- AS 38.05.035(e)(1)(C) allows the director to limit a written finding to the disposal phase, which is the issuance of an exploration license, and as applicable here, gas only leases, if the exploration license is converted.
- AS 38.05.035(e)(1)(C) (ii) and (ii), before the exploration phase of the project may proceed, public notice and the opportunity to comment must be provided. This was provided through the initial and extended public comment period which expired on October 30, 2025.
- AS 38.05.035(h) provides that the director may not be required to speculate about possible future effects subject to future permitting that cannot reasonably be determined until the project or proposed use for which a written finding is required is more specifically defined.

Per AS 38.05.132(b)(1), exploration licenses give the licensee the exclusive right to explore for deposits of oil and gas subject to the terms of the licenses. Per AS 38.05.132(a), the director has limited these Licenses to exploration for and recovery of gas only. If the Licensee accepts the Licenses and meets the work commitment obligations described in the License documents (Appendix B), the Licensee may request a conversion of the Exploration Licenses to a lease or leases with no other written finding required. Therefore, any language referring to the "License(s)" or "licensing" in this written finding also refers to subsequent gas-only leases.

C. Analysis Summary

At the disposal phase, it is unknown whether natural gas exploration, development, production, and transportation will be proposed, and if proposed, what the specific location, type, size, extent, and duration would be. This finding discusses the potential cumulative effects, in general terms, that may occur with natural gas, including sand bed methane, coalbed methane, exploration, development, production, and transportation activities within the License Areas while considering mitigation measures that have been developed for Licenses and any subsequent leases. The director has limited the scope of the review for this finding to the applicable statutes and regulations, facts, and issues pertaining to the License Areas, and the reasonably foreseeable significant cumulative effects of natural gas exploration and development.

Any future development in subsequent phases of the project, if any, do not constitute separate disposals, but will be subject to a detailed review, which will include consideration of cumulative impacts as constitutionally required to ensure that that use of the state's natural resources is for the maximum benefit of its people.[1]

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[1] Alaska Const. art. VIII, §1. *See also* Sullivan v. Resisting Env't Destruction on Indigenous Lands (REDOIL), 311 P.3d 625, 633 (Alaska 2013) ("For an oil and gas development project, the lease is the only conveyance of property rights that DNR approves."); *Id*. 311 P.3d at 634 ("We hold that consideration of cumulative impacts is constitutionally required throughout all the phases of a project.); Orutsararmiut Native Council v. Boyle, 579 P.3d 434, 448 (Alaska 2025) ("[W]e do not view *REDOIL*'s holding regarding the duty to consider cumulative impacts as limited to projects in which approval is phased over time.")

In making this final written finding, the director weighed the facts and issues known at the time of this administrative review, considered applicable laws and regulations, and balanced the potential positive and negative effects after consideration of the proposed mitigation measures and other regulatory guidelines. The director finds that the potential benefits of issuing the Susitna Valley Gas Exploration Licenses outweigh the possible negative effects and that issuing the Licenses will best serve the interests of the State of Alaska. The discussion of these matters is set out in the accompanying chapters of this final written finding which are summarized and analyzed here.

1. License Area Description and Petroleum Potential

The License Areas are located in the Susitna basin in the Matanuska-Susitna Borough west of the George Parks Highway. The License Areas are mostly forested and undeveloped except along the eastern boundaries. Transportation systems within the License Areas include a few gravel roads and a complex network of summer and winter trails. Natural hazards include wildland fires, flooding, erosion, and earthquakes.

The boundaries of the license areas have been adjusted and reduced in comparison to the original proposal to eliminate the Susitna River and land to the east of the river. These lands were excluded from the proposed license area to reduce conflict with private landowners, conflicts with recreational use, as well as reduce impacts to the important fisheries associated with the Susitna River.

Another significant amount of acreage was eliminated from the proposed License Areas in the southwest portion of License Area 1 as the Susitna basin is bound by the Beluga fault, which now forms a boundary for that License Area. A significant amount of acreage was eliminated from the western portion of License Area 2 as the known geology of the region did not see a great potential for gas exploration in that area and also excludes the community of Skwentna. The significantly smaller License Areas match the proposed exploration plan of the applicant, and it was determined to be more feasible to conduct exploration over this reduced footprint in the 10-year term of the exploration licenses. Additionally, the existing geologic data suggests that the highest potential for this exploration project exists within the smaller footprint defined in these adjusted License Area boundaries.

Unconventional gas resources, such as biogenic gas-charged coals and carbonaceous shales, are more likely to occur in the Susitna basin than conventional gas resources, such as thermogenic gas-charged sandstone reservoirs. In 2017, a United States Geological Survey assessment estimated the mean total undiscovered microbial gas resources in the Susitna basin of southern Alaska to be 1.67 trillion cubic feet. The Cook Inlet basin has served as southcentral and interior Alaska's exclusive source of natural gas for nearly 60 years. Cook Inlet natural gas generates 70 percent of the Railbelt's electricity, heats over 140,000 homes and businesses, and supplies fuel for industrial users. Demand for Cook Inlet natural gas is expected to remain around 70 billion cubic feet per year, while the supply from baseline production supplemented by continued investment and development in currently producing fields is projected to meet these demand levels through about 2030. Investment in exploration and delineation of natural gas resources therefore is crucial for the continued security of natural gas supplies for the Railbelt.

The Susitna basin remains extremely underexplored and is considered to have low-to-moderate potential for conventional and unconventional gas plays based on basin geology, limited exploration history, limited available seismic, well, and engineering data, and distance from other proven hydrocarbon accumulations. If unconventional gas resources or coalbed methane could be economically produced in the Susitna basin, it would provide an attractive alternative to diesel fuel for home heating and power generation in rural areas accessible by road or rail. Information from License Area exploration wells could also be helpful in defining suitability of stratigraphy and coal resources for potential use for carbon dioxide capture and storage (carbon sequestration), which could be used to mitigate the impact of greenhouse gas buildup from fossil fuel-based energy generation. Coal seam sequestration potential in the Susitna basin has been rated high. Deep coal seams of the Tyonek Formation in the Cook Inlet basin have an estimated sequestration capacity of 43.0 gigatons of carbon dioxide based on a carbon dioxide to methane storage ratio of about 7 to 1.

2. Habitat, Fish and Wildlife

The License Areas cover about 7 percent of the Susitna River basin, primarily within the Lower Susitna River and Yentna River subbasins. This region contains high value fish and wildlife habitat with a mosaic of vegetation communities that range from closed forests to open shrub and herbaceous communities in both upland and wetland settings. The License Areas include portions of state recreation areas managed by DNR – Susitna Basin Recreation Rivers (Deshka River, Alexander Creek, Talachulitna River, and Lake Creek Units), and freshwater Essential Fish Habitat (EFH) managed by the National Marine Fisheries Service (NMFS).

Important fish and wildlife populations include salmon, waterfowl, waterbirds, landbirds, moose, bears, and furbearers. An estimated 1.9 million salmon return in even years (1.6 million salmon in odd years) to spawn in the Susitna and Yentna river drainages. Chinook, chum, coho, pink, and sockeye salmon and eulachon spawn in the License Areas. Tule white-fronted geese, one of the least abundant goose populations in North America, use habitats in License Areas for nesting and brood rearing from mid-April through mid-September. Birds of conservation concern in the License Areas may include: Hudsonian godwit, lesser yellowlegs, short-billed dowitcher, blackpoll warbler, olive-sided flycatcher, and rusty blackbird. Moose use habitats in the License Areas for summer range, concentrated calving, rutting, and winter range, with populations fluctuating due to die-offs during severe winters and heavy snow once or twice a decade. Bears move seasonally across the landscape making use of early green vegetation and moose calves in spring; early berries and salmon in summer; salmon, roots, late berries and fruits in fall; and alpine, subalpine, or forested den habitats in winter. Marten, red fox, wolf, beaver, wolverine, and river otter are the more commonly trapped and hunted furbearers in the region.

3. Current and Projected Uses

Fish and wildlife populations in the License Areas support fishing, hunting, trapping, and wildlife viewing. State land management classifications in the License Areas are 40 percent forestry, 23 percent wildlife habitat or water resources, 15 percent settlement, 13 percent public recreation, and 6 percent agriculture. Most of the License Areas are located within Game Management Unit (GMU) 16 with about 60 percent within the Anchorage-Mat-Su-Kenai Peninsula non-subsistence use area. Residents from Skwentna use fish, wildlife, and plant resources within about 15 miles of the village; harvesting an average of 285 pounds per household in 2012 dominated by moose, salmon, northern pike, and bear.

Establishing fishery allocations among user groups for upper Cook Inlet salmon fisheries has been controversial for many years. Salmon returning to the Northern Cook Inlet management area are harvested by Upper Cook Inlet set and drift gillnet commercial fisheries which take several orders of magnitude more salmon than sport fisheries in the area. Northern Cook Inlet stocks are also harvested in the Yentna River subsistence fish wheel fishery. From 2010 to 2019 the average sport fishing effort for Knik Arm was 78,134 days fished and for Susitna was 98,107 days fished. Fishing effort statewide and in both Knik Arm and Susitna decreased steadily between 2014 to 2019. In 2018, sport fishing in Alaska generated approximately $475 million in salaries and wages, 12,639 jobs, and contributed over $1.4 billion to the statewide economy. Commercial fisheries in Upper Cook Inlet have an average annual ex-vessel value of about $750,000. The Northern District commercial harvest averages 23 percent of Chinook, 2 percent of sockeye, 21 percent of coho, 4 percent of pink and 2 percent of chum salmon harvested in the Upper Cook Inlet commercial salmon fishery. Susitna and Yentna river eulachon stocks support a commercial fishery that averages 95.6 tons and 3.9 permits per year.

Moose, black bear, brown bear, waterfowl, upland game birds, and furbearers are the most harvested wildlife in the License Areas. Most moose in GMU 16 are taken in general season hunts with harvest tickets during August 20 through September 25 and a limit of one bull. Most hunters in GMU 16 are nonlocal and local resident hunters. Moose harvest in GMU 16A averaged 176 moose for 920 hunters and 19 percent success and GMU 16B averaged 296 moose for 862 hunters and 27 percent success during 2010 to 2019. Trends for moose harvest and hunters increased from 2010 to 2019 in both GMUs. Because of high concentrations of migrating waterfowl, wetlands, waters, and backwaters in and south of the License Areas are popular for waterfowl hunting from September 1 through December 16.

The Susitna Valley is used for recreation, forestry, and mineral and oil and gas exploration. Important recreational resources in the License Areas include Nancy Lake and Willow Creek state recreation areas, Susitna Basin Recreation Rivers, Susitna Landing, Deshka Landing, and the numerous historic trails. Sightseeing, fishing, camping, hunting, boating, hiking, cross-country and backcountry skiing, snowmachining, and all-terrain vehicle use are popular activities. Most Alaskans, 81 percent, participate in outdoor recreation and 61 percent of tourists participate in at least one outdoor recreation activity. An estimated 700,000 visitors enjoy wildlife and scenery, and hike, camp, fish, and hunt in the Matanuska-Susitna Borough each year. Visitor spending directly and indirectly supported 1,700 full- and part-time jobs and $47 million in labor income in the Matanuska-Susitna Borough in 2016. Nancy Lake and Willow Creek state recreation area visitors are primarily Alaska residents with an estimated 70,000 Willow Creek and 56,000 Nancy Lake visitors during fiscal year 2017. Visitation at both of these state recreation areas peaks in June and July.

Private lands cover 4 percent of the License Areas based on Matanuska-Susitna borough tax parcel data, with an estimated 3,178 private individual, corporate, and trust landowners for an estimated 34,915 acres. Estimated appraised value of private lands and improvements within the License Areas is $237,944,320, representing about 2 percent of the total appraised value for all MSB lands as of February 2022. A total of 1,291 acres of agricultural homestead or agricultural sales lands occurs within the License Areas. State surface use class agricultural lands cover 6 percent of the License Areas, while soil survey data classifies 14 percent of the License Areas as Farmland of Local Importance.

No timber sales have occurred in the License Areas since 1998, and there are no upcoming timber sales planned in the License Areas. Gold was discovered in upper Susitna Valley in 1898, and the License Areas are characterized by generally poor placer deposits for small scale commercial mining. License Area 2 has 117 active placer mining claims along Kahiltna River and Peters Creek and one mining lease on Hneh'itnu Creek. Transportation facilities include George Parks Highway and Alaska Railroad along the eastern edge of the License Areas, small public airports at Willow and Skwentna and private airstrips at Deshka Landing, Parker Lake, and Montana Creek. A few secondary and primitive roads extend into the License Areas and a network of trails (most winter use) occur throughout the License Areas.

4. Governmental Powers to Regulate Oil and Gas

The Alaska Department of Natural Resources has exclusive powers to issue oil and gas exploration licenses, oil and gas leases, or gas only leases under AS 38.05. All oil and gas activities are also subject to numerous federal, state, and local laws and regulations. Other agencies that have broad authority to regulate and condition activities related to oil and gas include Alaska Departments of Environmental Conservation, and Fish and Game; Alaska Oil and Gas Conservation Commission (AOGCC); US Environmental Protection Agency (EPA); US Army Corp of Engineers; US Fish and Wildlife Service; National Marine Fisheries Service; and Matanuska-Susitna Borough.

5. Reasonably Foreseeable Cumulative Effects of Licensing and Subsequent Activity

The issuance of exploration licenses is not expected to have any effect other than to provide initial revenue to the state and to grant the licensee with a right to explore for natural gas on state-owned subsurface mineral estates with an option to convert the licensed area(s) into one or more gas-only leases. Activities to be permitted under future phases could have reasonably foreseeable cumulative effects on habitats, fish and wildlife populations, and uses in the License Areas. Potential future activities could include seismic surveys, construction of support facilities, exploration and development drilling, and construction of drilling and production facilities, roads, and pipelines. Some potential cumulative effects of these activities include physical disturbances that could alter air and water quality; habitats and landscape connectivity; behavior and habitat use of fish, birds, and mammals; recreation and subsistence activities; and contamination from well drilling spills, gas blowouts, or spills of produced water or hazardous substances. Based on studies of cumulative effects from coalbed methane and conventional oil and gas exploration and development in boreal forest regions and resources within the License Areas, the primary areas of concern are potential cumulative effects on water resources, fish and wildlife resources, and recreation and tourism.

Coalbed methane exploration, development, production, transportation, and site closure all would potentially contribute to air pollution. Equipment used during these activities produce air emissions through combustion and particulates and dust from traffic. During operation and maintenance, methane can be released from wells, pipes, and machinery especially during exploration and upset conditions when methane is routed to a flare system and combusted to carbon dioxide. EPA’s New Source Performance Standards, that went into effect for volatile organic compounds in 2012 and methane in 2016, require oil and gas producers to reduce greenhouse gas emissions. Emission controls installed to reduce volatile organic compound emissions as required in the New Source Performance Standards that were in effect in 2012 also reduce methane emissions. Injection of carbon dioxide into coal seams has been shown to be environmentally and commercially desirable to both reduce atmospheric concentrations of carbon dioxide and enhance production of coalbed methane. Oil and gas facilities and activities are required to control and limit emissions. Combustion and fugitive emissions are minimized and mitigated by using best management practices and control technologies; and construction and traffic induced fugitive dust is minimized and mitigated by using best management practices such as construction area and road watering. Industry compliance with federal and state air quality regulations are expected to mitigate potential cumulative negative effects on air quality.

Cumulative effects from gas exploration and development on water resources in the License Areas could include altered drainage patterns, increase turbidity and sedimentation from erosion and fugitive dust, drawdown and contamination of groundwater, and contamination of freshwaters from discharges from well drilling and production. Coalbed methane development concerns include the potential high densities of wells, well pads, and roads; hydraulic fracturing; and the potentially large quantities of water pumped from coalbeds. New and existing facilities are required to control and manage stormwater and snow melt runoff during construction and operation to avoid and minimize potential increased sedimentation and contamination. Potential cumulative effects on water resources depend on hydrogeology; connectivity between methane bearing coal deposits and surface water and groundwater systems; and the chemistry and age of coalbed waters. Water wells in the License Areas average 76 feet deep while coalbeds likely to produce methane lie between 1,000 and 6,000 feet deep. Several impermeable layers of silt, clay, and till may isolate coalbeds from unconsolidated sand and gravel aquifers in the License Areas. Where aquifers are isolated, dewatering coalbeds to produce methane should not impact drinking water aquifers or shallow groundwater. Disposal of drilling fluids and cuttings and produced water is usually accomplished by annular and underground injection regulated by AOGCC, which requires protection of underground sources of drinking water. Surface discharge of produced water would require an Alaska Pollutant Discharge Elimination System permit, and mitigation measures in this finding require produced water management plans that identify locations, amounts, and potential impacts; prohibit the use of diesel-based fracturing fluids; and require well pad spacing to be balanced between gas pool management and minimizing surface impacts.

The primary identified cumulative effect on fish and fish habitat occur through erosion and sediment deposition; restricted fish passage; water withdrawal or discharge; increased access and fishing pressure; introduction or spread of non-native plants and animals; and fuel or hazardous material spills. Improperly sized, installed, and unmaintained stream crossing culverts can restrict fish access to upstream or downstream spawning, foraging, and overwintering habitats. Potential changes to water temperature through direct discharge of produced water or through decreased upwelling from groundwater drawdown and leakage from streambeds could have cumulative effects on watersheds that support salmon, trout, and char. AS 16.05 requires protection of anadromous streams and mitigation measures in this finding include requirements for erosion control, water quality monitoring, and other environmental protection; prohibit siting facilities within 1/2 mile from Alexander, Lake, and Peters creeks and the Susitna, Deshka (Kroto and Moose creeks), Kahiltna, Talachulitna, and Yentna rivers; and require that pipelines crossing fish streams use directional drilling techniques.

The primary identified cumulative effects on wildlife and wildlife habitat include habitat loss, fragmentation, and disturbance that change habitat availability and suitability, and wildlife behavior. Habitat effects from vegetation clearing for seismic lines and pipelines are greatest in forested areas where forests are fragmented making wildlife more vulnerable to predation, hunting and trapping especially when these corridors are used for recreation, hunting, or trapping. Activity, vehicle traffic, aircraft traffic, sounds from pumps, compressors, and machinery, and changes in vegetation can result in reduced use or avoidance of areas surrounding oil and gas facilities by some wildlife, although moose and some common landbirds may not avoid these areas. Mitigation measures for wildlife included in this best interest finding address: protection of wetland, riparian, and aquatic habitats; minimizing disturbance and noise impacts on important wildlife habitat; minimizing disturbance of bald eagles and trumpeter swans; protecting denning brown bears; and preventing bears from becoming food conditioned.

Fish and wildlife resources in the License Areas support subsistence, commercial, and sport fishing; hunting and trapping; and non-consumptive wildlife viewing. Consumptive and non-consumptive uses depend on healthy habitats and wildlife populations. The primary cumulative impact from oil and gas development, besides impacts to habitats and distribution and abundance of fish and wildlife, is changes in access for users. New roads open to public traffic could facilitate year-round access to remote locations within the License Areas. Trails created or improved for exploration activities and pipeline or power line corridors would likely be used for recreation, hunting, trapping, and fishing access. New or improved access could create community development, land use planning, and fish and wildlife management issues which could have both negative and positive effects. Mitigation measures address fish, wildlife, and habitat, harvest interference avoidance, public access, and road construction.

Recreation and tourism are important to the economy in the Matanuska-Susitna Borough providing employment opportunities, generating revenue for communities, and supporting infrastructure that benefits residents. Potential cumulative effects on outdoor recreation from development of gas resources in the License Areas could include forest clearing, increased traffic, noise pollution, loss of scenic vistas, trail conflicts, and overall degradation of the outdoor recreation experience. Mitigation measures included in this best interest finding address facility design to minimize sight and sound impacts to recreational users, and unrestricted public access except for in the immediate vicinity of drill sites and related structures.

There is little privately-owned land within the License Areas. Historically, landowners have expressed concerns that reasonably foreseeable cumulative effects on property values and farmland were not adequately considered in the previous written findings considering exploration in this area. Should lands wherein the surface is owned by an entity other than the state be offered and licensed or leased by the State of Alaska, rights to exploration and development of the oil and gas resources may not be exercised until the licensees make provisions to compensate the landowner for full payment for all damages sustained by the owner, by reason of entering upon the land, as required by the license, subsequent leases and AS 38.05.130 as applicable.

Issues commonly reported for oil and gas development in rural areas include high truck traffic and associated impacts on the safety and function of local roads; increased dust; increased costs of living, property taxes, and legal fees; and costs for additional remediation and reclamation. While the potential location, schedule, and extent of coalbed methane exploration, development, and transportation within the License Areas is unknown, some disruption of local land use may occur. DO&G has developed mitigation measures that should minimize any potential impacts to private land owners should they occur. In addition, AS 38.05.130 provides for payment to the owner of lands entered for all damages sustained from gas extraction and provides for posting of a surety bond to secure payment for damages.

Some negative effects related to historic and cultural resources may occur. Mitigation measures included in this written finding and those developed through permitting in future phases, along with laws and regulations imposed by state and federal agencies, are expected to mitigate these potential cumulative effects.

Natural gas, including coalbed methane, exploration and development activities may result in fiscal effects on nearby communities such as Wasilla, Willow, Houston, and Skwentna and the state. Award of the exploration licenses will result in short-term positive initial revenue to the state. If exploration finds commercial quantities of gas, the exploration acreage could be converted into gas leases and positive potential effects are substantial local and state revenues, job creation, and the potential for regional and local use of natural gas for home heating and electric generation. Royalty and rental payment benefit all Alaska residents through payments to the General Fund and Permanent Fund. If local and Alaska residents and contractors are hired for work in the License Areas the multiplier effect may benefit local and state economies. The level and geographical distribution of the employment effect will depend on the size of any commercial resource that is identified. If the exploration program does not find commercial quantities of natural gas, the labor market effect of the exploration licenses would likely be negligible.

6. Mitigation Measures

Mitigation measures address protection of state lands; air and water quality; habitat for fish and wildlife; local subsistence, and nonlocal and nonresident harvest activities; access; management of fuels, hazardous substances, and wastes; potential spills of hazardous substances; and citing of facilities and operations.

At the disposal phase, the exact location, type, size, extent, and duration of potential exploration activities of the license areas is unknown. It is likewise unknown whether subsequent development, production or transportation will occur on specific portions of the license areas if converted to a gas-only lease in the future. As the licensee's exploration program progresses, DNR will be better able to determine impacts directly associated with proposed operations on those tracts. DNR may then identify and impose additional requirements necessary to protect the state's interest during approval of later phase activities.

All exploration activities conducted under the exploration licenses, and any gas-only lease activities are subject to numerous federal, state, and local laws and regulations with which the licensee/lessee must comply. Most potentially negative effects of oil and gas activities on water resources, fisheries resources, wildlife resources, and recreation and tourism; on local uses, residents, and property owners; and on local communities, if not adequately addressed by federal or state law, may be mitigated through measures imposed on the exploration licenses and subsequent lease activities. DO&G has adopted DNR's Enforceable Standards for Development of State Owned Coalbed Methane Resources in the Matanuska-Susitna Borough (DNR's Enforceable Standards; DNR 2004). These standards serve as the minimum level of protection established by this decision document for both License Areas. In addition to the mitigation measures listed in Chapter Nine, all post-disposal activities are subject to applicable local, state, and federal statutes, regulations, and ordinances.

D. Director’s Final Written Finding and Request for Public Comment

The director weighed the facts and issues known at this time and has set out findings. The director considered all applicable statutes and regulations, weighed the facts and comments received during public review, and balanced the potential positive and negative effects given the mitigation measures and other regulatory protections. The director finds that the potential benefits outweigh the possible negative effects, and that issuance of the Susitna Valley Gas Exploration Licenses for a 10-year term for the two licenses best serve the interests of the State of Alaska.

The director has further established a $3,000,000 work commitment for each of the Exploration Licenses (totaling $6,000,000.00) to reflect the work proposed by the Licensee. Pursuant to AS 38.05.133(g), the Licensee has 30 days from the issuance of a final finding to accept or reject the Exploration Licenses, as limited and conditioned by the terms of this finding. The Licensee’s acceptance or rejection of the Exploration Licenses must be submitted in writing.

The state is sufficiently empowered through constitutional, statutory, and regulatory authority, and its interests are protected through the exploration license document and plans of operations to ensure that the Licensee conducts their activities safely and in a manner that protects the environment and maintains opportunities for existing and anticipated uses.

A person is eligible to appeal to the Superior Court only if the person has meaningfully participated in this process by submitting written comment during the public comment periods.

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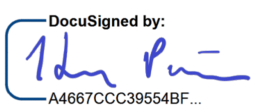

Haley Paine
Acting Director, Division of Oil and Gas

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Chapter Two: Authority and Scope of Review

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Chapter Two: Authority and Scope of Review

The Alaska Department of Natural Resources (DNR), Division of Oil and Gas (DO&G) finds it to be in the state's best interest to offer the Susitna Valley gas exploration licenses to the Alaska Natural Gas Corporation.

This is the director's final written finding and decision issued under AS 38.05.035(e). As required, this chapter establishes the scope of the administrative review and scope of the written finding for the Susitna Valley gas exploration licenses (Licenses or License Areas).

A. Constitutional and Statutory Authority

The Alaska Constitution provides that the general policy of the state is "to encourage… the development of its resources by making them available for maximum use consistent with the public interest" and that the "legislature shall provide for the utilization, development, and conservation of all natural resources belonging to the State… for the maximum benefit of its people." (Alaska Constitution, Article VIII, §§ 1 and 2). The legislature has been empowered to make all policy decisions to carry out these general goals, as well as to provide the policies and procedure for the lease, sale, and granting of state-owned land. (Alaska Constitution Article VIII, §§ 8, 9, and 12). The Alaska Land Act guides the land management and disposal policy of the state. The Act, codified at AS 38.05, provides the commissioner of DNR the authority to select, manage, and dispose of state lands, and directs DNR to implement the requisite statutes. The commissioner has delegated authority for these disposals to the director of DO&G under DNR Department Order 003.

The Alaska Lands Act states the people of the state "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)(1)(A)). Further, the legislature found that it is in the state's best interests to "minimize the adverse impact of exploration, development, production and transportation activity," and "to offer acreage for oil and gas leases or for gas only leases." (AS 38.05.180(a)(2)(A)(ii); AS 38.05.180(a)(2)(B)).

AS 38.05.180(a)(2) further provides it is in the state's best interest to encourage an assessment of its oil and gas resources; allow the maximum flexibility in the methods of issuing leases to recognize the many varied geographical regions of the state and the different costs of exploring for oil and gas in these regions and minimize the adverse impact of exploration, development, production, and transportation activity; and to offer acreage for oil and gas leases or gas only leases.

B. Written Findings

Alaska statutes govern the disposal of state-owned mineral interests. Under AS 38.05.133(f), which refers to AS 38.05.035(e), the director may, with the consent of the commissioner, dispose of state land, resources, property, or interests after determining in a written finding that such action will serve the best interests of the state. The written finding is known as a "best interest finding" and describes the License Area(s), considers and discusses the potential effects of the license(s), describes measures to mitigate those effects, and constitutes the director's determination whether the interests of the state will be best served by the disposal. On August 7, 2024, DO&G provided a first opportunity for public comment during the solicitation for comments and competing proposals. On August 27, 2025, DO&G issued a preliminary written finding, which provided additional opportunity for public comment. DO&G has now issued a final written finding that includes a discussion of material issues raised during the public comment period, as well as a summary of the comments received. The final written finding includes a discussion of material issues raised during the public comment periods, as well as a summary of, and responses to the comments received (See Appendix A).

1. Applicable Law and Facts

The best interest finding requirements outlined in AS 38.05.035 and AS 38.05.133(f) provide DO&G with procedures to ensure Alaska's resources are developed for the maximum benefit of the state as mandated by article VIII, § 2 of the Alaska Constitution. The authorities applicable to this written finding include the requirements and procedures set out in AS 38.05.035(e)–(m), and Alaska case law applicable to the disposal phase. The provisions in AS 38.05.035(e) set out the scope of review and process for the written finding.

The statute also expressly empowers DNR to review projects in phases, allowing the analysis of proposed licensing or leasing to focus on the issues pertaining to the disposal phase and the reasonably foreseeable significant effects of licensing or leasing. (AS 38.05.035(e)(1)(C)). Further explanation of the statutory direction is provided in the sections below. The regulatory authorities governing exploration, development, production, and transportation of oil and gas development are discussed further in Chapters Six and Seven.

2. Scope of Review

As required by AS 38.05.035(e)(1)(A)–(C), the director, in the written finding:

- shall establish the scope of the administrative review on which the director's determination is based, the scope of the written finding supporting that determination, and the scope of the administrative review and finding may only address reasonably foreseeable, significant effects of the uses proposed to be authorized by the disposal;
- may limit the scope of an administrative review and finding for a proposed disposal to a review of: (1) applicable statutes and regulations; (2) facts pertaining to the land, resources or property, or interest in them that are material to the determination and known to the director or knowledge of which is made available to the director during the administrative review; and (3) issues that, based on the applicable statutes, regulations, facts, and the nature of the uses sought to be authorized by the disposal the director finds are material to the determination of whether the proposed disposal will serve the best interests of the state; and
- may, if the project for which the proposed disposal is sought is a multi-phased development, limit the scope of an administrative review and finding for the proposed

disposal to the applicable statutes, and regulations, facts and issues that pertain solely to the disposal phase of a project when the conditions of AS 38.05.035(e)(1)(C)(i)–(iv) are met.

a. Reasonably Foreseeable Effects

The scope of this administrative review and final written finding addresses only the reasonably foreseeable, significant effects of the uses proposed to be authorized by the disposal (AS 38.05.035(e)(1)(A)). A detailed discussion of the possible effects of unknown future exploration, development, and production activities is not within the scope of this best interest finding. Therefore, the director has limited the scope of this final written finding to the applicable statutes and regulations, facts, and issues pertaining solely to the License Areas, and the reasonably foreseeable significant effects of the license disposal. However, this finding does discuss the potential cumulative effects, in general terms, that may occur with oil and gas activities related to exploration, development, production, and transportation within the License Areas and any mitigation measures as required by AS 38.05.035(g)(1) and (2).

b. Matters Considered and Discussed

Pursuant to AS 38.05.133(f), a written finding issued in support of an exploration license, must consider and discuss facts related to topics set out under AS 38.05.035(g)(1)(B)(i)–(x) that are known at the time the finding is being prepared. The director must also consider public comments during the public comment period and within the scope of review set out in Sections A and B.1–2 of this Chapter.

To aid those reviewing this final written finding, this document is organized for ease of reading and reviewing and does not necessarily follow the order as found in AS 38.05.035(g)(1)(B) (Table 2.1).

Table 2.1. Topics required by AS 38.05.035(g)(1)(B).

AS 38.05.035(g)(1)(B) subsection number	Description	Location in this document
i	Property descriptions and locations	Chapter Three
ii	Petroleum potential in general terms	Chapter Six
iii	Fish and wildlife species and their habitats in the License A rea	Chapter Four
iv	Current and projected uses in the area; including uses and value of fish and wildlife	Chapter Five
v	Governmental powers to regulate the exploration, development, production, and the transportation of oil and gas or of gas only	Chapter Seven
vi	Reasonably foreseeable cumulative effects of exploration, development, production, and transportation for oil and gas or for gas only on the License Area, including effects on subsistence uses; fish and wildlife habitat and populations and their uses, and historic and cultural resources	Chapter Eight
vii	Stipulations and mitigation measures, including any measures to prevent and mitigate releases of oil and hazardous	Chapter Nine

AS 38.05.035(g)(1)(B) subsection number	Description	Location in this document
	substances, to be included in the license, and a discussion of the protections offered by these measures	
viii	Method or methods most likely to be used to transport oil or gas from the License Area, and the advantages, disadvantages, and relative risks of each	Chapter Six
ix	Reasonably foreseeable fiscal effects of the license disposal and the subsequent activity on the state and affected municipalities and communities	Chapter Eight
x	Reasonably foreseeable effects of exploration, development, production, and transportation involving oil and gas or gas only on municipalities and communities within or adjacent to the License Area	Chapter Eight

The facts and issues under consideration in this finding may address only reasonably foreseeable, significant effects of the uses proposed to be authorized by any future disposals in the License Areas (AS 38.05.035(g); AS 38.05.035(e)(1)(A)). The director may not be required to speculate about possible future effects subject to future permitting that cannot reasonably be determined until the proposed use subject to the best interest finding is more specifically defined (AS 38.05.035(h)).

C. Review by Phase

The director may limit the scope of an administrative review and finding for a proposed disposal when the director has sufficient information and data available upon which to make a reasoned decision. A discussion of phases of oil and gas activities is contained in Chapter Six.

Under AS 38.05.035(e)(1)(C), if the project for which the proposed disposal is sought is a multi-phased development, the director may limit the scope of an administrative review and finding for the proposed disposal to the applicable statutes and regulations, facts, and issues that pertain solely to the disposal phase of the project under the following conditions:

(i) the only uses to be authorized by the disposal are part of that phase;
(ii) the disposal is a disposal of oil and gas, or of gas only, and, before the next phase of the project may proceed, public notice and the opportunity to comment are provided under regulations adopted by the department;
(iii) the department's approval is required before the next phase may proceed; and
(iv) the department describes its reasons for a decision to phase.

Phased review is appropriate for exploration licensing. Although the licensee may propose specific exploration activities in an application, the issuance of a license does not authorize any oil or gas activities in the license area without further permits from DNR and other agencies.

Here, the director has met condition (i) because the only uses authorized are part of the disposal phase. As defined in *Kachemak Bay Conservation Society v. State, Department of Natural*

Resources, "disposal" is a catch all term for all alienations of state land and interests in state land[2]. In *Northern Alaska Environmental Center v. State, Department of Natural Resources*, the court further provided that a disposal was a conveyance of a property right[3]. For an oil and gas development project, the license or lease is the only conveyance of property rights DNR approves.[4] A gas exploration license gives the licensee the exclusive right to explore for natural gas on the state lands contained within the license areas. The license may be converted to one or more gas-only leases under the provisions of AS 38.05.134 and 11 AAC 82.978. If converted, such leases will provide the lessee with the exclusive right to drill for, extract, remove, clean, process, and dispose of gas, as well as the nonexclusive right to conduct within the leased area geological and geophysical exploration for gas, the nonexclusive right to install pipelines and build structures on the lease area to find, produce, save, store, treat, process, transport, take care of, and market all gas, and to house and board employees in its operations on the lease area. While the licensee or lessee has these property rights upon entering into the license or lease, the license or lease itself does not authorize any oil and gas activities on the tracts without further permits from DNR and other agencies. Per the Alaska Supreme Court, there are no additional property rights to be conveyed at later phases.[5]

Condition (ii) is met because (1) the disposal is for the license of available land or an interest in land, for gas only, scheduled under AS 38.05.132, and (2) public notice and opportunity to comment will be provided before each subsequent phase of the project may proceed. Public notice and the opportunity to comment on the disposal phase of this license was provided through the solicitation for public comments under AS 38.05.035(e)(5), AS 38.05.945, AS 38.05.133(d) and 11 AAC 82.918, and again through the August 27,2025 preliminary written finding.

DNR is required to continue to analyze and consider all factors material and relevant to what is in the public interest after the initial disposal of the exploration licenses, including the cumulative impacts of the project, and provide the public with timely and meaningful notice of its cumulative impacts assessment.[6] Subsequent post-disposal phases of the project may not proceed unless public notice and the opportunity to comment are provided. DNR provides public notice and opportunity to comment for plans of operation that initiate a new phase under 11 AAC 83 and in accordance with, *Enforceable Standards for Development of State Owned Coalbed Methane Resources in the Matanuska-Susitna Borough* and mitigation measures adopted by DNR (DNR 2004; see Chapter Nine, measure 1.a) .

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2 6 P.3d 270, 278 n.21 (Alaska 2000) (superseded by statute as stated in *Sullivan v.* Resisting Env't Destruction on Indigenous Lands (*REDOIL),* 311 P.3d 625 (Alaska 2013).

3 2 P.3d 629, 635-36 (Alaska 2000) (The term "disposal" as used in AS 38.05.035(e) is not limited to final and permanent conveyances of property rights but rather includes property interests limited duration such as permits and licenses.)

4 *Sullivan v. REDOIL*, 311 P.3d 625, 633 (Alaska 2013).

5 *Id*., 311 P.3d at 633.

6 Id. 311 P.3d at 636.

Condition (iii) is met because DNR's approval is required before the next phase may proceed.

Condition (iv) is met by the findings in Chapter One discussing the speculative nature of current information on what future development projects and methods may be proposed that would require post-disposal authorizations; and what permit conditions and mitigation requirements will be appropriate for authorizations at later phases.

The preliminary written finding and inclusion of public comments and responses satisfies the requirements for phased review under AS 38.05.035(e)(1)(C).

D. Licensing Process

1. Licensing Proposal

Prior to reviewing applications for exploration licensing, DO&G must first make a preliminary and final determination of lands subject to exploration licensing. The preliminary determination must be given public notice, and following the comment period, and evaluation of the comments received, a final written determination must be published (AS 38.05.131(c)). On February 2, 2016, the director made a preliminary written determination of state land for Southcentral Alaska. On May 9, 2016, DO&G issued the Final Director's Determination of State Lands Subject to Oil and Gas Exploration Licensing for the Southcentral Region of Alaska which includes the Susitna Valley exploration license areas[7] (DNR 2016). The 2016 Final Determination grants that all state-owned acreage in the Southcentral determination area will be available for oil and gas exploration licensing subject to the provisions of AS 38.05.132.

The state's exploration licensing program[8] supplements the state's conventional oil and gas leasing program by targeting areas outside known oil and gas reserves[9] and select lands identified in Senate Bill 266, effective March 18, 2004, which prohibit exploration licensing in the vicinity of Bristol Bay (SLA 2004). The licensing program encourages exploration in areas far from existing infrastructure, with relatively low or unknown hydrocarbon potential, and where there is a higher investment risk to the operator. Through exploration licensing, the state will receive subsurface geologic information about these regions. Furthermore, if production occurs after exploration, the state will also receive additional revenue through royalties and taxes.

The licensing process begins in one of two ways:

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[7] The Final Director's Determination of State Lands Subject to Oil and Gas Exploration Licensing for the Southcentral Region of Alaska was appealed on May 27, 2016 and the DNR commissioner resolved the appeal on December 22, 2017.

[8] AS 38.05.131 provides that the oil and gas exploration licenses statutes (AS 38.05.132–.134) do not apply to land:

1) north of the Umiat baseline, and
2) in the vicinity of Cook Inlet that is within the area bounded by
    A) the north boundary of Township 17 North, Seward Meridian;
    B) the Seward Meridian;
    C) the south boundary of Township 7 South, Seward Meridian; and
    D) the west boundary of Range 19 West, Seward Meridian.

[9] Known oil and gas reserves include the North Slope, Beaufort Sea, and Cook Inlet areas.

1. Annually in April, applicants may submit to the commissioner a proposal for exploratory activity within an area they have specified (11 AAC 82.909(d)); or
2. The commissioner can request proposals anytime to explore areas determined to be subject to the provisions of AS 38.05.132.

Any proposal received by the commissioner must describe the lands proposed to be subject to licensing; state a specific work commitment expressed in dollars; propose the term of the license; describe the amount and form of security to be posted based on the projected cost of the planned exploration work (11 AAC 82.909(e)). An exploration license area may range from 10,000 to 500,000 acres and must be reasonably compact and contiguous (AS 38.05.132(c)(2)). The exploration license term may not exceed 10 years (AS 38.05.132(b)(1)). The proposal need not describe the type of exploration activity, although direct exploration expenditures must meet the requirements of AS 38.05.132(f)(1). However, before any exploration activities that require authorizations may occur, the proposed activity must first go through the authorization processes required under 11 AAC 83.158.

2. License Proposal Notice and Preliminary Finding

The Susitna Valley exploration license process was initiated on April 30, 2024, when DO&G received a timely exploration license application from the Alaska Natural Gas Corporation. Agency review and public comments were requested and reviewed as part of the adjudication process for this exploration license proposal. Summaries of the comments received and responses to those comments are included in Appendix A. Chapter 1 contains a more thorough review of the timeline and process for reviewing the license proposals and requesting public comments.

The process for receiving public input begins with a request for information from state and federal agencies, and local governments. DO&G requests information and data about the region's property ownership status, peoples, economy, current uses, subsistence, historic and cultural resources, fish and wildlife, and other natural resource values. Using this information and other relevant information that becomes available, DO&G develops a preliminary written finding and releases it for public comment (AS 38.05.035(e)(7)(A)).

Once a preliminary written finding is issued, DO&G follows AS 38.05.945(a)(3)(A)–(b)(2) to notify the public and obtain public comments on the preliminary written finding. Public comments assist in developing information for written findings. Information provided by agencies and the public assists the director in determining which facts and issues are material to the decision of whether the exploration license is in the state's best interest, and in determining the reasonably foreseeable, significant effects of the exploration license. After receiving public comments on the preliminary best interest finding, DO&G reviewed all comments and incorporates additional relevant information and issues into this final written finding. DO&G has included a summary of, and responses to comments received during the public comment periods in Appendix A.

3. Term and Work Commitment

In accordance with 11 AAC 82.906, the director set a 10-year term for the exploration licenses. The exploration license applications included a proposal with the maximum possible term for an exploration license – 10 years. Due to the large area included in the proposal, the Exploration Licenses were granted a term of 10 years.

The work commitment amounts in each of the initial proposals was for $3,000,000. The proposed amount was accepted because it reflects the current economic climate and the likely costs to conduct a field program sufficient to realize usable data. Costs of the proposed activities described in the proposal were considered, including remote sensing; geological, geochemical, and geophysical studies; and exploration drilling. The director determined that a $3,00,000 work commitment for each of the two respective Exploration Licenses is compatible with the respective proposals.

4. Appeal

A person affected by the final written finding who provided timely written comment on the original solicitation or this final decision may appeal 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 include the appropriate fee. An appeal may be mailed or delivered to 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.

An eligible person must first appeal the final written finding in accordance with 11 AAC 02 before appealing that decision to Superior Court. A copy of 11 AAC 02 may be obtained from any regional information office of DNR..

5. Exploration License Issuance and Conversion to Lease

After an Exploration License is issued, the Licensee must pay a one-time, nonrefundable $1.00 per acre license fee (AS 38.05.132(c)(6)). The Licensee must annually post a bond equal to the work commitment, less the cumulative expended, divided by the years of the remaining License term (AS 38.05.132(c)(4)). There are no additional charges during the term of the License. Upon fulfilling the work commitment, the bond is released. If the work commitment is not fulfilled, the bond is forfeited to the state.

An annual report for the license is due on or before the anniversary date of the effective date of the License. The annual report satisfies statutory, regulatory, and exploration requirements for:

- Reporting direct expenditures as requested under 11 AAC 82.960 and defined by AS 38.05.132(f);
- Calculating annual bond as required by the license Schedule 2 (See Appendix B);
- Annual bonding as required by AS 38.05.132(c)(4)(A) and 11 AAC 82.945(c); and
- Submitting geologic or geophysical data as required by 11 AAC 82.981.

The Exploration Licenses will be terminated, and the remainder of the bond will be forfeited to the state, if the Licensee has not completed at least 25 percent of the total work commitment by the fourth anniversary of the Exploration License (AS 38.05.132(d)(1)). Twenty-five percent of the licensed area would be removed or deleted by the commissioner or relinquished by the Licensee if the Licensee has completed less than 50 percent of the total work commitment, and an additional 10 percent relinquished each successive year until half of the original acreage has been relinquished (AS 38.05.132(d)(2)).

The commissioner will convert all or a portion of the License Areas to a standard gas-only lease(s), subject to acreage limitations imposed by AS 38.05.140, once the work commitment has been met and if the Licensee requests conversion (AS 38.05.134). If the Exploration Licenses issued were for exploration for and recovery of gas only, then the lease issued shall be limited to exploration for and recovery of gas (AS 38.05.180(d)(2)(E)). For these reasons, this final written finding contemplates that the Exploration Licenses may be converted to a lease or leases.

E. References

DNR (Division of Oil and Gas Alaska Department of Natural Resources). 2004. Enforceable standards for development of state owned coalbed methane resources in the Matanuska-Susitna Borough. Anchorage, Alaska.

DNR (Divsion of Oil and Gas Alaska Department of Natural Resources). 2016. Director's Determination of State Lands Subject to Oil and Gas Exploration Licensing Southcentral Alaska Region. Division of Oil and Gas. Anchorage, Alaska. https://dog.dnr.alaska.gov/Documents//Programs/SouthCentral_Region_Determination_05092016.pdf (Accessed October 11, 2021).

SLA 2004. An Act. Approving an interim classification by the commissioner of natural resources closing certain land within the area of the proposed Bristol Bay (Alaska Peninsula) competitive oil and gas areawide lease sale to oil and gas exploration licensing and shallow natural gas leasing; and providing for an effective date. Chapter 9. Senate Bill 244, March 17, 2004. State Legislative Act. http://www.akleg.gov/basis/folioproxy.asp?url=http://wwwjnu01.legis.state.ak.us/cgi-bin/folioisa.dll/slpr/query=*/doc/{t3041}? (Accessed October 13, 2021).

Chapter Three: Description and Location of the License Area

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Chapter Three: Description and Location of the License Area

AS 38.05.035(g)(1)(B)(i) requires that the director consider and discuss the property descriptions and locations of the Susitna Valley gas exploration licenses (Licenses or License Areas). The following overview includes the property descriptions and locations of the License Areas and other information material to the director's written finding that the exploration license will best serve the state's interest (AS 38.05.035(e)(1)(B)(iii)).

A. Property Location and General Description

The combined License Areas consist of approximately 567,359 acres and are located primarily within the Matanuska-Susitna Borough. The License Areas are located in the Susitna River basin within the Susitna Valley. The License Areas were originally proposed to include a larger area that included the Susitna River and lands to the east of the current boundary. The proposed boundary included a larger percentage of private property and important recreation areas including Nancy Lake State Recreation Area. The boundaries of the license areas have been adjusted and reduced in comparison to the original proposal to eliminate the Susitna River and land to the east of the river. These lands were excluded from the proposed license area to reduce conflict with private landowners, conflicts with recreational use, as well as reduce impacts to the important fisheries associated with the Susitna River.

Another significant amount of acreage was eliminated from the proposed License Areas in the southwest portion of License Area 1 as the Susitna basin is bound by the Beluga fault, which now forms a boundary for that License Area. A significant amount of acreage was eliminated from the western portion of License Area 2 as the known geology of the region did not see a great potential for gas exploration in that area and also excludes the community of Skwentna.

The Division of Oil and Gas (DO&G) evaluated the proposed license areas and determined that the state would benefit more from a more focused area for gas exploration and reduced the acreage from the original proposal by approximately 39 percent. The significantly smaller License Areas match the proposed exploration plan of the applicant, and it was determined to be more feasible to conduct exploration over this reduced footprint in the 10-year term of the exploration licenses. Additionally, the existing geologic data suggests that the highest potential for this exploration project exists within the smaller footprint defined in these adjusted License Area boundaries. The Susitna Valley is bounded by the Alaska Range to the northeast, the Talkeetna Mountains to the northwest, and the Chugach Mountains to the south and east. The License Areas are generally located west of the community of Houston, south of Talkeetna, and west of the Susitna River (Figure 3.1).

Specifically, the License Areas consist of state-owned, unencumbered gas estates within Townships 16 through 24 N., Ranges 5 through 11 W., Seward Meridian. The License Areas contain subsurface ownership of state-owned lands and waters, privately-owned lands, Alaska Mental

Health Trust lands, University of Alaska lands, and School Trust lands (Figure 3.2). Only free and unencumbered state-owned subsurface mineral estates are included in the exploration licenses.

Portions of the License Areas may be accessed by various public secondary roads from the Parks Highway and from the north from Petersville Road and some existing mining roads and trails. Alternatively, certain portions of the west side of the License Areas may be accessed by helicopter or by floatplane via small lakes.

B. Land and Mineral Ownership

Approximately 71 percent of the surface estate in the License Areas is owned by the State of Alaska, based on hierarchical general land status at the section level. The remaining 29 percent is owned by private individuals and the local municipalities. The Alaska Statehood Act granted to the State of Alaska the right to select from the federal public domain 102.5 million acres of land to serve as an economic base for the new state. The Statehood Act also granted to Alaska the right to all minerals underlying these selections and specifically required the state to retain this mineral interest when conveying its interests in the land (Alaska Statehood Act, Section 6(i); AS 38.05.125). Accordingly, when state land is conveyed to an individual, local government, or other entity, state law requires that the deed reserve the mineral rights for the state unless there is a prior, valid claim. Furthermore, state law reserves to the state, the right to reasonable access to the surface for purposes of exploring for, developing, and producing the reserved mineral.

The Alaska Native Claims Settlement Act (ANCSA), passed by Congress in 1971, also granted newly created regional Native corporations the right to select and obtain the land and mineral estates within the regional Native corporation boundaries from the federal domain. It also allowed Native village corporations and individual Alaskan Natives to receive land estate interests. However, overlapping selections created conflicts and delays in conveying the land from the federal government, and some selected lands have yet to be conveyed.

Titles conveyed under the Alaska Native Allotment Act are held in restricted status cannot be alienated or encumbered without approval from the Bureau of Indian Affairs (BIA) (43 CFR 2561.3). However, some allottees have successfully applied to the BIA to have the restrictions removed and were issued a patent in fee which vested all management authority in the allottee. Mineral closing orders, which are commonly associated with surface land disposal, do not apply to oil and gas leasing.

The Exploration Licenses grant an exclusive right to explore for gas on state lands within License Area 1 and License Area 2. Expressly excluded from the Exploration Licenses are subsurface lands not owned by the State, which may include those owned by Alaska Native corporations or other individual, institutional or government owners. However, if and only during the term of the Exploration License, the state receives title to additional subsurface lands with License Area 1 or License Area 2, it is the intention of the state to then include those lands in the Exploration License when they enter the state domain. The Licensee may request to include such acreage in the Licenses. DO&G has considered the impacts of adding this additional acreage to either License Area and determined that automatically including such acreage shall not materially impact this finding. Upon the acquisition, by the state, of any additional acreage within the License Areas during the term of the Licenses, DO&G shall provide all legally required notice of the disposal. At this time, the state has identified approximately 627 acres of unconveyed lands in License Area 1, and approximately 423 acres of unconveyed lands in License Area 2. If these or other additional acreage in either License Area results in that License surpassing the 500,000-acre limit, the Licensee must relinquish other acreage in order to bring the License to a total acreage of 500,000 or less.

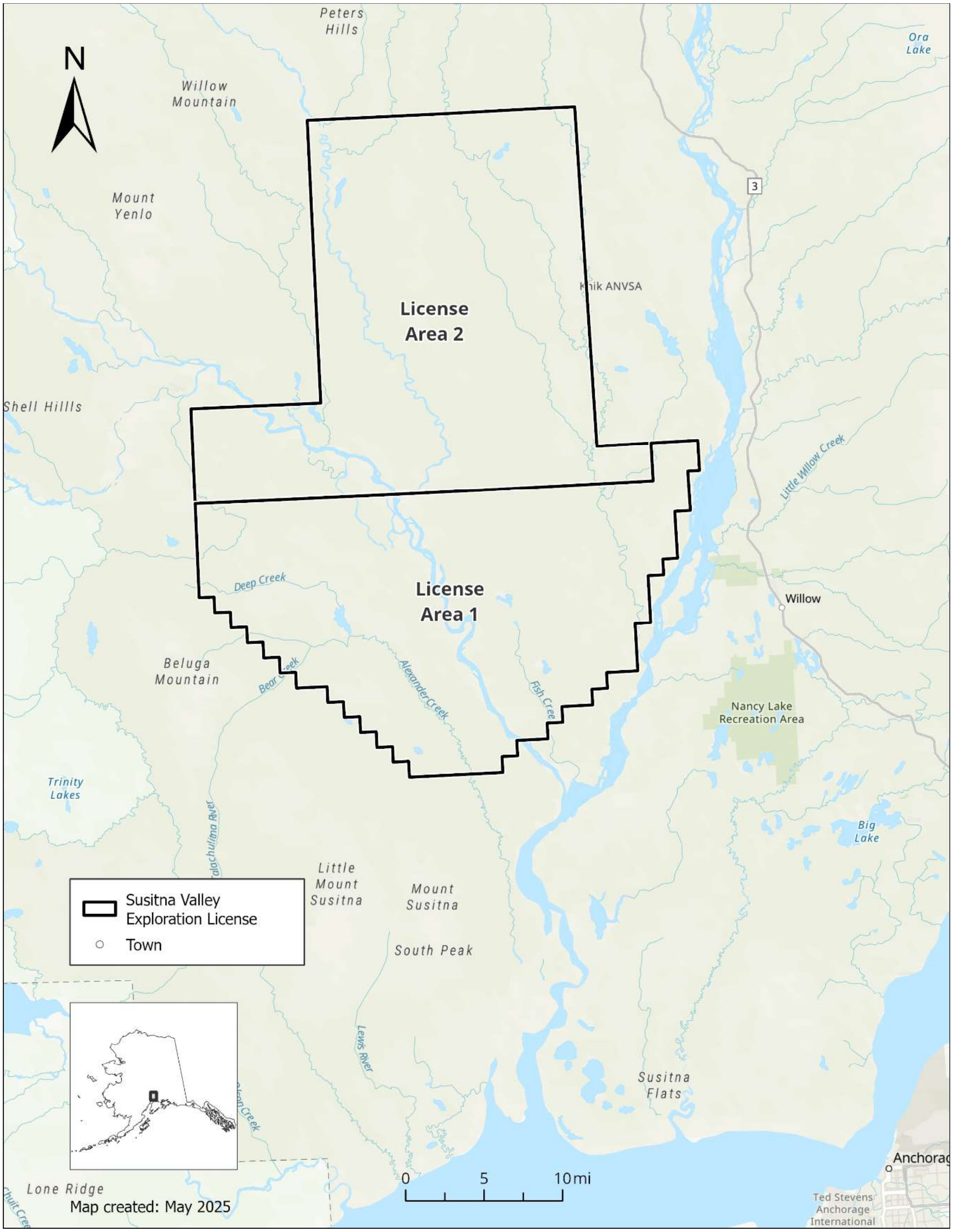

Figure 3-1. Susitna Valley Area Map

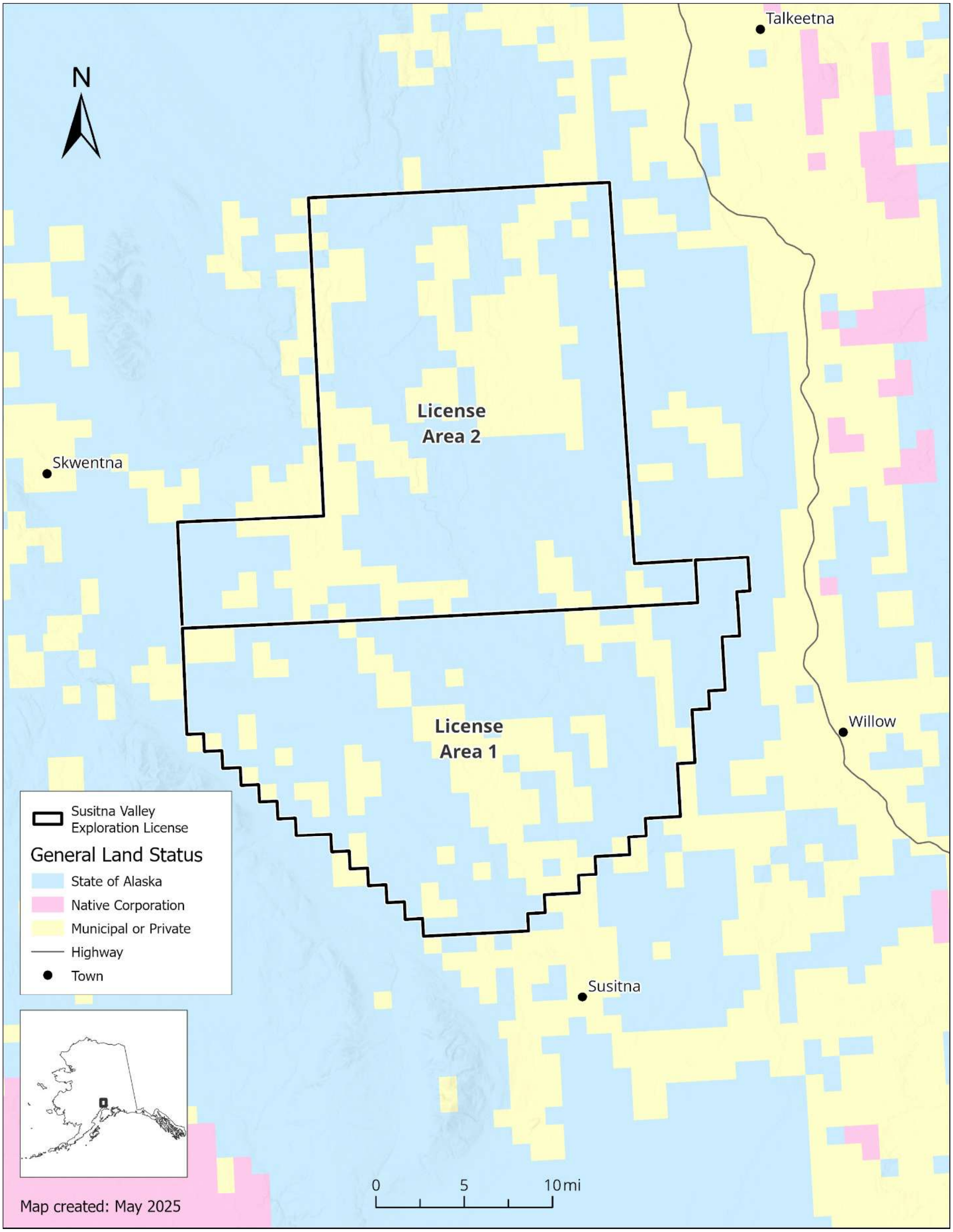

Figure 3-2. Susitna Valley general land status map

C. History and Cultural Resources

Historic and cultural resources can include a range of sites, deposits, structures, ruins, buildings, graves, artifacts, fossils, and objects of antiquity that provide information pertaining to the historical or prehistoric culture of people in the state, as well as to the natural history of the state.

The Alaska Heritage Resources Survey database indicates that there are approximately 50 reported cultural resource sites within the License Areas. Most known cultural resources sites are within License Area 1, with a few known cultural resources in the southern portions of License Area 2. Half of the previously documented sites are categorized as prehistoric, and 32 percent of the previously documented sites are categorized as historic sites. Several historic trails cross License Area 1 and the lower portions of License Area 2. Many of these trails are related to the Iditarod National Historic Trail (INHT). The INHT runs from southeast to northwest along two primary trails, one paralleling the Yentna River within the License Areas and the other within License Area 1 paralleling Mt Susitna and Beluga Mountain, which are southwest just outside the project area (OHA 2025).

Previously identified cultural resources potentially represent only a fraction of the number of cultural resources within the State of Alaska. Only a small portion of the state in general (less than 5 percent) has been systematically surveyed for cultural resources. Given the general lack of systematic cultural resources survey in the License Areas, previously unidentified resources may be encountered within the License Areas. A general historical context for the Upper Cook Inlet area is provided (OHA 2025).

There is a lack of identified and excavated archeological sites documenting the prehistory of Southcentral Alaska. A handful of archeological sites in the Matanuska-Susitna region date to over 8,000 years old, and most of those are found in the mountainous alpine regions. However, two cultural sites in the Susitna River area, the Trapper Creek Overlook, and the Susitna Overlook, are dated from 5,000 to 10,000 years old. Excavations of these sites have led archaeologists to conclude that the sites were used for hunting in a period spanning from 7,000 to 12,000 years ago, with the potential for earlier occupations (Wygal and Goebel 2012).

Archaeologists theorize that the Kachemak tradition occupied the Cook Inlet region from 3,400 to 5,000 years ago (Workman and Workman 2010). More recently, the Dena’ina tradition in the Cook Inlet region can be traced archeologically to between 3,000 and 3,500 years ago. The Upper Inlet regional band of the Dena’ina cultural tradition occupied the License Areas and much of the Matanuska and Susitna valleys (Metiva and Hanson 2008).

The Upper Inlet regional band of the Dena’ina occupied the Matanuska-Susitna valley area when Russian sailors first sighted Alaska in 1741 and, subsequently, established Russian fur trading outposts in the Alaska region. However, Russian influence was primarily focused along the coast; most Upper Inlet Dena’ina communities remained outside of direct Russian control until the 1840s (Kari and Fall 2003). As such, early Alaska Native village sites exist along the Matanuska and Susitna rivers and their tributaries (Metiva and Hanson 2008).

After the purchase of Alaska by the United States in 1867, the scope of original Dena'ina territory decreased due to gold exploration and American settlement in the Upper Cook Inlet region. Several trails throughout the License Area saw prehistoric and historic use by Alaska Natives, European and American explorers, gold miners, trappers, and the United States government. The Dena'ina people have lived and used the area in and around the License Areas for centuries living in semi-permanent villages (Boraas and Leggett 2013).

The community of Willow was developed just before 1900 when gold was discovered in the Willow Creek drainage. The prospectors created a series of trails that are now being used as the Alaska Railroad line and a winter trail known as the Double Ender Sled Trail to move materials into the area. The construction of the Alaska Railroad brought more people to the area and a station house was constructed in 1920. An airfield and radar station were constructed by the military during World War II in the area and by the mid-1950s Willow was the largest gold mining district in Alaska. In 1976 Alaskans selected Willow for their new state capital site. However, funding to enable the capital move was defeated in the November 1982 election(DCCED 2025c).

Dena'ina Athabascans have hunted and fished along the Skwentna and Yentna Rivers in and around the License Areas for centuries. In 1908 an Alaska Road Commission crew constructed a trail from Seward to Nome, going through Old Skwentna from the Susitna River to Rainy Pass. Many roadhouses were later constructed along the trail, including the Old Skwentna Roadhouse. Max and Belle Shellabarger homesteaded and started a guide service in 1923 and later a flying service and weather station. A post office was opened in in Skwentna 1937. After World War II, Morrison-Knudson built an airstrip, and in 1950 the United States Army established a radar station at Skwentna. In the 1960s, state land disposals increased settlement in the area (DCCED 2025a).

D. Local Communities

There are no communities located within the boundaries of License Areas. The License Areas lie predominantly within the Matanuska-Susitna Borough. Anchorage is located approximately 40 miles to the south of the License Areas' southern boundary.

1. Matanuska-Susitna Borough

a. Population

The Matanuska-Susitna Borough is a second-class borough, with an estimated population of 115,239 people in 2024. At that time, the population was 81.3 percent Caucasian, 8.1 percent multiracial, 7.0 percent Alaska Native or American Indian, 1.8 percent Asian, 1.4 percent Black or African American, and 0.4 percent Pacific Islander. The population increased 7.6 percent between 2020 and 2023 (USCB 2024).

b. Current Economy, Facilities, and Transportation

Between 2019 and 2023, the estimated per capita income of the Matanuska-Susitna Borough was $40,945, with the estimated median household income at $90,625. In 2023, about 9.7 percent of the population was below the poverty level (USCB 2024). In 2025, there were 49 primary and secondary schools in the Matanuska-Susitna Borough with a student population of just over 19,000.

The Matanuska-Susitna Borough School District is the largest public employer in the borough with approximately 2,200 staff members, more than half of which are teachers (MSBSD 2025). The Matanuska-Susitna College is located in the Matanuska-Susitna Borough and serves over 1,000 students per semester(MSC 2025). The Matanuska-Susitna Borough fire department has over 125 members with a combination of on-call paid responders and full-time responders for emergency medical and fire services (MSB 2025b). The Matanuska-Susitna Borough operates a 620 acre central landfill in Palmer. There are 13 transfer stations within the Matanuska-Susitna Borough (MSB 2025a).

2. Skwentna

a. Population and Setting

Skwentna is a Census Designated Place (CDP) within the Matanuska-Susitna Borough, with an estimated population of 56 in 2023. In 2019-2023, Skwentna' s population, was 100.00 percent Caucasian. Skwentna lies on the south bank of the Skwentna River at its junction with Eight Mile Creek, 70 air miles northwest of Anchorage in the Matanuska-Susitna Borough. It lies in the Yentna River Valley (DCCED 2025a).

b. Current Economy, Facilities, and Transportation

In 2023, the Skwentna employment rate was 23.7 percent and 43 percent of the workforce worked in for local, state or federal government agencies and 57 percent were employed by private companies. The United States census bureau did not collect estimated per capita income for the population of Skwentna, however, it was estimated that 53.4 percent of the population was living below the poverty level. An estimated 12 percent of the population had achieved a bachelor's degree or higher level of education (USCB 2023a).

Skwentna does not have a fire department or state trooper post but is served by the Skwentna Transfer Station. Skwentna cannot be accessed by the George Parks Highway, making residents reliant on snow machine and air travel. The Rainy Pass Lodge Airport and the Skwentna Airport are two airports within the CDP. Additionally, Alexander Lake has both float plane access and a private airstrip (DCCED 2025a).

3. Trapper Creek

a. Population and Setting

Trapper Creek is a CDP within the Matanuska-Susitna Borough, with an estimated population of 540 in 2023. Trapper Creek lies between mile 107 and 133 of the George Parks Highway, in the Matanuska-Susitna Borough. It lies about 17 miles north of the Talkeetna Spur Road and west of the junction of the Chulitna, Susitna, and Talkeetna Rivers. Between 2020 and 2023, the population increased roughly 8 percent. Trapper Creek's population, was 90.27 percent Caucasian, 3.31 percent Asian, and 6.42 percent two or more races (DCCED 2025e).

b. Current Economy, Facilities, and Transportation

In 2023, 38.0 percent of the population of Trapper Creek was employed. Between 2019 and 2023, the estimated median household income of Trapper Creek was $70,048, and median family income was $102,708 with 29 people or approximately 5.7 percent living below the poverty level. An estimated 11.9 percent of the population had achieved a bachelor's degree or higher level of (USCB 2023d).

In the 2023-2024 school year, 24 students attended Trapper Creek Elementary School. There are no middle or high schools within the CDP. There is one public library in Trapper Creek. Emergency services are provided by the Caswell Fire Station and the Trapper Creek ambulance. The CDP also contains a transfer site. Trapper Creek can be accessed by the George Parks Highway. Trapper Creek has multiple private airstrips (DCCED 2025e).

4. Willow

a. Population and Setting

Willow is a CDP within the Matanuska-Susitna Borough, with an estimated population of 2,429 in 2023. Between 2020 and 2023, the population increased 9.6 percent. In 2023, Willow's population was 88.64 percent Caucasian, 3.5 percent Alaska Native or American Indian, 0.68 percent Asian, and 7.18 percent two or more races. Willow is located in the Matanuska-Susitna Borough, between mile 60 and 80.7 of the George Parks Highway, north of Houston. Its western boundary is the Susitna River (DCCED 2025c).

b. Current Economy, Facilities, and Transportation

In 2023, 43.7 percent of the population of Willow was employed. Between 2019 and 2023, the estimated median household income of Willow was $74,669, and median family income was $107,604 with 14.8 percent of the population living below the poverty level. An estimated 25.8 percent of the population had achieved a bachelor's degree or higher level of education (USCB 2023e).

In the 2023-2024 school year, 119 students attended Willow Elementary School served by nine teachers and 31 students attended the Beryozova School. There is one public library and one post office in Willow. The CDP contains two health care facilities and is served by the Willow Volunteer Fire Department, the Caswell Lakes Fire Station, and the Palmer landfill. Willow can be accessed by road via the George Parks Highway and access to the statewide highway system and the transportation facilities of Wasilla, Palmer, and Anchorage. The Alaska Railroad system passes through Willow. There is one public airstrip at mile 69.7 Parks Highway. There are five additional private airstrips and a seaplane base at Kashwitna Lake (DCCED 2025c).

5. Susitna

a. Population

Susitna is a CDP within the Matanuska-Susitna Borough, and in 2023, had an estimated population of 11 people (DCCED 2025b). Approximately 53.3 percent of the population is employed, and 26.7 percent of the population have achieved a bachelor’s degree or higher level of (USCB 2023b).

b. Current Economy, Facilities, and Transportation

The community of Susitna is not accessible by road. It is located on the Iditarod Trail Sled Dog Race path. Charter float planes provide transportation and cargo from Anchorage. A dirt runway is available. Its river is often shallow and air boats and jet-propulsion river boats are necessary for travel to and from the community in summer months if not by air. Data on the demographics, economy, and workforce is not currently available (DCCED 2025b).

6. Talkeetna

a. Population and Setting

Talkeetna is a CDP within the Matanuska-Susitna Borough, with an estimated population of 1,076 in 2023. Between 2020 and 2023, the population increased 2 percent. In 2023, Talkeetna’s population was 98.7 percent Caucasian, 0.1 percent Alaska Native or American Indian, 0.1 percent Asian, and 1.1 percent Black or African American. Talkeetna is located in the Matanuska-Susitna Borough (DCCED 2025d).

b. Current Economy, Facilities, and Transportation

In 2023, 77.5 percent of the people living in Talkeetna were employed. The median household income was $72,250 and 38.7 percent of the population had achieved a bachelor’s degree or higher level of education and 16.1 percent were without health care coverage (USCB 2023c). In the 2023–2024 school year, 108 students attended Talkeetna Elementary School. There is one public library in Talkeetna. The CDP is serviced by the Sunshine Community Health Center. Talkeetna is located at the junction of the Talkeetna, Chulitna, and Susitna Rivers, it lies 115 miles north of Anchorage at mile 226.7 of the Alaska Railroad. The paved Talkeetna Spur Road runs 14 miles east off the George Parks Highway at milepost 98.7. The CDP is serviced by one airport on the eastern edge of the town (DCCED 2025d).

E. Climate

1. Current Conditions

The License Areas are in a transitional climate zone between the maritime Cook Inlet climate and the interior continental climate. This transitional climate is semi-arid with long, cold winters and mild summers (DCCED 2025a). Winter monthly low temperatures range from 1 to 4°F and monthly high temperatures range from 18 to 25°F. Summers are comfortable and mostly cloudy with monthly low temperatures ranging from 44 to 48°F and monthly high temperatures ranging from 66 to 70°F. Precipitation peaks in September as rain with an annual average precipitation of 27.86 inches, and annual snowfall of 119 inches (US Climate Data 2025).

2. Climate Change

The average global temperature, an average over the entire surface of the planet, has increased by approximately 1.9°F since 1880, increasing at a rate of about 0.27 to 0.36°F per decade, with most of the warming occurring since 1975. Global temperature depends on the amount of energy received from the sun and the amount of energy radiated back into space. The amount of energy radiated by the earth depends on many variables, including the chemical composition of the atmosphere, particularly the amount of heat-trapping greenhouse gases. Unlike global temperature, local or regional temperatures fluctuate substantially due to predictable cyclical events, like night and day, summer and winter, and variable, sometimes hard-to-predict, wind and precipitation patterns (Carlowicz 2022).

Temperatures are increasing in Alaska more rapidly than in other parts of the United States. The mean annual temperature change in Alaska from 1949 to 2020 follows an increasing linear trend of 4.3°F, and 3.3°F from 1976 to 2020. Seasonal mean temperature increases were greatest in winter and spring from 1949 to 2020, and in fall from 1976 to 2020. A shift in temperature trends in 1976 corresponds with a phase shift of the Pacific Decadal Oscillation from a negative phase to a positive phase. Positive Pacific Decadal Oscillation phase tends include increased southerly flow and warm air advection into Alaska during the winter. In Talkeetna, north of the License Areas, the average annual temperature increased by 4.8°F, with the largest temperature increase in fall by 6.7°F during 1976 to 2020. Temperature increases in Anchorage, south of the License Areas, were more moderate, where the average annual temperature increased by 2.8°F, with the largest temperature increase in fall by 4.8°F (ACRC 2025).

Recent 30-year temperature and precipitation normals (1991 to 2020) were calculated in May 2021 by the National Oceanic and Atmospheric Administration. Comparison with the previous 30-year normal period (1981 to 2010) shows climate warming across the state with normal temperature rising nearly 1°F with notably warmer fall temperatures. Annual average temperatures rose in the License Areas by an estimated 1.1°F between the two normal periods. Although precipitation does not appear to have changed considerably in the Susitna Valley between the two normal periods, seasonal shifts have occurred with less snow in the fall and more snow in the winter for an overall shortening of the snow season (ACRC 2024). Precipitation has increased throughout the state over the past 50 years with the annual trend from 1969 to 2018 in the License Areas indicating an increase of 3.4 percent (Thoman and Walsh 2019).

Effects of climate change that may be affecting fisheries resources in the License Areas include: increasing ocean temperatures, changing ocean circulation patterns, ocean acidification, changes to stream temperatures and flows, loss of glaciers, wetland drying, and increases in invasive plants and animals (Haufler et al. 2010; Schoen et al. 2017; Markon et al. 2018). These changes are projected to have negative and positive effects on Cook Inlet fisheries. Invasive species, harmful algal blooms, and pathogens have become more common and have harmed fish and shellfish; commercial fish stocks are undergoing changes in distribution, abundance, and behaviors; most salmon stocks probably will continue to prosper and some may expand their range (Johnson 2016; Schoen et al. 2017).

A risk assessment that evaluated global ocean model hindcasts and projections of ocean chemistry, fisheries harvest data for shellfish, salmon and other finfish, and demographic information found that the risk of ocean acidification to fisheries systems for the Matanuska-Susitna Borough was low, ranking in the bottom quarter (22 of 29) of the census regions evaluated. Although overall risk was considered low, assessment scores for economic sensitivity – the amount of revenue per capita from harvesting and processing acidification sensitive fish and shellfish; and hazard – the Gulf of Alaska was projected to have the largest changes in aragonite and calcium carbonate saturation were both rated high for the Matanuska-Susitna Borough (Mathis et al. 2015). Estimated economic costs of climate change in Alaska for increased costs for infrastructure maintenance, repair, protection, and relocation; wildfire property losses and firefighting costs; shortened ice-road seasons; and reduced energy demand for space heating result in a net cost of $340 to $700 million per year or 0.6 to 1.3 percent of Alaska's gross domestic product (Berman and Schmidt 2019). The relative scale of economic effects already occurring in Alaska that are impacting the License Areas are described in Table 3.1.

Table 3.1. Currently occurring economic effects of climate change induced alterations in environmental services for the License Areas.

Environmental Service Effect	Relative Certainty	Economic Effect	Magnitude*
Warmer summers			
More extremely hot days	Medium	Reduced productivity, increased energy for air conditioners and fans	Small (-)
Longer growing season	High	Increased agriculture, increased local gardening and food production businesses	Small (+)
Decreased soil moisture	Low	Reduced white spruce growth, reduced firewood and sawtimber	Small (-)
Warmer spring, longer summer	Low	Tourism Climate Index: increased fishing, sightseeing season	Small (+)
Milder winters			
Fewer extremely cold days	High	Reduced energy use for heating	Large (+)
Shorter winter season	High	Reduced snow sport season, reduced sales and winter recreation	Small (-)
Increased precipitation			
More summer rain	Medium	Tourism Climate Index: more rainy days, reduced outdoor recreation	Small (-)
Terrestrial ecosystem change			
More summer wildfires – air quality	High	Increased firefighting, decreased tourism, health and safety impacts, property damage	Medium (-)
More insect damage – white spruce	Medium	Fewer trees for forestry, increased fire danger [most damage has already occurred]	Small (-)

Source: (Berman and Schmidt 2019)
* Magnitude of state-wide economic effects. Large = >$50 million per year; Medium = $5 to $50 million per year; Small = <$5 million per year; + = positive effect; - = negative effect

F. Natural Hazards

Natural hazards include geological, meteorological, and other naturally occurring phenomena that may have a negative effect on people or the environment. Natural hazards may impose constraints on oil and gas exploration, development, production, and transportation activities. There are five major categories of natural hazards within the License Areas, including earthquakes, erosion, floods, permafrost, and wildfire.

1. Earthquakes

Earthquakes are a common natural hazard that occur in or near the License Areas. Ground shaking and surface faulting that accompany an earthquake can trigger secondary effects such as landslides, liquefaction, snow avalanches, rockfalls, and other ground disturbances. The shaking and secondary effects of an earthquake may cause damage or destruction to infrastructure, industry, and human lives (Bolt et al. 2013).

The Castle Mountain fault is a contractional feature in the southern portion of the License Areas (Haeussler et al. 2002). This fault extends along the southern Talkeetna Mountains and into the Susitna Lowland (Koehler et al. 2011). Paleoseisimic studies have indicated that four significant earthquakes have occurred on the Castle Mountain Fault throughout approximately the past 2,700 years, with an average recurrence interval of about 700 years between significant earthquakes. As such, a significant Castle Mountain Fault earthquake may be likely in the near future because it has been approximately 600–700 years since the last significant earthquake (Haeussler et al. 2002).

The recorded history of seismicity in this source region indicates a bimodal distribution of events with 27 percent of located earthquakes originating in the shallow crust and 73 percent as intermediate and deep intraplate and interplate events, respectively, extending far inland along the shallowly dipping Alaska Aleutian megathrust. The zone of ongoing seismicity that outlines the subducting Pacific plate at the plate interface is known as the Wadati-Benioff zone. Historical data indicate that a strong earthquake has occurred in south-central Alaska once every few years, with approximately 1,600 magnitude 4 or greater earthquakes and more than ten major earthquakes with a magnitude 7 of greater. The main known sources for shallow crustal earthquakes in the south-central Alaska source region (i.e., faults identifiable at the earth's surface) include the Castle Mountain fault, fault-cored folds in Cook Inlet, and the Pass Creek fault, but the entire region is subject to effects of great earthquakes on the Alaska-Aleutian megathrust and intermediate-depth intraplate earthquakes on previously unknown faults (Koehler et al. 2018).

2. Erosion

Erosion may occur within or near the License Areas. Erosion is the gradual destruction or diminution of land where land and water or wind interface. Water erosion may occur through flooding, natural stream channel migration, or gravity driven processes. Impacts from erosion may include loss of infrastructure, structures, and property (ASFPM 2016).

Soils in the Susitna valley range from well to poorly drained. Riverbanks in the Susitna drainage range from gradual beaches to vertical cut banks and many of the shoreland soils are easily eroded. River channels migrate seasonally and erode different reaches of riverbank at different times (USACE 2007). The town of Talkeetna is experiencing some recent erosion as the channel of the Susitna and Talkeetna rivers have changed course at their convergence in recent years (Starrs

2019). In Skwentna, The Federal Aviation Administration Skwentna Dump No. 1 is being eroded by the Skwentna River. Analytical soil sample results indicated the site was contaminated by DDT and its daughter products, lead from broken lead-acid batteries, and petroleum. During removal of the debris a portion of the contaminated river bank had to be left in place to act as a dam to prevent flooding of the excavation when the river started to rise in the spring. At completion of the removal activities the riverbank was reconstructed by placement of tree trunks with root wads and jute matting to stabilize the bank and resist erosion, leaving the berm in place and buried. Groundwater monitoring is on-going at the site (ADEC 2025).

3. Floods

Flooding may occur in or near certain portions of the License Areas. Impacts of flooding include damage to property and infrastructure, loss of human life, and spread of disease due to water contaminated by raw sewage, toxins, or other hazardous materials (OSHA 2021).

Excessive rainfall, rapid snow melt, and glacial lake outburst floods may contribute to overbank flooding when stream water levels rise to the point of overflowing their banks. Glacial lake outburst floods, also known as jökulhlaups, occur when water is rapidly released from a glacial lake due to the sudden failure of an ice or moraine dam, or to water overtopping the dam as a result of waves caused by mass wasting (landslide) of nearby unstable slopes that create a landslide-generated tsunami in the lake. These outburst floods are a potential hazard impacting floodplain-adjacent areas along the Susitna, Yentna, and Skwentna rivers (Post and Mayo 1971). Ice jams in rivers or streams may also cause overbank flooding. Ice jams are common during the spring in Alaska, caused by ice moving downstream catching on an obstruction or freezing together. An ice jam can create flooding upstream due to water backing up behind the ice dam, as well as flash flooding downstream when the ice floats, moves, or melts and the blockage breaks. Additionally, river ice breakup and snowmelt commonly occurs around the same time, which may lead to excess water in the channels and increased chance of flooding (NWS 2025a, b).

4. Fires

Wildfires have a high likelihood of occurring within or near the License Areas. Burning trash, clearing land, slash burning, and burning debris are the most common causes. Impacts from wildfires may include damage to or loss of structures, infrastructure, or human life (MSB 2008).

April, May, and June are the most active months for wildfires in the Matanuska-Susitna Borough. Most of the large wildfires in the Matanuska-Susitna Borough have been in dense black spruce forests and associated with windy conditions. Fire risk has also increased in recent years because of forest damage from spruce bark beetle infestations, which have affected an estimated 309,746 acres of forest in the Matanuska-Susitna Borough (MSB 2008), including acreage in the License Areas.

Several major fires that recently occurred near the License Areas including the Miller's Reach Fire, Sockeye Fire and most recently, the McKinley Fire. The Miller's Reach Fire burned 37,000 acres around Big Lake and Houston in 1996, destroying or damaging nearly 450 structures and extensively damaging public infrastructure (FEMA 2016).

In response to the Miller's Reach fire, local, state, and federal organizations created a plan to mitigate future fire damages in the MSB. The planning effort emphasized several fire mitigation goals, including protecting critical public facilities; developing incentive programs that assist homeowners in protecting residential properties; and developing fuel management programs. In support of these fire damage reduction goals, a number of projects were implemented including, creation of firebreaks and evacuation routes; structural retrofits of public buildings; development of alternative water supplies and installation of dry hydrants; and, installation of an automated weather data collection system for the MSB (FEMA 2016).

In 2015, the Sockeye Fire near Willow destroyed 55 homes and caused major damage to outbuildings on 44 properties (Sullivan 2015). The McKinley fire was part of a late-season extreme fire activity in Southcentral Alaska during the summer of 2019. That fire season was unusual and significant. Firefighting operations had to be extended by a month in 2019 due to the extreme conditions of hot summer temperature and an extended drought. The ongoing fires created poor air quality in the region that blanketed Anchorage and the Matanuska-Susitna Valley communities in smoke leading to substantial impacts to public health (Bhatt et al. 2021).

5. Permafrost

Permafrost is rock or soil that has remained at or below 0 °C for 2 years or more (Ferrians 1994). Permafrost may become a natural hazard if it begins to thaw. Permafrost thawing may be triggered by climate warming, increases in snow accumulation, changes in surface hydrology, or natural or human-caused ground disturbances, such as forest fire or construction (Richter-Menge et al. 2006). Impacts from permafrost thawing may include changes in surface hydrology, changes in ecological systems, changes in the carbon cycle, and thaw settlement (Pastick et al. 2015; Romanovsky 2004). Thawing permafrost may also result in increased erosion and potentially landslides.

The License Areas lie within an area of the state that is considered to have isolated distribution of permafrost. Isolated patches of permafrost have been documented in Upper Cook Inlet (Jorgenson et al. 2008; Pastick et al. 2015; Kanevskiy et al. 2013).

6. Volcanoes

No volcanoes are present in the License Areas, however, active volcanos along the west side of Cook Inlet may present an ash hazard to the License Areas if an eruption should occur. The amount of volcanic ash fallout, if any, in the License Areas may vary depending on the strength and length of the eruption and the distance of the erupting volcano from the License Area. Large amounts of volcanic ash may cause lost economic opportunities and may pose a risk to operation of industrial equipment and facilities (NOAA 2010).

Numerous historic and prehistoric eruptions have deposited volcanic ash in the License Areas (Mulliken et al. 2018). In recorded history, frequency of confirmed eruptions and suspected but not confirmed eruptions from the Cook Inlet volcanoes average about 1.7 eruptions per year (AVO 2016). Ash columns may rise tens of thousands of feet into the air from an eruption and prevailing winds tend to blow from the Cook Inlet volcanoes towards the east and northeast (Waythomas and Nye 2002). In 2009, volcanic ash advisories from Mount Redoubt eruptions were issued for

Southcentral Alaska several times and volcanic ash fell in several communities in the Susitna Valley (KelJenkins 2016; Associated Press 2009).

7. Mitigation Measures

Several geologic hazards exist in the License Areas that could pose potential risks to oil and gas installations and are discussed above.

Detailed site-specific studies may be necessary to identify any specific earthquake hazards for any specific site within the area. The risks from earthquake damage can be mitigated by siting facilities away from potentially active faults and unstable areas, and by designing them to meet or exceed national standards and International Building Code seismic specifications for Alaska. Firebreaks around facilities are recommended to reduce the potential for wildfires to damage infrastructure. Additionally, mitigation measures requiring the siting of facilities away from waterbodies and fish bearing rivers are included in this license to reduce the potential for flood damage to facilities and the resulting effects on the environment.

Although natural hazards could damage oil and gas infrastructure, measures in this best interest finding, regulations, and design and construction standards, are expected to mitigate those hazards. Mitigation measures in this finding address siting of facilities and design and construction of pipelines. A complete listing of mitigation measures is found in Chapter Nine.

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Chapter Four: Habitats, Fish and Wildlife

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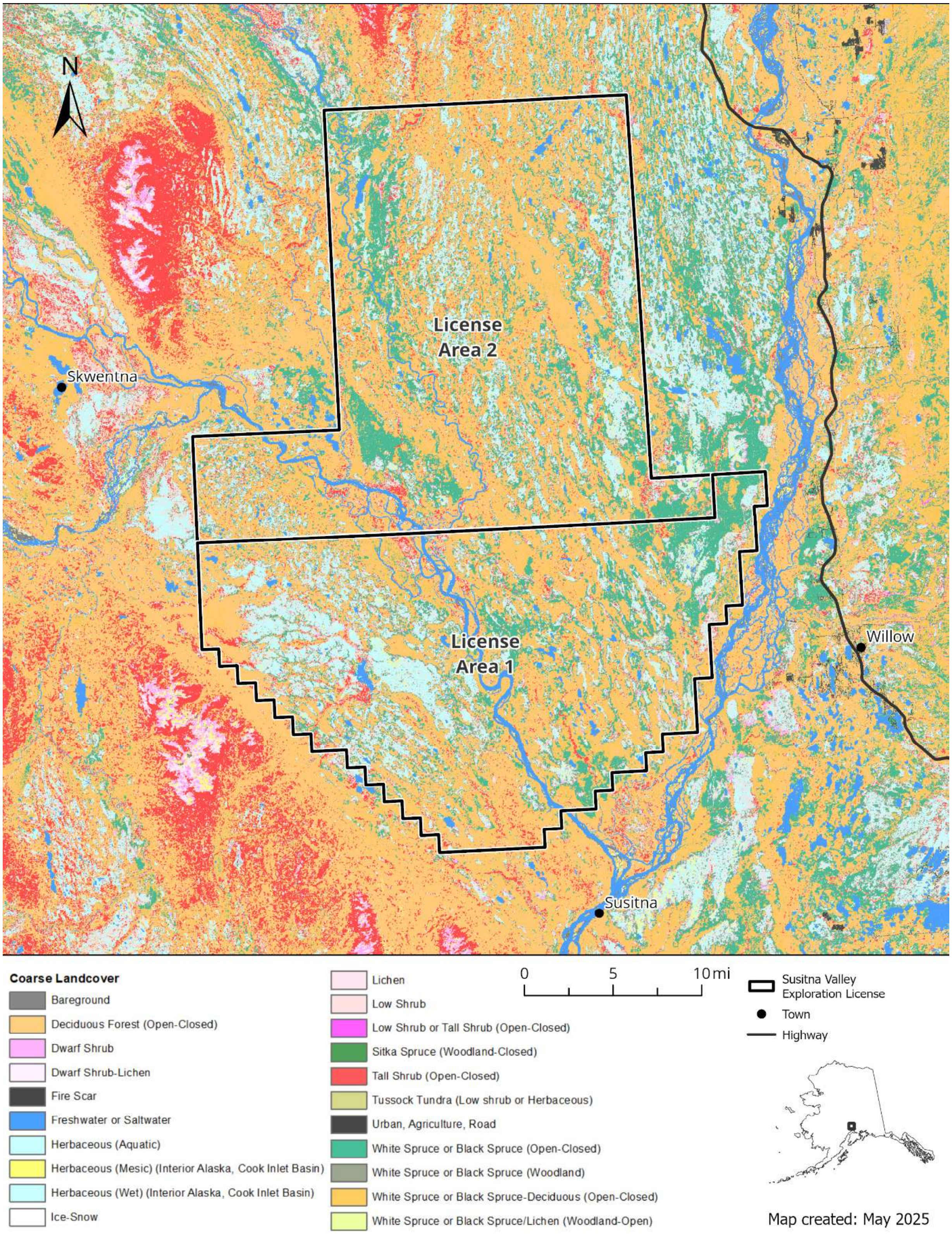
Chapter Four: Habitats, Fish and Wildlife

This chapter considers and discusses the habitats and fish and wildlife populations of the License Areas, as required by AS 38.05.035(g)(1)(B)(iii). The intent is to focus on habitats and fish and wildlife of the area that have recreational, commercial, or subsistence value that are material to the determination of whether the exploration licenses will best serve the interests of the state (AS 38.05.035(e)(1)(A)-(B)). The Susitna Valley gas exploration licenses (Licenses or License Areas) cover small portions of the Susitna River basin, and more significant portions of the Yentna River subbasin. This area contains high value fish and wildlife habitat that supports fishing, hunting, trapping, subsistence, and year-round recreation as described in Chapter Five. Fish and wildlife populations of importance include Pacific salmon *Oncorhynchus* spp., moose *Alces alces*, bears *Ursus* spp., furbearers, waterfowl, and diverse waterbird and landbird communities.

A. Habitats

Key wildlife habitats in the License Areas are interior/boreal forests, low and tall shrubs, sedge and bog wetlands, and freshwater rivers and lakes. Complex interrelationships between climate, solar radiation, surface water, slope, aspect, soil characteristics, and disturbance create a mosaic of vegetation communities in the region ranging from closed forests to open shrub and herbaceous communities in both upland and wetland conditions (ADF&G 2015). (Figure 4-1). No ecosystems of conservation concern have been identified within the License Areas (Boggs, Flagstad, Boucher, et al. 2019).



Source: (Boggs, Flagstad, Aisu, et al. 2019)

Figure 4-1. Landcover in the License Areas.

1. Forests

Deciduous forests predominate in the License Areas followed by evergreen and mixed forests (Figure 4-1). Deciduous forests are dominated by Alaska paper birch *Betula neoalaskana*, quaking aspen *Populus tremuloides*, balsam poplar *Populus balsamifera*, and black cottonwood *Populus trichocarpa*. Birch-aspen forests are widespread in the Cook Inlet basin developing on well-drained uplands and on residual or reworked deposits of glacial till, loess, and colluvium. Deciduous forests of balsam poplar and black cottonwood, or a mix of the two develop on floodplains of meandering rivers. Evergreen forests are dominated by spruce trees with white spruce *Picea glauca* growing primarily on well drained south-facing slopes and along rivers and hillsides and black spruce *Picea mariana* growing on floodplain terraces and in flat to rolling landscapes on well- to poorly-drained soils. Mixed forests have combinations of these evergreen and deciduous trees (ADF&G 2015; Boggs, Flagstad, Aisu, et al. 2019). Forest stands in the Susitna Valley are generally dominated by Alaska paper birch with lesser amounts of white spruce and pure stands of balsam poplar on river floodplains (Hanson 2014).

Wildland fires shape the extent and character of boreal forest habitats and are expected to become larger and more frequent as the climate continues to warm (ADF&G 2015). Fires and floods trigger regeneration of spruce and birch forests in Southcentral Alaska. Black and white spruce depend on ground fire to burn organic layers and expose mineral soil seedbeds. Black spruce seeds are released as cones open after exposure to heat from a fire. Periodic outbreaks of tree-killing insects are also characteristic of boreal forests and promote many important ecological processes (MSB 2008). Significant current outbreaks in the License Areas include spruce beetles *Dendroctonus rufipennis* and invasive birch leafminers *Profenusa thomsoni* and *Heterarthrus nemoratus*. The spruce beetle outbreak in the Matanuska-Susitna Borough (MSB) was in its eighth year in 2023, and spruce beetle activity in black spruce increased in the Susitna River valley where preferred susceptible-sized white spruce hosts had been nearly exhausted. About 81,000 acres of forests were damaged by Aspen leafminers, and over 90,000 acres were damaged by the spruce bark beetle in the state in 2023 (USFS 2024).

2. Shrubs

Low and tall shrubs communities are interspersed with forested habitats in the License Areas. Tall shrub communities with alders *Alnus* spp. and/or willows *Salix* spp. develop in braided river floodplains, along stream and lake margins, and in burned or disturbed areas. Willows that colonize along streams help to stabilize stream banks. Low shrub communities (shrubs less than 4 feet tall) in the Cook Inlet region are generally mesic dwarf birch *Betula nana* with ericaceous shrubs and dwarf birch with bog blueberry *Vaccinium uliginosum* or marsh Labrador tea *Rhododendron tomentosum* in peatlands. Low shrub communities generally develop in moist areas and on north-facing hill slopes (ADF&G 2015; Boggs, Flagstad, Aisu, et al. 2019).

Shrubs provide food and cover for moose, snowshoe hare *Lepus americanus*, and ptarmigan *Lagopus* spp. as well as perching, nesting habitat and foraging habitat for many types of landbirds that forage for insects or seeds. Tall willows are especially important summer and winter moose forage and for breeding passerines – such as warblers. Shrubs contribute leaf litter nutrients to soils and trap drifting snow in winter (ADF&G 2015).

3. Wetlands

Wetlands serve as a link between land and water and are abundant in the basins and valleys of river systems in the License Areas. Riparian zones, the interface between terrestrial and aquatic habitats, provide leaf litter, filter sediments and pollution, reduce wind, regulate water temperature through shading and heat retention, and root systems stabilize stream banks and floodplains (ADF&G 2006). Wetlands function to control floods, improve and maintain water quality, recharge and discharge groundwater, control erosion and stabilize shorelines while providing fish and wildlife habitat, and open space for recreation, education, and cultural resources (HDR 2012). Most wetlands in the Matanuska-Susitna Valley are bogs. Bog habitats feature non-flowing, stagnant water, and deep peat layers. Well-developed bogs in this region are often forested by black spruce with a dense low shrub understory of leatherleaf *Chamaedaphne calyculata*, sweetgale *Myrica gale*, or marsh Labrador tea *Rhododendron tomentosum* and a thick sphagnum moss mat. Spring fens in the License Areas are areas of groundwater discharge that are connected to other wetlands and streams through shallow unconfined groundwater movement (HDR 2012).

Forested wetlands are most abundant in the License Areas followed by emergent herbaceous and shrub wetlands. Area 2 contains slightly higher percentages of forested, emergent, and total wetlands than Area 1.

4. Rivers and Lakes

Freshwaters in the License Areas include many clearwater streams and glacial rivers that provide migration routes, spawning and rearing habitats, and overwintering habitats for anadromous and freshwater fishes and aquatic invertebrates. Freshwater sources include glaciers and icefields, glacial and other run-off streams, spring-fed streams, rivers, lakes, and wetlands. Glaciers and snowmelt provide a large portion of the input to watersheds in the License Areas. A large aquifer system lies beneath much of Cook Inlet’s lowlands, composed of unconsolidated glacial outwash and alluvial deposits. Groundwater discharge provides most of the water in Cook Inlet streams during the winter (Glass 1999).

Substrates define stream and river habitats ranging from large boulders, cobble, and gravel to glacial silt, clay, and mud. Stream and river morphology determined by instream and flood flows contributes to defining the habitat, including such characteristics as straight, meandering, or braided watercourses. Large, woody debris in rivers and streams stabilizes banks and substrates and provides cover, creates pool habitats, and increases stream productivity (ADF&G 2006).

5. Designated Habitats

Land and waters in the License Areas include areas established by state or federal law to protect and preserve natural habitat and fish and wildlife populations while maintaining public use of these resources. The License Areas include Essential Fish Habitat (EFH) managed by the National Marine Fisheries Service (NMFS) (Figure 4-2).

a. State Legislatively Designated Areas

i. Susitna Basin Recreation Rivers

The Recreation Rivers Act of 1988 established mile-wide corridors along 460 river miles of Susitna basin rivers totaling about 243,000 acres of state-owned land. The Act specifies that these rivers remain in public ownership, identifies purposes and management intent for the designation, and provides a management plan and advisory board that guides access, commercial uses, and development (AS 41.23.400 et seq.). A focus of the Susitna Basin Recreation Rivers management plan is protection and maintenance of fish and wildlife populations and habitat. Wildlife guidelines reduce bear conflicts, protect bald eagle *Haliaeetus leucocephalus* and trumpeter swan *Cygnus buccinator* nesting sites, and enhance habitat. Riparian guidelines protect these areas from overuse and degradation; shoreline development guidelines ensure that projects are sited, designed, and constructed to minimize degradation of water quality, and impacts on recreation, navigation, and fish and wildlife habitat. Upland development guidelines for powerlines, pipelines, and airstrips reduce potential safety hazards, and impacts on recreation, and fish and wildlife habitat. Motorized boat access is limited on some river reaches to provide a range of recreational experiences (DNR 1994).

Deshka River (Kroto and Moose Creeks) Unit

The Deshka River unit includes the Deshka River from its confluence with Susitna River to and including Kroto and Moose creeks. Peak recreation and fishing on the Deshka River occur during Chinook *Oncorhynchus tshawytscha* and coho salmon *Oncorhynchus kisutch* runs from late May through early July. Highest use fishing areas are the mouth of the Deshka, the Forks, and the mouth of Trapper Creek. High densities of moose use Moose and Kroto creeks in winter when riparian willows are critical for winter forage and survival. Black bears *Ursus americanus* use lowlands and river flats in early May and forested riparian habitats provide food and cover in summer. During June and July, salmon provide a significant portion of black and brown bears' *Ursus arctos* diet. Travel corridors along the river are important for moose and brown bear habitat. Bald eagle nest trees, primarily black cottonwood over 50 feet tall, occur near the river and trumpeter swan nests occur in this unit (DNR 1991).

Alexander Creek Unit

The Alexander Creek unit includes most of Alexander Creek, part of Sucker Creek, and Alexander Lake. Alexander Creek originates at Alexander Lake and flows south to the Susitna River. Peak recreation and fishing activity occur at the mouth of Alexander Creek, south of the License Areas during Chinook runs in May and June and coho runs in July and August. In late summer fishing for arctic grayling and rainbow trout are popular. High winter moose densities occur along Sucker Creek and the lower portions of Alexander Creek, and the extensive wetlands are important for moose calving in spring. Moose summer on Mount Susitna and Beluga Mountain, bald eagles nest along the creek and trumpeter swans nest on Alexander Lake (DNR 1991).

Lake Creek Unit

The Lake Creek management unit begins at the confluence of Lake Creek with the Yentna River, includes a one-mile section of the Yentna River, and extends beyond Chelatna Lake. Subunit 4a

Lake Creek Mouth, 4b Lower Lake Creek, and 4c Middle Lake Creek to about river mile 10 are within License Area 2. The Yentna River is wide and turbid while Lake Creek is generally clear. Salmon fishing on Lake Creek is primarily centered near the mouth of Lake Creek and the outlet of Bulchitna Lake. Bald eagles nest near the creek and brown bear densities are high during summer and fall when salmon are running in Yenlo Creek. Fall and winter moose densities are high in the Yenlo Hills and Yenlo Creek area north and west of License Area 2 (DNR 1991).

ii. Nancy Lake State Recreation Area

Nancy Lake State Recreation Area contains approximately 22,000 acres of rolling hills with mature spruce-birch forests, numerous lakes and ponds, and extensive wetlands. It was excluded from the License Areas and is located to the east of the boundary of License Area 1. This recreation area can be accessed by highway vehicle or float plane. and supports year-round recreation. Public facilities include the Lynx Lake Loop Canoe Trail, South Rolly Lake Campground, public use cabins, public launch facility, easily accessible campground and day use facilities. Hiking opportunities include Red Shirt Lake Summer Trail, East Red Shirt Lake Trail, Chicken Lake Cross-Park Trail, and the Butterfly Lake Trail. Water orientated recreation is popular and includes motorized boating, waterskiing, fishing, swimming, and canoeing. Winter uses include snow machining, dog mushing, skiing, snowshoeing, and ice fishing among other uses (DNR 2016).

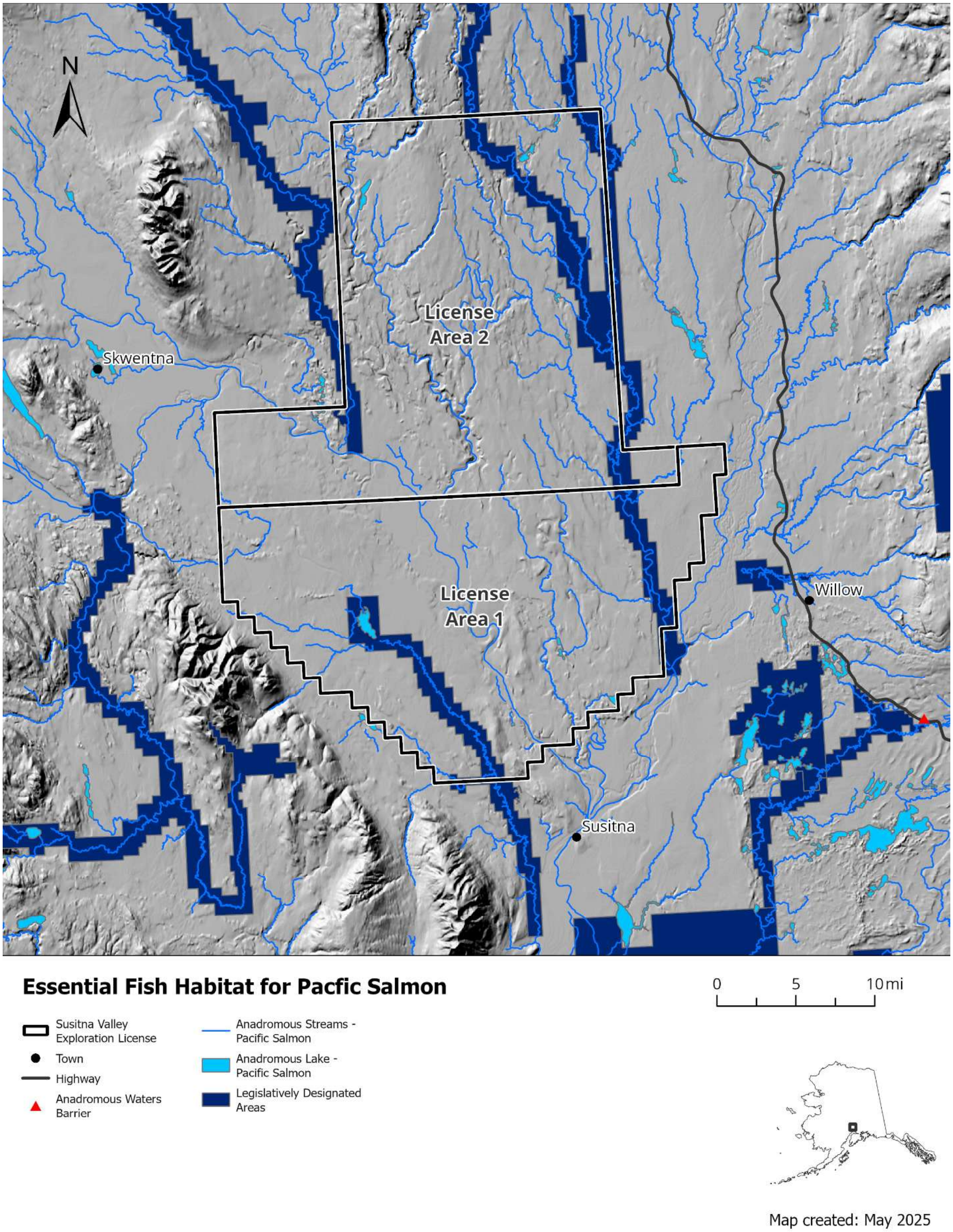
iii. Willow Creek State Recreation Area

The Willow Creek State Recreation Area was excluded from the License Areas and is located east of the boundary of License Area 1. This 3,583-acre recreation area centers around the confluence of Willow Creek and the Susitna River. The region was eroded by massive glaciers that created a rolling landscape dotted with hundreds of lakes and ponds. The area provides habitat for many mammals and birds, especially beavers and waterfowl. Beavers *Castor canadensis* maintain water levels in the ecosystem and beaver dams and lodges are protected. Campsites are available for recreational vehicles, trailers, and tents and popular activities include camping, fishing, hiking trails, and wildlife viewing (DNR 2021).

b. Federal Designated Areas

i. Essential Fish Habitat

NMFS defines areas of EFH for federally managed fisheries in Alaska as required by 1996 revisions to the Magnuson-Stevens Act (NOAA Fisheries 2021). EFH is habitat necessary for spawning, breeding, feeding, or growth to maturity for fishes managed under federal fishery management plans. Freshwater EFH for Pacific salmon is identified in the Salmon Fisheries Management Plan (NPFMC et al. 2012; NMFS 2017), and is regularly updated in Alaska Department of Fish and Game's (ADF&G) Anadromous Waters Catalog (Giefer and Blossom 2020). Rivers and lakes in the License Areas provide about 23 and 26 percent of freshwater EFH for Pacific salmon *Oncorhynchus* spp. in the Susitna basin, respectively (Figure 4-2).



Source: (Giefer and Blossom 2020)

Figure 4-2. Essential Fish Habitat areas in the License Areas.

B. Fish and Wildlife Populations

Boreal forest and shrub habitats and wetlands and waters in the License Areas provide habitat for an abundance of fish and wildlife. Uses of fish and wildlife populations of the License Areas include commercial and sport fisheries, hunting, trapping, and wildlife viewing. The following discussions focus on economically and ecologically important fish and wildlife resources that may be susceptible to cumulative effects from post-disposal oil and gas exploration and development within the License Areas.

1. Fish

At least 20 anadromous and resident freshwater fish species in 8 families occur in the License Areas(Giefer and Graziano 2023; ADF&G 2021). Rivers and streams within the License Areas provide spawning habitat for anadromous Pacific salmon, Dolly Varden *Salvelinus malma* and eulachon *Thaleichthys pacificus*. An estimated 1.9 million salmon return in even years (1.6 million salmon in odd years) to spawn in the Susitna and Yentna river drainages. Spawning habitat for all five Pacific salmon occurs in the License Areas: Chinook (king), chum (dog) *Oncorhynchus keta*, coho (silver), pink (humpback) *Oncorhynchus gorbuscha*, and sockeye (red) *Oncorhynchus nerka*. Area lakes and streams also provide habitat for resident freshwater fishes including arctic grayling *Thymallus arcticus*, rainbow trout *Oncorhynchus mykiss*, lake trout *Salvelinus namaycush*, and burbot *Lota lota*. Forage fish such as eulachon, ninespine stickleback *Pungitius pungitius*, threespine stickleback *Gasterosteus aculeatus*, and slimy sculpin *Cottus cognatus* play key roles as consumers of primary and secondary productivity transferring energy as prey to fish, waterbirds, seabirds, marine mammals, and humans. Northern pike *Esox lucius*, native to interior Alaska drainages, also occurs in the License Areas and is considered invasive in Southcentral Alaska waters.

Table 4.1 summarizes population attributes for key fishes of the License Areas. Relative abundance, expressed as abundant, common, uncommon, or rare, expresses the contribution of the population to the fish community. Trends were estimated based on stock assessments when available. Resilience is the ability of a population to recover after a disturbance based on the species intrinsic rate of growth, age at maturity, maximum age, and fecundity that is estimated based on the time required for a population to double in size where high = <15 months, medium = 1.4 to 4.4 years, and low = 4.5 to 14 years for population doubling (Love et al. 2016).

a. Salmon and Trout

Coho, Chinook, and sockeye salmon spend the longest periods rearing in freshwater and are the most widely distributed salmon in the License Areas. Pink and chum salmon spend little to no time rearing in freshwater and have more limited distributions in the License Areas. Wild rainbow trout populations occur throughout the License Areas and rainbow trout are stocked by ADF&G in many area lakes. Pacific salmon stocks are managed for sustained yield through establishment and monitoring of escapement goals. Escapement is the number of adult fish that escape harvest from commercial, subsistence, and sport fisheries to return each year to streams or lakes for spawning.

Table 4.1. Attributes of key fish populations of the License Areas.

Common Scientific Names	Relative Abundance and Trends	Population / Stock Escapement	Population Resilience
Chinook Salmon *Oncorhynchus tshawytscha*	Uncommon East Susitna – below long-term average Susitna – 64,000 ± 19% Yentna – 30,000 ± 13%	Anadromous East Susitna = 2,400 Alexander Creek = 500 Deshka River = 17,000 Talachulitna River = 2,000	Medium: Double – 1.4-4.4 yrs Maturity – 4 years Fecundity – 4,000 eggs License Areas = 97,000 ± 14%
Chum Salmon *Onchorhynchus keta*	Abundant Stable Susitna – 616,000 ± 28% Yentna – 196,000 ± 29%	Anadromous Clearwater Creek = 7,500	Medium: Double – 1.4-4.4 yrs Maturity – 2-5 years Fecundity – 700-7,000 eggs License Areas = 813,000 ± 20%
Coho Salmon *Oncorhynchus kisutch*	Common Stable Susitna – 116,000 ± 28% Yentna – 97,000 ± 19%	Anadromous Deshka River = 25,000; Fish Creek (Knik) = 6.100	Medium: Double – 1.4-4.4 yrs Maturity – 2-4 years Fecundity – 1,400 eggs License Areas = 204,000 ± 18%
Pink Salmon *Onchorhynchus gorbuscha*	Common Stable Deshka – 58,200 even Deshka – 16,000 odd	Anadromous No Upper Cook Inlet stocks monitored	Medium: Double – 1.4-4.4 yrs Maturity – 2 years Fecundity – 800 eggs License Areas = 383,000 even 75,000 odd
Sockeye Salmon *Oncorhynchus nerka*	Abundant Stable Susitna – 88,000 ± 26% Yentna – 280,000 ± 15%	Anadromous Fish Creek (Knik) = 62,000 Susitna River = 19,600 Yentna River = 75,000	Medium: Double – 1.4-4.4 yrs Maturity – 2-4 years Fecundity – 300 eggs License Areas = 368,000 ± 14%
Rainbow Trout *Oncorhynchus mykiss*	Common Unknown	Freshwater	Medium: Double – 1.4-4.4 yrs Maturity – 2-5 years Fecundity – 200 eggs
Arctic Grayling *Thymallus arcticus*	Common Unknown	Freshwater	Medium: Double – 1.4-4.4 yrs Maturity – 2-6 years Fecundity – 416 eggs
Lake Trout *Salvelinus namaycush*	Uncommon Unknown	Freshwater	Low: Double – 4.5-14 years Maturity – 5-20 years Fecundity – 5,000 eggs
Burbot *Lota lota*	Uncommon Unknown	Freshwater	Low: Double – 4.5-14.0 yrs Maturity – 2-7 years Fecundity – 970,000 eggs
Eulachon *Thaleichthys pacificus*	Seasonally abundant ~600 million	Anadromous Susitna River Yentna River	Medium: Double – 1.4-4.4 yrs Maturity – 2-6 years Fecundity – 17,000-60,000 eggs License Area = ~350 million

Sources: (Roach and Evenson 1993; Willette 2017; Froese and Bailly 2018; Luna 2019; Munro 2019; ADF&G 2020; Luna and Torres 2020a, b, c, d, e, f, g; Luna and Valdestamon 2020; Ivey 2021)

Notes: yrs = years; see text for definitions of relative abundance and population resilience; stock size = average of 2010 to 2018 escapement (Munro 2019).

i. Chinook (King) Salmon

Chinook salmon are the largest of the Pacific salmon and can exceed 30 pounds. Adult Chinook salmon migrate from marine waters to natal clear water streams to spawn between May and July, with juvenile fish rearing in rivers for 1 year, feeding on plankton and insects. The following spring, smolt move to estuaries before moving further offshore where they spend from 1 to 5 years feeding on herring, pilchard, sand lance, squid, and crustaceans (ADF&G 2025g). The Susitna River run of Chinook salmon is the fourth largest in the state. Willow Creek is the only stream in the region that has been stocked with Chinook salmon smolt by ADF&G, a program that began in 1985 (ADF&G 2008b). The East Susitna River and Alexander Creek Chinook stocks are considered stocks of management concern because of an inability to maintain escapements despite implementation of management measures (ADF&G 2025m). Spawning habitat for Chinook salmon occurs in both east and west-side Susitna drainages within the License Areas (Figure 4-3).

ii. Chum (Dog) Salmon

Adult chum salmon average 10 to 13 pounds. Chum salmon spawn in September and October, and while they prefer to spawn in small to medium, slow-flowing side channels, they may also spawn in large, muddy rivers, in cold and clear headwaters, and in the mouths of rivers below the high tide line. Eggs hatch after 3 to 4 months and the alevin remain in the gravel for an additional 60 to 90 days, after which they emerge and move to saltwater within days or weeks. In rivers, chum fry feed on insect larvae; in estuaries they feed on crustaceans, insects, and young herring; and in offshore waters they school and feed primarily on zooplankton (ADF&G 2025h). Spawning habitat for chum salmon occurs in both east and west-side Susitna drainages, primarily in the mainstem Yentna, Susitna, and Skwentna rivers and Hneh'itnu Creek within the License Areas. Most chum stream habitat, 52 percent, in the License Areas is located within Area 2. Hewitt Lake in Area 2 is also used by chum salmon.

iii. Coho (Silver) Salmon

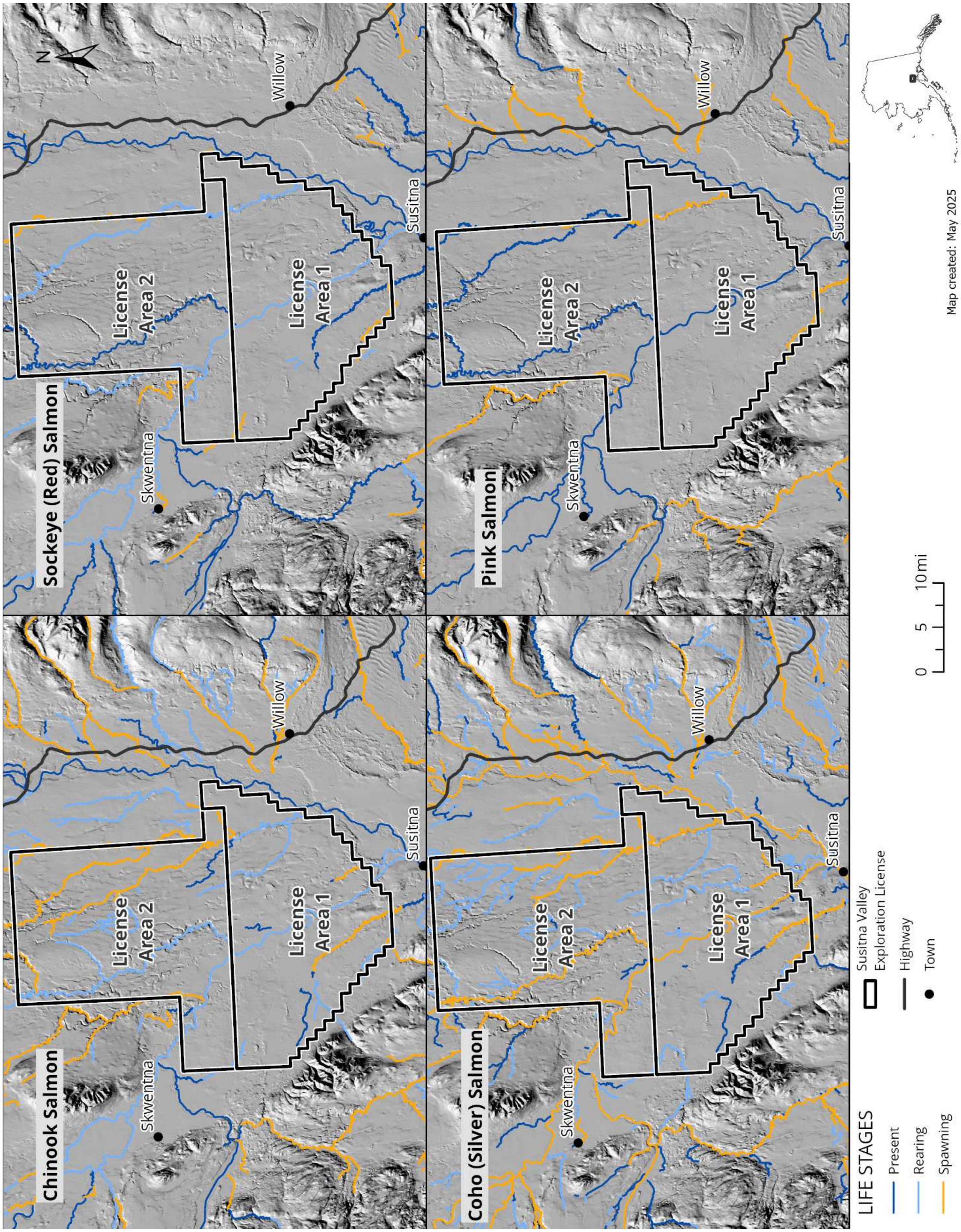
Adult coho salmon typically weigh 8 to 12 pounds. Coho salmon spawn from July to November and eggs develop over the winter, hatching in early spring and emerging from redds in May or June. In the fall, juvenile coho move out of the main channel to pass the winter, which protects them from the effects of flooding. Some juvenile coho salmon leave freshwater in the spring to rear in estuaries returning to freshwaters in the fall. They spend 1 to 3 winters in streams and may spend up to 5 winters in lakes before smolting and moving to saltwater. Most coho salmon remain in saltwater for 18 months, feeding on small fishes, before returning to freshwater to spawn (ADF&G 2025i). Spawning habitat for coho salmon occurs in both east and west-side Susitna drainages within the License Areas (Figure 4-3). Most coho stream spawning habitat, 62 percent, in the License Areas is located within Area 2 and most stream habitat in the License Areas is used for rearing, 56 percent. Lake habitats used by coho are evenly divided between Area 1 and Area 2, although rearing habitat predominates in Area 1 with 56 percent.

iv. Pink Salmon

Adult pink salmon weigh between 3 and 5 pounds and spawn between late June and mid-October. Pink salmon complete their life cycle in 2 years. As soon as fry emerge from redds they move to saltwater, where they feed on plankton, larval fishes, and aquatic insects. Adults return to spawn 18 months later (ADF&G 2025s). Pink salmon runs in Upper Cook Inlet are even-year dominated. Spawning habitat for pink salmon occurs in both east and west-side Susitna drainages within the License Areas (Figure 4-3). Most pink salmon stream spawning habitat, 60 percent, in the License Areas is located within Area 1. Pink salmon occur in Fish Lakes in License Area 2.

v. Sockeye (Red) Salmon

Sockeye salmon weigh 4 to 15 pounds and typically spawn in June and July in rivers and streams with lakes as their headwaters. Eggs hatch during the winter and the alevins remain in the gravel until spring, when fry emerge and move to rearing areas. Juvenile fish spend 1 to 3 years in fresh water feeding on zooplankton and small crustaceans before moving to saltwater. At sea juveniles feed on zooplankton, larval and small adult fishes, and squid (ADF&G 2025v). Spawning habitat for sockeye salmon occurs in both east and west-side Susitna drainages within the License Areas (Figure 4-3). Most sockeye salmon stream spawning habitat, 69 percent, in the License Areas is located within Area 2 and most stream habitat in the License Areas is used for rearing, 36 percent. Lake habitats used by sockeye salmon are more abundant in Area 1, with rearing habitat predominating in Area 1 at 78 percent.



Source: (Giefer and Blossom 2020)

Figure 4-3. Pacific salmon distribution and habitat in the License Areas.

vi. Rainbow Trout

Resident rainbow trout populations occur in the License Areas, and many Susitna Valley lakes are stocked annually with rainbow trout. Rainbow trout seek shallow gravel riffles in clear-water streams to spawn in late winter or early spring. Spawning begins in late March and lasts through early July. Eggs hatch a few weeks to 4 months after spawning, depending on water temperature. By mid-summer, fry emerge from the gravel to feed on crustaceans, plant material, and aquatic insects and their larvae. Rainbow trout move into lakes and streams after 2 or 3 years and eat fish, salmon carcasses, eggs, and small mammals. Due to population concerns, Susitna Valley wild rainbow trout are primarily available for catch and release fishing only. Wild populations of rainbow trout are considered healthy in Alaska (ADF&G 2025w).

b. Char

i. Dolly Varden

Both anadromous and freshwater resident Dolly Varden populations occur in in the License Area. Resident Dolly Varden tend to be a much smaller fish found in small headwater streams, or in land-locked lakes and ponds. Anadromous Dolly Varden spawn in late August to November and may spawn more than once, although rarely more than three times. Alevins remain in the gravel for an additional 1 to 2 months after hatching before emerging in April and May. Juveniles feed on insects and, later, annelids, fish eggs, and other small fish. After 2 to 4 years rearing in freshwater juvenile fish move to saltwater in May or June, where they spend the summer feeding before returning to freshwater to spawn and overwinter (ADF&G 2025k). Dolly Varden occur in 29.4 miles of the mainstem Susitna and Kashwitna rivers in the License Areas; with all occupied habitats in Area 1 (Giefer and Graziano 2023).

ii. Lake Trout

Lake trout, Alaska's largest freshwater fish, can reach nearly 50 pounds and are found in lakes throughout the Susitna River basin. Lake trout spend their entire lives in lakes, preferring lakes that are large, deep and cold. Lake trout broadcast spawn at night in September or October over the rocky lake bottom. Eggs hatch the following spring and young lake trout feed on plankton during the first few years. Lake trout feed on zooplankton, aquatic insect larvae, small crustaceans, clams, snails, leeches, fish, mice, shrews, and occasionally young birds. Where available, lake trout may feed extensively on whitefish, arctic grayling, sticklebacks, and sculpins. Growth rates depend on diet, water temperature, altitude and genetics – but lake trout are generally slow growing and long-lived, reaching ages over 50 years (ADF&G 2025p).

c. Freshwater Resident Fishes

i. Arctic Grayling

Arctic grayling are found in nearly all Alaskan streams and lakes that support fish. Although grayling of all ages can be found throughout a stream, adults tend to live in the cooler upper reaches of the river and stream systems, sub-adults occupy middle reaches, and juveniles prefer the warmer lower reaches. Some grayling move seasonally to spawn, feed, and overwinter while others remain in a short section of a stream for their entire lives. Extensive movements occur upstream in the spring to spawn and then back downstream to summer feeding areas and to overwintering areas in early fall. In winter, arctic grayling seek out lakes and deep pools in rivers. Their main foods are aquatic insects, salmon eggs, or smaller fish, voles, and shrews. Most grayling stocks in Alaska are considered healthy and many are isolated from potential negative effects such as over-fishing, mining, agriculture, and development (ADF&G 2025b).

ii. Burbot

Burbot broadcast spawn under the ice from February through March. Eggs settle to the bottom. Burbot grow slowly and young burbot feed on invertebrates and insects. By age 5 or 6 burbot feed primarily on fish. Burbot occupy most large clear and glacial rivers and many lakes throughout Alaska. Burbot are long-lived and late maturing and many populations in the Glennallen area were overharvested in the 1970s and 1980s when set lines were allowed. With management actions, most burbot populations have recovered (ADF&G 2025f).

iii. Northern Pike

Northern pike spawn in the spring, soon after the ice goes out. Eggs are deposited in the grassy margins of a lake shore, slow-moving stream, or slough. Pike overwinter in the deep, slow waters of large rivers. Juvenile northern pike feed on small crustaceans, insects, and smaller fish when they reach 2 inches in length. Adults feed on other fish (whitefish, burbot, smaller northern pike, and juvenile salmon), voles, shrews, and small waterfowl (ADF&G 2025r). Northern pike are not native to the Susitna River drainage and are considered invasive because they can damage salmon and rainbow trout populations. Confirmed and unconfirmed northern pike populations are found in many streams and lakes in the Susitna basin (ADF&G 2025o).

d. Forage Fish

i. Eulachon (Hooligan)

Eulachon spawning runs occur in the License Areas in the Susitna and Yentna Rivers during May. Stream water temperature can affect the timing of the spawning migration, and the numbers of returning eulachon can vary substantially year to year depending on stream water conditions and marine survival. Eggs hatch in 21 to 40 days and river currents carry newly hatched young to the sea where they feed on copepod larvae and other plankton (ADF&G 2025l). Spawning sites on the Susitna River are characterized by moderate flow, mostly sand/silt substrate or mixed gravel in waters less the 3.3 feet deep. During peak spawning runs between June 6 and June 8 an estimated 40,000 to 100,000 fish per hour or 1,250,000 to 1,750,000 fish per day migrate through the lower Susitna River to spawning locations in the Susitna and Yentna rivers (HDR, Inc. and LGL 2014). Total biomass for the 2016 Susitna River eulachon run, estimated from larval densities, was 52,911 tons (48,000 tonnes); with the current commercial harvest levels of 200 tons or about 0.4 percent harvest rate (Willette 2017). Eulachon spawning habitat occurs in 59.4 miles of lower reaches of the mainstem Susitna and Yentna rivers in the License Areas; with most spawning habitat, 90 percent, in Area 1 (Giefer and Graziano 2023).

2. Birds

Birds represent the most diverse group of vertebrates in the boreal forest region. Alaska's boreal forests are an important part of the breeding range for several landbird populations that are declining throughout their range, including rusty blackbird *Euphagus carolinus*, boreal chickadee *Poecile hudsonicus*, and olive-sided flycatcher *Contopus cooperi* (ADF&G 2015). Bird taxa documented in and near the License Areas include 21 waterfowl and waterbirds, 9 shorebirds, 4 seabirds, and 51 landbirds (Pardieck et al. 2020; Groves 2021). Waterfowl and waterbirds in the region are generally considered migratory. Landbirds breeding in the License Areas are primarily migratory, 75 percent, with 25 percent resident birds such as ravens, magpies, jays, woodpeckers, chickadees, and finches. Migratory birds arrive or pass through this region beginning with raptors and waterfowl in April continuing with arrival of songbirds through May; and then pass through or depart in July through October. Waterfowl are harvested during the fall migration from September to December, and upland game birds are harvested from late summer through March.

The License Areas are located between two Audubon Important Bird Areas (IBAs), Susitna Flats and Kahiltna Flats – Petersville Road. Susitna Flats is primarily important for large concentrations of spring and fall migrant waterfowl and shorebirds. Kahiltna Flats – Petersville Road supports concentrations of nesting trumpeter swans, post-breeding and brood-rearing Tule greater white-fronted geese *Anser albifrons elagasi*, and multi-species assemblages of landbirds including blackpoll warblers *Setophaga striata* (Audubon Alaska 2015). Eagles, both bald and golden eagles *Aquila chrysaetos* are potentially susceptible to certain types of activities and are protected by the federal Bald and Golden Eagle Protection Act (16 U.S.C. 668 – 668c), which prohibits harassment of eagles and disturbance or destruction of eagle nests (USFWS 2021). Birds of conservation concern likely present in the License Areas include three shorebirds: Hudsonian godwit *Limosa haemastica*, lesser yellowlegs *Tringa flavipes*, and short-billed dowitcher *Limnodromus griseus*; and three landbirds: blackpoll warbler, olive-sided flycatcher, and rusty blackbird (Audubon Alaska 2015; USFWS 2021).

The information presented below is focused on key bird populations that provide harvestable and recreational resources, depend upon aquatic and terrestrial habitats within the License Areas, and may be susceptible to cumulative effects from oil and gas exploration and development. Life history, migration, and population attributes are summarized for some of these key bird populations in Table 4.2 and are discussed below.

a. Waterbirds

Waterbirds, including geese, swans, ducks, loons, cranes, seabirds, and shorebirds, are considered migratory. Aerial breeding pair surveys have consistently recorded 21 waterbird taxa: 2 geese, 1 swan, 1 crane, 3 loons, 5 dabbling ducks, and 9 diving ducks. Of these groups, diving ducks were the most abundant followed by dabbling ducks and geese and swans (Groves 2021). Comparisons of 2000 to 2009 with 2010 to 2019 averages for total indicated birds indicates that 15 of these 21 taxa decreased, 2 remained the same, and 4 increased in abundance. In general decreases in total indicated birds averaged 4 times more than increases between these decades.

Table 4.2. Attributes of key bird populations of the License Areas.

Common Scientific Names	Life History	Migration	Population and Trends
Tule White-fronted Goose *Anser albifrons elagasi*	**Mass**: 4-5 pounds **Life span**: 22 years **Clutch**: 6 eggs **Breed**: mid-May - Aug	**S**: March – April **M**: mid-Jun – July **F**: Oct – mid-Nov	NA: 13,500 Alaska: 13,500 Susitna: 2.7 TIB AGR: stable
Trumpeter Swan *Cygnus buccinator*	**Mass**: 21-26 pounds **Life span**: 29 years **Clutch**: 4-6 eggs **Breed**: mid-May – mid-Sep	**S**: mid-March – late-April **M**: July – Aug **F**: early-Oct – early-Nov	NA: 63,000 Alaska: 22,000 Susitna: 8.9 TIB AGR: 1.030
Northern Pintail *Anas acuta*	**Mass**: 1.8-2.2 pounds **Life span**: 21 years **Clutch**: 7-8 eggs **Breed**: Apr – July	**S**: mid-Feb – March **M**: mid-Aug – early Sep **F**: early Sep – mid-Nov	NA: 2,507,673 AK/YK: 612,703 Susitna: 17.2 TIB AGR: decrease
Lesser or Greater Scaup Aythya *affinis* or *Aythya* marila	**Mass**: 1.9-2.2 pounds **Life span**: 18-22 years **Clutch**: 8-9 eggs **Breed**: early June – Aug	**S**: Mar – late-May **M**: Jun – July **F**: Oct – late Nov	NA: 3,983,950 AK/YK: 649,905 Susitna: 40.5 TIB AGR: increase
Arctic Tern *Sterna paradisaea*	**Mass**: 4 ounces **Life span**: 34 years **Clutch**: 2 eggs **Breed**: late May – July	**S**: mid-Mar – mid-May **F**: mid-Aug – Oct	Global: 2-4 million Alaska: 200,000 Susitna: 1.3 BBR AGR: decline
Sandhill Crane *Antigone canadensis canadensis*	**Mass**: 7.6-8.7 pounds **Life span**: 35 years **Clutch**: 2 eggs **Breed**: Apr – Sep	**S**: Mar – mid-Apr **F**: Aug – early Nov	PFW: 29,000 Alaska: 29,000 Susitna: 0.1 TIB AGR: increasing
Hudsonian Godwit *Limosa haemastica*	**Mass**: 6.9-12.6 ounces **Life span**: 29 years **Clutch**: 4 eggs **Breed**: late May – late July	**S**: Mar – mid-May **F**: Aug – mid-Nov	NA: 21,000 Alaska: 21,000 Susitna: 0.2 BBR Moderate decline
Lesser Yellowlegs *Tringa flavipes*	**Mass**: 3.0 ounces **Life span**: unknown, 4 years **Clutch**: 4 eggs **Breed**: mid-May – Jul	**S**: Mar – mid-May **F**: mid-Jul – Sep	NA: 660,000 Alaska: 158,400 Susitna: 4.4 BBR Substantial decline
Short-billed Dowitcher *Limnodromus griseus caurinus*	**Mass**: 2.8-5.4 ounces **Life span**: 13 years **Clutch**: 4 eggs **Breed**: June – early Aug	**S**: late Mar – May **F**: Jul – mid-Sep	WCan/AK: 75,000 Alaska: 60,000 Susitna: 0.1 BBR Moderate decline
Blackpoll Warbler *Setophaga striata*	**Mass**: 0.4 ounces **Life span**: 8 years **Clutch**: 5 eggs **Breed**: Jun – late Jul	**S**: early May – May **F**: mid-Sep – late Oct	NA: 59,000,000 Alaska: 13,000,000 Susitna: 31.2 BBR AGR: AK -2.3%
Olive-sided Flycatcher *Contopus cooperi*	**Mass**: 1.1-1.2 ounces **Life span**: unknown **Clutch**: 3-4 eggs **Breed**: early Jun – Jul	**S**: late Apr – May **F**: mid-Aug – mid-Sep	NA: 1,900,000 Alaska: Susitna: 1.2 BBR AGR: AK -1.2%
Rusty Blackbird *Euphagus carolinus*	**Mass**: 1.9-2.4 ounces **Life span**: 8 years **Clutch**: 5 eggs **Breed**: mid-May – mid-Jul	**S**: early Mar – mid-May **F**: mid-Sep – late Nov	NA: 5,700,000 Alaska: 700,000 Susitna: 0.7 BBR AGR: AK 0.4%

Source: (Ely et al. 2006; ADF&G 2015; Collins et al. 2016; Rosenberg et al. 2016; Groves 2017, 2021; Handel and Sauer 2017; ASG 2019; USFWS 2019; Altman and Sallabanks 2020; Anteau et al. 2020; Avery 2020; Clark et al. 2020; DeLuca et al. 2020; Ely et al. 2020; Gerber et al. 2020; Hatch et al. 2020; Jehl Jr. et al. 2020; Kessel et al. 2020; Mitchell and Eichholz 2020; Olson 2020; Tibbitts and Moskoff 2020; Walker et al. 2020)

Notes: Migration: S = spring, M = molt, F = fall; Population: NA = North America; Susitna = Susitna Strata; AGR = annual growth rate; AK = Alaska; YK = Yukon Territory; BBR = total of mean breeding birds per route 2001-2019 for the Willow and Petersville routes; PFW = Pacific Flyway population.

i. Waterfowl

Waterfowl – geese, swans, and ducks – go through a flightless molt period, when all flight feathers are shed and regrown. Adult waterfowl typically molt when one (ducks) or both (geese and swans) sexes of a breeding pair are rearing flightless young. Molting and brood-rearing geese often form large flocks that forage and move together. Post-breeding male ducks and nonbreeding and juvenile waterfowl also form large flocks during molting.

The entire population of **Tule white-fronted geese** or Tule geese, a subspecies of the greater white-fronted goose, is believed to nest in the upper Cook Inlet basin (Ely et al. 2006). Tule geese nest along sloughs in salt marsh habitats, in freshwater marsh/shrub bogs, and on south slopes of Alaska Range, using habitats in License Areas from mid-April through mid-September. Tule geese nest on the ground on tussocks in spruce bogs and other marsh-edge habitats. They feed on grasses, berries, bulbils, tubers, and rhizomes of grasses and sedges and consume both terrestrial and aquatic invertebrates. Brood rearing Tule geese use riparian wet meadows, alder and willow-lined stream banks, patches of spruce and birch forest, and expanses of outwash plain (Ely et al. 2020). Molting occurs primarily along the Kahiltna River, although many non-breeding or failed breeding Tule geese migrate to molt on the Innoko and Yukon Delta National Wildlife Refuges, returning to upper Cook Inlet in late July to early August where they remain until fall migration (Ely et al. 2006). They migrate south in September to fall staging and wintering areas in Oregon and California (Petrula and Rothe 2008). Tule geese are one of the least abundant goose populations in North America, with a 3-year average of about 13,521 birds during 2017 to 2019, which was 35 percent above the population goal of 10,000 birds (Olson 2020). Occurrence of Tule geese on Susitna transects is annually variable with no apparent trend in abundance (Groves 2021).

Trumpeter swan nesting habitat features room for takeoff (~300 feet); accessible aquatic forage plants; shallow, stable water levels; and emergent vegetation with muskrat *Ondatra zibethicus* mounds or beaver lodges, islands, or other structure for nest sites. Swans are primarily herbivorous, with adults consuming primarily foliage, seeds, and tubers of submerged and emergent vegetation, although they occasionally take fish and fish eggs. Young swans eat aquatic invertebrates and fragments of aquatic vegetation (Mitchell and Eichholz 2020). Statewide, trumpeter swan populations increased 7 percent between surveys in 2005 and 2010 as they began to occupy previously unoccupied breeding grounds (Groves 2012, 2017). Swans also have an increasing trend on Susitna transects from 1964 to 2019 (Groves 2021).

Northern pintails are circumpolar dabbling ducks, with core North American nesting habitat in Alaska and the Prairie Pothole Region. In Alaska, breeding pairs frequent small semipermanent wetlands with stands of horsetail *Equisetum* and cattail *Typha* and sedge meadows in boreal forests. Females build nests on the ground, often far from water. Only females incubate the eggs. Ducklings follow the female to water after a day in the nest and fledge by July or August. Adults and ducklings consume primarily aquatic invertebrates during the breeding season (Clark et al. 2020). Northern pintails breeding in Alaska were 53 percent below their long-term average population size in 2019 and 34 percent below the 2018 estimate (Olson 2020). North American populations have been below population management goals most years since the 1980s (USFWS 2019). Northern pintails also have a decreasing trend on Susitna transects from 1964 to 2019 (Groves 2021).

Greater scaup are larger and heavier than **lesser scaup**, are difficult to distinguish from each other, and both breed in the License Areas. Lesser scaup are generally more abundant than greater scaup, and both species usually nest near water foraging on aquatic insects, amphipods, crustaceans, and mollusks such as small clams and snails. Nests are constructed on the ground in tall vegetation in upland habitats often under shrubs, although both greater and lesser scaup may nest in graminoid patches on floating mats of buckbean *Menyanthes trifoliata* (Kessel et al. 2020; Anteau et al. 2020). Scaup breeding in Alaska were 44 percent below their long-term average population size in 2019 and 26 percent below the 2018 estimate (Olson 2020). North American populations have been below population management goals most years since the 1990s (USFWS 2019). Scaup show a slight increasing trend on Susitna transects from 1964 to 2019, although the mean number of birds decreased by half from 2000 to 2009 and 2010 to 2019 (Groves 2021).

ii. Loons

Common loons *Gavia immer* are more abundant on Susitna transects than either Pacific loons *G. pacifica* or red-throated loons *G. stellata* (Groves 2021). Common loons are the largest of these three loons and generally breed on lakes. Pacific and red-throated loons may breed on lakes or ponds. These loons winter along the coast from the Aleutians to Baja California, migrating to coastal areas in September or early October and returning to freshwater nesting habitats in May. Both parents incubate and care for young and breeding success may be related to predators such as gulls and foxes. Loons dive to feed on small to medium sized fish, aquatic vegetation, insects, mollusks, and frogs (ADF&G 1994). These three loons are widely distributed throughout Alaska and have experienced local or regional declines over the past 20 years (USFWS 2020b). All three of these loons had increasing trends in abundance on Susitna transects from 1964 to 2019, although the mean number of birds decreased by nearly half from 2000 to 2009 and 2010 to 2019 (Groves 2021).

iii. Seabirds

Seabirds nesting in the Susitna basin include gulls and arctic terns (Pardieck et al. 2020). **Arctic terns** complete a 44,000 mile round-trip annually between their Arctic breeding range and their Antarctic non-breeding range (ADF&G 2015). They nest in colonies at coastal sites and on small islands in lakes, dispersed throughout tundra, and in wetland habitats throughout interior Alaska. Nests are scrapes usually on bare ground near water. Terns forage over water diving to capture small fish which are fed to their young, although they also eat crustaceans, insects (adults and aquatic larvae) and other invertebrates. Abundant small fish to feed to their young may be necessary for successful breeding (Hatch et al. 2020). No population trend information is available for colonies nesting in interior Alaska, where most of the Alaska population is thought to breed (AKNHP 2019).

iv. Cranes

Sandhill cranes nesting in the Cook Inlet basin belong to the Pacific Coast population that winters in California's Central Valley and nests in coastal areas in Southcentral Alaska, the Alaska Peninsula, and Aleutian Islands. Cranes typically nest in areas with emergent marshes and typically nests are constructed over water in either attached or floating vegetation, although they will also nest on dry ground. Sandhill Cranes capture prey from the surface of the ground and subsurface by probing with their bills consuming a variety of plant materials, small vertebrates, and invertebrates (Gerber et al. 2020). The Pacific Coast population is increasing and supports a low level of harvest in southern Alaska (Collins et al. 2016). Few cranes are sighted on Susitna transects and no cranes have been documented since 2011 (Groves 2021).

v. Shorebirds

The most abundant shorebirds in the License Areas are Wilson's snipe *Gallinago delicata* with 37.7 breeding birds per route (BBR), lesser yellowlegs with 4.4 BBR, and greater yellowlegs *Tringa melanoleuca* with 2.1 BBR (Pardieck et al. 2020).

Hudsonian godwits wade through bogs and tidal mudflats, using their long bills to reach into the substrate for invertebrates. After breeding in wet meadows and bogs in the boreal forest, they migrate from arctic and subarctic nesting areas to wintering habitats near the southern tip of South America. In the Cook Inlet basin, they breed in large open areas of muskeg with a mixture of wet bog, small shallow pools, small spruce islands, and drier upland areas, surrounded by mostly coniferous forest. Nests, small depressions on dry hummocks, are found in sweetgale bogs, surrounded by spruce forest with spruce islands and small ponds. Hudsonian godwits are considered vulnerable because of their relatively small global population, small and fragmented breeding distribution, and high potential for catastrophic events that could affect a large proportion of the population during the non-breeding season. Heavy hunting on wintering grounds in North America may have contributed to their small population and populations declines (Walker et al. 2020). Muskeg habitats at Beluga River southwest of the License Areas support the largest known Alaska breeding population of Hudsonian Godwits. The Pacific population, which has remained stable for the past 30 years, is currently estimated at about 30,000 birds of which a large proportion likely breed in Alaska. The Pacific population however has retracted their nonbreeding range, and their patchy distribution in Alaska may be the result of aggregated nesting (ASG 2019).

Short-billed dowitchers feed by wading in shallow water or wet mud, probing in the mud with its bill. Short-billed dowitchers arrive in wetland and boreal forest breeding grounds unpaired, and males establish breeding territories. Dowitchers feed on aquatic and terrestrial invertebrates, including annelid worms, snails, insects, and spiders while during breeding. During migration and in winter they prefer coastal habitats where they forage on mollusks, marine worms, crustaceans (Jehl Jr. et al. 2020). Threats to the *Limnodromus grieseus caurinus* subspecies that breed in Alaska and western Canada include: small population size, restricted breeding distribution, hunting and habitat loss on the wintering grounds, habitat loss at migration stopover areas due to development. Data from Kachemak Bay during migration suggests that this subspecies has declined in abundance since the 1990s (ASG 2019).

Lesser yellowlegs arrive in southeast Alaska in late April, with some continuing north to nest in south coastal and southwest Alaska. Yellowlegs breed in the boreal forest and the transitions between forest and tundra in wet bogs and open muskeg. Typical nesting areas contain a combination of shallow wetlands, trees or shrubs, and open areas. Nest sites are on the ground on dry, mossy ridges or hummocks next to fallen branches and logs underneath low shrubs or small trees. Yellowlegs forage for aquatic and terrestrial invertebrates, particularly flies and beetles with small fish and seeds taken occasionally (Tibbitts and Moskoff 2020). Lesser yellowleg populations appear to have declined by 70 to 80 percent or more across their range, and have also declined in abundance throughout their breeding range in the boreal United States and Canada (Woodford 2019). Alaska breeding birds are hunted on nonbreeding areas in Central and South America (ASG 2019). Recent breeding bird surveys indicate that between 2003 and 2015, lesser yellowlegs declined by about 5 percent per year in Alaska (Handel and Sauer 2017). Boreal wetlands in Alaska where lesser yellowlegs breed are drying due to climate change, although effects of this habitat change on survival and productivity have not been documented (ASG 2019).

b. Landbirds

Many landbirds use boreal forests for breeding and rearing young, but winter as far away as Central or South America. Alaska's boreal forest is an important part of the breeding range for several boreal forest landbirds with declining populations in other parts of their range, including rusty blackbird, boreal chickadee, and olive-sided flycatcher (ADF&G 2015). About 25 percent of landbirds using the License Areas are resident birds. Migratory landbirds in the License Areas fall into two classes, long-distance migrants, 47 percent – those that winter in Central America, South America or Caribbean Islands, and short-distance migrants 27 percent – those that winter in North America (Stralberg et al. 2016; Pardieck et al. 2020).

i. Eagles

Bald eagles are widely distributed along waterways and are present throughout the License Areas. Bald eagles are usually found near water in coastal areas and along lake and river shorelines. The breeding season in Alaska begins with courtship and nest building in February and ends when the young fledge by late August into early September. Fish are the primary diet of bald eagles in summer, but they also prey on waterfowl, small mammals, and carrion. Nests, large structures that can weigh more than 1,000 pounds, are usually constructed in mature old-growth trees or snags, and on cliffs or rock outcrops. In coastal Alaska breeding eagles may remain near their nests year-round. In Interior Alaska eagles begin moving to wintering grounds, likely in the Pacific Northwest or Intermountain West, as waters begin to freeze and prey becomes limited in the fall. Eagles may congregate at communal roost sites in winter for feeding and sheltering (USFWS 2020a). Based on limited surveys the bald eagle population in Alaska is estimated at 70,500 birds and is considered to be increasing slowly and projected to remain stable (USFWS 2016).

Golden eagles are typically found south of the Brooks Range in Alaska. Golden eagles build nests on rugged cliffs or bluffs and prefer open prairie-like areas for foraging. Breeding occurs from nest construction and egg laying from late April through May continuing for up to 100 days until hatchlings leave the nest and become independent. While golden eagles feed primarily on small mammals and birds such as cranes, owls, and ptarmigan, they may also take caribou neonates. Golden eagles nesting in Alaska generally migrate to the Intermountain West where they spend the winter, although some birds may remain in Alaska through the winter (ADF&G 2025n). Based on limited surveys the golden eagle population in Alaska is estimated at 4,100 birds and is considered to be decreasing slowly (USFWS 2016).

ii. Passerines

The most abundant passerines in the License Areas are Swainson's thrush *Catharus ustulatus* with 109.5 breeding birds per route (BBR), alder flycatcher *Empidonax alnorum* with 102.8 BBR, yellow-rumped warbler *Setophaga coronate* with 80.7 BBR, dark-eyed junco *Junco hyemalis* with 71.3 BBR, and American robin *Turdus migratorius* with 70.3 BBR (Pardieck et al. 2020).

Blackpoll warblers breed across the northern coniferous forests of Alaska and Canada and have the longest migration of North American warblers wintering in northern South America. Nest are constructed primarily in willow and alter shrubs in Alaska where riparian or other moist habitats are preferred, with most nest found less than 2 feet above the ground in dense cover. The female gathers nest materials and constructs the nest which is lined with feathers. Young birds are altricial requiring parental care for brooding and feeding while in the nest and after fledging. They feed primarily on adult and larval insects and other arthropods, with some fruit used during fall migration (DeLuca et al. 2020). Blackpoll warblers have experienced range wide population loss of 92 percent since the 1970s (Rosenberg et al. 2016). Blackpoll warblers were more abundant on the Petersville route with 24.3 BBR compared to the Willow route with 6.9 BBR (Pardieck et al. 2020). In Alaska, blackpoll warblers declined from 1993 to 2015 at an annual rate of 2.3 percent within the Northwest Interior Forest Bird Conservation Region (BCR) (Handel and Sauer 2017).

Olive-sided flycatchers breed in open dwarf white spruce forests and black spruce bogs in Alaska. Nests are open-cups constructed by the female on horizontal branches well out from the trunk in a cluster of live needles and twigs, averaging about 21 feet above the ground located in about the top 1/4 to 1/3 of the nest tree height in Alaska. Nearly all nests in central Alaska were in spruce trees with most, 79 percent, in black spruce trees. Olive-sided Flycatchers prey almost exclusively on flying insects and often forage from high, prominent perches at the tops of snags or uppermost branches of live trees. They arrive in Alaska in late spring and depart in early fall likely due to the availability of aerial insects. Their migrations is one of the longest of any North American breeding flycatcher, wintering primarily in Panama and the Andes Mountains of South America (Altman and Sallabanks 2020). Olive-sided flycatchers have experienced range wide population loss of 78 percent since the 1970s (Rosenberg et al. 2016). Olive-sided flycatchers were more abundant on the Petersville route with 0.8 BBR compared to the Willow route with 0.4 BBR (Pardieck et al. 2020). In Alaska, olive-sided have been declining from 1993 to 2015 at an annual rate of 1.2 percent in the Northwest Interior Forest BCR (Handel and Sauer 2017).

Rusty blackbirds breed north to the tree line in wet boreal forests of Alaska, Canada, and the northeastern United States. They migrate relatively short distances between wintering areas in mid-western and southeastern United States to breeding areas along bogs, muskeg swamps, beaver ponds, and streams. Nests are always close to water in dense vegetation in living and dead trees and shrubs or on stumps 2 to 20 feet above the ground. Only females incubate and brood while both male and female parents feed and protect the young. Rusty blackbirds forage opportunistically on both plant and animals matter year-round with winter foods including crops, acorn masts, pine seeds, and some fruits, while summer diet is primarily aquatic insects and other animal food (Avery 2020). Rusty blackbirds have experienced range wide population loss of 89 percent since the 1970s (Rosenberg et al. 2016). Potential factors identified for the decline include loss of wetlands in wintering habitats in the southeast, contaminants on breeding grounds, poisoning of blackbirds on winter roosts, and increased disturbance of boreal wetland breeding habitats (Avery 2020). Rusty blackbirds were more abundant on the Willow route with 0.5 BBR compared to the Petersville route with 0.2 BBR (Pardieck et al. 2020). In Alaska, rusty blackbirds have remained stable to a slight increase from 1993 to 2015 with an annual rate of 0.4 percent in the Northwest Interior Forest BCR (Handel and Sauer 2017).

iii. Grouse and Ptarmigan

Grouse and ptarmigan use habitats in the License Areas for breeding and overwintering. Ruffed grouse *Bonasa umbellus* native to Alaska north of the Alaska Range were introduced to the Matanuska-Susitna Valley by ADF&G over a 3-year period from 1988 to 1990 and ruffed grouse have since spread throughout the Susitna Valley supporting a huntable population (Paul 2009). Spruce grouse *Falcipennis canadensis* and willow ptarmigan *Lagopus lagopus* commonly occur in the License Areas, although no grouse or ptarmigan were reported during survey near the License Areas (Pardieck et al. 2020). Rock ptarmigan *Lagopus muta* may also occur but are generally found in alpine tundra habitats outside of the License Areas.

Spruce grouse inhabit forested habitats and are often found in mature white spruce and birch woodlands and occasionally in black spruce bogs. During May, hens lays eggs in a shallow nest on the ground lined with twigs, leaves and a few feathers. During summer and fall, spruce grouse feed on flowers, green leaves, spruce buds, and berries. Insects are an important food for newly hatched chicks. During fall and winter spruce grouse feed primarily on spruce needles (ADF&G 2008a). Since summer 2016 the spruce beetle outbreak in the Susitna basin has killed 60 to 100 percent of mature white spruce trees that spruce grouse depend on for forage and overwinter habitat. Based on field observations and hunter reports from within Units 14 and 16 road accessible areas, densities of spruce grouse appeared to be near to slightly below numbers observed in the recent past during mid-summer 2022. Many hunters reported seeing fewer spruce grouse within the entire Southcentral Road System region during 2021 and based on field observations in spring and summer 2022, spruce grouse densities continue to be lower than normal (Merizon and Carroll 2023).

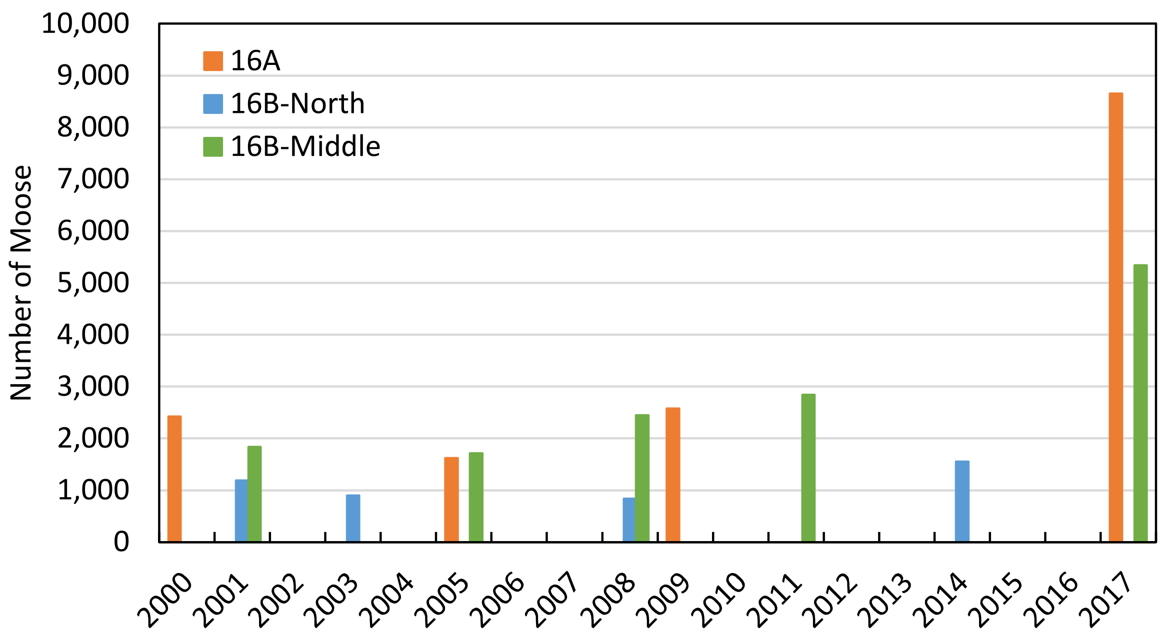
Willow ptarmigan, found in alpine and subalpine non-forested habitats, are the most common and abundant ptarmigan in Alaska. They feed primarily on willow buds, twigs, and catkins and various berries. Male willow ptarmigan establish breeding territories in April through late May. Females lay eggs in nests on the ground under a shrub which hatch after about 21 days. Chicks are precocial up and feeding shortly after they hatch in late June and early July. Male willow ptarmigan stay with and protect the chicks. Families of willow ptarmigan form flocks in September and by late September and October females segregate in small groups and move to lower elevations for food and shelter (ADF&G 2025x). The 2022 spring breeding estimate for willow ptarmigan in Unit 14C increased considerably from 2021. During spring 2022 all survey routes in Unit 14C were above the recent 5- and 10-year averages. Hunters generally reported seeing above average numbers of willow ptarmigan in the southern Talkeetna and western Chugach mountains during fall and winter of 2021–2022 (Merizon and Carroll 2023).

3. Terrestrial Mammals

Key terrestrial mammals in the License Areas that provide subsistence and non-consumptive recreational resources and that may be susceptible to cumulative impacts from oil and gas exploration and development include: moose, black bear, brown bear, wolf *Canis lupis*, and other furbearers (ADF&G 2006). Most, 94 percent, of the License Areas is located within Game Management Unit (GMU) 16, more specifically subunits 16A, 54 percent, and 16B, 40 percent.

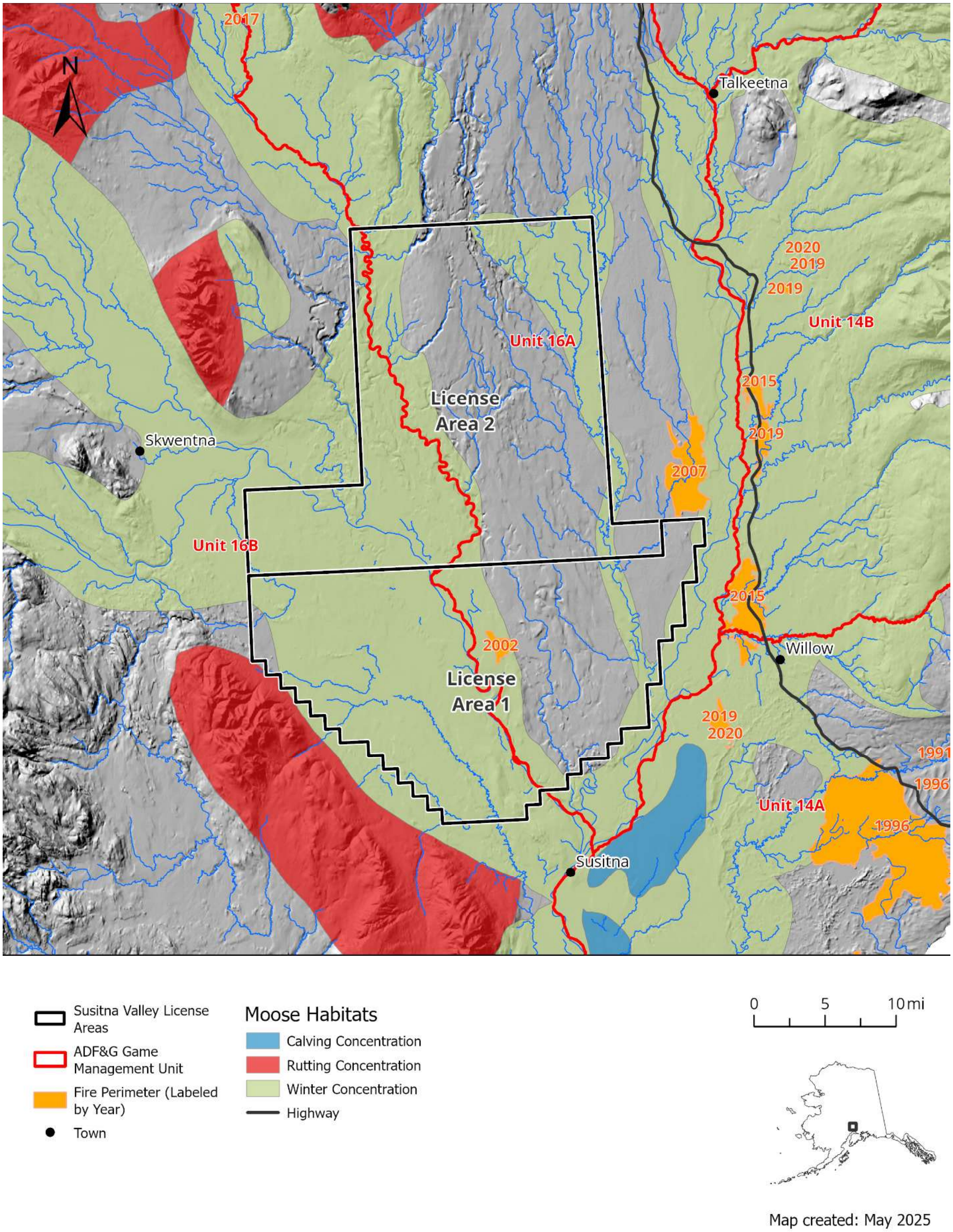
a. Moose

Moose populations in GMU 16A and 16B fluctuate due to die-offs during severe winters and heavy snow that seem to occur once or twice a decade (Figure 4-4). Recovery may be hampered by wolf and bear predation (Peltier 2017c). Moose use habitats in the License Areas year-round for summer range and for concentrated calving, rutting, and winter range. Female moose typically breed during the fall rut in late September and early October and calves are born in mid-May through early June. Moose move seasonally between calving, rutting, and wintering areas, traveling a few miles to as many as 60 miles between these areas. Moose browse on willow, birch, and aspen twigs in the fall and winter; and on forbs, aquatic vegetation, and the leaves of birch, willow and aspen in spring and summer (ADF&G 2025q). Vegetation type, seral stage, and production are important determinates of moose habitat quality. Winter snow depths, as well as fire and flood history influence the availability and type of vegetation (Woodford 2006). Moose densities are generally higher in neighboring GMU 14A at 4.2 moose per square mile (moose/mi^2) and GMU 14B at 2.4 moose/mi^2, than in GMU 16A at 1.9 moose/mi^2 and 16B North and Middle at 0.9 to 1.0 moose/mi^2, respectively. Moose from GMUs 14A, 14B and 16A likely move back and forth across the Parks Highway and the Alaska Railroad resulting in substantial vehicle and train collision mortality in some years, especially during winters with heavy snow (Peltier 2017a, b, c). While calf production in GMU 16 had generally been adequate to good, calf survival to fall was poor which prompted development of an intensive management program in 2004 with predator control measures for wolves, black bears, and brown bears. Intensive management was suspended in 2017 because target GMU 16 moose population size and harvest targets were achieved (ADF&G 2019).



Source: (Peltier 2017c; Peltier and Rinaldi 2014b; ADF&G 2019)

Figure 4-4. Moose population estimates for GMU 16A, 16B-North, and 16B-Middle.



Source: (ADF&G 1985; BLM 2021)

Figure 4-5. Game Management Units and moose habitat and in the License Areas.

b. Bears

Bears move about the landscape making predictable seasonal use of various resources: in spring bears are usually found on low elevation south-facing slopes, and in riparian forests and wetlands for early green vegetation and moose calves; in summer bears use mid-elevation herbaceous habitats, low elevation river bottoms, and fluvial benches for early berries, use high-elevation burns and openings for berries, and anadromous waters for salmon; in fall bears are most commonly found on large rivers for salmon and in associated riparian forest areas for roots, late berries and fruits; and in winter most brown bears hibernate in dens in alpine and sub-alpine habitats while most black bears den in forested habitats (ADF&G 2025e, d).

i. Black Bear

Black bears hibernate for 7 to 8 months in winter excavating dens in a variety of habitats. Mating takes place during June and July, and cubs are born in dens in January and February. Black bears breed every 2 to 3 years and commonly give birth to twin cubs. Black bears are omnivorous and opportunistic with a varied diet of vegetation, berries, small mammals, newborn moose and caribou, salmon, and insects (ADF&G 2025d). An estimated 11 to 38 black bears/100 mi^2 occur in GMU 14 based on 1996 surveys and an estimated 49 black bears/100 mi^2 occur in GMU 16 based on 2007 surveys and harvest patterns within these GMUs (Peltier 2014; Peltier and Rinaldi 2014a).

ii. Brown Bear

Most brown bears reach sexual maturity at 5 years of age, and breed from May to July. In the fall, Pregnant females are usually the first to enter dens in the fall and the last to emerge with their cubs in spring. Cubs are born in the den during January and February, and twins are common. Adult males are usually the last to entering dens in the fall and emerge earlier in the spring. Den sites are found on hillsides or mountain slopes, usually below 1,800-foot elevation. In areas with mild winters, some male bears may stay active all winter. Brown bears feed on sedges, grasses, horsetails, herbs, roots, berries, moose calves, waterfowl eggs and young, spawning salmon, ground squirrels, and carrion(ADF&G 2025e). An estimated 2.5 to 4.0 brown bears/100 mi^2 occur in GMU 14 based on anecdotal data and an estimated 6.8 brown bears/100 mi^2 occur in northern GMU 16 based on 2007 surveys and harvest patterns within these GMUs (Peltier 2015a, b).

c. Furbearers

American marten *Martes americana*, red fox *Vulpes vulpes*, wolf, beaver, wolverine *Gulo gulo*, coyote *Canis Latrans*, and North American river otter *Lontra canadensis* are the more commonly trapped and hunted furbearer in GMU 16 (Bogle 2025). Furbearer population trends are monitored using harvest data, trapper questionnaires, and research.

Marten use a variety of forested habitats but are most often associated with mature spruce forests that have well-developed understory and ground covers. Marten mate in July and August, and females give birth the following April or May in dens in tree crevices, snags, logs, or squirrel middens; and use multiple den and resting sites throughout the year. Voles and mice are their primary food source, although they also consume small birds, eggs, berries, vegetation, and carrion including salmon carcasses (ADF&G 2025a). Marten were considered scarce during 2023, with no change in abundance in the region (Bogle 2025).

Coyotes were first noted in the state shortly after the turn of the 20th century. Populations were first reported on the mainland of Southeast Alaska and then slowly expanded northward into the upper Tanana Valley from which they radiated in all directions. Coyotes breed between January and March. A mated pair may stay together through the spring and share parental duties after the pups are born. Other coyotes, especially young of the previous years, may also help care for the pups. They are quick to respond to increases or decreases in prey. They have fewer pups when food is scarce, or they can have large litters when food (primarily snowshoe hares) is abundant. Although coyotes are opportunists, they developed different hunting skills and strategies. Some coyotes focus on small rodents, others target carrion (ADF&G 2025j). Coyote were considered scarce during 2023, with no change in abundance in the region (Bogle 2025).

Red foxes prefer mixed habitats with extensive lowland marshes crossed by hills and draws. They breed during February and March and give birth in earthen dens in April and May with young leaving the den in May or June. Den sites are usually located on the side of a small hill or mound and may have several entrances. Both parents care for the young through fall, when the family unit disperses. Voles are their preferred food, but red foxes also eat muskrats, squirrels, hares, birds, eggs, insects, vegetation, and carrion. Foxes cache excess food (ADF&G 2025t). Red fox were considered common during winter 2023-2024, with no change in abundance in the region (Bogle 2025).

Wolves use a wide variety of habitats. They are social and territorial, usually living in packs. Wolves breed in February and March and litters are born in May or early June. Pups are born in dens dug in well-drained soils that become the center of activity in May and June. In mid to late summer pups are moved from the den and by early winter young wolves travel and hunt with the pack. Wolves are carnivores, and in most of Alaska moose and/or caribou are their primary food, with salmon seasonally important, especially for young wolves (ADF&G 2025y). An estimated 160 to 245 wolves in 25 to 28 packs occurred in GMU 16 in fall 2001. A wolf control plan was initiated in 2004 in response to declining moose populations and a high wolf population. The population in GMU 16 was estimated at 61 to 106 wolves in 10 to 13 packs in 2010 (Brockman and Peltier 2018), and the predator control program for GMU 16 was suspended in 2017 (ADF&G 2019). Wolves were considered scarce during winter 2023-2024, with no change in abundance in the region (Bogle 2025).

Beavers require 2 to 3 feet of water year-round that provides refuge and food storage. Beavers construct dams to provide these water levels if necessary, felling small to large trees to build and repair dams and lodges usually in spring and fall. They mate during January or February and young are born from late April to June in bank dens or lodges. Young beavers stay with their family for about 2 years. Beavers feed on aquatic plants, roots, grasses, and bark (ADF&G 2025c). Beaver were considered scarce during winter 2023-2024, with a marked reduction in abundance in the region from previous years (Bogle 2025).

Wolverines travel extensively tending to use higher elevations in summer and lower elevations in winter. Male home ranges in Southcentral Alaska are between 270 to 300 square miles, and female home ranges are between 115 to 230 square miles. Breeding season is from May through August with litters born the following February through April, typically in snow caves with one or two tunnels up to 60 yards long. Wolverines primarily feed on carrion in winter and they are well adapted for scavenging. Throughout the year, wolverines prey on small and medium-sized animals such as voles, squirrels, snowshoe hares, and birds (ADF&G 2025z). Wolverines were considered scarce during winter 2023-2024, with no change in abundance in the region (Bogle 2025).

River otters use riparian habitats in the Susitna basin and are designed for swimming but can also run across the ground. They breed in May and pups are born the next year from late January to June in a subterranean den. Otters often travel overland between bodies of water and develop well-defined trails that are used year after year. Otters are social and remain in family groups with or without the male. They travel over a wide area, although families usually range within a few square miles. They feed on snails, clams, insects, frogs, fish, and occasionally birds, small mammals, and vegetation (ADF&G 2025u). River otters were considered scarce during winter 2023-2024, with a marked reduction in abundance in the region from previous years (Bogle 2025).

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Chapter Five: Current and Projected Uses

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Chapter Five: Current and Projected Uses

This chapter considers and discusses the current and projected uses in the Susitna Valley Exploration License Areas (License Areas), including uses and value of fish and wildlife as required by AS 38.05.035(g)(iv). The land and waters included in and near the License Areas provide habitat for fish and wildlife as described in Chapter Four, which provide a variety of uses including subsistence, fishing, hunting, trapping, and wildlife viewing. In addition, the Susitna Valley region has been used for recreation, forestry, and mineral and oil and gas exploration. These and other current and projected uses are considered and discussed below. The following information is not intended to be all inclusive, but to provide an overview of the current and projected uses.

The License Areas are located within both the Susitna Matanuska Area Plan (DNR 2011) and the Southeast Susitna Area Plan boundaries (DNR 2008). These two plans classify 831,802 acres of state land that covers the majority of the License Areas. Guidelines and direction for managing state lands established by these area plans do not apply to oil and gas related activities (AS 38.04.065(i)). Oil and gas lease sales and gas only lease sales are subject to the planning process established under AS 38.05.180.

A. Fish and Wildlife Uses and Value

Alaska Department of Fish and Game (ADF&G) compiles and analyzes harvest and biological information, enabling the establishment of ecologically sound population-based fishing, hunting, and trapping regulations as well as the promotion of conservation strategies and recovery actions. Wildlife resources are managed by game management units and subunits (GMUs). Most, of the License Areas are located within Game Management Unit GMU 16, specifically subunits 16A,, and 16B (Figure 5-1). About 80 percent of the License Areas is located within the Anchorage-Mat-Su-Kenai Peninsula nonsubsistence use area, where dependence upon subsistence (customary and traditional uses of fish and wildlife) is not a principal characteristic of the economy, culture, and way of life (AS 16.05.258(c)). The nonsubsistence use area includes the portions of GMU 16A and GMU 14A and 14B in the License Areas.

1. Local Subsistence

The state, through the Boards of Fisheries and Game, manages subsistence resources on all state-owned lands and waters in Alaska. Residents from Skwentna use resources within about 15 miles of the village for harvest and use of fish, wildlife, and plants. State and federal laws define subsistence use as customary and traditional uses of wild resources for food, clothing, fuel, transportation, construction, art, crafts, sharing, and customary trade (Fall 2018).

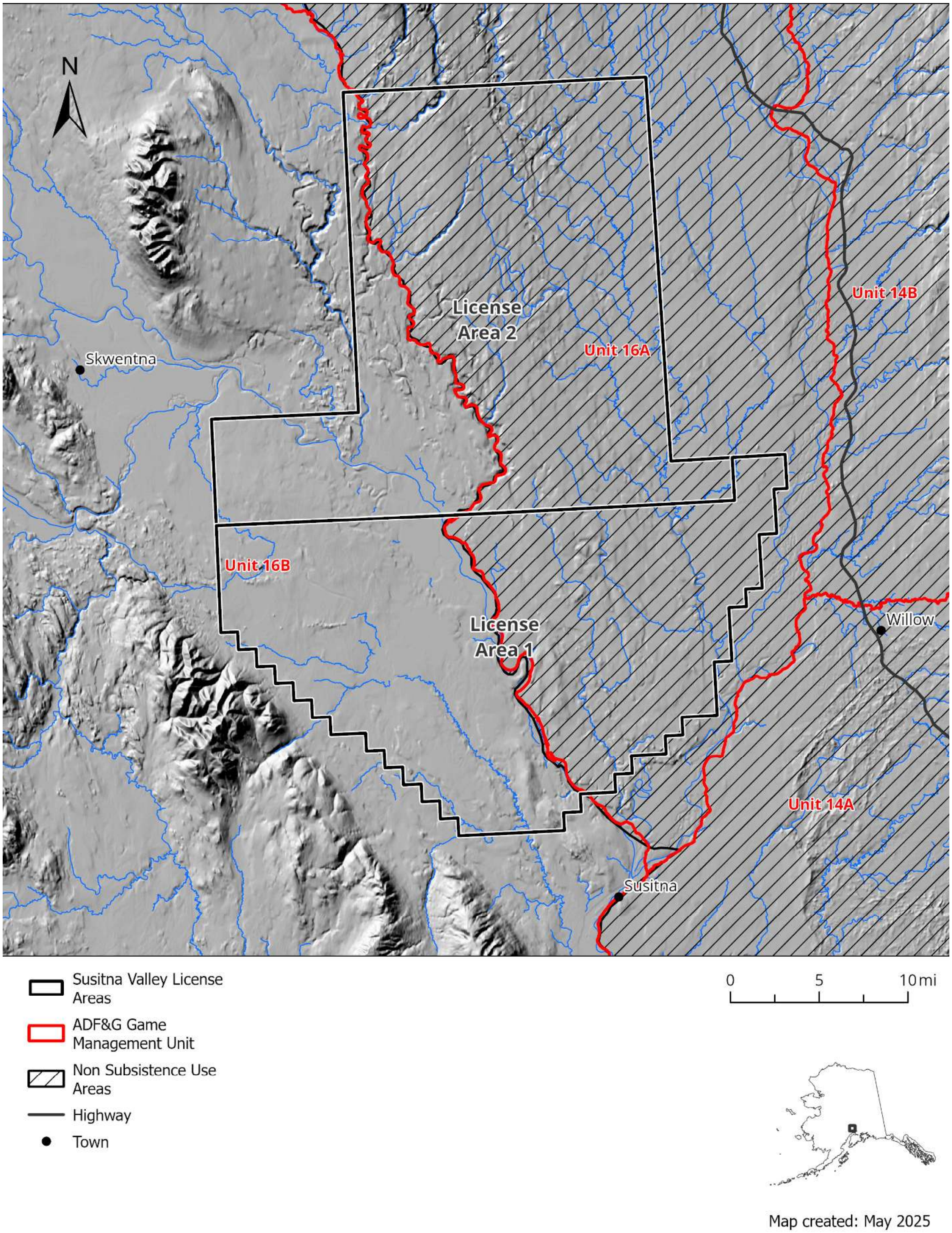
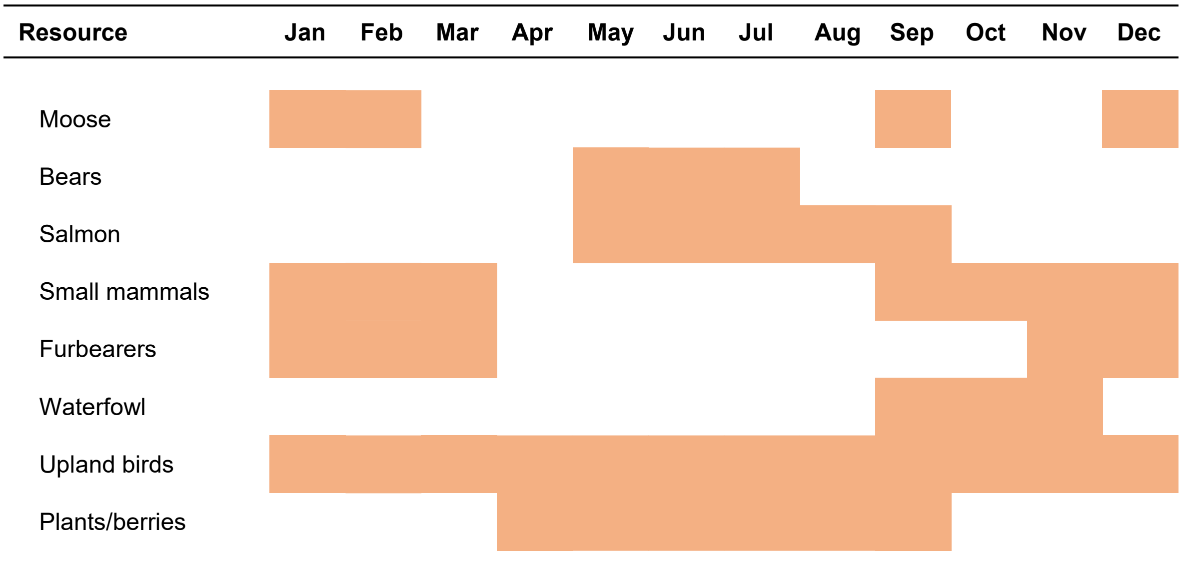


Figure 5-1. Game Management Units and nonsubsistence area in the License Areas.

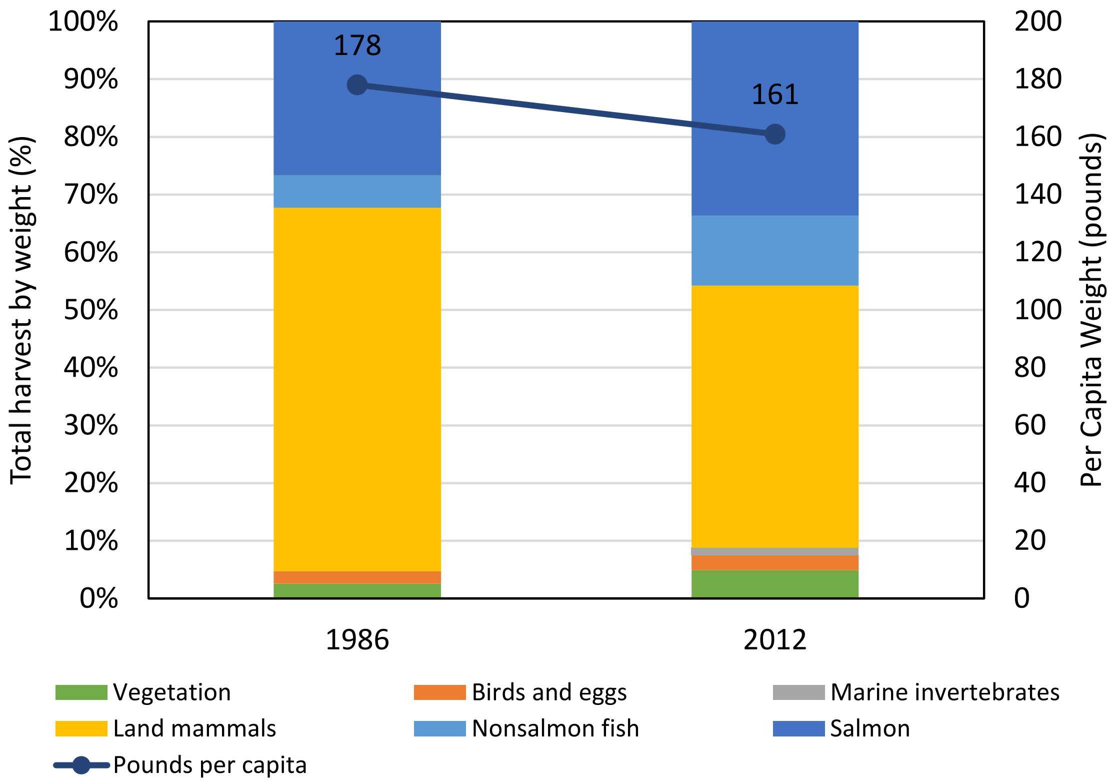
Approximate harvest seasons for subsistence resources within or near the License Areas used by Skwentna residents are shown in Table 5.1. All Skwentna households used and attempted to harvest subsistence resources in 2012, the most current year of study, averaging about 285 pounds per household or 162 pounds per person based on a sample of 30 surveyed households, representing 86 percent of households. The top 10 most commonly used resources for households were: coho salmon 73 percent, moose 70 percent, sockeye salmon 67 percent, spruce grouse 63 percent, Chinook salmon 60 percent, northern pike 60 percent, blueberries 50 percent, Pacific halibut *Hippoglossus stenolepis* 47 percent, highbush cranberries *Viburnum edule* 37 percent, and raspberries *Rubus pedatus* 37 percent (Holen et al. 2014).

Table 5.1. Subsistence harvest timing for Skwentna.



Source: (Holen et al. 2014)

Harvest by usable weight in 2012 was dominated by large land mammals at 44 percent, followed by salmon at 34 percent, non-salmon fish at 12 percent, vegetation at 5 percent, and birds and eggs at 3 percent (Figure 5-2). Harvest for the top 10 resources by species in 2012 was moose at 37 percent (Table 5.2). Comparison of the 1986 and 2012 harvests shows a decline in overall subsistence resource harvest over this 26-year period, with harvest shifting in response to declining availability of moose toward increase harvest of salmon and northern pike (Holen et al. 2014).



Source: (Stanek et al. 1988; Holen et al. 2014)

Figure 5-2. Total harvest in usable weight per person, Skwentna 1986 and 2012.

Table 5.2. Top resource harvest in usable weight per person, Skwentna 2012.

Resource	Usable Weight per capita (pounds)	Percent
Moose	59.4	37%
Coho salmon	25.3	16%
Sockeye salmon	22.0	14%
Northern pike	13.0	8%
Black bear	8.8	6%
Chinook salmon	3.8	2%
Brown bear	2.8	2%
Chum salmon	2.2	1%
Spruce grouse	2.2	1%
Blueberry	2.1	1%
All other resources	19.6	12%

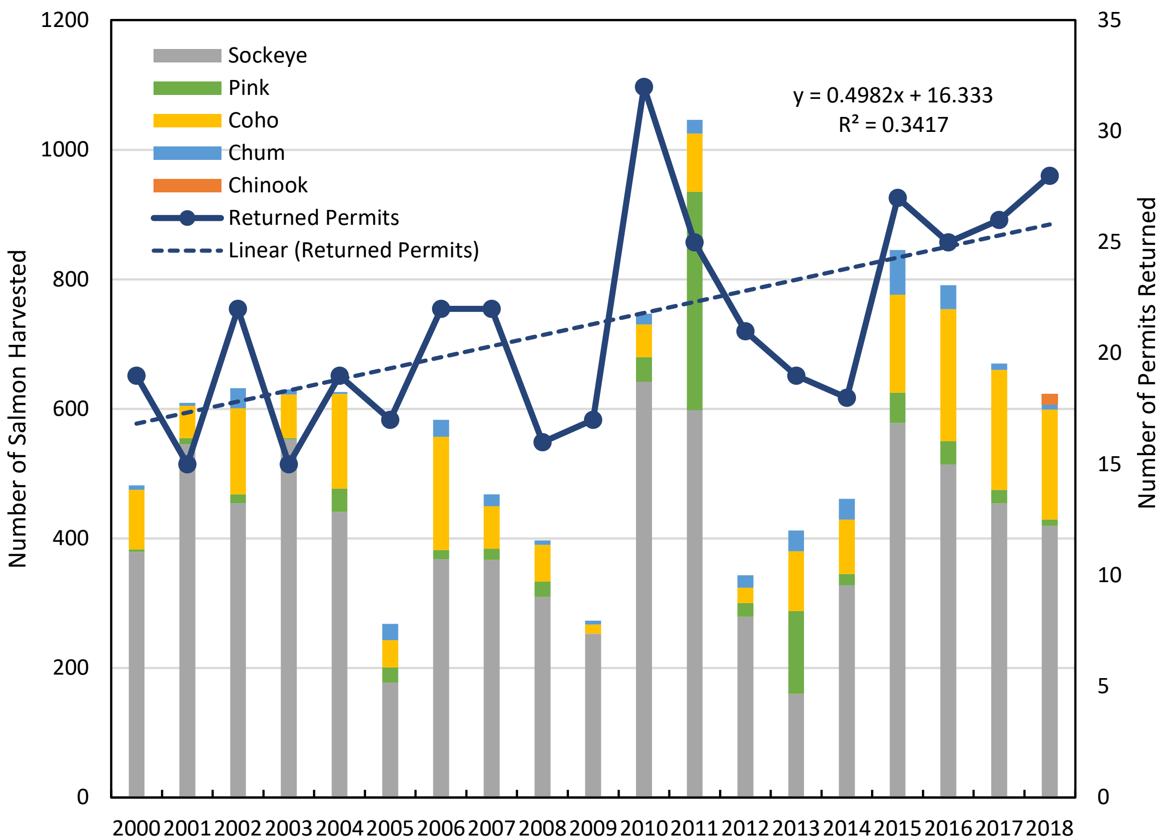
Source: (Holen et al. 2014)

Note: top 10 resources, the "all other resources" category is all other resources that contributed less than 1% of the total harvest.

a. Upper Yentna River Fish Wheel

Northeast of Skwentna on the Yentna River upstream from its confluence with the Skwentna River in License Area 2, the Yentna River subsistence fish wheel fishery targets primarily sockeye salmon (Figure 5-3). This fishery began in 1996 as a personal use fishery but was reclassified as a subsistence fishery in 1998. The fishery is open 3 days a week from July 15 to July 30 (Jones and Fall 2020). Compliance with reporting is high for this fishery, with most issued permits returned. Although the number of permits issued varies each year, the general trend from 2000 to 2018 has been an increase in the number of permits (Figure 5-3).

In 2018, 28 permits were issued, and all were returned. Of these permits, 12 permit holders were Skwentna residents, 10 were Wasilla residents, 3 were Anchorage residents, and 1 each were Chugiak, Palmer, and Willow residents. Skwentna residents harvested 43 percent of the 623 salmon harvested in 2018, and this was the first year that Chinook salmon could be retained. Most of the salmon harvested in 2018 were sockeye at 67 percent, followed by coho at 27 percent, Chinook at 3 percent, pink at 2 percent, and chum at 1 percent (Jones and Fall 2020).



Source: (Jones and Fall 2020)

Figure 5-3. Subsistence salmon harvest and permits, Upper Yentna River, 2000 to 2018.

2. Fisheries

a. Sport Fisheries

ADF&G's Division of Sport Fish divides the state into management areas and subareas. The Northern Cook Inlet sport fish management area covers all freshwater drainages of upper Cook Inlet and is dominated by the Susitna River drainage (ADF&G 2025g). The License Areas are located primarily within the Westside Susitna Management Unit, but also include the west side of the Eastside Susitna Management Unit and part of the Knik Arm management unit north of the Little Susitna River. The License Areas fall within the Susitna River Drainage reporting unit (Area M) and the Knik Arm Drainage reporting unit (Area K) for the statewide harvest survey. Establishing allocations for upper Cook Inlet salmon fisheries has been controversial for many years. Salmon returning to Northern Cook Inlet management area are harvested by Upper Cook Inlet set and drift gillnet commercial fisheries which take several orders of magnitude more salmon than sport fisheries in the area. Fish stocks in the Northern Cook Inlet management area are also harvested in the Yentna River subsistence fish wheel fishery in the License Areas, as well as the Fish Creek personal use dip net fishery and several education fisheries outside of the License Areas although the harvest by these fisheries is relatively small compared to recreational and commercial harvests (Oslund and Querin 2024). Table 5.3 shows the peak sport fish availability for the License Areas.

Table 5.3. Peak sport fish availability in the Anchorage, Matanuska-Susitna area.

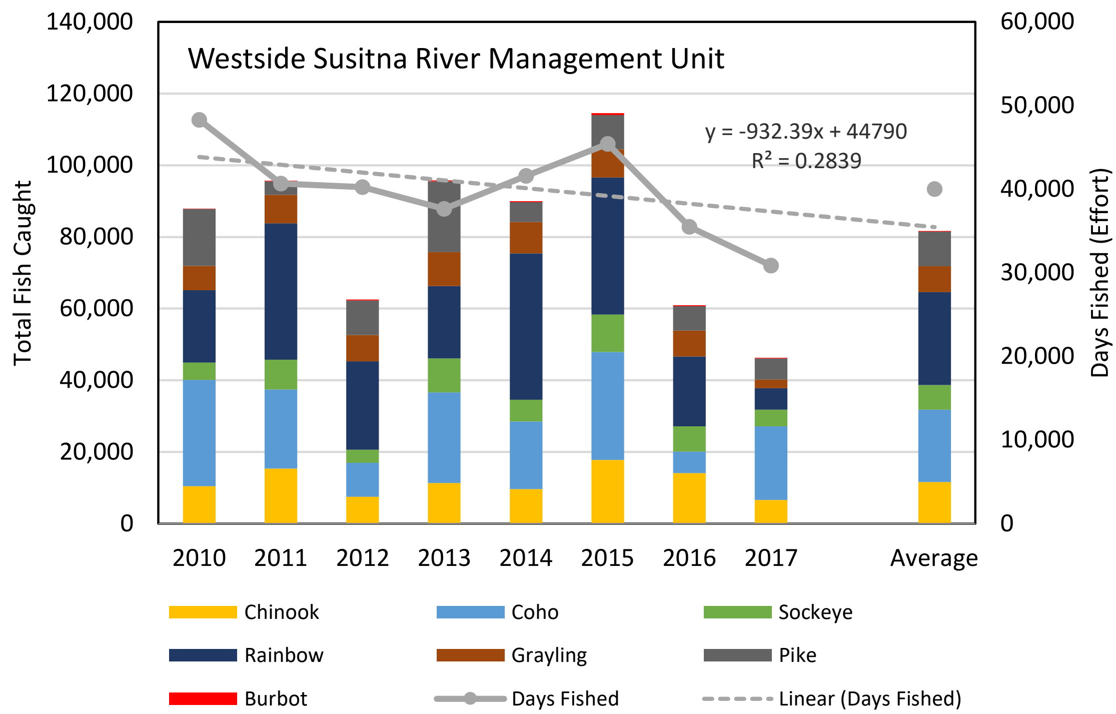
Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Chinook salmon						X	X					
Sockeye salmon							X	X				
Coho salmon								X				
Pink salmon							X					
Chum salmon							X	X				
Dolly Varden								X	X	X		
Rainbow trout								X	X	X		
Lake trout					X	X			X	X		
Northern pike					X	X			X	X		
Burbot	X											X
Arctic grayling				X	X	X		X	X	X		
Smelt (eulachon)				X	X							

Source: (ADF&G 2025h)

On average about 42 percent of angler effort in Northern Cook Inlet occurs in the Knik Arm management unit with almost all effort focused on the Little Susitna River and many area stocked lakes. About 30 percent of angler effort in Northern Cook Inlet occurs in the Eastside Susitna management unit with most of the effort focused on Willow Creek, Montana Creek, Talkeetna River, and Sheep Creek, which were catch and release only for Chinook in 2017 and were closed in

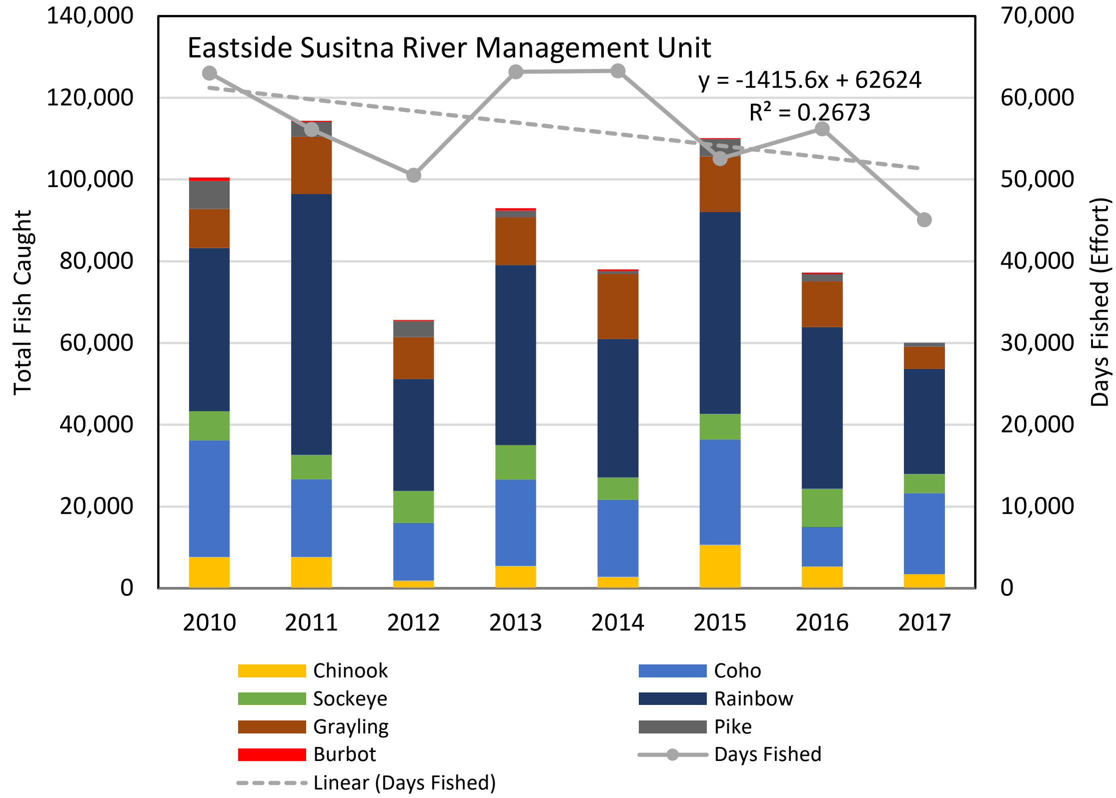
2018. About 22 percent of angler effort in Northern Cook Inlet occurs in the Westside Susitna management unit with most of the effort focused on Deshka River, Lake Creek, and Alexander Creek, which was closed to fishing for Chinook in 2008 (Oslund et al. 2020). From 2010 to 2019 an average effort of 2 million days fished occurred statewide, with an average effort for the Susitna River drainage (Area M) of 53,846 days fished. Fishing effort statewide and in both Knik Arm and Susitna decreased steadily over the past 10 years (ADF&G 2023).

The proportion of fish caught and released in the Northern Cook Inlet management area varies among management units and with regulations but generally most, 80 to 90 percent, pink salmon, chum salmon, lake trout, Dolly Varden, rainbow trout, and arctic grayling are released; with the proportion of Chinook salmon released increasing to 70 to 80 percent in recent years (Oslund et al. 2020). Total catch averages about 50,000 fish higher for the Eastside Susitna management unit than the Westside Susitna management unit and effort has declined in both units with a steeper decline for effort in Westside Susitna days fished (Figure 5-4). For both Eastside and Westside units, 25 to 26 percent of fish caught are rainbow trout and 7 percent are arctic grayling; with overall higher proportions of Chinook, coho, and sockeye salmon caught in Westside waters compared to Eastside Susitna waters (Figure 5-5). In general, pink and chum salmon make up a higher proportion of the catch in eastside waters than in westside waters (Oslund and Querin 2024).



Source: (Oslund et al. 2017, 2020)

Figure 5-4. Selected sport fish catch for Westside Susitna River, 2010 to 2017.



Source: (Oslund et al. 2017, 2020)

Figure 5-5. Selected sport fish catch for Eastside Susitna River, 2010 to 2017.

In 2018 sport fishing in Alaska generated approximately $475 million in salaries and wages, 12,639 jobs, and contributed over $1.4 billion to the statewide economy through multiplier effects, which is a steady increase since 2006 estimates (Table 5.4).

Table 5.4. Economic impact of sport fishing in Alaska, 2001 to 2018.

Year	Retail Sales	Multiplier Effect	Wages and Salaries	Jobs
2001	$587,028,597	$959,821,921	$238,011,311	11,064
2006	$530,165,682	$800,921,744	$252,957,398	8,465
2011	$718,452,401	$1,073,716,980	$358,679,292	9,992
2016	$942,977,816	$1,462,626,460	$470,961,645	12,689
2018	$939,200,000	$1,472,000,000	$475,000,000	12,639

Sources: (Southwick Associates 2002, 2008, 2013, 2019b, 2020; Southwick Associates et al. 2008)

Notes: Estimates use data from the US Fish and Wildlife Service's National Survey of Fishing, Hunting and Wildlife-Associated Recreation and probably underestimate the total economic impact of sport fishing in Alaska because they do not include expenditures made outside Alaska. The economic contribution of sport fishing to the local Matanuska-Susitna Borough economy was an estimated $57.4 million in 2017. Local and nonlocal resident anglers accounted for 65 percent of days fished, while out of state anglers accounted for 35 percent of days fished in 2017, while total spending was relatively balanced between Alaska residents and nonresidents ($29.0 million and $28.4 million). Spending for sport fishing in the MSB was 37.6 percent trip-related, 32.3 percent real estate, 24.6 percent equipment purchase, and 6.3 percent trip packages. Resident anglers spent more on equipment and real estate, 73 percent of resident expenditures; while nonresident anglers spent more on trips and trip packages, 60 percent of nonresident expenditures (Southwick Associates 2019a).

Many sport anglers, especially nonresident anglers, use the services of sport fishing guides and charters. The guided fishing industry provides significant economic benefits to Alaska and the License Areas by providing jobs and supporting tourism. Sport fishing businesses and guide services supported primarily by nonresident anglers, 90 percent, in the Knik Arm and Susitna areas in 2014. Sport fishing businesses and guides licensed by ADF&G supported 1.1 percent of days fished in the Knik Arm (primarily on the Little Susitna River) and 8.5 percent of days fished in the Susitna area (primarily on Lake Creek, Talkeetna River, Deshka River/Kroto Creek, and Yentna River drainage). Most of the businesses, 87 percent, were owned by and 63 percent of guides were Alaska residents (Powers and Sigurdsson 2016).

b. Commercial Fisheries

Salmon and eulachon stocks in the Susitna basin support commercial fisheries in Upper Cook Inlet.

i. Salmon

Salmon stocks of concern in Upper Cook Inlet that spawn in the License Areas include Chinook salmon in Alexander Creek – management concern designated 2010, and East Susitna River – management concern designated 2019 (ADF&G 2025b). Salmon are harvested commercially in marine waters of the Northern District of Upper Cook Inlet with set gillnets. The Susitna Drainage was the fourth highest stock proportion in the commercial harvest in 2022. The Susitna River sockeye salmon stock was listed by the Board of Fisheries as stock of yield concern in 2008 after yields had decreased. Management measures to lower commercial harvests were implemented within a recovery plan after 2008. After yields stabilized and conservative management measures of the recovery plan were put into permanent regulation, the stock of concern status was removed at the 2017 Board of Fisheries meeting. Total returns per spawner have ranged from 0.9 to 3.0 for the decade of 2007–2016 and remained variable in 2022. Total spawner abundance drainagewide has ranged from 135,948 to 367,871 and has been variable from 2007 through 2022. Total return by brood year has ranged from 278,370 to 545,655 for the decade ending in 2016 and shows a recent downward trend since 2010 (Lipka and Stumpf 2024).

ii. Smelt (Eulachon)

The Cook Inlet smelt fishery allows commercial harvest of smelt for bait or food in marine waters from May 1 to June 30 from northeast of the Chuit River to southwest of the Little Susitna River by hand dip net with the annual harvest capped at 200 tons (Lipka and Stumpf 2024). Eulachon stocks spawning in the Susitna and Yentna Rivers support this fishery which averages 95.6 tons and 3.9 permits per year (Marston and Frothingham 2019).

3. Hunting and Trapping

Hunting is an important part of the culture and economy of the License Areas. Revenue from sales of licenses, tags, and permits funds ADF&G’s research and management of fish and wildlife

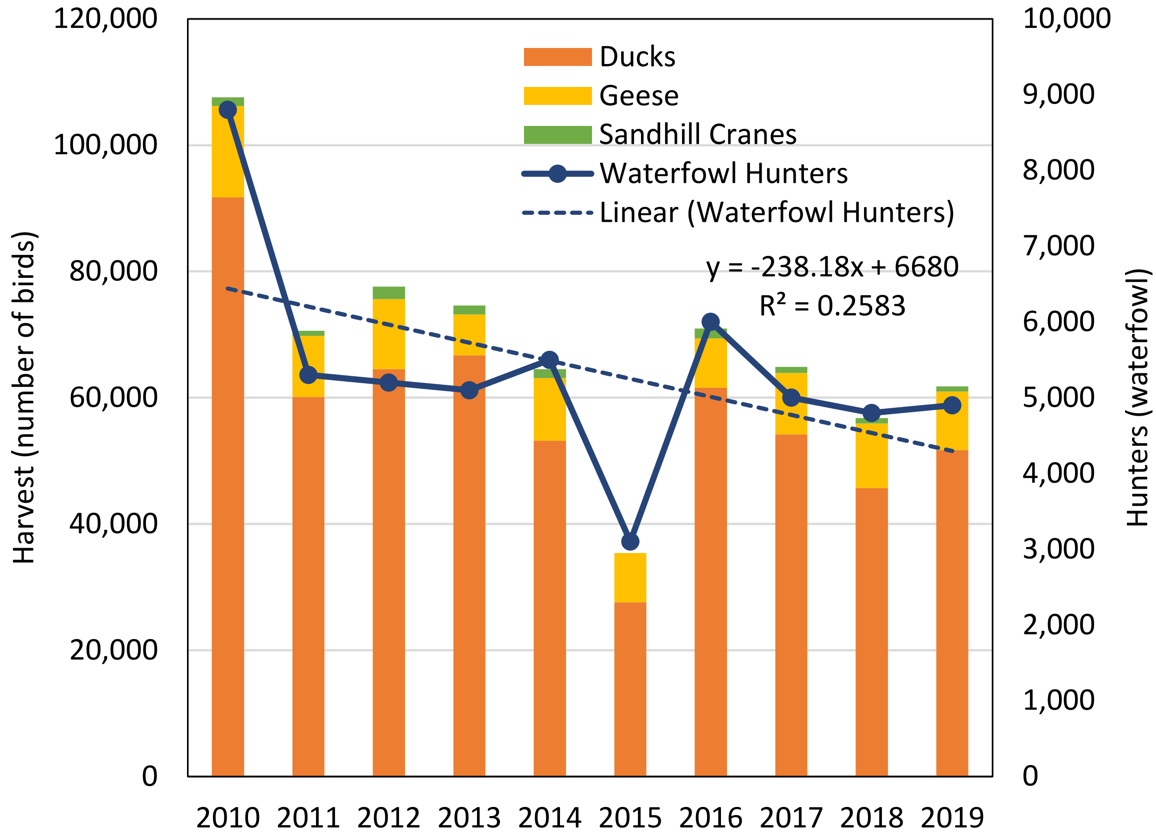
(ADF&G 2025c). Hunting guide services are available in and around the License Areas and contribute to the local economy. In 2021, 42 big game hunting guides were licensed to guide within GMU 16 (DCCED 2025). Moose, black bear, brown bear, waterfowl, upland game birds, and furbearers are the most commonly harvested wildlife in and around the License Areas. Because most of the License Areas is located within GMU 16A and 16B, discussions below are focused on use of wildlife in these subunits.

a. Birds

Wetlands, waters, and backwaters in and south of the License Areas are popular for fall waterfowl hunting because of high concentrations of migrating waterfowl and proximity to the state's population center. Migratory game birds hunted in GMU16 include ducks, geese, sandhill cranes, and snipe with the general hunting season open from September 1 through December 16 (ADF&G 2025a).

Information on migratory game bird harvest, hunter participation, and effort specific to the License Areas is not available. Statewide an annual average of 5,370 waterfowl hunters harvested on average 57,700 ducks and 9,650 geese during 2010 to 2019. Annual variation in statewide harvest of ducks, geese, and cranes and the number of active waterfowl hunters is illustrated in Figure 5-6. The general trend shows a decrease in waterfowl hunters over the past decade (Figure 5-6). Ducks harvested over the past decade were 77 percent dabbling ducks, predominately mallards 35 percent, wigeon 16 percent, and northern pintail 11 percent; with 19 percent diving ducks, predominately scoters 6 percent and goldeneyes 5 percent. Trends for duck hunters, days afield (effort), and duck harvest in Alaska over the past decade were all declining. Geese harvested were predominately Canada geese (72 percent). As with ducks, trends for goose hunters, days afield, and goose harvest in Alaska over the past decade were all declining. Confidence intervals for annual estimates for duck harvest and effort ranged from 5 to 40 percent and confidence intervals for goose harvest and effort ranged from 12 to 70 percent (Raftovich et al. 2012; Raftovich et al. 2014; Raftovich et al. 2016; Raftovich et al. 2018; Raftovich et al. 2020).

An annual average of 1,041 hunters spent 4,323 days afield to harvest 1,243 cranes in Alaska during 2010 to 2019 with declining trends in number of hunters, days afield, and harvest over the past decade. An annual average of 330 hunters spent 1,060 days and harvested 280 snipe with highly uncertain, but declining trends in number of hunters, days afield, and harvest over the past decade (Raftovich et al. 2012; Raftovich et al. 2014; Raftovich et al. 2016; Raftovich et al. 2018; Raftovich et al. 2020).



Source: (Raftovich et al. 2012; Raftovich et al. 2014; Raftovich et al. 2016; Raftovich et al. 2018; Raftovich et al. 2020)

Figure 5-6. Alaska duck, goose, and crane harvest and waterfowl hunters, 2010 to 2019.

Upland game bird hunting is open from August 10 to March 31 in the portions of GMU 16 that cover the License Areas. Small game hunters in the Matanuska-Susitna (Mat-Su) and Southcentral Rural geographic areas (that include portions of GMU 16 and the License Areas) focused upland game bird hunting effort on spruce grouse with an average of 8.5 and 3.2 days hunted, respectively and ptarmigan with an average of 5.9 and 4.0 days hunted in 2013. Transportation methods between these two areas differed with most hunters using all-terrain vehicles 31 percent, highway vehicles 28 percent, snowmachines 22 percent and foot 14 percent for access in the Mat-Su area, and most hunters using foot 66 percent, all-terrain vehicles 24 percent, and highway vehicles for access in the Southcentral Rural geographic area (Merizon et al. 2015). Statewide an estimated 40,239 hunters (± 4,180 hunters 95 percent confidence interval [CI]) targeted small game including upland game birds in 2013, which was an apparent decrease from an estimated 66,423 (± 9,500 CI) small game hunters in 2011 (Merizon and Carson 2013; Merizon et al. 2015). About 32 percent of statewide spruce grouse hunting effort and 12 percent of ptarmigan hunting effort was expended in the combined Mat-Su and Southcentral Rural geographic areas (Merizon et al. 2015).

b. Moose

Annual moose harvest and hunter activity are controlled to ensure sustainable harvest levels through hunting regulations that are specific to each GMU. Moose populations in GMU 16A and 16B had been depressed and these subunits have been the focus of Intensive management (IM) programs authorized by the Alaska Board of Game to allow for adequate and sustained harvest of moose by hunters. IM programs may include restricting hunting seasons and bag limits, improving habitat, and predator control. Bears and wolves are effective predators on moose and caribou that Alaskans also rely on for food, with predators often killing more than 80 percent of moose and caribou that die during an average year, while people harvest less than 10 percent (ADF&G 2025f). Currently, the IM program established for GMU 16 is active (ADF&G 2025e).

Most moose in GMU 16 are taken in general season hunts with harvest tickets during August 20 through September 25 and a limit of one bull (ADF&G 2025d). Moose harvest in GMU 16A averaged 176 moose with an average of 920 hunters and 19 percent hunter success during 2010 to 2019. In 2023, most hunters in GMU 16A, 91 percent, and 16B, 77 percent, are nonlocal and local resident hunters. Moose harvest in GMU 16A totaled 74 moose with 863 hunters and a 9 percent hunter success during 2023. ADF&G's management objectives for GMU 16A are annual harvest of 190 to 360 moose from a population of more than 3,500 moose (ADF&G 2024a). Moose harvest in GMU 16B averaged 296 moose from 2010 and 2019 with an average of 862 hunters and 27 percent hunter success. In 2023, moose harvest in GMU 16B totaled 209 moose with 905 hunters and 23.1 percent success (ADF&G 2024b). ADF&G's management objectives for GMU 16B are annual harvest of 310 to 600 moose from a population of more than 6,500 moose. Annual harvest objectives for GMU 16A were achieved from 2015 through 2019. Trends for moose harvest and hunters increased from 2010 to 2019 in both GMU 16A and 16B (ADF&G 2024b, a).

c. Black Bear

Black bear harvests fluctuate with fall berry crops, moose hunting season, and late spring travel conditions and since the 1990s harvest has shifted from predominantly fall to spring harvest with baiting. Harvest levels in Unit 16B were flat and averaged less than 100 bears between 1974 and 2004. Harvest in Unit 16A was 40 bears annually during the same 30-year period; however, there was a steady increase in the harvest, from 13 bears in 1974 to 74 bears in 2004. This was likely the result of improved access and increased use of all-terrain vehicles (Brockman, C. J. 2024a). Black bear seasons, bag limits and restriction on baiting were liberalized in GMU 16 beginning in 2007 to increase harvest (Peltier and Rinaldi 2014). There is no closed season for black bears in GMU 16 in the License Areas, with an annual bag limit of three bears (ADF&G 2021b). Most black bear harvest in GMU 16 takes place in the last 2 weeks of May and throughout June, although black bears are also taken during fall moose hunts. Most hunters used aircraft and boats to reach hunt areas; as well as all-terrain vehicles where there is access. An annual average of 604 hunters harvested 249 black bears between 2010 and 2019. Most black bear hunters, 81 percent, were Alaska residents, with 19 percent nonresident hunters (Peltier and Rinaldi 2014). Table 5.5 summarizes black bear harvest, hunter residency, and success rates for regulatory years 2010 to 2019 in GMU 16.

Table 5.5. GMU 16 black bear harvest and successful hunter residency, 2010 to 2019.

Regulatory Year	Black Bear Harvest	Resident Hunters	Nonresident Hunters	Total Hunters	Success (%)
2010	673	444	108	552	122%
2011	378	238	73	311	122%
2012	241	154	49	203	119%

2013	187	633	140	773	24%
2014	199	625	173	798	25%
2015	123	53	139	678	18%
2016	191	577	162	739	26%
2017	169	591	121	712	24%
2018	200	546	125	671	30%
2019	132	535	69	604	22%
Average	249.3	488.2	115.9	604.1	53%

Source: (Peltier and Rinaldi 2014; ADF&G 2021a; Brockman, C. J. 2024a)

d. Brown Bear

Brown bear harvests are annually variable, harvest is evenly split between spring/summer (51 percent, April through July) and fall (48 percent, August through October). Hunting seasons, bag limits and restriction on baiting were liberalized in GMU 16 beginning in 2011 to increase harvest (Peltier 2015). Under this program, permittees in the Brown Bear Control Area may take any brown bears except cubs of the year or females accompanied by cubs of the year (Brockman, C. J. 2024b). There is no closed season for brown bears in GMU 16 in the License Areas, with an annual bag limit of one bear in GMU 16A and two bears in GMU 16B; nonresident hunters must be accompanied by a guide (ADF&G 2025d). Must hunters use aircraft to access hunt areas, with increased use of snowmachines with good snow conditions in spring. The emphasis on reducing the number of brown bears in the unit to increase moose calf survival does not appear to have had a significant effect on the size of the bear population. An annual average of 123 successful hunters harvested 126 brown bears between 2010 and 2019. Brown bear harvests were predominately by Alaska residents, 55 percent, with 45 percent harvest by nonresident hunters (Peltier 2015). Table 5.6 summarizes successful brown bear hunter residency and harvest for regulatory years 2010 to 2019 in GMU 16.

Table 5.6. GMU 16 brown bear harvest and hunter residency, 2010 to 2019.

Regulatory Year	Total Harvest	Resident Harvest	Nonresident Harvest
2010	162	104	60
2011	125	65	54
2012	94	56	38
2013	123	68	55
2014	128	54	74
2015	113	47	66
2016	96	58	38
2017	86	49	37
2018	56	32	24
2019	60	40	20
Average	104.3	57.3	46.6

Source: (Peltier 2015; ADF&G 2021a; Brockman, C. J. 2024b)

e. Furbearers

Furbearer trapping in Alaska is monitored through license sales, fur sealing records, and an annual questionnaire survey of trappers. The estimated 2,500 to 3,500 trappers in Alaska are mostly recreational trappers, and in Region IV (Central/Southwest) about half keep the fur they harvest. Trappers across Region IV consistently rank marten, lynx, wolf, beaver, and red fox within the top five most important furbearers (Bogle 2025). Lynx harvest, however, is generally low in GMU 16 due to lack of habitat for snowshoe hares (Brockman, C. J. & T. C. Peltier 2021). Wolves are also hunted, and in GMU 16, the number of wolves harvested by shooting often exceeds the number taken by trapping (Table 5.7. Furbearer harvest in GMU 16, 2007 to 2018.). Trapping season varies by species and GMU but is generally from late fall to late winter, when trappers typically go out 2 to 3 days a week over a 10-week period that has been reduced to 7 to 8 weeks since 2015. Fur harvest fluctuates with weather and snow conditions, trapper effort, and fur prices. Trappers in Region IV access their traplines primarily by highway vehicle and snowmachine and run their traplines primarily by snowmachine and walking/skiing. Most GMU 16 trappers access their trapping areas by snowmachine (Bogle 2025).

Furbearer harvest for GMU 16 based on trapper surveys is summarized for selected furbearers in Table 5.7. Furbearer harvest in GMU 16, 2007 to 2018., and likely represents about 1/4 to 1/3 of harvest based on ADF&G sealing records. Trapper harvest in GMU 16 declined during the second half of this decade, potentially in response to reduced fur values beginning in 2013. If 1/4 of the harvest based on fur sealing records is reflected by trapper survey responses, the value of the listed furbearers averaged about $21,000 per year and represented on average about 6 percent of the statewide total value for all harvested furs (Table 5.7).

Table 5.7. Furbearer harvest in GMU 16, 2007 to 2018.

Regulatory Year	Trappers	Beaver	Marten	Red Fox	River Otter	Wolf Trap / Hunt	Wolverine	Estimated Value
2007	-	92	348	11	8	5 / 6	16	$45,698
2008	-	141	913	41	23	13 / 8	6	$43,481
2010	11	92	209	9	11	0 / 13	3	$16,041
2011	15	104	162	11	7	1 / 17	3	$27,422
2012	18	108	183	21	30	0 / 2	2	$35,090
2013	17	98	119	28	13	0 / 3	7	$14,901
2015	6	64	204	14	4	1 / 2	0	$10,916
2016	8	40	11	4	6	1 / 4	2	$2,943
2017	10	18	59	1	1	0 / 2	8	$6,676
2018	14	63	145	2	12	0	5	$8,961
Average	12.4	82.0	235.3	14.2	11.5	2.1 / 6.3	5.2	$21,213

Source: (Schumacher 2010a, b, 2012, 2013a, b; Harper 2012; Parr 2017, 2016, 2018; Brockman, C. J. and Peltier 2018; ADF&G 2019; Spivey 2019, 2020)
Note: value estimated based on average fur prices listed in trapper questionnaire reports

B. Recreation and Tourism

The Matanuska and Susitna Valleys has a long history as a visitor destination. Drawn by the area's scenic beauty, abundant recreational opportunities, and unique communities and cultures, travelers from both inside and outside of Alaska have become an integral part of the Borough's economy and way of life (McKinley Research Group 2022). The License Areas offer year-round outdoor recreational activities and opportunities valuable to both Alaska residents and out-of-state visitors to the area (UAA 2019).

Abundant rivers, streams, lakes, and trails are used for hiking, wildlife viewing, fishing, hunting, sightseeing, cross-country skiing, snowmachining, rafting, boating, camping, and other commercial and private recreational activities. Tourism consumers want to see reduced environmental impacts, support for local economies, and support for local cultures and communities as part of a sustainable travel plan (McKinley Research Group 2022). Nancy Lakes and Willow Creek state recreation areas, Susitna Basin recreation rivers, Susitna Landing, Deshka Landing, and the numerous historic trails are some of the most important recreational resources near the License Areas, which were excluded from these license areas in response to public concern in the past (DNR 2008, 2011). There are more than 2,020 miles of dedicated trails in the MSB, including the Iditarod National Historic Trail that crosses through the License Areas (Metiva and Hanson 2008). MSB attracts visitors for winter activities, especially Alaska residents, for snowmachining, dog-sledding, skiing, snow-boarding, snow-shoeing, and ice fishing (McDowell Group 2017).

Annual Alaska visitor volume increased at a rate of 3.7 percent per year over the past decade to an estimated 2.5 million visitors in winter 2018-2019 and summer 2019 combined. Most visitors arrive by cruise ship 53 percent or air 43 percent with 4 percent of visitors arriving in Alaska by highway or ferry in 2018-2019 (McDowell Group 2020). Because of the COVID-19 pandemic, Alaska's tourism industry experienced a severe decline in spring 2020. During 2020 no cruise ships landed in Alaska, air traffic was limited, non-essential travel through Canada was closed, and quarantine restrictions were placed on travelers that resulted in a 48 percent drop in the leisure and hospitality and a 10 percent drop in transportation and warehousing business sectors (Guettabi 2020).

An estimated 700,000 visitors, 44 percent resident and 56 percent out-of-state, normally travel to the MSB each year to enjoy wildlife and scenery, and to hike, camp, fish, and hunt. Out-of-state visitors, 89 percent, primarily come to the MSB during the summer months from May through September. The most common destinations for summer visitors are Talkeetna 69 percent and the Palmer – Wasilla area 50 percent (McDowell Group 2017).

Out-of-state visitors spent an estimated $98 million in the MSB in 2016 on tourism activities. Visitor spending directly and indirectly supported 1,700 full- and part-time jobs and $47 million in labor income in the MSB in 2016. Economic output from visitor spending totaled $133 million for food/beverage – 28 percent, lodging – 23 percent, tours/activities – 23 percent, transportation – 18 percent, and gifts/clothing/souvenirs – 8 percent (McDowell Group 2017).

C. Forestry

About 40 percent of state lands in the License Areas are classified for forestry, 331,528 acres (DNR 2008, 2011), and are located within the Matanuska-Susitna Forest Region (Region II). DNR recommended creation of a state forest within the Susitna Valley (DNR 2011). Forest stands in the Susitna Valley are generally dominated by Alaska paper birch with lesser amounts of white spruce and pure stands of balsam poplar on river floodplains (Hanson 2014).

Thirteen timber sales occurred in the License Areas between 1974 and 1998 totaled just over 4,400 acres. There have been 10 sales in License Area 1 ranging from 11 to 640 acres, and three sales in License Area 2 ranging from 274 acres to 1,863 acres (DOF 2021). No timber sales have occurred in the License Areas since 1998, and there are no upcoming sales planned in the License Areas. Timber use has declined over the years; the typical mill operator is a small sawmill producing rough, green lumber or house logs for the local market (Metiva and Hanson 2008).

Division of Forestry completed a forest inventory on state land in the Susitna Valley that includes the License Areas. Of the 772,416-acre inventory area, 488,735 acres, or 63 percent, was timberland with 76 percent mixed white spruce/hardwood forest and 24 percent hardwood (deciduous) forests. Total volume of timber was estimated based on seven timber strata with an overall cumulative volume estimate of 620,223,584 net cubic feet for trees ≥ 5 inches in diameter at breast height (dbh) (Hanson 2014). Stratum 3 yields the highest net cubic feet per acre and the highest board feet per acre (Table 5.8).

Stratum 1, mixed poletimber closed, is primarily birch with 2:1 ratio of poletimber to sawtimber. With the average tree age of 109 years, this is the second youngest stratum. Stem count is the highest of all strata, averaging 220 trees per acre. **Stratum 2**, mixed poletimber open, is evenly split between white spruce and birch with minor amounts of black spruce poletimber. With the average tree age of 102 years, this is the youngest stratum in the inventory. Stem count averages 138 trees per acre. **Stratum 3**, hardwood sawtimber closed, includes balsam poplar stands along the major river systems with about 45 percent birch, 23 percent white spruce, and 11 percent balsam poplar. Average stand age is 130 years, and stem count averages 149 trees per acre, **Stratum 4**, hardwood sawtimber open, is birch and white spruce at about a 2:1 ratio. The average tree age is 131 years, and stem count averages 91 trees per acre. **Stratum 5**. mixed sawtimber closed, is birch and white spruce comprise in nearly equal portions with small amounts of black spruce. The average tree age is 133 years, and stem count averages 130 trees per acre. **Stratum 6**, mixed sawtimber open, is birch and white spruce comprise in nearly equal portions with small amounts of black spruce. The average tree age is 126 years, and stem count averages 114 trees per acre, with the highest volume of white spruce sawtimber. **Stratum 7**, mixed reproduction, although variable in stand structure, 43 percent is black spruce >5 inches dbh, with balsam poplar, birch, and white spruce. Most trees are <5 inches dbh, with some stands comprised of very slow growing trees, not true reproducing stands. Poletimber average age was 120 years, with an average stem count of 166 trees (Hanson 2014).

Table 5.8. Volume summary by timber strata in the Susitna Valley.

Stratum	Description	Acres	Tons/ acre	Cubic Feet/acre	Board Feet/acre	Total Volume (%)
1	Mixed Poletimber Closed	43,463	41	1,645	3,807	12%
2	Mixed Poletimber Open	117,882	24	1,049	3,065	20%
3	Hardwood Closed	47,503	56	2,280	9,178	17%
4	Hardwood Open	70,464	25	1,093	4,530	12%

5	Mixed Spruce/Hardwood Closed	81,521	32	1,434	5,445	19%
6	Mixed Spruce/Hardwood Open	61,506	26	1,240	5,144	12%
7	Mixed Reproduction	66,395	16	703	721	8%
	Total	**488,735**				

Source: (Hanson 2014)

Notes: Poletimber is trees between 5 and 8.9 inches diameter at breast height (dbh); Sawtimber is trees greater than or equal to 9 inches dbh.

Threats to forestry in the Susitna Valley are the ongoing spruce beetle outbreak in Southcentral Alaska, northern spruce engraver *Ips perturbatus*, and defoliating insects including birch leafminers. Most susceptible mature white spruce in the Susitna Valley have been killed by spruce beetles, which have also infested black spruce, a less common host. DOF with support of ADF&G removed about 700 dead spruce and other hazardous fuels from sites along the Susitna River to increase user safety and reduce fire risk. While defoliating insects may weaken trees, they do not typically kill them (DOF 2023).

Harvesting birch sap to make syrup and birch water has gained popularity and there are commercial operations harvesting and processing birch sap from Susitna Valley trees. In Talkeetna, Kahiltna Birchworks is the largest producer of birch syrup in the world. Sap is collected during a short harvest each spring and water is evaporated to produce syrup. It takes about 110 gallons of sap to produce 1 gallon of birch syrup. Birch sap contains 1 to 1.5 percent sugar and is marketed as a beverage sold as birch water (Alaska Wild Harvest 2025). Non-Timber Forest Products are regulated under 11 AAC 96.035.

D. Private and Agricultural Land Use

Land ownership is described in Chapter Three based on a hierarchical general land ownership, which prioritizes municipal and private lands at the section level, as illustrated in Figure 3.2. Estimated appraised value of private land and improvements within the License Areas is $237,944,320 as of February 2022. Appraised land and improvement values for the License Areas represents about 2 percent of these values for all Matanuska-Susitna Borough lands (MSB 2022, 187). Additional subdivision lots within the License Areas may be sold and move from borough, Mental Health Trust, or state ownership to private ownership where they would potentially contribute to borough property taxes over the coming years (Table 5.9).

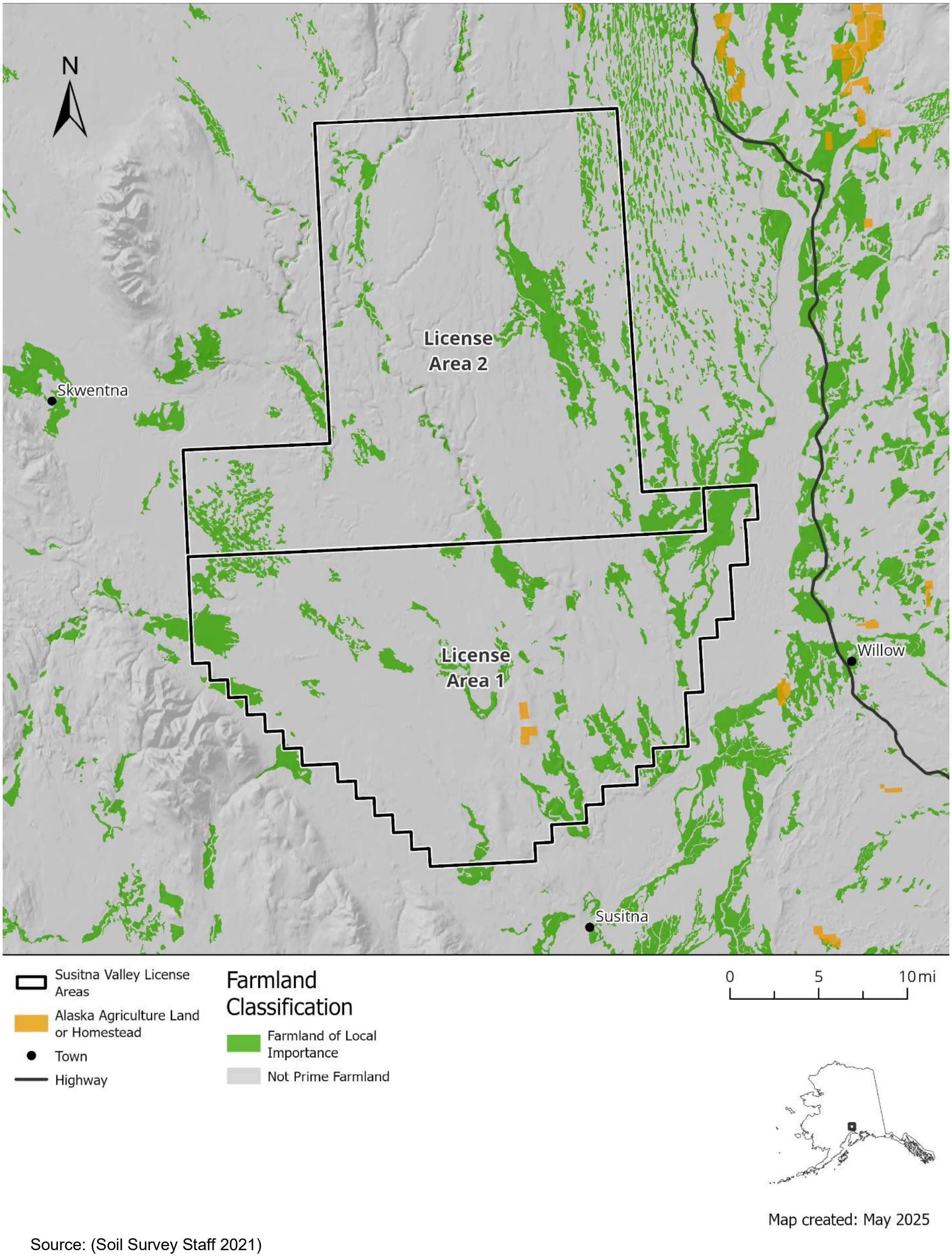
Table 5.9. Current subdivision lots within the License Areas.

Owner	Parcels (No.)	Area (acres)	Average Size (acres)	Land Value Appraised
Matanuska-Susitna Borough	86	33,571	390	$8,464,600
Federal	13	117	9	$99,200
Mental Health Trust	2	94	47	$119,500
Private	3,741	24,716	7	$73,334,200
State	123	1,629	14	$1,454,900
Total	**3,965**	**60,128**	**15**	**$83,472,400**

Source: (MSB 2021)

Note: Area = area contained within License Areas, some lots extend beyond the License Areas

State lands with a primary surface use classification for agricultural within the License Areas include a total of 48,988 acres or 5.9 percent of state lands. Soil survey data indicate that the License Areas contain no soils classified as Prime Farmland, and an estimated 126,700 acres classified as Farmland of Local Importance, with 65,100 acres in Area 1 and 61,600 acres in Area 2 (Figure 5-7). Of this area 1,291 acres have been conveyed as agricultural homestead or agricultural sale lands. Designated agricultural lands are all located in License Area 1 and represent 0.3 percent of License Area 1.



Source: (Soil Survey Staff 2021)

Figure 5-7. Active farmland and suitable farmland soil in the License Areas.

E. Mining

Gold was discovered in the Yentna mining district and upper Susitna Valley in 1898. Placer mining for gold began in Cache Creek in 1905, and Mills Creek in 1906 located north of the License Areas (Capps 1913). There are 117 active placer mining claims covering a total of 5,194 acres along the Kahiltna River and Peters Creek and one mining lease on Hneh'itnu Creek in License Area 2 (DNR 2021). The License Areas are characterized by generally poor placer deposits for small scale commercial mining as they are buried under significant glacial alluvium. Gold found within the License Areas is typically extremely fine flour gold. Coal was mined in the early decades of the 20th century and high-quality coal deposits exist but they are not currently being mined (Metiva and Hanson 2008).

F. Transportation

Transportation facilities in and near the License Areas are discussed briefly for local communities in Chapter Three. Facilities for transport of equipment and crews to the License Areas include George Parks Highway and Alaska Railroad east of the License Areas, and small public airports at Willow and Skwentna. There are also several private airstrips scattered within and in the vicinity of the License Areas at Deshka Landing, Parker Lake, and Montana Creek. Deshka Landing is road accessible and from here boats can access the Susitna River and major tributaries. There are a few secondary and primitive roads within the License Areas and a network of trails extends through the License Areas (Figure 5-8). Oilwell Road extends into License Area 2 from the north, and Deshka Landing Road extends the furthest west towards License Area 1 from the east. The network of trails would primarily be accessible during winter and many trails would likely need to be widened to allow for passage of equipment larger than snowmachines. In addition to existing transportation resources, the proposed West Susitna Access road would cross through the western portions of Area 1 and run adjacent to the southwest corner of Area 2 (HDR Alaska 2014); and the Donlin Gold project would create and improve winter trails for access and construction of the Donlin Gold gas pipeline across both License Areas. ENSTAR transports natural gas through a 20-inch pipeline from the Beluga gas fields north and east across the Susitna Flats State Game Refuge south of the License Areas (Figure 5-8).

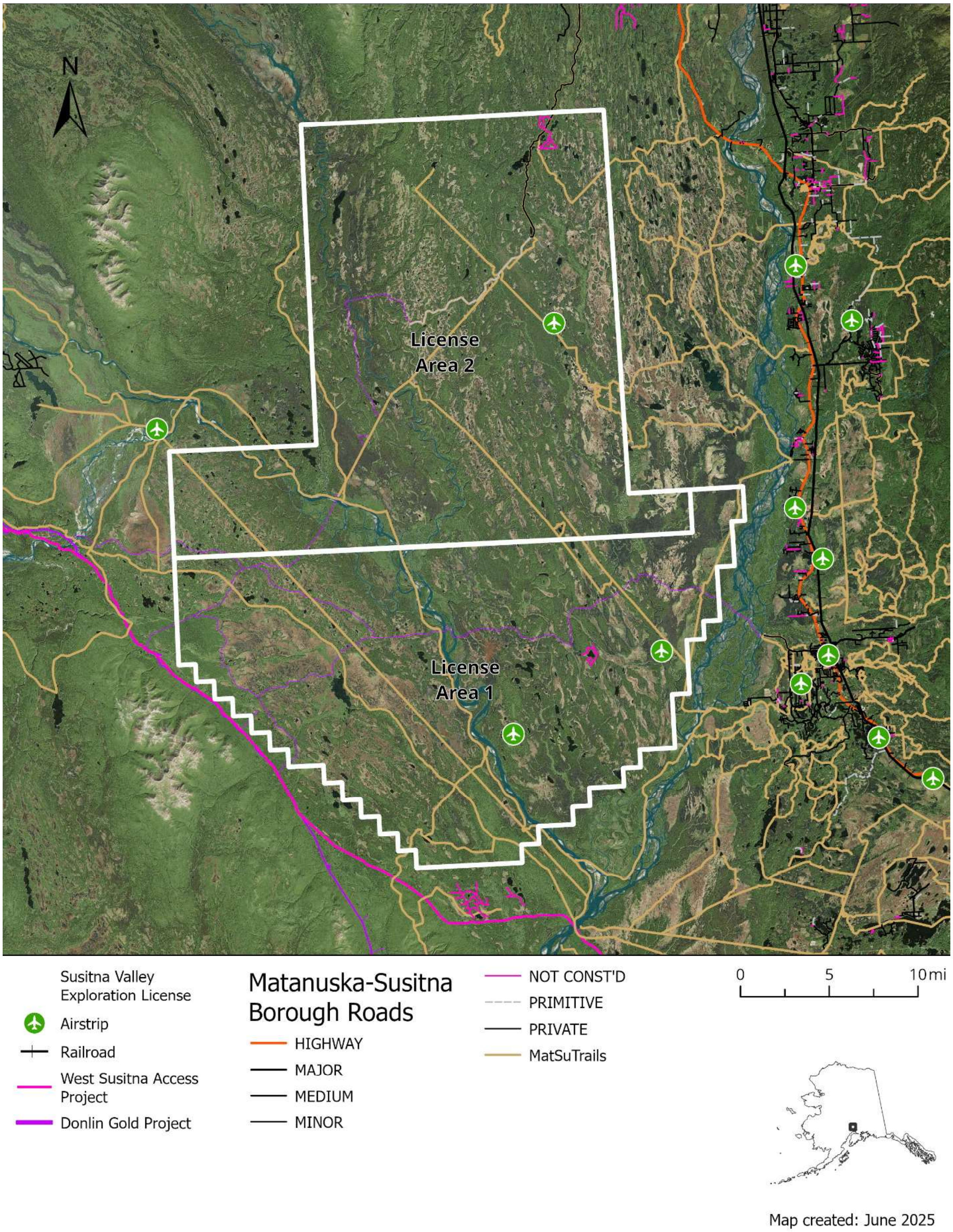


Figure 5-8. Transportation routes in the License Areas.

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Chapter Six: Petroleum Potential and the Likely Methods of Oil and Gas Transportation in the License Areas

Contents

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A. Geology and Hydrocarbon Potential

1. Geologic background and regional setting

The Susitna basin is near a geologically active convergence zone where the oceanic Pacific plate collides with the continental North American plate. When two plates collide as in Southcentral Alaska, some of the less dense silica-rich continental materials are faulted and folded into mountains and the denser oceanic basalt and remaining continental materials are subducted. Subducted rocks eventually melt at depth and then rise generating volcanic plumes and volcanic mountain chains near plate boundaries.

Igneous rocks cool at or near the earth's surface and form the material for other rock types. Metamorphic rocks are formed and reformed, physically, chemically, and molecularly altered by increased heat and pressure. Sedimentary rocks, like shale and sandstone, are derived from the decomposition and disintegration of other rocks and often also contain biogenic material. This is deposited as sediment, which is then compacted through burial. Under certain conditions, petroleum and natural gas are generated in sedimentary rocks. Oil and gas are also almost always found in sedimentary rock reservoirs. During late Paleozoic and early Mesozoic times, sediments were deposited in a sea that occupied the Southcentral Region of Alaska. A volcanic island arc occupied a widespread area in the general vicinity of the now existing Alaska Range, erupting lava and volcanic materials into adjacent areas. The area occupied by the island arc was deformed and uplifted during Triassic time, providing a source of sediments that were deposited to the south in the adjacent marine basin (Selkregg 1975).

Uplift and erosion of the Alaska Range during Jurassic and Cretaceous times provided the material for a thick sequence of continental shelf sediments deposited in an adjacent, low-lying basin which extended from the southern Alaskan Peninsula through the Cook Inlet region to the Copper River basin. Here fine-grained sediments rich in organic material were deposited along with conglomerates, sands, and clays providing the possible source beds and reservoir rocks for the Tertiary petroleum reservoirs of the Susitna basin. During the Tertiary Period in the Susitna basin, deposition of sand and gravel alternated with swamp vegetation growth. Through this repetitive cycle of vegetative growth and sediment deposition, peat layers were developed and buried, producing present-day coal formations. The sands and gravels would later become oil and gas reservoirs (Selkregg 1975).

The Susitna basin is separated from the Cook Inlet basin by the Castle Mountain Fault, a major regional structural feature of Southcentral Alaska. Since the late Jurassic, the rocks on the north side of the fault have moved about 130 kilometers to the east. Tertiary strata were deposited on top of impervious metamorphic rocks rather than on the Mesozoic sedimentary strata of the Cook Inlet basin. The depth of the sedimentary section of the Susitna basin is too cold to have generated thermogenic oil in all but the southwest corner at 13,000 feet where no oil seeps have been documented. However, the abundance of coal is conducive to creating biogenic gas (Bailey 2017).

The structural style of the Susitna basin is a combination of graben and half-graben basement faulting. The Tertiary sedimentary fill consists of mostly the same formations that are found in Cook Inlet. However, Eocene age West Foreland Formation and Oligocene age Hemlock Conglomerate reservoir rocks appear to be missing in the Susitna basin. It is significant that the Jurassic oil-prone source rocks found in the Cook Inlet basin have not been found in the Susitna basin wells or outcrops (Rouse and Houseknecht 2012).

The Susitna basin has not been extensively explored. Eight oil and gas exploration wells, including four with core holes collected, have been drilled within and near the proposed License Areas. All exploration wells were plugged and abandoned as dry holes, though some did have minor gas shows. The two wells drilled near the deepest part of the basin were the Union Texas Pure Kahiltna Unit #1, completed in March 1964 to a total depth of 7,265 feet, and the Unocal Trail Ridge Unit #1, completed in October 1980 to 13,708 feet. Both wells ended in the volcanic rocks age-correlated to the Arkose Ridge formation of the Talkeetna mountains and volcanic rocks on the eastern flank of the Tordrillo mountains (Stanley et al. 2013).

The coal-bearing sedimentary basin is underlain by granitic volcanic bedrock of late Paleocene to early Eocene age found at the bottom of most wells in the area (Stanley 2013). The wells in the west (Trail Ridge Unit 1 and Pure Kahiltna Unit #1) find the volcanic rocks between 6,000’ and 13,000’ while wells in the east (Red Shirt Lake #1 and Fish Creek #1) find volcanics at around 2,000’ depth. The shallowing of the basement to the east is also represented in the seismic data presented in the 2015 USGS Interpretation (Lewis et al. 2015).

2. Hydrocarbon and Coalbed Methane Potential

For accumulations of hydrocarbons to be recoverable, certain geologic conditions must exist. There must be source and reservoir rock present, the depth and time of burial must be right, and there must be migration routes and geologic traps. Source rocks are organic-rich sediments, often marine shales, that have been buried long enough and deep enough to achieve temperatures and pressures adequate to form hydrocarbons. Reservoir rocks are commonly sedimentary rocks like sandstones and carbonates that hold and transmit fluids like hydrocarbons with sufficient porosity and permeability.

The United States Geological Survey (USGS) Susitna basin oil and gas review reports that while there is adequate source rock (coal, shale, mudstone) capable of generating oil, the material has not reached oil window temperatures and depths capable of forming oil in all but possibly the southwest corner of the license area (Bailey 2017).

The likely petroleum source rocks in the Susitna Valley are Tertiary age organic rich non-marine coals and shales. Undiscovered petroleum accumulations may exist in sandstone and conglomerate structural and stratigraphic traps. A 2017 USGS assessment estimated the mean total undiscovered microbial conventional gas resources in the Susitna basin to be nearly 1.7 trillion cubic feet and the mean undiscovered oil volume to be about 2 million barrels (Stanley et al. 2018).

Coalbed methane production is largely dependent on thermal maturity and the depth to the coal bed. Secondary biogenic gases are generated through the metabolic activity of bacteria introduced by meteoric waters moving through permeable coal beds. These bacteria generate methane and carbon dioxide in sub-bituminous through low-volatile bituminous and higher rank coals (DGGS 2001). The methane can be held in place on the surface of the coal source rocks by groundwater pressure which acts as the trapping mechanism (Lennon 2020).

Coalbed methane can occur in Cretaceous and Tertiary subbituminous coal seams which are abundant in the Susitna Valley basin. Multiple such seams with fractures and cleats were documented at shallow depths in the AK-94 CBM-1 well, which was an Alaska Department of Natural Resources (DNR) coalbed methane evaluation well in the Matanuska-Susitna Valley that encountered relatively high gas content. Flores et al. 2004 reported coal seams in five wells in the Susitna basin, but a lack of development indicates coalbed methane has not been discovered in economic quantities (Flores et al. 2004).

The Susitna basin is composed of mostly lignite and subbituminous coals which pose several problems for reservoir properties. Because the coal beds are lignite and subbituminous rank, there are minimal fractures to allow methane to escape when the coalbed is dewatered. Additionally, there are no oil or gas shows in well tests at Pure Kahiltna Unit #1, Trail Ridge Unit #1, Fish Creek #1, Sheep Creek #1 and Kashwitna Lake #1. At the Willow Fishhook #1 well, various techniques were attempted to produce methane however none were proven to be economical (Flores et al. 2004). The resource potential of these coals, however, may be low, because these coals are generally thin, have a low net-to-gross ratio with respect to other lithologies, and are a very low grade of coal, with low adsorbed gas content.

The 2017 USGS Assessment of Undiscovered Oil and Gas Resources of the Susitna Basin expects 99.8 percent of the mean estimate of 1,675 billion cubic feet of gas to be found in conventional accumulations. Examples of these accumulations are sandstone and conglomerate reservoirs in structural traps (anticlines or adjacent to faults) and stratigraphic traps (sandstones in ancient river channels confined by impermeable, fine-grained strata that formed on adjacent floodplains) (Stanley 2018).

The Susitna basin remains extremely underexplored and is considered to have low-to-moderate potential for conventional and unconventional gas plays based on basin geology, limited exploration history, limited available seismic, well, and engineering data, and distance from other proven hydrocarbon accumulations. DNR's Geology and Hydrocarbon Potential section is based on a resource evaluation made by the Division of Oil and Gas (DO&G) Resource Evaluation Section. This evaluation involves several factors including geology, seismic and well engineering data, exploration history of the area, and proximity to known hydrocarbon accumulations. In order to protect the seismic and well engineering data, which are kept confidential under AS 38.05.035(a)(9)(C), DO&G must generalize the assessment presented to the public.

a. Exploration History

Since the early 1950's, approximately 30 wells have been drilled in the Matanuska-Susitna Borough in search of oil and gas. These wells have targeted both conventional oil and gas resources and coalbed methane. In 1996, the Alaska legislature passed legislation authorizing a shallow natural gas leasing program (AS 38.05.177). The Pioneer Unit was formed in 1998 which had a mix of conventional and coalbed methane resource targets. A total of 270 leases were applied for through the shallow natural gas leasing program, 162 of which were in the Matanuska-Susitna Borough. In February 2003, 60 leases were issued.

In 2004, the legislature repealed the shallow natural gas leasing program through House Bill 531. House Bill 531 allowed for companies with pending lease applications to convert their lease applications into exploration license applications. The legislation also contained provisions related to the regulation of coalbed methane activities, prohibiting coalbed methane development from an aquifer used for drinking water or agricultural purposes, and mandatory setbacks and noise restrictions for coalbed methane exploration and development activities. This led to DNR conducting a series of public meetings in December 2004 and publishing the Enforceable Standards for Development of State Owned Coalbed Methane Resources in the Matanuska-Susitna Borough (DNR 2004), to which the Susitna Valley Exploration License Areas (License Areas) would be subject.

Beginning in 2003, Cook Inlet Energy, LLC conducted an exploration program in the Susitna basin. The program planned for two gas exploration wells at its Kroto Creek prospect near the Susitna River. In April 2011, the company acquired the Susitna Basin Exploration License No. 4, a 10-year license covering 62,909 acres with a $2.25 million work commitment. In April 2012, Cook Inlet Energy, LLC acquired the Susitna Basin Exploration License No. 5, a 5-year license covering 45,764 acres with a $250,000 work commitment. They completed a winter access trail and a two-well pad at Kroto Creek and a third well farther west at Moose Creek in March and April 2013. However, this work was not completed, and Cook Inlet Energy, LLC surrendered the last of their licenses in March 2016. ANGC was awarded an Exploration License in 2022 but the license was not issued due to non-compliance with the award notice. The previous Susitna basin exploration licenses overlapped much of the same area that the License Areas cover. Currently, there are no producing oil or gas wells in the License Areas.

b. Natural Gas Supply and Demand

The Cook Inlet basin has served as southcentral and interior Alaska’s exclusive source of natural gas for nearly 60 years. Cook Inlet natural gas generates roughly 70 percent of the Railbelt’s electricity, heats over 150,000 homes and businesses, and supplies fuel for industrial users. Natural gas has been produced from 35 different Cook Inlet fields with five fields – Beluga River, Kenai, McArthur River, North Cook Inlet, and Swanson River. These five fields were among the first discovered and have been producing for more than 50 years (DO&G 2022).

In an analysis completed in 2024 for the House Energy Committee, demand for Cook Inlet natural gas was expected to remain around 70 billion cubic feet per year (bcf/year). Based on the study assumptions, in the mean case, supply from baseline production, estimated through a basin-wide decline analysis, supplemented primarily by augmented production from continued investment and development in currently producing fields was projected to meet current demand levels until about 2029. Further, new field development and current production could extend gas supply through 2038 (DO&G 2023). Investment in exploration and delineation is crucial for the continued security of natural gas supplies for the Railbelt. Continuous exploration has led to establishment of 20 new fields and 485 new wells since 2000, with about 88 percent of the almost 200 million cubic feet per day of produced gas in 2024 coming from wells drilled within the last 25 years.

c. Carbon Sequestration Potential

Carbon dioxide capture and storage (carbon sequestration) technologies could mitigate the impact of greenhouse gas buildup from fossil fuel-based energy generation (USDOE 2015). Carbon sequestration potential for sedimentary basins and coal seams were evaluated for the Cook Inlet basin including the Susitna basin. The Susitna sedimentary basin was rated moderately low for carbon dioxide sequestration potential, primarily because reservoir and seal potential were considered limited based on the best well and seismic data available. Coal seam sequestration potential, however, in the Susitna basin was rated high. Extensive deep Tertiary age subbituminous to high volatile bituminous coal in the Tyonek Formation have the greatest potential for near term carbon dioxide sequestration, with an estimated capacity of 43.0 gigatons for the Cook Inlet basin based on a carbon dioxide to methane storage ratio of about 7 to 1. Existing infrastructure such as roads and pipelines surround the northern and eastern portion of the Cook Inlet basin, which is also adjacent to major emission sources (Shellenbaum and Clough 2010).

Information from exploration wells drilled in the License Areas could be helpful in defining suitability of stratigraphy and coal resources for potential use for carbon dioxide sequestration. Carbon dioxide adsorption capacity has not been measured directly for Alaskan coals. Estimates of coal seam carbon dioxide storage capacity are based on comparison to analogous coal basins outside of Alaska. Details on coal cleating, fracture density, coal seam porosity, and laboratory measurement of carbon dioxide adsorption and permeability of cores from coal seams could be used to refine the carbon dioxide storage potential for Alaska's unmineable coal seams (Shellenbaum and Clough 2010). As discussed in Chapter Eight, injection of carbon dioxide into coal seams can also be used to enhance production of coalbed methane

B. Phases of Oil and Gas Development

There are several different phases of oil and gas activities: disposal or licensing and leasing, exploration, development, and production. While not all post-disposal oil and gas activities are routine, there are some oil and gas activities that are reasonably foreseeable because they are commonly undertaken regardless of the project. Routine oil and gas activities include seismic surveys, drilling, construction of facilities, and pipelines and production.

Oil and gas activities include those direct and indirect activities that have occurred in the past, are presently occurring, or are likely to occur in the future. Petroleum-related activities include such major undertakings as conducting seismic operations, constructing roads and trails for transporting equipment and supplies, drilling exploration and delineation wells, constructing gravel pads and roads, drilling production and service wells, installing pipelines, and constructing oil and gas processing facilities. The activities likely to have the greatest effects vary by resource.

Common industrial facilities potentially associated with the oil and gas industry in the License Areas include: drill sites, well pads, production pads and injection pads, wells (such as exploratory, development, production and waste disposal), processing facilities, facility piping, natural gas transmission pipelines, flow lines and pipelines, maintenance complex, emergency response center, gravel roads, airports, bridges, power plants, and camp facilities.

1. Disposal Phase

An exploration license serves as the disposal of state lands, and as the license can be converted to leases, is the first required step in developing the state's oil and gas resources. The exploration license program supplements the state's oil and gas leasing program by targeting areas outside of known oil and gas provinces. The intent of exploration licensing is to encourage exploration in areas far from existing oil and gas infrastructure, with unknown hydrocarbon potential, and where there is a higher investment risk to the operator. Through exploration licensing, the state receives the license fee and valuable subsurface geologic information on these undeveloped regions and, if the license is converted to leases and development occurs, additional revenue through royalties and taxes could be realized.

Exploration licensing allows interested parties to explore frontier basins without the initial expense of bonus bids or the other costs and restrictions of a competitive oil and gas lease sale. An exploration license gives the licensee the exclusive right to use the licensed area for exploration activities. If the license is converted to leases, then the now lessee will have the right to use the leased area for development and production activities. However, neither a license nor a lease authorizes operations or any specific activities to be conducted on the area.

2. Exploration Phase

The purpose of the exploration phase is to search for reservoirs of oil and gas. Oil and gas resource exploration begins with gathering information about the petroleum potential of an area by examining the surface and subsurface geology, researching data from existing wells, performing environmental assessments, conducting geophysical surveys, and drilling exploratory wells. The surface analysis includes the study of surface topography or the natural surface features, and near-surface structures revealed by examining and mapping nearby exposed rock layers. Geophysical surveys, primarily seismic, help reveal the characteristics of the subsurface geology, and normally precede exploratory drilling. Although geophysical exploration and exploration drilling are activities that could result in potential effects to the License Areas, exploration predominately occurs in the winter to mitigate effects on the landscape and wildlife.

Common activities undertaken during the exploration phase include aerial and geophysical surveys used to define prospects, geological studies, core testing, and exploratory drilling. Exploration wells may be used to drill in unproven areas, for field extension step outs, or delineation wells used in unproven areas to increased proven limits of a field.

3. Development and Production Phase

The development and production phases are interrelated and overlap in time; therefore, this section discusses them together. During development, operators evaluate the results of exploratory activities and develop plans to bring the discovery into production. Production operations bring well fluids to the surface and prepare them for transport to the processing plant or refinery. These phases can begin only after some exploration has been completed and tests show that a discovery is economically viable. However, exploration in new formations for additional reserves can continue in concert with development and production activities.

The purpose of development is to gather, examine, and analyze geologic and other data pertaining to newly discovered reservoirs drilled in exploration to plan how to maximize the recovery of hydrocarbons from a reservoir. Common activities include drilling development and disposal wells, construction of roads and pads, and installation of pipelines and production facilities. Development wells are drilled in proven areas of a field to prepare for production operations. Some production operations overlap with development operations. Delineation and development drilling occur after initial discovery of hydrocarbons in a reservoir, and several wells may be required.

Production is the process of bringing well fluids to the surface and preparing them for transport to the processing plant or refinery. The fluids undergo operations to be purified, measured, tested, and transported. Pumping, storage, handling, and processing are typical production processes. The final project parameters will depend on the surface location, size, depth, and geology of a specific commercial discovery. Production also refers to the amount of oil or gas produced in a given period. Pipeline systems are built, and transportation of oil and natural gas begins.

C. Oil and Gas Exploration, Development, and Production Activities

1. Seismic Surveys

Seismic survey work is an integral part of exploration for oil and gas fields. Seismic data is collected from surface-induced seismic pulses to image subsurface formations with sensors collecting the data as seismic shock waves bounce off formations. The shock waves are generally created by vibrator trucks or explosive charges along predetermined lines or deploying these techniques behind a marine vessel. Seismic surveys are typically conducted in two-dimension (2D) or three-dimension (3D) surveys. Both survey types are useful for evaluating a prospect.

Seismic survey work may be used during all phases of oil and gas development, including before disposal, to locate and produce oil and gas from new and existing developments. Companies may elect to license existing data and reprocess the data without conducting a seismic survey. Other companies may acquire data through commissioning their own program. It is also common for seismic contractors to conduct seismic surveys on behalf of, or with the potential to market to, a licensee. Geophysical exploration by means of seismic surveys informs the analysis of a play, where a company will conduct exploratory drilling, further mapping of a producing field, and evaluating new intervals throughout the development process.

To conduct a seismic survey, source and receiver locations are surveyed using Global Positioning Systems and traditional land survey methods. Source and receiver locations are laid out in predesigned patterns. For 2D surveys, receivers collected data over a loose grid pattern, with lines several miles apart. A 3D seismic survey is similar to 2D acquisition, but with many more sensors collecting data across a much denser grid (Rigzone 2025a). Seismic programs for 2D surveys usually have fewer crewmembers and employ much less equipment than 3D surveys.

Multiple seismic sources can be used for land-based surveys, based on the terrain and conditions, including explosives, weight drop, and hydraulic devices (vibrator trucks). Explosives may be placed into drill holes and detonated, or, much less commonly, they may be suspended on stakes above the ground (Poulter method). When buried, drill holes are typically 20 to 35 feet deep with 2.5 to 5 pounds of explosives set at the bottom of the hole. Holes are either drilled with track-mounted drills or, in remote or sensitive areas, drills are slung into position by helicopter (Shellenbaum 2013). Soil is disturbed in the immediate vicinity of the explosive charges. At locations with existing developments, if explosives are contra-indicated, vibrators or a weight drop may be used to produce the seismic wave energy.

Receivers are generally connected to each other by cables that are strung across predetermined lines. Telemetry-equipped receivers are cableless and battery-powered and may store data internally or transmit data to recording instruments (Shellenbaum 2013). These receivers are preferred in rough terrain, urban areas and applications near roads, and river crossings. Seismic techniques are also used to gather information specifically about near surface geology to identify drilling hazards such as pockets of shallow gas or over pressured sediments.

In addition to seismic data, gravity and magnetic data surveys are collected. In these surveys, airborne instruments measure the intensity of the earth's gravity or magnetic field. Resulting measurements are processed and interpreted to yield information about the subsurface mineralogy and structure. Since the field measurements are passive, as opposed to the use of an active seismic source, these surveys are often referred to as "potential field data." There are little to no impacts to the environment from this type of passive survey methodology.

When a contractor seeks a permit to perform a seismic survey of any variety in the License Areas, a miscellaneous land use permit (MLUP) is required through DNR. Seismic surveys can be performed at any phase of oil and gas development, whether a party holds interest in the subject license or not. Through the MLUP review, DNR will evaluate the project plan and consider other agencies' input and authorities to assess potential impacts of the project. Public notice and the opportunity to comment are provided under regulations adopted by the department. Potential project impacts are mitigated through mitigation measures contained in Chapter 9 or stipulations in the license and lease documents.

2. Drilling

Before initiating any drilling, a plan of operation application must be submitted to DNR for review. The application is reviewed for legal compliance by DNR and other state, federal, and local government entities. DNR evaluates foreseeable effects of the proposed operations, assesses compliance with mitigation measures, and determines the need for additional stipulations to protect resources and the best interest of the state. Before final approval of a plan of operations additional conditions or stipulations may be applied. All well drilling is subject to plan of operation approval. Similar to MLUPs, public notice and the opportunity to comment are provided under regulations and adopted by the department before plans of operation that initiate a new phase under 11 AAC 83. Other agencies also issue authorizations for drilling of wells.

a. Exploration Drilling

Exploratory drilling often occurs after seismic surveys are conducted, and when the interpretation of the seismic data incorporated with all available geologic data reveals oil and gas prospects. Exploration drilling, which proceeds only after obtaining the appropriate permits, is the only way to determine whether a prospect contains commercial quantities of oil or gas. Drilling operations collect rock cuttings, core samples, well logs, and a variety of other data. A well log is a record of one or more physical measurements as a function of depth in a borehole and is achieved by lowering measuring instruments into the well bore. Well logs can also be recorded while drilling. Cores may be cut at various intervals so that geologists and engineers can directly examine the sequences of rock that are being drilled (Chaudhuri 2011).

Very generally, the drilling process begins with special steel pipe (conductor casing) bored into the ground and cemented in place. Then, a drill bit, connected to the end of the drill pipe, rotates and drills a hole through the rock formations below the surface. Upon reaching a targeted depth, the hole is cleaned up and surface casing, a smaller diameter steel pipe, is lowered into the hole and cemented in place to keep the hole from caving in, seal off rock formations, seal the well bore from groundwater, and provide a conduit from the bottom of the hole to the drilling rig. After surface casing is set, drilling continues until the objective formation is reached. Once the drilling is complete, the well is tested, and decisions are made on well completion techniques or plugging and abandoning the well (Rigzone 2025b).

b. Delineation or Development Drilling

After designing the facilities and obtaining the necessary permits, the operator constructs permanent structures and drills production wells. The operator must build production structures that will last the life of the field and may have to design and add new facilities for enhanced recovery operations as production proceeds. Drilling technology continues to improve to minimize environmental footprint and maximize oil or gas recovery. Multilateral, horizontal, and extended reach wells can access a greater reservoir extent than a conventional straight-hole well while improving pressure maintenance and enhanced recovery methods (Joshi 2008).

Directional drilling is used to extend the length of the reservoir that is penetrated by the well. The drilling technique used is controlled to direct the bore hole to reach a particular part of the reservoir. Directional drilling technology enables the driller to steer the drill stem and bit to a desired bottom-hole location, sometimes miles away from the surface location of the rig, and then horizontally through the reservoir. Directional wells initially are drilled straight down to a predetermined depth and then gradually curved at one or more different points to penetrate one or more given target reservoirs (Duplantis 2016).

Directional drilling allows multiple production and injection wells to be drilled from a single surface location such as a gravel pad or offshore production platform, thus minimizing cost and the surface impact of oil and gas drilling, production, and transportation facilities. A single production pad and several directionally drilled wells can develop more than one and possibly several 640-acre sections. It can also be used to reach a target located beneath an environmentally sensitive area and may offer the most economical way to develop offshore oil fields from onshore facilities. Extended reach drilling is used to access reservoirs that are remote, up to 6 miles, from the drilling location.

These techniques allow for drilling into reservoirs where it is not possible to place the drilling rig over the reservoir (US Senate 2011).

When coal seams are formed by compaction, gases including methane are generated and accumulated into the coal cleats or adsorbed into the coal micropores. Coalbed methane is normally recovered by means of reservoir-pressure depletion, for example by pumping out water and degassing the reservoir. A more attractive process with higher yields is Enhanced Coal Bed Methane recovery, where carbon dioxide is pumped into the coal seam to displace methane. Injecting carbon dioxide in coal seams leads not only to increased methane recovery but also to carbon dioxide sequestration (Mazzotti and Marx 2011).

Optimizing coalbed methane production is important to operators and drilling horizontal and multilateral wells is becoming more common in coalbed reservoirs. Coal represents an unusual reservoir rock because of its complex structure. The coal provides both the source and the reservoir rock with the methane gas adsorbed on the internal structure of the coal. Fracture structure and spacing in the coal drives coalbed methane production levels. Longer horizontal well bores increase contact with coal seams which yields higher gas recovery (Maricic et al. 2008).

In addition to production wells, other wells are drilled to inject water or other gases into the reservoir to maximize recovery. These wells generally are referred to as service, or injection, wells. Numerous injection wells are required for waterflood programs, which are used routinely throughout the production cycle to maintain reservoir pressure. The Alaska Oil and Gas Conservation Commission (AOGCC), through its statutory and regulatory mandate, oversees drilling and production practices for safety measures, to maximize oil and gas recovery, prevent waste, and ensure protection of correlative rights within the state. It is a quasi-judicial agency that conducts hearings to review drilling and development to ensure regulatory compliance.

c. Drilling and Production Discharges

The bulk of the waste materials produced by oil and gas activities are produced water and drilling muds and cuttings. Small quantities of treated waste, produced sand, chemical products, excess cement, and trash and debris can also be produced. The fluids pumped down the well are called “mud” and are naturally occurring clays with small amounts of biologically inert products. Different formulations of mud are used to meet the various conditions encountered in the well. The mud cools and lubricates the drill bit, prevents the drill pipe from sticking to the sides of the hole, seals off cracks in down-hole formations to prevent the flow of drilling fluids into those formations, and carries cuttings to the surface (Joshi 2008).

Coalbed methane gas is not structurally trapped in the natural fractures in coalbeds. Most of the methane gas is adsorbed to the coal. To extract the coalbed methane, a production well is drilled through the rock layers to intersect the coal seam that contains the coalbed methane. Next, fractures are created or existing fractures are enlarged using hydraulic or other gas injection methods in the coal seam through which the coalbed methane can be drawn to the well and then pumped to the surface (EPA 2004).

Coalbed methane gas exploration has been facilitated by the development of sophisticated engineering technologies that enhance gas mobilization by fracturing the seams. Sand is commonly used as a proppant that can wedge open the seams permitting gas to escape. Other materials such as ceramic particles are also used for this purpose. The proppant used depends on the geology, depth, and formation characteristics. The efficiency of this process is enhanced by the addition of a mixture of chemicals to the fracking fluid whose functions comprise:

- dissolving minerals and aiding in crack formation,
- reducing bacterial growth,
- restricting fluid loss,
- reducing friction in the fissures to allow proppant delivery and the flow back of water to the surface,
- minimizing corrosion of metal components (drill casings etc), and
- assisting in post fracture fluid recovery by reducing viscosity.

Water and salt management are major issues associated with coal seam gas production. The water pumped into wells for hydraulic fracturing returns to the surface as the pressure is reduced. The chemistry of the water becomes altered as it interacts with the coal seam minerals, and typically is quite saline containing other constituents and minerals associated with the deposits. Depending on the water quality and the operation, the produced waters may be reinjected, treated, stored, used for livestock watering, irrigation, or shipped off the site (Batley and Kookana 2012).

Disposal of mud, cuttings, and other effluent is regulated by the National Pollutant Discharge Elimination System (NPDES) and the United States Environmental Protection Agency's (EPA) Underground Injection Control program administered by the AOGCC under regulations in 20 AAC Chapter 25. The state discourages the use of reserve pits, and most operators store drilling solids and fluids in tanks or in temporary on-pad storage areas until they can be disposed of, generally down the annulus of the well or in a disposal well that is completed and equipped to take mud and cuttings; and permitted in accordance with 20 AAC 25.080 and 20 AAC 25.252. Drilling muds, fluids, and cuttings produced from the well are separated and disposed of, and they may be shipped to a disposal facility out-of-state.

Produced water is water that comes from an oil and gas reservoir to the surface through a production well with hydrocarbons. It is the largest waste stream of conventional oil and gas wells and is a concern when dealing with the large amounts of water associated with producing coalbed and sand bed methane. The produced water volume increases over the economic lifetime of a producing field and may be up to 95 percent of the total volume produced by the end of the field's production history. Produced water contains formation water, injection water, and other chemical additives such as hydrate inhibitors, emulsion breakers, flocculants, coagulants, defoaming agents, scale and corrosion inhibitors bactericides and other substances (AMAP 2010). When produced water can no longer be treated and reinjected, the alternative is disposal. The Alaska Department of Environmental Conservation (ADEC) and AOGCC authorize disposal of produced water. More information can be found in Chapter Seven outlining government authorities to regulate wastewater disposal and produced water injection.

3. Roads, Pads, and Facility Construction

After a discovery of oil or gas is sanctioned for development upon positive results from delineation wells and seismic surveys, several construction activities are required to develop a permanent production operation. A production operation complex would, at a minimum, contain a production pad that could potentially support from one well to dozens of wells and contain a central processing facility or a combined central processing and gas compressor facility. In addition, a production complex may typically include an airstrip, roads, camp facilities, and storage yard. The production operation also may include feeder lines, regional pipelines, or additional compression stations for gas, a gas conditioning facility, and a gas sale pipeline to transport the resource to market (NRC 2003). Similar to drilling operations, all construction activities on a license or lease are subject to a plan of operations approval by the DNR with the opportunity to comment through the public notice process provided under regulations adopted by the department. The construction or maintenance of major production facilities also requires plans of exploration or development.

When drilling, the drill site is selected to provide access to the prospect and, if possible, is located to minimize the surface area that may have to be cleared. Sometimes temporary roads must be built to the area. Construction of support facilities such as production pads, roads, and pipelines may be required. A typical drill pad is made of sand and gravel and is about 300 feet by 400 feet. The pad supports the drill rig, which is brought in and assembled at the site, and, if necessary, a fuel storage area and a camp for workers. If possible, an operator will use nearby existing facilities for housing its crew. If the facilities are not available, a temporary camp of trailers on skids may be placed on the pad.

Production facilities generally include several production wells, water injectors, gas injection wells, and a waste disposal well. Wellhead spacing may be as little as 10 feet. A separation facility removes water from the gas, and pipelines carry the product to the storage and terminal facilities. Some of the natural gas produced is used to power equipment on the well pad, or processing facility.

Oil and gas production operations generally follow similar paths to market. Once produced from downhole, oil and gas move through production facilities for separation and processing, the sales product through a metering station, and on to market. At the time of writing the finding, it is nearly impossible to predict what a full development scenario will entail. The final project parameters will depend on the surface location, size, depth, and geology of a specific commercial discovery.

D. Likely Methods of Oil and Gas Transportation in the License Areas

AS 38.05.035(g)(1)(B)(viii) directs that best interest findings shall consider and discuss the method or methods most likely to be used to transport oil or gas from the License Areas and the advantages, disadvantages, and relative risks of each.

A discussion of specific transportation alternatives for oil from the License Areas is not possible at this time because strategies used to transport potential petroleum resources depend on many factors, most of which are unique to an individual discovery. The location and nature of gas deposits determine the type and extent of facilities necessary to develop and transport the resource. DNR and other state, federal, and local agencies will review the specific transportation system when it is proposed. Modern transportation systems usually include the following major components: pipelines, trucks, and tankers from marine terminals. Gas produced in the License Areas would most likely be transported by a combination of these depending on the type, size, and location of the discovery.

The possible modes of transport from a discovery will be an important factor in determining whether future discoveries can be economically produced – the more expensive a given transportation option is, the larger a discovery will have to be in order to be economically viable. For these exploration licenses, the most viable transportation methods would be through pipelines or trucks.

1. Pipelines

The most common method of transporting hydrocarbons in the Alaska is by pipeline. A pipeline or pipeline facility means all the facilities of a total system of pipe, whether owned or operated under a contract, agreement, license or lease, used by a carrier for transportation of natural gas, or products for delivery, for storage, or for further transportation. A pipeline is a general term that includes all the components of a total system of pipe to transport natural gas or hydrocarbon products for delivery, storage, or further transportation (AS 38.35.230).

Unlike oil, coalbed methane gas is difficult to store due to its physical nature. Coalbed methane gas needs high pressures and low temperatures to increase the bulk density and needs to be transported immediately to its destination after production from a reservoir (Mokhatab et al. 2006). Moving coalbed methane gas from producing regions to markets requires a transportation system. The gas may have to travel a great distance to reach its point of use. Pipelines may follow elevated or buried routes, depending upon the engineering requirements needed and the soils found in the field. Coalbed methane gas may require treatment to remove impurities and to prepare it for transport. Treatment may include depressurization and dehydration. To keep the gas flowing along the pipeline route, the gas may also undergo pressurization by compressors and liquid separation treatment.

During transport, the gas is monitored. Pigging facilities and metering stations are constructed along the pipeline to monitor and manage the gas. Central control stations manage information along the pipeline to allow for quick prevention and necessary reaction to problems (Mokhatab et al. 2006).

Burial of gas pipelines can be desirable for both safety and operational reasons. High-pressure gas lines pose a risk of rupture and explosion. Burial of a pipeline may mitigate the potential impacts if a gas explosion were to occur. High-pressure gas lines operate more efficiently when chilled. In designing buried pipelines for use in Alaska, it is important to consider large deformations that could occur from frost heave, thaw settlement, and slope movement (DeGeer and Nessim 2008).

a. Advantages of Pipelines for Transporting Coalbed Methane Gas

Pipeline monitoring is now done mainly by using remote instrumentation, and in some cases using smart pigs and maintenance pigs. Numerous monitoring and safety systems are installed to provide redundancy in these electrical and mechanical safety systems. Additionally, mechanical shutoff valves are being replaced by vertical expansion loops to provide a more fail-safe method of controlling pipeline pressures and leaks.

The incidence of accidents from transportation of natural gas via gathering lines is historically very low. Data provided by the Pipeline and Hazardous Materials Safety Administration within the United States Department of Transportation (PHMSA) shows what types of pipelines systems are most susceptible to accidents. Over the course of the period from 1992 to 2011, PHMSA data shows far fewer incidents from gathering lines than transmission and distribution lines. The data further shows the incidents of rail and trucking far exceed the incident rates of natural gas pipelines (Furchtgott-Roth 2013). Additional advantages of transporting natural gas through pipelines include the reduced cost, expanding the development of lower emission fuel, and a faster, more dependable delivery to markets.

b. Disadvantages of Pipelines for Transporting Oil and Gas

The most distinct disadvantage of pipelines is their high up-front investment for construction costs. Additional considerations for pipeline operators are the challenges of preserving the quality of the product along with maintenance of the pipe. The larger the pipeline, the more cold weather challenges are manifested, and the more operational costs are shifted to address these issues. This is exacerbated by fluctuations in throughput. Pipes wear down and corrode over time, and inadequate observation and maintenance can lead to leaks. Other spills have occurred slowly, as older pipes fall into disuse and any remaining product seeps out over time (Factoring 2019)

The potential problems and risks associated with transportation of coalbed methane gas through pipelines are typically addressed in mitigation measures. A major risk of transporting gas through a pipeline is a leak or explosion. The measures and methods employed to prevent leaks or explosions, including line integrity protection, pipeline monitoring, and in-line inspections, are detailed in the Spill and Leak Prevention section below. Other disadvantages related to waterbody crossings are addressed through mitigation measures listed in Chapter Nine.

2. Trucking

Transporting hydrocarbons by trucks is associated with greater risks than transporting by pipeline when measured by incidents, injuries, and fatalities (Furchtgott-Roth 2013). Between 2011 and 2012 trucks moving oil to refineries within the United States and Canada increased by 38 percent (IER 2013). Truck transportation is commonly used to move smaller amounts of product shorter distances which may be applicable in the License Areas. Trucking gas produced in the License Areas would be very unusual and inefficient, but some other products may be transported around the field via truck to the drill sites and other facilities.

The federal government is the major source for transportation funding in Alaska. The Alaska Department of Transportation and Public Facilities (DOTPF) is responsible for prioritizing, arranging, and administering the majority of transportation related capital projects. The State of Alaska pays for maintenance and operations for State roadways but may not dedicate revenue to transportation purposes. The Alaska legislature maintains a large degree of control over State transportation programs and priorities. DOTPF projects and programs must compete each year with other social and infrastructure needs for money from the General Fund.

a. Advantages of Trucks for Transporting Oil and Gas

Transporting oil and gas by trucks has an advantage in that trucks can go anywhere roads are in place to service the production facilities and transport to a refinery facility, or other end user. Additionally, immediate environmental impacts tend to be smaller because trucks carry smaller quantities than the other transportation alternatives, thus any release would be limited in size (Factoring 2019).

b. Disadvantages of Trucks for Transporting Oil and Gas

Moving oil and gas by truck is more expensive on a per barrel basis than using a pipeline. Studies show that the average cost to move a barrel of oil or gas equivalent by truck is quadruple the cost to move it by pipeline. It is difficult to make these comparisons because trucks are typically used to move the product much shorter distances, and they are more feasible for a smaller scale project where developing new infrastructure can be prohibitive (Dursteler 2021). Also, trucking can be more dangerous than pipeline transportation. Accidents are more frequent, and trucks are often driven through vulnerable areas such as cities and busy highways. Additionally, since trucks can only carry a small volume, the number of trucks on the road must go up to keep pace with other transportation options. This can create an even higher accident risk, and it also effects local air quality and the environment (Factoring 2019).

3. Mitigation Measures and Other Regulatory Protections

The decision to license or lease oil and gas resources in the state does not authorize the transportation of any product. If gas is found in commercial quantities and production is proposed, final decisions on transportation will be made through the local, state, and federal permitting processes. Those processes will consider any required changes in spill contingency planning and other environmental safeguards and will involve public participation. The state has broad authority to withhold, restrict, and condition its approval of transportation facilities. In addition, boroughs, municipalities, and the federal government have jurisdiction over various aspects of any transportation alternative. Measures are included in this best interest finding to avoid, minimize, and mitigate potential negative effects of transporting hydrocarbons (see Chapter Nine). Additional site-specific and project-specific mitigation measures may be imposed as necessary if exploration and development take place.

E. Spill Risk, Prevention, and Response

AS 38.05.035(g)(1)(B)(vii) requires the director to consider and discuss mitigation measures to prevent and mitigate releases of oil and hazardous substances and a discussion of the protections offered by these measures.

Petroleum spills and gas releases could occur on pads within the License Areas during exploration activities, development and production drilling, and in transportation.

Chapter Seven provides information on regulatory authorities for prevention and response, process for spill or release containment, cleanup, and response training. Chapter Nine includes mitigation measures related to the release of petroleum products and hazardous substances developed after the director considered the risk of spills, methods for preventing spills, and techniques for responding to spills.

1. Regulation of Oil Spill Prevention and Response

The Exploration Licenses are targeting coalbed and sand bed methane gas and the threat of a large oil spill would not be from the extraction of that target resource. However, some risk exists of an oil or hazardous substance release because of the various petroleum products stored on site that are required to operate the equipment used to extract and transport the targeted resource. Therefore, oil spill prevention and response is discussed in detail below.

2. Spill History and Risk

Any time petroleum products are handled there is a risk that a spill might occur. Spills associated with exploration, development, production, storage, and transportation may occur from well blowouts, or pipeline or other accidents. Petroleum activities may generate chronic low volume spills involving fuels and other petroleum products associated with normal operation of drilling rigs, vessels, and other facilities for gathering, processing, loading, and storing of petroleum products. Spills may also be associated with the transportation of refined products to provide fuel for generators and other vehicles used in exploration and development activities. According to ADEC's contaminated sites database, there are five active contaminated sites within the License Areas, and they are all associated with the Federal Aviation Administration in and around the Skwentna airport (ADEC 2025a).

The ADEC commonly cites the primary causes of spills by volume as line failure, equipment failure, human error, containment overflow, and tank failure. There are dozens of spills on the ADEC Prevention, Preparedness and Response database, but most of those reported spills are related to releases from vehicles, hydraulic lines, and home heating oil tanks. None of the reported spills on the database from the License Areas are from oil and gas exploration work or facilities (ADEC 2025b). Although there are risks associated with spills resulting from exploration, production, storage, and transportation of oil and gas, these risks can be mitigated through prevention and response plans such as the Unified Plan and Subarea Contingency Plans (ARRT 2022).

a. Drilling

One form of spill from drilling operations can occur during a well blowout. A well blowout can take place when high pressure is encountered in the well and customary precautions, such as increasing the weight of the drilling mud, are not effective. The result is that oil, gas, or mud is suddenly and violently expelled from the wellbore, followed by uncontrolled flow from the well. Blowout preventers, which immediately close off the open well to prevent or minimize any discharges, are required for all drilling and work-over rigs and are routinely inspected by the AOGCC to prevent such occurrences.

Blowouts are extremely rare in Alaska and their numbers decline worldwide as technology, experience, and regulations influence drilling practices. The AOGCC regulations set forth a comprehensive well permitting process and rigorous well operations inspection program. It also has a program to ensure well failures or blowouts do not occur. Drilling plans and procedures are scrutinized to assess potential problems within rock formations and the drilling fluids used to control downhole pressure. Well construction is evaluated, and rigs are inspected before permission to drill is granted.

b. Pipelines

Both state and federal agencies have oversight of pipelines in Alaska. State agencies include the ADEC and DO&G, which includes the State Pipeline Coordinator's Section. Federal agencies include the PHMSA within the United States Department of Transportation and the Bureau of Safety and Environmental Enforcement within the United States Department of the Interior. Additionally, there is the Joint Pipeline Office which consists of a variety of state and federal agencies that oversee Trans-Alaska Pipeline System (TAPS).

3. Spill and Leak Prevention

A number of measures contribute to the prevention of spills and releases during the exploration, development, production, and transportation of petroleum products. Some of these prevention measures are presented as mitigation measures in Chapter Nine. Prevention measures are also described in the contingency plans that the industry must prepare before beginning operations. Thorough training, well-maintained equipment, and routine surveillance are important components of spill prevention.

The oil and gas industry employs, and is required to employ, many techniques and operating procedures to help reduce the possibility of spilling petroleum products, including use of existing facilities and roads; water body protection, including proper location of onshore storage and fuel transfer areas; use of proper fuel transfer procedures and secondary containment, such as impermeable liners and dikes; and appropriate siting of facilities and pipelines. Additionally, there are some newer technologies and tools that help prevent and mitigate large spills such as employing pipeline leak detection and well blowout prevention.

a. Blowout Prevention

Blowout preventers greatly reduce the risk of a gas release. If a release occurs, the released gas will dissipate unless it is ignited by a spark (Florence et al. 2011). Each well has a blowout prevention program that is developed before the well is drilled. Operators review bottom-hole pressure data from existing wells in the area and seismic data to learn what pressures might be expected in the well. Engineers use this information to design a drilling mud program with enough hydrostatic head to overbalance the formation pressures from the surface to the total depth of the well. Engineers also design the casing strings to prevent various formation conditions from affecting well control performance. Blowout preventer (BOP) equipment is installed on the wellhead after the surface casing is set and before actual drilling begins. BOP stacks are routinely tested in accordance with government requirements. Under 20 AAC 25.035, AOGCC regulates compliance with blowout prevention requirements.

If well control is lost and there is an uncontrolled flow of gas or fluids at the surface, a well control plan is devised. The plan may include instituting additional surface control measures, igniting the blowout, or drilling a relief well. Regaining control at the surface is faster than drilling a relief well and has a high success rate. Operators may pump mud or cement down the well to kill it, replace failed equipment, remove part of the BOP stack and install a master valve, or divert the flow and install remotely-operated well control equipment (API 2019).

b. Leak Detection

Leak detection systems and effective emergency shut-down equipment and procedures are essential in preventing discharges from any pipeline that might be constructed in the License Areas. These systems protect the public and the environment from consequences of a pipeline failure. Pipeline operators are alerted when a leak occurs, so that appropriate actions can be taken to minimize the volume and duration of a release. Leak detection methods vary from simply comparing "metered out" product volumes with "metered in" volumes or more complex computational monitoring systems that simultaneously monitor numerous operating conditions. In most cases, pipeline operators will employ two or more different types of leak detection systems to improve the effectiveness of their leak detection program (PHMSA 2011).

The technology for monitoring pipelines is continually improving. Leak detection methods may be categorized as hardware-based (optical fibers or acoustic, chemical, or electric sensors) or software-based (to detect discrepancies in flow rate, mass, and pressure). Leak detection methods include acoustic monitoring, pressure point analysis, ultrasound, radiographic testing, magnetic flux leakage, regular ground and aerial inspections, and combinations of some or all of the different methods. The approximate location of a leak can be determined from the sensors along the pipeline. A computer network is used to monitor the sensors and signal any abnormal responses. In recent years, computer-based leak detection through a Real-Time Transient Model has come into use, to mathematically model the flow within a pipe (Scott and Barrufet 2003).

Modern pipeline systems are operated from control centers with computer connectivity and satellite and telecommunication links to strive for rapid response and constant monitoring of pipeline conditions. Design and use of "smart pigs," data collection devices that are run through the pipeline while it is in operation, have greatly enhanced the ability of a pipeline operator to detect internal and external corrosion and differential pipe settlement in pipelines. Pigs can be sent through the pipeline on a regular schedule to detect changes over time and give warning of any potential problems. Three types of pigs are used. A caliper pig is used to measure internal deformation such as dents or buckling. A geometry pig records configuration of the pipeline system and determines displacement. A wall thickness pig measures the thickness of the pipeline wall. All can provide early warnings of weaknesses where leaks may occur (NRC 2003).

4. Spill Response

Spill preparedness and response practices for the License Areas are driven by the Alaska Federal/State Preparedness Plan for Response to Oil and Hazardous Substance Discharges/Releases (Unified Plan) and the Alaska Inland Area Contingency Plan. The Unified and Contingency Plans represent a coordinated and cooperative effort by government agencies and were written jointly by the USCG, EPA, and ADEC (AKIAC 2021; ARRT 2022).

a. Incident-Command System

An Incident Command System (ICS) response is activated in the event of an actual or potential oil, gas, or hazardous material spill. The ICS system is designed to organize and manage responses to incidents involving several interested parties in a variety of activities. Since spills usually involve multiple jurisdictions, the joint federal and state response contingency plan incorporates a unified command structure in the oil and hazardous substance discharge ICS. The unified command consists of the FOSC, the State On-Scene Coordinator (SOSC), the Local On-Scene Coordinator, and the responsible party On-Scene Coordinator. The ICS is organized around five major functions: command, planning, operations, logistics, and finance/administration (ARRT 2022).

The Unified Command jointly makes decisions on objectives and response strategies; however, only one Incident Commander oversees the spill response. The Incident Commander is responsible for implementing these objectives and response strategies. If the responsible party is known, the responsible party Incident Commander may remain in charge until or unless the FOSC and SOSC decide that the responsible party is not doing an adequate job of response (ARRT 2022).

b. Response Teams

The Alaska Regional Response Team (ARRT) monitors the actions of the responsible party. The ARRT is composed of representatives from 15 federal agencies and one representative agency from the State of Alaska. The ARRT is co-chaired by the USCG and EPA, while the ADEC represents the state. The team provides coordinated federal and state response policies to guide the FOSC in responding effectively to spill incidents. The Statewide Oil and Hazardous Substance Incident Management System Workgroup, which consists of the ADEC, industry groups, spill cooperatives, and federal agencies, published the *Alaska Incident Management System* (AIMS) for oil and hazardous substance response (ARRT 2022).

c. Training

Individual members of the spill response team train in basic spill response; skimmer use; detection and tracking of oil; oil recovery on open water; river booming; radio communications; all-terrain vehicle, snowmobile, and four-wheeler operations; oil discharge, prevention, and contingency plan review; communication equipment operations; open water survival; oil spill burning operations; pipeline leak plugging; and spill volume estimations.

5. Cleanup and Remediation

Cleanup plans for spills on terrestrial and wetland ecosystems must balance the objectives of maximizing recovery and minimizing ecological damage. Many past cleanup operations have caused as much or more damage than the spilled product itself. All petroleum products are not the same, and knowledge of the chemistry, fate, and toxicity of the spilled product can help identify cleanup techniques that can reduce the ecological impacts of a spill. Hundreds of laboratory and field experiments have investigated the fate, uptake, toxicity, behavioral responses, and population and community responses to spills (Jorgenson and Cater 1996).

Spills can affect freshwater environments as well. The effects of a spill into a surface water environment are dependent on factors including the flow rate, wave action, and temperature of the water. Cleaning spilled petroleum products from shorelines can be a difficult task with many variables that determine the techniques that are most effective and environmentally responsible. Some physical methods that are employed include deploying booms and sorbent material to contain the spill; wiping the shore with adsorbent materials; pressure washing to mobilize the contaminant; or raking and bulldozing to remove the impacted material (EPA 1999).

After a spill, the physical and chemical properties of the individual constituents in the product begin to be altered by the physical, chemical, and biological characteristics of the environment; this is called weathering. The factors that are most important during the initial stages of cleanup are the evaporation, solubility, and movement of the spilled product (Jorgenson and Cater 1996).

Cleanup stages include initial response, remediation, and restoration. During initial response, the responsible party gains control of the source of the spilling product; contains the spill; protects the natural and cultural resource; removes, stores and disposes of collected product; and assesses the condition of the impacted areas. During remediation, the responsible party performs site and risk assessments; develops a remediation plan; and removes, stores, and disposes of more collected product. Restoration attempts to re-establish the ecological conditions that preceded the spill and usually includes a monitoring program to access the results of the restoration activities (Jorgenson and Cater 1996).

6. Hazardous Substances

Hazardous substances are identified as a large range of elements, compounds, and substances regulated by the EPA, USCG, ADEC, and other government agencies. In addition to petroleum products, waste products, toxic water pollutants, hazardous air pollutants, hazardous chemical substances, and other products presenting an imminent danger to public health or welfare are identified for prevention from release and response in cases of spills. AS 46.03.826(5). ADEC, USCG, and EPA monitor and inspect operations and facilities to enforce compliance with preventative measures to ensure safe use and storage of hazardous substances (AKIAC 2021). Mitigation measures have been developed to minimize releases or spills during oil and gas operations and can be found in Chapter Nine.

Spill response protocols are well established for the Alaska Inland Area. ADEC, USCG and EPA – Region 10 have established guidelines for operations in the event of a major response effort to an oil spill or hazardous material release in the Alaska Inland Area Contingency Plan. Any release of a hazardous substance must be reported by a responsible party as soon as the person has knowledge of the discharge. The release must be reported to the National Response Center and the ADEC, and response protocols must be initiated. There are several safeguards in place to react quickly to hazardous releases. Coordination, trained personnel, and technological advances can be employed quickly to address the occasions when releases occur (AKIAC 2021).

It is essential for those in command control to recognize and identify the substance release for safe containment. An initial characterization of the hazard during the evaluation phase of containment requires an assessment of potential threat to public health and environment, need for protective actions, and protection of response personnel. A more comprehensive characterization will follow if necessary. In certain cases, local or state entities have the authority to order evacuations beginning with those living or working in downwind or in low-lying areas. Response personnel will secure sites, establish control points, and establish work zones. The Local On-Scene Coordinator is in command and control until they determine an imminent threat to public safety no longer exists. While the largest volume of transport hazard substance is coalbed methane gas, agency coordination between federal, state, and local entities are equipped to contain and manage releases of all hazardous substances present in the License Areas (AKIAC 2021).

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Chapter Seven: Governmental Powers to Regulate Oil and Gas

Contents

Chapter Seven: Governmental Powers to Regulate Oil and Gas

AS 38.05.035(g)(1)(B)(v) requires the director to consider and discuss the governmental powers to regulate the exploration, development, production, and transportation of oil and gas or gas only. Oil and gas activities are subject to numerous federal, state and local laws, regulations, policies, and ordinances. Each licensee is obligated to comply with all federal, state, and local laws. Regulatory agencies may have different roles in the oversight and regulation of oil and gas activities, and some agencies may have overlapping authorities with other agencies.

Most oil and gas activities require individual authorizations regardless of the phase (disposal, exploration, and development and production) with which they are associated. Common oil and gas activities associated with exploration requiring prior authorization include seismic surveys, development of drill pads, and drilling exploration wells. In the development and production phase, common activities requiring prior authorization include construction of pads, roads, support facilities, and drilling development wells. In the production phase, common oil and gas activities requiring prior authorization include constructing and operating processing facilities, construction of transmission pipelines, flowlines, and above-ground storage tanks. The likely methods of transportation in the production and development phase are focused on moving oil and gas, and regulatory authorities tend to shift toward monitoring activities and facilities in the field to ensure post-disposal oil and gas activities are conducted as approved. These phases are not always sequential, and associated oil and gas activities may occur at any point throughout the project. The completion of one phase does not automatically trigger the beginning of a new phase.

This chapter is not intended to provide a comprehensive description of the multitude of laws and regulations that may be applicable to oil and gas activities. However, its intent is to display the broad spectrum of government agencies authorized to prohibit, regulate, and condition oil and gas activities which may ultimately occur as a result of the issuance of the Susitna Valley exploration licenses. Actual processes, terms, conditions, and required authorizations will vary with time and certain, site-specific operations, and the activities discussed in the previous paragraph are not all inclusive. Licensees are responsible for knowing and complying with all applicable federal, state, and local laws, regulations, policies, ordinances, and the provisions of the license. Some, but not all, of the major permits and approvals required by each agency are discussed below.

A. State of Alaska

The State of Alaska has several agencies that approve, oversee, or coordinate activities related to oil and gas exploration, development, production, and transportation. The licensee is required to keep the area open for inspection by authorized state officials. Several state agencies including the Alaska Department of Natural Resources (DNR), Alaska Department of Environmental Conservation (ADEC), Alaska Department of Fish and Game (ADF&G), and Alaska Oil and Gas Conservation Commission (AOGCC) may monitor field operations for compliance with each agency’s terms. The agencies and their authorities are set forth below.

1. Department of Natural Resources (DNR)

The Alaska Department of Natural Resources (DNR) reviews, coordinates, conditions, and approves plans of exploration, or operations and other permits as required before on-site activities can take place. The DNR monitors activities through field inspections once they have begun. Each plan of operations is site-specific and must be tailored to the activity requiring the permit. Applicable fees for DNR permits and applications are outlined in 11 AAC 05.010.

a. Oil and Gas Exploration License

The Division of Oil and Gas (DO&G) has the authority to issue oil and gas, or gas only, exploration licenses. An oil and gas, or gas only, exploration license grants to the licensee, without warranty, the exclusive right to explore for deposits of oil and gas, or for deposits of gas only. While an oil and gas, or gas only, exploration license grants the licensee exclusive rights to explore for deposits of oil and gas, or deposits of gas only, it does not authorize subsequent post-disposal oil and gas activities on the license. The oil and gas, or gas only, exploration license serves as the agreement that disposes of state land. DO&G has adopted the DNR's *Enforceable Standards for Development of State Owned Coalbed Methane Resources in the Matanuska-Susitna Borough* guidance document (DNR 2004). The standards contained within this guidance document will be the minimum level of protection for the mitigation measures established in this decision document for both License Areas.

b. Plan of Operations Approval

Oil and gas operations undertaken on or in the License Areas are regulated by 11 AAC 83.158 and 11 AAC 83.346. An application for approval of a plan of operations must contain sufficient information for DO&G to determine the surface use requirements and impacts directly associated with the proposed operations. Amendments may be required as necessary, but DO&G will not require an amendment that is inconsistent with the terms of the exploration license. The terms and conditions of the license, including amendments to the plan of operations, are attached to the plan of operations approval, and are binding on the licensee. In addition to an approved plan of operations, a bond must be furnished to DNR in accordance with regulation, before starting operations (11 AAC 83.160).

c. Permits, Pipeline Rights-of-way, and Easements

DO&G has authority delegated by the commissioner to issue any required permits, rights-of-way, or easements on state land under AS 38.05.850 for roads, trails, ditches, field gathering lines or transmission and distribution pipelines not subject to AS 38.35, and for telephone or electric transmission and distribution lines, oil well drilling sites and production facilities for the purposes of recovering minerals from adjacent land under valid lease, and other similar uses or improvements. The majority of all improvements will be required to be temporary under an exploration license. The DO&G State Pipeline Coordinator's section is the lead state agency for processing pipeline right-of-way leases under AS 38.35, the Right-of-Way Leasing Act. This responsibility includes coordination of the state's efforts related to the federal right-of-way process. The State Pipeline Coordinator also coordinates the state's oversight of preconstruction, construction, operation and termination of jurisdictional pipelines. Several Revised Statute (RS) 2477 rights-of-way are located within the project area, and if those routes are used, efforts should be made to protect and restore those routes if they are impacted by exploration activities. Their locations should be confirmed with DNR.

d. Temporary Water Use Authorization

Temporary water use authorizations may be required for oil and gas activities. The Division of Mining, Land, and Water (DMLW) administers temporary water use authorizations as required under 11 AAC 93.035 before (1) the temporary use of a significant amount of water, (2) if the use continues for less than 5 consecutive years, and (3) the water applied for is not otherwise appropriated. The volume of water to be used and permitted depends upon whether it is for consumptive uses, and the duration of use. The authorization may be extended one time for good cause for a period of time not to exceed 5 years.

The authorization is subject to conditions and may be suspended or terminated if necessary to protect the water rights of other persons or the public interest. Information on lake bathymetry, fish presence, and fish species may be required when winter water withdrawal is proposed to calculate the appropriate withdrawal limits.

e. Permit and Certificate to Appropriate Water

Industrial or commercial water use requires a Permit to Appropriate Water under 11 AAC 93.120. The permit is issued for a period consistent with the public interest and adequate to finish construction and establish full use of water. The maximum duration for this permit is 5 years, unless the applicant proves, or the commissioner independently determines, a longer time is required. The commissioner may issue a permit subject to terms, conditions, restrictions, and limitations necessary to protect the rights of others, and the public interest. Under 11 AAC 93.120(e), permits are subject to conditions to protect fish and wildlife habitat, recreation, navigation, sanitation or water quality, prior appropriators, or any other purpose DNR determines is in the public interest.

A Certificate of Appropriation will be issued under 11 AAC 93.130 if the permit holder remits the fee required under 11 AAC 05.010 and (1) submits a statement of beneficial use stating that the means necessary for the taking of water have been developed and the permit holder is beneficially using the quantity of water to be certified, and (2) has substantially complied with all permit conditions.

f. Land Use Permits

DO&G issues land use permits, such as a geophysical permit or a miscellaneous land use permit, under 11 AAC 96.010. Geophysical exploration permits are required for all geophysical and exploration activity in the License Areas.

Seismic surveys are the most common activity authorized by this permit. The purpose of the permit is to minimize adverse effects on the land and its resources while making important geological information available to the state (11 AAC 96.210). Under AS 38.05.035(a)(8)(C), the geological and geophysical data made available to the state are held confidential at the request of the permittee.

A $100,000 bond is required to conduct seismic work. The bond amount for other geophysical surveys is determined when the activity is proposed. A geophysical exploration permit contains measures to protect the land and resources of the area.

DMLW issues land use permits to manage surface uses and activities on state public domain land and to minimize adverse effects on the land and its resources under 11 AAC 96. Land use permits may be issued for a period of up to 5 years depending on the activity and may be revoked at will or for cause in accordance with 11 AAC 96.040. Generally allowed uses on state land are subject to the conditions set out in 11 AAC 96.025.

g. Material Sale Contract

If the licensee or operator proposes to use state-owned gravel or other materials for construction of pads and roads, DMLW requires a material sale contract (11 AAC 71). The contract must include, at a minimum, a description of the License Areas, the materials to be extracted, the volume of material to be extracted, the method of removal of the material, the bonds and deposits required of the purchaser, and the purchaser’s liability under the contract. The material sale contract must also include the purchaser’s site-specific operating requirements (11 AAC 71.200).

A contract may be extended if the DMLW director determines the delay in completing the contract is due to unforeseen events beyond the purchaser’s control, or the extension is in the state’s best interests (11 AAC 71.20).

The DMLW director may require the purchaser to provide a performance bond guaranteeing performance of the terms of the contract. If required, the bond amount is based on the total value of the sale and must remain in effect for the duration of the contract unless released in writing by the DMLW director (11 AAC 71.095).

h. Office of History and Archaeology (OHA)

The Office of History and Archaeology (OHA) performs the work of the State Historic Preservation Office pursuant to the National Historic Preservation Act of 1966 (OHA 2025). OHA follows the state’s historic preservation plan in maintaining the Alaska Heritage Resources Survey (AHRS). The historic preservation plan guides preservation activities in the state from 2018 through 2023 (OHA 2018).

AHRS is an inventory of all reported historic and prehistoric sites within the state. This inventory includes objects, structures, buildings, sites, districts, and travel ways, with a general guideline that the sites are over 50 years old. The fundamental use of the AHRS is to protect cultural resource sites from unwanted destruction (AHRS 2025). Before beginning a multi-phase development project, information regarding important cultural and historic sites should be obtained by contacting OHA. The AHRS data sets are “restricted access documents” and site-specific location data should not appear in final reports or be distributed to others.

AS 41.35.010 enables the state to preserve and protect the historic, prehistoric, and archaeological resources of Alaska from loss, desecration, and destruction so the scientific, historic, and cultural heritage embodied in these resources may pass undiminished to future generations. Further, the historic, prehistoric, and archaeological resources of the state are properly the subject of concerted and coordinated efforts exercised on behalf of the general welfare of the public, so these resources may be located, preserved, studied, exhibited, and evaluated.

2. Alaska Department of Environmental Conservation (ADEC)

ADEC has the statutory responsibility to conserve, improve, and protect Alaska's natural resources and environment, by regulating air, land, and water pollution, and oil spill prevention and response. ADEC implements and coordinates several federal regulatory programs in addition to state laws (ADEC 2025c).

a. Interference with Salmon Spawning Permits

ADEC is responsible for issuing permits for activities that interfere with salmon spawning streams and waters. Activities that may potentially obstruct, divert, or pollute waters of the state used by salmon for spawning, or that may interfere with the free passage of salmon must first apply for and obtain a permit before beginning any work (AS 16.10.010). Permits may be granted if ADEC finds the purpose of the permit is to develop power, obtain water for civic, domestic, irrigation, manufacturing, mining, or other purposes with the intent to develop the state's natural resources. The applicant may also be required to construct and maintain adequate fish ladders, fishways, or other means by which fish may pass over, around, or through the dam, obstruction, or diversion in the pursuit of spawning.

b. Air Quality Permits

ADEC administers the federal Clean Air Act (42 U.S.C. §§7401-7671 et seq.) and the state's air quality program under the federally approved State Implementation Plan (AS 46.14; 18 AAC 50). Through this plan, federal requirements of the Clean Air Act are met, including National Ambient Air Quality Standards (NAAQS), Non-Attainment New Source Review (N-NSR), New Source Performance Standards (NSPS), National Emission Standards for Hazardous Air Pollutants (NESHAP), and Prevention of Significant Deterioration (PSD). Additionally, ADEC monitors air quality and compliance.

NAAQS set limits on certain pollutants (called criteria pollutants) considered harmful to public health and the environment. NAAQS have been established for: carbon monoxide, lead, nitrogen dioxide, particulate matter (PM10), small particulate matter (PM2.5), ozone, ammonia, and sulfur dioxide. NSR and PSD, a permitting program required for the review of new sources, new construction projects, or modifications to an existing facility, ensures that air quality is not degraded by the new project, and that large, new, or modified industrial sources are as clean as possible (EPA 2025b). NSPS are intended to promote the use of the best air pollution control technologies available, and account for the cost of technology and any other non-air quality, health and environmental impact, and energy requirements (EPA 2024b). NESHAPs are set for air pollutants (air toxics) that are not covered by NAAQS, but that may be harmful (EPA 2025a). The standards are categorized by type of source and require the maximum degree of reduction in emissions that is achievable, as determined by the United States Environmental Protection Agency (EPA).

Title I Construction Permits, and Title V Operations Permits are the two primary types of permits issued to meet air quality requirements. These permits specify what activities are allowed, what emission limits must be met, and may specify how the facility must be operated. The permits contain monitoring, recordkeeping, and reporting requirements to ensure that the applicant meets the permit requirements (EPA 2024c).

i. Title I (NSR) Construction Permits

Title I permits refer specifically to air construction permits and minor source specific permits for certain activities such as the PSD program as well as other requirements of the Clean Air Act. This permit must be obtained before onsite construction may begin. Operators of existing and new facilities who propose to construct or modify a stationary source may need to apply for either a construction or minor source specific permit. Title I permits are required for projects that are new major sources for pollutants, or major modifications at existing sources. PSD requires installation of the "Best Available Control Technology," an air quality analysis, and additional impacts analysis and public involvement (EPA 2025a).

The process for a Title I permit can take up to 3 years, depending on the amount of pre-construction meteorological or pollutant monitoring data that must be collected. Once a complete Title I permit application is submitted, ADEC strives to issue Title I minor permits within 130 days. Title I PSD permits can take up to 18 months to issue once a complete permit application is received. Article 5 of 18 AAC 50 contains the regulations covering Title I minor permits. Article 3 of 18 AAC 50 contains the regulations covering the Title I PSD permits. With a few exceptions, ADEC has adopted the federal PSD permit program under 40 CFR 52.21 by reference.

ii. Title V Operations Permits

The federal Clean Air Act gives EPA authority to limit emissions from air pollution sources after the source has begun to operate. EPA regulations require facilities that emit certain pollutants or hazardous substances to obtain a permit to operate the facility, known as a Title V permit. In Alaska, ADEC is responsible for issuing Title V permits and making compliance inspections (AS 46.14; 18 AAC 50). The permit establishes limits on the type and amount of emissions, requirements for pollution control devices and prevention activities, and requirements for monitoring and record keeping (EPA 2024c).

If a Title V permit is required, a permittee has up to 1 year after becoming a major source to submit a complete Title V permit application. Operations can continue while ADEC processes the application (the application shield) if the application is both timely and complete. However, significant revisions to an existing permitted facility cannot be made until ADEC approves the permit revision. Processing time for permit revisions can generally take up to 6 months. Title V permits and revisions can be processed concurrently with Title I permits. Article 3 of 18 AAC 15 contains the regulations covering Title V permits. With a few exceptions, ADEC has adopted the federal operating permit program under 40 CFR Part 71 by reference.

iii. Other Requirements

ADEC also operates ambient air quality monitoring networks under the Clean Air Act to assess compliance with NAAQS for carbon monoxide, particulates, nitrogen dioxide, sulfur oxide, and lead; assesses ambient air quality for ambient air toxics levels; provides technical assistance in developing monitoring plans for air monitoring projects; and issues air advisories to inform the public of hazardous air conditions (ADEC 2025a). ADEC provides oversight for operators that must collect air and meteorological monitoring data to meet air permit requirements.

Operators in Alaska are required to minimize the volume of gas released, burned, or permitted to escape into the air (20 AAC 25.235(c)). Operators must report monthly to AOGCC any flaring event lasting over an hour. The AOGCC investigates these incidents to determine if there was unnecessary waste. More information is provided in Section 4 below.

c. Solid Waste Disposal Permit

ADEC regulates solid waste storage, treatment, and disposal under 18 AAC 60. The EPA administers the Resource Conservation and Recovery Act (RCRA) relating to hazardous wastes and Underground Injection Control (UIC) Class I injection wells. AOGCC regulates UIC Class II oil and gas waste management wells.

ADEC requires a comprehensive plan for all solid waste disposal facilities that it regulates. Solid waste permit applications are reviewed for compliance with air and water quality standards, wastewater disposal, drinking water standards, and consistency with the Alaska Historic Preservation Act before approval. A comprehensive facility plan is required and includes specific engineering design criteria and a discussion demonstrating how the various design features (liners, berms, dikes) will ensure compliance with regulations.

Disposal of waste in Municipal Solid Waste Landfills (MSWLFs) is regulated under 18 AAC 60.300-398. Other solid waste disposal facilities that accept primarily one type of solid waste are regulated as monofill under 18 AAC 60.400-495. An inactive reserve pit is a historic, generally unlined drilling waste disposal area that operated prior to 1996 and is required to be closed under 18 AAC 60.440. Currently 95 percent of the identified inactive reserve pits have met closure requirements.

Waste storage, treatment, and land applications facilities also require permits under 18 AAC 60. Permit applications include detailed reviews of design and operations to ensure that the facilities will perform their planned function, comply with other ADEC regulations, and be protective of health, safety and the environment. Typical permitted treatment facilities include municipal solid waste incinerators and treatment facilities for medical waste, sewage solids, and drilling waste (prior to underground injection).

Hazardous waste storage, treatment, and disposal facilities are permitted and regulated by EPA. Currently, no hazardous waste disposal facilities are permitted in Alaska. If a hazardous waste management facility is proposed for Alaska, ADEC is responsible for a review of the facility siting under 18 AAC 63, although no specific program is designated to perform the review.

d. Wastewater Disposal Permit

Domestic graywater must be disposed of properly at the surface and requires a wastewater disposal permit (18 AAC 72). Monitoring records must be available for inspection, and a written report may be required upon completion of operations.

e. APDES Discharge Permits and Certification

ADEC administers the Alaska Pollution Discharge Elimination System (APDES) program under the federal Clean Water Act for the State of Alaska under a federally approved state implementation plan. This program regulates discharges of pollutants into United States waters by "point sources," such as industrial and municipal facilities. Permits are designed to maximize treatment and minimize harmful effects of discharges. The APDES covers a broad range of pollutants, which include any type of industrial, municipal, and agricultural waste discharged into water.

ADEC's Oil and Gas Section issues state permits for wastewater discharges to land and Alaska Pollutant Discharge Elimination System (APDES) permits for wastewater discharges to Waters of the United States for the oil and gas industry. Permits are issued to the oil and gas operators based on local knowledge and conditions, receiving water characteristics, industry processes, and treatment technology used by the industry. Facilities related to oil and gas exploration, development, or production activities that seek to discharge wastewater to surface waters must apply for an APDES permit. General permits cover multiple facilities that have similar wastewater characteristics in a defined area. Individual permits are issued to a single facility and the terms, limits, and conditions are specifically tailored for that facility and circumstances. An APDES permit is effective for a period not exceeding 5 years and must be renewed before it expires. When a general permit is not available for a specific oil and gas industry discharge from an activity or facility, or when aspects of a facility are not addressed in a general permit, an applicant may request, ADEC may require, or the public may petition the development of an individual permit (ADEC 2025b).

f. Industry Oil Discharge Prevention and Contingency Plans

ADEC regulates spill prevention and response under AS 46.04.030. ADF&G and DNR support the ADEC in these efforts by providing expertise and information. Oil discharge prevention and contingency plans (contingency plans) must be filed with ADEC before beginning operations. DNR reviews and provides comments to ADEC regarding the adequacy of these contingency plans.

Contingency plans for exploration facilities must include a description of methods for responding to and controlling blowouts, the location and identification of oil spill cleanup equipment, the location and availability of suitable drilling equipment, and an operations plan to mobilize and drill a relief well. Holders of approved plans are required to have sufficient oil discharge containment, storage, transfer, cleanup equipment, personnel, and resources to meet the response planning standards for the particular type of facility, pipeline, tank vessel, or oil barge (AS 46.04.030(k)). If development and production follow, additional contingency plans must be approved for each facility before activity commences.

Discharges of oil or hazardous substances must be reported to ADEC. The report must record the volume released, whether the release is to land or to water, and whether the release has been contained by secondary containment or a structure. The discharge must be cleaned up to ADEC's satisfaction. ADEC will modify proposed cleanup techniques or require additional cleanup techniques for the site as it determines to be necessary to protect human health, safety, welfare, and the environment (18 AAC 75.335(d)).

Contingency plans must describe existing and proposed means of oil discharge detection, including surveillance schedules, leak detection, observation wells, monitoring systems, and spill-detection instrumentation (AS 46.04.030; 18 AAC 75.425(e)(2)(E)). Contingency plans must include: a Response Action Plan, a Prevention Plan, and Supplemental Information to support the response plan, including a Best Available Technology Section (18 AAC 75.425). Operators must also provide proof of financial ability to respond to damages (AS 46.04.040).

3. Alaska Department of Fish and Game (ADF&G)

ADF&G, Division of Habitat, evaluates the potential effect of any activity on fish and wildlife, their habitat, and the users of those resources. ADF&G manages approximately 750 active fisheries, 26 game management units, and 32 special areas. The Division of Habitat's mission is to protect Alaska's valuable fish and wildlife resources and their habitats as Alaska's population and economy continue to expand. For activities in the License Areas, fish habitat and hazing permits may be required.

a. Fish Habitat Permit

Under AS 16.05.841–871, ADF&G has the statutory responsibility for protecting freshwater anadromous fish habitat and providing free passage for anadromous and resident fish in freshwater bodies and any activity or project that is conducted below the ordinary high-water mark of an anadromous stream. These activities include, but are not limited to, construction and maintenance for bridges and culverts, stream diversion, stream crossing, and using explosives in the bed of a specified river, lake, or stream. ADF&G may attach additional stipulations to any permit authorization to mitigate potentially negative impacts of the proposed activity. A fish habitat permit from the Habitat Section may be required for exploration activities. The potential applicants and lease holders are welcome to contact the Palmer Habitat Section at (907) 861-3200 or dfg.hab.infopaq@alaska.gov

b. Special Area Permit

Under AS 16.20, authorization for land and water use activities that may impact fish, wildlife, habitats, or existing public use in any of the refuges, sanctuaries, or critical habitat areas designated by the Alaska State Legislature, may require a special area permit. Examples of activities requiring a special area permit include, but are not limited to, construction or placement of structures, damaging or clearing vegetation, detonation of explosives, natural resource development, or energy exploration, and any activity that is likely to have a significant effect on vegetation, drainage, water quality, soil stability, fish, wildlife, or their habitat, or which disturbs fish or wildlife (5 AAC 95.420). The ADF&G may require a mitigation plan pursuant to 5 AAC 95 when deemed necessary.

4. Alaska Oil and Gas Conservation Commission (AOGCC)

AOGCC is an independent, quasi-judicial agency of the State of Alaska established under the Alaska Oil and Gas Conservation Act, AS 31.05.005, The AOGCC's regulatory authority is outlined in 20 AAC 25.

AOGCC acts to prevent waste, protect correlative rights, improve ultimate recovery, and protect underground freshwater. They issue permits, orders, and administers the UIC program for enhanced hydrocarbon recovery and underground disposal of waste. AOGCC serves as an adjudicatory forum for resolving certain oil and gas disputes between owners, including the state (AOGCC 2025a).

a. Permit to Drill

Under AS 31.05.090, AOGCC is authorized to issue permits to drill. Any licensee wishing to drill a well for oil, gas, or geothermal resources must first obtain a permit to drill from AOGCC. This requirement applies to exploratory, stratigraphic test and development wells, and injection and other service wells related to oil, gas, and geothermal activities. Typically, operating companies have obtained approval from all other concerned agencies by the time an operator, as defined by 20 AAC 25.990(46), applies to the AOGCC for a permit to drill. The application must be accompanied by the items set out in 20 AAC 25.005(c).

Under 20 AAC 25.015, once a permit to drill has been approved, the operations detailed in the permit to drill application must not be changed without additional approval from the AOGCC. After issuance of a permit to drill, information on the surface and proposed bottom-hole locations and the identity of the license, pool, and field for each well is published as part of the AOGCC's weekly drilling report (AOGCC 2025b).

b. Underground Injection Control Program (UIC)

The goal of the UIC program under the federal Safe Drinking Water Act is to protect underground sources of drinking water from contamination by oil and gas (Class II) injection activities. The UIC program requires the AOGCC to verify the mechanical integrity of injection wells, determine if appropriate injection zones and overlying confining strata are present, determine the presence or absence of freshwater aquifers and ensure their protection, and prepare quarterly reports of both in-house and field monitoring for EPA. Through a Memorandum of Understanding with EPA, AOGCC has primacy for Class II wells in Alaska, including oilfield waste disposal wells and hydrocarbon storage wells (AOGCC 2025d).

AOGCC reviews and takes appropriate action on proposals for the underground disposal of Class II oil field wastes (20 AAC 25.252). Before receiving approval, an operator must demonstrate that injected fluids will not move into freshwater sources. Disposal or storage wells must be cased and the casing cemented in a manner that will isolate the disposal or storage zone and protect oil, gas, and freshwater sources. Once approved, liquid waste from drilling operations may be injected through a dedicated tubing string into the approved subsurface zone.

c. Annular Disposal of Drilling Waste

An AOGCC permit is required if drilling wastes are to be injected into the well annulus. Annular disposal provides an efficient means for on-site and safe disposal of waste from drilling activities. AOGCC reviews and approves specific wastes, generally limited to drilling muds and cuttings, for annular disposal and ensures that wells permitted for annular disposal will safely contain injected drilling waste. Waste not generated from a hydrocarbon reservoir cannot be injected into a reservoir (AOGCC 2025d).

d. Disposal Injection Orders

Under 20 AAC 25.252, operators may apply for disposal injection orders to dispose of waste in individual wells. After the public review process and AOGCC's analysis, an order may be issued that approves the proposed disposal project (AOGCC 2025c).

e. Area Injection Orders

Area injection orders describe, evaluate, and approve subsurface injection on an area wide basis for enhanced oil recovery and disposal purposes in accordance with 20 AAC 25.402 (AOGCC 2025d).

f. Flaring Oversight

The goal of the flaring oversight program is the elimination of unnecessary flaring whenever possible in accordance with 20 AAC 25.235. Operators are required to report all flaring events lasting longer than one hour to AOGCC. Flaring events over one hour are analyzed and investigated if necessary. The operator may be penalized if it is determined that waste has occurred (AOGCC 2025d).

5. Department of Labor and Workforce Development (DOLWD)

Recent studies of the state's workforce by the Alaska Department of Labor and Workforce Development (DOLWD) identified the need to increase the supply of skilled construction workers available in the state. In response, Governor Walker signed Administrative Order No. 278 (AO 278) to increase opportunities for on-the-job training through monitoring the use of apprentice workers on state-financed construction projects and improve the available pool of skilled construction workers. AO 278 directed DNR to consider ways to encourage licensees and lessees developing minerals, including oil and gas, on state-owned land to employ apprentices for work performed on the licensed or leased area. In February 2019, Alaska Governor Michael Dunleavy rescinded AO 278 by AO 309.

DOLWD also administers some delegated authorities of the Occupational Safety and Health Administration (OSHA) Section 18 of the OSHA Act of 1970 allows states to obtain approval to assume responsibility for development and enforcement of federal occupational safety and health standards. The DOLWD has obtained approval from OSHA for administration of some of the federal OSHA standards (OSHA 2004; DOLWD 1992).

B. Federal

1. Environmental Protection Agency (EPA)

EPA implements, administers, or oversees programs required by federal environmental laws and regulations. The implementation of some programs has been delegated to the states to safeguard the air, land, and water.

a. Air Quality Permits

ADEC administers the federal Clean Air Act and the air quality program for the State of Alaska under a federally-approved state implementation plan (EPA 2024a). For more information, see section 2(b) above.

b. Hazardous Waste (RCRA) Permits

Hazardous waste storage, treatment, and disposal facilities are permitted and regulated by EPA. The federal RCRA regulates the management of solid waste, hazardous waste, and underground storage tanks holding petroleum products or certain chemicals (40 CFR 264.175(b)-(c)). Regulations set the parameters for transporting, storing, and disposing of hazardous wastes and for designing and operating treatment, storage, and disposal facilities safely (40 CFR 264.193(b)). Regulations are enforced through inspections, monitoring of waste handlers, taking legal action for noncompliance, and providing compliance incentives and assistance (EPA 2024c).

Some states may receive authorization to administer parts of the program, which requires that state standards be at least as strict as federal standards. EPA administers the RCRA program in Alaska. Currently, no hazardous waste disposal facilities are permitted in Alaska. If a hazardous waste management facility is proposed for Alaska, ADEC would be responsible for reviewing facility siting under 18 AAC 63.

c. National Pollutant Discharge Elimination System Discharge Permit

The National Pollutant Discharge Elimination System (NPDES) discharge permit is required under the federal Clean Water Act, although its administration may be delegated to a state agency. ADEC administers this EPA program within state waters, under the APDES (see Section 2(e) above). However, EPA retains responsibility for issuing NPDES permits in Alaska for facilities within Denali National Park, outside of state waters, on tribal lands, and facilities subject to Clean Water Act Section 301(h) waivers. Both ADPES and NPDES permits specify the type and amount of pollutant, and include monitoring and reporting requirements, so that discharges do not harm water quality or human health.

d. Underground Injection Control (UIC) Class I and II Injection Well Permits

The EPA regulates injection wells used to dispose of fluid pumped into the well. Authorized as part of the federal Safe Drinking Water Act of 1974, the EPA’s UIC program protects underground sources of drinking water from being contaminated by the waste injected in the wells. Injection wells are categorized into five classes; Classes I and II are most common in the oil and gas industry. The EPA administers the program for Class I wells in Alaska, and authority for Class II oil and gas wells has been delegated to AOGCC.

All injections falling into Class I must be authorized through the EPA’s UIC Class I program. Class I wells must operate under a permit that is valid for up to 10 years. Permits stipulate requirements such as siting, construction, operation, monitoring and testing, reporting and record keeping, and closure. Requirements differ for wells depending on whether they accept hazardous or non-hazardous wastes.

2. US Army Corps of Engineers

The United States Army Corps of Engineers (USACE) has regulatory authority over construction, excavation, or deposition of materials in, over, or under navigable waters of the United States, or any work which would affect the course, location, condition, or capacity of those waters under Section 10 of the Rivers and Harbors Acts of 1890 (superseded) and 1899 (33 USC 401, et seq.; 33 USC 403). In addition, under Section 404 of the Clean Water Act, USACE regulates discharge of dredged and fill material into waters of the United States including wetlands (USACE 2025b).

The primary goals of the USACE's regulatory program are to maintain navigation (Section 10), and to restore and maintain the physical, chemical, and biological integrity of the nation's waters (USACE 2025a). Section 404 permits cover oil and gas activities that potentially discharge fill materials into waters of the United States, which are defined as "those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce (USACE 2025b)." Oil and gas activities that may require Section 404 permits could include placement of gravel fill for roads, drill site and facility pads, and bridge or pipeline pilings in wetlands, floodplains, streams and rivers.

Individual permits issued for specific projects are the basic type of permits issued. General Section 10 and 404 permits (including nationwide, and regional general permits) authorize activities that are minor and will result in minimal individual and cumulative adverse effects. General permits carry a standard set of stipulations and mitigation measures. Letters of permission, another type of permit authorization, are applicable to certain activities regulated under Section 10 in Alaska that do not involve discharge of fill in navigable waters (USACE 2025a).

In making a final decision on whether to issue a Section 10 or 404 permit, USACE is required to consider the public interest. USACE considers the benefits and detriments of the proposed project on public resources including: conservation, economics, aesthetics, wetlands, cultural values, navigation, fish and wildlife values, water supply, water quality, and any other factors considered important for the needs and welfare of the people (USACE 2025b). Section 10 and 404 permits must also comply with other federal and state requirements. Permits are typically reviewed by EPA, US Fish and Wildlife Service (USFWS), and National Marine Fisheries Service (NMFS) to ensure compliance with Endangered Species Act (ESA), National Environmental Policy Act, Fish and Wildlife Coordination Act, Essential Fish Habitat Provisions of the Magnuson-Stevens Fishery Conservation and Management Act, and National Historic Preservation Act (USACE 2025a).

ADEC reviews Section 10 and 404 permit applications for compliance with Alaska water quality standards (Section 401 state certification). If the applications comply, ADEC issues a Certificate of Reasonable Assurance which allows the 404 permit to become valid (USACE 2025b).

3. Pipeline and Hazardous Materials Safety Administration (PHMSA)

The federal Office of Pipeline Safety (OPS) in the Pipeline and Hazardous Materials Safety Administration (PHMSA), an agency of the United States Department of Transportation, regulates movement of hazardous materials by pipeline (PHMSA 2018). PHMSA inspectors review technical issues on hazardous liquid pipelines in Alaska. The 2016 PIPES Act requires hazardous liquid pipeline operators to develop integrity management programs for transmission pipelines (PHMSA 2016).

Jurisdictional authority over pipelines depends on many factors such as design, pipe diameter, product transported, or whether it meets state or federal designation, e.g., transmission line, gathering line, or distribution line, and other attributes as specified in regulations. Generally, the design, maintenance, and preservation of transmission pipelines transporting hydrocarbon products are under the authority and jurisdiction of PHMSA with specific federal regulations for natural gas (49 CFR 192) and hazardous liquids (49 CFR 195). Both regulations prescribe the minimum requirements that all operators must follow to ensure the safety of their pipelines and piping systems. The regulations not only set requirements, but also provide guidance on preventive and mitigation measures, establish time frames for upgrades and repairs, development of integrity management programs, and incorporate other relevant information such as standards, incorporated by reference, developed by various industry consensus organizations.

4. US Fish and Wildlife Service

The United States Fish and Wildlife Service (USFWS) is a federal agency within the Department of the Interior dedicated to conservation, protection, and management of fish, wildlife, and natural habitats. USFWS has management authority for migratory birds, threatened and endangered species, the national wildlife refuge system, aquatic resources, and landscape conservation (USFWS 2025a). USFWS issues incidental take permits under the ESA for a limited set of marine mammals such as polar bears, walrus, and sea otters, as well as freshwater and terrestrial endangered species. Incidental take permits with respective habitat conservation plans are required when non-federal activities will result in take of threatened or endangered species (USFWS 2025b).

C. Other Federal and State Regulatory Considerations

1. Regulations of Oil Spill Prevention and Response

Section 105 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) (42 U.S.C. § 9605), and § 311(c)(2) of the Clean Water Act, as amended (33 U.S.C. § 1321(c)(2)) require environmental protection from oil spills. CERCLA and the Clean Water Act require a National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR § 300; 33 U.S.C. § 1321(d)). Under the implementing regulations, a violator must plan to prevent and immediately respond to oil and hazardous substance spills and be financially liable for any spill cleanup. If the pre-designated Federal On-Scene Coordinator (FOSC) determines the response is neither timely nor adequate, the federal government may elect to respond to the spill absent adequate actions by the responsible party and if it so chooses, may seek to recover the costs of such response from the responsible party.

The Oil Pollution Act of 1990 (OPA 90) requires the development of facility and tank vessel response plans and an area-level planning and coordination structure to coordinate federal, regional, and local government planning efforts with the industry. OPA 90 amended the Clean Water Act

(§ 311(j)(4); 33 U.S.C. § 1231(j)) and established regional citizen advisory councils (RCACs) and area contingency plans as the main parts of the national response planning structure.

The Alaska Regional Response Team (ARRT) is an advisory board to the FOSC. It provides processes for participation by federal, state and local governmental agencies to participate in response to pollution incidents (ARRT 2022). The Alaska Regional Contingency Plan is the area contingency plan for Alaska, and the License Areas are located within the Alaska Inland Area Contingency Plan (ADEC 2021).

2. Alaska National Interest Lands Conservation Act (ANILCA)

The Alaska National Interest Lands Conservation Act (ANILCA) designated over 100 million acres of conservation system units across Alaska, which are each separately managed by one of four federal land management agencies, the National Park Service, the United States Fish and Wildlife Service, the Bureau of Land Management and the USDA Forest Service. ANILCA includes numerous special provisions intended by Congress to balance the national interest in Alaska's vast scenic and wildlife resources with recognition of Alaska's developing economy and infrastructure, and distinctive rural way of life. The State, through its interagency ANILCA program, continues to closely monitor the implementation of ANILCA. State interests include the need for continued public access for traditional activities; guaranteed access to State and private inholdings within CSUs for economic and other uses; consideration of transportation and utility systems within or across CSUs; access for subsistence activities; and recognition of state authorities concerning fish, wildlife, navigable waterways, tidelands and submerged lands.

Title XI of ANILCA provides that Alaska's transportation and utility network is largely undeveloped and future needs for those systems should be identified through a cooperative effort involving the state and federal government, with public participation. The development of any transportation or utility corridors should be established to minimize any adverse impacts to the environment. Additionally, ANILCA requires drafting a timely environmental impact statement for a proposed utility or transportation corridor, prepared by all federal agencies with which the application was filed under.

3. Native Allotments

Licensees must comply with applicable federal law concerning Native allotments. Activities proposed in a plan of operations must not unreasonably diminish the use and enjoyment of lands within a Native allotment. Before entering lands subject to a pending or approved Native allotment, licensees must contact the Bureau of Indian Affairs (BIA) and the Bureau of Land Management and obtain approval to enter.

D. Local Governmental Powers

1. Matanuska-Susitna Borough

Under the authority of Title 29 of the Alaska Statutes, Matanuska-Susitna Borough (MSB) is responsible for planning and zoning through the implementation of Title 15 of MSB Code. The land management principles and procedures contained in Title 15 ordinance evolved from the information used to develop the Matanuska-Susitna Borough Comprehensive Development Plan (MSB 2005). Under Title 17.62, MSB may require conditional use permits for coalbed methane exploration, development, and production activities. These conditional use permits typically include a proposed site plan with a description and schedule of planned activities site buffering and screening, vehicle access and circulation, fencing and security measures. Emergency response, archaeological and historic preservation, fish and wildlife mitigation, groundwater and surface water monitoring, methane seepage testing, and reclamation plans may also be requested for coalbed methane conditional use permits. MSB's conditional use permit for non-state managed lands is patterned after DO&G's plan of operation requirements under 11 AAC 83.158 and 11 AAC 83.346.

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Chapter Eight: Reasonably Foreseeable Effects of Licensing and Subsequent Activity

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Chapter Eight: Reasonably Foreseeable Effects of Licensing and Subsequent Activity

The Division of Oil and Gas (DO&G) has cooperatively developed general mitigation measures that the Licensee must follow to minimize pollution and habitat degradation, and disturbances to fish and wildlife, subsistence users, and communities adjacent to the License Areas. Further, post-disposal authorizations may be subject to additional project specific and site-specific mitigation measures that the director deems necessary to protect the state's interest. Despite these protective measures, effects may occur. In accordance with AS 38.05.035(g), the reasonably foreseeable cumulative effects of post-disposal oil and gas activities and brief summaries of measures to mitigate those effects are presented in this chapter. See Chapter Nine for a complete listing of the mitigation measures for the License Areas.

Alaska statutes specify that speculation about possible future effects is not required (AS 38.05.035(h)). Many studies describe the individual and cumulative effects of oil and gas activities on fish and wildlife habitat, populations, and uses; subsistence uses; historic and cultural resources; fiscal effects; and effects on municipalities and communities. In accordance with AS 38.05.035(g), the reasonably foreseeable effects of post-disposal oil and gas activities and brief summaries of measures to mitigate those impacts are presented in this chapter.

A. Introduction

Under AS 38.05.035(g)(1)(B)(vi), the director is required to consider and discuss the reasonably foreseeable cumulative effects of post-disposal oil and gas activities on the License Areas including: effects on fish and wildlife habitat and populations; subsistence and other uses; and historic and cultural resources. Under AS 38.05.035(g)(1)(B)(ix), the director is required to consider and discuss facts material to the reasonably foreseeable fiscal effects of the exploration license on the state and affected municipalities and communities. The director must also consider and discuss facts material to the reasonably foreseeable effects of exploration, development, production, and transportation of oil and gas on municipalities and communities within or adjacent to the License Areas under AS 38.05.035(g)(1)(B)(x). To understand potential cumulative effects from coalbed and sand bed methane exploration and production within the License Areas studies of cumulative effects from coalbed and sand bed methane, oil sands development, and conventional oil and gas exploration and development in the boreal forest regions of Canada and various habitats throughout the western United States where extensive energy developments have occurred were identified and reviewed.

An exploration license includes a specified work commitment expressed in dollars; these Exploration Licenses have work commitments of $3,000,000 for License Area 1 and $3,000,000 for License Area 2. A licensee's strategy and methods for expending this work commitment are variable and the director cannot predict whether the full commitment will be met in post-disposal activities. If a commercially viable resource is found, development would require construction of one or more drill sites. If commercial quantities of gas are located, construction of pipelines would be likely, and additional production and transportation facilities may also be necessary. New roads may be required, and machinery, laborers, and housing would be transported to and located at or near the project sites.

Issuing the exploration licenses is not expected to have any effects other than to provide initial revenue to the state in the form of the $1 per acre license fee. DO&G evaluates the reasonably foreseeable effects of oil and gas development by describing the License Areas and the communities in Chapter Three; habitats, fish, and wildlife in Chapter Four; and the uses of the resources in Chapter Five. This chapter is dedicated to analyzing the effects on those potential receptors based on the established oil and gas operations discussed in Chapter Six.

DO&G has adopted the Alaska Department of Natural Resources' Enforceable Standards for Development of State Owned Coalbed Methane Resources in the Matanuska-Susitna Borough (DNR's Enforceable Standards; DNR 2004). These standards serve as the minimum level of protection established by this decision document for both License Areas. In addition to the mitigation measures in Chapter Nine, all post-disposal activities are subject to applicable local, state, and federal statutes, regulations, and ordinances. Additional project-specific and site-specific measures may be required by other regulatory agencies, in response to public comments received during review of the proposed activity in the form of a plan of operations, or as deemed necessary.

B. Reasonably Foreseeable Cumulative Effects on Air

Oil and gas exploration, development, and production include a wide range of activities and equipment that produce emissions and have the potential to affect air quality. Combustion emissions are generated by construction equipment, transport trucks, vehicles, drilling rigs, and compressor engines. Fugitive dust and particulate matter can be generated by traffic as well as combustion. Methane and other volatile organic compounds can be released during flaring and venting, and may also escape through leaks in piping and equipment (NPC 2011; Alvarez and Paranhos 2012).

Emissions from oil and gas activities typically include carbon monoxide; nitrogen oxides; sulfur dioxide; coarse and fine particulate matter; volatile organic compounds; ozone; and greenhouse gases including carbon dioxide, methane, and nitrous oxide (Allison and Mandler 2018a). In addition to these air pollutants, small quantities of hazardous pollutants including hydrogen sulfide, and compounds released during volatilization of oil and gas such as benzene, toluene, ethylbenzene, and xylenes may also be released (Alvarez and Paranhos 2012). The US Environmental Protection Agency (EPA) and the Alaska Department of Environmental Conservation (ADEC), Division of Air Quality require industries with emissions that may affect air quality to control and reduce their air emissions such that Alaska and national ambient air quality standards are maintained. The oil and gas industry has developed best management practices and implemented control technologies where appropriate to meet regulatory requirements (NPC 2011).

1. Potential Cumulative Effects on Air Quality

The main air quality issues of concern in Alaska are fine and coarse particulate matter, followed by wildland fire monitoring, carbon monoxide, rural community and tribal village monitoring, lead, and ozone (ADEC 2024a). Emissions from combustion are the primary source of fine particulates. ADEC requires an annual emissions inventory report for sources with potential emissions at or above 2,500 tons per year of sulfur oxide, nitrogen oxide, or carbon monoxide, and for annual emission of 250 tons for volatile organic compounds, ammonium, and for coarse and fine particulate matter (ADEC 2025f). Fuel-burning equipment, vehicles, and vessels; oil and gas storage, handling and transport; venting, flaring, and spills; and construction and traffic generated fugitive dust from oil and gas activities could cumulatively effect air quality within the License Areas.

The primary concern regarding air quality monitoring in the Matanuska-Susitna Borough is particulate matter from windblown dust (primarily PM_{10}). When the braided Matanuska and Susitna river channels have low flow that expose extensive areas of barren glacial silts, sand, and gravel bars, strong winds lift large amounts of fine sediment into the atmosphere. Several air quality alerts are issued each year in the spring and fall due to windblown dust events. Fine ($PM_{2.5}$) and coarse (PM_{10}) particulates are measured at the Butte monitoring station east of the License Areas, which is representative of the Matanuska-Susitna area (ADEC 2025g).

Industrial air pollutant point sources in the Matanuska Susitna Borough (MSB) include one major source the Titan Liquified Natural Gas (LNG) plant south of the License Areas, and three minor source asphalt plants along the eastern edge of the License Areas. All industrial sources are in compliance with national and Alaska ambient air quality standards (ADEC 2025a).

Local weather conditions influence the dispersal and distribution of air pollutants, and in-air concentrations of volatile organic compounds including benzene, hydrogen sulfide, and formaldehyde, may be present near oil and gas production sites (Macey et al. 2014). Coalbed and sand bed methane exploration, development, production, transportation, and site closure all contribute to air pollution. Equipment used during these activities produce air emissions through combustion and particulates and dust from traffic. During operation and maintenance, methane can be released from wells, pipes, and machinery especially during exploration and upset conditions when methane is routed to a flare system and combusted to carbon dioxide (Steyn 2019). A recent environmental risk assessment study determined that both the consequence of air emissions from daily activities and the likelihood of air emissions from well failure are low; and that the risks associated with coalbed methane exploration and extraction are similar to those associated with other drilling operations (Uliasz-Misiak et al. 2020).

Fugitive emissions from coalbed methane production, processing, transport, and distribution include methane, carbon dioxide, nitrous oxides, and volatile organic compounds. While average fugitive emissions from coalbed methane have been estimated to be about 36 percent higher than from conventional natural gas production, fugitive emissions are even higher for shale gas production, with the differences occurring during production. Methane and other volatile organic compound emissions can interact in the atmosphere to form ground-level ozone that can have detrimental effects on human and animal health, soil and vegetation toxicity, and regional haze (Schultz and Adler 2016).

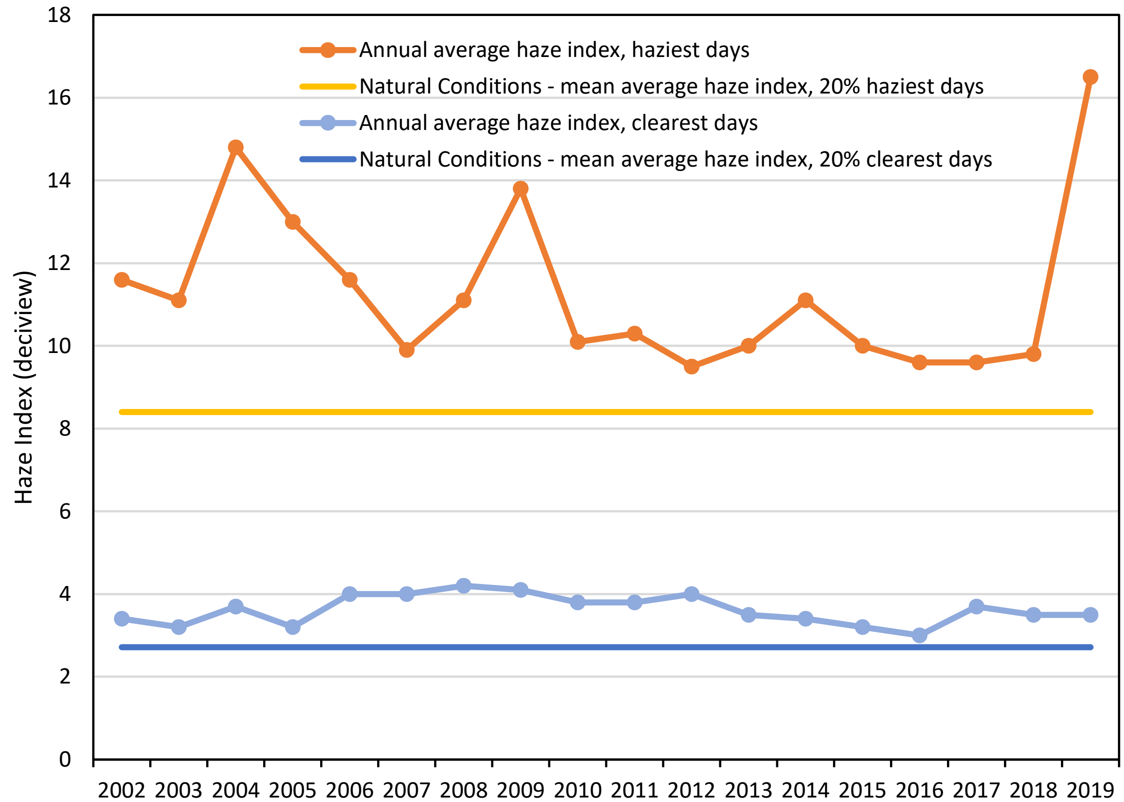
a. Greenhouse Gas Emissions

Methane is a potent greenhouse gas and the main component of natural gas. EPA estimates that nearly 29 percent of fugitive methane emissions in the United States in 2012 came from the oil and gas industry (Rassenfoss 2015). Fugitive methane emission sources identified from natural gas well operations include: pneumatic controllers – 29 percent, equipment leaks – 13 percent, liquid unloading – 11 percent, workovers – 6 percent, and completion flowback – 1 percent (Rassenfoss 2015). Pneumatic controllers use gas pressure to control the opening and closing of valves and emit gas as they operate (Allen et al. 2013). Liquid unloading is a method commonly used to clear older wells of excess liquids to increase production (Allen et al. 2013).

Use of enhanced recovery of coalbed methane through injection of carbon dioxide (another greenhouse gas) could reduce carbon dioxide in the atmosphere through sequestration in coalbeds. Coal can store twice the volume of carbon dioxide as methane (Rassenfoss 2015). Coal seams have stored large quantities of absorbed gases for millions of years, and they exhibit significant potential for sequestration of carbon dioxide for the indefinite future. Injection of carbon dioxide into coal seams has been shown to be environmentally and commercially desirable to both reduce atmospheric concentrations of carbon dioxide and enhance production of coalbed methane (Sams et al. 2005). In a study of Nenana Basin coalbed modeling, fluid flow scenarios showed that carbon dioxide sequestration through a primary reservoir depletion method was the most effective way to inject carbon dioxide in the coals present there. This modeling also showed that horizontal injection wells provided a more efficient gas sweep as the carbon dioxide migrates vertically and laterally to the top of the coal, allowing more methane to be produced (Dixit et al. 2017). Coal seam carbon dioxide sequestration potential in the Susitna basin was rated high, with extensive deep Tertiary age subbituminous to high volatile bituminous coal in the Tyonek Formation showing the greatest potential for sequestration (Shellenbaum and Clough 2010),

b. Regional Haze

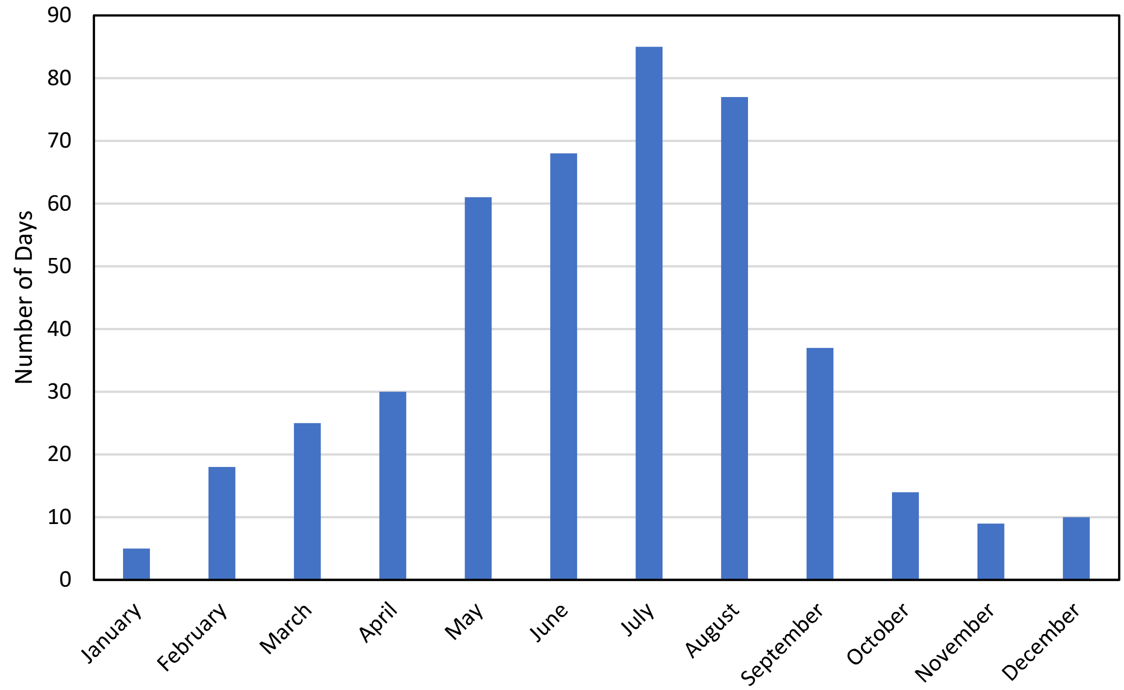
Regional haze is a basic form of air pollution that can impair visibility and scenic quality. Haze results when sunlight is absorbed or scattered by pollution particles in the air, obscuring views. Regional haze is generated by both natural and anthropogenic sources. Clear views of Denali are important for tourism as well as for local recreation and an IMPROVE monitoring station near Trapper Creek, north of the License Areas, measures air pollutants (both natural and anthropogenic) that effect visibility (CIRA 2021). Natural sources of visibility impairment in Alaska include dimethyl sulfide from oceanic algal blooms, volcanoes both eruptions and off-gassing, glacial dust, wildfires, and sea salt (Goodfellow 2020). Alaska is also exposed to large amounts of internationally generated pollution. Typical anthropogenic air pollution sources include power plants, manufacturing, oil and gas exploration and development, mining, agriculture, and mobile sources such as highways, railroads and aircraft (Goodfellow 2020). Data from the Trapper Creek IMPROVE station indicate that the haze index on the haziest days declined at a rate of 0.12 deciview (dV) per year from 2002 to 2019; and the haze index on the clearest days ranged from 0.3 to 1.5 dV above natural conditions generated by natural sources, while the haze index on the haziest days ranged from 1.1 to 8.1 dV above natural conditions at the Trapper Creek station (Figure 8-1).



Source: (CIRA 2021)

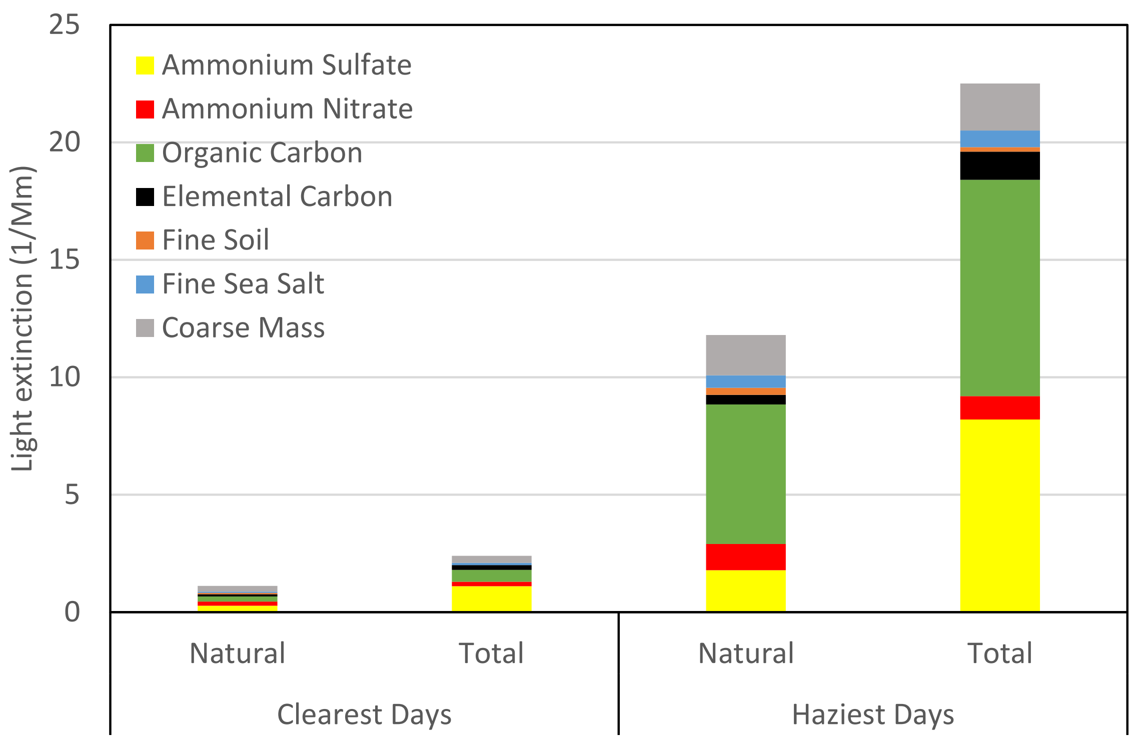
Figure 8-1. Haze index for conditions at Trapper Creek IMPROVE site, 2002 to 2019.

Haze at the Trapper Creek station is seasonal, with the clearest days occurring during late fall and winter and the haziest days occurring throughout summer – when the greatest numbers of tourist generally visit the region (Figure 8-2). The top three components contributing to regional haze at the Trapper Creek station are organic carbon, ammonium sulfate, and coarse mass on both the clearest and haziest days for both natural sources and all sources combined (Figure 8-3). Most impaired days, 68 percent, occur predominantly in March, April, May, July, and August (CIRA 2021).



Source: (CIRA 2021)

Figure 8-2. Distribution of haziest days 2001 to 2019 at the Trapper Creek IMPROVE station.



Source: (CIRA 2021)

Figure 8-3. Particle contributions to light extinction on clearest and haziest days at the Trapper Creek IMPROVE station.

2. Mitigation Measures and Other Regulatory Protections

Oil and gas facilities and activities are required to control and limit emissions. Combustion and fugitive emissions are minimized and mitigated by using best management practices and control technologies. Construction and traffic induced fugitive dust is minimized and mitigated by using best management practices such as construction area and road watering.

Emissions associated with oil and gas activities would increase with exploration and subsequent development. Maximum concentrations of air pollutants occur close to facilities and disperse with air movements. All oil and gas activities are required to control emissions and maintain national and Alaska ambient air quality standards enforced by ADEC.

Industry compliance with federal and state air quality regulations, particularly the Clean Air Act (42 U.S.C. §§ 7401-7671), AS 46.03, AS 46.14, and 18 AAC 50 are expected to mitigate potential cumulative negative effects on air quality. Additional information regarding air quality permits and regulations can be found in Chapter Seven.

C. Reasonably Foreseeable Cumulative Effect on Water

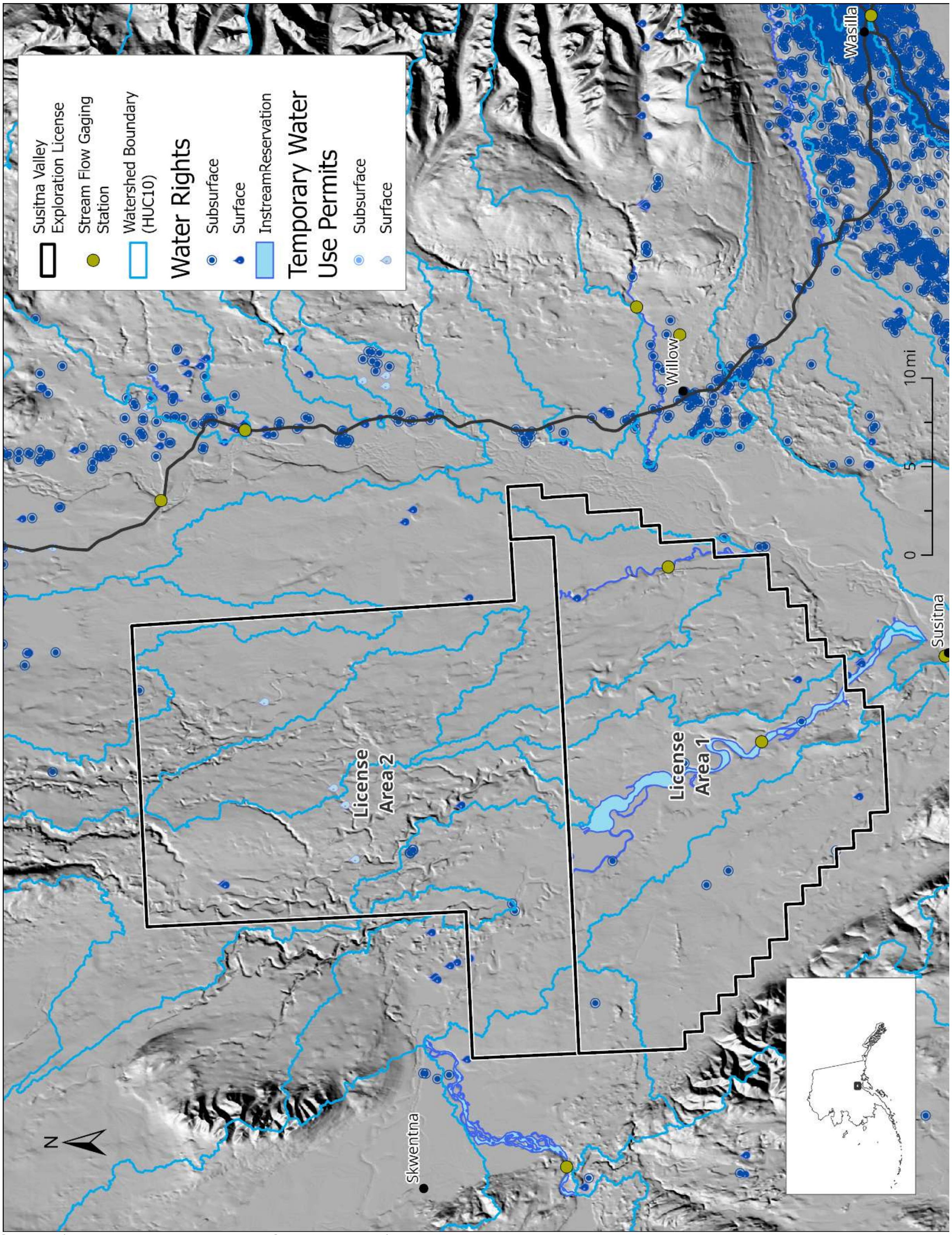
Oil and gas activities both consume and produce water. Water is used to drill and hydraulically fracture wells, to hydrostatically test pipelines, to process oil and gas, to enhance oil and gas recovery through waterflood, to construct and maintain facilities, and in camps. Water is extracted with and separated from oil and gas during production, sometimes in large quantities (Allison and Mandler 2018b). Activities that may affect water resources within the License Areas include seismic exploration and overland transport, gravel mining, gravel road and pad construction, and water withdrawals to support drilling and production. Hydraulic fracture or fracking of coalbeds uses large quantities of water and to produce coalbed methane large quantities of produced water are generated during dewatering of the coal. Water use is regulated by the Department of Natural Resources (DNR), Division of Mining, Land, and Water (DMLW) to ensure waters maintain the standards to support recreation activities, navigation, water rights, or other substantial public interests. Discharges are regulated by ADEC to ensure protection of Alaska’s waters.

1. Potential Cumulative Effects on Water Resources

Cumulative effects from gas exploration and development on water resources in the License Areas could include physical disturbances that could alter drainage patterns, increase turbidity and sedimentation from erosion and fugitive dust, drawdown and contamination of groundwater, and contamination of freshwaters from discharges from well drilling and production. Specific concerns for coalbed methane development on water resources are potential high densities of wells, well pads, and roads; hydraulic fracturing; and the potentially large quantities of water pumped from coalbeds to produce methane from coal seams (EPA 2004; Griffiths and Severson-Baker 2006; NRC 2010; Steyn 2019).

Surface and groundwater resources are abundant in the License Areas and are used for domestic water supplies for farms, livestock, lawn and garden; commercial hotels or motels, recreational camps, parks, or recreational services (Figure 8-4). Water well depths range from 6 to 480 feet in the License Areas, averaging 85.6 feet in Area 1, and 37.4 feet in Area 2 (DNR Land

Administration System Records). ADF&G has reserved instream flows for conservation of fish and wildlife resources for the Yentna River (LAS 25692), Deshka River (LAS 13654), and Willow Creek (LAS 11562) in License Area 1; and in the Skwentna River (LAS 28727), Lake Creek (LAS 30058), Moose Creek (LAS 31744), and Montana Creek (LAS 27786) in License Area 2. License Area waters are important for fish and wildlife habitat and recreation.



Source: (DNR – Land Administration System records)

Figure 8-4. Surface and subsurface water rights in the License Areas.

The National Research Council (NRC) was mandated by Congress in 2005 to evaluate the effects of coalbed methane production on surface and groundwater resources in western states (Public Law 109-58, Section 1811) where coalbed methane production had developed rapidly since the 1990s. Although the focus of the study was coalbed basins in the arid West, NRC's conclusions are pertinent to coalbed methane production and produced water issues in other coalbed methane basins in the United States (NRC 2010). Cumulative environmental effects of pumping and disposal of coalbed and sand bed methane produced water depend on water quantity, potential water drawdown or discharge volume, and changes in water quality. Water quantity or quality could change because of coalbed and sand bed methane produced water management depending on the relative quality of produced water and whether produced water is being discharged or injected. Understanding potential environmental consequences relies on understanding the hydrogeology of the basin; connectivity between water in methane bearing coal deposits and surface water and groundwater systems; and the chemistry and age of coalbed waters (NRC 2010).

a. Surface Water

There are no waters with impaired water quality in the License Areas (ADEC 2024c). The lower Deshka River was revised in 2020 from Category 3 (insufficient information to determine status) to Category 2 (water quality standards met for designated use) for total aromatic hydrocarbons due to pollution from concentrated boat use (ADEC 2024b). Average daily water temperatures on the lower Deshka River, however, exceeded the water quality criteria to protect migrating adult and rearing juvenile salmon on 86 percent of days sampled during June 26 to August 19, 2018 (ARRI 2019).

Gas exploration, development, and production generally require construction and continued use of support facilities such as roads, production and well pads, fuel tanks, and gathering and distribution pipelines. In addition to the clearing of trees and vegetation cover, facility construction may require site preparation, placement of gravel fill, and impoundment and diversion of surface water that may alter water quality and distribution leading to increased erosion, storm water runoff, and altered hydrology. Turbidity, particulate matter suspended in water, increases when sediment-laden runoff from facility construction or pipeline construction or repair flows into surface waters. Erosion from ground disturbing activities can result in elevated turbidity and increased sedimentation of nearby streams and lakes.

Hydraulic fracturing or fracking is the process of injecting fluids (water, sand, and chemicals) under high pressure into coal seams to create cracks in the seams for distances up to 100 feet (30 meters). Sand is used as a proppant to wedge open the seams to allow gas to escape (Batley and Kookana 2012). Fracking fluid is composed primarily of water (85 percent) and sand (14 percent) with chemical additives (<1 percent) designed to: dissolve minerals and aid in crack formation, reduce bacteria, restrict fluid loss, reduce friction in cracks to allow sand infiltration and flow of water, minimize corrosion of metal components (casing), and assist in post fracture fluid recovery by reducing viscosity (FracFocus 2021; Batley and Kookana 2012). Fluid returning within a few days after fracking (flow-back water) may contain residual sand and chemicals from the fracking operation.

Formation water associated with coalbed methane production is essentially devoid of sulfate, calcium, and magnesium and contain primarily sodium and bicarbonate, and where influenced by marine association also contains chloride (Van Voast 2003). The amount of water produced and the ratio of water to gas varies widely among coalbed methane producing basins from 16,800 gallons/well/day and 2.75 water to gas ratio in the Powder River Basin in Wyoming and Montana to 1,050 gallons/well/day and 0.031 water to gas ratio in the San Juan Basin in Colorado and New Mexico (USGS 2000). Rouse and Houseknecht (2012) used the Upper Forte Union Formation in the Powder River Basin of Wyoming and Montana as a production analog for coalbeds in the Cook Inlet-Susitna region because these beds have similar coal rank (lignite to subbituminous), range of thickness, and coal-quality characteristics similar to the Tertiary Kenai Group. Powder River Basin coalbeds produce the most water and have the highest water to gas ratio of coalbed methane producing basins in the western United States (NRC 2010). The large quantities of relatively fresh produced water from the Powder River Basin are primarily managed through discharge to surface storage ponds or to ephemeral and perennial streams and rivers, with or without treatment depending on regulatory requirements (NRC 2010).

Discharge of coalbed and sand bed methane produced water to land or surface waters can affect the water quality of surface waters depending on the quality and quantity of produced water that is discharged. Concern for surface discharge of produced water include the potential for erosion, soil damage, immersion of nonhydric vegetation, water and land discoloration, and development of algal mats. Coalbed methane produced waters are monitored using the sodium adsorption ratio (SAR). In terms of impacts to streams, two studies reported no statistically significant increases in total dissolved solids or the sodium absorption ratio associated with development (NRC 2010). A recent study evaluating impacts of coalbed methane produced water discharge to a stream found that stream SAR levels did not differ from 1970s predevelopment levels within a reach that had received produced water. Wells had not discharged to the stream for a minimum of 3 years, and the authors concluded that water quality impacts from coalbed methane development in this watershed may have been temporary (Bulltail and Walter 2020). Discharge of drilling fluids, cuttings, and produced water is regulated and is usually accomplished by annular or underground injection. Produced water must be either re-used or sent to disposal wells, although in either case some treatment may be required (Allison and Mandler 2018b).

Contamination from discharge of gray water, produced water, and inadvertent release from well blowouts or fuel, hazardous materials, or fracking fluid spills could degrade surface and groundwater quality. There are no active contaminated sites within the License Areas. The closest active contaminated sites to the License Areas include five sites associated with a former Federal Aviation Administration airstrip near Skwentna where diesel and gasoline range organics, polycyclic aromatic hydrocarbons, and pesticides have been found on Cook Inlet Region Corporation lands (ADEC 2025d). Spill and leak prevention and response are addressed in Chapter Six. Discharges and freshwater use may result in cumulative effects to surface waters such as increased turbidity and sedimentation from activities associated with exploration, development, and production of oil and gas. Section C2 of this chapter discusses mitigation measures and other regulatory protections that are expected to avoid, minimize, and mitigate potential cumulative effects to freshwater quality and availability.

b. Groundwater

Short and long-term groundwater concerns associated with coalbed and sand bed methane production and produced water management include groundwater depletion and drawdown from water pumping during methane extraction, potential aquifer contamination from fracking, and management of produced water by either permitted discharge or disposal wells (NRC 2010).

Groundwater provides drinking water for 49 percent of Alaska's population, and 83 percent of public water systems. Most groundwater public water systems, 98 percent, are protected by depth, geological stratification, or other factors from surface water pollutants or microorganisms, while 2 percent of groundwater public water systems are under the direct influence of surface water (ADEC 2023). All but one of the 318 public water systems in the Matanuska-Susitna Borough use groundwater as their primary source (EPA 2024b). One public water system (King Point Lodge – Transient Non-Community Water System) occurs in the License Area 2 and is protected by a 2-year groundwater time of travel buffer that extends upgradient for about 0.3 miles and covers about 150 acres (ADEC 2025e). Groundwater in Southcentral Alaska is ecologically and economically important because groundwater discharge to streams and rivers creates upwelling zones that are important for sustaining salmon eggs and alevins in redds and providing thermal refugia for fish (Callegary et al. 2013) that support commercial, subsistence, and recreational fisheries.

Hydrogeologic and groundwater modeling for the Cook Inlet Aquifer System (Miller, J. A. and Whitehead 1999; Callegary et al. 2013; Kikuchi 2013) indicate that water in unconsolidated-deposit aquifers moves from recharge areas on exposed colluvial deposits on the flanks of the mountains or alluvial deposits near streams, down the hydraulic gradient to discharge areas beneath major streams or Cook Inlet. Water may also leak upward from localized permeable zones in the underlying bedrock and streams may lose water by leakage through stream beds. Groundwater generally moves laterally through the Cook Inlet unconsolidated-deposit aquifers toward discharge areas, where it moves upward (Miller, J. A. and Whitehead 1999). In general, groundwater age increases with distance traveled from recharge areas along mountain fronts to discharge areas in lowlands at rates of several feet/year, with most wells producing water recharged within the last 25 years (Glass 2002). Age estimates based on tritium isotope and chlorofluorocarbon levels indicated, however, that water from one 219-foot deep well near the eastern edge of the License Areas was more than 50 years old and was likely older than the dating method used (Glass 2002).

Typical industrial use of groundwater could lower the water table elevation within a conic area surrounding industrial wells that can affect water depths in nearby domestic wells. These effects are usually insignificant and temporary as hydraulically connected groundwater sources infiltrate and replace the pumped volume. Groundwater withdrawal from aquifers confined at their lower boundaries induces leakage from streams while decreasing groundwater upwelling that maintains stream flows (Callegary et al. 2013). Reduction of in-stream flow may be of greater consequence during winter months when stream flows are maintained primarily by groundwater (Zenone and Anderson 1978).

The coalbeds and sand beds targeted for methane wells will normally be at a greater depth than groundwater used for drinking water. Water wells in the License Areas average 76 feet deep and all wells were less than 500 feet deep, while coalbeds and sand beds likely to produce methane in the Cook Inlet-Susitna region lie between 1,000 and 6,000 feet deep (Rouse and Houseknecht 2012). There may be several impermeable layers of silt, clay, and till between coalbeds and unconsolidated sand and gravel aquifers in the License Areas (Miller, J. A. and Whitehead 1999). Where aquifers are isolated, dewatering coalbeds to produce methane should not impact drinking water aquifers or shallow groundwater used for drinking water or domestic use. However, in some cases there may be interconnectivity between shallow groundwater, aquifers, and coalbeds such that dewatering one may result in lowering water levels in aquifers nearer the surface, dewatering streambeds, and lowering water levels in wetlands and lakes (Griffiths and Severson-Baker 2006; Callegary et al. 2013; Kikuchi 2013). Where coalbed methane reservoirs lack a topseal (an impermeable layer which traps gas in the coalbed) depressurization by removing water from the coalbeds to produce methane production could allow methane from shallow coalbeds to migrate into overlying aquifers. Geology of fluvial basins, such as the Susitna basin, can be highly variable and site-specific studies at proposed drilling locations are necessary to quantify this potential risk. Because coalbed methane projects may require a high density of wells extending over a considerable area, the effect of dewatering could be felt over a wide area and may be long term (Griffiths and Severson-Baker 2006).

Petroleum products spilled on the ground may infiltrate through soils until they reach the water table, where the spill plume disperses and dilutes. Diesel and gasoline penetrate soils rapidly and once spills reach the water table, they are very difficult to cleanup. Oil and gas exploration, development, and production may impact groundwater through spills at the surface that penetrate soils to reach shallow groundwater, leaks from wells, cracks in overlying formations that allow movement of fluids or gas into an aquifer from wells, or through industrial use of water from water wells. Oil and gas wells generally have multiple casing layers and cement barriers to prevent oil, water, or gas from leaking into aquifers or other surrounding rock formations. Oil or gas wells may leak if the steel casing or cement are poorly constructed or damaged (Allison and Mandler 2018b).

As discussed above, fracking through the high pressure injection of fluids into coal seams creates cracks in the seams for distances up to 100 feet (Batley and Kookana 2012). Pathways for fracking to affect groundwater resources include fluid (meaning, liquid or gas) movement into a drinking water resource through defects or deficiencies in the production well casing and/or cement; and fluid movement into a drinking water resource through the fracture network. Fluids potentially affecting drinking water could include hydraulic fracturing fluids, hydrocarbons (including methane gas), and naturally occurring brines (EPA 2016). Fracking likely represents the greatest stresses imposed on a well and if the casing or cement fail the well can lose mechanical integrity. Estimates of rates of production well loss of mechanical integrity (from all sources) resulting in loss of all barriers protecting groundwater are 1 percent or less, with the lowest rates for wells with at least one additional layer of casing from the surface through the lowest depth of drinking water and for wells that fully cement casing through the lowest depth of drinking water resources (EPA 2016). Inadequate design of well casing, cement, and components to withstand stresses during fracking has resulted in contamination of water wells. Integrity testing, including pressure testing to detect casing issues and monitoring the annular space, can detect well component failure.

If during fracking, the fracture network is extended to a nearby well or its fracture network this well communication event can result in damage to the nearby well causing a surface or subsurface release of fluids. If the fracture network is extended out of the production zone to another permeable subsurface feature, such as natural fractures or faults, fluid may reach groundwater drinking water resources. Presence, distance, and condition of nearby wells; vertical separation distance; and characteristics of formations between the production zone and drinking water resources are factors that could affect this potential pathway. Coalbed and sand bed methane wells tend to be shallower and closer to underground sources of drinking water than conventional oil and gas production wells (EPA 2004). Potential for an out-of-zone fracture reaching an underground source of drinking water is more likely where there is less than the 2,000 foot maximum documented fracture height (EPA 2016).

In the early 2000s, EPA assessed the potential for hydraulic fracking fluid injection into coalbed methane wells to contaminate underground sources of drinking water. During this review, EPA determined that in some cases fracturing fluids including diesel fuels were injected directly into underground sources of drinking water, and service companies voluntarily eliminated diesel fuel from fracking fluids injected for coalbed methane production. EPA found no conclusive evidence of water quality degradation as a direct result of injection of hydraulic fracturing fluids into coalbed methane wells and subsequent underground movement of these fluids. EPA determined that given the concentrations and flowback of injected fluids, and the mitigating effects of dilution and dispersion, adsorption, and potentially biodegradation the injection of hydraulic fracturing fluids into coalbed methane wells poses little or no threat to underground sources of drinking water because (EPA 2004).

Water produced during coalbed and sand bed methane extraction is generally managed through disposal wells or permitted discharge (NRC 2010). During initial dewatering, large quantities of water may be produced that require disposal. One coalbed methane well in the Houston, Alaska area (Houston No. 3, API 50009200110000) produced an average of 18,870 gallons/day with disposal of a total of 2.6 million gallons into the Tyonek Formation at about 2,000 feet below surface (AOGCC 2010). Because the water from the coals was pumped for disposal within the same well bore and not brought to the surface, a permitted injection order was not required (AOGCC 2010).

Disposal wells are classified by use and waste type. Class II underground injection wells are used for disposal of produced water, for enhanced recovery, or for storage of hydrocarbon associated with oil and natural gas production (EPA 2024a). Ensuring isolation of subsurface liquids and liquid wastes is the purpose of the underground injection control (UIC) program. The Alaska Oil and Gas Conservation Commission has primacy for Class II wells in under UIC program and is required to protect underground sources of drinking water from contamination by oil and gas injection activities (GWPC 2021). Class II injection wells in Cook Inlet region generally require an aquifer exemption such as those for wells nearest to the License Areas that inject Class II brines into the Tyonek Formation (40 CFR 147.102; EPA 2021). Exempt aquifers meet the criteria for protection as an underground source of drinking water but have been exempted from that protection (40 CFR 144.7).

While most disposal injection of produced water and hydraulic fracturing does not pose an induced earthquake hazard, under some geologic and operational conditions injection wells and hydraulic fracture operations have been found to induce earthquakes. Clearly distinguishing induced and natural tectonic earthquakes is difficult. The mechanism for triggering injection-induced earthquakes is an increase in pore pressure on stressed fault surfaces, which allows the fault to slip. Induced earthquakes to date have been due to fluid injection from disposal wells compared to hydraulic fracturing. Induced earthquakes are generally shallow within the top 3.7 miles (6 kilometers), often in the vicinity of the formation where the injection is occurring (GWPC and IOGCC 2021).

Wells used for production, storage, or injection must demonstrate that barriers prevent any flow from the well to the surrounding rocks or the surface. Barriers include casing, pipeline strings, cement, and mechanical packers. Cemented surface casing must be installed below the base of the deepest formation that could be used as a source of drinking water. Wells are monitored, and mechanical integrity tests are completed to ensure there is no loss of integrity. Wells that are proposed for hydraulic fracturing must be identified and the volume and chemical composition of the fluids used must be disclosed. Stringent construction requirements, pressure monitoring, and periodic integrity testing are required to ensure that underground sources of drinking water are protected (AOGCC 2015, 2016).

2. Mitigation Measures and Other Regulatory Protections

Oil and gas activities such as exploration, development, production, and transportation could result in adverse effects to the water resources of the License Areas. Many adverse effects could be lessened by mitigation but would not be eliminated completely. Most of the effects to water resources and water quality would result from oil and gas development and production activities, with construction of roads, stream-crossing structures, pads, offshore platforms with discharges, runoff, and water use being the major contributors. Potential effects include changes in surface drainage due to construction of roads and pads, loss of wetlands and associated chemical and hydrologic functions, gravel mine development, and increased risk of spills and leaks. New and existing facilities are required to control and manage stormwater and snow melt runoff during construction and operation to avoid and minimize potential increased sedimentation and contamination (ADEC 2011, 2022). Groundwater protection is accomplished through regulation of contaminated sites, storage tanks, underground injection wells, spill response, and specific waste disposal activities under state and federal programs (ADEC 2008).

Water quality is not expected to be impacted by drilling muds, cuttings, produced waters, and other effluents associated with oil and gas exploration, development, and production because of permitting requirements for proper disposal. Permanent roads, large-scale fill of wetlands, and facilities will require a Clean Water Act Section 404 permit and/or a Rivers and Harbors Act Section 10 permit. Effluents discharged by the oil and gas industry are regulated through ADEC's Alaska Pollution Discharge Elimination System (APDES) program (ADEC 2025b).

Before a permit to appropriate water is issued, DNR considers local demand and may require permit applicants to conduct aquifer yield studies. Generally, water table declines associated with upper unconfined aquifers can be best mitigated by industrial users tapping confined (lower) layers or searching for alternate water sources. Permits may contain stipulations on water use and withdrawal quantity to meet standards related to protection of recreation activities, navigation, water rights, or any other substantial public interest. Water use permits may also be subject to conditions, including suspension and termination of exploration activities, to protect fish and wildlife habitat, public health, or the water rights of other persons.

Coalbed and sand bed methane produced water may contain salts and metals depending on the geology and hydrology of the coalbeds and surrounding rocks. The method used to manage produced water depends on the quality of the produced water and the quantity removed to facilitate methane extraction. Produced water may be managed by discharge to the surface or by injection in disposal wells. Continued monitoring and analysis of groundwater, surface water, soil, and ecological systems are required to understand the potential for long-term environmental impacts from management of coalbed and sand bed methane produced water (NRC 2010).

Measures in this best interest finding, along with applicable regulations imposed by state, federal, and local agencies are expected to avoid, minimize, and mitigate potential effects on water resources. Risk of oil spills, spill avoidance, and spill response planning are discussed in Chapter Six. A complete listing of mitigation measures can be found in Chapter Nine.

D. Reasonably Foreseeable Cumulative Effects on Freshwater Habitats and Fish

Potential gas exploration and development activities that could have cumulative effects on freshwater habitats and fish within the License Areas include seismic surveys, construction of production and support facilities, drilling and production activities, discharges from well drilling and production, transportation, and gas blowouts or other spills. Some potential cumulative effects of these activities include physical changes and disturbance that could alter watersheds, waterbodies, and wetlands; habitat availability and suitability; and behavior and abundance of fish (Entrekin et al. 2011; Cott et al. 2015).

Gas extraction carries the risk of fuel and produced water spills, both small and large, within and outside the boundaries of the License Areas. Localized effects from small spills are generally limited to the direct damage to habitat and fish in the immediate vicinity representing a very small effect in relation to habitat and fish in the Susitna Basin. Effects from spills become dispersed and potentially more significant when they occur within or near open water because spills are more difficult to contain and recover from water than from land or ice. A spill that contaminates groundwater could also result in impacts to wetlands, ponds, lakes, streams and rivers.

1. Potential Cumulative Effects on Freshwater Habitats and Fish

Linear features constructed for gas exploration and development such as roads, seismic lines, and pipelines would cross wetlands, lakes, streams and rivers in the License Areas. Oil and gas activities may affect freshwater habitats and fish through increased sediment transport, sedimentation, pressure impacts from the use of explosives for seismic surveys or gravel extraction, water withdrawal, produced water discharge, blockage of stream flow and fish passage, removal of riparian vegetation, changes in water temperature, increased access and fisheries exploitation, and contaminant spills (Entrekin et al. 2011; Cott et al. 2015). Impacts can be direct through physical or chemical damage to fish or eggs, or indirect through habitat loss and degradation (Cott et al. 2015).

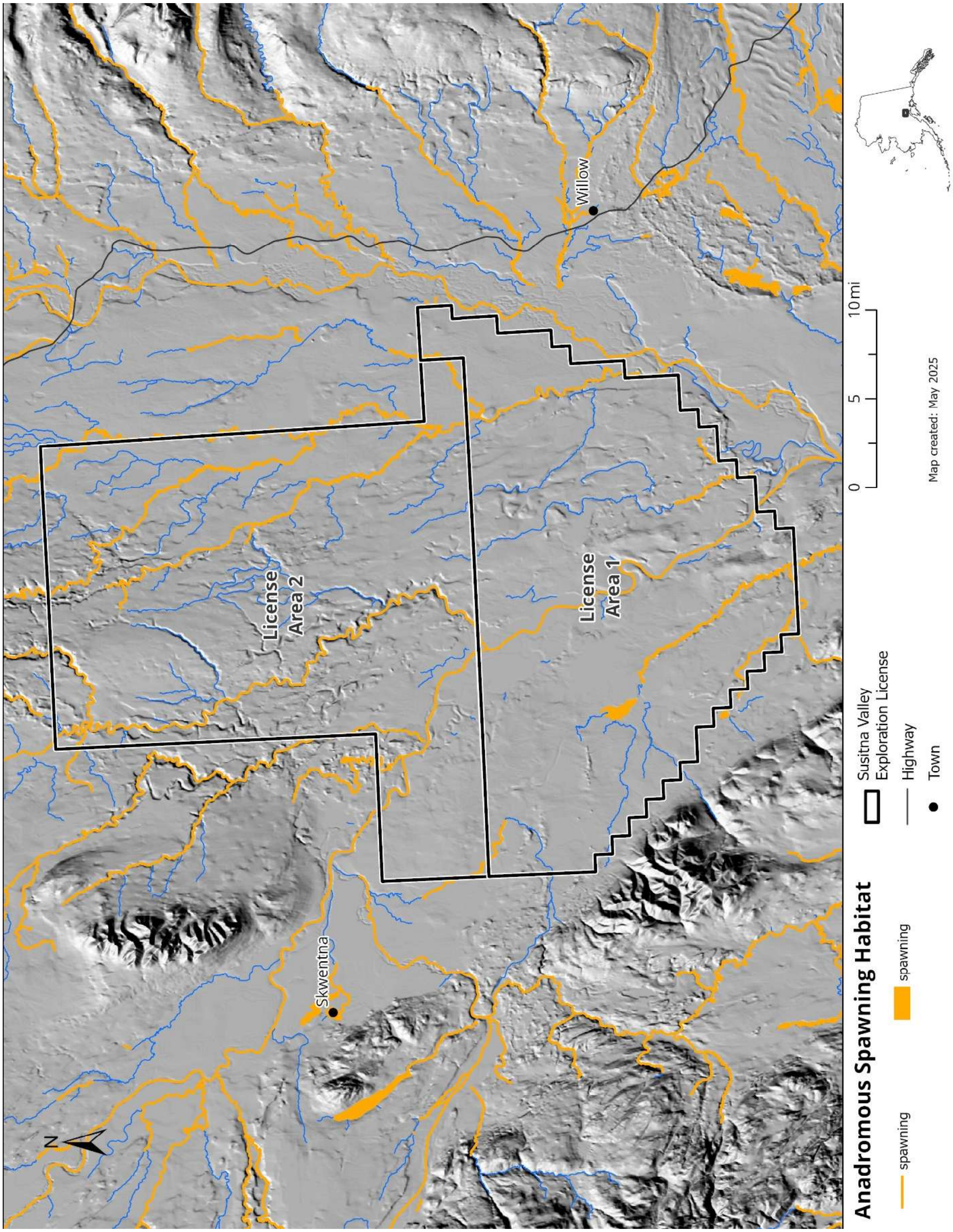
Wetlands and waters cover significant portions of both License Areas, with many lakes, ponds, clearwater streams and glacial rivers across all or part of 17 watersheds. Most waters in the License Areas are important migration routes, spawning and rearing habitats, and overwintering habitats for anadromous and freshwater fishes and aquatic invertebrates that support subsistence, commercial, and sport fisheries as discussed in Chapter Four and Chapter Five. Most Matanuska-Susitna Basin streams are predominantly cold with four distinct thermal regimes determined by climate and landscape factors including spring and summer air temperatures, spring snowpack, summer precipitation, wetlands, and lakes (Shaftel et al. 2020).

a. Seismic Surveys

Potential effects from seismic surveys could occur through direct impacts to fish and eggs from use of explosives and winter water withdrawals and through blocked fish passage or habitat degradation at stream crossings (NWT 2012). Upland seismic surveys in the Cook Inlet Basin are typically acquired in winter, usually from late October through March, to protect fish and wildlife habitat and facilitate work across wetlands (Shellenbaum 2013). Seismic surveys across spawning habitats have the potential to reduce survival of eggs or alevins (Figure 8-5). Fish hear primarily through the detection of particle motion rather than sound pressure (Popper and Hawkins 2019).

Onshore seismic surveys are generally conducted by using explosive charges or vibroseis which imparts lower energy than explosives. Exposure to instantaneous pressure changes from explosions in or very near fish habitat can injure or kill juvenile and adult fish and disturb gravels with incubating eggs (Cott et al. 2015). Because of this potential for injury to fish and fish embryos, ADF&G has established best management practices for blasting to avoid and minimize impacts to fish and where unavoidable sets limits on instantaneous pressure changes in rearing habitat and migration corridors and limits on peak particle velocities in spawning gravels during early stages of embryo incubation (Timothy 2013). An evaluation of potential injury and behavioral effects of vibroseis across overwintering fish, with a possible maximum overpressure as high as 201 decibels (dB) reference level in water of 1 micropascal (1µPa) at the source, found no mortality or serious injury and that behavioral responses were brief and limited to the time of operation of the equipment (Morris and Winters 2005). Behavioral flight responses were vigorous, however, and could have energetic consequences for wintering fish. Best management practices include avoidance or limiting exposure to a short time frame with minimal delays between seismic shots (Morris and Winters 2005).

Cumulative effects from seismic surveys are primarily indirect through habitat degradation at stream crossings, especially where cleared seismic corridors are used by off-road vehicles long after the surveys have been completed (Dabros et al. 2018). Bank alteration and exposed soil are the most common physical impacts from off-road vehicles at stream crossings. Damage to banks and riparian vegetation increases the input of fine sediment to streams that can smother salmon and trout eggs in redds and reduce primary and secondary productivity that contribute to overall reduced growth and survival of fish (Wiedmer 2002). Seismic survey techniques using wireless nodal receivers, helicopter-supported seismic crews, and stake-free Global Positioning System (GPS) surveying with reduced or no clearing to establish seismic lines reduce the potential for this type of long-term environmental impact (Shellenbaum 2013).



Source: (Giefer and Blossom 2020)

Figure 8-5. Spawning habitat for anadromous fishes in the License Areas.

b. Exploration, Development, and Production

The greatest potential for cumulative effects from gas activities on fish habitats and fish would occur during development and production. It may require 10 to 20 coalbed methane wells at densities of 40, 80, or 160 acres/well to produce the equivalent of two to three conventional gas wells; as a result extensive contiguous areas are generally required that may result in widespread surface development with roads, well pads, and pipelines (Griffiths and Severson-Baker 2006; Entrekin et al. 2011). By comparison well densities are 160 to 320 acres/well for the conventional Kenai Gas Field (Flores et al. 2004).

Gas development and production require the construction and continued use of support facilities such as roads, production pads, gathering and export pipelines, and fuel tanks for equipment and vehicles. Facilities usually require road construction, site preparation, excavation and placement of gravel fill that may result in impoundment and diversion of surface water. These activities may affect fish and fish habitat through erosion and sediment deposition; removal of riparian vegetation; noise and pressure changes; restricting fish passage; water withdrawal; increasing access and fishing pressure; introduction or spread of non-native plants and animals; and fuel or hazardous material spills (Schneider 2002; Cott et al. 2015).

Erosion increases turbidity and deposition of fine sediments in aquatic habitats, that result in decreased primary productivity and reduced food for aquatic insects, freshwater mollusks, and fish. Secondary effects of road construction and use could include dust deposition, which may reduce photosynthesis and plant growth for adjacent riparian vegetation (Cott et al. 2015). This can lead to direct mortality, reduced physiological function, and depressed growth rates and reproduction in aquatic organisms (Henley et al. 2000). Stream water turbidity during a high spring flow was positively correlated with gas well density across seven stream drainages suggesting cumulative effects from gas well and associated infrastructure at the landscape scale (Entrekin et al. 2011).

Sound from blasting, pile driving, drilling, heavy equipment, and compressors, even at levels far lower than those that might result in mortality, may cause temporary hearing impairment, physiological changes from stress, changes in behavior, and the masking of biologically important sounds. While impulse sounds have the greatest potential for temporary hearing impairment, they are usually short-term in duration during construction. Continuous loud sounds have a greater potential for long-term physiological, behavioral, and masking effects that may lower productivity and could potentially deflect fish from migration routes. While effects on individual fish from loud impulse and continuous sound have been established, primarily through laboratory experiments, the extent to which anthropogenic sounds effects fish populations has not yet been established (Popper and Hawkins 2019).

Improperly sized, installed, and unmaintained stream crossing culverts can restrict fish access to many miles of upstream or downstream spawning, foraging, and overwintering habitats (Cott et al. 2015; Sethi et al. 2021). Juvenile salmon make extensive seasonal movements, with juvenile coho salmon often moving between summer rearing habitats in streams and rivers to mid and upper catchment lake overwintering habitats multiple times during their freshwater rearing stage (Sethi et al. 2021). Culverts that do not allow passage of young-of-the-year and juvenile salmonids may constrain salmonid life history diversity (Sethi et al. 2021). New roads would be required to construct and maintain stream crossings that allow for fish passage, and industry use of existing roads and trails on state lands may require upgrades to stream crossing structures to ensure that fish passage is maintained.

Winter water withdrawals from lakes and rivers can reduce water quality by lowering dissolved oxygen levels, trap or entrain overwintering fish, loss of overwintering habitat, loss of littoral habitat, or desiccation or freezing of eggs. Although withdrawal of 10 percent of the volume had no effect on the volume-weighted oxygen concentration or volume of over-wintering habitat in a small lake, withdrawal of 20 percent resulted in a 26 percent reduction in volume-weighted oxygen concentration and a 23 percent reduction in volume of over wintering habitat. Water temperature can be altered if large winter water withdrawals break stratification, however, water temperatures were not affected in two Northwest Territory lakes following 10 and 20 percent water withdrawal (Cott et al. 2008; Cott et al. 2015). Water withdrawals from small streams, especially during winter months, can reduce flows such that pools or migration corridors freeze potentially affecting habitats many miles downstream from the withdrawal point (Cott et al. 2015). Surface water use is regulated to prevent damage to fish and fish habitat.

c. Discharges, Leaks, and Spills

Some discharges from well drilling and production are intentional, such as permitted discharges regulated by Alaska Pollutant Discharge Elimination System (APDES), others are unintentional, such as gas blowouts, well leakage, and spills. Discharges, spills, and leaks from oil and gas activities could affect freshwater habitats and fish populations. There are no contaminated sites within the License Areas attributable to oil and gas exploration (ADEC 2025c). Over the past 25 years (2001 to 2025), natural gas production facilities in the Cook Inlet region averaged about 14 spills/year with most spills ≤ 100 gallons (85 percent). The reported cause for most spills (66 percent) and the largest volume of spills (86 percent) was structural or mechanical failure. Substances spilled by natural gas production facilities are summarized in Table 8.1. Most (92 percent) of the produced water discharge volume was attributable to a single 84,000-gallon spill that occurred in 2014 (ADEC 2025h).

Table 8.1. Natural Gas Production facility spills 2001 to 2025 in the Cook Inlet region.

Substance Type	Spills (Number)	Mean Quantity (Gallons)	Total Quantity (Gallons)
Extremely Hazardous Substance			
Hydrochloric Acid	3	2.8	8.3
Sulfuric Acid	2	6.0	12.0
Total	5	4.1	20.3
Hazardous Substance			
Bases	2	10.0	20.0
Drilling Muds	12	1,182.1	14,185.0
Ethylene Glycol (Antifreeze)	20	30.7	614.9
Firefoam-fluorine-free	2	17.0	34.0
Glycol, Other	19	76.4	1,451.0
Methyl Alcohol (Methanol)	20	2.1	42.5
Other	13	350.9	4,561.1
Propylene Glycol	4	64.8	259.3
Sodium Hypochlorite	1	350.0	350.0
Total	93	231.4	21,517.8
Noncrude Oil			
Diesel	28	777.1	21,759.2
Engine Lube/Gear Oil	14	21.9	307.0
Gasoline	1	7.0	7.0
Hydraulic Oil	32	29.0	926.9
Natural Gas Liquids	7	12.5	87.6
Other	8	22.3	178.7
Transformer Oil	4	36.3	145.0
Transmission Oil	1	3.0	3.0
Used Oil (all types)	8	15.4	123.5
Total	103	228.5	23,537.8
Process Water			
Process Water	2	51.0	102.0
Produced Water	72	1,267.2	91,237.8
Total	74	1,234.3	91,339.8
Grand Total	275	496.1	136,415.6

Source: (ADEC 2025h)

Some non-crude oil, fuels, drilling muds, and other hazardous substances (Table 8.1) would likely be stored on site and could leak or spill. Oil, fuel, and associated polycyclic aromatic hydrocarbons are toxic to fish and a spill that affects spawning habitats could kill eggs and impair recruitment (Cott et al. 2015). Sublethal effects and contamination from spills and leaks can reduce productivity and impact use of fisheries resources. Failure of sumps used to store drilling mud or camp greywater can also be harmful if wastes reach fish-bearing waters (Cott et al. 2015). The effects of oil spills on fish and their habitat depend on the timing and location of the spill. Spills into open water are more likely to affect fish than a spill on top of ice or frozen ground that can be easily contained and removed. Spills into lakes may have longer lasting effects than a spill into a large stream or river that is quickly diluted and dispersed. Spills occurring farther upstream in a watershed also place more freshwater habitat at risk than those that occur in lower reaches where the contaminants are more readily diluted by the higher volumes of water. Spill and leak prevention and response are addressed in Chapter Six.

Coalbed and sand bed methane extraction generates large quantities of produced water and management of produced water either through surface discharge may have cumulative effects on surface water quality or quantity that could degrade fish habitat (NRC 2010; Wang and Yang 2008). In the Powder River Basin in Wyoming, where much of coalbed methane produced water is discharged to surface waters, discharges were modeled to increase stream flows, water temperature, and salinity compared to baseline conditions (Wang and Yang 2008). Produced water may contain trace concentrations potentially toxic metals, such as arsenic, lead, and chromium and organic substances including phenols, biphenyls, heterocyclic compounds, polycyclic aromatic hydrocarbons. Contaminants of primary concern for produced water discharges into streams or impoundments include several trace elements; total dissolved solids or salinity; bicarbonate, potassium and chloride; and increased turbidity. Increased total dissolved solids may have the greatest potential for direct toxicological impacts to aquatic organisms in receiving streams (NRC 2010). However, NRC (2010) concluded that direct exposure to toxic undiluted coalbed or sand bed methane produced water would be unlikely in fish-bearing perennial waters because of: permitted discharge requirements; mixing zones; the limited extent of undiluted produced water once it enters a mixing zone; and the relative mobility of fish and other aquatic organisms in perennial streams and rivers.

Salmon, trout, and char are stressed by high water temperatures because warm waters have lower dissolved oxygen levels. Potential changes to water temperature regimes in Matanuska-Susitna Basin streams through direct discharge of coalbed or sand bed methane produced water or through decreased upwelling as a result of groundwater drawdown and leakage from streambeds could have cumulative effects on watersheds that support salmon, trout, and char (Mauger et al. 2017; Schoen et al. 2017; Shaftel et al. 2020). A recent thermal imagery study characterized the importance of groundwater sources to mid-summer (July 4) stream temperature moderation in the Deshka River. This study identified seepage or upwelling, and springs across the river’s floodplain and found that unlike most rivers that typically have a downstream warming gradient, the Deshka River has a downstream cooling gradient. Cold water tributaries and cold-water seepage, subsurface flow, hyporheic flow, or upwelling at the edge of the river channel reduced overall water temperature by 7.6 degrees Fahrenheit (°F) from 72.9°F at the confluence of Moose and Kroto creeks to 65.3°F at the confluence with the Susitna River (Mauger and NV5 Geospatial 2021). Alteration of groundwater upwelling could lead to increased water temperatures that may be unsuitable for salmon.

2. Mitigation Measures and Other Regulatory Protections

Oil and gas activities could potentially have cumulative effects on freshwater habitats and fish, although cumulative impacts are expected to be localized and minor. Cumulative effects on freshwater habitats and fish would most likely occur through construction and use of well pads, roads, pipelines, and the gravel mining necessary to build this infrastructure and could potentially occur from coal dewatering if groundwater and coalbed aquifers are connected and from management of produced water, if produced water is discharged to surface waters. Gravel road and degraded trail crossings have contributed to impeded fish movements and potentially have the quality of fish habitat in the License Areas. Mitigation measures in this best interest finding along with applicable regulations imposed by state, federal, and local agencies are expected to avoid, minimize, and mitigate potential cumulative effects to freshwater habitats and fish populations.

AS 16.05 requires protection of documented anadromous streams from disturbances associated with development, and DNR's Enforceable Standards includes requirements for erosion control, water quality monitoring, and other environmental protection (DNR 2004). New facilities are required to be located away from lakes and rivers and stream crossing must be designed and maintained to allow fish passage. Any water intake structures in fish bearing waters will be designed, operated, and maintained to prevent fish entrapment, entrainment, or injury. All water withdrawal equipment must be equipped and must use fish screening devices approved by the ADF&G and withdrawal volumes are regulated to prevent damage to fish wintering habitats. Discharge of drilling muds and cuttings to freshwaters or wetlands is prohibited. Discharge of wastewater or produced water into waterbodies is prohibited unless authorized by an APDES permit. Best management practices and mitigation including perpendicular crossing of waterways by roads and pipelines, appropriately sized culverts and bridges, and siting permanent infrastructure at least 500 feet from fish-bearing waterbodies minimizes the potential for cumulative effects of oil and gas activities in the License Areas.

Specific mitigation measures for fish habitats and fish in this best interest finding address siting facilities 1/2 mile away from the banks of Alexander, Lake, and Peters creeks and the Susitna, Deshka (Kroto and Moose creeks), Kahiltna, Talachulitna, and Yentna rivers. DNR's Enforceable Standards also specify requirements for APDES discharge permits and produced water management plans that identify locations, amounts, and potential impacts associated with surface disposal of produced waters; prohibit the use of diesel-based fracturing fluids; specify that pipelines crossing fish streams must be constructed using directional drilling techniques, and that well pad spacing must be balanced between gas pool management and minimizing surface impacts (DNR 2004). A complete listing of mitigation measures can be found in Chapter Nine. Chapter Seven also provides information on requirements for wastewater and solid waste disposal in the License Areas.

E. Reasonably Foreseeable Cumulative Effects on Terrestrial Habitats and Wildlife

Oil and gas activities that could have cumulative effects on terrestrial habitats and wildlife within the License Areas include seismic surveys, construction of support facilities, drilling activities, discharges from well drilling and production, transportation, and gas blowouts or fuel, hazardous substance, or produced water spills. The primary identified cumulative effects for wildlife from coalbed and sand bed methane extraction include habitat loss, fragmentation, and disturbance that change habitat availability and suitability, and wildlife behavior (Griffiths and Severson-Baker 2006; Northrup and Wittemyer 2013). Cumulative habitat effects from vegetation clearing for seismic lines and pipelines are greatest in forested areas where natural vegetation is disturbed, and forests are fragmented making wildlife more vulnerable to predation and hunting (Griffiths and Severson-Baker 2006; Dabros et al. 2018; Northrup and Wittemyer 2013).

1. Potential Cumulative Effects on Terrestrial Habitats and Wildlife

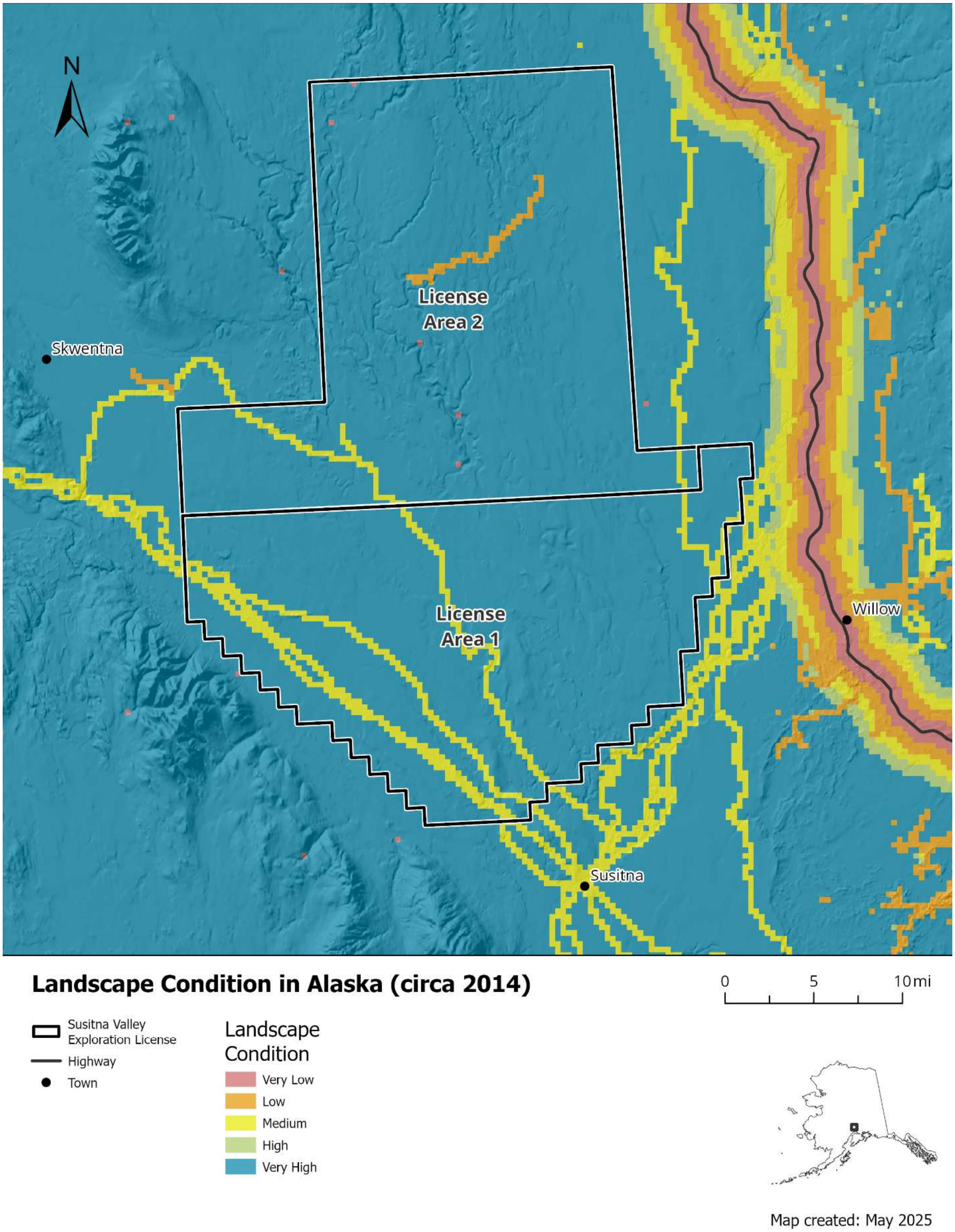
Cumulative effects of oil and gas activities on terrestrial habitats and wildlife are primarily related to habitat loss from construction of drill pads, roads, pipelines, and facilities and habitat alteration from indirect effects resulting from construction and use of these facilities such as altered drainage patterns, fugitive dust, and changes in vegetation communities. Activity, vehicle traffic, aircraft traffic, sounds from pumps, compressors, and machinery, and changes in vegetation cover can result in reduced use or avoidance of the area surrounding oil and gas facilities by some wildlife (Griffiths and Severson-Baker 2006; NWF and NRDC 2015; Bayne et al. 2016; Loss 2016; Carlisle et al. 2018; Wittische et al. 2021).

The License Areas contain primarily forested habitats within a mosaic of vegetation communities ranging from closed forests to open shrub and herbaceous communities in both upland and wetland conditions. Landscape condition (a measure of habitat modification from transportation infrastructure, urban and industrial development, and spread of invasive species) within the License Areas is primarily undeveloped and rated very high (Trammell and Aisu 2015) (Figure 8-6). Crucial habitat rankings for the License Areas are 4 and 5 on a 1 to 6 scale where 1 represents the most crucial habitat. Crucial habitat rankings are based on: terrestrial species of concern, aquatic species of concern, species of concern identified in Alaska's Comprehensive Wildlife Conservation Strategy, and an index of freshwater integrity based on an assessment of human effects on fish habitat (ADF&G 2021). Crucial habitats within the License Areas are distinguished by aquatic species of concern (based on ADF&G's Anadromous Waters Catalog), and freshwater integrity with a higher percentage of License Area 2 ranked most crucial for freshwater integrity (Table 8.2).

Table 8.2. Freshwater integrity within the License Areas.

Freshwater Integrity Rank		License Areas Area 1	Area 2	Combined
1	Most Crucial	43%	71%	57%
2		49%	18%	33%
3		8%	10%	9%
4		1%	1%	1%

Source: (ADF&G 2021) Note: no areas were ranked 5 or 6 for freshwater integrity



Source: (Trammell and Aisu 2015)

Figure 8-6. Landscape condition in the License Areas.

Attributing potential cumulative effects from routine oil and gas activities to population level changes is often problematic as it may not be possible to distinguish oil and gas activity effects independently from other sources of population variation. Other factors influencing wildlife populations include weather events, precipitation, and snow depth; flood, fire, vegetation succession, and pest induced changes in habitat quality; disease outbreaks; immigration and emigration; predation, hunting, and traffic-related mortality; and habitat loss or alteration from other land uses (Wasser et al. 2011; Brockman et al. 2017; Plante et al. 2020; Toews et al. 2018).

a. Seismic Surveys

Clearing operations to prepare seismic lines, source vehicles, seismic acquisition explosions, and field crew activity during seismic surveys may cause short-term disturbance to wildlife. Wildlife can be particularly sensitive to disturbance during nesting and calving periods, but disturbances during winter when food resources are limited can be more problematic. Seismic surveys in the License Areas would likely be conducted during winter (Shellenbaum 2013) when hibernating bears and wintering moose could be disturbed. Source vehicles and seismic acquisition explosions near den sites could disturb bears during hibernation such that they prematurely emerge from the den (Linnell et al. 2000). Winter seismic surveys through moose wintering areas within the Susitna River drainage could reduce overwinter survival and/or facilitate wolf predation due to increased stress and energy expenditures during a time when animals are already nutritionally stressed (Wasser et al. 2011; Harris et al. 2014; Neilson and Boutin 2017). Winter disturbances are likely most detrimental to moose when they are unpredictable, cover large areas, last for extended periods, and when animals are displaced from high quality habitats (Harris et al. 2014). Disturbance would be a short-term impact and although a few individual animals may be disturbed, impacts are not likely to be cumulative or substantially affect healthy wildlife populations.

Clearing trees for seismic surveys creates long linear corridors through forested habitats that can affect habitat quality and wildlife behavior for decades. The width cleared for seismic lines has decreased over the past decade from the traditional 20 to 30-foot-wide corridors spaced at 1,000 to 1,640 feet to current three-dimensional (3D) surveys with receiver lines as narrow as 5 feet spaced at 164 to 328 feet and source lines usually less than 18 feet wide (Dabros et al. 2018). Boreal forest habitats disturbed by seismic lines often do not follow typical successional stages, with 60 percent of traditional seismic lines remaining in early successional stages even after 35 years (Dabros et al. 2018). Establishment of thick stands of early succession graminoid plants such as bluejoint reedgrass *Calamagrostis canadensis* on drier sites and water sedge *Carex aquatilis* in wetter areas can shade and smother small conifer seedling delaying succession to forested habitats. Bog and fen habitats that have been disturbed may fail to return naturally to pre-disturbance conditions even after 50 years (ADF&G 2006; Dabros et al. 2018). The use of heavy equipment may result in erosion, and cratering may occur from improperly filled shot holes. Increased access for all-terrain vehicles, snow machines, and off-road trucks, and continued use of seismic lines by these vehicles may also contribute to extended recovery times (Schneider 2002; Dabros et al. 2018).

Habitat changes resulting from seismic line corridors through boreal forests alter predator-prey interactions by facilitating movement of predators (Dabros et al. 2018). Black bears, brown bears, and wolves are the primary predators on moose calves within the License Areas (Ballard and Van Ballenberghe 2007; Brockman et al. 2017). In boreal forests in Alberta, tracked radio-collared wolves were found significantly closer to linear corridors, and they traveled faster along linear seismic corridors than through forests (James and Stuart-Smith 2000). Black bears and brown bears are both attracted to edge habitats such as those created by traditional seismic line corridors (Tigner et al. 2014; Stewart et al. 2013) and moose are also attracted to early seral stage vegetation for winter forage (Wasser et al. 2011; Pattison et al. 2020). Most large boreal mammals responded strongly, either positively or negatively to overall cumulative impact measured as total footprint. Although, black bears may not use seismic lines that are less than 7 feet wide more often than interior forest habitats (Tigner et al. 2014), and natural regeneration reduces brown bear but not wolf movements in response to seismic lines (Finnegan et al. 2018).

Boreal forest mammal communities within habitats impacted by seismic lines were characterized by relatively higher abundances of moose, lynx, and weasels in winter than nearby forest habitats although fine-scale effects are inconsistent with landscape-scale effect (Pattison et al. 2020). American marten use of seismic lines depends on the type of line, with open lines ≥ 10 feet (3 meters) wide used up to 90 percent less than forest interiors while open lines ≤ 6.5 feet (2 meters) wide or conventional lines with some woody regeneration used the same as forest interiors (Tigner et al. 2015). Marten probability of occurrence at the home range scale, however, decreases significantly with cumulative seismic line density. This decrease in marten abundance in areas with dense seismic networks may be a cumulative effect of cleared seismic lines that facilitate access for trapping that may result in over-trapping in remote areas (Tigner et al. 2015).

Boreal forest bird response to cleared seismic line corridors ranges from avoidance, to no response, to attraction with responses varying with both the width of clearing and the amount of forest regeneration within the seismic line corridor (Dabros et al. 2018). Most boreal forest birds, 69 percent, show no difference in abundance due to proximity of seismic lines compared to forest interior habitats based on 328-feet (100-meter) point counts, while 24 percent, 14 species, increased in abundance and 7 percent, four species, decreased in abundance (Bayne et al. 2016). Of the five most abundant passerines found in the License Areas, four (alder flycatcher, American robin, Swainson’s thrush, and yellow-rumped warbler) showed no change in abundance in proximity to seismic lines, while dark-eyed junco increased in abundance (Bayne et al. 2016; Pardieck et al. 2020). Of the six birds of conservation concern likely occurring in the License Areas, (blackpoll warbler, Hudsonian godwit, lesser yellowlegs, olive-sided flycatcher, rusty blackbird, and short-billed dowitcher; USFWS 2021), only lesser yellowlegs occurred in the Bayne et al. (2016) study; lesser yellowlegs show no change in abundance in relation to disturbance from seismic lines.

b. Exploration, Development, and Production

Development and production of coalbed and sand bed methane resources typically requires a higher density of wells, well pads, road and pipeline networks than conventional natural gas production. Higher well densities result in greater land disturbance that may limit other land uses and make wildlife more vulnerable to predators, hunters, and trappers (Griffiths and Severson-Baker 2006). Long-term cumulative effects of oil and gas activities on terrestrial habitats and wildlife are primarily related to habitat loss from facility construction and habitat alteration and fragmentation from indirect effects resulting from construction and use of facilities (Venier et al. 2014; Toews et al. 2018; Wittische et al. 2021; Barlow et al. 2020). Vehicle traffic, aircraft traffic, sounds from equipment and machinery, and changes in vegetation communities around facilities can result in avoidance, attraction, or no change in wildlife use of areas around oil and gas facilities (Bayne et al. 2016; Carlisle et al. 2018; Darling et al. 2019; Duquette et al. 2019; Shonfield and Bayne 2019).

Most wildlife, however, are not in danger of extirpation from Canada's boreal forest region despite extensive habitat changes from resource development (Venier et al. 2014).

Clearing for road, well pad, and pipeline construction and gravel mining with associated noise and field crew activity may cause short-term disturbance of wildlife. Wildlife can be particularly sensitive to disturbance during nesting, calving, and during winter hibernation. Vegetation clearing and ground-disturbing construction during nesting can result in large losses of bird nests, eggs, and young (Van Wilgenburg et al. 2013); although in Alaska nest losses are generally avoided through best management practices that schedule these activities during late summer through winter after most young birds have hatched and fledged (USFWS 2017). Bald and golden eagle nest structures are specifically protected from destruction whether active or not by the Bald and Golden Eagle Protection Act (USFWS 2020). Noise and disturbance from winter construction of ice roads, well pads and roads, pipelines, and explosions from gravel extraction near bear den sites could disturb hibernating bears such that they prematurely emerge from the den (Linnell et al. 2000). Winter exploration and development activities are required to avoid identified bear dens.

Direct mortality from collisions with vehicles, planes, buildings, power lines, and communication towers supporting oil and gas development and production has the potential for cumulative effects (Child 2007; Northrup and Wittemyer 2013; Van Wilgenburg et al. 2013; Loss 2016). Disturbance from human activity at facilities can reduce waterfowl nesting success, although disturbance from vehicle and aircraft traffic appears to have less influence than direct observer encroachment on nest survival (Meixell and Flint 2017). Oil and gas infrastructure may provide nest platforms for raptors, ravens, and other nest predators that could reduce nesting success of ground-nesting birds like Tule geese and trumpeter swans (Liebezeit et al. 2009; Wallace et al. 2016). Some raptors, however, are likely to avoid nesting in areas proximate to coalbed methane development (Carlisle et al. 2018).

Small mammals are important as prey for weasels, owls, and foxes; influence vegetation recovery after disturbance; and influence boreal forest food webs. Their relative abundance is influenced by buried pipeline corridors (39 to 197 feet wide [12 to 60 meters wide]) through boreal forests that includes changes in species-specific abundance that extends into forest-edge habitats. On average, forests supported fewer meadow voles *Microtus pennsylvanicus*, which typically inhabit grasslands, more red-backed voles *Myodes* spp., which typically inhabit forests, and more deer mice *Peromyscus maniculatus*, which are habitat generalists, than pipeline corridors (Darling et al. 2019). Anthropogenic disturbances also have been found to influence the occurrence frequency of boreal forest predators (Wittische et al. 2021), which may be related to an abundance of small mammals associated with increased linear corridors and forest edge habitats (Darling et al. 2019). Moose are also attracted to early seral stage vegetation created in linear clearings for pipelines, powerlines, and low-trafficced roads similar to seismic lines (Wasser et al. 2011; Pattison et al. 2020). At a landscape scale, however, use of areas with increasingly high densities of linear features was predicted to be reduced for moose but increased for wolves (Pattison et al. 2020); although Toews et al. (2018) did not find a strong response to overall cumulative human footprint for moose. Wolf kills of moose were found to increase somewhat at lower densities of linear features, but increased significantly with proximity to rivers (Neilson and Boutin 2017).

Moose are likely tolerant of human activity and based on stress hormone levels were found to select forage, which increased with linear features, over security with no significant effects of primary or oil exploration roads (Wasser et al. 2011). Disturbance from oil and gas industry roads and compressor stations was not found to alter small mammal abundance or activity (Shonfield and Bayne 2019). Although, boreal forest songbird density was significantly reduced near compressor stations (average noise level 48 dB), and the interaction between noise level and distance to compressor station indicates that chronic noise pollution influences habitat quality for boreal forest birds (Bayne et al. 2008). Response to compressor noise for boreal forest birds, however, was species-specific. Of the five most abundant passerine species found in the License Areas, yellow-rumped warbler abundance was lower near compressor stations; alder flycatcher abundance was higher near to compressors and noiseless well pads than farther away; American robin and Swainson's thrush showed no difference in abundance; and dark-eyed junco did not occur in the study (Bayne et al. 2008). Cumulative effects of noise generated during oil and gas activities on wildlife may lead to localized short-term disturbance and displacement during exploration and development, and localized long-term displacement during production for a few sensitive animals during sensitive periods. Oil and gas activities may be limited during sensitive periods within important habitats to minimize disturbance, permanent facilities are generally sited away from sensitive habitats and are designed to reduce noise exposure to the surrounding environment.

Boreal forest bird response to buried pipeline corridors compared to seismic line corridors and well pads range from avoidance to no response, to attraction with more species avoiding well pad areas than pipeline corridors. Most boreal forest bird species, 57 percent, showed no difference in abundance due to proximity of pipelines or well pads compared to forest interior habitats based on 164-feet (50-meter) point counts. More species increased in abundance in proximity to pipeline corridors 38 percent, 20 species, while more species decreased in abundance in proximity to well pads 26 percent, 14 species (Bayne et al. 2016). Across all species, boreal birds associated with older growth forests were less likely to be more abundant in disturbed habitats, while birds associated with open habitats, shrublands, young forests, or mixed habitats were more likely to be neutral or more abundant in disturbed habitats (Bayne et al. 2016).

Of the five most abundant passerine species found in the License Areas, two (alder flycatcher, and yellow-rumped warbler) showed no change in abundance in proximity to pipelines, while three (American robin, dark-eyed junco, and Swainson's thrush) increase in abundance (Bayne et al. 2016; Pardieck et al. 2020). For well pads, two of the five most abundant species found in the License Areas (yellow-rumped warbler, and Swainson's thrush [both species typically use older forest habitats]), decreased in abundance, while three (alder flycatcher, American robin, and dark-eyed junco [species typically associated with shrublands or open habitats]) increase in abundance (Bayne et al. 2016; Pardieck et al. 2020). Of the six birds of conservation concern likely occurring in the License Areas (blackpoll warbler, Hudsonian godwit, lesser yellowlegs, olive-sided flycatcher, rusty blackbird, and short-billed dowitcher; USFWS 2021), only lesser yellowlegs occurred in the Bayne et al. (2016) study; with lesser yellowlegs showing no change in abundance in relation to disturbance from well pads with no data for pipelines.

c. Discharges, Leaks, and Spills

Discharges from well drilling and production may be intentional, such as permitted discharges regulated under Alaska Pollutant Discharge Elimination System (APDES) permits, or unintentional, such as gas blowouts, leakages, and spills. Substances spilled by natural gas production facilities in the Cook Inlet region over the past 25 years by volume were 67 percent produced water, 16 percent diesel fuel, and 10 percent drilling fluids (Table 8.1). Cumulative effects of discharges, leaks, and spills on terrestrial wildlife would primarily be exclusion from and temporary loss of contaminated habitats, although some individual animals may be lost due to toxic effects. Produced water spills are the most likely environmental release from coalbed methane exploration and extraction because of the large amounts of produced water associated with moving methane from the coalbeds to the surface.

Environmental concerns for surface discharge of treated produced water include potential for erosion, soil damage, immersion of nonhydric vegetation, water and land discoloration, and development of algal mats (NRC 2010). Coalbed methane produced water characteristics depend on coal geology, but produced water is generally higher in total dissolved solids (more saline) than surface water. Salts in produced water can alter the chemical and physical properties of soils. Chloride levels may be toxic, and sodium can change soil structure and impeding water infiltration. Salts damage plant roots and non-halophilic plants usually die from salt stress (Meehan et al. 2017). Remediation of produced water spills may vary depending on chemical composition of the produced water, climate, land use, and resource availability. Common methods include excavation and disposal, excavation and washing, natural attenuation, leaching through irrigation, adding chemical or organic soil amendments, and growing halophytic plants to remove salt through direct uptake (Green et al. 2020).

Hydrocarbon spills may result in habitat degradation, changes in prey or forage availability, and contamination of prey or forage resources, and direct toxic effects on wildlife. Changes in preferred prey or forage may lead to displacement into lower quality habitats with reduced prey or forage, which can reduce survival or reproductive fitness. Sub-lethal physiological and ecological effects of hydrocarbons may persist after cleanup activities are complete and may have consequences on the fitness of individuals and populations (Henkel et al. 2012; Burns et al. 2014).

Diesel fuel would be used to run heavy equipment and stored on site creating the potential for spills. Potential effects of hydrocarbon spills on terrestrial habitats depend on the size of the spill, type of product spilled, time of year, type of vegetation, and terrain. Spilled hydrocarbons spread both horizontally and vertically depending on the volume spilled, type of ground cover (plant or snow), slope, presence of cracks or troughs in the ground, moisture content of the soil, temperature, thickness of the oil, discharge point, and ability of the ground to absorb the oil (Linkins et al. 1984). Because dry soils are more porous, the potential for spilled oil to seep downward into the soil is greater (Everett 1978). If oil penetrates the soil layers and remains in the plant root zone, longer-term effects, such as mortality or reduced regeneration could occur in following summers. Under the right conditions involving oxygen, temperature, moisture in the soil, and the composition of the spilled oil, bacteria may assist in the breakdown of hydrocarbons in soils. Hydrocarbon spills in boreal forests can have a range of potential effects, including killing plants directly, slowing growth of plants, inhibiting seed germination, and creating conditions in which plants cannot receive adequate nutrition. (Robertson et al. 2007).

Spill response and cleanup activities could also affect wildlife although effects are not likely to be cumulative and cleanup operations decrease the likelihood that wildlife will contact diesel fuel or contaminated forage or prey.

2. Mitigation Measures and Other Regulatory Protections

Oil and gas activities could potentially have cumulative effects on terrestrial habitats and wildlife populations, although cumulative impacts are expected to be localized and minor to moderate. Cumulative effects are most likely to include some direct habitat loss and alteration from facilities and disturbance from vehicle and air traffic, and noise from compressors.

Gas development, and production in the License Areas are most likely to contribute to cumulative effects on terrestrial habitats and wildlife through construction and use of roads, well pads, pipelines, airstrips, facilities, and disturbance from associated activity. Seismic line, pipeline, and power line corridors would likely increase recreational, hunter, and trapper access and use of off-road vehicles on these corridors that can damage vegetation and disturb wildlife. Because most terrestrial habitats within the License Areas are forested, cumulative effects to forest from vegetation clearing for seismic surveys, pipelines, and facility construction are expected to persist for decades. Pre-construction den surveys, food waste containment and management, and human-bear interaction plans are required mitigation to avoid and minimize impacts on bears. Oil and gas activities may be limited during sensitive periods within important habitats to minimize disturbance; permanent facilities are generally sited away from sensitive habitats and are designed to reduce noise exposure to the surrounding environment. All migratory birds are protected under the Migratory Bird Treaty Act, and eagles are additionally protected under the Bald and Golden Eagle Protection Act. Mitigation measures in this best interest finding along with applicable regulations imposed by state, federal, and local agencies are expected to avoid, minimize, and mitigate potential cumulative effects to terrestrial habitats and wildlife populations.

Specific wildlife mitigation measures included in this best interest finding address: protection of wetland, riparian, and aquatic habitats; minimizing disturbance and noise impacts on important wildlife habitat; and minimizing disturbance of bald eagles, and trumpeter swans. Mitigation measures protect denning brown bears and prevent bears from becoming food conditioned, or unnecessarily destroyed during interactions with workers. DNR's Enforceable Standards include environmental protection requirements that are incorporated into the mitigation measures of this Best Interest Finding (DNR 2004).

A complete listing of mitigation measures can be found in Chapter Nine. Chapter Seven also provides information on requirements for wildlife protection, solid waste management, and wastewater disposal in the License Areas.

F. Reasonably Foreseeable Cumulative Effects on Fish and Wildlife Uses

As described in Chapter Five, fish and wildlife resources in the License Areas support subsistence, educational, commercial, and sport fishing and hunting, as well as non-consumptive recreation and tourism use. Consumptive and non-consumptive uses both depend on healthy habitats and wildlife populations, which can experience cumulative effects from oil and gas activities as described above. Additional potential effects on consumptive uses are discussed in the following sections.

Potential oil and gas activities that could have cumulative effects on fish and wildlife uses within the License Areas include seismic surveys, construction of roads and support facilities, discharges from well drilling and production, and ongoing disturbances from production activities such as vehicle, vessel, and aircraft traffic. In addition, spills could potentially occur during exploration, development, and production.

1. Potential Cumulative Effects on Subsistence

The communities near the License Areas use a wide variety of wild resources, including salmon and other fish, large terrestrial mammals, and berries (Holen et al. 2014). The primary cumulative impact from construction of support facilities for oil and gas development, besides impacts to habitats and distribution and abundance of fish and wildlife populations, is related to changes in access for these uses. During oil and gas exploration, seismic surveys could displace game animals from hunting and trapping areas, limiting their availability for harvest. During oil and gas development and production, field access roads may be unavailable for access for subsistence uses with potentially cumulative effects on hunting, fishing and gathering access (USFWS 2016). Alternatively, when access is allowed for subsistence, users' perceptions of possible contamination or unwillingness to hunt, fish, or gather near developments may result in long-term changes to subsistence-use areas. Seismic line, pipeline, and power line corridors and new roads into the License Areas could increase access for non-local hunting, trapping, and fishing that could increase competition for fish and wildlife resources.

A major oil spill could decrease resource availability and accessibility and create or increase concerns about food safety which could result in significant effects on subsistence users, which could linger for decades or longer (Jones and Kostick 2016). Potential effects on subsistence uses may also include increased or decreased access to hunting and fishing areas; concerns about safety of subsistence foods; and increased competition for nearby subsistence resources. If access to areas is restricted, subsistence users may have to travel greater distances and spend more time away from home in order to harvest resources (EVOSTC 2017). This type of catastrophic oil spill is highly unlikely. With gas development, spills are generally much smaller and be composed of diesel fuel or produced water as discussed above.

2. Potential Cumulative Effects on Hunting and Sport, Commercial, Personal Use, and Educational Fishing

Cumulative effects from construction of support facilities for onshore oil and gas development includes changes in public access and impacts to habitats and abundance and distribution of fish and wildlife populations. Seismic surveys could displace game animals from hunting and trapping areas, limiting their availability for harvest. During oil and gas development and production, the public use of oil field roads may be prohibited, excluding public access to public lands with potentially cumulative effects on hunting and fishing access. Increased public access to hunting, trapping and fishing areas through construction of new roads and trails could reduce costs for subsistence activities, increase harvest efficiency, and increase competition between user groups for fish and wildlife resources (USFWS 2016).

Noise and activities associated with seismic surveys and construction could result in localized temporary displacement of fish and wildlife resources and their user groups. Findings from one study concluded that sites within 5 kilometers of oil and gas wells see less visitation, compared to sites farther away from wells, in the western region of the United States. This research suggests that the presence of oil and gas development may have a significant enough effect on the user experience to motivate users to hunt, fish, or camp farther away. The results of this study extend the discussion of the effects of facilities and infrastructure on the wilderness experience, suggesting that its presence may deter visitation to natural areas (Rasch et al. 2018).

One study concluded that local, state, and national park users are concerned that some fracking operations near parks would disrupt the accessibility and usage of those parks. Knowledge of fracking and the technological processes behind it is mixed among park users, suggesting that educational outreach efforts may be helpful to local communities participation in providing comments on fracking projects (Kellison et al. 2017). Another study concluded that from a policy and management standpoint, it is important to assess and communicate recreationists' perceptions and subsequent opinions when planning, developing, and managing natural gas development projects and related decisions (Ferguson et al. 2019). The public participation opportunities including the solicitation and issuing a preliminary finding with another opportunity for public comment provide this opening for communication among the various user groups.

3. Mitigation Measures and Other Regulatory Protections

Oil and gas activities could potentially have cumulative effects on subsistence uses; hunting; and sport, commercial, personal use, and educational fishing, primarily through cumulative effects on habitat, fish and wildlife populations, access, or competition among user groups. Measures in this finding, along with applicable regulations imposed by state, federal and local agencies, are expected to avoid, minimize, and mitigate potential cumulative effects. In addition to mitigation measures addressing fish, wildlife, and habitat, other mitigation measures specifically address harvest interference avoidance, public access, road construction, and oil spill prevention.

Measures in this best interest finding, along with applicable regulations imposed by state, federal and local agencies, are expected to avoid, minimize, and mitigate potential cumulative effects on fish and wildlife uses. A complete listing of mitigation measures is found in Chapter Nine.

G. Reasonably Foreseeable Cumulative Effects on Historic and Cultural Resources

1. Potential Cumulative Effects on Historic and Cultural Resources

The Alaska Heritage Resources Survey database indicates that there are 50 reported cultural resource sites within the two License Areas. The resource types include paleontological sites, prehistoric sites, and early 20th century era sites (OHA 2025). Historic buildings, cultural sites, and prehistoric archeological sites may be encountered during field-based activities, and these resources could be damaged or destroyed by ground disturbance during exploration, development, and production.

If development occurs, impacts and disturbances to the historic and cultural resources could be associated with installation and operation of oil and gas facilities, including drill pads, roads, airstrips, pipelines, processing facilities, and any other ground disturbing activities. Damage to archaeological sites may include: direct breakage of cultural objects; damage to vegetation and the thermal regime, leading to erosion and deterioration of organic sites; shifting or mixing of components in sites resulting in loss of association between objects and damage or destruction of archeological or historic sites by oil spill cleanup crews collecting artifacts (Clough et al. 1987).

Spills can have an indirect effect on archaeological sites by contaminating organic material, which would eliminate the possibility of using carbon C-14 dating methods (Clough et al. 1987). The effects of cleanup activity on these resources are minor because the work plan for cleanup is constantly reviewed, and cleanup techniques are changed as needed to protect archaeological and cultural resources (Bittner 1996).

For example, historic and cultural resources may be encountered during field-based activities, and these resources could be affected by accidents such as an oil spill. Following the *Exxon-Valdez* oil spill, 24 archaeological sites experienced adverse effects including oiling of the sites, disturbance by clean-up activities, and looting and vandalism. Monitoring of the sites over a 7-year period indicated that vandalism continued to be a minor problem, and that although some sites were initially badly damaged by oiling, residual oil does not appear to be contaminating known sites, and sites are now considered to be recovered (Reger et al. 2000; EVOSTC 2014).

2. Mitigation Measures and Other Regulatory Protections

Because historic and cultural resources are irreplaceable, caution is necessary to not disturb or impact them. AS 41.35.200 addresses unlawful acts concerning cultural and historical resources. It prohibits the appropriation, excavation, removal, injury or destruction of any state-owned cultural site. In addition, all field-based construction and spill response workers are required to adhere to historic properties protection policies that reinforce these statutory requirements and to immediately report any historic property that they see or encounter (OHA 2025).

Because of the varying circumstances of occurrence surrounding the location and vulnerability of cultural resources, the significance of future impacts to these resources is difficult to assess in terms of the cumulative case. However, if the protections that are currently in place carry forward, then the cumulative impact would be expected to be minor within the License Areas. As in the past, assessments to identify and protect cultural resources before initiation of surface disturbing activities is a major factor in reducing future cumulative adverse impacts to cultural resources. A complete listing of mitigation measures is found in Chapter Nine.

H. Reasonably Foreseeable Fiscal Effects of the Disposal and Subsequent Activity on the State and Affected Municipalities and Communities

This section considers and discusses the fiscal effects of licensing activities. Licensing and subsequent activity may generate income for state government, with additional benefits that include increased revenue sharing, creation of new jobs, and indirect income multiplier effects. Fiscal effects may be statewide and local.

1. Fiscal Effects on the State

Alaska's economy is significantly reliant on revenues from oil and gas production, with petroleum revenues accounting for 37 percent of unrestricted general fund revenues, which is the money available to pay for government operations, basic services and capital improvements, in fiscal year 2024. The Alaska Department of Revenue reported unrestricted general fund revenues from petroleum of $2.47 billion in FY2024, forecasted to decrease to $1.88 billion in FY2025 (ADOR 2025c).

Should the exploration licenses be awarded, there will be positive initial revenue. To receive an exploration license, the licensee must provide the state with a licensing fee of $1 per acre of exploration area (AS 38.05.132(c)(6)). Given that exploration acreage must range between 10,000 and 500,000 acres (AS 38.05.132(c)(2)), the licensing fee associated with the proposed exploration license will vary between $10,000 and $500,000. In the case of these exploration licenses, the license fee is approximately $570,161.00. This licensing fee would provide a one-time increase in State revenues. Beyond the licensing fee, the licensee is also required to provide the state with a performance bond in an amount equal to the unfulfilled portion of the work commitment made during the award of the licenses. Should the work commitments be unfulfilled, the state may call against this bond and receive a cash consideration in an amount up to the penal sum of the bond. The license fee and any draw against the performance bond would represent one-time, incremental revenue to the state stemming from the licenses.

While a short-term revenue increase is expected if an exploration license is issued, the ultimate revenue impact associated with exploration in the Susitna Valley is presently indeterminate. The ultimate revenue impact of issuing an exploration license depends critically on whether commercial quantities of hydrocarbons are ultimately found and placed into production.

The License Areas lie south of 68 degrees North latitude and outside of the Cook Inlet sedimentary basin, a region commonly referred to as "Middle Earth." While most exploration tax credits have expired for the North Slope and Cook Inlet basins, many remain in effect for Middle Earth. For example, qualified capital exploration expenditures in Middle Earth may qualify for a 10 percent Qualified Capital Expenditure Credit for Exploration (AS 43.55.023(a)(2)). Certain expenditures for exploration wells in Middle Earth are eligible for a 20% Well Lease Expenditure Credit for Exploration (AS 43.55.023(l)(2)). Should these credits be claimed for an exploration program that ultimately fails to identify commercial quantities of hydrocarbons, the net revenue impact of the proposed exploration licenses could be negative. However, the state would receive data from the exploration work which is one of the primary goals of the exploration licensing program.

However, should exploration activity find commercial quantities of gas, the net revenue impact may be positive. By statute, if the licensee completes the work commitments required under the exploration licenses, the licensee may request that some portion of the exploration acreage granted under the licenses be converted to gas leases (AS 38.05.134). Under the assumption that at least some part of the License Areas are converted to gas leases, and these leases are placed into production, the fiscal benefits to the state will include royalties, rents, state corporate income tax, oil and gas property tax, and production tax.

a. Royalties

By statute, should any of the exploration acreage be converted into gas leases, these leases must reserve for the state a royalty interest of at least 12.5 percent (AS 38.05.134(3)). While currently lacking an empirical basis to determine the expected magnitude of the royalty payments from the exploration acreage, the royalty revenue would be positive and potentially significant. Royalties received from oil and gas leases are a material source of revenue for the state. Beyond contributing to the general fund, at least 25 percent of the cash flows generated by royalties must be deposited into the Alaska Permanent Fund ($519.9 million in FY2024) and 1/2 of 1 percent of royalty revenue must be placed in the Public-School Trust ($8.5 million in FY2024) (ADOR 2025c).

b. Rents

Should exploration acreage granted under the proposed licenses be converted into gas leases, the state would also collect rental revenue from these leases. Leases attributable to exploration licensing would yield yearly rents of $3 per acre until sustained commercial production was initiated (AS 38.05.134(4)). AS 38.05.140 limits the land that a person can hold at any one time to 750,000 acres thus limiting this Licensee from converting all the licensed acreage. Due to the uncertainty surrounding the number of exploration acres that will ultimately be converted to gas leases and the uncertainty around the time to production, it is not possible to provide a definitive estimate of revenues from rentals payments. However, with reasonable certainty the yearly revenue impact would be non-negative, but likely small.

c. State Corporate Income Tax

The state may also receive benefits from exploration licensing through increased corporate income tax receipts. The State of Alaska levies an income tax on Alaska apportioned income for all oil and gas C-corporations. The corporate income tax is a progressive tax levied on Alaska apportioned income with a highest marginal tax rate of 9.4 percent (ADOR 2025a). Should the proposed exploration activity result in hydrocarbon production, the organization(s) that place that resource into production may generate sufficient income to owe a state corporate income tax liability, thereby creating a positive revenue benefit to the state.

Beyond the potential direct revenue benefits provided by the corporate income tax received from the entities that develops the resource, there may be a positive revenue impact from the economic activity associated with exploration and development activities facilitated by the exploration licenses. When a dollar is spent, or a worker hired, the economic impact of that action is not siloed solely to the business receiving the dollar or the worker earning the wage. Rather, a cascading economic effect is set in motion in which the business spends the dollar to buy goods and services, the worker builds a home, and so on. The change in the total volume of goods and services produced as a consequence of the initial economic injection is commonly referred to as the economic multiplier. To the extent that exploration has a positive multiplier, and the additional economic activity is retained in Alaska, then some of the multiplier may be captured by state corporate income taxes.

d. Oil and Gas Property Tax

Oil and gas property taxes are levied each year on the full and true value of exploration, production, and pipeline transportation properties at a rate of 2 percent of the assessed value (AS 43.56). Municipalities may levy a tax on oil and gas property, and the tax paid to a municipality is credited against the property tax paid to the state. In state fiscal year 2024, total state oil and gas property tax revenues were $130.8 million (ADOR 2025c).

e. Production Tax

If the License Areas are converted to leases, gas produced in the License Areas is subject to the state production tax (AS 43.55). The production tax is based on the net value of production, but there are tax ceilings for gas in License Areas (AS 43.55.011(p)). The tax ceiling for the License Areas is 4 percent of the gross value at the point of production.[10] This 4 percent tax ceiling applies to production for the first 7 years of a development and production must begin before 2027. Thus, should a commercial discovery be made in the License Areas, and should that discovery be placed into production, the state would receive direct revenue benefits through the production tax.

f. Alaska Permanent Fund

At least one-quarter of rental, royalty, and bonus revenue received by the state is deposited into Alaska’s sovereign wealth fund, the Alaska Permanent Fund. In fiscal year 2024, oil and gas revenues contributed $519.9 million to the Alaska Permanent Fund (ADOR 2025c). As of January 31, 2024, the Alaska Permanent Fund had a balance in excess of $80 billion (APFC 2024).

g. Public School Trust Fund

The Public-School Trust Fund is an endowment trust fund created by the legislature to provide funding to the state public school system (AS 37.14.110). Each year, 0.5 percent of the receipts from the state’s management of its public lands, including royalties and rent, must be deposited into the School Trust Fund (AS 37.14.150). The legislature may then appropriate up to 5 percent of the market value of the fund for the purpose of funding public education. The principal balance of the fund in as of March 31, 2025 was $845.2 million dollars (ADOR 2025b).

2. Fiscal Effects on Municipalities and Communities

As discussed above, the economic benefit of exploration activity does not necessarily accrue only to the organizations involved in the exploration activity. Rather, the benefits will circulate throughout the economy and multiply the effect of the spending associated with the exploration licenses. The distribution of the local-level economic benefits associated with the exploration activity are difficult to forecast and depend on several factors including aggregate spending on

[10] Gross Value at the Point of Productions is the well-head value of taxable, produced oil and gas.

exploration, the size and commerciality of any identified resource, how spending is distributed between goods and services, where those goods and services are sourced, the behavior of municipalities and communities in response to increased oil and gas activity in the localities, etc. As was the case when considering the fiscal effect of the proposed exploration activity on the state, the empirical basis for making quantitative forecast of local impacts is lacking. However, it is possible to discuss the avenues through which benefits may accrue should the exploration licenses lead to production.

a. Property Tax

Local municipalities and communities may directly benefit from oil and gas activity by levying a tax on the oil and gas property (AS 43.56.010(b)). The local fiscal impact of taxing oil and gas property is significant in many communities. For example, in fiscal year 2023, the North Slope Borough generated $405.2 million in property tax revenues, accounting for 69.3 percent of borough general revenue (NSB 2023). As a state, in fiscal year 2024, oil and gas property taxes resulted in $130.8 million in revenue (ADOR 2025c).

The License Areas are contained largely within the Matanuska-Susitna Borough. As such, the License Areas would currently levy a petroleum property tax to the Matanuska-Susitna Borough. Additionally, under current law, a share of the revenue benefit that would flow to the state could be captured by the local communities should they choose to institute an oil and gas property tax.

b. Community Assistance Program

Local municipalities and communities may also indirectly benefit from the exploration licenses through the Community Assistance Program (CAP). The CAP takes revenues received by the state in the form of corporate income taxes and distributes non-locally generated, unrestricted revenue to communities and municipalities throughout the state (AS 29.60.855). In fiscal year 2022, $22.9 million in assistance was distributed to 230 communities in Alaska (McKinley Research Group 2023).

c. Employment

The oil and gas sector also plays a prominent role in the Alaska labor market. In 2023, a study prepared for the Alaska Oil and Gas Association estimated the employment and wage impact of 15 “Primary Companies” that explore, produce, refine, and transport North Slope and Cook Inlet petroleum resources.[11] It found that including all direct, indirect, and induced employment and wages, oil and gas industry spending in Alaska accounted for 36,200 jobs and $3.3 billion in total wages in Alaska in 2022. Combined, the report found that the employment and wage impacts of Primary Company spending in the private sector together with taxes and royalties to Alaska’s state and local governments totaled 69,250 jobs in Alaska, or 17 percent of all wage and salary jobs in Alaska (McKinley Research Group 2023).

[11] Primary Companies include Alaska Gasline Development Corporation, Alyeska Pipeline Service Company, BlueCrest Energy Inc., Chevron Corporation, ConocoPhillips Alaska Inc., Eni US Operating Co. Inc., ExxonMobil, Furie Operating Alaska LLC, Glacier Oil & Gas Corporation, Hilcorp Alaska LLC, Marathon Petroleum Corporation, Petro Star Inc., Repsol, Santos,and Shell Exploration & Production Company (McKinley Research Group 2023).

The level, and geographical distribution, of the employment effect driven by the exploration licenses will depend on the size of any commercial resource that is identified. If the exploration program does not find material quantities of hydrocarbons, the labor market effect of the exploration licenses would likely be negligible. However, should the exploration program find commercial quantities of hydrocarbons, and should these hydrocarbons be placed into production, the labor market effect of the exploration licenses could be significant and could impact communities throughout Alaska.

I. Other Reasonably Foreseeable Effects on Municipalities and Communities Near the License Area

1. Private and Agricultural Lands

Although there is very little private, or active agricultural land within the License Areas some landowners have expressed concerns that reasonably foreseeable cumulative effects on property values and farmland should be considered in the finding. Most private landowners in Alaska and in the License Areas do not own the subsurface, or mineral estate. The Alaska Statehood Act granted the state land to manage as an economic base, along with the subsurface mineral estate for those lands, and requires the state to retain mineral rights when conveying the surface estate to private entities. Under AS 38.05.125 oil and gas licensees and lessees may enter privately owned surface estates for exploration and development of the state's licensed or leased subsurface resources. A licensee must work in good faith to enter a private land owner's property and negotiate a surface use agreement. If an agreement cannot be reached and the operator demonstrates that a reasonable amount of time has passed since the initial contact, the Alaska Department of Natural Resources may initiate bond proceedings pursuant to AS 38.05.130.

While the exploration licenses grant the Licensee the right to explore for and develop natural gas resources within the License Areas, they do not authorize any operations or any specific activities. A Plan of Operations (11 AAC 83.158) must be submitted, reviewed, and approved before any activity can begin in the License Areas. Each Plan of Operations must identify all subsurface and surface owners. Before undertaking any operations in a license area, the licensee must provide for full payment of all damages sustained by the owner of the surface estate due to entering the land (AS 38.05.130; 11 AAC 83.158). In addition, mitigation measures included in this finding require operators to contact surface owners where activities are proposed and make good-faith efforts to negotiate a surface use agreement as well as notifying all landowners within 1/2 mile of any proposed workspace.

A literature review of community impacts from unconventional natural gas developments found that large-scale developments can put pressure on available local housing, with residents and temporary workers potentially facing limited housing stock and increasing housing and rental costs during the development boom phase. Community residents may be exposed to an increased risk for eviction, water contamination, and exposure to industry-related noise, traffic, and nighttime lighting. Homeowner concerns included perceptions of water well contamination, reduced air quality, property damage due to fracking induced earthquakes, changes in property values, and decreased safety from pipeline and facility failures (Buse et al. 2019). Adjoining landowners may also be potentially affected by visual or environmental effects (Baen 1996). Although unconventional oil and gas development undoubtedly increases employment and earnings, rural and remote communities may be inadequately prepared for the strain on local services and housing (Weinstein 2014).

Perceptions of ground water contamination, even without evidence of contamination, were found to decrease home values by 9.9 to 16. 5 percent within about 1 mile from shale gas wells (Muehlenbachs et al. 2015). Factors identified as negatively impacting property values were distance to wells, storage facilities, and industrial roads; risk of groundwater contamination; perceived and actual costs of drilling-induced earthquakes; and impediments to obtaining mortgage or property insurance. Pipeline development, however, was not found to significantly impact property values (Buse et al. 2019).

Coalbed methane development in Australia and oil and gas development across the western United States – where landowners generally do not own the mineral estate – is perceived by rural farming and ranching families as having both costs and benefits (Huth et al. 2018; Haggerty et al. 2019). While the extent of agriculture in the License Areas is orders of magnitude less by comparison, the insights from these studies are useful for identifying potential impacts to land, landowners, and rural communities. Benefits include increased off-farm employment and wages, regional economic growth, infrastructure improvements including access roads and water systems, and an energy supply with lower greenhouse gas emissions than coal-fired power plants. Coalbed methane in these developments is produced from wells at a well pad density of 1 to 2 per 250 acres, with a network of access roads, pipelines, and electric transmission lines. Produced water is treated and either reinjected or reused for agriculture in this arid region. Direct agricultural impacts have included topsoil and/or subsoil compaction, introduction and spread of invasive plants and pests, brine spills, and livestock losses from vehicle collisions (Huth et al. 2018).

The most reported issues in rural areas from oil and gas development are high truck traffic and associated impacts on the safety and function of local roads; increased dust; increased costs of living, property taxes, and legal fees; and costs for additional remediation and reclamation. A common theme was that industry and subcontractor personnel that interact with farmers and ranchers have a substantial influence on the outcome of the interaction (Huth et al. 2018; Haggerty et al. 2019).

2. Access

The License Areas are a mosaic of state and private or municipal lands and Native allotments with the State of Alaska the predominant landowner. Existing transportation systems within the License Areas include a few gravel roads and a complex network of summer and winter trails. Access to the License Areas would likely be primarily by overland vehicles and aircraft. Ground-based access to the License Areas would most likely be via the Parks Highway, Oilwell Road (via Petersville Road), Deshka Landing Road, or Willow Creek Parkway. Annual average daily traffic for the Parks Highway at Willow (3,370 vehicles/day), Petersville Road (300 vehicles/day), and Willow Creek Parkway (110 vehicles/day) show increasing trends over the past decade. Parks Highway traffic increased at an annual rate of 60 vehicles/year or about 2 percent/year, Petersville Road increased by 20 vehicles/year or 10 percent/year, and Willow Creek Parkway may have increased by

6 vehicles/year or 4 percent/year (DOT&PF 2025). Most airstrips and floatplane landing areas (about 200) in the MSB are private with 10 publicly operated airports. Air traffic in the region is monitored at Talkeetna and Palmer airports, air traffic increased by about 8 percent per year between 2010 and 2014, with scheduled air service available only at the Skwentna airport (HDR Alaska 2014). Vehicle and air traffic would incrementally increase with exploration and development of oil and gas projects and traffic increases would be cumulative with existing traffic levels that also appear to be increasing.

Temporary roads may be constructed for exploratory drilling, and access roads, well pads, pipelines, and airstrips may be constructed for projects. Use of existing highways, roads, and trails for transportation of heavy equipment and supplies could create traffic delays and could degrade road or trail surfaces. New roads open to public traffic would facilitate year-round access to remote locations within the License Areas. Trails created or improved for exploration activities such as seismic surveys or exploratory drilling and pipeline or power line corridors cleared during development would likely be used for recreation, hunting, trapping, and access for fishing (Griffiths and Severson-Baker 2006; Northrup and Wittemyer 2013; Dabros et al. 2018). New or improved access could create community development, land use planning, and fish and wildlife management issues.

Cumulative increases in vehicle and air traffic would likely be greatest during construction when more equipment and personnel are generally required. Expected increases in new permanent roads, improved trails, and new seismic, pipeline, and transmission line corridors would also be cumulative, although impacts from increased oil and gas related traffic would be reduced during operation compared to traffic during construction (NRC 2010; Venier et al. 2014).

3. Recreation and Tourism

Recreation and tourism are important to the economy in the Matanuska-Susitna Borough providing employment opportunities, generating revenue for communities, and supporting infrastructure that benefits residents (Ressler 2017). Sightseeing, fishing, camping, hunting, boating, hiking, cross-country and backcountry skiing, snowmachining, and all-terrain vehicle use are popular activities (DNR 2008, 2011; UAA 2019). Most Alaskans, 81 percent, participate in outdoor recreation and 58 percent of Alaskans identify opportunities for outdoor activities as a reason they live in Alaska (UAA 2019). Alaska is also a major destination for outdoor recreation with 61 percent of tourists participating in at least one outdoor recreation activity (UAA 2019). Potential cumulative effects on outdoor recreation from development of shallow gas or coalbed methane resources in the License Areas could include forest clearing, increased traffic especially heavy truck traffic, noise pollution, loss of scenic vistas, trail conflicts, and overall degradation of the outdoor recreation experience (Rasch et al. 2018; Ferguson et al. 2019).

A study of overnight use recreation sites across 27 National Forests with oil and gas development found that for each additional well within 3.1 miles (5 kilometers) of an overnight campground site visitation declined by 6 visits/year. This relationship with number of wells, however, was inconsistent at a local scale with a significant relationship across the Rocky Mountain western states but not in eastern or midwestern regions or California. The results of this study imply that the presence of infrastructure may detract from the recreation experience and may deter visitation to natural areas, but that small-scale oil and gas developments are not likely to significantly impact visitation at a local level or impact the local recreation economy (Rasch et al. 2018). In Texas, North Dakota, Pennsylvania, and California oil and gas and tourism industries co-exist and have prospered with increases in both oil and gas production and visitor spending over the 2008 to 2015 time period (Jacobs 2017).

Where oil and gas activities coincide with or restrict access to fishing or hunting areas, campgrounds or other recreation areas, a visitor's use or enjoyment of the area could be adversely affected. In Pennsylvania's Marcellus Shale natural gas development areas, 13.6 percent of outdoor recreationists indicated that they had experienced impacts to their recreation activities. Their concerns included disruption of traditional hunting lands, fragmented habitats, changes in game animal behavior, and increased numbers of outsiders. Recreationists also expressed concerns over rerouted, widened, and detoured trails, tree removal, exposure to industrial activity, and perceptions of tainted water. Some respondents, 9.4 percent, indicated that they avoided areas because they did not want to be exposed to drilling activity, and 8.5 percent were concerned over potential health effects, dangerous roadways with large truck traffic, contaminated water at campsites, and disrupted access (Kellison et al. 2017; Ferguson et al. 2019). Transportation planning that includes routing heavy equipment and trucks on bypass routes away from schools, residences, and sensitive areas; minimizing new roads through remote monitoring of well sites; minimizing damage from off-road access by limiting use during wet conditions; and ensuring that new roads minimize surface impacts, habitat fragmentation, and interference with public access to trails rights-of-way are required by DNR's Enforceable Standards and the mitigation measures contained in Chapter Nine (DNR 2004).

Compressors are used to transport natural gas through pipelines and pumps may be used to reinject produced water into disposal wells. Noise from compressors can negatively affect recreational users' experience. A threshold model developed from state forest user survey responses found that sounds from compressors become unacceptable to non-motorized users (canoe/kayak, hike/walk, bicycle, hunt/fish) at about 55 dBA (A-weighted decibels), and to motorized users (off-highway vehicle, all-terrain vehicle) at about 124 dBA (loud enough to damage hearing) (Miller, Z. D. et al. 2020). Using a similar threshold model approach, Denali National Park visitors identified aircraft noise louder than 53 dBA were unacceptable (Miller, Z. D. et al. 2020). Noise from compressors and facilities attenuates with distance from the facility and can be minimized by using mufflers, sound insulating enclosures, and setbacks (DNR 2004).

4. Mitigation Measures and Other Regulatory Protections

The scale of potential private land and agricultural impacts depends on the location and scale of any proposed development which are not known at the disposal phase. Cumulative effects described in this section are based on large scale coalbed methane and shale gas developments that likely overestimate the scale of impacts that could occur within the License Areas. Multiple mitigation measures have been specifically developed and incorporated into this finding to address Matanuska-Susitna Borough community and landowner concerns about natural gas resource exploration and development in the Susitna Valley. Mitigation measures contained in Chapter Nine, informed by DNR's Enforceable Standards (DNR 2004), address transportation planning to minimize hazardous roadway conditions, control dust, use visual mitigation, light shielding, and noise mitigation to minimize potential impacts to aesthetics and viewsheds among other environmental concerns. Licensees are required to identify components of any hydraulic fracturing materials and fracking fluids may not include diesel fuel. Public notice measures specify that all landowners within 1/2-mile of a proposed worksite are notified in writing by the Licensee.

Oil and gas activities could potentially have cumulative effects on access, recreation, and tourism, although cumulative impacts are expected to be localized and minor. Cumulative effects are most likely to include forest clearing, increased vehicle and air traffic, noise pollution, loss of scenic vistas, trail conflicts, and overall degradation of the outdoor recreation experience. Expected increases in new permanent roads, improved trails, and new seismic, pipeline, and transmission line corridors would also be cumulative.

Gas development, and production in the License Areas are most likely to contribute to cumulative effects on access and recreation through construction and use of roads, well pads, pipelines, airstrips, facilities, and disturbance from associated activity. Seismic line, pipeline, and power line corridors would likely increase recreational, hunter, and trapper access and use of off-road vehicles on these corridors. Mitigation measures in this best interest finding along with applicable regulations imposed by state, federal, and local agencies are expected to avoid, minimize, and mitigate potential cumulative effects to access, recreation, and tourism. Mitigation measures contained in Chapter Nine, informed by DNR's Enforceable Standards address transportation planning to minimize hazardous roadway conditions, and visual mitigation and light shielding to minimize potential impacts to viewsheds. In addition, the mitigation measures specify noise limits near sensitive public facilities and describes measures for reducing noise from facilities including mufflers, sound insulating enclosures, and using topography to buffer noise (DNR 2004).

Specific mitigation measures included in this best interest finding address: facility design to minimize sight and sound impacts to recreational and subsistence use; and unrestricted public access except for the immediate vicinity of drill sites and related structures. A complete listing of mitigation measures can be found in Chapter Nine.

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Chapter Nine: Mitigation Measures

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Under AS 38.05.035(e), the director of Alaska Department of Natural Resources' (DNRs'), Division of Oil and Gas (DO&G) is authorized to impose conditions or limitations, in addition to those imposed by statute, to ensure that a resource disposal is in the state's best interest. AS 38.05.133(f)(1) also requires that this written finding describe the limitations, stipulations, conditions, or changes from the initiating proposal that are required to make the issuance of the exploration licenses conform to the best interests of the state. Finally, AS 38.05.035(g)(1)(B)(vii) requires that this written finding consider and discuss lease stipulations and mitigation measures, and the protections offered by these measures, including any measures to prevent and mitigate spills. To mitigate the potential adverse social and environmental effects of specific post-disposal related activities, DO&G has developed mitigation measures which are conditions and limitations to the exploration licenses and any subsequent leases, are binding on the licensee, and will condition plans of operation, plans of development, and other permits.

The mitigation measures presented in this written finding were developed to mitigate potential effects of license and lease-related activities, after considering all information made known to the director at this time. Additional project-specific mitigation measures may be imposed when the licensee submits plans of operation or development.

The mitigation measures discussed in this chapter will apply to oil and gas activities in, on, or accessing all licensed land and waterbodies as a condition of issuing the licenses, regardless of the ownership status of the land. The director may consult with local government organizations and other agencies in implementing the mitigation measures below. The licensee is subject to applicable local, state, and federal laws and regulations, as amended.

DO&G has adopted the Alaska Department of Natural Resources' Enforceable Standards for Development of State Owned Coalbed Methane Resources in the Matanuska-Susitna Borough guidance document (DNR 2004). This document is included as Appendix C of this finding. The standards contained within this guidance document and adopted in these mitigation measures will be the minimum level of protection established in this finding for both licenses.

The director may grant exceptions to these mitigation measures. Exceptions will only be granted upon a showing by the licensee that compliance with the mitigation measure is not practicable and that the licensee will undertake an equal or better alternative to satisfy the intent of the mitigation measure. Requests and justifications for exceptions must be included in the plan of operations application as specified by the application instructions, and decisions of whether to grant exceptions will be made during the plan of operations review.

A. Mitigation Measures

1. Public Notice and Information

a. DO&G will provide at least a 30-day public notice (If DO&G finds that the plan of operation raises new issues of significant public interest, then DO&G will provide at least

60-day public notice) and review/comment period for each phase of coalbed methane development requiring a plan of operation (exploration, development, and transportation) by the following methods:

i. DO&G will require the applicant to provide notice by return receipt mail or personal delivery to all owners of surface lands within 1/2-mile of the proposed work site who can be reasonably identified and located based on records at the state Recorder's Office and Matanuska-Susitna Borough (MSB) tax records;

ii. legal notice in the Anchorage Daily News and the Frontiersman;

iii. public notice distributed to municipalities (including MSB's Planning and Land Use and Public Works departments), regional and village corporations, federally recognized Tribal governments, libraries, and post offices within or adjacent to the proposed activity area;

iv. public notice distributed to any community councils whose boundaries are within or adjacent to the proposed activity area; and

v. all residents and organizations that have submitted a written request for notice of proposed coalbed methane activities within the area of the proposed activity will be notified electronically or, if requested, by regular mail. A written request for notice will be honored for 3 years, at which time it should be updated by the requestor.

b. A plan of operations will be submitted to and approved by DO&G before conducting exploration, development, or production activities in accordance with 11 AAC 83.

c. A plan of operations will include a disclosure of the components in any hydraulic fracturing materials to be used, the volume and depths at which such materials are expected to be used, and the volume capacity of the vessels to be used to store such materials.

d. A plan of operations will include an emergency preparedness and response plan for potential emergencies that may be associated with the operation of facilities. This may include explosions, fires, gas or water pipeline leaks or ruptures, earthquake or flood events, or hazardous material spills. A plan will include contact names and phone numbers of at least two persons responsible for emergency field operations. The operator will conduct annual or periodic training and drills for response personnel. A copy of the plan will be provided to the MSB Emergency Services department and local fire service district chiefs. A plan of operations will be reviewed at least annually for any necessary updates.

e. The operator will maintain Material Safety Data Sheet (MSDS) information on all hazardous substances currently used by the operator at coalbed methane facilities within the MSB. The operator will ensure MSB Emergency Services and local fire service district chiefs are provided information concerning the use or transport of any hazardous substances associated with coalbed methane exploration and development. The operator will post at each drill site and coalbed methane facility the contact's name and phone number from whom interested persons can obtain information regarding the hazardous materials used at the drill site or facility.

f. DO&G will require as-built surveys upon completion of any permanent coalbed methane facility.

2. Facilities and Operations

a. Oil and gas facilities, including pipelines, will be designed using industry-accepted engineering codes and standards. Technical submittals to the DO&G that reflect the "practice of engineering," as defined by AS 08.48.341, must be sealed by a professional engineer registered in the State of Alaska.

b. A plan of operations will be submitted and approved before conducting exploration, development or production activities in accordance with 11 AAC 83.

c. Facilities will be designed and operated to minimize sight and sound impacts in areas of high residential, recreational, and subsistence use and important wildlife habitat.

d. The operator will construct drill pads at least 500 feet and compressor stations at least 1,500 feet from any residential structure or public facility.

e. An exception may be granted from this requirement if the operator obtains the consent of the owner of the residential structure or demonstrates that the drill pad and/or compressor station will be substantially hidden from view from the public facility, and that the noise levels experienced by the public facility will not exceed ambient noise levels.

f. A plan of operations will include the measures to be used to mitigate potential noise impacts associated with facilities and compressor stations. The operator will provide an analysis of the noise impacts on residential and commercial users of the proposed project area. Coalbed methane operations shall not cause the ambient statistical noise levels L_1, L_{10} and L_{50} for any hour measured at the property line, residential structure, or sensitive public facility, to be greater than the levels specified below. (L_1 means that the sound level specified can be exceeded 1 percent of the time, L_{10} means that the sound level specified can be exceeded 10 percent of the time, and L_{50} means that the sound level specified can be exceeded 50 percent of the time.)

Day (7 AM to 8 PM)		Night (8 PM to 7 AM)	
L_{50}	55 dBA	L_{50}	45 dBA
L_{10}	60 dBA	L_{10}	50 dBA
L_1	75 dBA	L_1	55 dBA

g. A plan of operations will include a noise monitoring plan. A noise monitoring plan will include short-term manned monitoring to ensure compliance with the noise standards. If the monitoring shows that the standards are not met, the operator will be required to submit a corrective action plan within 10 days.

h. Measures to mitigate noise impacts may include but are not limited to:

i. venting exhaust in a direction away from the closest existing residences of platted subdivision;

ii. using quiet design mufflers on non-electric motors;

iii. limiting the hours of noise-generating operation to daytime hours;

iv. using sound insulating enclosures where facilities would otherwise create noise impacts because of proximity, population density, other adjacent land uses sensitive to adverse impacts from noise; and

v. siting facilities and compressor stations in locations that use geographic features to buffer noise.

i. The operator will not construct drill pads or compressor stations in any residential subdivision in which more than half of the land is divided into lots sized at 5 acres or less, without the consent of all surface property owners within that subdivision.

j. The siting of facilities, including roads, airstrips, and pipelines, is prohibited within 500 feet of all fish-bearing waterbodies.

k. Notwithstanding (i) above, the siting of facilities, is prohibited within 1/2 mile from the banks of the Deshka (Kroto and Moose creeks), Kahiltna, Susitna, Talachulitna, and Yentna rivers, and Alexander, Lake, and Peters creeks: as measured from the ordinary high-water mark. Facilities may be sited, on a case-by-case basis, within the 1/2 mile buffer if the licensee demonstrates that siting of such facilities outside this buffer zone is not feasible or prudent, or that a location within the buffer is environmentally preferable.

l. Impacts to important wetlands will be minimized to the satisfaction of the director, in consultation with Alaska Department of Fish and Game (ADF&G) and Alaska Department of Environmental Conservation (ADEC). The director will consider whether facilities are sited in the least sensitive areas.

m. Artificial gravel islands and bottom founded structures will not be in active stream channels, except as provided for in (m).

n. Each proposed structure will be reviewed on a case-by-case basis. Docks, artificial gravel islands, and bottom-founded structures may be permitted if the director, in consultation with ADF&G and ADEC, determines that the structures are necessary for field development and that no practicable alternatives exist. A monitoring program may be required to address the objectives of water quality and free passage of fish, and mitigation will be required where significant deviation from objectives occurs.

o. Forestry access roads into the license areas must be undamaged or restored after use. The licensee must consult with the Division of Forestry on road locations, design, construction, financing, improvements, maintenance, signage, and safety.

p. Upon abandonment of material sites, drilling sites, roads, buildings or other facilities, such facilities must be removed, and the site rehabilitated to the satisfaction of the director, unless the director, in consultation with any non-state surface owner, as applicable, determines that such removal and rehabilitation is not in the state's interest.

q. Material sites required for oil and gas activities will be:

i. restricted to the minimum necessary to develop the field efficiently and with minimal environmental damage;

ii. designed and constructed to function as water reservoirs for future use where practicable; and

iii. located outside active floodplains of a watercourse unless the director, after consultation with DNR's Division of Mining, Land, and Water (DMLW) and ADF&G, determines that there is no practicable alternative, or that a floodplain site would enhance fish and wildlife habitat after mining operations are completed and the site is closed.

r. A plan of operations will include the measures to be used to mitigate visual impacts associated with facilities. Measures to mitigate visual impacts may include but are not limited to:

i. minimizing the size of structures;

ii. minimizing damage to vegetation and the use of vegetation to buffer visual impacts;

iii. minimizing the work pad size to only that area necessary to provide a safe work area;

iv. locating facilities away from prominent features, hilltops and ridges;

v. locating facilities at the base of slopes;

vi. painting permanent facilities in uniform, non-contrasting, non-reflective color tones slightly darker than the adjacent landscape; and

vii. applying one or more of the following landscape practices for permanent facilities:

- Establishing berms, ground covers, shrubs and trees;
- Placing vegetation clusters 10 to 15 feet apart along the edge of the permanent pad site in residential areas;
- When clearing trees and vegetation for construction of facilities, feather and thin edges of the clearing;
- Shaping cuts and fills to appear as natural forms;
- Cutting rock areas to appear as natural forms;
- Designing the facility to utilize natural screens; and
- Constructing fences, such as woven wood or rock, for use with landscaping.

s. The operator will direct exterior lighting, when required, away from residential areas, or effectively shield the light from such areas.

t. On-site temporary storage of waste will not be permitted for longer than 6 months. Open pit solid waste storage is not allowed in residential areas. In these areas, solid waste must be stored in a closed container. The operator will exclude people, livestock, and wildlife from solid waste disposal areas using fencing or other barriers approved by DO&G.

u. A plan of operations will include measures to be used to appropriately control soil erosion and sedimentation during all activities associated with exploration and development. The operator, after construction of a permanent facility, will replace temporary erosion control structures with permanent structures within 45 days of project completion or, if seasonal conditions dictate timing constraints, within 45 days after seasonal conditions permit the activity.

v. Timber harvested as part of exploration and development activities (including right-of-way and pad clearing slash) will be processed and disposed of in a manner approved by the Division of Forestry to avoid spruce bark beetle infestation.

w. The director may include plan stipulations if necessary to reduce or eliminate adverse impacts to fish and wildlife or to protect the environment.

x. Plan of operations approvals will include monitoring requirements. The monitoring requirements will be tailored to the specific situations and potential impacts. In approving a monitoring plan, DO&G will consider the following factors: whether the activities are for exploration or development, potential impacts to water quality and quantity, potential noise and/or visual impacts to adjacent users, magnitude of proposed ground disturbance, proximity to residential structures, proximity to sensitive habitats or use areas, and potential impact to fish or wildlife populations.

y. A plan of operations will identify any geophysical hazards in the area of operations. A plan of operations for proposed development in the vicinity of a geophysical hazard must include siting, design, and construction measures for minimizing property damage and protecting against loss of life.

z. Upon abandonment of material sites, drilling sites, roads, buildings, or other facilities, such facilities must be removed, and the site rehabilitated to the satisfaction of the director, unless the director, in consultation with DMLW, ADF&G, ADEC, and any non-state surface owner, determines that such removal and rehabilitation is not in the state's best interest.

aa. Operators must comply with all current or future DNR area plans and recreation rivers plans; as well as any ADF&G game refuge plans, critical habitat area plans, and sanctuary area plans within which operations are located.

3. Roads and Pipelines

a. Road and pipeline crossings will be aligned perpendicular or near perpendicular to watercourses.

b. Exploration roads, pads, and airstrips will be temporary. Exploration activities must use existing road systems, ice roads, air or boat service, or vehicles that cause minimal damage to the ground surface or vegetation. Construction of permanent roads will be prohibited during the exploration phase unless requested by and approved by all private surface owners upon whose land the road will be built.

c. Use of gravel roads, pads, and airstrips may be permitted on a case-by-case basis by the director, in consultation with DMLW and ADF&G.

d. The operator will minimize disturbance of vegetation within rights-of-way during construction, maintenance, and operational activities.

e. All pipelines, including pipelines carrying produced water, must be designed and constructed to prevent releases and assure integrity against climatic conditions and geophysical hazards.

f. Pipelines that must cross fish streams will be constructed beneath the fish streams using directional drilling techniques, unless the director, in consultation with ADF&G, approves an alternative method.

g. The operator will bury pipelines unless safety, seismic, or environmental conditions dictate otherwise. In areas with above ground placement, pipelines shall be designed, sited, and constructed to allow free movement of moose and other wildlife. The operator must minimize duplication of existing transportation corridors when planning a pipeline route.

h. Additionally pipelines:

   i. Will use existing transportation corridors and be buried where soil and geophysical conditions permit.

   ii. Where practicable, pipelines must be located on the upslope side of roadways and construction pads, unless it is determined that an alternative site is environmentally acceptable.

   iii. Pipelines and gravel pads will facilitate the containment and cleanup of spilled fluids.

   iv. Pipelines must be located and constructed in consultation with ADF&G and MSB.

i. A plan of operations will include an analysis of road and access issues associated with site development. All aspects of transportation related to the proposed activity and possible effects to existing uses and mitigation measures will be considered. The plan will address, at minimum:

   i. the adequacy of existing roads and access to the site (operator activities must use existing road systems to the maximum extent possible);

   ii. when feasible, heavy equipment and trucks should use bypass routes to avoid schools, rural residences, and other sensitive areas;

   iii. whether dust control measures are necessary (in such instances, the use of non-toxic dust control measures will be used);

   iv. the operator's measures to minimize the need for new road development, including the use of remote monitoring/telemetry and using two-track roads where operationally feasible and safe;

   v. the estimated number of site visits by vehicle; type;

   vi. the operator's measures to minimize damage to the surface for approved off-road access, including limiting use during inclement weather and wet ground conditions;

   vii. the operator's measures to ensure that new roads are constructed to allow for access by emergency response personnel;

   viii. the operator's measures to ensure that construction of new roads minimizes surface impacts by following existing grades, minimizing cuts and fills, and minimizing habitat fragmentation; and

   ix. the operator's consideration of public access granted under RS 2477 and other established rights-of-way.

4. Split Estate

a. Operators are required to contact the surface owner of lands upon which activities are proposed and make good-faith efforts to negotiate a surface use agreement. If agreement cannot be reached, DO&G may initiate bond proceedings pursuant to AS 38.05.130, but only if the operator demonstrates that a reasonable period of time has passed from the initial contact between the surface owner and operator, and the operator has made a good-faith effort to reach an agreement.

b. When determining the damage bond amount under AS 38.05.130, DO&G shall consider the current market value of the property, the potential duration of operations, the loss of use of the property during operations, potential cost of damage to existing surface improvements, crops, and timber. In addition, the bond terms should include provisions to ensure that any bond with a potential duration of greater than 2 years is periodically reviewed to ensure it remains set at a sufficient amount.

5. Water Management

a. Where DO&G determines that water withdrawal has significant potential to unduly affect waters currently used by others, such as an individual owner's well or a drinking water aquifer, DO&G will require the licensee to provide baseline information concerning water quantity for temporary water use authorizations or water rights. The information will be designed to document the pre-withdrawal conditions in case the withdrawal causes a change in water availability to current users. The baseline information may include one or more measurements of water table depth or piezometric head. Baseline information may also include testing individual wells or other information as appropriate.

b. Where DO&G determines that water withdrawal has significant potential to unduly affect waters currently used by others, DO&G, in consultation with the DMLW, will condition temporary water use authorizations or water rights with the requirement to monitor the water availability in the area of concern. Conditions may include the requirement to establish a monitoring well, monitor existing wells, or other measures as appropriate.

c. If surface disposal of produced water is proposed, the plan of operations shall include a water management plan providing detailed information on the location, amounts, and potential impacts associated with the proposed surface disposal. Surface disposal of produced water will not be allowed unless ADEC determines that the discharge will meet state water quality standards and the director has approved the water management plan.

d. The operator will not use diesel-based fracturing materials.

6. Fish, Wildlife, and Habitat

a. Detonation of explosives is prohibited in open water areas of fish bearing waterbodies and in fish bearing waterbodies that are not solidly frozen, including the substrate unless otherwise approved. Blasting criteria have been established by ADF&G and are available from ADF&G upon request. The location of known fish-bearing waters within the project area can be obtained from ADF&G.

b. Any water intake structures in fish bearing or non-fish bearing waters will be designed, operated, and maintained to prevent fish entrapment, entrainment, or injury. All water withdrawal equipment must use fish screening devices approved by ADF&G.

c. Removal of snow from fish-bearing water bodies is subject to prior written approval by ADF&G. Compaction of snow cover overlying fish-bearing waterbodies is prohibited except for approved crossings. If ice thickness is not sufficient to facilitate a crossing, then ice or snow bridges may be required.

d. The director, in consultation with ADF&G, may impose seasonal restrictions on activities located in, or requiring travel through or overflight of, moose calving and wintering areas during the plan of operations approval stage.

e. The licensee must consult with ADF&G before commencing any activities to identify the locations of known brown bear den sites that are occupied in the season of proposed activities.

f. Exploration and production activities will not be conducted within 1/2 mile of occupied brown bear dens unless alternative mitigation measures are approved by ADF&G.

g. If a licensee encounters an occupied brown bear den not previously identified by ADF&G, they shall report it to the Division of Wildlife Conservation, ADF&G, within 24 hours. The licensee will avoid conducting mobile activities 1/2 mile from discovered occupied dens unless alternative mitigation measures are approved by the director, with concurrence from ADF&G. Non-mobile facilities will not be required to relocate.

h. For projects in proximity to areas frequented by bears, the licensee is required to prepare and implement a human-bear interaction plan designed to minimize conflicts between bears and humans. The plan will include measures to:

    i. minimize attraction of bears to facility sites;

    ii. organize layout of buildings and work areas to minimize interactions between humans and bears;

    iii. warn personnel of bears near or on facilities and the proper actions to take;

    iv. if authorized, deter bears from the drill site;

    v. provide contingencies in the event bears do not leave the site;

    vi. discuss proper storage and disposal of materials that may be toxic to bears; and

    vii. provide a systematic record of bears on the site and in the immediate area.

i. A disturbance buffer of 660 feet must be implemented to reduce impacts to bald eagles and to avoid blasting and other activities that produce extremely loud noises within 1/2 mile of bald eagle nests (or within 1 mile in open areas), unless greater tolerance to the activity (or similar activity) has been demonstrated by the eagles in the nesting area. US Fish and Wildlife Service (USFWS) will identify bald eagle nest sites at the request of the operator.

j. If the operator discovers a previously unreported active or inactive bald eagle nest, the operator must report the nest location to the director as soon as possible. Operators are advised that activities likely to disturb nesting eagles are subject to the provisions of the Bald and Golden Eagle Protection Act.

k. Surface entry will be prohibited within 1/4 mile of trumpeter swan nesting sites from April 1 through August 31. The siting of permanent facilities, including roads, material sites, storage areas, powerlines, and above-ground pipelines are prohibited within 1/4 mile of known nesting sites. USFWS will identify trumpeter swan nesting sites at the request of the operator.

7. Subsistence, Commercial, and Sport Harvest Activities

a. License-related use will be restricted if necessary to prevent unreasonable conflicts with subsistence, commercial, or sport harvest activities. Traditional and customary access to subsistence areas will be maintained unless reasonable alternative access is provided to subsistence users. "Reasonable access" is access using means generally available to subsistence users. Licensees will consult nearby communities, and Native organizations for assistance in identifying and contacting local subsistence users.

b. Before submitting a plan of operations that has the potential to disrupt subsistence activities, the licensee will consult with the potentially affected subsistence communities (collectively "parties") to discuss the siting, timing, and methods of proposed operations and safeguards or mitigating measures that could be implemented by the operator to prevent unreasonable conflicts. The parties will also discuss the reasonably foreseeable effect on subsistence activities of any other operations in the area that they know will occur during the licensee's proposed operations. Through this consultation, the licensee will make reasonable efforts to ensure that activities are compatible with subsistence hunting and fishing activities and will not result in unreasonable interference with subsistence harvests.

8. Fuel and Hazardous Substances

a. Secondary containment must be provided for the storage of fuel or hazardous substances and sized as appropriate to container type and according to governing regulatory requirements in 18 AAC 75 and 40 CFR 112. Containers with an aggregate storage capacity of greater than 55 gallons that contain fuel or hazardous substances will not be stored within 100 feet of a waterbody, or within 1,500 feet of a current surface drinking water source.

b. During equipment storage or maintenance, the site must be protected from leaking or dripping fuel and hazardous substances by the placement of drip pans or other surface liners designed to catch and hold fluids under the equipment, or by creating an area for storage or maintenance using an impermeable liner or other suitable containment mechanism.

c. During fuel or hazardous substance transfer, secondary containment or a surface liner must be placed under all container or vehicle fuel tank inlet and outlet points, hose connections, and hose ends. Appropriate spill response equipment, sufficient to respond to a spill of up to 5 gallons, must be on hand during any transfer or handling of fuel or hazardous substances.

d. Vehicle refueling will not occur within the annual floodplain, except as addressed and approved in the plan of operations.

e. All independent fuel and hazardous substance containers must be marked with the contents and the licensee's or contractor's name using paint or a permanent label.

f. A freshwater aquifer monitoring well, and quarterly water quality monitoring are required down gradient of a permanent storage facility, unless alternative acceptable technology is approved by ADEC.

g. Waste from operations must be reduced, reused, or recycled to the maximum extent practicable. Garbage and domestic combustibles must be incinerated whenever possible or disposed of at an approved site in accordance with 18 AAC 60.

h. Proper disposal of garbage and putrescible waste is essential to minimize attraction of wildlife. The licensee must use the most appropriate and efficient method to achieve this goal. The primary method of garbage and putrescible waste is prompt, on-site incineration in compliance with State of Alaska air quality regulations. The secondary method of disposal is on-site storage in animal-proof containers with backhaul to an approved waste disposal facility. The tertiary method of disposal is on-site non-frozen storage in animal-proof containers with backhaul to an approved waste disposal facility. Daily backhauling of non-frozen waste is required unless safety considerations prevent it.

i. New solid waste disposal sites, other than for drilling waste, will not be approved or located on state property for exploration.

j. The preferred method for disposal of muds and cuttings from oil and gas activities is by underground injection. Drilling mud and cuttings will not be discharged into lakes, streams, rivers, or wetlands. On-pad temporary cuttings storage may be allowed as necessary to facilitate annular injection and backhaul operations.

9. Access

a. Except for approved off-road travel, exploration activities must be supported only by temporary roads, winter trails, existing road systems, or air service. Wintertime off-road travel across wetlands may be approved in areas where snow and frost depths are sufficient to protect the ground surface. Summertime off-road travel across wetlands may be authorized subject to time periods and vehicle types approved by DMLW. Exceptions may be granted by the director if it is determined that travel can be accomplished without damaging vegetation or the ground surface. Exceptions, including the use of gravel, may also be granted on a site-specific basis if it is determined that no practicable alternatives exist for constructing an exploration road or pad.

b. Public access to, or use of, the license areas may not be restricted except within the immediate vicinity of drill sites, buildings, and other related structures. Areas of restricted access must be identified in the plan of operations. Facilities and operations will not block access to or along navigable or public waters as defined in AS 38.05.965.

10. Prehistoric, Historic, and Archaeological Sites

a. Before the construction or placement of any structure, road, or facility supporting exploration, development, or production activities, the licensee must conduct an inventory of prehistoric, historic, and archaeological sites within the area, including a detailed analysis of the effects that might result from that construction or placement.

b. The inventory of prehistoric, historic, and archaeological sites must be submitted to the director and the Office of History and Archaeology (OHA), who will review and provide comments. If prehistoric, historic, or archeological sites or areas could be adversely affected by a license activity, then the director, after consultation with OHA and the MSB, will direct the licensee as to the course of action to take to avoid or minimize adverse effects.

c. If a site, structure, or object of prehistoric, historic, or archaeological significance is discovered during license operations, the licensee shall report the discovery to the director as soon as possible. The licensee will make all reasonable efforts to preserve and protect the discovered site, structure, or object from damage until the director, after consultation with the State Historic Preservation Office, has directed the licensee on the course of action to take for its preservation.

11. Hiring Practices

a. The licensee is encouraged to employ local and Alaska residents and contractors, to the extent they are available and qualified, for work performed in the License Area. The licensee will submit, as part of the plan of operations, a hiring plan that will include a description of the operator's plans for partnering with local communities to recruit, hire, and train local and Alaska residents and contractors. As a part of this plan, the licensee is encouraged to coordinate with employment and training services offered by the State of Alaska and local communities to train and recruit employees from local communities.

b. A plan of operations application must describe the licensee's past and prospective efforts to communicate with local communities and interested local community groups.

c. A plan of operations application must include a training program

   i. for all personnel including contractors and subcontractors;

   ii. designed to inform each person working on the project of environmental, social, and cultural concerns that relate to that person's job;

   iii. using methods to ensure personnel understand and use techniques necessary to preserve geological, archaeological, and biological resources; and

   iv. designed to help personnel increase their sensitivity and understanding of community values, customs, and lifestyles in areas where they will be operating.

B. Definitions

Facilities – Any structure, equipment, or improvement to the surface, whether temporary or permanent, including, but not limited to, roads, pads, pits, pipelines, power lines, generators, utilities, airstrips, wells, compressors, drill rigs, camps, and buildings.

Hazardous substance – As defined under 42 USC 9601 – 9675 (Comprehensive Environmental Response, Compensation, and Liability Act of 1980).

Important wetlands – Those wetlands that are of high value to fish, waterfowl, and shorebirds because of their unique characteristics or scarcity in the region or that have been determined to function at a high level using the hydrogeomorphic approach.

Minimize – To reduce adverse impacts to the smallest amount, extent, duration, size, or degree reasonable considering the environmental, social, or economic costs of further reduction.

Plan of operation – A plan of operations under 11 AAC 83.158 and a unit plan of operations under 11 AAC 83.346.

Practicable – Feasible in light of overall project purposes after considering cost, existing technology, and logistics of compliance with the mitigation measure.

Residential structure – a building used regularly as a residence;

Residential subdivision – a subdivision in which more than half of the parcels currently contain, or within the reasonably foreseeable future will contain, a residential structure;

Secondary containment – An impermeable diked area, portable impermeable containment structure, or integral containment space capable of containing the volume of the largest independent container. The container will, in the case of external containment, have enough additional capacity to allow for local precipitation. Minimum secondary requirements are identified in 18 AAC 75.075.

Sensitive public facility – a hospital, school, public library, or court building; and

Subdivision – a collection of land parcels whose legal description is determined by a single plat recorded at the State's Recorders Office.

Temporary – No more than 12 months.

C. References

DNR (Division of Oil and Gas Alaska Department of Natural Resources). 2004. Enforceable standards for development of state owned coalbed methane resources in the Matanuska-Susitna Borough. Anchorage, Alaska.

Appendix A: Summary of Comments and Responses

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Appendix A. Summary of Comments and Responses

AS 38.05.035(e)(7)(A) requires that written findings include a summary of agency and public comments, if any, and the Alaska Department of Natural Resources' (DNR's) responses to those comments. This appendix summarizes agency and public comments received in response to the August 27, 2025, preliminary written finding and the August 7, 2024, notice of intent to evaluate a gas exploration license proposal, request for competing proposals, and request for comments on exploration within the solicitation area, and the Alaska Department of Natural Resources' (DNR's) responses.

A. Comments and Responses on Exploration Licensing in the Solicitation Area

AS 38.05.035(e)(7)(A) requires that written findings include a summary of agency and public comments, if any, and the Alaska Department of Natural Resources' (DNR's) responses to those comments. This appendix summarizes agency and public comments received in response to the August 7, 2024, notice of intent to evaluate a gas exploration license proposal, request for competing proposals, and request for comments on exploration within the solicitation area, and the Alaska Department of Natural Resources' (DNR's) responses. Comments were received from 34 commenters (Table A.1). Comments were primarily from the public, 82 percent with 6 percent coming from non-governmental organizations, and 12 percent coming from tribal, community or governmental organizations and agencies. Comments received were coded for 21 topics grouped by issues for summary and response (Table A.2). By far the biggest issue was opposition expressed as the exploration license not being the state's best interest primarily due to potential impacts to the value of the region's habitat to support tourism, recreation, and subsistence resources.

Table A.1. Commenter groups for solicitation comments.

Commenter Group	Solicitation Comments Submitted
Government Agency	1
Community Councils	2
Non-Governmental Organizations	2
Tribal Organizations	1
Public	28
Total	34

Agency comments were received from the Matanuska-Susitna Borough's Fish and Wildlife Commission. They provided information on fish and wildlife populations and uses in the License Areas that were incorporated into Chapters Four, Five, and Eight. The Chickaloon Village Traditional Council submitted comments that were related to habitat and water quality impacts that were incorporated into Chapters Four, Five, and Eight. The Willow Area Community Organization, Talkeetna Community Council, Susitna River Coalition, and Cook Inlet Keeper submitted comments concerning a broad range of topics that covered many of the summarized issues of concern. The comments are categorized in the following tables and are also summarized in the text below.

Table A.2. Issue and comment topics for solicitation comment summary and response.

Issue	Comment Topics	Topic Code	Responses
Process	Comment deadline – extension request	1	1
Process	Inadequate public notice – exploration license process	2	1
Air & Water	Air pollution, green house gas emissions, and fugitive dust	3	9
Air & Water	Surface water quality/quantity impacts	4	15
Air & Water	Fracking - aquifer contamination, seismic effects	5	5
Air & Water	Contamination/spill impacts	6	5
Habitat	Intact ecosystem/wilderness values/fragmentation	7	22
Habitat	Riverine/riparian/salmon habitat impacts	8	19
Habitat	Moose fall/winter habitats, and hunting	9	12
Habitat	Bear habitat	10	1
Habitat	Special area protection	11	2
Socio-Economic	Private property impacts	12	12
Socio-Economic	Tourism, recreation, subsistence impacts	13	20
Socio-Economic	Salmon/Cook Inlet commercial fisheries impacts	14	5
Climate Change	No more fossil fuels - causes climate change	15	2
Climate Change	Impacts on salmon - warming streams	16	2
Climate Change	State should focus on renewable energy	17	2
Best Interest	Not in the state's best interest because of economics applicant ability and restoration costs	18	5
Best Interest	Not in the state's best interest; Requested specific areas withdrawn	19	8
Best Interest	Not in the state's best interest; Oil and gas inconsistent with area plan goals	20	5
Best Interest	Not in the state’s best interest; Failed to consider cumulative effects – other projects/uses	21	10
Best Interest	Support for oil and gas exploration and development	22	5

1. Process Issues

Public review process issues included one request for an extension of the comment period. The comment period extension request noted that area residents were busy with fishing and tourism and were unable to review and comment on the solicitation during the public comment period from August 7, 2024, to September 7, 2024.

DNR Response: The notice of intent to evaluate the gas exploration license application was published on August 7, 2024, with an original comment deadline of September 7, 2024, consistent with the required 30-day review and comment period (AS 38.05.945). The notice was published in the Alaska Dispatch News, Frontiersman, as well as on DNR’s Online Public Notice and Division of Oil and Gas’s (DO&G’s) webpages. Notices were sent to post offices in communities near the License Areas, and notification was sent by email and mail to the nearby tribal organizations, villages and native regional corporations. Notice was also sent by email to all subscribers to the DO&G Leasing listserv. The comment period was extended on August 21, 2024, to add 30 days and established a new comment deadline of October 7, 2024. DO&G considered all agency and public comments submitted in response to this notice regardless of when it was received. Additional opportunities for public review and comment were provided with publication of the preliminary best interest finding, and opportunity to comment on specific projects will occur with notice of a plan of operations.

2. Air and Water Resources Issues

Several commenters expressed concerns that oil and gas exploration and development activities would impact air and water quality through emission and spills that pollute air and water. Specific concerns included: air pollution from machinery and facility emissions (26 percent); surface water quality and quantity impacts from infrastructure, industrial discharges, and use of surface waters (44 percent); and aquifer contamination, damage from fracking, and potential for induced seismic effects from fracking (15 percent); and contamination and spill impacts (15 percent).

DNR Response: The potential for reasonably foreseeable cumulative effects from gas exploration activities on air and water quality is evaluated in Chapter Eight. Air emissions and waste discharge are regulated by the Alaska Department of Environmental Conservation (ADEC) to prevent deterioration of air or water quality. Potential facility emissions and discharges would likely require permits. Construction of facilities would be required to follow best management practices to protect surface water quality and hydrology. Surface and subsurface water use would require authorization from DO&G or DNR's Division of Mining, Land and Water (DMLW). The Alaska Oil and Gas Conservation Commission (AOGCC) requires that all oil and gas wells are constructed with barriers to protect drinking water aquifers. Potential for groundwater contamination and disposal of produced water from production of gas from coal beds are discussed in Chapter Eight. Mitigation measures are included in Chapter Nine of this best interest finding to reduce and minimize potential impacts especially on setbacks from streams and rivers and impacts to water quality including important fish rearing habitat, as well as impacts to residential, recreation, and sensitive habitat areas.

While some leakage and fugitive emissions of methane would undoubtedly occur as described in Chapter Eight, unlike other states the Alaska Oil and Gas Conservation Commission (AOGCC) prohibits non-upset condition flaring and venting of gas and considers these actions as well as facility and pipeline leaks as waste of the state's resource. Gas production and transmission facilities would be required to control emissions and comply with all applicable federal and state air quality regulations as discussed in Chapter Eight and Chapter Seven including the United States Environmental Protection Agency's (EPA's) New Source Performance Standards to reduce emissions of greenhouse gases and volatile organic compounds, as applicable. Additional discussion of fugitive methane emissions from natural gas production and the related contribution to greenhouse gas emissions were added to Chapter Eight. DO&G concludes that federal and state air quality permitting, and emission control regulations are adequate to prevent significant deterioration of air quality within the License Areas.

Because natural gas, which may include toxic hydrogen sulfide, is generally heavier than air, if released to the atmosphere these gases may concentrate in nearby low-lying areas where oxygen may be displaced rendering the atmosphere hazardous to humans. The posting of warning signs would be intended to prevent exposure to potentially hazardous air conditions. Warning signs do not necessarily mean that hazardous air conditions exist, but that there is a potential for hazardous conditions. Whether similar circumstances and signage could occur because of issuance of these exploration licenses is unknown but unlikely because gas wells and facilities are required to be sited away from residences and to control emissions. Most potential oil and gas toxic air quality conditions are confined to the immediate vicinity of facilities and are rapidly dispersed by winds. Potential for similar site-specific air quality impacts, with warning signs that may be required by Occupational Health and Safety Administration regulations, would be evaluated during development of the plan of operations.

DO&G agrees that concerns over produced water management, groundwater and aquifer contamination and drawdown, and reduced groundwater input to streams and rivers with consequences for salmon habitat suitability are potential significant cumulative effects from production of coalbed methane. These reasonably foreseeable cumulative effects on water resources in the License Areas are considered and discussed in Chapter Eight and mitigation designed to minimize these potential effects is presented in Chapter Nine. Understanding groundwater recharge and discharge in the region as well as site specific lithology that would identify whether impermeable cap rocks are present are essential to prevent aquifer contamination with methane, water user conflicts, and damage to salmon habitat from dewatering. Current use of water resources in the Susitna basin includes surface and subsurface water rights, and ADF&G instream flow reservations for the protection of salmon habitat. DO&G concludes that additional site-specific information may be required to adequately evaluate potential natural gas or coalbed methane impacts on groundwater, aquifers, and streambed upwelling. DO&G recommends that mitigation measures addressing water management in Chapter Nine should include ADF&G's instream flow reservations to ensure protection of salmon habitat.

DO&G describes and discusses the process of hydraulic fracturing and its application in opening cracks in coalbeds to facilitate methane production in Chapter Eight; but DO&G does not state that hydraulic fracturing is always required to produce methane from coalbeds. Although the applicant currently may not anticipate using this process, hydraulic fracturing could be proposed for development and production if a commercially viable resource is identified. Alaska Oil and Gas Conservation Commission (AOGCC) regulates drilling and hydraulic fracturing. Measures in this finding prohibit the use of diesel in fracking fluids and require public disclosure of the composition of fluids used for hydraulic fracturing. Induced or triggered earthquakes may occur from underground injection of large quantities of produced water and hydraulic fracturing of rock formations, although most underground injection and fracking does not result in induced earthquakes. Induced earthquakes are generally small-magnitude and shallow resulting from increased pore pressure that changes stress conditions on or within a fault surface that allow the fault to slip. Induced earthquakes are difficult to separate from natural tectonic quakes. DO&G concludes that hydraulic fracking and underground injection are adequately regulated and have been used safely in Alaska. DO&G concludes that current regulatory controls and mitigation measures are sufficient that potential widespread environmental damage and pollution from exploration and production of natural gas or coalbed methane would be avoided and minimized.

3. Habitat Issues

Concerns over habitat were expressed at two levels regional and localized. At the regional level, concern was that oil and gas development would damage the intact ecosystem and wilderness value of the region. This was a topic addressed by 65 percent of the commenters. The Susitna basin's value for pristine riverine, riparian, and salmon habitat was also a regional concern that was a topic of the from letter, that was also addressed by 56 percent of the commenters. Localized and specific concerns were expressed in the comments for potential oil and gas impacts to moose fall and winter habitat and bear habitat at salmon spawning streams that were voiced by 35 and 3 percent of the commenters, respectively. Potential impacts to designated special areas were a concern for two commenters (6 percent).

DNR Response:

DO&G acknowledges and discusses the value and potential cumulative effects of gas and coalbed methane exploration and development on terrestrial and aquatic habitats that support fish and wildlife populations and are important for recreation, tourism, fishing and hunting in the License Areas. Habitats and fish and wildlife populations and their uses are considered and discussed in Chapters Four and Five. Discussion of potential cumulative effects on habitats and fish and wildlife from coalbed methane exploration, development, production, and transportation are in Chapter Eight with brief discussion of mitigation designed to minimize potential impacts.

A relatively small portion of state lands within the License Areas are classified for public recreation; area plans classify approximately 40 percent of lands for forestry, 23 percent for wildlife habitat or water resources, 15 percent for settlement, and 6 percent for agriculture.

Salmon habitats are protected, and pipeline crossings would be directionally drilled beneath stream beds to prevent disturbance to instream habitat. New facilities are required to be located away from lakes and rivers, and stream crossings must be designed and maintained to allow fish passage. The potential for dewatering of streams through streambed leakage into underlying aquifers due to coalbed dewatering is discussed in Chapter Eight. This discussion includes a discussion of the potential for altered summer stream temperatures if groundwater upwelling is reduced through dewatering of coals to produce methane. As discussed in Chapter Eight, where aquifers are isolated, dewatering coalbeds to produce methane should not impact drinking water aquifers or shallow groundwater. There may be several impermeable layers between coalbeds and sand and gravel aquifers in the License Areas, although site-specific studies and monitoring would likely be required to determine coalbed and groundwater connectivity or isolation. Where there is interconnectivity between shallow groundwater, aquifers, and coalbeds dewatering one may result in lowering water levels in overlying aquifers, dewatering streambeds, and lowering water levels in wetlands and lakes. If there is a significant potential for coalbed methane water withdrawal to affect current water users, mitigation measures in Chapter Nine require licensees to monitor baseline pre-withdrawal conditions and water availability in the area of concern which may include measurements of water table depth or piezometric head, establishment of monitoring wells, or monitoring of existing wells or other measures as appropriate.

4. Socio-Economic Issues

Socio-economic issues are linked to the value of the region for supporting tourism, recreation, subsistence, and Cook Inlet commercial salmon fisheries. Tourism, recreation, and Cook Inlet commercial fishery impacts were the focus of several commenters. Of these issues, tourism, recreation, and subsistence impacts were a concern for 20 commenters (58 percent). Twelve commenters expressed concerns about potential impacts to private property (35 percent). The potential impacts to commercial fishing and the Cook Inlet fishery were noted by 15 percent of the commenters.

DNR response: DNR acknowledges the value of the License Areas to support tourism, recreation, subsistence and Cook Inlet commercial salmon fisheries as discussed in Chapter Five. DNR does not conclude that oil and gas exploration and development in the License Areas would preclude or be inconsistent with these values and would ensure that appropriate best management practices and mitigation measures are incorporated to allow for safe exploration and potential development that maintains the resource values that support tourism, recreation, and Cook Inlet salmon fisheries.

In response to concerns about potential impacts to private and agricultural lands, DO&G included information in Chapter Five and Chapter Eight that quantify the area and value of private lands within the License Areas based on Matanuska-Susitna Borough appraised values of land and improvements. Additionally, in response to the concerns around private property impacts, the DO&G reduced the footprint of the proposed License Areas to limit the potential for private property impacts. Reasonably foreseeable cumulative effects from coalbed methane development on rural and agricultural lands were researched and summarized in Chapter Eight. This research identified community and landowner issues similar to those expressed by commenters. Payment for use of and restoration of damages caused by the licensee or operators to the surface estate are the subject of surface use agreements. Where split estate landowners negotiated successful surface use agreements and had positive interactions with local company representatives, positive effects for national energy security, increased off-farm employment and income, and farm infrastructure improvements were noted.

DO&G has included mitigation measures based on DNR's Enforceable Standards that address facility siting, noise and visual impacts, traffic and road impacts, surface use agreements, and water management. At the disposal phase, before a plan of exploration or development is submitted, the schedule, location, and extent of potential impacts on private or agricultural lands are unknown. DO&G has considered and discussed reasonably foreseeable cumulative effects of natural gas and coalbed methane exploration and development generally without knowing specific locations where activities could occur within the License Areas. After considering applicable regulatory controls and measures included in this finding DO&G concludes that most impacts to private and agricultural lands associated with exploration, development, and transportation of natural gas within and from the License Areas can be successfully minimized, restored, or compensated.

A recent estimate for the economic impact of visitors to the MSB is summarized in Chapter Five, including state-wide trends in visitor volumes and a list of important recreational resources within the License Areas. Additional information on recreational use is included in Chapter Five. Potential cumulative effects on recreation and tourism and fish and wildlife uses, including subsistence, are considered and discussed in Chapter Eight. Known historical and cultural resources are discussed in

Chapter Three, with potential impacts and survey and other mitigation requirements discussed in Chapter Eight. Mitigation discussed in Chapter Eight and Chapter Nine includes requirements for completion of surveys for prehistoric, historic, and archaeological sites prior to any construction; and notification and preservation of any previously unknown sites discovered during construction or operations. DO&G concludes, based on its reviews, that the greatest potential effects on tourism and recreation would occur primarily during construction of facilities which would be short-term and that with implementation of regulatory controls, and the required mitigation measures for visual, noise, and traffic impacts, potential effects on recreational use of the License Areas would be minimized.

The value of commercial fisheries supported by salmon runs in the Susitna Basin is discussed in Chapter Five. Coalbed dewatering during production and management of produced water would have the greatest potential for cumulative effects on salmon spawning and rearing habitats in the License Areas. Mitigation measures designed to protect riparian habitats, groundwater availability, and fish are included in Chapter Nine. DO&G concludes that potential impacts associated with exploration, development, and transportation of natural gas within and from the License Areas on salmon habitats and populations that support commercial, recreational, and subsistence fisheries would be avoided or minimized.

5. Climate Change Issues

Several commenters opposed granting an exploration license because they are against the development of any fossil fuels because they credit the burning of fossil fuels for causing climate change (15 percent). Two commenters cited climate change for warming streams above the threshold for supporting healthy salmon populations (6 percent). Considering climate change, 6 percent of commenters recommended that the state turn away from a reliance on oil and gas production and revenues and focus on developing renewable energy projects.

DNR response: DNR has identified and described local climate and recent climate change in in the Written Finding. Emissions from oil and gas exploration and development would be subject to regulation under ADEC's air quality regulations described in Chapter Seven. As discussed in Chapters Six and Eight, carbon sequestration in the coalbeds provides an opportunity for the operator to reduce the emission of greenhouse gases into the environment while enhancing the recovery of the resource. The function of DO&G is to manage state lands for oil, gas, and geothermal exploration and development to maximize prudent use of resources for the greatest benefit for all Alaskans.

Climate change in Alaska with an emphasis of climate change impacts that are occurring in the Susitna basin including increasing summer stream temperatures, wildland fires, and changes in precipitation are discussed in Chapter Three and Chapter Five. The climate change section in Chapter Three includes specific information on climate change impacts occurring in southcentral Alaska and the associated costs of these impacts. Chapter Eight addresses potential coalbed methane emissions including fugitive methane emissions from leaking wells, process facilities, pipelines, venting, and flaring. The fugitive methane emissions discussion includes references and EPA's New Source Pollutant Standards designed to control these fugitive methane emissions. In

Alaska, Alaska Oil and Gas Conservation Commission regulates flaring and venting of natural gas during non-upset conditions to conserve the state's resource.

DO&G acknowledges and discusses that exploration and production of natural gas or coalbed methane in the License Areas would produce emissions that could contribute to global climate change. Many Alaskan households depend primarily on natural gas for home heating, 49 percent, followed by fuel oil, 31 percent, and electricity 12 percent for home heating. Compared to firewood and fuel oil, natural gas used for home heating burns more completely and produces fewer emissions, including fewer particulate emissions which can contribute to air quality issues in Alaska. States that switch to natural gas from high CO_2-intensity heating oil and propane fuels achieved greater emission intensity reduction. In the United States residential natural gas consumption, and consequent CO_2 emissions, has remained essentially flat for nearly 50 years, despite an increase of 32 million residential customers. Improvements in energy efficiency, more efficient appliances and equipment, utility efficiency programs, and consumer consumption behavioral changes have contributed to a growing number of customers using the same amount of natural gas (Zabor et al. 2019). Natural gas also is used to generate 42 percent of Alaska's utility-scale electricity (EIA 2022). Compared to coalfired power plants, natural gas power plants produce fewer emissions.

Alaska continues to encourage the exploration and development of its renewable energy resources including geothermal energy which is delegated to DO&G. In 2020, renewable energy accounted for about 31 percent of Alaska's utility-scale electricity generation, with hydropower accounting for 90 percent of renewable electricity followed by wind and biomass (EIA 2022).

6. Best Interest Issues

Opposition to granting an exploration license in the Susitna Valley was expressed by 85 percent of commenters who felt that granting a license was not in the state's best interest. Five commenters (15 percent) stated opposition to granting the Exploration Licenses because of the economics of the project and the high cost and challenges of environmental restoration (15 percent). Several community organizations, NGOs, and public commenters noted that oil and gas exploration and development in the region was inconsistent with area plan management and goals (15 percent). Several commenters requested specific areas be withdrawn from or that stipulation be added to the license area (24 percent). Ten commenters stated the proposed exploration project was not in the state's best interest because of the cumulative impacts and not taking into account the importance of other projects and uses of the area (29 percent). Five commenters submitted information supporting oil and gas exploration and development in the License Areas that was largely based on the state's need for bringing gas to market and improving the state's economy (15 percent).

DNR response: DNR considers potential impacts to habitats in the area and considers the value and use of these habitats when developing a disposal decision. After considering the value of the waters for supporting commercial and sport fisheries; moose and bear habitats; and the value of the License Areas for recreation and tourism, mitigation measures were selected to reduce conflicts between oil and gas activities and these important resources and other uses. Mitigation measures which may include seasonal restrictions in concert with buffer zones from anadromous rivers and streams on shore are in place to eliminate conflicts with sport and subsistence fishing activities in and around the License Areas.

The exploration licensing process is described in Chapter Two. As described in Chapter One, DO&G issued notice on August 7, 2024, of the intent to evaluate this exploration license proposal and requested competing proposals at this time. No competing proposals were submitted. Information on the status of current natural gas supplies and usage in Cook Inlet was included in Chapter Six along with a description of the level of uncertainty for conventional natural gas and coalbed methane resource potential within the License Areas. The potential economic viability of coalbed methane production in the License Areas would depend on identification of a commercially viable resource and that is beyond the scope of this administrative review. DO&G does not consider that damages from natural gas or coalbed methane activities would be extensive, unavoidable, unmitigable, or irreparable and has described regulatory controls and developed specific mitigation measures to minimize potential impacts. DO&G considers that these controls and measures would prevent extensive environmental damage and that current uses of the License Areas are not incompatible with regulated and mitigated natural gas (including coalbed methane) exploration, development, or transportation.

Commenters requested that specific areas be excluded from the License Areas including: all private surface estate lands; Nancy Lake and Willow Creek state recreation areas; Susitna Basin Recreational Rivers; and Willow Area Community Organization boundary. As discussed under socio-economic issues above, the state is required to retain the mineral estate when disposing of the surface estate with the intent that the state provides for its citizens and funds its government though development of its natural resources. Additionally, the majority of the lands identified as in conflict with oil and gas exploration and development were eliminated from the proposed License Areas in this finding. As discussed in Chapter Eight, oil and gas fees and royalties continue to fund substantial portion of Alaska's government and earnings from Alaska's Permanent Fund, established from oil and gas revenues, provide the majority of government funding while continuing to provide dividends for Alaskans. We do not anticipate that exploration, development, or transportation of natural gas or coalbed methane would focus on or prevent use of state recreation areas or private lands within the License Areas.

DO&G described existing transportation facilities and potential access to the License Areas in Chapter Five and Chapter Eight. DO&G describes the current and projected use of the License Areas in Chapter Five and considers and discusses reasonably foreseeable cumulative effects of natural gas and coalbed methane exploration and development on resources and uses of the License Areas in Chapter Eight. These discussions include reasonably foreseeable cumulative effects of natural gas and coalbed methane exploration on existing uses and renewable freshwater resources as well as regulatory controls and mitigation measures designed to avoid and minimize these cumulative effects.

EIA (United States Energy Information Administration). 2022. Alaska state energy profile. Last Modified February 17, 2022. https://www.eia.gov/state/print.php?sid=AK#60 (Accessed March 21, 2022).

Zabor, B., B. Kemp, N. Pinchuk, J. Shah, and S. Liu. 2019. Opportunities for reducing greenhouse gas emissions through emerging natural gas direct-use technologies. American Gas Foundation December 2019. Washington, DC. https://gasfoundation.org/2019/12/18/opportunities-for-reducing-greenhouse-gas-emissions-through-emerging-natural-gas-direct-use-technologies/ (Accessed March 21, 2022).

Table A.3. Comment topics by commenter for issues on the solicitation.

	Response Topic Codes by Issue																					
	Process		Air & Water				Habitat					Socio-Economic			Climate Chage			Best Interest				
Commenter	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Agency																						
Matanuska Susitna Borough Fish and Wildlife Commission				1	1		1	1	1				1	1					1			
Agency Total				**1**	**1**		**1**	**1**	**1**				**1**	**1**					**1**			
Tribal Councils																						
Chickaloon Village Traditional Council				1			1	1														
Communities																						
Talkeetna Community Council Inc.			1	1	1			1	1			1	1						1	1		
Willow Area Community Organization				1			1					1	1					1	1	1		
Community Total																						
NGO																						
Cook Inletkeeper			1	1	1		1	1	1				1		1	1					1	
Susitna River Coalition	1			1		1	1	1	1				1					1	1	1	1	
NGO Total																						
Public																						

Commenter	Response Topic Codes by Issue																					
	Process		Air & Water				Habitat					Socio-Economic			Climate Chage			Best Interest				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Cuthriell, Adam													1	1							1	
Ellithrope, Dennis								1	1													
Brown, Barbara							1										1					
Long, Becky			1	1			1	1	1				1	1	1	1		1	1		1	
Potter, Caitlin							1	1				1									1	
Richards, Edwin																						1
Farkas, Gerard																						1
Buskirk, Jane			1	1			1	1				1	1									
Kliniski, Janice			1			1	1	1	1	1		1	1	1				1	1	1		
Woods, Jennifer							1	1														
Tymick, Judy		1					1	1	1				1						1			
Ellithrope, Silas								1				1	1	1								
Hogan, Sara			1	1			1						1									
Ransy, Denis			1	1		1	1	1	1			1										
Santana, Barry				1			1						1						1		1	
Markis, Constance							1	1			1		1								1	
Wahl, Julie			1	1		1	1						1				1					
Walker, Kara				1			1	1														
Hinshaw, Karen			1	1			1	1	1			1									1	
Wright, Laura				1	1		1	1	1		1	1	1							1		
Breinholt, Michelle					1								1					1				
Williams, Rick																						1
Brooks, Ryan												1	1								1	
Hogan, Sara						1	1						1									
Blackstone, Sarah							1					1									1	
Elithorpe, Silas								1	1			1	1									
Smith, Stewart																						1
Krug, Tim																						1
TOTALS	1	1	9	15	5	5	22	19	12	1	2	12	20	5	2	2	2	5	8	5	10	5

Commenter	Response Topic Codes by Issue																					
	Process		Air & Water				Habitat					Socio-Economic			Climate Chage			Best Interest				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22

Notes: See Table A.5 for brief topic subjects. Form letters identified with Yes, + means with additional text, - means with removed test. Abbreviations: ADF&G = Alaska Department of Fish and Game; DNR = Alaska Department of Natural Resources; DOA = Division of Agriculture; DOF = Division of Forestry; AMHTA = Alaska Mental Health Trust Authority; CVTC = Chickaloon Village Traditional Council; TCCI = Talkeetna Community Council, Inc.; WACO = Willow Area Community Council; NOLS = National Outdoor Leadership School; NGO = Non-Governmental Organization; CAN = Yukon, Canada.

B. Comments and Responses on the Preliminary Written Finding of the Director

This section summarizes agency and public comments received in response to the preliminary written finding issued on August 27, 2025. A total of 35 comment letters/emails were received from 32 commenters (Table A.4). Comments were primarily from the public. Comment emails were coded for 23 topics grouped by issues for summary and response (Table A.5). Two of two community councils, three non-governmental organizations (NGOs), and 24 members of the public submitted comments in response to the Preliminary Finding.

Table A.4. Commenter groups for the Preliminary Finding comments.

Commenter Group	Preliminary Finding Comments Submitted
Government Agency	1
Community Councils	2
Non-Governmental Organizations	3
Tribal Organizations	0
Public	26
Total	32

Table A.5. Issue and comment topics on the Preliminary Finding; comment summary and response.

Issue	Comment Topics	Topic Code	Responses
Process	Comment deadline – extension request	1	1
Process	Inadequate public notice	2	2
Air & Water	Air pollution, green house gas emissions, and fugitive dust	3	1
Air & Water	Surface water quality/quantity impact s	4	21
Air & Water	Aquifer contamination and depletion	5	13
Air & Water	Contamination/spill impacts	6	13
Habitat	Intact ecosystem/wilderness values/fragmentation	7	21
Habitat	Riverine/riparian/salmon habitat impacts	8	2
Habitat	Moose fall/winter habitats, and hunting	9	14
Socio-Economic	Private property impacts and split estate issues	10	16
Socio-Economic	Tourism, recreation, subsistence impacts	11	3
Socio-Economic	Salmon/Cook Inlet commercial fisheries impacts	12	5
Climate Change	Impacts on salmon - warming streams	13	3
Climate Change	State should focus on renewable energy	14	15
Policy	Conduct a waterbodies survey and create a map	15	17
Policy	Reduce size of License Areas and Shorten term of Licenses	16	13
Policy	Provide map of proposed drilling sites	17	3
Policy	Administrative Order 360	18	9

Issue	Comment Topics	Topic Code	Responses
Best Interest	Not in the state's best interest because of economics applicant ability and restoration costs	19	5
Best Interest	Not in the state's best interest; Requested specific areas withdrawn	20	20
Best Interest	Not in the state’s best interest; Failed to consider cumulative effects – other projects/uses	21	10
Best Interest	Not in the state’s best interest because of concerns specific to coalbed methane activities	22	16
Best Interest	Support for oil and gas exploration and development		1

1. Process Issues

Public review process issues included one request for an extension of the comment period. The comment period extension request noted that area residents were busy with fishing and tourism and were unable to review and comment on the Preliminary Written Finding of the Director during the public comment period from August 25, 2025, to September 30, 2025. One commenter requested documentation of consultation with the tribes and village corporations that could be impacted by the proposed Exploration Licenses. They stated it is essential that the licensing and permitting process meaningfully incorporate community and Tribal input at every stage. They stated that neighboring community councils had not been informed of the opportunity to engage in the public comment process, and that nearby property owners should be directly notified of the opportunity to provide public comment.

DNR Response: The Susitna Valley Gas Exploration License Preliminary Written Finding of the Director was published on August 25, 2025, with an original comment deadline of September 30, 2025, consistent with the required 30-day review and comment period (AS 38.05.945). The notice was published in the Alaska Dispatch News, as well as on DNR’s Online Public Notice and Division of Oil and Gas’s (DO&G’s) webpages. Notices were sent to post offices in communities near the License Areas, and notification was sent by email and mail to the nearby tribal organizations, villages and native regional corporations. Notice was also sent by email to all subscribers to the DO&G Leasing listserv. The comment period was extended on September 12, 2025 to add 30 additional days and established a new comment deadline of October 30, 2025. Additional opportunities for public review and comment will be provided on specific projects which will occur with notice of any future actions including any future plan of operations.

2. Air and Water Resources Issues

Several commenters expressed concerns that coalbed methane and gas exploration and development activities would impact air and water quality through emission and spills that pollute air and water. Specific concerns included: air pollution from machinery and facility emissions; surface water quality and quantity impacts from infrastructure, industrial discharges, and use of surface waters; and aquifer contamination, aquifer degradation from improper management of produced water; and contamination and spill impacts.

DNR Response: The potential for reasonably foreseeable cumulative effects from gas exploration activities on air and water quality is evaluated in Chapter Eight. Air emissions and waste discharge are regulated by the Alaska Department of Environmental Conservation (ADEC) to prevent deterioration of air or water quality. Potential facility emissions and discharges would likely require permits. Construction of facilities would be required to follow best management practices to protect surface water quality and hydrology. Surface and subsurface water use would require authorization from DO&G or DNR's Division of Mining, Land and Water (DMLW). The Alaska Oil and Gas Conservation Commission (AOGCC) requires that all oil and gas wells are constructed with barriers to protect drinking water aquifers. Potential for groundwater contamination and disposal of produced water from production of gas from coal beds are discussed in Chapter Eight. Mitigation measures are included in Chapter Nine of this best interest finding to reduce and minimize potential impacts especially on setbacks from streams and rivers and impacts to water quality including important fish rearing habitat, as well as impacts to residential, recreation, and sensitive habitat areas.

While some leakage and fugitive emissions of methane would undoubtedly occur as described in Chapter Eight, unlike other states the Alaska Oil and Gas Conservation Commission (AOGCC) prohibits non-upset condition flaring and venting of gas and considers these actions as well as facility and pipeline leaks as waste of the state's resource. AOGCC also regulates other subsurface activities including the reinjection of produced water. Because coalbed methane is a target of this exploration license, large amounts of produced water are expected to be a part of the exploration, production, and development activities. DO&G agrees that concerns over produced water management, groundwater and aquifer contamination and drawdown, and reduced groundwater input to streams and rivers with consequences for salmon habitat suitability are potential significant cumulative effects from production of coalbed methane. These reasonably foreseeable cumulative effects on water resources in the License Areas are considered and discussed in Chapter Eight and mitigation designed to minimize these potential effects is presented in Chapter Nine.

Understanding groundwater recharge and discharge in the region as well as site specific lithology that would identify whether impermeable cap rocks are present are essential to prevent aquifer contamination with methane, water user conflicts, and damage to salmon habitat from dewatering. Current use of water resources in the Susitna basin includes surface and subsurface water rights, and ADF&G instream flow reservations for the protection of salmon habitat. DO&G concludes that additional site-specific information may be required to adequately evaluate potential natural gas or coalbed methane impacts on groundwater, aquifers, and streambed upwelling. DO&G recommends that mitigation measures addressing water management in Chapter Nine should include ADF&G's instream flow reservations to ensure protection of salmon habitat.

Gas production and transmission facilities would be required to control emissions and comply with all applicable federal and state air quality regulations as discussed in Chapter Eight and Chapter Seven including the United States Environmental Protection Agency's (EPA's) New Source Performance Standards to reduce emissions of greenhouse gases and volatile organic compounds, as applicable. Additional discussion of fugitive methane emissions from natural gas production and the related contribution to greenhouse gas emissions were added to Chapter Eight. DO&G concludes that federal and state air quality permitting, and emission control regulations are adequate to prevent significant deterioration of air quality within the License Areas.

Because natural gas, which may include toxic hydrogen sulfide, is generally heavier than air, if released to the atmosphere these gases may concentrate in nearby low-lying areas where oxygen may be displaced rendering the atmosphere hazardous to humans. The posting of warning signs would be intended to prevent exposure to potentially hazardous air conditions. Warning signs do not necessarily mean that hazardous air conditions exist, but that there is a potential for hazardous conditions. Whether similar circumstances and signage could occur because of issuance of these exploration licenses is unknown but unlikely because gas wells and facilities are required to be sited away from residences and to control emissions. Most potential oil and gas toxic air quality conditions are confined to the immediate vicinity of facilities and are rapidly dispersed by winds. Potential for similar site-specific air quality impacts, with warning signs that may be required by Occupational Health and Safety Administration regulations, would be evaluated during development of the plan of operations.

DO&G describes and discusses the process of hydraulic fracturing and its application in opening cracks in coalbeds to facilitate methane production in Chapter Eight; but DO&G does not state that hydraulic fracturing is always required to produce methane from coalbeds. Although the applicant currently may not anticipate using this process, hydraulic fracturing could be proposed for development and production if a commercially viable resource is identified. AOGCC regulates drilling and hydraulic fracturing. Measures in this finding prohibit the use of diesel in fracking fluids and require public disclosure of the composition of fluids used for hydraulic fracturing. Induced or triggered earthquakes may occur from underground injection of large quantities of produced water and hydraulic fracturing of rock formations, although most underground injection and fracking does not result in induced earthquakes. Induced earthquakes are generally small magnitude and shallow resulting from increased pore pressure that changes stress conditions on or within a fault surface that allow the fault to slip. Induced earthquakes are difficult to separate from natural tectonic quakes. DO&G concludes that hydraulic fracking and underground injection are adequately regulated and have been used safely in Alaska. DO&G concludes that current regulatory controls and mitigation measures are sufficient that potential widespread environmental damage and pollution from exploration and production of natural gas or coalbed methane would be avoided and minimized.

3. Habitat Issues

Concerns over habitat were expressed at two levels regional and localized. At the regional level concern was that oil and gas development would damage the intact ecosystem and wilderness value of the region. The Susitna basin's value for pristine riverine, riparian, and salmon habitat was also a regional concern that was a topic of concern from the public. Localized and specific concerns were expressed in the comments for potential oil and gas impacts to moose fall and winter habitat and riparian habitat at salmon spawning streams.

DNR Response:

DO&G acknowledges and discusses the value and potential cumulative effects of gas and coalbed methane exploration and development on terrestrial and aquatic habitats that support fish and wildlife populations and are important for recreation, tourism, fishing and hunting in the License Areas. Habitats and fish and wildlife populations and their uses are considered and discussed in Chapters Four and Five. Discussion of potential cumulative effects on habitats and fish and wildlife from coalbed methane exploration, development, production, and transportation are in Chapter

Eight including a discussion of mitigation measures designed to minimized potential impacts which are included in Chapter Nine.

Salmon habitats are protected and pipeline crossings would be directionally drilled beneath stream beds to prevent disturbance to instream habitat. Mitigation measures require that any new facilities are be located away from lakes and rivers and stream crossing must be designed and maintained to allow fish passage. The potential for dewatering of streams through streambed leakage into underlying aquifers due to coalbed dewatering is discussed in Chapter Eight. This discussion includes a discussion of the potential for altered summer stream temperatures if groundwater upwelling is reduced through dewatering of coals to produce methane. As discussed in Chapter Eight, where aquifers are isolated, dewatering coalbeds to produce methane should not impact drinking water aquifers or shallow groundwater. There may be several impermeable layers between coalbeds and sand and gravel aquifers in the License Areas, although site-specific studies and monitoring would likely be required to determine coalbed and groundwater connectivity or isolation. Where there is interconnectivity between shallow groundwater, aquifers, and coalbeds dewatering one may result in lowering water levels in overlying aquifers, dewatering streambeds, and lowering water levels in wetlands and lakes. If there is a significant potential for coalbed methane water withdrawal to affect current water users, mitigation measures in Chapter Nine require licensees to monitor baseline pre-withdrawal conditions and water availability in the area of concern which may include measurements of water table depth or piezometric head, establishment of monitoring wells, or monitoring of existing wells or other measures as appropriate.

4. Socio-Economic Issues

Socio-economic issues are linked to the value of the region for supporting tourism, recreation, subsistence, and Cook Inlet commercial salmon fisheries. Tourism, recreation, and Cook Inlet commercial fishery impacts were the focus of several commenters. Of these issues, tourism, recreation, and subsistence impacts were a primary concern. Other commenters expressed concerns for potential impacts to private property. The potential impacts to commercial fishing and the Cook Inlet fishery were also noted by commenters.

DNR Response: DNR acknowledges the value of the License Areas to support tourism, recreation, subsistence and Cook Inlet commercial salmon fisheries as discussed in Chapter Five. DNR does not conclude that oil and gas exploration and development in the License Areas would preclude or be inconsistent with these values and would ensure that appropriate best management practices and mitigation measures are incorporated to allow for safe exploration and potential development that maintains the resource values that support tourism, recreation, and Cook Inlet salmon fisheries.

In response to concerns about potential impacts to private and agricultural lands, DO&G included information in Chapter Five and Chapter Eight that quantify the area and value of private lands within the License Areas based on Matanuska-Susitna Borough appraised values of land and improvements. Additionally, in response to the concerns around private property impacts, the DO&G reduced the footprint of the proposed License Areas to limit the potential for private property impacts. Reasonably foreseeable cumulative effects from coalbed methane development on rural and agricultural lands were researched and summarized in Chapter Eight. This research identified community and landowner issues similar to those expressed by commenters. Payment for use of and restoration of damages caused by the licensee or operators to the surface estate are the subject of surface use agreements. Where split estate landowners negotiated successful surface use agreements and had positive interactions with local company representatives, positive effects for national energy security, increased off-farm employment and income, and farm infrastructure improvements were noted.

DO&G has included mitigation measures based on DNR's Enforceable Standards that address facility siting, noise and visual impacts, traffic and road impacts, surface use agreements, and water management. At the disposal phase, before a plan of exploration or development is submitted, the schedule, location, and extent of potential impacts on private or agricultural lands are unknown. DO&G has considered and discussed reasonably foreseeable cumulative effects of natural gas and coalbed methane exploration and development generally without knowing specific locations where activities could occur within the License Areas. After considering applicable regulatory controls and measures included in this finding DO&G concludes that most impacts to private and agricultural lands associated with exploration, development, and transportation of natural gas within and from the License Areas can be successfully minimized, restored, or compensated.

A recent estimate for the economic impact of visitors to the MSB is summarized in Chapter Five, including state-wide trends in visitor volumes and a list of important recreational resources within the License Areas. Additional information on recreational use are included in Chapter Five. Potential cumulative effects on recreation and tourism and fish and wildlife uses, including subsistence, are considered and discussed in Chapter Eight. Known historical and cultural resources are discussed in Chapter Three, with potential impacts and survey and other mitigation requirements discussed in Chapter Eight. Mitigation discussed in Chapter Eight and Chapter Nine includes requirements for completion of surveys for prehistoric, historic, and archaeological sites prior to any construction; and notification and preservation of any previously unknown sites discovered during construction or operations. DO&G concludes, based on its reviews, that the greatest potential effects on tourism and recreation would occur primarily during construction of facilities which would be short-term and that with implementation of regulatory controls, and the required mitigation measures for visual, noise, and traffic impacts, potential effects on recreational use of the License Areas would be minimized.

The value of commercial fisheries supported by salmon runs in the Susitna Basin is discussed in Chapter Five. Coalbed dewatering during production and management of produced water would have the greatest potential for cumulative effects on salmon spawning and rearing habitats in the License Areas. Mitigation measures designed to protect riparian habitats, groundwater availability, and fish are included in Chapter Nine. DO&G concludes that potential impacts associated with exploration, development, and transportation of natural gas within and from the License Areas on salmon habitats and populations that support commercial, recreational, and subsistence fisheries would be avoided or minimized.

5. Climate Change Issues

Several commenters opposed granting an exploration license because they are against the development of any fossil fuels because they credit the burning of fossil fuels for causing climate change. Commenters cited climate change for warming streams above the threshold for supporting healthy salmon populations. Considering climate change, commenters recommended that the state turn away from a reliance on oil and gas production and revenues and focus on developing renewable energy projects.

DNR Response: DNR has identified and described local climate and recent climate change in in the Written Finding. Emissions from oil and gas exploration and development would be subject to regulation under ADEC's air quality regulations described in Chapter Seven. As discussed in Chapters Six and Eight, carbon sequestration in the coalbeds provides an opportunity for the operator to reduce the emission of greenhouse gases into the environment while enhancing the recovery of the resource. The function of DO&G is to manage state lands for oil, gas, and geothermal exploration and development to maximize prudent use of resources for the greatest benefit for all Alaskans.

Climate change in Alaska with an emphasis of climate change impacts that are occurring in the Susitna basin including increasing summer stream temperatures, wildland fires, and changes in precipitation are discussed in Chapter Three and Chapter Five. The climate change section in Chapter Three includes specific information on climate change impacts occurring in southcentral Alaska and the associated costs of these impacts. Chapter Eight addresses potential coalbed methane emissions including fugitive methane emissions from leaking wells, process facilities, pipelines, venting, and flaring. The fugitive methane emissions discussion includes references and EPA's New Source Pollutant Standards designed to control these fugitive methane emissions. In Alaska, Alaska Oil and Gas Conservation Commission regulates flaring and venting of natural gas during non-upset conditions to conserve the state's resource.

DO&G acknowledges and discusses that exploration and production of natural gas or coalbed methane in the License Areas would produce emissions that could contribute to global climate change. Many Alaskan households depend primarily on natural gas for home heating, 49 percent, followed by fuel oil, 31 percent, and electricity 12 percent for home heating. Compared to firewood and fuel oil, natural gas used for home heating burns more completely and produces fewer emissions, including fewer particulate emissions which can contribute to air quality issues in Alaska. States that switch to natural gas from high CO_2-intensity heating oil and propane fuels achieved greater emission intensity reduction. In the United States residential natural gas consumption, and consequent CO_2 emissions, has remained essentially flat for nearly 50 years, despite an increase of 32 million residential customers. Improvements in energy efficiency, more efficient appliances and equipment, utility efficiency programs, and consumer consumption behavioral changes have contributed to a growing number of customers using the same amount of natural gas (Zabor et al. 2019). Natural gas also is used to generate 42 percent of Alaska's utility-scale electricity (EIA 2022). Compared to coalfired power plants, natural gas power plants produce fewer emissions.

Alaska continues to encourage the exploration and development of its renewable energy resources including geothermal energy which is delegated to DO&G. In 2020, renewable energy accounted for about 31 percent of Alaska's utility-scale electricity generation, with hydropower accounting for 90 percent of renewable electricity followed by wind and biomass (EIA 2022).

6. Policy Issues

Several commenters requested that DNR conduct comprehensive surveys of the waterways and wetlands within the License Areas, and produce maps of the waterbodies and wetlands within the License Areas. With this data, commenters requested that the footprint of the License Areas be reduced to eliminate any vulnerable waterbodies from the Licensed Areas. Commenters also requested that DNR require the Licensee to provide a map of all proposed exploratory well sites. Commenters also requested that DNR reduce the term of the Licenses from 10 years to a maximum of 5 years. Another concern regarding state policy included Administrative Order 360 which the state is scoping and reviewing public comments during the drafting of this Final Written Finding of the Director. The commenter stated, these regulatory changes could mean that the potential benefits outweigh the possible negative effects. That the lessening of regulations which protect the wilderness and private property values could mean that the two licenses do not best serve the interests of the State. Degradation of these values will bring negative impacts to state land and affect the current economies and livelihoods. The commenter wanted to know which regulations would be eliminated in this process, as well as questions about the appeal process. This comment is further summarized and responses are included at the bottom of this section as there is a solicitation for comments on the scoping of this administrative order concurrent to the drafting of this Final Written Finding of the Director.

DNR Response: DNR has considered these policy suggestions. The state relies on the Alaska Department of Fish and Game's (ADF&G) Anadromous Waters Catalog which is a dynamic tool available to the public and will be utilized by future permitting sections and agencies to determine where the established mitigation measures outlined in Chapter Nine will be implemented including required setback from waterbodies for citing of new facilities. Alaska Statute 16.05.871(a) requires ADF&G to specify the various rivers, lakes, and streams, or parts of them, that are important for spawning, rearing, or migration of anadromous fishes. Adopted by reference under 5 AAC 95.011 of the Alaska Administrative Code, the Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes (referred to as the "Catalog") and the Atlas to the Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes (referred to as the "Atlas") are used to make this specification. The Catalog is a numerically-ordered list of the water bodies with documented use by anadromous fish for these purposes. The Atlas shows cartographically the location, name and number of these specified water bodies, the anadromous fish species using these water bodies, and the fish life history phases for which the water bodies are used.

The Catalog of Waters Important for the Spawning, Rearing or Migration of Anadromous Fishes and its associated Atlas (the Catalog and Atlas, respectively) currently lists almost 20,000 streams, rivers or lakes around the state which have been specified as being important for the spawning, rearing or migration of anadromous fish. Protection of these specified water bodies is addressed by other sections of AS 16.05.871, which requires persons or governmental agencies to submit plans and specifications to ADF&G and receive written approval in the form of a Fish Habitat Permit prior to beginning the proposed use, construction or activity that would take place in specified water bodies. The Catalog and Atlas are important because they specify which streams, rivers and lakes are important to anadromous fish species and therefore afforded protection under AS 16.05.871. Water bodies that are not "specified" within the Catalog and Atlas are not afforded that protection. To be protected under AS 16.05.871, water bodies must be documented as supporting some life function of an anadromous fish species (salmon, trout, char, whitefish, sturgeon, etc.) Anadromous fish must have been seen or collected and identified by a qualified observer. Most nominations come from Department of Fish and Game fisheries biologists. Others are received from private individuals, companies and biologists from other state and federal agencies.

The boundaries of the license areas have been adjusted and reduced in comparison to the original proposal to eliminate the Susitna River and land to the east of the river. These lands were excluded from the proposed license area to reduce conflict with private landowners, conflicts with recreational use, as well as reduce impacts to the important fisheries associated with the Susitna River. Furthermore, mitigation measures in Chapter Nine require licensees to monitor baseline pre-withdrawal conditions and water availability in the area of concern which may include measurements of water table depth or piezometric head, establishment of monitoring wells, or monitoring of existing wells or other measures as appropriate.

Another significant amount of acreage was eliminated from the proposed License Areas in the southwest portion of License Area 1 as the Susitna basin is bound by the Beluga fault, which now forms a boundary for that License Area. A significant amount of acreage was eliminated from the western portion of License Area 2 as the known geology of the region did not see a great potential for gas exploration in that area and also excludes the community of Skwentna. The significantly smaller License Areas match the proposed exploration plan of the applicant, and it was determined to be more feasible to conduct exploration over this reduced footprint in the timeframe of the exploration licenses. Additionally, the existing geologic data suggests that the highest potential for this exploration project exists within the smaller footprint defined in these adjusted License Area boundaries.

A map of the proposed exploration drilling sites are not available at the time of this Final Written Finding as they have not been determined by the Licensees. Once an exploration drill site is identified by the Licensee, they will be required to apply for additional land use authorizations, including a plan of operations to be reviewed by DO&G Permitting staff as well as other agencies identified in Chapter Seven of this document. A plan of operations and those associated authorizations will provide another opportunity for public review and comment on the specific location and types of authorizations being considered at the time they are applied for through the phased review approach. Under AS 38.05.035(e)(1)(C), if the project for which the proposed disposal is sought is a multi-phased development, the director may limit the scope of an administrative review and finding for the proposed disposal to the applicable statutes and regulations, facts, and issues that pertain solely to the disposal phase of the project.

Phased review is appropriate for exploration licensing. Although the licensee may propose specific exploration activities in an application, the issuance of a license does not authorize any oil or gas activities in the license area without further permits from DNR and other agencies. Additional information on this phased review approach is outlined in Chapter Two of this document.

The term of 10 years was deemed appropriate for these exploration licenses because of the size of the License Areas and the distance from existing infrastructure which may delay progress and access to conduct the proposed work on the Licenses. The work commitment is set for $3 million dollars for each license and the director determined that approving a 10 year term was appropriate for these exploration licenses to provide the licensee the best opportunity to gather the necessary data to provide the state, and to make the best decision about applying for lands within the license boundaries to convert to leases if they are able to spend their work commitments on approved direct expenditures. The approved term of 10 years and the work commitments are aligned and proportioned with other previously approved exploration licenses within the state.

Administrative Order 360 Comment 1:

In the public notice, DOG has NOT proposed any specific changes now for the public to comment on. But does not DOG/DNR have to report the state's baseline number of regulations upon which the 15% would be based? This was supposed to be done by 10/13/25. Only seven divisions have completed their baseline count information. The rest have asked for an extension.

What has the Division reported as their baseline number? And which regulations have been chosen? Or do you have an extension of time to report this? 1. In the public notice, DOG has NOT proposed any specific changes now for the public to comment on. But does not DOG/DNR have to report the state's baseline number of regulations upon which the 15% would be based? This was supposed to be done by 10/13/25. Only seven divisions have completed their baseline count information. The rest have asked for an extension.

Administrative Order 360 Comment 2:

What resources do the public have if the regulatory elimination does change the particular intent of a state law? Is there an appeal process?

Administrative Order 360 Comment 3:

AO 360 requires the agency to submit guidance documents that tell Alaskans how to follow the regulations. Guidance documents could become regulations. These documents are supposed to be sent to the Department of Law by Feb 2. Has DOG submitted their guidance documents? And would those docs become a regulation?

Administrative Order 360 Comment 4:

The public is at the tail end of the Best Interest Finding Process for the 2 Susitna Valley Gas Exploration Leases. This regulatory review process under AO 360 throws the legality of the Preliminary BIF for these leases into regulatory limbo.

These regulatory changes could mean that the potential benefits DO NOT outweigh the possible negative effects. The lessening of regulations which protect the wilderness and private property values could mean that the two licenses do NOT best serve the interests of the State. Degradation of these values will bring negative impacts to state land and affect the current economies and livelihoods.

Because these regulations could change. This means the lease process should be put on hold.

Regulations that could be under this regulatory review could be:

• 11 AAC 82.205 Statement of Quality of Leasing

- 11 AAC 82.300 Acreage Limitations
- 11 AAC 82.605(a)-Leases may be assigned or subleased. Transferor liable for all lease obligations
- 11 AAC 82.903 Exploration Licensing
- 11 AAC 83. Plan of Operations-which is extremely important

What regulations that would impact this exploration program and these specific leases are being considered for elimination?

Administrative Order 360 Comment 5:

What does Attorney General Designee Cox mean by “regulatory budgeting”?

Administrative Order 360 Comment 6:

AO 360 has flooded the public notice system with regulatory change scoping processes for the many state agencies. This is coming at time when Alaskan society is being inundated with public policy changes in state, federal and municipal lands along with climate change impacts. In fact, this whole effort is creating more work in regulatory permitting with less certainty in the permitting process.

The timeline for this process is too short. It is putting an overwhelming burden on the public and their investment of time in public policy issues. It is extremely hard for the public to do a rigorous job on scoping comments.

And the administration has still not defined “regulatory burden” that is quoted repeatedly.

This state process is defaulting on its responsibility to protect the ecosystems and will also hinder regulatory actions that could benefit the ecosystem. This is the very big public concern.

Administrative Order 360 Comment 7:

This unbudgeted questionable bureaucratic procedure started by AO 360 is creating UNNECESSARY work on agency staff. Roughly one in six state jobs were vacant at the beginning of 2025. On 5/8/25, the governor froze most state employee hiring and employee resources such as travel. Low oil prices have squeezed the state budget. The state workforce has and will continue to be stressed.

Administrative Order 360 Comment 8:

The AO 360 “provision for automatic approval if deadlines are not met” loophole means permits could be rubber stamped without review. Public input could be skipped. A lot of deadlines could NOT be met due to dwindling state staff as explained above. Having to work on this regulatory process. Staff is stretched thin. THIS PROVISION SHOULD BE ELIMINATED.

Administrative Order 360 Comment 9:

A public document that publishes stakeholder and public feedback and agency responses to this scoping process needs to occur. Please make this available to the public and commenters.

Administrative Order 360 Comment 10:

How much Artificial Intelligence will be used to define and determine which regulations are burdens? This needs to be transparent. Are all agencies using the same AI Guidelines? The way one asks a question of AI changes the answer.

Administrative Order 360 Comment 11:

Who is the Agency Regulatory Liaisons for these DOG/DNR regulation changes?

DNR Response:

The comments submitted in association with Administrative Order 360 (AO 360) are not within the scope of this Susitna Valley Gas Exploration Licenses Final Written Finding of the Director. The comments were also submitted in response to the scoping effort for AO 360 and they are addressed within the Department of Natural Resources Commissioner's letter dated March 3, 2026, that can be found here: https://aws.state.ak.us/OnlinePublicNotices/Notices/Attachment.aspx?id=160522 The comment summaries and responses associated with the Division of Oil and Gas are provided starting on Page 100 of the above-linked document.

7. Best Interest Issues

Opposition to granting an exploration license in the Susitna Valley was expressed by several commenters who felt that granting a license was not in the state's best interest. Many commenters expressed concerns specific to exploration and impacts specific to the exploration methodologies associated with coalbed methane as the target resource of these Exploration Licenses. Commenters stated opposition to granting the Exploration Licenses because of the economics of the project and the high cost and challenges of environmental restoration. Community organizations, Non-Governmental Organizations and public commenters noted that oil and gas exploration and development in the region was inconsistent with area plan management and goals. Several commenters requested specific areas be withdrawn from or that stipulation be added to the License Areas. Commenters also stated the proposed exploration project was not in the state's best interest because of the cumulative impacts and not taking into account the importance of other projects and uses of the area. One commenter submitted information supporting oil and gas exploration and development in the License Areas that was largely based on the state's need for bringing gas to market and improving the state's economy.

DNR response: DNR considers potential impacts to habitats in the area and considers the value and use of these habitats when developing a disposal decision. After considering the value of the waters for supporting commercial and sport fisheries; moose and bear habitats; and the value of the License Areas for recreation and tourism mitigation measures were selected to reduce conflicts between oil and gas activities and these important resources and other uses. Mitigation measures which may include seasonal restrictions in concert with buffer zones from anadromous rivers and streams on shore are in place to eliminate conflicts with sport and subsistence fishing activities in and around the License Areas.

The exploration licensing process is described in Chapter Two. As described in Chapter One, DO&G issued notice on August 7, 2024, of the intent to evaluate this exploration license proposal and requested competing proposals at this time. No competing proposals were submitted. Information on the status of current natural gas supplies and usage in Cook Inlet was included in Chapter Six along with a description of the level of uncertainty for conventional natural gas and coalbed methane resource potential within the License Areas. The potential economic viability of coalbed methane production in the License Areas would depend on identification of a commercially viable resource and that is beyond the scope of this administrative review. DO&G does not find that damages from natural gas or coalbed methane activities would be extensive, unavoidable, unmitigable, or irreparable and has described regulatory controls and developed specific mitigation measures to minimize potential impacts. DO&G considers that these controls and measures would prevent extensive environmental damage and that current uses of the License Areas are not incompatible with regulated and mitigated natural gas (including coalbed methane) exploration, development, or transportation.

Commenters requested that specific areas be excluded from the License Areas including: all private surface estate lands; Nancy Lake and Willow Creek state recreation areas; Susitna Basin Recreational Rivers; and Willow Area Community Organization boundary. As discussed under socio-economic issues above, the state is required to retain the mineral estate when disposing of the surface estate with the intent that the state provides for its citizens and funds its government through development of its natural resources. Additionally, the majority of the lands identified as in conflict with oil and gas exploration and development were eliminated from the proposed License Areas in this finding. As discussed in Chapter Eight, oil and gas fees and royalties continue to fund a substantial portion of Alaska's government and earnings into the Alaska Permanent Fund. We do not anticipate that exploration, development, or transportation of natural gas or coalbed methane would prevent use of state recreation areas or private lands within the License Areas.

DO&G described existing transportation facilities and potential access to the License Areas in Chapter Five and Chapter Eight. DO&G describes the current and projected use of the License Areas in Chapter Five and considers and discusses reasonably foreseeable cumulative effects of natural gas and coalbed methane exploration and development on resources and uses of the License Areas in Chapter Eight. These discussions include reasonably foreseeable cumulative effects of natural gas and coalbed methane exploration on existing uses and renewable freshwater resources as well as regulatory controls and mitigation measures designed to avoid and minimize these cumulative effects.

8. Additional Issues

Comment on Chemical Risk Assessment:

One commenter stated that under Australian Environmental Protection Agency regulations, all chemicals used in oil and gas exploration projects must be registered and accompanied by comprehensive hazard assessments documenting known health risks. They asked if appropriate risk assessments been conducted for the specific chemicals and produced water handling practices proposed for these exploration areas.

DNR Response:

At this phase of the project it is unknown what types of exploration activities are going to be conducted under the licenses, including the types of chemical compounds that may be used in any potential exploration wells or other elements of potential future development processes. Water quality and waste discharge are regulated by the Alaska Department of Environmental Conservation (ADEC) to prevent contamination entering the environment. Potential facility emissions and discharges would likely require permits. The Alaska Oil and Gas Conservation Commission (AOGCC) requires that all oil and gas wells are constructed with barriers to protect drinking water aquifers. Potential for groundwater contamination and disposal of produced water from production of gas from coal beds are discussed in Chapter Eight. Mitigation measures are included in Chapter Nine of this best interest finding to reduce and minimize potential environmental impacts. A detailed discussion of the possible effects of unknown future exploration, development, and production activities is not within the scope of this best interest finding. Therefore, the director has limited the scope of this final written finding to the applicable statutes and regulations, facts, and issues pertaining solely to the License Areas, and the reasonably foreseeable significant effects of the license disposal which are included in Chapter Eight. However, this finding does discuss the potential cumulative effects, in general terms, that may occur with oil and gas activities related to exploration, development, production, and transportation within the License Areas and any mitigation measures as required by AS 38.05.035(g)(1) and (2). These mitigation measures contained within Chapter Nine.

Comment on Economic Potential of the Proposed Exploration:

Commenters expressed concerns over the economic viability of the project. They requested disclosures on the lifespan, decline rates and remediation obligations so that communities can accurately weigh the costs and benefits over time of coalbed methane exploration and extraction.

DNR Response:

It is not within the scope of this written finding to discuss the potential lifespan of a project as this decision only approves the exploration phase and there are many unforeseen variables that could have influence over the lifespan of an exploration project for gas of this nature. Further, it is the applicant's responsibility to determine the economic viability of a project and DNR's role to hold the applicant accountable through the execution of a work commitment as one of the main goals of this exploration licensing program is to generate new subsurface geologic data regarding the state's resources. Reasonably foreseeable effects are thoroughly discussed in Chapter Eight, and the Mitigation Measures, license stipulations, and environmental protections provided by the various agencies that are involved in the review, permitting, and enforcement of environmental regulations described in Chapters Seven and Nine are in place to prevent and protect the environment and other resources of the area against the potential for damage. Further, bonding required by the division for the work commitment, surface activities, and additional bonding required by the Alaska Oil and Gas Conservation Commission further protect the state's interest in these regards. In the event that the licensee uses private property to access the state's resources, additional agreements will be required and if necessary mediated by the state to help with any remediation costs or obligations to the private landowner. The possibility of eventual profitability for the applicant or potential royalties are beyond the scope of this decision.

Comment on Carbon Sequestration Potential:

Commenters noted that the Preliminary Written Finding states that the coal seam sequestration potential has been rated as high, and that the Susitna sedimentary basing was rated moderately low for carbon dioxide sequestration potential. They stated that there is a difference between the Cook Inlet Basin and the Susitna Basin that is the focus of the License Areas, and that the Cook Inlet Basin has the higher potential for carbon sequestration.

DNR Response:

The purpose of this written finding is not to evaluate the potential for carbon sequestration as that is not the purpose of this disposal decision, and the information contained within the written finding is informational. A separate finding would be required to dispose of land for carbon sequestration authorized under AS 38.05.700 – AS 38.05.795 and 11 AAC 84.1000 – 11 AAC 84.1099.

Comment on Orphan Wells:

Commenters were concerned about orphan wells resulting from the Exploration Licenses, and state that the suspension of a well or the renewal of the suspension of a well should follow the Industry Guidance Bulletin 21-002B. The Alaska Oil and Gas Conservation Commission published guidance as a public notice on September 15, 2025.

DNR Response:

The Alaska Oil and Gas Conservation Commission has jurisdiction over the proper plugging and abandonment of wells in the state, and their roles and responsibilities are outlined in Chapter Seven of this Written Finding.

Comment on Tribal Consultation in Creating Boundaries and Conditions:

A commenter requested information on ways that input from Native tribal organizations and corporations influenced siting, buffers and conditions.

DNR Response: The boundaries of these exploration licenses were adjusted and the total acreage was significantly reduced in response to input received from community and non-profit organizations as well as the general public. The boundaries were adjusted and reduced in comparison to the original proposal to eliminate the Susitna River and land to the east of the river. These lands were excluded from the proposed license area to reduce conflict with private landowners, conflicts with recreational use, as well as reduce impacts to the important fisheries associated with the Susitna River.

Comment on the Applicant's Capabilities:

A number of comments were received expressing concerns about the applicant's capabilities to conduct the exploration work associated with this project.

DNR Response: The state is able to determine exploration by the applicant to be in the state's interest is because the state is protected by bonding that is required associated with the work commitment. The exploration licensing program is designed to provide geologic and geophysical information to the state on lands that have not previously been explored. If exploration work that would inform the state of the subsurface resources is not conducted in the timeline established in the license, then the licensee is held accountable for the work commitment, which is $3,000.000.00 for each of the two licenses. Additional bonding by DO&G's permitting section for surface work and the Alaska Oil and Gas Conservation Commission for any subsurface work further protects the state's interest in the event of damage to the natural resources during the process of exploration and development.

Table A.6. Comment topics by commenter for issues on the solicitation.

Commenter	Response Topic Codes by Issue																						
	Process		Air & Water				Habitat			Socio-Economic			Climate Chage		Policy				Best Interest				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Agency																							
Alaska Department of Fish and Game							1			1													
Agency Total							**1**			**1**													
Communities																							
Talkeetna Community Council Inc.				1		1	1				1				1	1	1				1	1	
Trapper Creek Community Council				1	1		1			1			1								1	1	
Community Total				**2**	**1**	**1**	**2**			**1**	**1**		**1**		**1**	**1**	**1**				**2**	**2**	
NGO																							
Cook Inletkeeper				1	1	1	1	1					1								1		
Susitna River Coalition		1	1	1	1	1	1			1					1	1	1				1		
Alaska Survival *				1	1			1		1								1	1		1		
NGO Total		**1**	**1**	**2**	**2**	**1**	**1**	**2**		**2**			**1**		**1**	**1**	**1**	**1**	**1**		**3**		
Public																							
Long, Becky	1																						
Frost, Bryson				1				1			1				1	1	1				1		
Bond, Robin		1					1														1		
Petrich, Hannah				1	1	1				1	1				1	1	1		1		1		
Houska, Greg				1			1				1				1	1	1				1		
Strasenburgh, John *				1			1	1		1	1		1	1	1				1	1		1	

Commenter	Response Topic Codes by Issue																						
	Process		Air & Water				Habitat			Socio-Economic			Climate Chage		Policy				Best Interest				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Long, Becky *				1			1		1	1	1					1		1	1	1	1	1	
Standifer, Brandy								1													1		
Wayner, Reise														1									1
Clayton, Trevor											1											1	
Twigg, Margareth				1	1	1	1				1	1	1		1	1	1		1		1	1	
Writer, Katie				1			1				1	1			1	1	1			1		1	
Merritt, Belle				1			1								1	1	1			1	1	1	
Breinholt, Michelle				1		1	1	1								1							
Ransy, Dennis				1		1	1	1	1	1			1						1				
Long, Becky																		1					
Tabony, Jade *							1	1			1	1			1				1			1	
Masteller, Mark				1	1	1		1		1						1	1					1	
Musgrave, Dave					1	1	1	1			1				1	1	1				1	1	
Birdsall, Cary				1	1		1			1	1					1			1		1		
Ben-East, Dulce				1	1	1				1	1				1	1	1				1	1	
Loomis, Sandra				1	1	1	1				1				1	1	1				1	1	
East, Michael				1		1	1			1	1				1	1	1				1	1	
Loomis, John				1	1	1					1				1	1	1				1	1	
Hill, Doug *				1	1	1	1	1		1				1							1	1	
Tiedje, Marjorie							1	1		1											1		
TOTALS	1	1	0	17	9	11	16	10	2	10	15	3	3	3	13	15	12	2	8	5	15	14	1
Additional Comment topics indicated with * next to commenter's names																							

Commenter	Response Topic Codes by Issue																						
	Process		Air & Water				Habitat			Socio-Economic			Climate Chage		Policy				Best Interest				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23

Notes: See Table A.5 for brief topic subjects. Form letters identified with Yes, + means with additional text, - means with removed test. Abbreviations: ADF&G = Alaska Department of Fish and Game; DNR = Alaska Department of Natural Resources; DOA = Division of Agriculture; DOF = Division of Forestry; AMHTA = Alaska Mental Health Trust Authority; CVTC = Chickaloon Village Traditional Council; TCCI = Talkeetna Community Council, Inc.; WACO = Willow Area Community Council; NOLS = National Outdoor Leadership School; NGO = Non-Governmental Organization; CAN = Yukon, Canada.

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Zabor, B., B. Kemp, N. Pinchuk, J. Shah, and S. Liu. 2019. Opportunities for reducing greenhouse gas emissions through emerging natural gas direct-use technologies. American Gas Foundation December 2019. Washington, DC. https://gasfoundation.org/2019/12/18/opportunities-for-reducing-greenhouse-gas-emissions-through-emerging-natural-gas-direct-use-technologies/ (Accessed March 21, 2022).

Appendix B: Susitna Valley Sample Exploration License

Gas Only Exploration License
Form #DOG 2022-06-EL-GO

STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES

Susitna Valley Exploration License 1
ADL 394291

THIS GAS ONLY EXPLORATION LICENSE is issued by the State of Alaska, Department of Natural Resources ("the state" or "the department") to

ALASKA NATURAL GAS CORPORATION

("the licensee") whether one or more, whose address for purposes of notification is set out in Paragraph 18.

In consideration of the nonrefundable Gas only exploration license fee, work commitment, and performance bond, and subject to the provisions of this exploration license ("license"), including the attached schedules, and by reference, incorporated into this license, the state and the licensee agree as follows.

1. GRANT. (a) Subject to the provisions contained in this license, the state grants to the licensee the exclusive right to explore for Gas on the state lands within the parcels described in Schedule 1 ("licensed land"), unless this license is terminated in whole or part under the provisions of this license or applicable statutes and regulations.

(b) This license may be converted to one or more Gas only Leases under the provisions of AS 38.05.134 and 11 AAC 82.978.

(c) Licensed land includes state-owned land and tide and submerged land, and any of the same acquired by the state during the Term.

(d) If the state's ownership interest in the Gas in the licensed land is less than an entire and undivided interest, the grant under this license is effective only as to the state's interest in that Gas.

(e) The state makes no representations or warranties, express or implied, as to title, or access to, or quiet enjoyment of, the licensed land. The state is not liable to the licensee for any deficiency in title to the licensed land, nor is the licensee or any successor in interest to the licensee entitled to any refund due to deficiency in title for work commitments or other expenditures made under this license.

2. RESERVED RIGHTS. (a) The state, for itself and others, reserves all rights not expressly granted to the licensee. These reserved rights include, but are not limited to:

(1) the right to dispose of to others the surface of the licensed land subject to the license, and the right to authorize others by grant, lease, or permit, subject to the license;

(2) the right to explore for Oil or Gas by geological or geophysical means including the drilling of shallow core holes or stratigraphic tests to a depth of not more than 1,000 feet;

(3) the right to explore for, develop, and remove natural resources other than Gas on or from the licensed land;

(4) the right to non-exclusive easements and rights-of-way for any lawful purpose, including shafts and tunnels necessary or appropriate for working of the licensed land or other land for natural resources other than Gas;

(5) the right to well sites and well bores of wells drilled from or through the licensed land to explore for or produce Oil, Gas, and Associated Substances in and from other land; and

(6) the right to undertake any other purpose authorized by law and not inconsistent with the rights under the license.

(b) Reserved rights may be exercised by the state, or by any person or entity acting under authority of the state, in any manner that does not unreasonably interfere with or endanger the licensee's operations under this license.

3. TERM. This license is issued for a term of **10** years from the Effective Date.

4. WORK COMMITMENT. This license is conditioned upon the performance of a work commitment, as required under AS 38.05.132, of **$3,000,000.00**. Failure of the licensee to timely meet this work commitment will result in the relinquishment, removal, or deletion of the licensed land, termination of this license, and forfeiture of the bond under the provisions of AS 38.05.132 and 11 AAC 82.903—11AAC82.990.

5. GEOLOGIC AND GEOPHYSICAL DATA. (a) On or before each Anniversary Date of the Effective Date of this license, the licensee shall submit to the department all geologic and geophysical data, as defined in 11 AAC 82.990, in accordance with 11 AAC 82.981 and 11 AAC 82.984.

6. DATA SUBMITTAL. (a) The licensee shall submit to the state, at the Department of Natural Resources, Division of Oil & Gas (Division), all geological, geophysical, and engineering data obtained from the license within 30 days following completion, abandonment, or suspension of each well, pilot hole, and plugged back well bore. The licensee shall also submit to the Division, on behalf of the state, data acquired subsequent to completion, abandonment, or suspension of each well, pilot hole, and plugged back well bore within 30 days following acquisition of those data. The Division, on behalf of the state, may waive receipt of operational data from some development, service, or injection wells, and will inform the operator of the waiver in writing prior to data submittal. Data shall be submitted according to the instructions set out in Attachment 1. Submission of data under this paragraph does not affect any statutory or regulatory obligation to submit data or other information to the state or any of its agencies.

(b) Any data submitted to the state, at the Department of Natural Resources, Division of Oil & Gas will be available at all times for use by the state and its agents, and will be held confidential as provided in AS 38.05.035(a)(8) and its applicable regulations. In accordance with AS 38.05.035(a)(8)(C), in order for geological, geophysical, and engineering data to be held confidential, the licensee must request confidentiality at the time of submission and mark the data “CONFIDENTIAL” in compliance with applicable regulations..

7. BONDING. (a) On or before the Effective Date of this license the licensee shall post, and during the term of this license the licensee shall maintain, a performance bond or other security in accordance with AS 38.05.132 and 11 AAC 82.945. The form to be used for bond calculations is incorporated as Schedule 2 to this license.

8. FORCE MAJEURE. (a) If by the fourth anniversary of this license the state determines that the licensee has been prevented by Force Majeure from performing an act that would maintain this license, the Effective Date of this license will be extended by adding the time lost as result of the Force Majeure.

(b) If Force Majeure occurs after the fourth anniversary and before the expiration of the term of this license, the term of this license will be extended by adding the period of time lost as a result of the Force Majeure.

9. AUDIT. The commissioner will, in the commissioner’s discretion, audit expenditures as set out in 11 AAC 82.960. The licensee shall keep and have in its possession books and records showing all expenditures regarding the licensee’s direct exploration expenditures, reports, data, or other information relevant to the drilling of a Gas exploration well or the gathering of geologic or geophysical data, whether or not that information is confidential. The licensee shall permit the state or its agents to examine these books and records at all reasonable times. Upon request by the state, the licensee's books and records must be made available to the state at the state office designated by the state. These books and records must employ methods and techniques that will ensure the most accurate figures reasonably available. The licensee shall use generally accepted accounting procedures consistently applied.

10. PLAN OF OPERATIONS. Before operations may be undertaken on the licensed land, the licensee shall comply with the applicable statutes and regulations in effect on the date the proposed activity is scheduled to commence, including the provisions of AS 38.05.130 and 11 AAC 82.951.

11. INSPECTION. The licensee shall keep open at all reasonable times, for inspection by any duly authorized representative of the State of Alaska, the licensed land, all wells, improvements, machinery, and fixtures on the licensed land, and all reports and records relative to operations and surveys or investigations on or with regard to the licensed land or under this license. Upon request, the licensee shall furnish the State of Alaska with copies of and extracts from any such reports and records.

12. ASSIGNMENT. This license, or an interest in this license, may be assigned or otherwise transferred in accordance with 11 AAC 82.966, 11 AAC 82.969, and 11 AAC 82.972.

13. SURRENDER. The licensee may, at any time, file with the state a written surrender of rights under the provisions of 11 AAC 82.957.

14. TERMINATION. The commissioner will, in the commissioner's discretion, terminate this license under the provisions of 11 AAC 82.975 for the licensee's failure to comply with any of its provisions, applicable statutes, regulations, or stipulations.

15. RIGHTS UPON SURRENDER OR TERMINATION. (a) Upon the surrender or termination as to all or any portion of the licensed land, the state will direct the licensee in writing and the licensee will have the right at any time within a period of one year after the surrender or termination, or any extension of that period as the state may grant, to remove from the licensed land or portion of the licensed land all machinery, equipment, tools, and materials. Upon the expiration of that period or extension of that period and at the option of the state, any machinery, equipment, tools, and materials that the licensee has not removed from the licensed land or portion of the licensed land become the property of the state or may be removed by the state at the licensee's expense. At the option of the state, all improvements such as roads, pads, and wells must either be abandoned and the sites rehabilitated by the licensee to the satisfaction of the state, or be left intact and the licensee absolved of all further responsibility as to their maintenance, repair, and eventual abandonment and rehabilitation. Subject to the above conditions, the licensee shall deliver the licensed land or those portions of the licensed land in good condition.

(b) The state may require such financial assurances as the commissioner determines necessary to ensure the licensee's ability to meet its obligation under this paragraph. If at any time the commissioner determines that existing financial assurances are insufficient to satisfactorily guarantee the performance of all the licensee's obligations under this paragraph, the commissioner may require the delivery of such substitute or supplemental financial assurances as the commissioner determines necessary.

16. DAMAGES AND INDEMNIFICATION. (a) The licensee shall indemnify the state for, and hold it harmless from, any claim, including claims for loss or damage to property or injury to any person caused by or resulting from any act or omission committed under this license by or on behalf of the licensee. The licensee is not responsible to the state under this subparagraph for any loss, damage, or injury caused by or resulting from the sole negligence of the state.

(b) The licensee expressly waives any defense to an action for breach of a provision of this license or for damages resulting from an oil spill, well blow-out, or other harm to the environment that is based on an act or omission committed by an independent contractor in the licensee's employ. The licensee expressly agrees to assume responsibility for all actions of its independent contractors.

17. AUTHORIZED REPRESENTATIVES. The Director of the Division of Oil and Gas, Department of Natural Resources, State of Alaska, and the person executing this license on behalf of the licensee will be authorized representatives for their respective principals for the purposes of administering this license. The state or the licensee may change the designation of its authorized representative or the address to which notices to that representative are to be sent by a notice given in accordance with Paragraph 17 below. When activities under a plan of operations are underway, the licensee shall also designate, by notice under Paragraph 17 below, by name, job title, and address, an agent who will be present in the state during all license activities.

18. NOTICES; PROTEST. (a) Any notices required or permitted under this license must be by electronic media producing a permanent record or in writing and must be given personally or by registered or certified mail, return receipt requested, addressed as follows:

TO THE STATE:

DIRECTOR, DIVISION OF OIL AND GAS
DEPARTMENT OF NATURAL RESOURCES
550 WEST 7TH AVENUE, SUITE 1100
ANCHORAGE, ALASKA 99501-3563

TO THE LICENSEE:

Alaska Natural Gas Corporation
Robert Fowler
310 K Street Suite 200
ANCHORAGE, ALASKA 99501

(b) Any notice given under this paragraph will be effective when delivered to the above authorized representative.

19. APPEALS. The licensee shall appeal decisions of the commissioner related to this license in accordance with 11 AAC 82.963.

20. STATUTES AND REGULATIONS. This license is subject to all applicable state and federal statutes and regulations in effect on the Effective Date of this license, and to all statutes and regulations placed in effect after the Effective Date of this license. A reference to a statute or regulation in this license includes any future change in that statute or regulation whether by amendment, repeal and replacement, or other means. This license does not limit the power of the State of Alaska or the United States of America to enact and enforce legislation or to promulgate and enforce regulations affecting, directly or indirectly, the activities of the licensee or its agents in connection with this license or the value of the interest held under this license. In case of conflicting provisions, statutes and regulations take precedence over this license.

21. INTERPRETATION. This license is to be interpreted in accordance with the rules applicable to the interpretation of contracts made in the State of Alaska. The paragraph headings are not part of this license and are inserted only for convenience. The state and the licensee expressly agree that the law of the State of Alaska will apply in any judicial proceeding affecting this license.

22. WAIVER OF CONDITIONS. The state reserves the right to waive any breach of a provision of this license, but any waiver extends only to the particular breach waived and does not limit the rights of the state with respect to any future breach; nor will the waiver of a particular breach prevent cancellation of this license for any other cause or for the same cause occurring at another time. Notwithstanding the foregoing, the state will not be deemed to have waived a provision of this license unless it does so in writing.

23. SEVERABILITY. If it is finally determined in any judicial proceeding that any provision of this license is invalid, the state and the licensee may jointly agree by a written amendment to this license that, in consideration of the provisions in that written amendment, the invalid portion will be treated as severed from this license and that the remainder of this license, as amended, will remain in effect.

24. LOCAL HIRE. The licensee is encouraged to hire and employ local and Alaska residents and companies, to the extent they are available and qualified, for work performed on the license area. Licensees shall submit, with the plans of operations, a proposal detailing the means by which the licensee will comply with this measure. The licensee is encouraged, in formulating this proposal, to coordinate with employment services offered by the State of Alaska and local communities and to recruit employees from local communities.

25. NONDISCRIMINATION. The licensee and the licensee's contractors and subcontractors may not discriminate against any employee or applicant because of race, religion, marital status, change in marital status, pregnancy, parenthood, physical handicap, color, sex, age, or national origin as set out in AS 18.80.220. The licensee and its contractors and subcontractors shall, on beginning any operations under this license, post in a conspicuous place notices setting out this nondiscrimination provision.

26.. DEFINITIONS. To the extent that the words and phrases used in this license are defined in 11 AAC 82.990, those definitions will apply to this license. With respect to all other words and phrases used in this license, they will be interpreted in accordance with AS. 01.10.040. However, the following words have the following meanings unless the context unavoidably requires otherwise.

(1) "Anniversary Date" means the date in each successive calendar year following the Effective Date that is the same as the Effective Date.

(2) "Associated Substances" means all substances except helium produced as an incident of production of Oil or Gas by ordinary production methods and not defined in this license as Oil or Gas;

(3) "Effective Date" means the first day of the month following the date on which the exploration license or, if an extension is granted, the extension was signed on behalf of the state or, upon written request, on the first day of the month in which it was signed on behalf of the state.

(4) "Force Majeure" means war, riots, acts of God, unusually severe weather, or any other cause beyond the licensee's reasonable ability to foresee or control and includes operational failure of existing transportation facilities and delays caused by judicial decisions or lack of them.

(5) "Gas" means all natural gas (except helium gas) and all other hydrocarbons produced that are not defined in this license as Oil;

(6) "Oil" means crude petroleum oil and other hydrocarbons, regardless of gravity, that are produced in liquid form by ordinary production methods, including liquid hydrocarbons known as distillate or condensate recovered by separation from Gas other than at a Gas processing plant.

27. EFFECTIVE DATE. This license takes effect on

BY SIGNING THIS LICENSE, the state and the licensee agree to be bound by its provisions effective .

STATE OF ALASKA

By: ______________________________________

Director, Division of Oil and Gas

STATE OF ALASKA)
) ss.
Third Judicial District)

On , before me appeared ______________________________of the Division of Oil and Gas of the State of Alaska, Department of Natural Resources, and who executed this license and acknowledged voluntarily signing it on behalf of the State of Alaska as lessor.

____
Notary public in and for the State of Alaska
My commission expires _________________________

LICENSEE: ______________________________________

Signature: _______________________________________

Printed Name/Title: ________________________________

INSERT NOTARY ACKNOWLEDGMENT OF LICENSEE'S SIGNATURE HERE

SCHEDULE 2

Annual Bonding Calculation

(This schedule must be updated and submitted annually to the Division of Oil & Gas)

1.	Enter	Beginning Work Commitment	$ ____________
2.	Enter	Cumulative Direct Exploration Expenditures	$ ____________
3.	Line 1 Minus Line 2	Balance of Remaining Work Commitment	$ ____________
4	Enter	# of Years Remaining in Term of License	________
5	Line 3 Divided by Line 4	Annual Bond Due	$ ____________

Attachment 1
Alaska Department of Natural Resources, Division of Oil & Gas
Submittal of Well Data Required by DNR License

Data shall be submitted to the Division in a digital format, generally in PDF. For spreadsheets, include the original Excel document. For images such as maps or charts, include a high-resolution TIFF or JPEG. For logs, see formats specified below, but include a graphical image file of the logs as a PDF or TIFF in addition to the final merged data file of the log curves. Data may be submitted on CD, DVD or USB mass storage device (include any necessary cables). Required data shall include any and all of the following:

1. A copy of the well completion report (AOGCC Form 10-407) for each well bore.
2. Daily drilling reports or a summary report of daily drilling.
3. Latitudinal and longitudinal coordinates for each well, pilot hole, and plugged back well bore with completed surface and bottom hole locations. Coordinates can be based upon either the NAD 83 or NAD 27 geodetic datum as long as the datum used is clearly specified.
4. Directional survey for each well, pilot hole, and plugged back well bore.
5. A list of all logs run and the depth interval covered for each well, pilot hole, and plugged back well bore.
6. A list of formations and other geologic markers encountered and the measured depths (MD) and true vertical depths (TVD) of each, for each well, pilot hole, and plugged back well bore.
7. Summary of cored intervals (conventional and sidewall), including depth, formation name, lithology, presence of oil, gas, gas hydrates, and water, porosity, fractures and apparent dips; indicate "**none**" on completion report or in an attachment if no cores were taken.
8. Core reports including lab analyses of lithology, porosity, permeability (vertical and horizontal, air and liquid), density, capillary pressure, and fluid saturation, if available.
9. Conventional and sidewall core photos (plain light and ultraviolet), if applicable.
10. Identified formation names and corresponding depths for oil, gas, and gas hydrate shows. Indicate "**none**" on the completion report or in an attachment if no shows were observed.
11. Identified depth zones of abnormal pressure. Indicate "**none**" on the completion report or in an attachment if none were observed.
12. A synopsis or summary of testing and all fluid recovery efforts, including production tests (IP), drill stem tests (DST), wireline formation tests (i.e. repeat formation tests (RFT) and modular dynamics tests (MDT)), and any other production and formation testing data; the summary should include test date, time, depth, formation name, method of operation, recovered fluid type(s) and amount(s), fluid rate, gas-oil ratio (GOR), oil gravity, pressure, and choke size, when available. If no tests were undertaken, indicate "**none**" where appropriate on the completion report or in an attachment, if tests were undertaken but failed to recover fluids indicate "**no recovery**".
13. Pressure build-up and fluid PVT analyses, if applicable.
14. Open flow potential test reports and report attachments to AOGCC Forms 10-421.
15. Well test procedures, field chronologies, and field data; including details necessary for evaluation (intervals open to test; volumes of oil, gas, water, mud, and other borehole substances; API gravity; gas density; wellhead and down hole pressure; and formation and wellhead temperature).
16. Geochemical and formation fluid analyses and reports, if applicable.
17. Down hole and surface fluid sampling procedures, field chronologies, raw data, and laboratory test results for all water and hydrocarbon-bearing zones (oil, gas, gas hydrates) sampled; including details sufficient to fully evaluate quality of sample data.
18. Permit to drill (AOGCC form 10-401) and the survey as-built of the well location.
19. LAS Version 2, TAP, TIF, LIS and DLIS (if available) files of final merged open-and cased-hole log data, including specialty logs (such as Schlumberger's cyberlook, formation microscanners and dipmeter logs), measured-while-drilling (MWD) and logged-while-drilling (LWD) logs. Include a graphical image file of the 2-inch MD & TVD logs as a PDF or TIFF in addition to the log data file.
20. LAS Version 2 of final composite mudlog or lithology log curves. Include a graphical image file of the final 2-inch MD & TVD logs, with lithology display, oil, gas, and gas hydrate show indicators, mud properties, and cuttings descriptions and report as a PDF or TIFF in addition to the log data file.
21. Clear, legible files of all well data and reports including, but not limited to, paleontology, palynology, petrography (including point-count analyses), X-ray diffraction analyses, SEM micrographs, thermal maturity, vitrinite reflectance, total organic carbon, RockEval pyrolysis, geochronology, fission track analyses, fluid inclusion analyses, Mercury injection capillary pressure analyses, chemical analyses

(EPMA, XRF, ICP, etc.), isotope analyses, water chemistry, burial and temperature history analyses, strain analyses, acoustic analyses, gas hydrate analyses and well pressure and temperature survey analyses.

22. Final reports of velocity, checkshot or VSP surveys (an ASCII format digital version of the above data shall also be submitted), including seismic profile data in SEG-Y format. Indicate “none” in your response to this request if no velocity, checkshot or VSP surveys were undertaken. Submission of velocity, checkshot, and VSP surveys is always required by DNR under the operator surface-use permit obligations.
23. All coalbed core, gas, and water quality reports including lab analyses of core lithology, coal rank, vitrinite reflectance, maceral composition, total organic carbon, ash, sulfur and BTU content, moisture content, cleating, adsorption/desorption data, residual gas measurements, porosity and permeability analyses, core photos, if available.
24. Any other geoscience- and engineering-related data sets from the well(s).

Please note: Physical samples of well cuttings or cores specified in 20 AAC 25.071(b)(2) and 20 AAC 25.071(b)(4) should be sent to AOGCC, not to the Division.

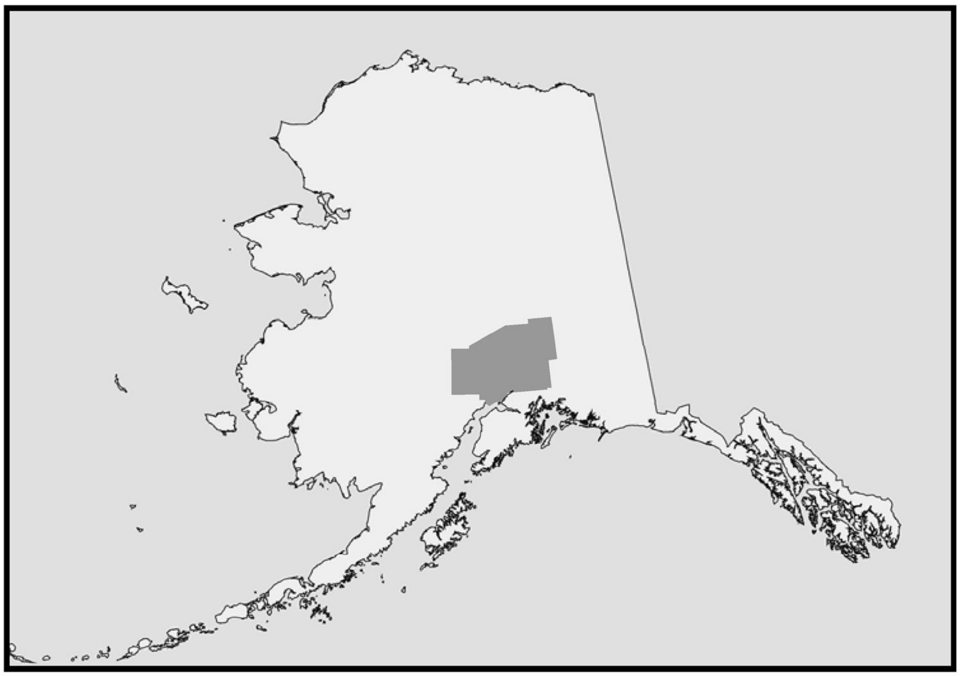
All material should be either hand-carried by bonded courier or mailed by registered mail to:

Resource Evaluation Section
Alaska Department of Natural Resources, Division of Oil & Gas
550 West 7th Avenue, Suite 1100
Anchorage, AK 99501-3510
Email: DOG.REdata@alaska.gov

Appendix C: Enforceable Standards for Development of State Owned Coalbed Methane Resources in the Matanuska-Susitna Borough

Enforceable Standards for Development Of State Owned Coalbed Methane Resources in the Matanuska-Susitna Borough

December 2004



Alaska Department of Natural Resources
Division of Oil and Gas
550 West 7th Avenue Ste 800
Anchorage, Alaska 99501

Table of Contents

Additional Reference Materials

1) Response to Comments on the Public Review Draft

Distributed and Available with the Final Enforceable Standards

2) Volume 2 of Public Review Draft:

List of Acronyms

ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
AOGCC	Alaska Oil and Gas Conservation Commission
CBM	Coalbed Methane
DGC	Division of Governmental Coordination
DO&G	ADNR, Division of Oil and Gas
DOT/PF	Alaska Department of Transportation and Public Facilities
EPA	U.S. Environmental Protection Agency
Mat-Su	Matanuska-Susitna
MSDS	Material Safety Data Sheet
OHMP	Office of Habitat Management and Permitting
OPMP	Office of Project Management and Permitting
SHPO	State Historic Preservation Office
USDA	U.S. Department of Agriculture

SECTION 1

INTRODUCTION

SECTION 1 INTRODUCTION

Summary of Purpose

Enforceable standards for coalbed methane development in the Mat-Su Borough are necessary to establish public confidence in the management of public resources in the affected area. These standards will be implemented by ADNR when making decisions related to coalbed methane development in the Mat-Su Borough. These decisions may include issuing oil and gas leases or licenses, reviewing proposed plans of operations, or reviewing applications for the formation or alteration of oil and gas units. In addition to the enforceable standards, this document includes recommendations for similar standards to be considered by the Matanuska-Susitna Borough, and the Alaska Oil and Gas Conservation Commission.

How This Document Is Organized

To present the coalbed methane standards, this document is organized into four sections, which are supported by extensive appendices.

Section 1 provides a brief explanation of why enforceable standards are necessary for coalbed methane development in the Mat-Su Borough, and provides a brief history of the events that preceded the public process to establish these standards. It also includes a discussion of how these standards will be implemented, and how they can be modified in the future.

Section 2 presents a summary of the public process used to develop these enforceable standards.

Section 3 presents the enforceable standards for coalbed methane development of state owned resources in the Mat-Su Borough.

Section 4 presents the recommendations for the Matanuska-Susitna Borough, and the Alaska Oil and Gas Conservation Commission.

Why Adopt Enforceable Standards for Coalbed Methane Development in the Mat-Su Borough?

The potential development of coalbed methane in the Mat-Su Borough has been the source of tremendous public debate since the summer of 2003 when ADNR announced that applications had been received for Shallow Natural Gas leases in the area. The public discussion of these applications led to a discussion of the extensive oil and gas leases already in existence in the valley. This was new information for many area residents. A series of public information meetings sponsored by the borough raised additional issues regarding the shallow gas leasing program and the regulations governing coalbed methane development in Alaska. In October 2003, ADNR Commissioner Tom Irwin announced that ADNR was initiating a public process to establish enforceable standards for coalbed methane development in the Mat-Su Borough. Commissioner Irwin said that ADNR has an obligation to take public concern into consideration before proceeding with further decisions associated with full coalbed methane development. The adoption of enforceable standards will provide the public with confidence that future decisions regarding coalbed methane development are being made with an understanding of what is required to protect the interests of the residents of the state.

What Lands are Affected by The Enforceable Standards?

These enforceable standards will apply to decisions made by ADNR related to coalbed methane activities, and therefore will apply to lands within the Mat-Su Borough that are subject to a state oil and gas lease or contained within an oil and gas unit, including private lands within the unit. State oil and gas leases are issued only when the state owns the oil and gas resources for the land. The remainder of the estate (i.e. everything other than oil and gas and other minerals) may be owned by a private party (i.e. the “surface owner”). These standards apply to coalbed methane activities on state leases regardless of whether there is a private surface owner or not. ADNR will also apply these standards when making decisions related to coalbed methane activities within oil and gas units. A unit is a large area containing many leases that are collected together to manage a field in an efficient manner. A unit may include lands not covered by a state oil and gas lease, but ADNR will apply these standards to all coalbed methane activities occurring within the unit.

History of Coalbed Methane in the Mat-Su Borough

Since the early 1950s, some 30 wells have been drilled in the Mat-Su Borough in search of oil and gas. The current oil and gas leases in the Mat-Su Borough date back to 1991. These conventional oil and gas leases may contain traditional oil and gas resources as well as coal bed methane resources. The Pioneer Unit was formed in the Mat-Su Borough in 1998, and includes only conventional oil and gas leases although exploration of coal bed methane is the primary intent of the current unit operator. The oil and gas resources in the Pioneer Unit are owned by many different entities; with only about 50% of the oil and gas in the unit owned by the State of Alaska. Pioneer Natural Resources Company (having recently merged with Evergreen Resources) is the current operator in the Pioneer Unit. Two four-well pilot production sites were developed in the unit area by Evergreen in 2002; three separate exploratory wells were drilled earlier by Ocean

Energy the previous unit operator along Vine Road; and one well that was drilled even prior to formation of the unit along Big Lake Road was re-entered and tested by Ocean. Some testing at the pilot production sites in the unit by Pioneer Natural Resources is still underway.

In addition to the activities within the Pioneer Unit, several core holes have been drilled in recent years in the Borough to evaluate coal bed methane resources. One core hole was drilled by the State near Wasilla in 1994, and several core holes were drilled in early 2004 by Evergreen. Also, GRI, Inc. drilled three coalbed methane wells in the Borough and production tested one of them in the Houston area in the 1990s.

In 1996, the Alaska Legislature passed legislation authorizing a shallow natural gas leasing program (AS 38.05.177). The shallow gas leasing program is non-competitive. ADNR is mandated to issue the leases if "the discovery of a local source of natural gas would benefit the residents of an area." In September of 1999, the Commissioner of ADNR issued a decision authorizing the Division of Oil and Gas to accept shallow natural gas lease applications for all eligible state land.

After issuing public notice and mailing application materials to parties that had expressed interest, the Division began accepting shallow natural gas lease applications on February 29, 2000. Thirty-six applicants applied for a total of 270 leases in various regions of the state during the first two weeks of opening. A total of 162 applications were submitted for the Mat-Su Borough. Among the applications received on February 29, 2000, many overlapped with each other. In order to determine priority among the applications, ADNR drew lots and assigned a control number to each lease application such that an application had precedence over applications with a lower control number. In February 2003, a decision was issued regarding the Mat-Su applications. Of the 162 applications, 60 were issued. The other applications were denied because of overlap with approved applications having a higher control number, no available state land in the application area, or denied for other reasons.

In 2004, the legislature repealed the shallow natural gas leasing program (HB 531). This legislation provided those with pending shallow gas lease applications the opportunity to convert their application into an application for an exploration license. The legislation also contained a number of provisions related to the regulation of coalbed methane activities, including a prohibition of coalbed methane development from an aquifer used for drinking water or agricultural purposes, and mandatory setbacks and noise restrictions on coalbed methane activities. In August 2004, Evergreen Resources converted a number of their pending shallow natural gas lease applications into exploration license applications. In September 2004, following the merger of Evergreen Resources and Pioneer Natural Resources, Pioneer notified the state that they were relinquishing their interest in all shallow natural gas leases in the Mat-Su, and withdrew their pending exploration license application.

Implementation of the Enforceable Standards

This document will be signed by the Commissioner of the Department of Natural Resources and will be state policy for the management of state resources within the Mat-Su Borough as it relates to coalbed methane development. All ADNR decisions related to coalbed methane development, whether taking place on leases issued prior to adoption of these standards or on subsequent leases, shall comply with the standards contained in this document. Possible decisions controlled by these standards include whether to issue oil and gas leases or licenses, and whether to approve proposed plans of operations. Two important methods of implementation will be imposing mitigation measures on leases and licenses to require compliance with these standards, and to impose conditions on plan of operations approvals.

The terms of a plan of operation, including conditions imposed by ADNR, are fully enforceable. If ADNR determines that a substantive default of the terms of a plan of operations has occurred, ADNR will notify the operator of the default. The operator then has 60 days in which to take action and cure the default. If the default has not been cured, ADNR can take action to terminate the lease.

Modification of the Enforceable Standards

Standards can never be so comprehensive and visionary as to provide solutions to all possible future conflicts, nor should they be inflexible. Therefore, the standards in this document may be changed if conditions warrant. The standards will be reviewed periodically as new data become available and as changing social and economic conditions place different demands on public lands and resources. The periodic review will include meetings with interested groups and the general public.

Amendments

The standards may be amended. An amendment adds to or modifies the basic intent of a standard. Amendments must be approved by the Commissioner of ADNR. Amendments require public notice and opportunity to comment, and consultation with affected agencies. The public comment period for a proposed amendment may, at the discretion of the Commissioner, include public hearings. Agencies, municipalities, applicants, or members of the public may propose amendments to ADNR for consideration.

Minor Changes

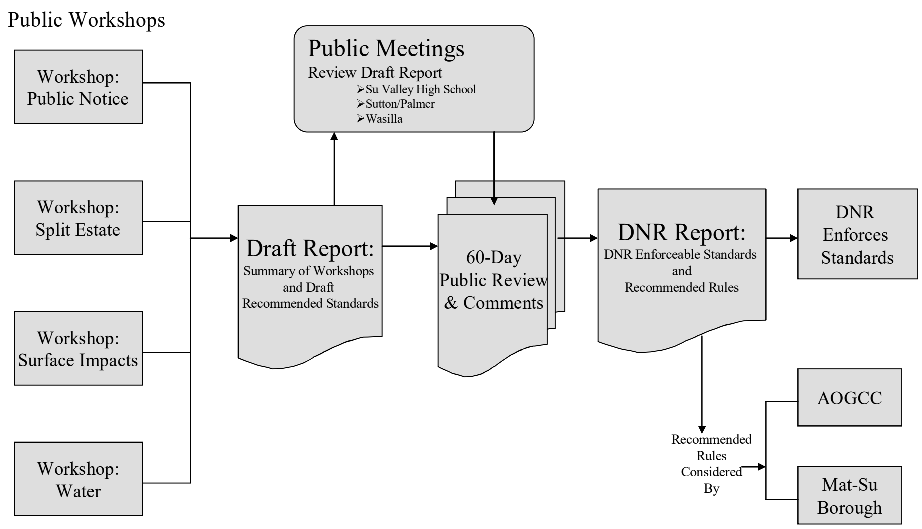
A minor change is one that does not modify or add to the basic intent of a standard. Minor changes may be necessary for clarification, consistency, or to facilitate implementation of the standards. Minor changes are made at the discretion of the Director of the Division of Oil and Gas following public notice and opportunity to comment. Agencies, municipalities, applicants, or members of the public may propose minor changes.

SECTION 2

PUBLIC PARTICIPATION

SECTION 2 PUBLIC PARTICIPATION

The process to establish the enforceable standards contained in this document involved tremendous public participation, as indicated in the following diagram of the process:



A series of public workshops were held in the Mat-Su Borough in January and February 2004. Materials from those workshops can be found in Volume 2 of the Public Review Draft of these standards, released in April 2004. Hundreds of area residents participated in the workshops. The information from the workshops was used to develop the Public Review Draft document which was distributed for public comment with a 60-day comment period. During the comment period, three public meetings were held in the Mat-Su Borough to review the draft document and take public comment.

The public comments received, both written and oral, were used to develop these final enforceable standards. A separate document titled "Response to Comments on the Public Review Draft" is being made available with this document.

Overall Impression of Workshops

The overwhelming majority of workshop participants were opposed to any coalbed methane development in the Mat-Su Borough. They expressed frustration that the workshops did not address such topics as buying back all shallow gas leases and requiring a best interest finding prior to issuing additional shallow gas leases. Most participants expressed distrust toward ADNR and skepticism that the process would result in legitimate standards. The participants in the first two workshops, in particular, devoted many of their responses to calls for bans on coalbed methane in residential areas and non-developed areas of the Mat-Su Borough, repeated calls for lease buybacks, and complaints that the current shallow gas leases were issued without proper public notice. At subsequent workshops, participants freely stated their general opposition to coalbed methane development, and their reluctant participation in the process of developing standards for that development, preferring an outright ban on coalbed methane activities.

Overall Impression of the Public Comments to the Public Review Draft

The written and oral public comments received were much more mixed than the input received at the workshops. In addition to comments from the company currently involved in coalbed methane exploration in the area, comments were also received from trade associations, other commercial operators, and individuals who support coalbed methane exploration and development in the Mat-Su Borough. These interests expressed the view that the standards were unnecessary and excessively restrictive. On the other end of the spectrum were comments from environmental organizations, citizen advocacy groups and individuals concerned with potential impacts from coalbed methane development. These commenters stressed that the proposed standards were too lax and needed to be significantly tightened to protect the interests of residents and recreational users.

SECTION 3

ENFORCEABLE STANDARDS

SECTION 3. ENFORCEABLE STANDARDS

Based on the results of the workshops, ADNR has developed the following list of enforceable standards for ADNR decisions regarding coalbed methane activities in the Mat-Su Borough. These standards are divided into two groups, enforceable standards for activities on state-managed lands to be implemented by DNR, and recommended standards for other state agencies and the Mat-Su Borough to implement through their respective authorities.

Public Notice

1. **Public Notice For Oil and Gas at the Exploration, Development and Transportation Phases.** ADNR will provide at least a 30-day public notice (If ADNR finds that the plan of operation raises new issues of significant public interest, then ADNR will provide at least 60-day public notice) and review/comment period for each phase of CBM development requiring a plan of operation (exploration, development and transportation) by the following methods:
   a. ADNR will require the applicant to provide notice by return receipt mail or personal delivery to all owners of surface lands within ½-mile of the proposed work site who can be reasonably identified and located based on records at the state Recorder’s office and the borough tax records;
   b. Legal notice in the Anchorage Daily News and the Frontiersman;
   c. Public notice distributed to municipalities (including the Mat-Su Borough directors of Planning, Community Development and Public Works), regional and village corporations, federally recognized Tribal governments, libraries, and post offices within or adjacent to the proposed activity area;
   d. Public notice distributed to any community councils whose boundaries are within or adjacent to the proposed activity area; and
   e. All residents and organizations that have submitted a written request for notice of proposed coalbed methane activities within the area of the proposed activity will be notified electronically or, if requested, by regular mail. A written request for notice will be honored for three years, at which time it should be updated by the requestor.

The plan of operation, which requires ADNR approval prior to the operator performing any activity on a state oil and gas lease or exploration license, is referenced throughout this document. The operator submits an application to ADNR that must include statements and maps or drawings setting out the following:

- *the sequence and schedule of the operations to be conducted in the lease area, including the date operations are proposed to begin and their proposed duration;*

- *projected use requirements directly associated with the proposed operations, including but not limited to the location and design of well sites, material sites, water supplies, solid waste sites, buildings, roads, utilities, airstrips, and all facilities and equipment necessary to conduct the proposed operations;*
- *plans for rehabilitation of the affected area after completion of operations or phases of those operations; and*
- *a description of operating procedures designed to prevent or minimize adverse effects on other natural resources and other uses of the lease area and adjacent areas, including fish and wildlife habitats, historic and archeological sites, and public use areas. 11 AAC 83.158(d).*

ADNR often requires other stipulations, in addition to those necessary to meet the mitigation measures developed for the lease. These stipulations address site-specific concerns directly associated with the proposed project and/or issues raised in public comment on the proposed plan. The mitigation measures are part of the terms and conditions of the lease and are attached to the plan of operations approval and are binding on the operator. Activities are field-monitored by ADNR to ensure compliance with the terms of plan approval. The lease contract requires that the operator keep the lease area open for inspection by authorized state officials.

Public Information

2. **Disclosure of Fracturing Materials**. A plan of operations will include a disclosure of the components in any hydraulic fracturing materials to be used, the volume and depths at which such materials are expected to be used, and the volume capacity of the vessels to be used to store such materials.

3. **Emergency Planning**. The plan of operations will include an emergency preparedness and response plan for potential emergencies that may be associated with the operation of facilities. This may include explosions, fires, gas or water pipeline leaks or ruptures, earthquake or flood events, or hazardous material spills. The plan will include contact names and phone numbers of at least two persons responsible for emergency field operations. The operator will conduct annual or periodic training/drills for response personnel. A copy of the plan will be provided to the MSB Emergency Services Director and local fire service area offices. The plan will be reviewed at least annually for any necessary updates.

4. **Information on Hazardous Materials.** The operator will maintain Material Safety Data Sheet (MSDS) information on all hazardous substances currently used by the operator at CBM facilities within the borough. The operator will ensure the MSB Emergency Services Director and local fire service area office is provided information concerning the use or transport of any hazardous substances associated with CBM exploration and development. The operator will post at each drill site and CBM facility the contact name and phone number from whom interested persons can obtain information regarding the hazardous materials used at the drill site or facility.

5. **As-Built Survey Required**. ADNR will require as-built surveys upon completion of any permanent CBM facility.

Setbacks

6. **Setbacks**.

    a. The operator will construct drill pads at least 500 feet and compressor stations at least 1,500 feet from any residential structure or public facility.

    b. An exception may be granted from this requirement if the operator obtains the consent of the owner of the residential structure, or demonstrates that the drill pad and/or compressor station will be substantially hidden from view from the public facility, and that the noise levels experienced by the public facility will not exceed ambient noise levels.

7. **Subdivisions**. The operator will not construct drill pads or compressor stations in any residential subdivision in which more than half of the land is divided into lots sized at five acres or less, without the consent of all surface property owners within that subdivision.

Surface Impacts

8. **Noise Mitigation**. The plan of operations will include the measures to be used to mitigate potential noise impacts associated with facilities and compressor stations. The operator will provide an analysis of the noise impacts on residential and commercial users of the proposed project area. CBM operations shall not cause the ambient statistical noise levels L_1, L_{10} and L_{50}[12] for any hour measured at the property line, residential structure, or sensitive public facility, to be greater than the levels specified below.

Day (7 AM to 8 PM)		Night (8 PM to 7 AM)	
L_{50}	55 dBA	L_{50}	45 dBA
L_{10}	60 dBA	L_{10}	50 dBA
L_1	75 dBA	L_1	55 dBA

The plan of operations will include a noise monitoring plan. The noise monitoring plan will include short-term manned monitoring to ensure compliance with the noise standards. If the monitoring shows that the standards are not met, the operator will be required to submit a corrective action plan within 10 days.

[12] L_1 means that the sound level specified can be exceeded 1% of the time, L_{10} means that the sound level specified can be exceeded 10% of the time, and L_{50} means that the sound level specified can be exceeded 50% of the time.

Measures to mitigate noise impacts may include but are not limited to:

a. Venting exhaust in a direction away from the closest existing residences of platted subdivision;
b. Using quiet design mufflers on non-electric motors;
c. Limiting the hours of noise-generating operation to daytime hours;
d. Using sound insulating enclosures where facilities would otherwise create noise impacts because of proximity, population density, other adjacent land uses sensitive to adverse impacts from noise; and
e. Siting facilities and compressor stations in locations that use geographic features to buffer noise.

9. **Visual Mitigation**. A plan of operations will include the measures to be used to mitigate visual impacts associated with facilities. Measures to mitigate visual impacts may include but are not limited to:
   - Minimizing the size of structures;
   - Minimizing damage to vegetation and the use of vegetation to buffer visual impacts;
   - Minimizing the work pad size to only that area necessary to provide a safe work area;
   - Locating facilities away from prominent features, hilltops and ridges;
   - Locating facilities at the base of slopes;
   - Painting permanent facilities in uniform, non-contrasting, non-reflective color tones slightly darker than the adjacent landscape.
   - Applying one or more of the following landscape practices for permanent facilities:
     a. Establishing berms, ground covers, shrubs and trees;
     b. Placing vegetation clusters 10-15 feet apart along the edge of the permanent pad site in residential areas;
     c. When clearing trees and vegetation for construction of facilities, feather and thin edges of the clearing;
     d. Shaping cuts and fills to appear as natural forms;
     e. Cutting rock areas to appear as natural forms;
     f. Designing the facility to utilize natural screens; and
     g. Constructing fences, such as woven wood or rock, for use with landscaping.

10. **Light Shielding**. The operator will direct exterior lighting, when required, away from residential areas, or effectively shield the light from such areas.

11. **Solid Waste Storage - Temporary**. On-site temporary storage of waste will not be permitted for longer than six months. Open pit solid waste storage is not allowed in residential areas. In these areas, solid waste must be stored in a closed container.

12. **Solid Waste Storage – Fencing**. The operator will exclude people, livestock, and wildlife from solid waste disposal areas using fencing or other barriers approved by DO&G.

13. **Erosion Control Plan**. A plan of operations will include measures to be used to appropriately control soil erosion and sedimentation during all activities associated with exploration and development.

14. **Permanent Erosion Control**. The operator, after construction of a permanent facility, will replace temporary erosion control structures with permanent structures within 45 days of project completion or, if seasonal conditions dictate timing constraints, within 45 days after seasonal conditions permit the activity.

15. **Timber Harvesting**. Timber harvested as part of exploration and development activities (including right-of-way and pad clearing slash) will be processed and disposed of in a manner approved by the Division of Forestry to avoid spruce bark beetle infestation.

Split Estate

16. **Good Faith Negotiations**. Operators are required to make contact with the surface owner of lands upon which activities are proposed, and make good-faith efforts to negotiate a surface use agreement. If agreement cannot be reached, ADNR may initiate bond proceedings pursuant to AS 38.05.130, but only if the operator demonstrates that a reasonable period of time has passed from the initial contact between the surface owner and operator, and the operator has made a good-faith effort to reach an agreement.

17. **Split Estate Brochure**. ADNR will develop an informational brochure describing split estate issues. The brochure will include a discussion on the right of access to the subsurface estate, surface owner rights, and general provisions of a surface use agreement.

18. **Bond Amount**. When determining the damage bond amount under AS 38.05.130, ADNR shall consider the current market value of the property, the potential duration of operations, the loss of use of the property during operations, potential cost of damage to existing surface improvements, crops, and timber. In addition, the bond terms should include provisions to ensure that any bond with a potential duration of greater than two years is periodically reviewed to ensure it remains set at a sufficient amount.

Water Management

19. **Baseline Water Quantity Information**. Where ADNR determines that water withdrawal has significant potential to unduly affect waters currently used by others, such as an individual owner's well or a drinking water aquifer, ADNR will require a CBM applicant for a temporary water use authorization or water right to provide baseline information concerning water quantity. The information will be

designed to document the pre-withdrawal conditions in case the withdrawal causes a change in water availability to current users. The baseline information may include one or more measurements of water table depth or piezometric head. It may also include testing individual wells or other information as appropriate.

20. **Surface Disposal of Produced Waters**. If surface disposal of produced water is proposed, the plan of operations shall include a water management plan providing detailed information on the location, amounts, and potential impacts associated with the proposed surface disposal. Surface disposal of produced water will not be allowed unless ADEC determines that the discharge will meet state water quality standards and the Director has approved the water management plan.

21. **Water Quantity Monitoring**. Where ADNR determines that water withdrawal has significant potential to unduly affect waters currently used by others, such as an individual owner's well or a drinking water aquifer, the Department will condition temporary water use authorizations or water rights with the requirement to monitor the water availability in the area of concern. The conditions may include the requirement to establish a monitoring well, monitor existing wells, or other measures as appropriate.

SPECIAL NOTE: Under AS 31.05.030(j)(2)(D), the Alaska Oil and Gas Conservation Commission must require the operator to design and implement a water well testing program to provide baseline data on water quality and quantity, and make the results available to the public.

<u>Hydraulic Fracturing</u>

22. **Diesel-Based Fracturing Materials**. The operator will not use diesel-based fracturing materials.

<u>Roads and Pipelines</u>

23. **Transportation Plan**. A plan of operations will include an analysis of road and access issues associated with site development. All aspects of transportation related to the proposed activity and possible effects to existing uses and mitigation measures will be considered. The plan will address, at minimum:
    a. The adequacy of existing roads and access to the site. Operator activities must utilize existing road systems to the maximum extent possible;
    b. When feasible, heavy equipment and trucks should use bypass routes to avoid schools, rural residences and other sensitive areas;
    c. Whether dust control measures are necessary (in such instances, the use of non-toxic dust control measures will be used);
    d. The operator's measures to minimize the need for new road development, including the use of remote monitoring/telemetry and using two-track roads where operationally feasible and safe;
    e. The estimated number of site visits by vehicle;

f. The operator’s measures to minimize damage to the surface for approved off-road access, including limiting use during inclement weather and wet ground conditions;
g. The operator’s measures to ensure that new roads are constructed to allow for access by emergency response personnel;
h. The operator’s measures to ensure that construction of new roads minimizes surface impacts by following existing grades, minimizing cuts and fills, and minimizing habitat fragmentation; and
i. The operator’s consideration of public access granted under RS 2477 and other established rights-of-way.

24. **Exploration Infrastructure**. Exploration activities must utilize existing road systems, ice roads, air or boat service, or vehicles that cause minimal damage to the ground surface or vegetation. Construction of temporary roads may be allowed. Construction of permanent roads will be prohibited during the exploration phase unless requested by and approved by all private surface owners upon whose land the road will be built.

25. **Disturbance Along Right-of-Way**. The operator will minimize disturbance of vegetation within rights-of-way during construction, maintenance and operational activities.

26. **Pipeline Design**. All pipelines, including pipelines carrying produced water, must be designed and constructed to prevent releases and assure integrity against climatic conditions and geophysical hazards.

27. **Pipelines and Fish Streams**. Pipelines that must cross fish streams will be constructed beneath the fish streams using directional drilling techniques, unless the Director, in consultation with OHMP, approves an alternative method.

28. **Buried Pipelines**. The operator will bury pipelines unless safety, seismic, or environmental conditions dictate otherwise. In areas with above ground placement, pipelines shall be designed, sited and constructed to allow free movement of moose and other wildlife. The operator must minimize duplication of existing transportation corridors when planning a pipeline route.

<u>Public Access</u>

29. **Public Access**. Other than private surface lands, public access to, or use of, the state lease area may not be restricted except within the immediate vicinity of pipelines, drill sites, compressor stations, buildings, and other related facilities, unless the Director, in consultation with OHMP, determines that additional restrictions are necessary to protect sensitive fish or wildlife habitats. Areas of restricted access must be identified in the plan of operations.

Monitoring

30. **Monitoring**. Plan of operations approvals will include monitoring requirements. The monitoring requirements will be tailored to the specific situation and potential impacts. In approving a monitoring plan, ADNR will consider the following factors: whether the activities are for exploration or development, potential impacts to water quality and quantity, potential noise and/or visual impacts to adjacent users, magnitude of proposed ground disturbance, proximity to residential structures, the proximity to sensitive habitats or use areas, and the potential impact to fish or wildlife populations.

Well Spacing

31. **Well Pad Spacing**. Well pad spacing will be reviewed and approved as part of a Unit plan of development. The decision whether to approve a well pad spacing proposal will be based upon a balancing of the gas pool management needs, the anticipated surface impacts and surface conflicts, and the technical and economic feasibility of minimizing those impacts.

Geophysical Hazards

32. **Geophysical Hazards**. A plan of operations will identify any geophysical hazards in the area of operations. A plan of operations for proposed development in the vicinity of a geophysical hazard must include siting, design, and construction measures for minimizing property damage and protecting against loss of life.

DR&R

33. **Dismantlement, Removal, and Rehabilitation**. Upon abandonment of material sites, drilling sites, roads, buildings, or other facilities, such facilities must be removed and the site rehabilitated to the satisfaction of the Director, unless the Director, in consultation with Division of Mining, Land, and Water; OHMP, DEC, and any non-state surface owner, determines that such removal and rehabilitation is not in the state's best interest.

Relation with Other State Requirements

34. **Compliance with Use Area Plans**. Operators must comply with all current or future ADNR area plans and recreation rivers plans; and ADF&G game refuge plans, critical habitat area plans, and sanctuary area plans within which operations are located.

35. **Prehistoric, Historic and Archeological Sites.** Operators will comply with ADNR's standard stipulations concerning protection of prehistoric, historic and archeological sites. (See sample mitigation measures in Appendix A).

36. **Local Hire, Communication and Training**. Operators will comply with ADNR's standard stipulations concerning local hire, working with local

constituencies, and cultural sensitivity. (See sample mitigation measures in Appendix A).

37. **Fish and Wildlife Resources**. The operator will comply with all standard mitigation measures designed to protect fish and wildlife and their habitat. (See sample mitigation measures in Appendix A).

38. **Hazardous Substances**. The operator will comply with ADNR's standard stipulations for handling hazardous substances (See sample mitigation measures in Appendix A).

39. **Definitions.** In this document

    a. "Facilities" means any structure, equipment, or improvement to the surface, whether temporary or permanent, including, but not limited to, roads, pads, pits, pipelines, power lines, generators, utilities, airstrips, wells, compressors, drill rigs, camps and buildings;
    b. "Feasible and prudent" means consistent with sound engineering practice and not causing environmental, social, or economic costs that outweigh the public benefit to be derived from compliance with the standard;
    c. "Geophysical Hazard" means the following natural processes or adverse conditions that present a threat to life or property in the area of operations: flooding, earthquakes, active faults, landslides, ice formations, snow avalanches, and erosion;
    d. "Minimize" means to reduce adverse impacts to the smallest amount, extent, duration, size, or degree reasonable in light of the environmental, social, or economic costs of further reduction; and
    e. "Permanent facility" means a facility that will be remain at a single location for period in excess of six months; and
    f. "Plan of operations" means a license plan of operations under 11 AAC 83.158 and a unit plan of operations under 11 AAC 83.346;
    g. "Residential structure" means a building used regularly as a residence;
    h. "Residential subdivision" means a subdivision in which more than half of the parcels currently contain, or within the reasonably foreseeable future will contain, a residential structure;
    i. "Sensitive public facility" means a hospital, school, public library, or court building; and
    j. "Subdivision" means a collection of land parcels whose legal description is determined by a single plat recorded at the State's Recorders Office.

SECTION 4

RECOMMENDATIONS TO OTHER AGENCIES

SECTION 4. RECOMMENDATIONS TO OTHER AGENCIES

ADNR recommends that Alaska Oil and Gas Conservation Commission and the Mat-Su Borough consider the following actions:

1. The Mat-Su Borough adopt an ordinance to establish standards similar to those adopted here by ADNR to be applied by the borough on non-state managed lands.

2. AOGCC continue its efforts to develop a public notice procedure for permits to drill CBM wells.

3. AOGCC continue its efforts to develop requirements for proposed CBM wells of baseline testing and on-going monitoring for water quality of any existing drinking water well that may be negatively affected by the CBM production. The testing to include methane content to identify any potential risk of methane seepage.

APPENDIX A

SAMPLE OIL AND GAS LEASE MITIGATION MEASURES

Sample Oil and Gas Lease Mitigation Measures

(Taken from Shallow Gas Leases and Susitna Exploration Licenses)

(**Special Note**: The following sample mitigation measures are provided here for demonstration purposes only. These represent the types of mitigation measures typically put in place for oil and gas leases and licenses. The specific species and waterbodies covered by the mitigation measures will be determined based upon the particular lease/license area.)

Abbreviations mean: Alaska Department of Environmental Conservation (ADEC), Alaska Department of Fish and Game (ADF&G), Alaska Department of Natural Resources (ADNR), Alaska Oil and Gas Conservation Commission (AOGCC), Director (Director, Division of Oil and Gas), Division of Oil and Gas (DO&G), Office of Habitat Management and Permitting (OHMP), Matanuska-Susitna Borough (MSB), and State Historic Preservation Officer (SHPO).

Fish and Wildlife Habitat

1. The siting of facilities, other than docks, or road, utility, or pipeline crossings, will be prohibited within 500 feet of all fish bearing waterbodies *(Note: For Shallow Gas Leases, it is 300 feet)*. Additionally, siting of facilities will be prohibited within one-half mile of the banks of Alexander, Lake, Peters, and Cache Creeks, and the Susitna, Deshka, Kahiltna, Talachulitna, and Yentna rivers. Facilities may be sited within these buffers if the operator demonstrates to the satisfaction of the Director, after consultation with OHMP, that site locations outside these buffers are not feasible or prudent or that a location inside the buffer is environmentally preferred. Road, utility, and pipeline crossings must be aligned perpendicular or near perpendicular to watercourses.

2. Impacts to important wetlands must be minimized to the satisfaction of the Director, in consultation with OHMP and ADEC. The Director will consider whether facilities are sited in the least sensitive areas.

3. Facilities and operations shall avoid unreasonable conflicts with subsistence harvests. When reviewing a proposed plan of operations, the Director will work with other agencies and the public to assure that unreasonable conflicts with subsistence harvests are identified and avoided.

Fishbearing Streams

4. Detonation of explosives within or in close proximity to fishbearing waters must not produce instantaneous pressure changes that exceed 2.7 pounds per square inch in the swim bladder of a fish. Detonation of explosives within or in close proximity to a fish spawning bed during the early stages of egg incubation must not produce a peak particle velocity greater than 0.5 inches per second. Blasting

criteria have been developed by ADF&G and are available upon request along with the location of fishbearing waters within the project area.

5. Compaction or removal of snow cover overlying fishbearing waterbodies is prohibited except for approved crossings. If ice thickness is not sufficient to facilitate a crossing, ice or snow bridges may be required.

6. Water intake pipes used to remove water from fishbearing waterbodies must be surrounded by a screened enclosure to prevent fish entrainment and impingement. Screen mesh size shall be no greater than 0.1 inches unless another size has been approved by OHMP. The maximum water velocity at the surface of the screen enclosure may be no greater than 0.2 feet per second.

Bear Habitat

7. Before commencement of any activities, operators shall consult data provided by the ADF&G identifying the locations of bear den sites that are actually occupied in the season of the proposed activities. Exploration and development activities begun between October 15 and April 31, may not be conducted within ½-mile of occupied brown bear dens, unless alternative mitigation measures are approved by ADF&G. An operator who encounters an occupied bear den not previously identified in the data provided by ADF&G must report it to the Division of Wildlife Conservation, ADF&G, within 24 hours. Mobile activities shall avoid such discovered occupied dens by ½-mile unless alternative mitigation measures are approved by DO&G with concurrence from ADF&G. Non-mobile facilities will not be required to be relocated.

Bald Eagle and Trumpeter Swan Habitats

8. Permanent facilities may be prohibited within ¼-mile and will be prohibited within 330 feet of bald eagle nests, active or inactive. Temporary activities within 330 feet of nesting sites may be allowed between September 1 and March 31 if they will not alter bald eagle habitat. Surface entry will be prohibited within 330 feet of active nests between April 1 and August 31. Maps identifying documented nest sites will be made available by ADF&G upon request.

9. If the operator discovers a previously unreported active or inactive bald eagle nest, the operator must report the nest location to the Director as soon as possible. Operators are advised that activities likely to disturb nesting eagles are subject to the provisions of the Bald Eagle Act of 1940, as amended.

10. Surface entry will be prohibited within ¼-mile of trumpeter swan nesting sites from April 1 through August 31. The siting of permanent facilities, including roads, material sites, storage areas, powerlines, and above-ground pipelines are prohibited within ¼-mile of known nesting sites. ADF&G will identify trumpeter swan nesting sites at the request of the operator.

Tule Goose Habitat

11. The special measures listed below will be imposed to preserve Tule white-fronted goose habitat along the Kahiltna and Yentna rivers. Mitigation measure 15 shall apply to activities within the "Tule Goose Habitat Area." Mitigation measure 16 shall apply to activities within the "Tule Goose Core Nesting and Molting Area."

   a. The two locations that comprise the "Tule Goose Habitat Area" are identified in Figure 3.1 in the final best interest finding and are described as:

      i. All of T19N R8W, T19N R9W, and T20N R9W; and the west half of T20N 8W, Seward Meridian.

      ii. The western third of T23N R8W and T24N R8W; all of T23N R9W and T24N R9W; and the east half of T23N R10W and T24N R10W, Seward Meridian.

   b. The location that comprises the "Tule Goose Core Nesting and Molting Area" is identified in Figure 3.1 and is described as:

      T25N R9W
      Section 4, 5, 6, 7, 8, 9, 15, 16, 17, 18, 19, 20, 21, 22, 27, 28, 29, 30, 32, 33, 34;

      T25N R10W
      Section 1, 2, 3, 11, 12, 13, 24;

      T26N R9W
      Section 19, 29, 30, 31, 32;

      T26N R10W
      Section 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 20, 21, 22, 23, 24, 25, 26, 27, 28, 33, 34, 35, 36; and

      T26N R11W
      Section 1, Seward Meridian.

12. Within the "Tule Goose Habitat Area":

   a. exploratory drilling, development, and major maintenance will be allowed only between August 16 and March 31, unless an extension is approved by the Director, in consultation with OHMP;

   b. during the production phase, routine maintenance and emergency repairs on a year-round basis will be permitted within this area, following approval of a detailed plan describing routine maintenance activities to be conducted between April 1 and August 15;

   c. the director will approve a routine maintenance plan following consultation with OHMP;

d. gravel pads, wellheads, pipelines and drillsite-related facilities are the only permanent aboveground structures that will be allowed;

e. temporary roads may be allowed as provided in Measure 17; and

f. permanent roads connecting pads may be allowed if the Director determines, in consultation with OHMP, that the road will have no significant impact on Tule geese during nesting and molting.

13. Within the "Tule Goose Core Nesting and Molting Area":

a. surface entry for drilling, and above ground lease-related facilities and structures, with the exception of pipelines, will be prohibited;

b. seismic exploration will be allowed only between August 16 and March 31;

c. geologic fieldwork may be conducted year round;

d. helicopter landings within this area during the nesting and molting season may be restricted; and

e. pipelines may be sited within this area only if the Director determines, in consultation with OHMP, that the proposed pipeline will have no significant impact on Tule geese (buried pipelines are preferred).

Fuel and Hazardous Substances

14. Secondary containment shall be provided for the storage of fuel or hazardous substances.

15. Containers with a total storage capacity of greater than 55 gallons which contain fuel or hazardous substances shall not be stored within 100 feet of a waterbody.

16. During equipment storage or maintenance, the site shall be protected from leaking or dripping fuel and hazardous substances by the placement of drip pans or other surface liners designed to catch and hold fluids under the equipment, or by creating an area for storage or maintenance using an impermeable liner or other suitable containment mechanism.

17. During fuel or hazardous substance transfer, secondary containment or a surface liner must be placed under all container or vehicle fuel tank inlet and outlet points, hose connections, and hose ends. Appropriate spill response equipment, sufficient to respond to a spill of up to five gallons, must be on hand during any transfer or handling of fuel or hazardous substances. Transfer operations shall be attended by trained personnel at all times.

18. Vehicle refueling shall not occur within the annual floodplain. This measure does not apply to water-borne vessels, provided no more than 30 gallons of fuel is transferred at any give time.

19. All independent fuel and hazardous substance containers shall be marked with the contents and the operator's name using paint or a permanent label.

Prehistoric, Historic and Archeological Sites

20. Before commencing construction or placement of a road, structure, or facility, the operator must conduct an inventory of prehistoric, historic, and archeological sites within the area affected by the activity. The inventory must include consideration of literature provided by the MSB and local residents; documentation of oral history regarding prehistoric and historic uses of such sites; evidence of consultation with the Alaska Heritage Resources Survey and the National Register of Historic Places; and site surveys. The inventory must include an analysis of the effects on any prehistoric, historic, and archeological site that might result from the proposed activity.

21. The inventory of prehistoric, historic, and archeological sites must be submitted to the Director and SHPO for review and comment. If a prehistoric, historic, or archeological site or area could be adversely affected by a lease activity, the Director, after consultation with SHPO and the MSB, will direct the operator as to the course of action to take to avoid or minimize adverse effects.

22. If a site, structure, or object of prehistoric, historic, or archaeological significance is discovered during lease operations, the operator must report the discovery to the Director as soon as possible. The operator must make reasonable efforts to preserve and protect the discovered site, structure, or object from damage until the Director, after consultation with the SHPO, has directed the operator as to the course of action to take for its preservation.

Local Hire, Communication and Training

23. To the extent available and qualified, the operator is encouraged to employ local and Alaska residents and contractors for work performed on the leased area. Operators shall submit, as part of a plan of operations application, a proposal detailing the means by which the operator will comply with this measure. The proposal must include a description of the operator's plans for partnering with local communities to recruit and hire local and Alaska residents and contractors. The operator is encouraged, in formulating this proposal, to coordinate with employment services offered by the state of Alaska and local communities and to recruit employees from local communities.

24. A plan of operations application must describe the operator's past and prospective efforts to communicate with local communities and interested local community groups.

25. A plan of operations application must include a training program for all personnel, including contractors and subcontractors. The program must be designed to inform each person working on the project of environmental, social,

and cultural concerns that relate to that person's job. The program must use methods to ensure that personnel understand and use techniques necessary to preserve geological, archeological, and biological resources. In addition, the program must be designed to help personnel increase their sensitivity and understanding of community values, customs, and lifestyles in areas where they will be operating.

Definitions

In this document

a. "Important wetlands" means those wetlands that are of high value to fish, waterfowl, and shorebirds because of their unique characteristics or scarcity in the region or that have been determined to function at a high level using the hydrogeomorphic approach;

b. "Secondary containment" means an impermeable diked area or portable impermeable containment structure capable of containing 110 percent of the volume of the largest independent container plus 12 inches of freeboard. Double walled tanks do not qualify as secondary containment unless an exception is granted for a particular tank.