ALASKA CHAPTER OF THE WILDLIFE SOCIETY

December 21, 2023

Stacie McIntosh
Ambler Road SEIS Project Manager
Bureau of Land Management
BLM Fairbanks District Office
222 University Avenue
Fairbanks, AK 99709

RE: Alaska Chapter of The Wildlife Society Comments on the Draft Supplemental Environmental Impact Statement for the Ambler Road Project

Dear Ms. McIntosh,

This letter represents the Alaska Chapter of The Wildlife Society's public comments on the Draft Supplemental Environmental Impact Statement (DSEIS) for the Ambler Road Project. We appreciate the opportunity to comment on this important document for a project that has the potential to greatly transform northern Alaska in many ways.

The Wildlife Society (TWS) was founded in 1937 and is a non-profit scientific and educational association of over 11,000 professional wildlife biologists and managers, dedicated to excellence in wildlife stewardship through science and education. Our mission is to inspire, empower and enable wildlife professionals to sustain wildlife populations and habitats through science-based management and conservation. Our professional membership represents and serves the community of scientists, managers, educators, technicians, planners, and others who work actively to study, manage and conserve wildlife and its habitats worldwide. The Alaska Chapter of TWS has about 200 members in Alaska representing wildlife scientists and resource managers including those working for state and federal agencies, Native organizations, universities, non-profit groups and consulting biologists. Our collective knowledge regarding wildlife and its habitat in Alaska is our greatest strength, and we offer these comments in hopes that they will be used to improve the analyses in the DSEIS.

We appreciate the attention that has been shown to analyzing the potential benefits and impacts of the Ambler Road Project. Many issues have been raised that are important for BLM and the public to consider as the decision proceeds regarding permitting of a single-purpose access road between the Dalton Highway and the Ambler Mining District. We previously commented on the Ambler Road Draft EIS process in 2019, raising a number of issues and concerns. We appreciate that several of our concerns and suggestions were incorporated into the SDEIS. Unfortunately, some other very important concerns appear to have been overlooked, or inadequately addressed in the DSEIS. We first provide a review of previous major requests and how they have or have not been addressed in the DSEIS before turning to remaining additional species and environment-specific issues. We conclude with a review of the DSEIS proposal for reclamation and restoration of the road and concerns about whether it will be implemented and effective.

Major issues we raised during the Draft EIS

1. Life of road.

   We raised concerns in our Draft EIS comments about whether the Ambler Road actually would be removed and the land reclaimed when the estimated 50-year life of the mines in the Ambler District was completed. The new DSEIS continues to claim that this will occur, though with greater acknowledgement that other possibilities exist. As described in more detail in the restoration section below, we remain skeptical about whether this will occur – a stance only increased by statements in the DSEIS. In our experience, Alaska does not have a record of removing and reclaiming roads and previously-mined areas in remote locations once they are built (Arnett 2005). The DSEIS' failure to consider an alternative with a longer life than 50 years, or possibly in perpetuity, represents a segmentation of the overall project such that a significant portion of future impacts are not analyzed. We requested in our Draft EIS comments that BLM disclose in the Final EIS how many miles of mining road they manage in Alaska that have actually been "put to bed" and reclaimed. This was not done in the Final EIS or the DSEIS. TWS attempted a search and could only find a few examples of short roads (e.g. Frying Pan Creek and Acme Creek) that were reclaimed. Rather, the record is one in which there is the continued existence and evolving uses of many short mining roads (e.g. Prospect Creek, Chapman Creek, Slate Creek, and Marion Creek off the Dalton, and Hogatza-Aloha Creek off the Koyukuk). To our knowledge there have been no *major* BLM- or State-permitted mining roads that have been reclaimed in Alaska. This is also reflected in prior reviews that found that virtually no infrastructure from previous oil and gas development had been removed (NRC 2003). TWS therefore recommends that the FSEIS include a scenario in which the road is planned to be open for a period much longer than 50 years, and in which it will not be removed and reclaimed and fully analyze the expected impacts this would have on wildlife, environmental processes, and subsistence and other human activities.

2. Public road access.

   TWS strongly objected to the repeated assumption in the Draft EIS that the road will be a private road and will never be opened to the public. Just as for the 50-year life mentioned above, once constructed, in our judgment it is reasonably foreseeable that economics, social justice concerns, and political pressure will likely cause the Ambler road to be made public, eventually. This is not speculative -- it is reality in rural Alaska and based on historic observations. We were pleased to see acknowledgement of this in the DSEIS. However, its treatment still falls short of a reasonable standard of scientific rigor, for although the likelihood of the road being made publicly available was mentioned, there was no analysis of how this would affect traffic levels, species, or other impacts in the future. This is a glaring omission and TWS once again strongly urges that BLM add an alternative scenario to the FSEIS in which the impacts are analyzed of the Ambler Road being eventually opened for public use.

3. Segmentation of impacts assessment.

   Another concern raised in our Draft EIS comments regarded how BLM artificially and incorrectly limited the scope of the Cumulative Impacts analysis by focusing primarily on four mines within the Ambler Mining District. TWS maintains that it is reasonably foreseeable that other mines outside of the Ambler District and near the road could be developed, given the improved access. Again, this is not speculative, rather it indicates that over the long term, the four hypothetical mines at the end of the Ambler Road represent a *minimum* impact scenario. The DSEIS acknowledges the potential for other mineral development, yet still fails to include a more intensive impact scenario that includes the additive and cumulative impacts from the host of other mines, large and small, which may be proposed and approved elsewhere along the routes of Alternatives A, B, or C. It is common in

scientific simulation studies to examine a range of possible alternatives (e.g., 5%, median, 95% or 25%, 50%, 75%) to depict the range of variation in expected effects of proposed treatments. TWS therefore recommends that BLM follow such an approach and analyze at least one additional future mine development scenario over and above the four Ambler mines in final analysis of cumulative impacts. Note that the Dalton Hwy, originally built only for industry access to North Slope, is now open to the general public, as is the DeLong Mountain Transportation System (run by the Alaska Industrial Development and Export Authority, AIDEA, who is the proponent of the Ambler Road Project).

4. Inter-jurisdictional permitting, mitigation, and enforcement issues.

A fourth issue raised in our Draft EIS comments was about the significant qualifications and caveats in the Draft EIS that raise questions about the effectiveness of permitting, mitigation and enforcement, given the multiple jurisdictional authorities that will share the Ambler Road. Each agency and private Native Corporation land owner/manager along the Ambler Road corridor has differing legal responsibilities and therefore may have differing interpretations of priorities pertaining to wildlife, fisheries and their habitats in the project area. These qualifications indicate to our cadre of professional wildlife biologists and habitat managers that there is potential for significant inter-agency and inter-organizational confusion, and possibly disagreements, on how permits will be approved, managed, and enforced. Unfortunately, this is an issue that continues to occur in the DSEIS, as the following quotes illustrate:

> "During winter, steep snow banks may prevent caribou movement and reduce road crossings…except on BLM-managed lands where this potential impact may be partially mitigated" (p. 3-137).
>
> "The Bureau of Land Management's (BLM's) authority to require and enforce mitigation generally is limited to mitigating impacts to BLM-managed lands and resources on those lands" (p. N-1).
>
> "The discussion includes consideration of whether and how the effectiveness of mitigation on BLM-managed land would be affected if the same mitigation is not applied off BLM-managed land. The landowner discussion is necessary, because the BLM manages only part of the land along each alternative and its authority is limited to mitigating impacts to BLM-managed lands and resources. The BLM would have authority over approximately 3,000 to 3,500 acres of the project on federal lands for Alternatives A and B (out of approximately 15,000 acres for the total project footprint), and authority over approximately 19,000 acres of the project on federal lands along Alternative C (out of approximately 23,000 acres total)" (p. N-1).
>
> "However, if the plan is only implemented within the BLM-managed portions of the routes, then this measure would be partially effective under Alternatives A and B. Under Alternative C, this measure still would be partially effective; however, given the larger proportion of BLM-managed lands on that route, the area of effectiveness would be larger" (p. N-30 – N-31)
>
> "Because BLM-managed land constitutes a small proportion of Alternatives A and B, if these mitigation measures are not adopted by AIDEA for other land management agencies, then their implementation would do little to reduce impacts across the entire project." (p. N-39).

TWS remains extremely concerned that because of multiple jurisdictions there will not be unified and consistent management and enforcement of permits, stipulations, and mitigation measures. In the late 1970s some of our membership worked on environmental monitoring aspects during construction and initial commissioning of the

Trans-Alaska Oil Pipeline System (TAPS). There is a significant body of research based on experience from the TAPS mega-project which suggests that a cooperative inter-agency approach is the only feasible means to ensure consistent application of environmental protection measures for a project of the magnitude of the Ambler Road and its associated mining development across multiple land jurisdictions (Morehouse et al. 1978, Pamplin 1979, CGI/Quest 1980). In the case of TAPS, a Joint Fish and Wildlife Assistance Team (JFWAT), consisting of State, Federal, and private consultant-level environmental experts, was formed to work under the Federal Alaska Pipeline Office and State Pipeline Coordinator office (*See also* Mead 1978, Wickwire 1979, McGrath 1977, Hanraban and Gruenstein 1977, and McCracken 1976 for historic descriptions of the chaotic start and effects of TAPS construction on Alaska wildlands and social systems).

TWS implores all agencies and land managers involved in permitting the road and ensuing mines to create and enforce a *consistent* set of strict permit stipulations and mitigation actions. Should the Ambler Road project advance to the design phase, TWS strongly urges the proponents, and all involved landowners and managers, to sign a cooperative agreement aimed towards unified permit approval procedures, stipulations, management, mitigation, and enforcement, for the road and ensuing mineral developments. We see a joint inter-organizational permit management field office, similar to JFWAT, as the only way for the Ambler Road project and the mineral development along the road to be managed in a manner that adequately protects fish, wildlife, habitats, and the people who depend on them.

Species- and environment-specific issues

1. Invasive species

The DSEIS properly addresses the threat of non-native invasive species (NNIS) introductions to the pristine study area to be impacted by all three alternative routes. McMillan and Callear (2014) documented white sweetclover (*Melilotus alba*) and bird vetch (*Viccia cracca*) as the two terrestrial NNIS with greatest abundance along the Dalton Highway, which have high invasion potential to move beyond the highway. We appreciate inclusion of Map 3-11, which documents the solid infestation at the eastern ends of all three alternatives at the Dalton, as well as the DSEIS' proactive analysis of the vulnerability of watersheds adjacent to Dalton Highway. We note that p. 3-65 calls out an infestation of bird vetch adjacent to the Dalton Highway at the eastern end of Alternative C, but does not mention infestation of white sweetclover at that location; it also fails to correctly report that both species have also infested the eastern end of Alternatives A/B along the Dalton. We are extremely concerned because terrestrial bird vetch and white sweetclover, along with the aquatic *Elodea*, are rated as highly invasive, and all three have the ability to alter habitats permanently (Spellman 2008, Gucker 2009, Graziano et al. 2016).

We appreciate that BLM accepted our suggestion from 2019 and added Potential Mitigation Measure 1.1.14 (p. N-5), which requires plowing and grading only in a west to east direction to minimize spread of NNIS seeds westward from the Dalton. The words "to the extent practicable" should be deleted from that mitigation. This must be strictly adhered to in order to minimize the spread of these habitat-altering species. Similarly, Potential Mitigation Measure 3.3.1.3.3 (p. N-28) should be modified slightly: "Permitted activities, including road and snow maintenance activities, would ALWAYS commence from areas known to not be infested with invasive plants (e.g., western end of the road) and progress toward known infested areas" (ALWAYS should be added). Furthermore, we appreciate that Mitigation 3.3.1.3.1 states BLM will require an overall Invasive Species Prevention and Management Plan for their lands (p. N-27), but we strongly recommend it be required along all lands traversed by the Ambler Road. As described above, this will require close coordination with the various land managers, ideally through a signed inter-organizational agreement and team.

Potential Mitigation Measure 3.3.1.1.2 (p. N-24) should be clarified to use previously stockpiled *local* topsoil with live native vegetation. Use of non-local topsoil would risk importation of non-local NNIS that could be within the non-local topsoil. Potential Mitigation Measure 3.3.1.3.2 provides for: "Specific practices, procedures, and BMPs for preventing the spread of NNIS, addressing inspection and washing/brushing of vehicles (including tires and undercarriage), and cleaning of equipment, clothing, and shoes….Specific procedures to ensure that aircraft, vehicles/equipment, or materials that have traveled to, parked in, or been staged in areas infested with invasive plants are inspected and certified weed-free prior to being allowed on the right of way" (p. N-27). These measures seem like they could be effective in non-winter months, however, TWS recommends more specific details for effective winter operations. Will there be a heated building at the start of the highway to conduct washing and inspections? If water cannot be used for washing in winter what other options will be approved in the final ROW permit? TWS adds this caution because seeds of the most invasive species on the Dalton, white sweetclover, are only about 1/16" in diameter and could easily be missed when embedded in snow or mud within treads (or other places) during an inspection. Studies have demonstrated that these seeds can be spread in winter simply from driving a snowmobile through an infested area to a non-infested area (T. Craig, Kanuti NWR, pers. comm.).

2. Monitoring plans

Potential Mitigation Measures 1.1.10 (p. N-4) and 3.3.2.2 (p. N-20) require water, fish, and wildlife monitoring plans. We suggest the water monitoring plan should be more specific as to what is required to be monitored, and for how long and where. Variables such as permafrost thaw depth; water temperature; turbidity; pH; petroleum, oil, and lubricant (POL) contaminants; fugitive dust contaminants; heavy metals; etc. should be specified before a ROW permit is issued. Similarly, the locations, features, and variables to be monitored in the fish and wildlife monitoring plan should be specified before any ROD and ROW permit are issued.

3. Water quality, aquatics and fisheries

TWS appreciates the numerous candid statements in the DSEIS, which taken together, concluded that even with expected mitigation actions, water quality and fisheries could suffer from construction of the Ambler Road and from the reasonably foreseeable indirect impacts from development of at least four large open pit mines that the road would enable. Such statements include:

> "Impacts on water resources quality may include increased dust from mining operations, potential spills and containment of ore concentrates, chemicals used in processing ore, fuels, and process water, in addition to wastewater from operations of facilities and camps, and *may require treatment of mine water in perpetuity*" (Italics added, p. 3-44).
>
> "Direct and indirect chemical stressors such as mining-related pollution, acid mine drainage, and the release of toxic materials have the potential to impact the health and the survival of fish populations and other aquatic species (Limpinsel et al. 2017). Toxic metals that bioaccumulate in fish tissue can lead to fish mortality, increased susceptibility to disease, and reduced growth rates and can pose health risks to human consumers (Hughes et al. 2016; Peplow and Edmonds 2005). Agencies with jurisdiction would propose mitigation measures to avoid and minimize water quality impacts; however, that does not ensure the measures would be fully effective" (p. 3-105).

These scientifically supported statements, and several others in the DSEIS, clearly disclose the risks posed to the aquatic environment if BLM decides to permit construction of the Ambler Road.

The DSEIS acknowledges that road dust is a major issue. We earlier suggested that BLM and the proponent research alternatives for dust control and include strong mitigation actions. We maintain that calcium chloride, pesticides, and herbicides should not be used at any time. We question why Potential Mitigation Measure 3.3.3.8 states "Dust suppressants or pesticides with ingredients potentially harmful to aquatic organisms would not be used within 328 feet of any fish-bearing stream and higher-value wetland" (p. N-35). Clear description and citation is needed of the scientific literature that supports the notion that toxic effects of these compounds would be ameliorated at distances greater than 328 feet from the water's edge if it is to be relied upon as a mitigation measure.

We support the Section 404 Clean Water Act mitigation measures to be adopted from the Corps of Engineers Permit (see Potential Mitigation Measure series 3.5, pp. N-51 to N-55), especially because they would apply to the entire road project. A commitment should be made in the FSEIS that a similar set of Corps stipulations will also be applied to any spur roads and vegetation clearing made for all ensuing mine developments. It is critical that fish passage is not impeded and impacts to water quality be minimized. Protection of water quality, fish spawning, rearing, migration paths, and wintering habitats should be among the highest priorities on the project, if it is to be built.

The DSEIS lists a suite of the important fish species in the Project Area stating that "Pacific salmon, Sheefish, Broad and Humpback Whitefish, Arctic Grayling, Northern Pike, and Burbot are the major targets of a subsistence, sport, or commercial fishery activity" (p. 3-82). Of the salmon species, the DSEIS states Chinook and Chum Salmon are most important, but due to declining abundance and fishing closures, the non-salmonids have become more important. The DSEIS further states, "Sheefish, Broad Whitefish, Humpback Whitefish, and Grayling comprise most of the non-salmon subsistence harvest for Koyukuk River and Upper Kobuk communities" (p. 3-85). TWS recommended in 2019, and suggests again, that Least Cisco also be added to the list of key species because of their subsistence importance (TWS 2019, Georgette and Scheidt 2005, Andersen 2007, and F. Adams, USFWS fish biologist, retired, pers. comm.). Perhaps insufficient species identification occurred in the harvest surveys, but this important species should not be ignored because of that.

Potential Mitigation Measure 3.2.5.1.1 specifies design of fish-bearing stream crossings to withstand 100-year discharge flood levels. It also has the qualification: "In developing estimates of flows and discharge for crossing design, climate trends would be used to improve the future discharge estimates and delineation of the floodplains" (pp. N-19 - N-20). We encourage the proponent and BLM to disclose how they will design more specifically to deal with the increasing frequency of extreme climate events, which increase the likelihood that the "old" 100-year flood level will occur more often (Lader et al. 2017). These crossings should have the resilience to deal with predicted extremes of 2X or 3X in the future.

Several mitigation measures include discretion or approval by the BLM Authorized Officer. The FSEIS should include citations of standards that the Authorized Officer would use to make such decisions. Standards for such decisions need to be supported by policy manuals that include the reference to the best available science and BMPs.

4. <u>Birds</u>

We appreciate that Table 17 (pp. E-15 to E-18) provides a comprehensive summary of bird species found in the study area. Importantly, it also notes 69 species that various agencies and organizations have called for special attention because of their status as being of conservation concern (USFWS); sensitive or watchlist (BLM); at risk (ADFG); red list or yellow list (Audubon); near-threatened or vulnerable (IUCN); and, common but steep decline or needing continental stewardship (BPIF). These species are variably associated with boreal wetland habitats,

riparian areas, mesic spruce forests, upland shrublands, and alpine tundra. We suggest the Wildlife Monitoring Plan should give special attention to the habitats used by the species of concern that have been listed by these separate organizations. Potential Mitigation Measure 3.3.4.1 (p. N-35) prohibiting land clearing May 15 - July 15 should be strictly enforced.

The Gray-headed Chickadee (*Poecile cinctus*) is listed incorrectly as 'uncommon' in the study area (p. E-17). This should be corrected because the species is rare in North America, occurring only in northern and western Alaska and northwestern Canada, and there is evidence of recent population decline and range contraction for the unique subspecies (*p. c. lathami*) that occurs in North America. Because of its small population size, limited distribution, and apparent population decline, the Gray-headed Chickadee should be the subject of focused surveys throughout any proposed road corridor in this region. It has been recorded using narrow belts of riparian shrubland and forest habitats along the southern Brooks Range for breeding within the region, and thus the species could be at great risk from any of the alternatives, but particularly A and B (DeCicco et al. 2017, Hailman and Haftorn 1995).

The stipulations for riparian floodplains (Proposed Mitigation Measure 3.2.5.1.6, pp. N20-21) and wetlands (Proposed Mitigation Measure 3.2.5.2.4, pp. N21-N22), should be adhered to strictly over the entire project in order to protect important bird habitats. However, the overall impacts of any of the three alternatives, plus those stemming from the reasonably foreseeable additional mining development, describe unavoidable impacts to birds and their habitats. We appreciate that the SDEIS discloses those impacts, stating: “Habitat loss and alteration due to the reasonably foreseeable development of the District could more than equal that from the road and exponentially increase fragmentation of avian habitat. Disturbance and displacement from mining activity would be in addition to disturbance due to road construction and use” (p. 3-124). The DSEIS properly recognizes that the North American avifauna is already in a prolonged and significant decline, citing on page 3-116 a concerning study by Rosenberg et al. (2019). Unfortunately, when important bird habitats such as boreal wetlands, riparian floodplains, mesic spruce forests, upland shrublands, and alpine tundra, are replaced with a gravel road and open-pit mining developments, there are no permit stipulations or mitigations that can eliminate that loss. Therefore, because of the continentally diminishing abundance and biodiversity TWS recommends that compensatory mitigation be a part of this project. BLM manages significant acreage of degraded and previously-mined riparian and wetland habitats elsewhere in Alaska, particularly in the Central Yukon (M. Spindler pers comm.), Eastern Alaska (Arnette 2005, Brady et al. 2018), and Glenallen Districts. The FSEIS should propose specific acreages of degraded placer mining areas that will be reclaimed and restored to functional riparian habitat. If the FSEIS and ROD conclude that the Ambler Road will be permitted, the compensatory mitigation should be funded by a percentage of profits derived from future mining developments in the Ambler District.

5. Small mammals

The DSEIS stated: “...currently available information on habitat value for most small mammal species is unavailable. Therefore, potential impacts cannot be quantified” (p. 3-141). We are aware of one study in the project area that was not cited that may help shed some light on this question (Swanson 1996). Even so, we believe the DSEIS correctly speculated “The indirect and cumulative impacts from development of the District and secondary access roads, and other development or activities to small mammals throughout the analysis area would add to those from the action alternatives. Habitat loss and alteration due to the reasonably foreseeable development of the District could equal or exceed that from the road itself” (p. 3-154). Again, compensatory mitigation should be required for these losses.

TWS appreciates that the DSEIS included the status and habitat information we provided regarding Little Brown Bat (*Myotis lucifugus*). We recommend the Fish and Wildlife Monitoring Plan and pre-clearing surveys take

specific note of any bat observations or roost sites. As with all bird nests, bat tree roosts should be identified to avoid destruction during the land clearing phase of the road project. Potential Mitigation Measure 3.3.4.1 for birds (p. N-35), preventing land clearing during bird nesting, should be added for the little brown bat pup rearing period: June through early August.

5. Large herbivores, particularly moose.

Appendix L clearly indicates the cultural and food-security importance of moose to subsistence and recreational users in the project area. The DSEIS states:

> "The indirect and cumulative impacts from development of the District and secondary access roads, and other development or activities to other large herbivores throughout the analysis area would be additive to and synergistic with the action alternatives (see Appendix H) and impacts from climate change. The development of the District and secondary access roads would result in habitat loss, alteration, and fragmentation of ungulate habitat" (p. 3-150).

Most of the region is extremely low-density moose habitat, and, as stated in the DSEIS, "According to NPS and ADF&G studies, population estimates do not appear to be meeting management objectives, natural mortality is high, and harvest is currently restricted" (p. 3-130). Given the average density of moose in the area, at 0.48/mi^2, that could mean the loss of 23-36 mi^2 of habitat for 48-75 moose, depending on the alternative. Again, TWS believes the only fair solution is compensatory mitigation that restores 23-36 mi^2 (14,000 to 23,000 acres) of riparian habitat previously degraded by placer mining, depending on the alternative.

6. Caribou

Caribou (*Rangifer tarandus*) are a key species in Alaska both ecologically and for Alaska Native subsistence and culture. Given the importance of this species and the multitude of potential impacts from the Ambler Road, we appreciate the attention caribou received in the DSEIS. There are, however, additional areas for improvement where the best-available scientific information relating to caribou is not considered or is conflicted by statements in the DSEIS. Such issues need to be addressed.

In our previous comments, we noted that while the Draft EIS states that studies have shown that caribou displacement may span up to 9.6 km from disturbance, it fails to reference and discuss recent studies, some of which indicate larger areas of displacement than those referenced in the Draft EIS. While the DSEIS did include more recent citations, it failed to update the indicated maximum displacement distance, still stating that "other studies have identified larger displacement zones: up to 6 miles (9.6 kilometers) from various forms of disturbance" (p. 3-136). Plante et al. (2018), which we recommended including in our Draft EIS comments is cited in the DSEIS, but its reported displacement zones around roads (0-15 km), mining exploration (2-21 km), mines (21-23 km), and human settlements (2-18 km) do not appear to have been taken into consideration in the text. We also recommended Boulanger et al. (2012) be cited in our Draft EIS comments, which found avoidance of 11-14 km around mines, but this was not cited in the DSEIS, nor was its more recent update (Boulanger et al. 2021). The maximum displacement distance mentioned in the FSEIS should be increased to reflect the information from these various studies.

In our Draft EIS comments we also urged BLM to go beyond reporting the physical footprint of infrastructure to also include expected displacement effects. As the citations above describe, as well as other studies such as those looking at effects of dust deposition along roads (e.g., Walker and Everett 1987, Myers-Smith et al. 2006,

Ackerman and Finlay 2019, Neitlich et al. 2022), the habitat area lost to caribou and other species is likely to be much larger than just that due to direct effects of the physical footprint (c.f., NRC 2003). Despite pointing this out, however, indirect impacts beyond habitat loss due to vegetation removal and gravel fill are not quantified in the DSEIS "because they are dependent on numerous variables" (p. 3-133). This is an insufficient rationale for not including analysis of these important and expected impacts of road and associated mining development. Various scientific techniques are available for forecasting potential impacts of future development while accounting for uncertainty (e.g., Wilson et al. 2013, Fullman et al. 2021). Such techniques or others from the many available in the scientific literature should be used to estimate potential displacement and other indirect habitat loss from development of the Ambler Road. This also needs to include the effects of mines and other infrastructure associated with or facilitated by the road. The DSEIS acknowledges that "habitat loss and alteration due to the reasonably foreseeable development of the District could equal or exceed that from the road itself…and exponentially increase fragmentation of migratory and winter range" (p. 3-147). We agree with the DSEIS' statement that "It is much more likely that a system of roads would jeopardize long-distance migration than any single road" (p. 3-148), making it important that these cumulative impacts be quantified alongside the anticipated direct and indirect impacts of the Ambler Road itself.

We do appreciate that greater attention has been paid in the DSEIS to temporal variability in patterns of space use by caribou. In our Draft EIS comments we noted that while caribou generally show high fidelity to calving grounds over time, they may show greater interannual or even decadal variability in use of other seasonal ranges and that there was a need for better depiction of such episodic use in the EIS maps. The DSEIS now contains depictions of variable amounts of winter use by collared caribou. Nonetheless, reporting on these historical patterns of use, while important, does not necessarily describe the future patterns of use. We previously asked that BLM analyze what the effects would be if another shift in winter distribution, as has been seen in the past for the Western Arctic Herd (e.g., Skoog 1968, Burch Jr. 2012, Dau 2001) causes the area to be more heavily used. This was not done in the DSEIS but should be for the FSEIS. For example, ADFG (Heming and Glenn 1968, Davis et al. 1977) documented a southward Western Arctic Herd (WAH) migration through Anaktuvuk Pass in the autumns of 1967 and 1976. Even earlier, in the timeframe of the 1920's to 1970's some Koyukon elders described large caribou migrations moving south from Anaktuvuk, with wintering activity extending onto the Kanuti Flats near Allakaket (p. Simon, & J. Moses as told to *Raven's Story* 2003-04). There is evidence some movements went southward from there, as J. Honea of Ruby told *Raven's Story* in 1995). Honea related stories of large caribou migrations coming south across the Melozitna River, crossing the Yukon River to winter on the Nowitna Flats in the 1930's and 1940's. Apparently, in a historic period of greater abundance the WAH was using more of its range towards the eastern extent before it moved westward in the 1980's (Western Arctic Herd Working Group 2019). In the future, if lichen ranges or snow conditions in the west of the WAH range become challenging, the herd may try to move east again in search of better conditions, especially in the absence of a major development like the Ambler Road. If the Ambler Road and mining developments are built perpendicular to the migration route, we question whether the WAH caribou would be successful in making such a shift again. We also again reiterate that even in years in which relatively few caribou pass through the project area, those individuals can be of vital importance to subsistence hunters from the communities in the area.

We noted before that treatment of potential habituation of caribou to disturbance associated with the Ambler Road was overstated in the Draft EIS and did not align with the best-available science, which has repeatedly failed to demonstrate habituation for caribou. We were pleased to see the DSEIS acknowledge this, though the statement in the DSEIS was limited to the calving season. In fact, recent scientific studies have found a lack of habituation in other seasons as well, with caribou continuing to exhibit displacement from infrastructure despite a long history of exposure and use of mitigation measures (e.g., Johnson et al. 2020, Prichard et al. 2020). In light of our previous comments on this topic and the extensive array of scientific information that we cited in our Draft EIS comments, it was disappointing to see that while the DSEIS was improved with regards to habituation, it still suggested that "initially exposing caribou to a small pioneer road may increase their tolerance of the

larger Phase 2 road" (p. 3-146, C-13). The lack of robust scientific evidence for caribou habituation to roads makes it inappropriate to even suggest that this might happen and we urge that these statements be removed.

One of the hallmarks of a sound scientific assessment is reliance on accurate reference to the previously established scientific literature. This standard does not seem to have been followed regarding the DSEIS' claim that the strongest reactions of caribou to human disturbance occur in response to humans on foot. Three studies are cited in support of this statement (p. 3-136), but none actually provide that support. The only peer-reviewed source cited does not deal at all with evaluation of caribou response to humans on foot (Curatolo and Murphy 1986). Cronin et al. (1994) is a report that makes recommendations for reducing impacts of oil and gas development on caribou. This includes reductions in human foot traffic, but the report does not present any data that would indicate greater disturbance from foot traffic compared to other sources. The final citation is an industry report on caribou monitoring for the Endicott Development Project that contains qualitative statements about strong reactions of caribou to humans on foot but does not actually state that these reactions were stronger than that to other sources, nor provides data to that effect. In that monitoring, humans on foot only comprised about 5% of caribou disturbance events while vehicles were the most common cause of disturbance in the study, comprising around 75% of events. In summary, none of the cited sources provide evidence for the associated statement, which should either be justified with accurate scientific sources or removed from the FSEIS.

Another discrepancy with the scientific literature occurs in the DSEIS' description of other Alaskan caribou herds. The DSEIS points to the Central Arctic Herd, which it says has "maintained habitat connectivity and general migration patterns despite being intersected by highways and roads" (p. 3-215). This statement does not consider the larger shifts in calving distribution of the Central Arctic Herd that took place after oil and gas infrastructure was constructed, with calving grounds shifting south away from areas of concentrated development (Wolfe. 2000; Cameron et al. 2002; Russell and Gunn. 2019). It also did not adequately reflect recent studies that find that despite caribou still using some developed areas, they show altered movement behavior and ongoing displacement around roads and human activity (e.g., Johnson et al. 2020; Prichard et al. 2020; Severson et al. 2023). A more complete picture of the scientific information regarding disruption of migration and connectivity by infrastructure and human activity is needed in the FSEIS.

After noting that Alternative B would lead to 15% more habitat loss and alteration than Alternative A but with less than half as much winter habitat affected, the DSEIS states that the functional effects of the two alternatives would likely be the same for caribou (p. 3-143). As is the case for many conclusions in the DSEIS, no citation or justification is made for this statement. Elsewhere, the DSEIS notes the disproportionate impact that loss of lichen-dominated winter forage vegetation types would have on caribou (e.g., p. 3-133) and that loss of winter range would be particularly detrimental to the Western Arctic Herd due to winter forage limitation (p. 3-219), but these concerns do not seem to have been taken into account here. Winter is a critical time for caribou. Foraging opportunities are limited during the winter and caribou rely on body stores of energy for survival and gestation (Barboza et al. 2008, Taillon et al. 2013). Studies in other ungulate species of displacement and altered habitat use due to energy development have noted that fitness costs are likely greater during winter, when individuals already exhibit a negative energy balance (Northrup et al. 2015). Further energetic costs at such a time may lead to loss of body mass and depletion of vital energy reserves (Bradshaw et al. 1998). There has been little study of winter responses by caribou to industrial development and activity in Alaska. Nonetheless, studies from Canada reveal that disturbances, such as loud noises, can lead to flight responses in caribou (Bradshaw et al. 1997, Bradshaw et al. 1998), causing them to expend additional energy, and that caribou may avoid human infrastructure and disturbance in the winter (Dyer et al. 2002, Johnson and Russell 2014, Plante et al. 2018). Behavioral changes have also been noted in proximity to temporary industrial ice roads (Smith and Johnson 2023, Smith et al. 2023). Any extra expenditure of energy that caribou undertake as a result of interaction with roads, mining activity, or other infrastructure is of concern as reproductive success in caribou is strongly correlated with nutritional stress (Cameron et al. 2005). Late winter body mass of female caribou has

been strongly linked to calf production and survival (Cameron et al. 2005, Albon et al. 2017, Veiberg et al. 2017), potentially influencing population growth rates. While caribou exhibit their lowest annual movement rates during the winter (Person et al. 2007, Prichard et al. 2014), this does not imply a lack of awareness or response to their environment. Studies of European reindeer (the same species as caribou) found vigilance was highest in winter, compared to other seasons (Reimers et al. 2000). A study in Canada found that caribou avoided human settlements more strongly in winter than summer, resulting in a smaller winter range due to development (Plante et al. 2018). In light of these factors, it is crucial that BLM support and justify from the scientific literature any claims about similar levels of impact between alternatives.

The DSEIS describes four clusters of state mining claims overlapping the range of the Ray Mountains Herd, which could see increased potential for development under Alternative C (p. 3-149). We note that the University of Alaska has reportedly requested a land transfer from BLM (e.g., Brooks 2023), which would overlap range for this herd, including areas of the Tozitna North Area of Critical Environmental Concern and Spooky Valley Research Natural Area (BLM n.d., DNR 2023). Our understanding is that one possibility for this land is that, if transferred, it may be sold by the university to mining interests. The Ray Mountains Herd is a small herd and has limited suitable habitat beyond the alpine refugia in this area. Additional discussion seems warranted in the FSEIS about the effects if the small caribou herd gets displaced from the known calving area or additional development is facilitated. This serves as another tangible example of how the Ambler Road will enable a far larger cumulative impact than just the footprint of the corridor.

Subsistence

TWS compliments BLM on the greatly revised Appendix L, Subsistence Technical Report, for its comprehensive summary of spatial and temporal harvest patterns over an extensive area that could be affected by development of the Ambler Road. We also appreciate a greater inclusion of Traditional Ecological Knowledge in Appendix L and the DSEIS impacts analysis. However, we believe the main "nugget" statement in the cumulative effects analysis understates impacts: "The cumulative impacts to subsistence resulting from the proposed road, other reasonably foreseeable developments, and climate change *could* result in reduced harvesting opportunities for local residents and alterations in subsistence harvesting patterns" (p. 3-324, italics added). This does not accurately portray the serious impacts to subsistence that professionals in our organization believe will undoubtedly occur. And, as we noted above, and in our 2019 letter, the cumulative effects analysis is flawed because BLM and AIDEA do not honestly recognize the political and economic reality that once constructed, the Ambler Road will eventually be opened to the public, and that it will remain open for longer than the 50 years stated in the DSEIS. Qualifiers such as: "While the BLM is not considering issuance of a ROW for a public road …" given in several places in the subsistence impacts discussion (e.g. pp. 3-272, 3-235) deny that reality. The statement "after the useful life of the road for mineral development…efforts to convert the road to a public road" (p. 3-235) offers a more realistic scenario of the future. Indeed, several entities, such as Noatak (p. M-39), WAH Working Group (2019) and WIRAC (M-38), Allakaket, Alatna, and Evansville told BLM they also believe the road will eventually open to the public. For those reasons, and BLM's established poor track record of closure and reclamation of other mining roads in Alaska (Arnett 2005), TWS believes the FSEIS and ROD must evaluate impacts to subsistence through the lens of a permanent Ambler Road that is in place indefinitely.

Notwithstanding the permanence issue above, the DSEIS evaluation of specific subsistence impacts was much improved from the 2019 DEIS. For example, we agree with the assessment that the Ambler Road and its reasonably foreseeable cumulative impacts could significantly reduce availability of fish for 18 communities (p. M-41) and reduce availability of caribou for 31 communities (pp. M-40-41).

Both State and Federal law have means to address a subsistence priority in times of shortage due to lack of abundance or lack of access, but they are complex and sometimes not successful. Some of our professional members have dealt with the imposition of management strategies that included complex additional restrictions that have become

necessary to manage the wildlife harvest along the Dalton Highway (c.f. hunting regulations for the Dalton Highway Corridor, Unit 24A moose, and/or Unit 26B caribou compared to adjacent units; ADFG 2023, USFWS 2022). Indeed, both the Alaska State Department of Fish and Game, Alaska Board of Game, and the Federal Subsistence Board have had to take special actions, and/or create a special management area along the Dalton Highway, as a result of the increased access and harvest pressures on these resources. It is our professional judgment that compensatory actions such as ROW permit mitigation measures and special fish and game management regulations will not be sufficient to avoid such serious impacts to subsistence harvest opportunity. It is our judgment that the decision to permit the construction of a very probable permanent Ambler Road means the certainty of diminished subsistence opportunity.

The DSEIS indicates in several places that access control points at both ends of the Ambler Road, and frequent patrols of the road, would deter unauthorized users from accessing the region *via* the project. TWS professionals experienced in wildlife and habitat management, including coordination with enforcement personnel, strongly state that the number of existing state and federal wildlife and fish enforcement personnel are currently woefully inadequate to cover even basic patrols of this huge area. Similarly, staffing and funding for the federal and state wildlife and fish managing agencies are so limited that it is doubtful they will be able to increase biological monitoring of the most important subsistence resources. Therefore, the burden of enforcement and biological monitoring will fall almost entirely upon the project proponents. TWS questions whether AIDEA and the mining companies who want the Ambler Road will be able to make an adequate long-term, 50-year, commitment of staff and funds to effectively enforce road usage for harvest of fish and wildlife, and to monitor abundance of those resources.

We are pleased the DSEIS provides a candid discussion, even though somewhat speculative, that portrays potential economic and subsistence pros and cons impacting residents of the NANA Region *vs*. Doyon Region in the respective villages near the Ambler Road alternatives (p. 3-236). As the DSEIS cited, recent research by Guettabi et al. (2016) and Magdanz et al (2016) call into question the commonly held belief pushed by developers that connection of a village to the road system automatically increases villages' incomes. At a village level, research has shown economic gains are often outweighed by diminished abundance, availability and access to subsistence resources, often caused by increased competition with non-local hunters and fishers (Guettabi et al. 2016, Magdanz et al. 2016). These two studies clearly point out the risk of loss of subsistence opportunity without significant income replacement in communities.

Below, we offer specific comments to improve accuracy of the DSEIS subsistence analyses:

Pages 3-325, M-35, and L-201 refer to the Manh Choh mine near Tetlin as a reasonably foreseeable action adding a cumulative impact to the Ambler Road. This mine is several hundred miles distant from even the southern terminus of the Dalton Highway. It would be more accurate to state that "A new model to develop small mineral prospects throughout Alaska now relies on using the public highway system for transport of ore." This is a controversial paradigm shift (Parshley 2023). It is reasonably foreseeable that additional projects near the Dalton Highway, and a future Ambler Road, would also propose to rely on the highway system to transport ore from the mine to a central processing facility such as Fort Knox near Fairbanks.

Page M-15-16 accurately refers to the Koyukon tradition of hunting black bears in dens at the onset of winter. This traditional practice occurs in Huslia, Hughes, Allakaket, Alatna, and sometimes adjacent villages (Raven's Story elders recordings 1995-2004). While the quantities may not be that large, the importance of this bear hunt was not adequately described in the subsistence impact analysis in Chapter 3. If for some reason moose or caribou are not available, black bears can be an important addition to food security, especially because elders know the specific den sites that are often occupied.

The statements regarding Teshekpuk Lake caribou not being as affected by road activities compared to the Western Arctic Herd at the Red Dog mine road (pp. M-19, L-179) are misleading. It could be a majority of the Teshekpuk herds movements are parallel the Dalton Highway rather than across it, so the impacts may be less than for the Red Dog Road.

Page L-195 states “Alternative C does not cross through the primary migratory range for the WAH and does not intersect the primary north-south migratory movement of the herd.” That may be true in recent times, but, as pointed out above in our Caribou discussion, there is traditional knowledge of large caribou migration southward across the Melozitna area nearly a century ago (Raven’s Story 1995).

Table 50, p. L197 does not accurately reflect Alatna and Allakaket village’s dependence on resources close to the Alternative B alignment. Alatna and Allakaket people regularly traveled up Alatna River beyond the confluence with Siruk Creek to harvest whitefish by seining in summer, and to hunt caribou in winter (Raven’s Story 1995-2004). This confluence region has been a fairly regular wintering area for WAH caribou, even in years of lesser southward or eastward extent (M. Spindler, USFWS Kanuti NWR (retired), Fairbanks, AK, pers. observation, and WAH Working Group 2019).

Proposed road reclamation

We have major concerns about the proposed plans for decommissioning and reclamation of the road that raise serious questions about the potential for impacts to wildlife and people to be reduced and mitigated at some point in the future. These include 1) whether the road will be decommissioned and reclaimed, 2) the lack of robustness of a reclamation plan, and 3) whether adequate funding will be obtained for a reclamation plan.

1. Will the road actually be decommissioned?

It is unclear from information in the DSEIS whether reclamation will actually take place. For example, the DSEIS states that,

> “…mining companies may request, from the underlying landowner(s), that some segments of the road within the District stay open and revert to mining company control to allow their continued access from the Dahl Creek airport or mining company airstrips to the mines for required water treatment and monitoring activities, to be conducted potentially in perpetuity” (p. 2-12).

This suggests that not all roads may be removed from the program area, with some roads, aircraft activity, and traffic likely continuing after mining has ceased. We note that the DSEIS states that these may continue “in perpetuity,” suggesting that infrastructure may never be removed and habitat recovered. Such features are in addition to things like fencing around mines, creation of pit lakes, and even establishment of onsite landfills that will be left after the project is completed (e.g., p. H-18). The impacts of the roads and mines can reasonably be expected to last long beyond the operation of the Ambler Mining District mines.

The intention to decommission the road may also be countered by community justice considerations. The Alaska Department of Transportation & Public Facilities has indicated that if the Ambler Road is developed, nearby communities may connect to the National Highway System on a permit basis” and BLM acknowledges that “once communities are connected to the road for commercial purposes, it is unlikely that those commercial uses would be discontinued” (p. H-33). Indeed, the DSEIS acknowledges that “given the dearth of developed infrastructure in Alaska, and the value of the road and associated facilities, it is reasonably foreseeable that ultimately, efforts will be taken to convert the Ambler Road to a public-accessible road, not unlike opportunities contemplated for the DMTS [Delong Mountain Transportation System, or Red Dog Road]” (p. H-33). Apparently, this has already been stated as a goal by some organizations (p. H-33). Furthermore, the DSEIS states that AIDEA proposes to place fiberoptic communications lines for internet and phone service along the road, which may be made available to communities to enhance their internet and phone access (p. H-35). It seems highly unlikely that removal of such telecommunications access to support

full reclamation will be undertaken. In fact, there are reasonable questions about whether it would be just to do so. This needs to be acknowledged and analyzed accordingly in the FSEIS.

Previous experience at the Red Dog Road, also operated by AIDEA, raises additional questions about whether AIDEA truly intends to remove the Ambler Road after its 50-year ROW ends. The DSEIS mentions a 2017 document from AIDEA that describes potential uses of the Red Dog Road after current mining ends (p. H-33). It is unknown to what extent there would be similar interest in uses for an Ambler Road, but this demonstrates that AIDEA has a record of pursuing additional uses for its roads rather than simply seeking to reclaim and restore them. This should be given due consideration in regard to the longevity of project impacts.

2. Lack of robustness of the reclamation plan

The DSEIS indicates that AIDEA does not intend to develop a reclamation plan until close to the road closure date (p. 1-3). This raises questions about whether it will be possible to meaningfully remove and reclaim impacts. As the old adage says, 'failure to plan is planning to fail.' By the time a mitigation plan is drafted, AIDEA will already have obtained revenues from decades of road use by mining companies, which may reduce incentives to produce a robust and potentially costly plan, as well as limiting options for strengthening the proposed plan. It is important to allow flexibility for plan improvements with new scientific studies and technological advances in restoration approaches, however this does not mean that no initial plan can be developed. A detailed reclamation plan should be developed before a ROW is approved that demonstrates that a technically feasible reclamation plan exists. This then can serve as a baseline which can be improved upon through periodic revisions of no less than every 10 years, as technology and conditions improve. The initial proposed plan and all subsequent updates should confirm to the best available scientific information and Indigenous Knowledge about environmental impacts of a potential road and mining and their remediation, being reviewed and approved by an independent group of scientists, agency staff, and subsistence users from communities potentially affected by the road and should be made available for public review and comment prior to approval.

BLM acknowledges that multiple uses of the Ambler Road area are considered irreversible and cannot be fully recovered, including reduction or abandonment of wildlife habitat, subsistence use areas, and cultural resources and uses (p. 3-252). Also, changes to subsistence uses have a high likelihood of occurring with a long or permanent duration (p. C-18). This raises questions about whether meaningful mitigation is even feasible. In our Draft EIS comments, we raised concerns about the facilitative effect the road could have for predators, based on studies in other systems that show that linear features, such as roads and seismic lines, act like highways for wolves (*Canis lupus*), allowing them to travel faster and farther, and altering their habitat selection patterns and distribution (James and Stuart-Smith 2000, Dickie et al. 2017, DeMars and Boutin 2018). Even if reclamation occurs, the DSEIS acknowledges that linear features would remain for decades after the road is closed, leading to a continuation of higher predation rates in the vicinity of the Ambler Road corridor (p. 3-139). The Western Arctic Herd is in a sustained decline with recent population counts at the lowest levels since the 1970s (WACH Working Group 2023). This has led to multiple proposals of reduced subsistence harvest of caribou for northwest Alaska residents, as well as near complete elimination of out-of-state harvest. In such a context, the potential for increased predation facilitated by the project activities, which would continue even after removal of project infrastructure, is of great concern and questions the effectiveness of proposed reclamation.

3. Uncertain adequacy of reclamation funding

BLM plans to require proof of ability to pay for the project and sufficient bonding to ensure road closure and reclamation prior to allowing construction to proceed (p. 2-13). It is difficult to ascertain how an appropriate amount will be identified, however, if the restoration plan is not developed until decades later. Nonetheless, BLM's requirement of

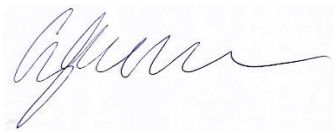
up-front bonding should be included as a stipulation in the event of right-of-way approval to ensure that it is clear to all parties and enforceable. The DSEIS notes that "there is uncertainty about this [reclamation bonding], given that the financing throughout the life of the project hinges on sufficient revenue from mining companies and is therefore vulnerable to the investment decisions of those entities" (p. 2-13). This acknowledgement, even before a plan is created, raises serious concerns about whether sufficient funding for meaningful restoration will be provided. The bonding amount needs to be set to a level that can be demonstrated to have a high likelihood of sufficiency for achieving the desired restoration outcomes, based on other similar projects, and should be protected from inflation so that intended actions are able to be carried out decades into the future. The bonding amount should be periodically reviewed along with the reclamation plan and be updated if necessary to account for future economic shifts that may increase the amount required for reclamation.

Conclusion

It is our judgment that the Ambler Road project will have far-ranging permanent detrimental effects to flora, fauna, Indigenous people's subsistence, and public outdoor recreation upon an entire region of Alaska and that most of these impacts cannot be effectively mitigated. The proponents state the economic advantages outweigh the environmental impacts. We disagree, and believe the impacts have gigantic external and intangible costs to rural Alaskan society through diminished abundance and accessibility to fish and wildlife. These costs cannot be fully compensated, and, we doubt the proponents will have the financial ability to even partially do so. Unlike the Trans-Alaska Pipeline and Haul Road, which were paid for by the oil companies, the Ambler Road project seeks to enable mines that will depend on large public subsidies to provide highway access for them to be viable. The DSEIS cumulative effects and reasonably foreseeable actions analyses were, in general, honest and candid. They highlight the likelihood and magnitude of expected impacts and we urge BLM to pay attention to their warnings and to those of the issues we have raised above as the final decision is made about permitting the Ambler Road.

Thank you for your review and consideration of these comments and requests. We look forward to your response.

On behalf of the Executive Board and membership of the Alaska Chapter of The Wildlife Society,



Cynthia Wardlow
President
Alaska Chapter of The Wildlife Society

References and literature cited

Ackerman DE, Finlay JC. 2019. Road dust biases NDVI and alters edaphic properties in Alaskan arctic tundra. Scientific Reports 9, 214.

Adams, Francis. 2019 USFWS fish biologist, retired, Fairbanks, AK. pers. comm. to TWS.

ADFG 2023. 2023-2024 Alaska Hunting Regulations: Governing general, subsistence, and commercial uses of Alaska's wildlife. Effective 1 July 2023 - 30 June 2024. No. 64. Alaska Department of Fish and Game, Juneau, AK. 144pp. Available from: https://www.adfg.alaska.gov/static/regulations/wildliferegulations/pdfs/regulations_complete.pdf.

Albon SD, Irvine RJ, Halvorsen O, Langvatn R, Loe LE, Ropstad E, Veiberg V, Van der Wal R, Bjørkvoll EM, Duff EI, Hansen BB, Lee AM, Tveraa T, Stein A. 2017. Contrasting effects of summer and winter warming on body mass explain population dynamics in a food-limited Arctic herbivore. Global Change Biology 23, 1374-1389.

Anderson, D.B. 2007. Local and Traditional Knowledge of Whitefish in the Upper Koyukuk River Drainage, Alaska. Draft Final Report for FIS Project 04-269. TEK Component. Funded by the U.S. Fish and Wildlife Service, Fisheries Resource Monitoring Program, Anchorage.

Arnett., H. 2005. Harrison Creek reclamation, phase 1, an overview of approaches for reclamation of placer mined lands. Final Report for BLM Northern Field Office, Fairbanks, AK, by USKH, Anchorage, AK. 80pp.

Barboza PS, Parker KL. 2008. Allocating protein to reproduction in Arctic reindeer and caribou. Physiological and Biochemical Zoology 81(6), 835-855.

Boulanger J, Poole KG, Gunn A, Wierzchowski J. 2012. Estimating the zone of influence of industrial developments on wildlife: a migratory caribou *Rangifer tarandus groenlandicus* and diamond mine case study. Wildlife Biology 18, 164-179.

Boulanger J, Poole KG, Gunn A, Adamczewski J, Wierzchowski J. 2021. Estimation of trends in zone of influence of mine sites on barren-ground caribou populations in the Northwest Territories, Canada, using new methods. Wildlife Biology 2021(1), wlb.00719.

BLM. n.d. Central Yukon Resource Management Plan: Areas of Critical Environmental Concern (ACECs) and Research Natural Areas. Bureau of Land Management Flyer. Available from: https://eplanning.blm.gov/public_projects/lup/35315/45759/49459/CYRMP_ACEC_poster-508B.pdf (accessed 2023-12-19).

Bradshaw CJA, Boutin S, Hebert DM. 1997. Effects of petroleum exploration on woodland caribou in northeastern Alberta. Journal of Wildlife Management 61(4), 1127-1133.

Bradshaw CJA, Boutin S, Hebert DM. 1998. Energetic implications of disturbance caused by petroleum exploration to woodland caribou. Canadian Journal of Zoology 76, 1319-1324.

Brady, C, M. Varner, J. Post, S. Miller, and N. Capuccio. 2018.Developing Quantifiable Management Objectives from Reference Conditions for Wadeable Streams in the BLM Eastern Interior Field Office, Fairbanks, AK. Open File Report #169: https://www.blm.gov/sites/default/files/docs/2022-05/Library_Alaska_OpenFileReport169.pdf

Brooks J. 2023. University of Alaska picks Philadelphia-sized section of Interior Alaska to own under new law. Alaska Beacon. July 21, 2023. Available from: https://alaskabeacon.com/briefs/university-of-alaska-picks-philadelphia-sized-section-of-interior-alaska-to-own-under-new-law/ (accessed 2023-12-19).

Burch Jr ES. 2012. *Caribou Herds of Northwest Alaska 1850-2000*. I. Krupnik and J. Dau, eds. Univ. of Alaska Press, Fairbanks, AK. 203 pp.

Cameron RD, Smith WT, White RG, Griffith B. 2002. The Central Arctic Caribou Herd. Pages 38-45 [*In*] Douglas, D.C., Reynolds, p. E., Rhode, E.B., editors. Arctic Refuge coastal plain terrestrial wildlife research summaries. U.S. Geological Survey, Biological Resources Division, Biological Science Report USGS/BRD/BSR-2002-0001.

Cameron RD, Smith WT, White RG, Griffith B. 2005. Central Arctic caribou and petroleum development: distributional, nutritional, and reproductive implications. Arctic 58, 1-9.

CGI/Quest Research. 1980. A proposed system for pipeline construction and operation monitoring in Washington State. Washington Department of Ecology, Seattle, WA. 173pp.

Craig, T. USFWS, wildlife biologist, Kanuti NWR (retired) Fairbanks, AK pers. comm. to TWS.

Cronin MA, Ballard WB, Truett J, Pollard R. 1994. Mitigation of the effects of oil field development and transportation corridors on caribou. Final Report to the Alaska Caribou Steering Committee, LGL Alaska Research Associates, Inc., Anchorage, Alaska. pp. 125.

Curatolo JA, Murphy SM. 1986. The effects of pipelines, roads, and traffic on the movements of caribou, *Rangifer tarandus*. Canadian Field-Naturalist 100(2), 218-224.

Dau J. 2001. Western Arctic Herd. pgs 160-197 in *Caribou management report of survey-inventory activities 1 July 1998-30 June 2000*. C. Healy, ed. Proj 3.0. Juneau, AK.

Davis, J.L, p. Valkenburg, H. Reynolds, C. Grauvogel, R Shideler, and D. Johnson 1977. Herd Identity, Movements, Distribution and Seasonal Patterns of Habitat Use of the Western Arctic Caribou Herd. Alaska Dept of Fish and Game Fed. Aid in Wildl. Rest. Project No.: W-17-8 & W-17-9 Job No.3.21. 112pp. https://www.adfg.alaska.gov/static/home/library/pdfs/wildlife/research_pdfs/78_ca_wah_davis_valkenburg.pdf

DeMars CA, Boutin S. 2018. Nowhere to hide: Effects of linear features on predator-prey dynamics in a large mammal system. Journal of Animal Ecology 87, 274-284.

DeCicco, L.H., Shutler, D., Mockford, S.W. 2017. Morphological differences between Nearctic and Eastern Palearctic Gray-headed Chickadees (*Poecile cinctus*). Wilson Journal of Ornithology 129, 171-175.

Dickie M, Serrouya R, McNay RS, Boutin S. 2017. Faster and farther: wolf movement on linear features and implications for hunting behaviour. Journal of Applied Ecology 54, 253-263.

DNR. 2023. Spooky Valley University Lands Selection. Alaska Department of Natural Resources Memorandum. July 19. 2023. Available from: https://aws.state.ak.us/OnlinePublicNotices/Notices/Attachment.aspx?id=142813 (accessed 2023-12-19).

Dyer SJ, O'Neill JP, Wasel SM, Boutin S. 2002. Quantifying barrier effects of roads and seismic lines on movements of female woodland caribou in northeastern Alberta. Canadian Journal of Zoology 80, 839-845.

Fullman TJ, Sullender BK, Cameron MD, Joly K. 2021. Simulation modeling accounts for uncertainty while quantifying ecological effects of development alternatives. Ecosphere 12(5), e03530.

Georgette, S., and A. Shiedt. 2005. Whitefish: traditional ecological knowledge and subsistence fishing in the Kotzebue Sound region, Alaska. Alaska Department of Fish and Game, Division of Subsistence, Technical Paper Number 290, Juneau, Alaska.http://www.adfg.alaska.gov/techpap/tp290.pdf

Graziano, G., Grant, A., Wurtz, T. 2016. Control of bird vetch (*Vicia cracca*). Alaska Cooperative Extension Services, University of Alaska Fairbanks, Fairbanks, AK. 2pp. Available from: http://cespubs.uaf.edu/index.php/download_file/1413/.

Gucker, C.L. 2009. *Melilotus alba*, *M. officinalis*. In: Fire Effects Information System. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. Available from: https://www.fs.fed.us/database/feis/plants/forb/melspp/all.html.

Guettabi, M., J. Greenberg, J. Little, and K. Joly. 2016. Evaluating Differences in Household Subsistence Harvest Patterns between the Ambler Project and Non-Project Zones. Natural Resource Report NPS/GAAR/NRR—2016/1280. U.S. Department of the Interior, National Park Service, Natural Resource Stewardship and Science. Fort Collins, Colorado.

Hailman, J.p. , Haftorn, S. 1995. Gray-headed Chickadee (*Poecile cinctus*), version 2.0. In The Birds of North America (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. Available from: https://doi.org/10.2173/bna.196.

Hanraban J, and Gruenstein p. 1977. Lost Frontier: The Marketing of Alaska. W.W. Norton and Company, New York, NY. 363pp.

Hemming, J.E. and L. p. Glenn 1968. Caribou Report, Alaska Dept of fish and Game, Fed Aid in Wildli Rest. Project W-15-R-2 and 3, Fairbanks, AK. 49pp. https://www.adfg.alaska.gov/static/home/library/pdfs/wildlife/federal_aid/68_ca_hemming_glenn.pdf

Hughes, R.M, F. Amezcua, D.M. Chambers, W.M. Daniel, J.S. Franks, W. Fanzin, D. MacDonald, E. Merriam, G. Neall, p. dos Santos Pompeu, L. Reynolds, L. Roulson, and C.A. Woody. 2016. Position Paper and American Fisheries Society Statement on Mining and Fossil Fuel Extraction.

James ARC, Suart-Smith AK. 2000. Distribution of caribou and wolves in relation to linear corridors. Journal of Wildlife Management 64, 154-159.

Johnson CJ, Russell DE. 2014. Long-term distribution responses of a migratory caribou herd to human disturbance. Biological Conservation 177, 52-63.

Johnson HE, Golden TS, Adams LG, Gustine DD, Lenart EA. 2020. Caribou use of habitat near energy development in Arctic Alaska. The Journal of Wildlife Management 84(3), 401-412.

Lader, R, Walsh, J.E , Bhatt, U.S., and Bieniek, P A. 2017. Projections of Twenty-First-Century Climate Extremes for Alaska via Dynamical Downscaling and Quantile Mapping. Journal of Applied Meteorology and Climatology, Volume 56: Issue 9; DOI: https://doi.org/10.1175/JAMC-D-16-0415.1; https://journals.ametsoc.org/view/journals/apme/56/9/jamc-d-16-0415.1.xml?tab_body=pdf

Lawhead BE, Byrne LC, Johnson CB. 1993. 1990 Endicott Environmental Monitoring Program Final Report: Caribou Synthesis, 1987-1990. Alaska Biological Research, Inc. Editors: Clarke J, Miller JD, Science Applications International Corporation, Anchorage, Alaska, USA.

Limpinsel, D.E., M.p. Eagleton, and J.L. Hanson. 2017. Impacts to Essential Fish Habitat from NonFishing Activities in Alaska. EFH 5 Year Review: 2010 through 2015. NOAA Technical Memorandum NMFS-F/AKR-14. U.S. Department of Commerce.

Magdanz, J.S., J. Greenberg, J. Little, and D. Koster, 2016. The Persistence of Subsistence: Wild Food Harvests in Rural Alaska, 1983-2013. May 13, 2016. https://ssrn.com/abstract=2779464.

McCracken DR. 1976. Pipeline on the Permafrost. Platen Press, Deer Lodge, MT. 92pp.

McGrath E. 1977. Inside the Alaska Pipeline. Celestial Arts, Millbrane, CA. 182pp.

Mcmillan, J., Callear, T. 2014. Invasive plants in the vicinity of the Dalton Highway, north of the Yukon River - A History and Update from the BLM Central Yukon Field Office Perspective. Powerpoint/pdf presentation. Bureau of Land Management, Fairbanks, AK. 23pp

Mead RD. 1978. Journeys Down the Line--Building the Trans-Alaska Pipeline. Doubleday and Company, Garden City, NY. 609pp.

Morehouse, T.A., Childers, R.A., Leash, L.E. 1978. Fish and Wildlife Protection in the Planning and Construction of the Trans-Alaska Oil Pipeline. U.S. Fish and Wildlife Service. Report Number FWS/OBS-78/70. October 1978. 131pp. Available from: https://play.google.com/store/books/details?id=ZB8l0Q9QxiYC&rdid=book-ZB8l0Q9QxiYC&rdot=1.

Myers-Smith IH, Arnesen BK, Thompson RM, Chapin III, FS. 2006. Cumulative impacts on Alaskan arctic tundra of a quarter century of road dust. Ecoscience 13(4), 503-510.

NRC [National Research Council]. 2003. Cumulative environmental effects of oil and gas activities on Alaska's North Slope. National Academies Press, Washington D.C., USA.

Neitlich PN, Berryman S, Geiser LH, Mines A, Shiel AE. 2022. Impacts on tundra vegetation from heavy metal-enriched fugitive dust on National Park Service lands along the Red Dog Mine haul road, Alaska. PLoS ONE 17(6), e0269801.

Northrup JM, Anderson Jr. CR, Wittemyer G. 2015. Quantifying spatial habitat loss from hydrocarbon development through assessing habitat selection patterns of mule deer. Global Change Biology 21(11), 3961-3970.

Pamplin Jr., W.L. 1979. Construction-Related Impacts of the Trans-Alaska Pipeline System on Terrestrial Wildlife Habitats. Joint Fish and Wildlife Advisory Team Special Report No. 24. 132pp. Available from: https://www.arlis.org/docs/vol1/AlaskaGas/Report2/Report_JFWAT_1979_ConstructionRelatedImpacts.pdf

Parshley, L. 2023. Alaska is facing a massive mineral boom,but at what dost? Grist. https://grist.org/transportation/alaska-is-facing-a-massive-mineral-boom-but-at-what-cost/

Person BT, Prichard AK, Carroll GM, Yokel DA, Suydam RS, George JC. 2007. Distribution and movements of the Teshekpuk Caribou Herd 1990-2005: Prior to oil and gas development. Arctic 60, 238-250.

Peplow, D, and R. Edmonds. 2005. The effects of mine waste contamination at multiple levels of biological organization. Ecological Engineering 24 (2005):101–119. Available at: www.sciencedirect.com. Accessed August 2023.

Plante S, Dussault C, Richard JH, Côté SD. 2018. Human disturbance effects and cumulative habitat loss in endangered migratory caribou. Biological Conservation 224, 129-143.

Prichard AK, Yokel DA, Rea CL, Person BT, Parrett LS. 2014. The effect of frequency of telemetry locations on movement-rate calculations in arctic caribou. Wildlife Society Bulletin 38, 78-88.

Prichard AK, Lawhead BE, Lenart EA, Welch JH. 2020. Caribou distribution and movements in a northern Alaska oilfield. Journal of Wildlife Management 84, 1483-1499.

Raven's Story. 1995-2004. Raven's Story compilation of Koyukon elder interviews, including p. Simon, J. Moses (Allakaket 2003, 2004) and J. Honea (Ruby 1995) as told to Raven's Story, Project Jukebox, University of Alaska Oral History Collection, Fairbanks, AK. https://jukebox.uaf.edu/ravenstory

Reimers E, Colman JE, Dervo L, Eftestol S, Kind J, Muniz A. 2000. [in Norwegian], cited in Reimers E, Loe LE, Eftestøl S, Colman JE, Dahle B. 2009. Effects of hunting on response behaviors of wild reindeer. Journal of Wildlife Management 73(6), 844-851.

Rosenberg, KV, A.M. Dokter, p. J. Blancher, J.R. Sauer, A.C. Smith, p. A. Smith, J.C. Stanton, A.p. Panjabi, L. Helft, M. Parr, p. p. Marra. 2019. Decline of the North American avifauna. Science, Vol 366, pp. 120-124, Issue 6461, https://www.science.org/doi/full/10.1126/science.aaw1313

Russell D, Gunn A. 2019. Vulnerability analysis of the Porcupine Caribou Herd to potential development of the 1002 lands in the Arctic National Wildlife Refuge, Alaska. Report prepared for: Environment Yukon, Canadian Wildlife Service, and NWT Environment and Natural Resources. 143 pp.

Severson JP, Vosburgh TC, Johnson HE. 2023. Effects of vehicle traffic on space use and road crossings of caribou in the Arctic. Ecological Applications 33(8), e2923.

Skoog RO. 1968. Ecology of the caribou (*Rangifer tarandus granti*) in Alaska. Ph.D. Dissertation. Univ. California, Berkeley, CA. 699 pp.

Smith A, Johnson CJ. 2023. Why didn't the caribou (*Rangifer taradus groenlandicus*) cross the winter road? The effect of industrial traffic on the road-crossing decisions of caribou. Biodiversity and Conservation 8-9.

Smith A, Johnson CJ, Clark K. 2023. Behavioral and physiological stress responses of barren-ground caribou (*Rangifer taradus groenlandicus*) to industrial ice roads. Polar Biology 46, 1053-1067.

Spellman, B.T. 2008. The impact of invasive sweetclover (Melilotus alba) in early-successional floodplain habitats of Alaska. MS. Thesis. University of Alaska, Fairbanks.

Swanson, Shelly A. 1996. Small Mammal Populations in Post-Fire Black Spruce (Picea mariana) Seral Communities in the Upper Kobuk River Valley, Alaska. Gates of the Arctic National Park & Preserve. Gates of the Arctic National Park offices, ARL Fires, DSC-TIC.

Taillon J, Barboza PS, Côté SD. 2013. Nitrogen allocation to offspring and milk production in a captial breeder. Ecology 94(8), 1815-1827.

TWS 2019. Alaska Chapter, The Wildlife Society, comments on the Draft Environmental Impact Statement for the Ambler Road Project, October 24, 2019. 20pp.

USFWS. 2022. Federal Subsistence Management Regulations for the Harvest of Wildlife on Federal Public Lands in Alaska. Effective 1 July 2020 - 30 June 2022. Office of Subsistence Management, Anchorage, AK. 156pp. Available from: https://www.doi.gov/sites/doi.gov/files/uploads/2018-20_wildlife_regs_book_final_web.pdf.

Veiberg V, Loe LE, Albon SD, Irvine RJ, Tveraa T, Ropstad E, Stien A. 2017. Maternal winter body mass and not spring phenology determine annual calf production in an Arctic herbivore. Oikos 126, 980-987.

Western Arctic Caribou Herd Working Group. 2019. Western Arctic Caribou HerdCooperative Management Plan. 54 pp. https://westernarcticcaribou.net/, or Alaska Department of Fish and Game (ADF&G) https://www.adfg.alaska.gov/static/research/plans/pdfs/wah_management_plan_final_2019.pdf

Western Arctic Caribou Herd Working Group. 2023. Caribou Trails: News From the Western Arctic Caribou Herd Working Group. 12 pp.

Walker DA, Everett KR. 1987. Road dust and its environmental impact on Alaskan taiga and tundra. Arctic and Alpine Research 19(4), 479-489.

Wickware p. 1979. Crazy Money--Nine Months on the Trans-Alaska Pipeline. Random House, New York, NY. 228pp.

Wilson RR, Liebezeit JR, Loya WM. 2013. Accounting for uncertainty in oil and gas development impacts to wildlife in Alaska. Conservation Letters 6, 350-358.

Wolfe SA. 2000. Habitat selection by calving caribou of the Central Arctic Herd, 1980-95. M.S. Thesis, University of Alaska Fairbanks, Fairbanks, Alaska, USA.