THE STATE of ALASKA
GOVERNOR MIKE DUNLEAVY

Department of Natural Resources

OFFICE OF PROJECT MANAGEMENT AND PERMITTING

P.O. Box 111030
Juneau, AK 99811-1030
907-465-3177

May 29, 2020

Matthew Reece
Minerals Program Manager
Tongass National Forest
8510 Mendenhall Loop Road
Juneau, AK 99801

Dear Mr. Reece,

Please find attached the State of Alaska's consolidated comments on the Preliminary Draft Supplemental Environmental Impact Statement for the Kensington Mine Plan of Operations Amendment 1. Thank you for the opportunity to provide comments at this juncture.

Please let me know if you have any questions or need clarification on any of the comments.

Sincerely,

Sylvia A. Kreel

Sylvia A. Kreel
Large Project Coordinator

Kensington POA1 PDEIS
Consolidated Comments Table

Department/Division/Section	Section/Fig./Table	Page #	Comment/Issue	Recommendation/Action
Department of Fish & Game	PD SEIS	N/A	Grammatical, spelling, punctuation, and reference errors found throughout the document and most notably in Chapter 3.	Proofread and edit the PD SEIS for these errors prior to public notice.
Department of Fish & Game	PD SEIS	N/A	More recent ADF&G reports are available than cited throughout the document: Kane (2020); White (2020).	Consider updating references where appropriate.
Department of Fish & Game	Acronyms and Abbreviations	xi - xii	Several acronyms presented in the document are omitted from this reference page including the following: **APE** (?), **GMU** (Game Management Unit), **RMA** (Riparian Management Area), **TCP** (?), **VCU** (Visual Comparison Unit), and **WAA** (Wildlife Analysis Areas).	Include all acronyms on this page for reference.
Department of Fish & Game	Section 1.1.1	1-1	Error of omission in agency title.	Revise "Department of Transportation" as follows: "Department of Transportation **and Public Facilities**".
Department of Fish & Game	Figure 2.2-2	2-4	Northeast upper tributaries in the Sherman Creek drainage are inaccurately depicted.	Rectify labeling and stream course of northeast tributaries: The most northern tributary is "Ivanhoe Creek"; the tributary to the east of Ivanhoe is "Ophir Creek". Per the 2004 FEIS (Figure 3-2), Ophir Creek comprises two tributaries: "North Ophir Creek Tributary" and "South Ophir Creek Tributary", consistent with our observations[a]. South Ophir Creek Tributary has historically flowed along the toe of the Comet Waste Rock Stockpile; this drainage warrants further field investigation in order to accurately document stream course and fish presence.
Department of Fish & Game	Section 2.2.7.2	2-13	Error of omission.	Revise "Ecological monitoring would include monitoring of aquatic life in the TTF, benthic invertebrate community composition, sediment quality and metal toxicity, and periphyton biomass and community composition." as follows: "Ecological monitoring would include monitoring of aquatic life in the TTF, benthic invertebrate community composition, sediment quality and metal toxicity, and periphyton biomass and community composition **within affected watersheds**." (i.e., Slate, Johnson, and Sherman Creeks)
Department of Fish & Game	Section 2.2.7.4	2-15	Inaccurate description: Dolly Varden **char** will not be manually introduced into the TTF (Lower Slate Lake). Per Section 3.7.1 of POA 1 Reclamation and Closure Plan and Section 2.3.4 of the PD SEIS (p. 2-37), "Upper Slate Lake will provide Dolly Varden to Lower Slate Lake directly once flooding results in the joining of the two lake when the water level exceeds the 765 foot elevation".	Revise "The ultimate introduction of Dolly Varden trout (Salvelinus malma) would consist of fish from Upper Slate Lake and would be coordinated with the ADF&G and the Forest Service." to "Upper Slate Lake will provide Dolly Varden **char** (Salvelinus malma) to Lower Slate Lake directly once flooding results in the joining of the two lakes".
Department of Fish & Game	Section 2.2.9.5	2-18	Error of omission.	Revise "Survey Sherman, Johnson, and Slate Creeks under APDES permit AK005057-1 including aquatic habitat and biological and fish resources." as follows: "Survey Sherman, Johnson, and Slate Creeks **per CAK's Plan of Operations and** APDES permit AK005057-1 including aquatic habitat and fish resources."

Department of Fish & Game	Section 2.3.1.1	2-24	Lack of clarity.	Clarify the following statement: "The Upper Slate Lake Diversion Pipeline intake would act as a retention structure when runoff is high, allowing the stored water to slowly drain down, instead of into, the TTF to reduce the water entering the TTF requiring treatment."
Department of Fish & Game	Section 2.3.2	2-27	Lack of clarity.	Clarify the following statement: "Each WRS design includes a toe channel to direct stormwater to sediment ponds that would intercept and redirect runoff that has been in contact with waste rock. Stormwater would be managed per the updated Storm Water Pollution Prevention Plan (Appendix C of POA 1)." Are these stormwater channels existing or to be implemented in the proposed action?
Department of Fish & Game	Figure 2.3-6	2-30	Upper Johnson Creek and its tributaries have not been thoroughly surveyed by ADF&G and may be affected under the proposed action via the location of a WRS Expansion.	ADF&G proposes that additional field investigation occur at the upper extent of Johnson Creek and that the DEIS be modified to incorporate the additional information to accurately document stream course and fish presence. ADF&G may be able to assist with stream surveys.
Department of Fish & Game	Figure 2.3-7	2-31	Northeast upper tributaries in the Sherman Creek drainage are inaccurately depicted.	ADF&G proposes that additional field investigation occur at the South Ophir Creek Tributary (i.e., Growth Media Stockpile location) and that the DEIS be modified to incorporate the additional information and accurately document stream course and fish presence. ADF&G may be able to assist with stream surveys.
Department of Fish & Game	Figure 2.3-10	2-35	South Creek is inaccurately depicted.	Correct stream course as shown in Albrecht (2018).
Department of Fish & Game	Section 2.5.1	2-45	Lack of supporting information for the statement "Upper Slate Creek and Upper Johnson Creek support similar fish populations".	Remove or clarify this statement.
Department of Fish & Game	Section 2.5.8	2-49	Redundant statement: "It would likely need a liner, poses a risk of acid rock drainage development, and would require an additional treatment system for contact water (rain and snow)."	Remove duplicate statement.
Department of Fish & Game	Section 3.1.1	3-2	Error of omission in agency title.	Revise "The Forest uses GIS software…" to "The Forest **Service** uses GIS software…" in this instance and elsewhere in the document.
Department of Fish & Game	Section 3.2.3.4	3-7	Reference error: Figure 3.2-1 is not in the document.	Remove the reference or include the figure.
Department of Fish & Game	Section 3.3.2.1	3-9	Error of omission for ambient monitoring metrics required by APDES permit AK0050571.	Per section 1.5.5.4 of APDES permit AK0050571, include the following requirement in the bulleted list of ambient monitoring requirements: "Periphyton biomass and community composition (annually in summer)."
Department of Fish & Game	Section 3.3.2.1	3-9	The Sherman Creek macroinvertebrate data presentation does not mention potential influence from white material, which persisted downstream of Outfall 001 September 2014-May 2017 and occasionally thereafter.[b]	Include recent information: Kane (2020) summarizes Lower Sherman Creek macroinvertebrate data trends, generally finding more macroinvertebrates and greater EPT proportions at sample sites in 2019 than observed the previous several years.
Department of Fish & Game	Section 3.3.2.1	3-13	Outfall not specified in final paragraph discussing exceedances of effluent limitation for cadmium.	Specify Outfall within this paragraph, as in all other paragraphs within this section.

Department of Environmental Conservation	Chapter 3	3-14	The text of DEIS in Section 1.2, page 1-3, bullet says, "Increase(in) the mill throughput from 2,000 to 3,000 tons per day." Chapter 3, page 3-14 further notes that "*Under all alternatives, future exceedances of effluent limitations in the discharges at Outfall 001 and Outfall 002 could occur. Exceedances could occur immediately downstream of the discharge but would be expected to be minor and temporary. The effects of exceedances on designated stream uses, including uses for aquatic life, would not be expected in the receiving water body (i.e., Sherman Creek or Slate Creek)* ."	Increasing the mill throughput may alter influent flow and quality into the Tailings Treatment Facility (TTF) and subsequently may affect the effluent quality into Lower East Fork Slate Creek at Outfall 002 of APDES Permit AK0050571. Since the proposed change to the mill throughput potentially affects the mine's ability to achieve compliance with APDES Permit AK0050571, further evaluation may be necessary to determine the proper permit conditions required as a result of the mill upgrade. Generally, changes to an APDES permitted facility that result in an increase of pollutant into the receiving water are subject to a permit modification process that may include a public opportunity to review and comment. Please add a final sentence to the quoted paragraph on page 3-14 that "T*he APDES permit evaluation of compliance and permit conditions will take place following the record of decision.* "
Department of Fish & Game	Section 3.3.3.1	3-14	Reference error: Table 3.3-1 is repeated and Table 3.3-2 is inaccurately referenced.	Rectify these references: remove one instance of Table 3.3-1 and replace the reference "Table 3.4-2" with "Table 3.3-2".
Department of Fish & Game	Section 3.3.3.4	3-19	Typographical error: "Treatment and discharge through an APDES discharge permit would be required until the effluent **does not meet** Alaska water quality standards."	Rectify statement: "Treatment and discharge through an APDES discharge permit would be required until the effluent **meets** Alaska water quality standards."
Department of Fish & Game	Section 3.3.3.4	3-19	Typographical error: "**Graphic** Phyllite"	Correct instances throughout document as follows: "**graphitic** phyllite".
Department of Fish & Game	Section 3.5.2	3-28	Error of omission: ADF&G Technical Report 18-02 not listed within in-text citations for monitoring studies.	Cite "Zutz (2018)" in text; Kane (2020) is the most recent annual publication.
Department of Fish & Game	Section 3.5.2.1	3-28, 3-29	Data presentation for streamflow in Sherman Creek Drainage, Slate Creek Drainage, and Johnson Creek Drainage: Streamflow data is a more useful metric if presented as an annual range as opposed to an average annual flow.	Provide annual range for respective streamflows.
Department of Fish & Game	Figure 3.5-1	3-29	Northeast upper tributaries in the Sherman Creek drainage are inaccurately depicted and labels are omitted for Ivanhoe and South Fork Sherman Creeks.	Rectify labels and stream course of Ophir Creek. Per the 2004 FEIS (Figure 3-2), Ophir Creek comprises two tributaries: "North Ophir Creek Tributary" and "South Ophir Creek Tributary", consistent with our observations[a]. South Ophir Creek Tributary has historically flowed along the toe of the Comet Waste Rock Stockpile; this drainage warrants further field investigation in order to accurately document stream course and fish presence.
Department of Fish & Game	Section 3.5.2.1	3-30	Error of omission in Slate Creek Drainage: Dolly Varden char have been documented above the TTF access road culvert in South Creek (Albrecht 2018).	Include full extent of documented Dolly Varden char presence in South Creek.
Department of Fish & Game	Section 3.5.2.1	3-30	Dolly Varden char are the only resident fish documented within West Fork Slate Creek.	Clarify the statement "West Fork Slate Creek has resident fish" as follows: "West Fork Slate Creek provides habitat for **Dolly Varden char**."
Department of Fish & Game	Section 3.5.2.2	3-31	Error of omission in data: Dolly Varden char have been documented in the TTF plunge pool (upper extent of East Fork Slate Creek) in years 2011, 2014-2017, and 2019[c].	Qualify the statement within Slate Creek Drainage suggesting Dolly Varden were absent in the East Fork reach.

Department of Fish & Game	Section 3.5.2.2	3-32	Population estimates for Dolly Varden populations in Upper Slate Lake and Lower Slate Lake can be more accurately reported (Coeur 2012; Earthworks 2002).	Clarify population estimates for Upper Slate Lake and Lower Slate Lake as "945 ± 58 fish" and "996 ± 292 fish".
Department of Fish & Game	Section 3.5.2.2	3-32	Information regarding threespine stickleback habitat in Johnson Creek Drainage is misleading: ADF&G has never captured threespine stickleback in Johnson Creek nor have we documented pond habitats in the watershed.	Remove the statement, "...based on observations in Slate Creek, they [threespine stickleback] are assumed to be present."
Department of Fish & Game	Section 3.5.2.3	3-34	The description of the Slate Creek fish barrier is technically inaccurate as two discrete waterfall barriers are present at the confluence of the West and East Fork — one in each fork.	Clarify the statement "The Slate Creek barrier is at the confluence of the West and East Forks" as follows: "The Slate Creek **barriers are** at the confluence of the West and East Forks."
Department of Fish & Game	Section 3.5.2.3	3-34	Descriptions of adult salmon run strengths are convoluted and incorporate inconsistent descriptors for run strength (e.g., "high" and "strong").	Consider revising this section.
Department of Fish & Game	Table 3.5-3	3-35	Escapement numbers are inaccurately reported for pink salmon in Sherman Creek in 2012 and Slate Creek in 2013.	Correct escapement numbers as follows: Sherman Creek (2012) — 1,608 pink salmon; Slate Creek (2013) — 3,637 pink salmon.
Department of Fish & Game	Figures 3.5-3, 3.5-4, and 3.5-5	3-37, 3-38, and 3-39	Aquatic Sciences, Inc. conducted the aquatic studies 2005-2010 (2006-2009b, 2011a), while ADF&G conducted the aquatic studies 2011-2019 (Kane 2020); discrepancies exist in study methods.	These figures should clearly demarcate results from Aquatic Sciences, Inc. and ADF&G.
Department of Fish & Game	Section 3.5.2.3	3-38	Statements comparing BMI communities across drainages are not presented in ADF&G aquatic biomonitoring reports due to localized differences in available stream habitat, geomorphology, hydrology, etc....	Reconsider data comparisons between stream systems.
Department of Fish & Game	Section 3.5.2.3	3-38	EPT statements are not consistently qualified with metric (e.g., "...low EPT over the years").	Ensure statements are qualified with a metric (i.e., number of taxa, percent of total BMI, total number).
Department of Fish & Game	Figure 3.5-5	3-39	Y-axis is labeled in accurately; each unit is a decimal ratio.	Correct label or units on y-axis.
Department of Fish & Game	Section 3.5.2.3	3-39	"... Copepoda and Ostracoda (75 percent of the **number**)" is vague.	Specify as follows: "...(75 percent of the **total**)."
Department of Fish & Game	Section 3.5.3.1	3-47	Within "Integrity of Freshwater Habitat": downstream fish passage from Upper Slate Lake through Lower Slate Lake to East Fork Slate Creek is required by the **ADNR Title 41 permit**.	Correct to "the ADF&G Title 16 permit".
Department of Fish & Game	Section 3.5.3.1	3-47	Within "Water Withdrawal": minimum flows are required by **ADF&G.**	Correct to "ADNR".
Department of Environmental Conservation	3.5.3.1	3-48 para 2	The text of DEIS says, "It (Sherman Creek) currently has a maximum permitted discharge limit of about 6.7 cfs."	The text of DEIS should read as follows: "It (Sherman Creek) currently has a maximum permitted discharge limit of about 10.03 cfs." The flow rate of 6.7 cfs should be changed to 10.03 cfs because the APDES Permit (AK0050571) with minor modifications made in 2019 allowed the Outfall 001 to have a maximum daily discharge changed from 3000 gpm (6.7 cfs) to 4500 gpm (10.03 cfs). Please adjust this amount to reflect the current permit stipulations.
Department of Fish & Game	Section 3.5.3.1	3-49	Within "Accidental Spills": the statement, "Anadromous fish resources that reside in the ocean would allow recolonization to occur in the lower anadromous zone **fairly quickly** as they would have been unaffected by the initial spill effects." lacks supporting information and provides a vague timeline.	Provide additional information since it's assumed Lower Slate Creek would be covered with tailings and clarify the phrase, "fairly quickly".

Department of Fish & Game	Section 3.5.3.2	3-50	The surface area at closure of the lake is inconsistently described as 119 acres and 120 acres; the POA 1 Reclamation and Closure Plan (p. 44) describes the final lake surface area as approximately 119.6 acres.	Report this metric consistently.
Department of Fish & Game	Section 3.5.3.2	3-51	References to tables are missing throughout this page.	Correct accordingly.
Department of Fish & Game	Tables 3.5-6 and 3.5-7	3-51	Possible impacts on Ophir Creek related to the proposed location of a Growth Media Stockpile are excluded; a map depicting specific impacts for these tables would be useful.	Include impacts of growth media stockpiles and consider including maps to correspond with these tables.
Department of Fish & Game	Section 3.5.3.2	3-51	Within "Filtered Tailings Facility Alternative": a new disturbance footprint is described as being "above" the existing TTF.	Correct as follows: "...a new disturbance footprint **north of** the existing TTF..."
Department of Fish & Game	Section 3.5.3.2	3-54	The table at the bottom of the page is without an in-text reference or title and likely misplaced (duplicate of Table 3.5-6).	Remove the table.
Department of Fish & Game	Section 3.6.2.1	3-55	An inaccurate metric is used in the description of POG: "...or having greater than 8 **thousand** board feet (MBF) per acre."	Correct as follows: "...or having greater than 8 million board feet (MBF) per acre."
Department of Fish & Game	Section 3.7.2.2	3-68	No introduction paragraph describing ESA listing or DPSs is present for humpback whales as observed for other threatened and endangered species.	Include this information for humpback whales.
Department of Fish & Game	Section 3.7.2.4	3-74	Impacted summer habitat for mountain goats is inaccurately stated as "at least 3 miles away."; White and Gregovich (2017) suggest the summer habitat was impacted out to 1000 m (0.62 miles) from the mine.	Correct accordingly.
Department of Fish & Game	Chapter 4	4-1	ADF&G reports should be cited by authors, not the agency title.	Correct references accordingly.
Department of Fish & Game	Chapter 4	4-1	Albrecht (2019) is incorrectly cited.	Cite as follows: Albrecht, G., 2019. Aquatic Studies at Kensington Gold Mine, 201**8**. Technical Report No. 19-06, Douglas, AK: Alaska Department of Fish and Game.
Department of Fish & Game	Chapter 4	4-2	Several Aquatic Sciences, Inc. NPDES report citations are omitted.	Include omitted citations.
Department of Fish & Game	Chapter 4	4-3	ADF&G Technical Report No. 16-03 (Brewster 2016) citation is omitted.	Include this citation.
Department of Fish & Game	Chapter 4	4-14	ADF&G Technical Report No. 12-10 (Timothy and Kanouse 2013) citation is omitted.	Include this citation.
Department of Fish & Game	Chapter 4	4-16	ADF&G Technical Report No. 18-02 (Zutz 2018) citation is omitted.	Include this citation.
DNR/DMLW/Water/Dam Safety	Fig 2.2-5	2-5	Leaders are not accurate.	Leaders should point to the labeled feature.
DNR/DMLW/Water/Dam Safety	Sec 2.2.2	Paragraph 2	9 feet of water required by whom? It is not clear these reasons for 9 feet of water cover during operations were included in the original EIS.	A reference or authority for this restriction should be included.
DNR/DMLW/Water/Dam Safety	Sec 2.2.7.1	2-11	Section 2.2.7.1 should include a bullet describing R&C for TTF dam.	Include bullet.
DNR/DMLW/Water/Dam Safety	Sec 2.2.7.4	2-13&14	The section omits any discussion of reclamation for the TTF dam.	Include reclamation requirements for closed tailings dam.
DNR/DMLW/Water/Dam Safety	Sec 2.2.7.4	Paragraph 3	What is source for 6.6 feet? This zone was related to the 9 feet of water around perimeter for littoral habitat in the original EIS.	Include reference.

DNR/DMLW/Water/Dam Safety	Sec 2.2.7.4	Jualin P1	Refer to hydraulic "dam" as “plug” or “barrier”: but not dam, because “dam” is defined in AS 46.17.900.	Edit terminology.
DNR/DMLW/Water/Dam Safety	Sec 2.2.8	2-16	Not an accurate description of state authority.	Authority for 3 year inspections is 11 AAC 93.159.
DNR/DMLW/Water/Dam Safety	Sec 2.2.8	2-16	Who is responsible for administering the funding and who is responsible for the work on the ground?	Clarify and add detail.
DNR/DMLW/Water/Dam Safety	Sec 2.2.8	2-16	The PDEIS states "Special event inspections included in the long-term care and maintenance plan would include one inspection by a qualified engineer in the event of a large earthquake, and one inspection in response to an extreme precipitation event such as a 100-year storm during the post-closure period." It is unclear whether "...during the post-closure period" means the 30-year post-closure monitoring period only or beyond that finite period. One seismic inspection and one hydrologic inspection seem finite for a “perpetual” time frame i.e. infinite. This description does not appear to reflect a comprehensive post closure financial estimate for LTCM.	Please clarify by describing the seismic and hydrologic inspections after an event, and the frequency, or triggers for subsequent inspections. Post closure LTCM requirements need careful presentation for review.
DNR/DMLW/Water/Dam Safety	Sec 2.2.8.1	2-17	First sentence is not an accurate description of state authority or authorizations. Last sentence is not an accurate description of regulatory requirements.	Alaska Dam Safety Program within ADNR writes Certificates of Approval to Construct or Operate a Dam. PE must be "qualified" for the type of dam being inspected. Lower Slate Lake Tailings Dam is not simply an embankment dam.
DNR/DMLW/Water/Dam Safety	Sec 2.2.8.1	2-17 Para 2	This does not appear to represent a comprehensive maintenance plan for LTCM. E.g. for an indefinite service life, a capital replacement cost for the concrete spillway should be included at least once every hundred years or so.	Provide more accurate estimate and disposition.
DNR/DMLW/Water/Dam Safety	Sec 2.2.8.1	2-17 Para 3	Post-closure maintenance is dependent on closure configuration which has not been approved for the Stage 3 TTF Dam.	Include caveat that details are subject to change to meet dam safety regulatory requirements.
DNR/DMLW/Water/Dam Safety	Sec 2.2.10	2-19	This section is not clearly written and conflicts with Section 2.2.8 where Coeur is doing the work for the first 30 years. 30 years is not equivalent to perpetuity. Who is doing the work for perpetuity?	Include additional detail describing long-term commitments and responsible parties.
DNR/DMLW/Water/Dam Safety	Sec 2.3	2-20 bullet 1	"Causeway" is a dam under AS 46.17.900.	Replace "causeway" with "dam" throughout document.
DNR/DMLW/Water/Dam Safety	Sec 2.3	Bullet 6	Constructing a new stream channel to reroute Fat Rat Creek into South Creek will require authorization from ADNR Water Resources Section.	Mention regulatory requirement for this detail.
DNR/DMLW/Water/Dam Safety	Fig 2.3.1	2-22	This design has not been reviewed or approved by ADNR Dam Safety and may not be constructible as shown. A respective caveat should be included in the EIS that the design is subject to change as necessary to protect life and property.	Include caveat that details are subject to change to meet dam safety regulatory requirements.
DNR/DMLW/Water/Dam Safety	Sec 2.3.1	2-24 Para 3	Soil cover over what? This detail is not approved for reclamation of the dam.	Include caveat that details are subject to change to meet dam safety regulatory requirements.

DNR/DMLW/Water/Dam Safety	Sec 2.3.1	2-24 Para 4	These design details have not been reviewed or approved by ADNR Dam Safety and are subject to change to protect life and property.	Include caveat that details are subject to change to meet dam safety regulatory requirements.
DNR/DMLW/Water/Dam Safety	Sec 2.3.1.1	2-24	"Causeway" appears to be a dam under AS 46.17.900. This design has not been reviewed by ADNR Dam Safety and is subject to change to protect life and property. This feature is unusual and precedence for similar performance requirements in operation and closure would be helpful.	Provide precedence for unusual feature in operations and closure. Include caveat that details are subject to change to meet dam safety regulatory requirements.
DNR/DMLW/Water/Dam Safety	Fig 2.3-3	2-25	This design is backwards for primary operations impoundment and containment for the TTF.	Include caveat that details are subject to change to meet dam safety regulatory requirements.
DNR/DMLW/Water/Dam Safety	Sec 2.3.1.2	2-25	The Stage 3 spillway is not a passive maintenance feature. Stage 4 is an opportunity for improvement. The proposed spillway location has not been reviewed or approved by ADNR Dam Safety.	Passive maintenance requirements should be incorporated in the design. Include caveat that details are subject to change to meet dam safety regulatory requirements.
DNR/DMLW/Water/Dam Safety	Sec 2.3.1.2	2-25	Roller compacted concrete is a design element mis-appropriated from the Stage 3 design and text is not an accurate description of Stage 3 design.	Include caveat that details are subject to change to meet dam safety regulatory requirements.
DNR/DMLW/Water/Dam Safety	Sec 2.3.1.2	2-25 Para 2	Technical error. The 100 year flood is not the PMF.	Use correct engineering terminology and be consistent.
DNR/DMLW/Water/Dam Safety	Sec 2.3.2	2-29 last P	All new ponds should be reviewed for dams as defined under AS 46.17.900.	Mention regulatory requirement for this detail.
DNR/DMLW/Water/Dam Safety	Sec 2.3.5	2-37	Inspections deemed acceptable to whom and for what? What are the performance requirements necessary to measure acceptability?	Provide more details and clarify intent.
DNR/DMLW/Water/Dam Safety	Sec 2.3.5.1	2-37 1st sentence	This standard conflicts with suggestions that dam embankment must be cleared of vegetation indefinitely.	Clarify reclamation requirements for dam.
DNR/DMLW/Water/Dam Safety	Fig 2.4-1	2-42	This diagram is cluttered by all alternatives on one figure.	Provide more useful, readable figure.
DNR/DMLW/Water/Dam Safety	Sec 2.4.3	2-43 Para 1	What numbers are these? Stage 4 crest is 776 feet.	Check specifications for elevations listed.
DNR/DMLW/Water/Dam Safety	Sec 2.4.3	2-43 Para 4	Reduced water cover closure will result in lower risk and potentially less maintenance. The spillway invert elevation may need to be modified.	Clarify and add detail. Include an assessment of long term risk into design elements.
DNR/DMLW/Water/Dam Safety	Sec 2.5.2	2-45	Long term risk including probability of incident and consequences and post-closure maintenance costs should be considered and described in the DEIS.	Elaborate on risk of alternatives in comparative format. Note that comparative Tables 2.7.1 and 2.7.2 do not reflect risk.
DNR/DMLW/Water/Dam Safety	Sec 2.6	Feb-49	Section is incomplete.	Complete section.
DNR/DMLW/Water/Dam Safety	Table 2.7.1	2-50	Depth of water over tailings for reduced water cover at 0 feet is probably not accurate. Groundwater may perch on tailings deposit, especially given dam face is lined with geomembrane.	Consider groundwater over tailings.
DNR/DMLW/Water/Dam Safety	Table 2.7.2	2-51	Consequence of filtered tailings storage facility on Stage 3 appears to be exaggerated.	Provide basis for consequence estimates.
DNR/DMLW/Water/Dam Safety	Table 2.7.2	2-51	34 to 50 miles of runout is exaggerated. Berners Bay is approximately 1 mile downstream.	Provide realistic consequence descriptions.
DNR/DMLW/Water/Dam Safety	Sec 3.2.1	3-3	This section discusses regulatory requirements but is deficient on analysis methods.	Headings should reflect content.

DNR/DMLW/Water/Dam Safety	Sec 3.2.1	3-3 para 2	The description is not a requirement of statutes.	Statutory citations should be specific and accurate.
DNR/DMLW/Water/Dam Safety	Sec 3.2.1	3-3 para 3	Lower Slate Lake Tailings Dam (AK00308) is listed on the National Inventory of Dams as a Class II (significant) hazard dam as defined in 11 AAC 93.157. The proponent agreed to design to Class I (high) hazard potential standards because of the indefinite service life. Loss of life is not considered probable if the dam fails for any reason.	Clarify hazard potential classification versus design standards.
DNR/DMLW/Water/Dam Safety	Sec 3.2.2	3-4	This section discusses regulatory requirements, design criteria, and subsurface conditions and location, but not much discussion of "affected environment".	Increase discussion of affected environment.
DNR/DMLW/Water/Dam Safety	Sec 3.2.3.1	3-5 Para 1	Sentence refers to Factor of Safety of 1.5 "consistent with Dam Safety requirements" [sic]. Not clear if intent was dam safety convention or regulatory requirements. Minimum factors of safety are not specified in regulations. If neither were intended, whose requirement is FS=1.5?	Clarify and reinforced with supporting information.
DNR/DMLW/Water/Dam Safety	Sec 3.2.3.1	3-5 para 3	Runout distance is outside of available distance to tidewater. Does this include dispersion into the marine environment?	Basis for consequence determination should be described such as the method of prediction. Is it a dam failure analysis or regression equations? How is tidal dispersion determined?
DNR/DMLW/Water/Dam Safety	Sec 3.2.3.1	3-5 para 4	Is this during operations or closure?	Indicate whether consequences are for operation or closure configurations.
DNR/DMLW/Water/Dam Safety	Sec 3.2.3.1	3-5 para 5	Is 3.3M average? Preceding paragraph indicates 75th%.	Tidewater is less than 1 mile. Consequence estimates should be based on realistic evaluations.
DNR/DMLW/Water/Dam Safety	Sec 3.2.3.2	3-6 para 3	Regardless of similar safety factors between Stage 3 and 4, how would larger dam result in less release?	Check estimates for accuracy. Appears to be transposed with preceding section based on last sentence.
DNR/DMLW/Water/Dam Safety	Sec 3.2.3.2	3-6 para 4&5	What difference does the percentile have to do with water ratio or stream channel geometry? Why is this noteworthy? The discussion is confusing.	Clarify. A table may help comparison.
DNR/DMLW/Water/Dam Safety	Sec 3.2.3.2	3-6 para 5	the reports seems to make inferences about consequences from runout distances that are not available at project. The correlations are not clear.	Elaborate on how long, theoretical runout distances equates to near site consequences estimates. I.e. what is the difference between 10 miles and 50 miles on the first mile?
DNR/DMLW/Water/Dam Safety	Sec 3.2.3.2	3-6	Did the failure evaluation of the proposed alternative consider the additional water contributed from Upper Slate Lake? Did the failure evaluation consider the failure of the "Causeway" from rapid drawdown, which could release even more water from Upper Slate Lake?	Failure evaluation of proposed alternative needs additional details and considerations.
DNR/DMLW/Water/Dam Safety	Sec 3.2.3.3	3-6 para 3	If the tailings are dewatered, compacted, and drained to achieve dilatant conditions, what is the basis of a flow failure? Was a deformation analysis conducted?	Provide technical basis for flow failure of filtered tailings.
DNR/DMLW/Water/Dam Safety	Sec 3.2.3.3	3-6 para 6	Lower Slate Lake Tailings Dam (AK00308) is listed on the National Inventory of Dams as a Class II (significant) hazard dam as defined in 11 AAC 93.157.	Show as Class II. No loss of life is probable under failure.
DNR/DMLW/Water/Dam Safety	Sec 3.2.3.4	3-7 para 2	The PDEIS states "It would be difficult to physically cover and cap the TTF at closure. ... Due to subaqueous deposition, the tailings would be very soft and would consolidate slowly."	Clarify the basis for determining this work would be "difficult" and how the consolidation rate of the tailings contribute to the difficulty of placing cover material.
DNR/DMLW/Water/Dam Safety	Sec 3.2.3.4	3-7 para 4	Option is referred to as "reduced water cover" not "dry".	Clarify meaning of reduced water cover. Is this intended to be bone dry? Why?

DNR/DMLW/Water/Dam Safety	Sec 3.2.3.4	3-7 para 5	It is not clear why the consequences of failure would be the same, given the removal of the open water in Stage 4.	Please clarify.
DNR/DMLW/Water/Dam Safety	Sec 3.2.3.4	3-7 para 6	Using the Brumadinho incident as an analog for a dry closure of a downstream tailings dam seems inappropriate.	Do not use Brumadinho incident as an analog for downstream fill dam. It is a completely different design and situation.
DNR/DMLW/Water/Dam Safety	Sec 3.3.3.1	3-16 Potential Dam Failure	Reference to Section 3.4 appears to be in error. Section 3.4 discusses Wetlands.	Clarify cross reference.
DNR/DMLW/Water/Dam Safety	Sec 3.3.3.1	3-16 Potential Dam Failure	Failure scenarios for all alternatives should be more thoroughly considered and described. Failure scenario for the preferred alternative should include consideration of a "causeway" dam failure.	Failure descriptions should be accurate and defensible.
DNR/DMLW/Water/Dam Safety	Sec 3.4.3.3	3-27	Reduced water cover could be developed into wetlands.	Consider wetlands development potential benefit for reduced water cover alternative.
DNR/DMLW/Water/Dam Safety	Sec 3.12.3.1	3-106	Effectively stating that the dam safety and geotechnical stability of all alternatives are essentially the same and all are subjectively considered as "very low risk" prevents an effective and defensible comparison. For example, by direct, subjective comparison, equating risk in terms of consequence and probabilities of incidents for Stage 4 with an open water pond versus a reduced water cover or filtered tailings does not measure up.	A more objective comparison of risk should be presented.

	[a] Gordon Willson-Naranjo, Habitat Biologist, to Jackie Timothy, Southeast Regional Supervisor, ADF&G Division of Habitat. Memorandum: Ophir Creek Fish Passage Kensington Gold Mine;
	[b] Greg Albrecht, Habitat Biologist, to Kate Kanouse, Acting Regional Supervisor, ADF&G Division of Habitat. Memorandum: 2018 Kensington Gold Mine Sherman Creek Trip Report; dated
	[c] Bill Kane, Habitat Biologist, to Kate Kanouse, Southeast Regional Supervisor, ADF&G Division of Habitat. Memorandum: 2019 Kensington Gold Mine TTF & Plunge Pool Trapping; dated

THE STATE of ALASKA
GOVERNOR MIKE DUNLEAVY

Department of Natural Resources
OFFICE OF PROJECT MANAGEMENT AND PERMITTING
P.O. Box 111030
Juneau, AK 99811-1030
907-465-3177

September 4, 2020

Matthew Reece
Minerals Program Manager
Tongass National Forest
8510 Mendenhall Loop Road
Juneau, AK 99801

Dear Mr. Reece,

Please find attached the State of Alaska's consolidated comments on the Preliminary Draft Supplemental Environmental Impact Statement for the Kensington Mine Plan of Operations Amendment 1. The comments refer to the revised document you provided to the State on August 24, 2020. Thank you for the opportunity to provide comments at this juncture.

Please let me know if you have any questions or need clarification on any of the comments.

Sincerely,

Sylvia A. Kreel

Sylvia A. Kreel
Large Project Coordinator

Kensington POA1 PDEIS
State of Alaska Consolidated Comments Table

Department/Division/Section	Section/Fig./Table	Page #	Comment/Issue	Recommendation/Action
Alaska Department of Natural Resources (DNR) - Division of Mining, Land, and Water (DMLW)	2.2.7	35 (2-11)	Line 19-20 The Reclamation plan approval was extended in March 25, 2018 to December 31, 2018 and extended again December 5, 2018 to December 31, 2021.	Rewrite the sentence to include all the extensions.
DNR-DMLW	2.2.7.2	37 (2-13)	Line 32-33 The last sentence should say that Coeur is working with the Forest Service and ADNR on how to proceed given the recommendations of the study, because this was reviewed and a discussion about the vague recommendations has occurred.	Update sentence.
DNR-DMLW	Fig 2.3-1	45 (2-21)	Some of the numbers in the figure are not legible.	Fix image in figure.
DNR-DMLW	2.3.1.1	47 (2-23)	Line 40 typo: A spillway on the Back Dam would ~~to~~ allow passage of the probable…	Edit.
DNR-DMLW	2.3.1.3	48 (2-24)	Line 15 typo: The existing seepage collection sump and seep lift station near the downstream toe of the Stage 4 (should say 3)…	Edit.
DNR-DMLW	Fig 2.3-4	49 (2-25)	The image should be rotated so that the words can be read easily.	Rotate image and fit to page.
DNR-DMLW	2.3.1.7	50 (2-26)	Line 5-6 needs clarification or could just be a typo: The Upper Slate Lake Diversion Pipeline in the TTF Stage 4 Dam area would be relocated at (to) the toe of the proposed raised Dam.	Edit.
DNR-DMLW	2.3.1.8	50 (2-26)	Line 12-13 needs clarification. It is not clear if the "access road" would be constructed out of HDPE or if the stormwater diversion pipeline would be constructed out of HDPE: An access road would be constructed with a high-density polyethylene pipeline to collect and divert stormwater…	Revise sentence to provide clarity.
DNR-DMLW	2.3.1.8	50 (2-26)	Line 15-16 duplicate sentence: The design of the West Diversion would minimize the excavating exposure of graphitic phyllite.	Delete duplicate sentence.
DNR-DMLW	2.3.1.9	50 (2-26)	Line 25 grammar: The TTF and seep water treatment ponds and reclaim pump station...	Edit.
DNR-DMLW	Fig 2.4-3	67 (2-43)	It is unclear if the ARD rock outcrop at the TTF will be covered with the reduced water alternative.	Clarify.
DNR-DMLW	2.4.4 WRS Options	70 (2-46)	A Table comparing WRS size, wetland impact, etc...would be helpful.	Add a note saying see Table 2.7-4 for WRS comparison.
DNR-DMLW	Table 2.7-3	79 (2-55)	The table is hard to read (especially page 81).	Please add some form of horizontal gridlines.
DNR-DMLW	Table 2.7-3	81 (2-57)	Changes in water quality or quantity…under TTF Closure with Reduced Water it says "Same as Proposed Action" which says "Same as No Action".	It should just be "Same as No Action".
DNR-DMLW	Table 2.7-4	84 (2-60)	There is not adequate discussion of the risk posed by locating the new WRS Pipeline Road above the camp.	Fully discuss the potential risks of locating the new WRS Pipeline Road above the camp.
Alaska Department of Environmental Conservation (DEC)	Abstract	5 (Abstract)	Line 20 uses the word "withstanding".	The two words should be separated "with standing"

DEC	1.1.1	17 (1-1)	Lines 27 - 33 discuss the Corp 404 permit.	Language should be added to state that the Department of Environmental Conservation must issue a certificate of reasonable assurance under Section 401 of the Clean Water Act (401 Certification) in order for the Corp of Engineers 404 permit to be valid.
DEC	1.1.4	20 (1-4)	Lines 11 - 13. The first sentence does not make sense grammatically due to use of the word "or" in line 12.	Please add the word "to" so the sentence reads "*The Responsible Official (Forest Supervisor) will decide whether to approve the proposed amendment of the Plan of Operations and under what conditions* ***or to*** *approve amendment of the Plan of Operation with additional mitigation or changes.*
DEC	1.1.4	20 (1-4)	Lines 23 - 27 discuss the Corp 404 permit.	This paragraph needs to mention Alaska Department of Environmental Conservation's 401 certification of the Corp 404 permit.
DEC	2.2.6	35 (2-11)	Lines 7-8 contain a grammatically incorrect sentence. The existing sentence notes that "*or Echo Cove when Yankee Cove depending on weather.* "	Please edit the sentence so it reads " *or Echo Cove when Yankee Cove is unavailable because of inclement weather conditions* ."
DEC	Table 2.7.2	79 (2-55)	Table 2.7.2 provides two separate indicators: (1) tailings and water volume and (2) likelihood of reaching Berners Bay. The data in the table provides the tons of tailings for each alternative, as well as the acre feet of water, but nowhere in the table is there any information provided on the likelihood of either tailings or water reaching Berners Bay.	Please add information on the likelihood of tailings or water reaching Berner's Bay or delete the second indicator from the table.
DEC	3.3.2.2	99 (3-13)	Line 22 says that maximum daily discharge of 4,500 gpm for Sherman Creek	Please replace 4,500 gpm with 3,000 gpm because the most recent modification (as of 8/1/20) of the APDES permit has changed the limit for Outfall 001/Sherman Creek from 4,500 gpm to 3,000 gpm.
DEC	3.3.3.1 Effects Common to All Alternatives - Water Quality	106 (3-20)	Line 7 says that APDES permit allows Outfall 001 a maximum daily discharge of 4,500 gpm. . . .	Please replace 4,500 gpm with 3,000 gpm because the most recent modification (as of 8/1/20) of the APDES permit has changed the limit for Outfall 001/Sherman Creek from 4,500 gpm to 3,000 gpm. With the change in flow to the currently permitted 3,000 gpm, recommend removing the sentence on lines 11-12 "It is not anticipated that greater discharge rates would need to be permitted ...". You may want to check with the applicant if they have any plans to increase the discharge within the foreseeable future.
DEC	3.5.3.1 Environmental Consequences, No Action Alternative - Water Quality	140 (3-54)	Lines 39-40 say that Outfall 001 is allowed a maximum daily discharge of 4,500 gpm ….	Please replace 4,500 gpm with 3,000 gpm because the most recent modification (as of 8/1/20) of the APDES permit has changed the limit for Outfall 001/Sherman Creek from 4,500 gpm to 3,000 gpm.

DEC	3.5.3.2 Proposed Action and Action Alternatives - TTF Closure with Reduced Water	144 (3-59)	Lines 22 - 25 discusses the TTF closure with reduced water alternative and note that "*Assuming the conceptual approach is feasible, draining and capping the TTF at closure…..* "	Alternatives were eliminated from consideration in Section 2.5 because they did not meet the requirement of being “practicable and technically feasible. ” It is not clear why later in the EIS document an alternative is analyzed and the question is raised through the statement “assuming the conceptual approach is feasible” as to whether the alternative meets that standard. Either the alternative has met the standard of being feasible or it has not. Please explain.

THE STATE of ALASKA
GOVERNOR MIKE DUNLEAVY

Department of Natural Resources

OFFICE OF PROJECT MANAGEMENT AND PERMITTING

P.O. Box 111030
Juneau, AK 99811-1030
907-465-3177

January 4, 2021

Matthew Reece
Minerals Program Manager
Tongass National Forest
8510 Mendenhall Loop Road
Juneau, AK 99801

Dear Mr. Reece,

The State of Alaska appreciates the opportunity to review and comment on the Draft Supplemental Environmental Impact Statement (DSEIS) for the Kensington Mine Plan of Operations Amendment 1 (POA 1). The Department of Natural Resources, Office of Project Management and Permitting coordinated with the Alaska Departments of Fish and Game, Natural Resources, Environmental Conservation, Health and Social Services, and Law in the development of the attached State of Alaska consolidate comments. Please consider the enclosed comments in the development of the Final Supplemental Environmental Impact Statement.

Please let me know if you have any questions or need further clarification on any of the comments.

Sincerely,

Sylvia A. Kreel

Sylvia A. Kreel
Large Project Coordinator

Attachments:
210104 State of Alaska Consolidated Comments
201120 Alaska Department of Fish and Game Memorandum (referenced in comments)
Kensington Mine POA 1 DSEIS Sec. 3.7 Revisions (referenced in comments)

Kensington Mine POA 1 DSEIS				
State of Alaska Consolidated Comments Table				
Department/Division/Section	**Section/Fig./Table**	**Page #**	**Comment/Issue**	**Recommendation/Action**
Alaska Department of Fish and Game (ADF&G) / Habitat	Draft Environmental Supplemental Impact Statement (DSEIS) – general comments for consideration	N/A	Expansion of the Kensington Waste Rock Storage (WRS) would fill resident fish habitat in a Johnson Creek channel braid near the upper extent of fish use, and the Comet WRS would encroach upon the upper extent of fish use in the Sherman Creek watershed (see attachment). Project boundaries for the Pipeline Road WRS and expansion of the Pit #4 WRS suggest development activities would occur immediately adjacent to Johnson Creek, which also provides resident fish habitat for Dolly Varden char. Should these WRSs be approved as proposed in Plan of Operations Amendment 1 (POA 1), field surveying will be required to verify stream courses and Habitat Section will work with Coeur to develop mitigation strategies for activities blocking fish passage, such as channel relocation.	
ADF&G / Habitat	DSEIS – general comments for consideration	N/A	Fish habitat permits are required for Coeur's proposed POA 1 activities having the potential to alter fish passage, including the Tailings Treatment Facility (TTF) Stage 4 dam raise, back dam and delta construction, culvert replacements, and channel relocations. The permits will require post-construction monitoring to document conformance with project designs and mitigation success. If an alternative tailings disposal design is approved and Lower Slate Lake fish habitat mitigation required as part of the 2005 project approvals is not possible, Habitat Section would need to reevaluate and approve mitigation necessary for permanent fish habitat loss in Lower Slate Lake.	
ADF&G / Habitat	DSEIS	N/A	Error of omission in species' common name.	Throughout the document, correct "Dolly Varden" to "Dolly Varden **char**".
ADF&G / Habitat	DSEIS	N/A	Remnant text is found in many in-text references for tables and figures, including on pages 2-15, 2-26, 3-11, 3-25.	Throughout the document, correct broken links to references or remove the phrase, "Error! Reference source not found".
ADF&G / Habitat	Summary	N/A	Page numbering is inconsistent throughout summary; pages are listed S-1, S-2, etc. until Tables S-1 through S-3 are presented. From there pages continue as 2-50 and 2-5 for the entirety of Table S-3.	Revise accordingly.
ADF&G / Habitat	Summary	S-6	ADF&G recommended replacing two culverts to improve fish passage, however Coeur proposes to replace three culverts in POA1 (including the Fat Rat Creek culvert).	Revise the second bullet at the top of the page.
ADF&G / Habitat	Summary	S-6	The sentence concerning ADF&G's permitting jurisdiction is out of place and inaccurately described.	Delete the last sentence in the second bullet at the top of the page.
ADF&G / Habitat	Summary	S-6	Aquatic resource reclamation, mitigation, and conservation measures would not be the same for the Filtered Tailings Facility as the Proposed Action, as implied with summary statement at the bottom of the page.	Revise accordingly.

ADF&G / Habitat	Summary	S-7	The description incorrectly describes the stage 4 dam height under the TTF Closure with Reduced Water Alternative (Fig. 2.4-3).	Correct the first sentence to "The Stage 4 Dam would be constructed similar to that described in the Propose**d** Action, except the Stage 4 Dam would be raised **17** feet instead of the **36** feet in the Proposed Action."
ADF&G / Habitat	Table S-3	2-5	In "Fish and Fish Habitat" under the indicator, "Change in water quality or quantity on fish or their habitat from spills and sedimentation," the alternative, "TTF Closure with Reduced Water" has an impact listed as "Same as Proposed Action" when the proposed action has an impact listed as "Same as No Action." The impact listed for the reduced water alternative should also state "Same as No Action" to reduce confusion.	Revise accordingly.
ADF&G / Habitat	Table S-3	2-5	Within "Wildlife and Wildlife Habitat" under the indicator, disturbance impacts under the Proposed Action would not be the same as under the No Action.	Revise accordingly.
ADF&G / Habitat	Figure 2.2-2	2-3	The clarifier is inaccurately associated with the Comet Waste Rock Stockpile.	Correct the label to "Comet WTP Clarifier" or remove label.
ADF&G / Habitat	Figure 2.2-4	2-5	Northeast of Johnson Creek, an unlabeled, unknown stream course is depicted.	Verify existence and label the stream course.
ADF&G / Habitat	Figure 2.2-5	2-6	Southwest of the TTF, unlabeled stream courses are depicted.	Verify existence and label the stream courses.
ADF&G / Habitat	Sec. 2.2.2	2-8	Graphitic phyllite material is present on the east and west sides of the TTF dam, not only the west side as stated.	Revise accordingly; also describe mitigation measures Coeur has employed reducing acid rock drainage produced on the east side (where concrete has not been used).
ADF&G / Habitat	Sec. 2.2.3	2-10	Sherman Creek (AWC 115-31-10330) is inaccurately described as providing habitat for coho salmon and the supporting in-text citation is outdated.	Correct the concluding statement in this section as follows: "The presence of a waterfall approximately 1,200 feet (366 meters) upstream from Lynn Canal prevents further upstream passage of fish in Sherman Creek. Habitat in Sherman Creek (AWC 115-31-10330) downstream of the falls supports chum and pink salmon (Johnson & Litchfield, 2015)." Consider updating the corresponding reference (Geifer and Blossom 2020) : Giefer, J. and B. Blossom. 2020. Catalog of waters important for spawning, rearing, or migration of anadromous fishes – Southeastern Region, effective June 1, 2020. Alaska Department of Fish and Game, Special Publication No. 20-04, Anchorage.
ADF&G / Habitat	Sec. 2.2.8	2-15	The concluding paragraph in this section is confusing and appears to be missing information.	Revise the paragraph for clarity.
ADF&G / Habitat	Sec. 2.2.8.3 and 2.2.8.4	2-16	The final sentence in each section should be bulleted.	Revise accordingly.
ADF&G / Habitat	Sec. 2.2.8.8	2-17	The final two conservation measures are not clearly attributed to the eulachon spawning period.	Format for clarity.
ADF&G / Habitat	Sec. 2.3	2-19	The sentence about ADF&G's permitting jurisdiction is inaccurately described.	Delete the last sentence in the section discussing construction of fish habitat.
ADF&G / Habitat	Figure 2.3-2	2-21	Southwest of the TTF, unlabeled stream courses are depicted.	Verify existence and label the stream courses.
ADF&G / Habitat	Sec. 2.3.1	2-22	The introductory sentence in this section is potentially misleading as the TTF height isn't currently 88 feet; the TTF **dam** height is currently 88 feet.	Consider revising as follows: "The TTF dam height would be raised by 36 feet from 88 feet (740 feet AMSL) to 124 feet (776 feet AMSL; Figure 2.3-1), to increase the tailings storage capacity from 4.5 million tons to 8.5 million tons, and be constructed in a downstream construction method."

ADF&G / Habitat	Sec. 2.3.2	2-26	The footprint of the proposed Kensington WRS expansion is stated as being "a minimum of 62 feet from Johnson Creek", which is not correct. The footprint as proposed would fill ~100 feet of a Johnson Creek channel braid. See attached memorandum for reference.	Incorporate information from recent field investigations (see attachment) into discussion of the Kensington WRS expansion.
ADF&G / Habitat	Figure 2.3-5	2-27	Proposed WRS expansion project boundaries are inconsistent with those found in POA 1 (Figures 4-1, 4-5, and 4-7).	Correct all project boundaries to align with those proposed in POA 1.
ADF&G / Habitat	Figure 2.3-6	2-28	The WRS Expansion footprint does not align with POA 1 (Fig. 4-5) and the stream course for Johnson Creek is inaccurate.	Correct all project boundaries to align with those proposed in POA 1; ADF&G has sent shapefiles pertaining to stream courses within the project area to USFS for review and incorporation into the FSEIS.
ADF&G / Habitat	Sec. 2.3.2	2-29	Recent fish investigations in the Comet area indicate probable resident fish habitat within the proposed Comet WRS expansion (see attachment). The disturbance boundary of both the Pit 4 WRS expansion and Pipeline Road WRS appear to intersect or approach the Johnson Creek stream channel; some discussion to that effect should be included in the SEIS.	Incorporate information from recent field investigations (attached) into discussion of the Comet WRS expansion. Include discussion of the Pit 4 WRS expansion and Pipeline Road WRS disturbance boundaries effect upon Johnson Creek, as mentioned with the Kensington WRS expansion on p. 2-26.
ADF&G / Habitat	Sec. 2.3.3	2-29	"Tributaries 1 and 2" are not defined in the figure referenced.	Remove the titles, "Tributaries 1 and 2" from the section, revise the statement as follows: "Construction of the new delta at the mouth of Upper Slate Creek would join the new Upper Slate Lake water level to the main stem **and two tributaries**, which would maximize the area of lake shore and creek spawning habitat created.", or include labels for "Tributaries 1 and 2" in Fig. 2.3-10.
ADF&G / Habitat	Figure 2.3-7	2-30	The project boundary for the proposed growth media stockpile does not align with POA 1 (Fig. 4-7).	Correct all project boundaries to align with those proposed in POA 1.
ADF&G / Habitat	Sec. 2.4.2	2-40	Aquatic resource reclamation, mitigation, and conservation measures would not be the same for the Filtered Tailings Facility as the Proposed Action, as implied in the concluding paragraph.	Revise accordingly.
ADF&G / Habitat	Sec. 2.4.3	2-42	The proposed Stage 4 Dam elevation is incorrectly stated as 779 feet.	Correct to **776** feet.
ADF&G / Habitat	Sec. 2.4.3	2-43	Aquatic resource reclamation, mitigation, and conservation measures would not be the same for the TTF Closure with Reduced Water alternative as the Proposed Action, as implied in the concluding paragraph.	Revise accordingly.
ADF&G / Habitat	Table 2.7-3	2-56	Within "Fish and Fish Habitat" under the indicator, "Change in water quality or quantity on fish or their habitat from spills and sedimentation", the alternative, "TTF Closure with Reduced Water" has an impact listed as "Same as Proposed Action" when the proposed action has an impact listed as "Same as No Action". Presumably, the impact listed for the reduced water alternative should also state "Same as No Action" to reduce confusion.	Revise accordingly.
ADF&G / Habitat	Sec. 3.3.2	3-17	Under "Stormwater Management," the second instance of the Alaska Pollutant Discharge Elimination System (APDES) permit cited is incorrect.	Correct to "APDES permit AK0050**5**71."

ADF&G / Habitat	Sec. 3.3.2.1	3-19	Monitoring components are not implemented consistently among sampling sites and streams as this section implies. E.g., "Quality of spawning substrate, including grain size distribution (July)…" occurs at two sites in Lower Slate Creek only.	Revise for clarity.
ADF&G / Habitat	Sec. 3.3.3.1	3-24	The definitive statement, "Temporary exceedances of effluent limitations would not affect designated stream uses, including uses for aquatic life in the receiving water body (i.e., Sherman Creek or Slate Creek)", requires qualification or revision.	Revise the statement as follows: "Temporary exceedances of effluent limitations are unlikely to affect designated stream uses, including uses for aquatic life in the receiving water body (i.e., Sherman Creek or Slate Creek)."
ADF&G / Habitat	Sec. 3.4.3.2	3-36, 3-37	Some in-text references to tables are incorrect.	Ensure tables are referenced accurately.
ADF&G / Habitat	Sec. 3.4.3.2	3-36	The statement, "Other Action Alternatives would result in reduced overall new impacts with the Filtered Tailings Facility and the TTF Closure with Reduced Water Alternatives approximately 23 acres and 18 acres, respectively (Table 3.4-5)," does not reflect data presented in the table referenced.	Ensure data presented aligns with that in tables referenced.
ADF&G / Habitat	Sec. 3.5.2.1	3-41	In "Sherman Creek Drainage," the first several sentences do not address Sherman Creek specifically. Rather, the statements broadly address affected freshwater habitat.	Consider relocating these broader statements under the preceding header.
ADF&G / Habitat	Sec. 3.5.2.1	3-41	The final paragraph on this page begins with a statement about Fat Rat and South Creeks, pivots to Upper Slate Creek, and returns to Fat Rat and South Creeks.	For clarity, consider revising this paragraph so statements pertaining to specific creeks are consecutive.
ADF&G / Habitat	Sec. 3.5.2.1	3-43	In "Johnson Creek Drainage," the statement, "Dolly Varden, Cutthroat Trout, Prickly Sculpin, Chum Salmon, Pink Salmon, and juvenile Coho Salmon have been captured in Lower Johnson Creek. Dolly Varden have also been captured on Upper Johnson Creek above the barrier falls," implies adult coho salmon have not been observed in Lower Johnson Creek, which is not true.	Remove "juvenile" from the statement.
ADF&G / Habitat	Sec. 3.5.2.3	3-52	Periphyton data is characterized incorrectly.	Correct the statement, "The cause for the highest value of chlorophyll a in Lower Slate Creek in 2013…" to "The cause for the **high** value of chlorophyll a in Lower Slate Creek in 2013…"
ADF&G / Habitat	Sec. 3.5.3.1	3-61	In "Water Quality," the statements characterizing the white residual periodically observed in Sherman Creek are incorrect and unsupported. White material continued to occasionally persist in Sherman Creek 2018-2020.	Update and clarify the white residual presence in Sherman Creek through 2020 and provide supporting information for the sentence conclusion "...and its occurrence has likely been corrected."
ADF&G / Habitat	Sec. 3.7.2.4	3-84	Updated and additional contextual information would improve this section.	Revise the section and include supporting figures per the attached document; proposed revisions are highlighted.
ADF&G / Habitat	Sec. 3.7.3.2	3-90	Updated and additional contextual information would improve this section.	Revise the section and include supporting figures per the attached document; proposed revisions are highlighted.
DNR/DMLW/Large Mine Program	Table S-3 Impacts of Tailings Disposal Alternatives on Issue and Resources	PDF page 13	Socioeconomics and Environmental Justice (Section 3.9) Indicator: Effects on employment (number of people) and annual wages ($ million) in the City and Borough of Juneau (CBJ) and statewide, and those effects on population (number of residents)	Filtered Tailings Facility and TTF Closure with Reduced Water both indicate that the impact would be the "Same as the Proposed Action". These Construction projects are very different from the Proposed Action, especially the Filtered Tailings Facility. Additionally, neither of these alternative have the additional habitat work; therefore, it is unlikely their impact would be the same.

DNR/DMLW/Large Mine Program	2.2.7 Reclamation and Closure (paragraph 1)	2-11	Please revise this sentence for clarity: On March 25, 2018 to December 31, 2018, and on December 2018, the ADNR extended the approval of the 2013 Reclamation and Closure Plan until December 31, 2021 (ADNR, 2018).	Suggested revision: The Reclamation Plan Approval was extended twice, once on March 5, 2018, where is was extended until December 31, 2018, and again on December 5, 2018, where it was extended until December 31, 2021.
DNR/DMLW/Large Mine Program	2.2.7 Reclamation and Closure (paragraph 1)	2-11	Please clarify this sentence: The Reclamation and Closure Plan would then be reviewed and possibly extended again or replaced with a new plan.	Information for your clarification: Under Alaska Administrative Code 11 AAC 97.320, the commissioner of the Alaska Department of Natural Resources may approve a reclamation plan for any term not to exceed 10 years.
DNR/DMLW/Large Mine Program	Figure 2.3-7	2-30	arrows not pointing to correct areas	Please correct the arrows on this Figure
DNR/DMLW/Large Mine Program	Restated again in Section - 2.3.4.1 TTF Closure	2-35	Restated again in Section - 2.3.4.1 TTF Closure "Areas around the TTF including the final Stage 4 Dam surface that will not be submerged would be reclaimed by placement of growth media where there is no vegetation growth and seeding."	A concise reclamation plan should be developed for the surface of the Dam to reduce long term maintenance.
DNR/DMLW/Water/Dam Safety	Sec 2.2.7.1	2-13 last paragraph	DSEIS states, "Areas around the TTF that will not be submerged, including the final Stage 3 Dam surface, would be reclaimed by placing growth media where there is no vegetation growth and seeding" which appears to conflict with Section - 2.2.7.4 *Long-Term Care and Maintenance and Dam Safety Inspections* which states "Annual Stage 3 Dam and spillway inspection and maintenance would include brush/shrub, tree, and debris removal from the Dam and spillway" which conflicts with Section - 2.3.4.1 *TTF Closure* which states, "Areas around the TTF including the final Stage 4 Dam surface that will not be submerged would be reclaimed by placement of growth media where there is no vegetation growth and seeding." Encouraging the growth of vegetation then including maintenance requirements to remove vegetation is unusual.	Clarify requirements for restoration of vegetation and maintenance in the closed configuration. A closure alternative that is passively safe without active removal of vegetation should be included. See comments on Table 2.7.1
DNR/DMLW/Water/Dam Safety	Sec 2.2.7.4	2-14 para. 1	Who is responsible for laborers? Laborers may not be qualified for annual inspections.	Indicate who will be responsible for administration and supervision of long term care and maintenance requirements in the post-closure period including authorizations for annual spending from the trust described in paragraph 2 of Section 2.2.7.4
DNR/DMLW/Water/Dam Safety	Sec 2.2.7.4	2-14 para. 2	Paragraph includes awkward reference to ADNR dam safety authorization for 3 year inspection requirement. Appropriate succinct reference is 11 AAC 93.159	Clarify regulatory requirement for dam safety inspections is 11 AAC 93.159
DNR/DMLW/Water/Dam Safety	Sec 2.3.1	2-23 Final Paragraph	Dam crest elevation at 776 feet in closure may not provide adequate cover for top of liner system. Four feet of fill at closure will raise dam crest to elevation 780 feet and encapsulate Zone A1. This will likely grow trees and be subject to erosion at the specified slope although buttressing the dam with waste rock at a flatter slope at closure may have significant benefits such as reduced maintenance requirements .	Provide additional detail on performance and maintenance requirements in the closed configuration. Include caveat that details are subject to change to meet dam safety regulatory requirements

DNR/DMLW/Water/Dam Safety	Sec 2.3.1.1	2-23	"Back Dam" appears to be a dam under AS 46.17.900. This feature is unusual in the closed configuration and precedence for similar performance requirements in operation and closure would be helpful. This design has not been reviewed by ADNR Dam Safety in detail.	Provide precedence for unusual feature in operations and closure. Include caveat that details are subject to change to meet dam safety regulatory requirements
DNR/DMLW/Water/Dam Safety	Fig 2.3.3	2-23	This liner system design on outboard face of dam appears backwards for primary operations impoundment and containment for the TTF.	Clarify how proposed liner system design will withstand uplift pressure from saturated embankment due to rising water levels in the TTF impoundment. Add "Design subject to change qualifier" similar to Figure 2.3.1.
DNR/DMLW/Water/Dam Safety	Sec 2.3.1.2	2-24	The DSEIS states, "The new spillway would be similar to the Stage 3 spillway" including reinforced concrete sidewalls and roller-compacted concrete along the base. A spillway for Stage 4 may not be subject to the same constraints as the existing Stage 3. The spillway configuration should be designed to be self-cleaning, safe for post-closure land use, and with limited maintenance requirements. The DSEIS specifies a number of elevations including the spillway invert and crest of dam. The new Roller compacted concrete is a design element from the Stage 3 and was encapsulated with structural concrete to provide freeze thaw protection. Rolled compacted concrete may not be appropriate specification in this application.	Instead of specific elevations, the DSEIS should include specific performance requirements such as the minimum areas of littoral habitat needed to meet environmental objectives. Designers must be allowed maximum flexibility for it to meet objectives necessary to ensure the safety of the dam. Include caveat that details are subject to change to meet dam safety regulatory requirements.
DNR/DMLW/Water/Dam Safety	Sec 2.3.1.2	2-24	Final sentence states "trees will be removed up to elevation 768 feet AMSL". Where will trees be removed from?	Please clarify tree removal requirement.
DNR/DMLW/Water/Dam Safety	Sec 2.3.5	2-36	This section does not include sufficient detail for post closure, operations, performance monitoring and maintenance requirements of the dams. The dams are subject to regulation under Alaska dam safety statutes (AS 46.17) and regulations (11 AAC 93), rather than the "jurisdiction of the state dam inspector". As written, the section implies the state is responsible for the inspections. Clarify that the dam owner/operator is responsible for operations, monitoring, maintenance and inspections in the post-closure period.	Provide more details on post-closure operations, performance monitoring and maintenance requirements of the dams. Clarify and provide distinction between dam owner/operator responsibilities and regulatory requirements.
DNR/DMLW/Water/Dam Safety	Sec 2.3.7	2-37	Reference to Section 2.2.8 does not appear to be accurate	Clarify reference to financial assurance calculations
DNR/DMLW/Water/Dam Safety and Large Mine Program	Sec 2.4.2	2-40 para. 1	The filtered tailings alternative should consider Stage 3 TTF closed with no TTF lake at closure similar to description under Section 2.5.1.1 so that long term requirements for Stage 3 dam are eliminated by waste rock from extended mining operations. This would eliminate concerns about stability of drystack with an inundated toe of slope, as described, replacing that concern with a waste rock buttress, eliminate new waste rock disposal sites, and reduce cost of closure by reducing handling of waste rock mentioned under comments on Section 2.5.1.1.	Consider filtered tailings alternative with waste rock disposal used to eliminate Stage 3 TTF lake and jurisdictional dam in perpetual post-closure operation.

DNR/DMLW/Water/Dam Safety	Sec. 2.5.1.1	2-47 para. 3	This may not be a technically accurate justification because the statement assumes that no consolidation has occurred due to the weight of the tailings. Waste rock disposal can be advanced across soft tailings to accelerate consolidation and support construction equipment and cover placement.	Indicate if statement about consolidation is based on assumptions of tailings behavior in sub-aqueous deposit or actual measurements of in-situ conditions.
DNR/DMLW/Water/Dam Safety	Sec. 2.5.1.1	2-48 para. 2	The reference to the Coreg do Feijao Dam failure in Brumadinho, Brazil is not an appropriate justification given significant differences in type of tailings retained, the design of the Lower Slate Lake Tailings Dam, actual and potential failure modes, and other factors.	Please clarify how design and failure mechanism of respective dam failure in Brazil is relevant to the alternative evaluation.
DNR/DMLW/Water/Dam Safety	Sec. 2.5.1.1	2-48 para. 3	This paragraph states that the alternative "does not meet the requirement to be practicable and technically feasible using today's technology due to the soft nature of submerged tailings" and describes "expensive" measures such as wick drains to address differential settlement from consolidation of deeper sections of soft tailings, assuming a level closure cover is necessary. Moving waste rock and capping tailings is technically feasible, but may be expensive due to the cost of handling waste rock after mining is complete; i.e. moving waste material twice is typically avoided. However, increasing the surcharge on the tailings deposit from loading with a permeable material will accelerate consolidation, provide drainage, reduce liquefaction potential, in addition to other benefits in the closed configuration such as creating a landform, eliminating the need for tree removal from a conventional dam embankment, creating terrestrial habitat, etc.	Consider including the "No TTF Lake at Closure" alternative in the range of alternatives evaluated in detail in the FSEIS. A level closure cover for this alternative may not be necessary. Consider mounding of waste rock cap to account for differential settlement. Compare expenses from moving waste rock to accomplish reclamation and closure objectives with the expense of operating and maintaining the water retention dam indefinitely.
DNR/DMLW/Water/Dam Safety	Sec. 2.5.1.1	2-48 last paragraph	The DSEIS states "the No TTF Lake at Closure Alternative does not provide an environmental benefit over other alternatives considered in detail." This statement implies that the DSEIS may not have fully evaluated the benefits of eliminating the water-covered, tailings disposal facility dam. Long term care and maintenance of a water-covered, tailings disposal facility dam is challenging and requires long-term funding for active management of operation, maintenance and inspection.	Consider benefits of eliminating long term care and maintenance of a water-covered, tailings disposal facility dam.
DNR/DMLW/Water/Dam Safety	Sec. 2.5.3	2-50	See comment on Section 2.4.2 and 2.5.1.1	Alternative waste rock disposal should include capping Stage 3 TTF and dam with waste rock to eliminate open water and long term care and maintenance requirements in the post-closure configuration

DNR/DMLW/Water/Dam Safety	Sec. 2.7.1	Table 2.7.1	Tabular comparison of advanced alternatives demonstrates that all alternatives include open water covers over the tailings deposit. The DSEIS does not clearly indicate whether a water cover is required for the chemical stability of the tailings at the Kensington Mine. Each of the advanced alternatives including the "TTF Closure with Reduced Water" appears inconsistent with Principle 3, Requirement 3.2 of the recently published Global Industry Standard on Tailings Management (2020) to "minimize the volume of... water in an external tailings facility." Further, the DSEIS does not indicate if any of the proposed alternatives were subject to independent technical review as recommended by the Global Standard. Finally, none of the advanced alternatives represent the industry trend to develop a "landform" (https://landformdesign.com/principles.html) in the closed configuration that transitions the Lower Slate Lake Tailings Dam from an active, jurisdictional tailings dam to a distinct, mine waste disposal facility.	The SEIS should clearly indicate whether a water cover is required for the chemical stability of the tailings at the Kensington Mine. The SEIS should consider applicable principles found in the Global Industry Standard on Tailings Management (August 2020) (https://globaltailingsreview.org/wp-content/uploads/2020/08/global-industry-standard-on-tailings-management.pdf). Please evaluate the "No TTF Lake at Closure" alternative in detail and consider landform design principles in the evaluation (https://landformdesign.com/principles.html). Also, the filtered tailings alternative should include closing the Stage 3 TTF with no lake to minimize the volume of water and eliminate the jurisdictional dam in perpetual post-closure operation, thereby providing an alternative that represents a passively safe, dry landform for tailings disposal with passive maintenance requirements and is consistent with the principles of the Global Standard.

MEMORANDUM

State of Alaska

Department of Fish and Game
Habitat Section

TO:	Kate Kanouse Southeast Regional Supervisor	DATE:	November 20, 2020
		SUBJECT:	Kensington Gold Mine POA 1 PDSEIS Investigations – Amendment 1[a]
FROM:	Bill Kane BK Habitat Biologist	PHONE NO:	(907) 465-6474

In May 2020, the U.S. Forest Service released for cooperating agency review the Preliminary Draft Supplemental Environmental Impact Statement (PDSEIS) for Coeur Alaska, Inc.'s Kensington Gold Mine Plan of Operations Amendment 1 (POA 1). Stream courses adjacent to the Comet and Jualin Areas were inaccurately depicted and expansion activities within the proposed action appeared to potentially intersect streams documented as providing habitat for resident fish.

On August 25 and 26, Habitat Biologists Dylan Krull and Jesse Lindgren, Fish and Wildlife Technician Nicole Legere, and I visited the Kensington Gold Mine to verify stream courses adjacent to proposed expansion activities near Ophir Creek South Tributary and Upper Johnson Creek. This work was conducted to further inform decisions regarding the proposed locations of the Comet Growth Media Stockpile and the Comet and Kensington Waste Rock Stockpiles outlined in POA 1. Our investigations confirmed stream courses and Dolly Varden char use of the Ophir Creek South Tributary and Upper Johnson Creek, as previously documented (Tetra Tech, Inc. et al. 2004a).

In transit to Ophir Creek, we incidentally discovered Dolly Varden char in the drainage adjacent and upgradient from the current Comet Beach Road corridor (Figures 1–3). Downstream, a culvert along this section of the road is perched, impeding fish passage (Figure 4). Proposed expansion activities associated with the Comet Waste Rock Stockpile would fill an undetermined amount of resident fish habitat (Figure 5).

The location of the Comet Growth Media Stockpile as proposed would not intersect Ophir Creek South Tributary (Figure 5).

---

[a] The original memorandum presented inaccurate boundaries from the PDSEIS for proposed expansion activities; this amendment incorporates verified boundaries outlined in POA 1 and information on a previously undocumented resident fish stream within the proposed Comet Waste Rock Stockpile footprint.

Northeast of the Jualin Area, Upper Johnson Creek comprises several active braided channels; the Kensington Waste Rock Stockpile as proposed would fill at least 30 meters of one of these channel braids (Figures 6, 7).

Figure 1.–Drainage upstream and adjacent to Comet Beach Road.

Figure 2.–Drainage downstream and adjacent to Comet Beach Road.

Figure 3.–Dolly Varden char captured in the drainage upstream and adjacent to Comet Beach Road.

Figure 4.–Perched culvert downstream of fish capture locations.

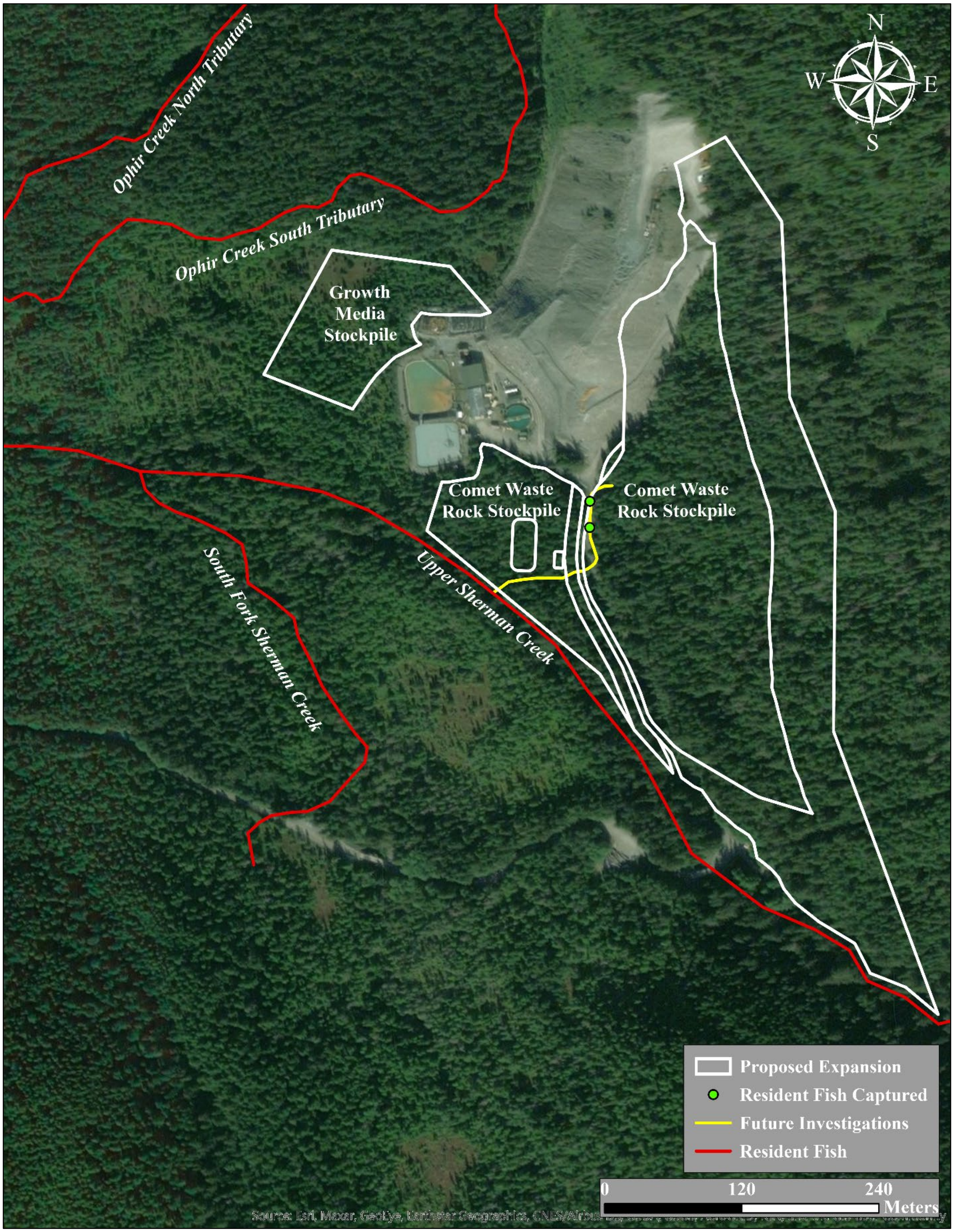


Figure 5.–Comet Area proposed action.

Figure 6.–Jualin Area proposed action.

Figure 7.–Active braided stream channel of Upper Johnson Creek within the proposed Kensington Waste Rock Stockpile site.

Recommendations

The drainage adjacent to Comet Beach Road requires further surveying to determine the extent of resident fish use. Since the contour of the proposed Comet Waste Rock Stockpile toe runs parallel to Upper Sherman Creek, further surveying is required to accurately document the stream course and upper extent of fish use.

Upper Johnson Creek requires further surveying to accurately document braided stream channels northeast of the Jualin Area.

Should the Comet and Kensington Waste Rock Stockpile footprints be approved as currently proposed, fish habitat permits will be required per AS 16.05.841; in which case, I will work with agencies and Coeur to develop mitigation strategies for fish passage, such as channel relocation.

Reference Cited

Tetra Tech, Inc., Tongass National Forest (Alaska), U.S. Environmental Protection Agency Region X, U.S. Army Corps of Engineers Alaska District, Alaska Department of Natural Resources. 2004a. Kensington Gold Project: final supplemental environmental impact statement Volume 1. U.S. Department of Agriculture Forest Service, Tongass National Forest, Juneau, AK.

Email cc:

Al Ott, ADF&G Habitat, Fairbanks
ADF&G Habitat Staff, Douglas
Dan Teske, ADF&G SF, Douglas
Dave Harris, ADF&G CF, Douglas
Matt Reece, USFS, Juneau
Sylvia Kreel, DNR OPMP, Juneau
David Khan, ADEC DOW, Juneau
Shannon Kelley, ADNR DMLW, Juneau
Kevin Eppers, Coeur Alaska, Inc., Juneau

3.7.2.4 Management Indicator Species (p. 3-84)

MIS that potentially occur within the project area are shown in Table 3.7-2 of which only the mountain goat is addressed in detail due to the new information that has become available since the 2004 FSEIS (i.e., the recent population decline of this species in the area). Impacts on the other MIS would be minor and would be the same as described in the 2004 FSEIS (see pages 4-63 through 4-77).

Mountain goats (*Oreamnos americanus*) are found throughout southeast Alaska, primarily on rocky terrain above the tree line during summer. In the project area, a small population occurs to the north on Lions Head Mountain, where they spend the majority of the summer months. During winter, they move into forested areas at lower elevation as snow depth increases. The availability and distribution of high-quality winter habitat (i.e., closed-canopy forest with understory forage) is a limiting factor for mountain goats in southeast Alaska (Forest Service 1997b).

Mountain goat monitoring in the Lions Head Mountain area has been conducted intermittently since the late 1980s, in part to help determine potential future mine impacts on this population (Robus and Carney 1995). In conjunction with population monitoring in the Kakuhan Range (east of Lynn Canal), annual monitoring has occurred consistently in the Kensington area since 2005. Population densities declined substantially in most survey areas in the Kakuhan Range since 2005, with an approximately 10 percent decline per year occurring in the Kensington Mine area (White 2019, 2020). Monitoring results indicate the greatest decline occurred between 2006 and 2009; between 2009 and 2019, the population has exhibited relative stability with a slight decline. Winter snowfall can have a negative effect on goat survival (White et al. 2011) and the decline in this population coincided with a succession of severe winters that occurred between 2006 and 2014 (Figures 1, 2; White 2019, 2020). Generally, greater declines have been observed in the Kensington area than in surrounding affected areas, suggesting factors beyond weather conditions (e.g., mine operations, predation, disease, etc.) may be contributing to the decline.

Recent studies have indicated that goat avoidance of winter habitats near the Kensington Mine may have reduced the functional winter ranges' carrying capacity by up to 42 percent in this area (White and Gregovich 2017). As a result, mine-related disturbance may have indirectly exacerbated the effects of severe winters in the local mountain goat population and contributed to the observed population decline (White 2019). While survey results from 2019 suggest the population may have increased compared to levels recorded in 2018, preliminary results from aerial surveys conducted in 2020 indicate a density similar to 2014–2018 (Kensington survey area, minimum count = 16 adults, 0 kids; K. S. White, 2020, unpublished data).

Sec. 3.7.3.2 (p. 3-90)

Mountain Goats

The project would not result in population-level impacts to wildlife species, with the possible exception of the mountain goat. As discussed above (see Section 3.7.2.4), mountain goat populations have declined near the Kensington Mine since 2005, including adjacent areas having no mine influence (White 2019, 2020). This decline coincided with a succession of severe winters that occurred during this time (primarily between 2006 and 2014), which contributed to the decline. Generally, greater declines have been observed in the Kensington area than in surrounding affected areas, suggesting factors beyond weather conditions (e.g., mine operations, predation, disease, etc.) may be contributing to the decline. White and Gregovich (2017) found that mountain goats avoided winter range habitats within 1.8 km of the Kensington Mine and that the mine has subsequently reduced the functional winter range carrying capacity of the area by 42 percent. As a result, mine-related disturbance may have indirectly exacerbated the effects of severe winters in the local mountain goat population and contributed to the observed population decline. Therefore, continuing operation of the mine for an additional 10 years beyond the currently permitted lifespan could result in a continuing decline in local mountain goat populations in the area. While survey results from 2019 suggest the population may have increased compared to levels recorded in 2018, preliminary results from aerial surveys conducted in 2020 indicate a density similar to 2014–2018 (Kensington survey area, minimum count = 16 adults, 0 kids; K. S. White, 2020, unpublished data). Coeur Alaska is required to minimize disturbances to mountain goats per minimization measures (e.g., 1,500-foot buffer between helicopters and goats, and avoiding important overwintering and potential kidding habitats during those critical life stages) outlined by USDA Forest Service Standards and Guidelines (Forest Service, 2016).

Additional References Cited

Robus, M. H. and B. L. Carney. 1995. Effects of Kensington mine development on black bears and mountain goats. Wildlife baseline studies and monitoring plan. Final report. Alaska Department of Fish and Game, Douglas, AK.

White, K. S., G. W. Pendleton and J. N. Waite. 2016. Development of an aerial survey population estimation technique for mountain goats in Alaska. Final Wildlife Research Report, Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK.

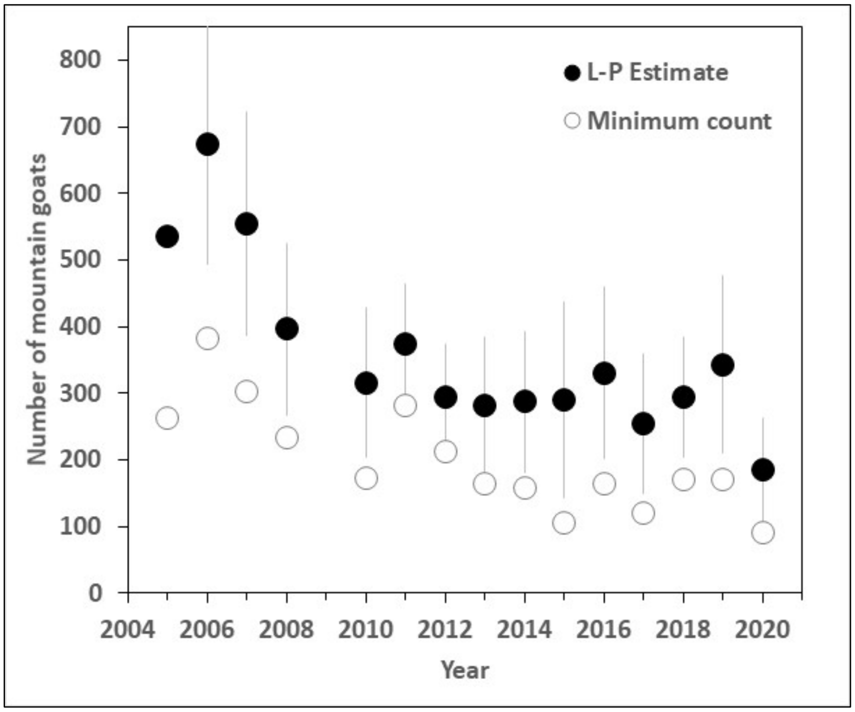


Figure 1.–Number of mountain goats in the Kakuhan Range, Alaska, 2005–2020. Aerial survey mark-resight methods (L-P [Lincoln-Petersen] Estimate) were used to estimate the number of mountain goats and 95% confidence intervals (closed circles; White et al. 2016). The minimum number of animals seen during surveys is also reported (open circles).

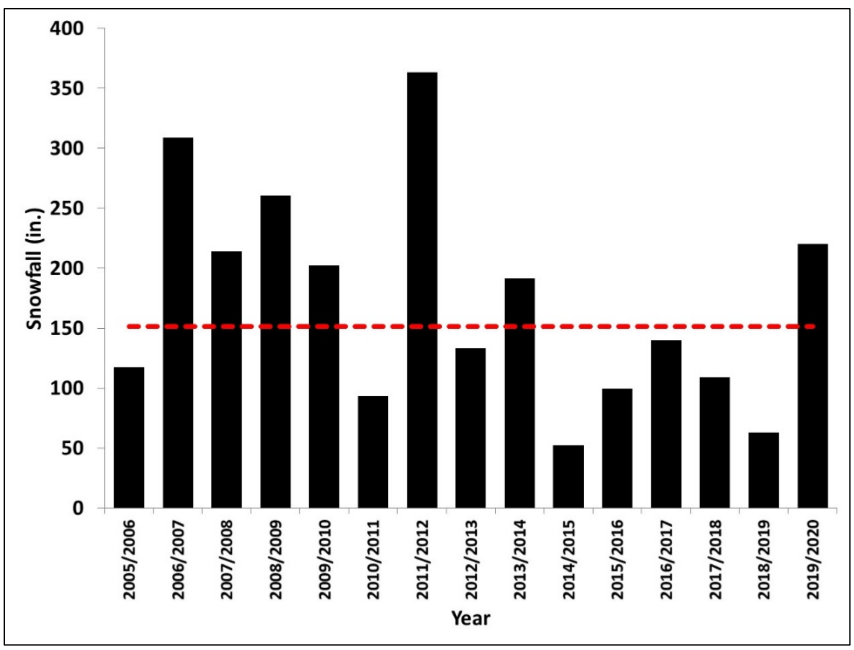


Figure 2.–Total annual snowfall recorded at the Haines #2 Cooperative Observer Program (COOP) National Weather Service (NWS) Station in Haines, AK 2005–2020. The red dashed line designates the long-term average (Haines Airport [1950–1955, 1973–1998] and Haines #2 COOP NWS Station [1999–2020]).

THE STATE of ALASKA
GOVERNOR MIKE DUNLEAVY

Department of Natural Resources

OFFICE OF PROJECT MANAGEMENT AND PERMITTING

P.O. Box 111030
Juneau, AK 99811-1030
907-465-3177

May 10, 2021

Matthew Reece
Minerals Program Manager
Tongass National Forest
8510 Mendenhall Loop Road
Juneau, AK 99801

Dear Mr. Reece,

The State of Alaska appreciates the opportunity to review and comment as a cooperating agency on the Preliminary Final Supplemental Environmental Impact Statement (FSEIS) for the Kensington Mine Plan of Operations Amendment 1 (POA 1). The Department of Natural Resources, Office of Project Management and Permitting coordinated with the Alaska Departments of Fish and Game, Natural Resources, Environmental Conservation, Health and Social Services, and Law in the development of the attached State of Alaska consolidate comments. Please consider the enclosed comments in the development of the Final Supplemental Environmental Impact Statement.

Please let me know if you have any questions or need further clarification on any of the comments.

Sincerely,

Sylvia A. Kreel

Sylvia A. Kreel
Large Project Coordinator

Attachments:
1. 210510 Kensington POA 1 Preliminary FSEIS-State of Alaska Consolidated Comments
2. DEC Attachment 1: Kensington pre-mining surface water data for aluminum, 95% Upper Tolerance Level
3. DEC Attachment 2: Setting Triggers to Detect Leakage from “Zero Discharge” Facilities-DRAFT
4. White, K., 2021. Mountain goat population monitoring and movement patterns near the Kensington Mine, Alaska. Wildlife Research Annual Progress Report

Kensington POA1 PFSEIS
Consolidated Comments Table

Department/Division/Section	Section/Fig./Table	Page #	Comment/Issue	Recommendation/Action
ADNR Dam Safety	Appendix A	A-19	USFS response refers to Section 3.2.3.2 and states there is a "trash rack" on the spillway. A trash rack is not described in Section 3.2.3.2 nor is there a trash rack on the spillway. This term is used in same context in several other USFS responses in Appendix A.	The USFS response may be referring to the "log boom" in the reservoir adjacent to the spillway. Please clarify.
ADNR Dam Safety	Appendix A	A-20	First comment on page indicates the "last visual inspection performed by DNR of the dam was February 8, 2017". This is incorrect.	Modify FS response to note that ADNR also observed the dam in 2018 and 2019 and that the visual inspection for the periodic safety inspection required by 11 AAC 93.159 occurred on July 28, 2020.
ADNR Dam Safety	Appendix A; Section 2.2.7.4	A-25; 2-14	The second full paragraph of the USFS response states "LTCM will consist of dam safety inspections and annual routine maintenance of the TTF dam and spillway in perpetuity". This is mentioned in Section 2.2.7.4 which states that Coeur is responsible for "funds for inspections" for 30 years, and that Coeur will establish a trust fund for inspections and monitoring after that 30 year period. However, provisions for maintenance costs, or the parties responsible for the long term care and maintenance, are not specifically discussed.	The document should clarify that Coeur is responsible for funding maintenance indefinitely, and clearly describe who is responsible for conducting the work, other than "two laborers with appropriate equipment for cutting and removing brush, debris, and small trees from the Dam and spillway."
ADNR Dam Safety	Appendix A	A-27	The second USFS response on page A-27 states "The FSEIS clarified the use of terminology with respect to the TTF as a water dam as opposed to a tailings dam." The TTF is listed on the National Inventory of Dams as the Lower Slate Lake Tailings Dam (NID#AK00308). ADNR regulates this facility as a tailings dam, which is the primary purpose of the structure. ADNR Dam Safety discourages referring to a tailings dam as a water dam, even though the facility will be closed with a water cover over the tailings and shares design features with a typical water dam.	Refer to dam as a tailings dam through out the FSEIS.
ADNR Dam Safety	Appendix A	A-32	USFS response states, "The independent review would be conducted by the State of Alaska during the dam permitting phase." ADNR will conduct a regulatory review of the proposed project under 11 AAC 93.171, but not an "independent" review in the context of the comment.	Clarify that ADNR conducts a regulatory review, and an additional independent review may occur if agreed upon under 11 AAC 93.171(f)(1)(F)(iv).
ADNR Dam Safety; DMLW	Appendix A; Summary, 2.2.7.1, &2.3.4.1	A-35; S-5(11); 2-13(53); & 2-37(77)	The second USFS response under the Topic-Reclamation and Closure does not address the conflict pointed out in the comment. Growth media placed on the dam face with perpetual maintenance requirements to keep the trees off, is not a desirable option. Growth media is more erodible than the waste rock that the dam is built from.	The proposed alternative should not include growth media for erosion and sediment control in areas where natural reinvasion of woody species must be removed for maintenance critical to the safety of the dam

ADNR Dam Safety	Appendix A Figure 2.3-3	A-36; 2-24	The first comment appears to be two separate comments on the Main Dam and the Back Dam. The respective USFS comment does not address the comment about the Back Dam in the second paragraph of the comment as presented.	Clarify how the proposed liner system design for the Back Dam will withstand uplift pressure from the saturated embankment due to the rising water levees in the TTF impoundment. Add "Design subject to change" qualifier to Figure 2.3-3 and other design figures that are not approved by ADNR Dam Safety
ADNR Dam Safety	Appendix A; Sec 2.3.5	A-38; 2-36	Appendix A: USFS response to first comment on page is non-responsive	Add detail to Sec 2.3.5 to describe the post closure operations, performance monitoring, and maintenance requirements for both dams. Clarify and provide distinction between dam owner/operator responsibilities and regulatory requirements.
DNR-DMLW	2.3.1	2-23(63)	The 9 feet of water cover during operations is currently under investigation. Coeur has requested a change from this operational requirement.	Build that answer into this document.
DNR/OPMP	Appendix A - List of Commentors	A-67 and A-68	The state and federal agencies associated with the list of commentors is not correct. It may be a formatting issue.	Provide the correct agency for each commentor.
ADEC/Env. Health/Solid Waste	Appendix A - Compliance with Laws and Regulations	A-7	Paragraph six on this page includes discussion of a comment that proposed that the use of Upper Tolerance Limits (UTLs) instead of the Numeric Criteria found in the Alaska Water Quality standards at 18 AAC 70 is inappropriate. It further notes that ADEC allowed the use of UTLs when it approved the October 2013 addendum to the Kensington Mine's "Integrated Waste Management and Disposal Plan." The Forest Service response to this comment was simply that "It is the responsibility of the State of Alaska (a cooperating agency for this SEIS) to enforce the permit compliance." This response suggests a lack of compliance on this issue that does not exist.	Add the following language to the response: The purpose of Waste Management Permit 2012DB0002, issued to Kensington Mine, is to assure protection of the surrounding environment through proper containment of solid and liquid wastes. The permit requires monitoring, which is necessary to achieve and document that goal. For meaningful, permit-required, monitoring the following steps are necessary. First, the natural, pre-mining, background, water quality must be documented. Second, based on the natural condition, protective standards must be established. Lastly, compliance with those standards must be documented. (comment continues in cell below)

				(comment continued from cell above) Regarding Upper Tolerance Limits (UTLs), there are four surface water monitoring stations, MLA, SLSP-SL5, SLB, and SLC at Kensington Mine where the naturally occurring, pre-mining, aluminum concentrations (Attachment 1) frequently exceeded criteria listed Alaska Water Quality Standards. Each of the four data sets contained a large population with great variability. Solid waste regulations contain provisions in 18 AAC 60.830(j) for using statistical methods to determine whether there is a statistically significant increase in background values for a constituent being analyzed. The department has developed draft guidance titled Setting Triggers to Detect Leakage from “Zero Discharge” Facilities (Attachment 2) and applied that guidance to the pre-mining water quality data submitted for aluminum in the surface waters at stations MLA, SLSP-SL5, SLB, and SLC. On October 16, 2013, the department approved the natural condition based UTLs for aluminum at the four stations. Use of the UTLs allows the department to differentiate natural variations from statistically significant increases, and contrary to concerns expressed in the comment, it does not involve site specific criteria, 18 AAC 70, or relief from water quality standards. [Please see two attached PDF documents, which are referred to above]
Fish and Game / Habitat	General	N/A	In multiple instances throughout the document, habitat loss as a consequence of the proposed action is not directly compared to habitat acquired through mitigation of enhancement measures.	Ensure habitat gains/losses are accurately reflected throughout document.
Fish and Game / Habitat	Summary	S-2	Under "Decisions to be Made," remnant text, "3.7.3or," [sic] remains.	Remove this text.
Fish and Game / Habitat	Summary	S-6	Per Table S-1, aquatic resource reclamation, mitigation, and conservation measures would not be the same for the Filtered Tailings Facility as the Proposed Action, as implied in the summary statement (i.e., the proposed fish habitat enhancement associated with the proposed action would not occur).	Revise accordingly.
Fish and Game / Habitat	Table S-3	S-12	Under the indicator, "change in short and long-term integrity of freshwater fish habitat…," the table states for all alternatives that 2.6 miles of habitat in the upper Sherman and Johnson Creek drainages would be directly affected by WRS expansion; as proposed, only a small drainage upgradient of the Comet Beach Rd. would be directly affected by WRS expansion or construction.	Reevaluate these statements.
Fish and Game / Habitat	Table S-3	S-9 through S-16	Statements presented in tables are often difficult to attribute to specific subjects/indicators; there is often no spacing between subject lines.	Consider revising the format of tables presented to improve clarity.

Fish and Game / Habitat	Section 2.4.3	2-43	Aquatic resource reclamation, mitigation, and conservation measures would not be the same for the TTF Closure with Reduced Water alternative as the Proposed Action, as implied in the concluding paragraph.	Revise accordingly.
Fish and Game / Habitat	Table 2.7-4	2-66	Under the indicator, Surface Water Quality: Miles of altered stream, the table indicates no stream alterations associated with the Comet WRS expansion; though not yet quantified, a small amount of resident Dolly Varden char habitat will be altered under the proposed footprint of the Comet WRS expansion.	Revise the table accordingly or provide qualifying information.
Fish and Game / Habitat	Section 3.3.2	3-19	Under "Stormwater Management," the second instance of the Alaska Pollutant Discharge Elimination System (APDES) permit cited is incorrect.	Correct to "APDES permit AK0050**5**71."
Fish and Game / Habitat	Section 3.3.2.1	3-21	Specific timing for ambient monitoring components is included inconsistently.	Include "…(July)" with the ambient monitoring component, Periphyton biomass and community composition.
Fish and Game / Habitat	Section 3.3.2.1	3-22	In regards to the first sentence in the first full paragraph on the page, the 2018 and 2019 annual aquatics reports do not present pre-mining data as ADF&G began the studies in 2011, so a review of earlier reports may be warranted. Aquatic study components and methods changed since inception in the late 1990s, and in some cases pre-mining data is not available or few samples were taken. Compared to the pre-mining data available, generally since mining began select sediment element concentrations in East Fork Slate Creek were elevated and changes in Sherman Creek BMI abundance and composition have varied, possibly attributable to the presence of white residual.	Revise statement to cite reports containing pre-mining data and summarize.
Fish and Game / Habitat	Section 3.5.2.1	3-48	In "Johnson Creek Drainage," the statement, *"Dolly Varden, Cutthroat Trout, Prickly Sculpin, Chum Salmon, Pink Salmon, and juvenile Coho Salmon have been captured in Lower Johnson Creek. Dolly Varden have also been captured on Upper Johnson Creek above the barrier falls,"* implies adult coho salmon have not been observed in Lower Johnson Creek, which is inaccurate.	Remove "juvenile" from the statement.
Fish and Game / Habitat	Section 3.5.2.3	3-54	Under Macroinvertebrates, the statement, *"This has occurred at times in Slate, Sherman, and Johnson Creek project area streams."* The frequency of BMI sampling could be described in further detail.	Consider revising the statement as follows: "Since 2011, benthic macroinvertebrate sampling has occurred annually in the spring at sample sites in Sherman, Slate, and Johnson Creeks; sampling occurred intermittently prior to 2011."
Fish and Game / Habitat	Section 3.5.2.3	3-54	In the final paragraph on the page, the statement, "The East Fork Slate Creek had some of the highest abundances," is potentially misleading as pea clams typically compose the largest proportion of samples at this site; this detail is acknowledged in the subsequent paragraph.	Remove this statement.

Fish and Game / Habitat	Section 3.5.2.3	3-57	Under Periphyton, the statements, *"This elevated nutrient condition was mostly corrected after 2011 although it remained elevated in 2012 but was reduced by 2013 (Timothy & Kanouse, 2014). The cause for the highest value of chlorophyll a in Lower Slate Creek in 2013 is not known but the direction of change followed a regional trend of most sites increasing from lows in 2012 to higher values in 2013,"* are based on preliminary and outdated information; updated data does not necessarily support these conclusions.	Remove these statements.
Fish and Game / Habitat	Section 3.5.2.4	3-63	In the final paragraph on the page, "Catalog" is misspelled and the citation is outdated.	Correct the spelling and consider updated the citation as follows: Giefer, J ., and B. Blossom. 2020. Catalog of waters important for spawning, rearing, or migration of anadromous fishes – Southeastern Region, effective June 1, 2020. Alaska Department of Fish and Game, Special Publication No. 20-04, Anchorage.
Fish and Game / Habitat	Section 3.5.3.1	3-66	The white residual has been observed below Outfall 001 as recently as April 2021; as presently stated, the pertinent statement implies the white residual hasn't been observed in Sherman Creek since 2017. Also, the original source of this information are documents from Coeur, AK (not "Kane 2020a" as cited here).	Update and clarify the white residual presence in Sherman Creek to date.
Fish and Game / Habitat	Section 3.5.3	3-66	Under Water Quality, the maximum permitted discharge limit is incorrectly stated as "about 10.03 cfs." APDES AK0050571 - Modification# 3 imposes a maximum permitted discharge at Outfall 001 as 3,000 gpm (~6.68 cfs).	Update the discharge limit to be consistent with the current APDES permit.
Fish and Game / Habitat	Section 3.7.3.2	3-97	The statement, "Furthermore, White (2020) concluded that “mine related disturbance may have indirectly exacerbated the effects of severe winters in the local mountain goat population” but that interpretation of the causes of population declines of mountain goats in the area should be considered preliminary, and that future monitoring will be critical in assessing such dynamics," is redundant; most of this language is included above within the same paragraph and within Section 3.7.2.4. Results from monitoring efforts 2005–2020 indicate population trends near the project area are generally consistent with area wide trends observed in the Kakhuan Range.	Remove this statement.

Fish and Game / Habitat	Section 3.7.3.2	3-97	The statement, "Therefore, the USFWS has recommended that monitoring of mountain goats at the mine site should continue through the life of the project," mischaracterizes USFWS comments within the letter dated January 4, 2020. As written, USFWS comments suggest that should monitoring continue, efforts should be made to incorporate the following components: Detailed efforts should be made to link temporal and site-specific disturbance factors (e.g., helicopter overflights, blasting, heavy equipment, or mill site machinery operation) to mountain goat movement patterns and habitat selection; Demographic changes and other potential effects from mining activity should be closely monitored (e.g., using GPS location data) at least throughout the life of the mine; Impacts from variable environmental conditions (e.g., increased snowfall, severe winter events) should be integrated into monitoring efforts and management plans (e.g., White and Gregovich 2017, White et al. 2012). Though these additional analyses may provide a more comprehensive representation of specific dynamics, the practicality of implementation and associated costs must be carefully considered.	Revise the statement to be consistent with USFWS recommendations.
Fish and Game / Habitat	Section 3.7.3.2	3-97	Per comments submitted for the DSEIS, updated analyses and associated figures of pertinent data would provide necessary context for this section; these data are now presented in the most recent monitoring report and should be included for consideration in the SEIS.	Include relevant updated information and associated figures for context presented in the following publication (attached): White, K., 2021. Mountain goat population monitoring and movement patterns near the Kensington Mine, Alaska. Wildlife Research Annual Progress Report.
Fish and Game / Habitat	Section 3.7.3.2	3-98	The disturbance minimization measures cited are USFS guidelines, not ADF&G.	Remove ADF&G from this statement.

DEC Attachment 1

Kensington pre-mining surface water data for Aluminum, 95% Upper Tolerance Level

		Dissolved Aluminum	Total Recoverable Aluminum
Station Name	**Date**	**ug/L**	**ug/L**
MLA	1/4/2006	99	100
MLA	2/8/2006	63	65
MLA	3/8/2006	58	64
MLA	4/5/2006	84	92
MLA	5/3/2006	45	5
MLA	6/7/2006	35	52
MLA	7/5/2006	30	83
MLA	7/24/2006	49	484
MLA	8/2/2006	41	104
MLA	9/21/2006	57	110
MLA	10/4/2006	53	147
MLA	10/11/2006	44	92
MLA	12/6/2006	42	79
MLA	1/3/2007	75	117
MLA	2/5/2007	48	70
MLA	3/28/2007	48	84
MLA	4/4/2007	48	53
MLA	5/9/2007	60	80
MLA	6/6/2007	32	32
MLA	7/2/2007	21	23
MLA	8/29/2007	33	44
MLA	9/5/2007	30	38
MLA	10/3/2007	90	105
MLA	11/7/2007	81	93
MLA	12/12/2007	52	86
MLA	1/9/2008	33	59
MLA	2/7/2008	25	50
MLA	3/6/2008	79	102
MLA	4/7/2008	106	130
MLA	5/14/2008	76	87.7
MLA	6/12/2008	40.4	45.6
MLA	7/15/2008	35.2	40.5
MLA	8/20/2008	81.9	101
MLA	9/10/2008	76.9	86.1
MLA	10/22/2008	89.3	99.1
MLA	11/11/2008	74.7	81.9
MLA	12/11/2008	90.5	97.6
MLA	1/21/2009	81.7	101
MLA	2/19/2009	56.1	62.4
MLA	3/12/2009	44.9	53.3
MLA	4/6/2009	52.4	61.9
MLA	5/14/2009	70.9	78.1

MLA	6/9/2009	27.1	33.2
MLA	7/9/2009	22.9	26.9
MLA	8/18/2009	28	33.7
MLA	9/9/2009	70.3	68.9
MLA	10/14/2009	73.5	86.3
MLA	11/4/2009	72.2	146
MLA	12/22/2009	64.5	72.3
MLA	1/6/2010	67.3	74
MLA	2/15/2010	82.1	90.3
MLA	3/9/2010	84.8	93.8
MLA	4/7/2010	101	124
MLA	5/18/2010	42.1	49.7
MLA	6/21/2010	21.1	27.1

		Dissolved Aluminum	**Total Recoverable Aluminum**
Station Name	**Date**	**ug/L**	**ug/L**
SLSP-SL5	1/22/2009	75.2	
SLSP-SL5	2/25/2009	55.1	
SLSP-SL5	3/12/2009	55.1	
SLSP-SL5	4/6/2009	59.9	
SLSP-SL5	5/14/2009	76.1	
SLSP-SL5	6/9/2009	30.8	44.8
SLSP-SL5	6/10/2009	33.4	
SLSP-SL5	7/8/2009	16.2	
SLSP-SL5	8/13/2009	10.6	
SLSP-SL5	9/16/2009	79.2	
SLSP-SL5	10/15/2009	56.9	
SLSP-SL5	4/6/2010		134
SLSP-SL5	4/20/2010		167
SLSP-SL5	4/27/2010		110
SLSP-SL5	5/4/2010		85.4
SLSP-SL5	5/11/2010		272
SLSP-SL5	5/12/2010		86.5
SLSP-SL5	5/18/2010		66.8
SLSP-SL5	5/24/2010		44.3
SLSP-SL5	6/1/2010		85
SLSP-SL5	6/8/2010		138
SLSP-SL5	6/15/2010		81.2
SLSP-SL5	6/22/2010		26.2
SLSP-SL5	6/29/2010		74.2

		Dissolved Aluminum	**Total Recoverable Aluminum**

Station Name	Date	ug/L	ug/L
SLB	1/4/2006	88	97
SLB	2/8/2006	72	73
SLB	3/8/2006	53	60
SLB	4/5/2006	53	63
SLB	5/3/2006	48	112
SLB	6/7/2006	28	49
SLB	7/5/2006	23	57
SLB	8/2/2006	49	158
SLB	9/6/2006	69	323
SLB	9/21/2006	45	174
SLB	10/4/2006	119	630
SLB	12/6/2006	42	143
SLB	1/3/2007	63	109
SLB	2/8/2007	29	62
SLB	3/28/2007	31	32
SLB	4/4/2007	30	36
SLB	5/9/2007	72	85
SLB	6/6/2007	33	36
SLB	7/2/2007	26	35
SLB	8/29/2007	28	43
SLB	9/5/2007	84	108
SLB	10/3/2007	124	167
SLB	11/7/2007	88	138
SLB	12/12/2007	60	99
SLB	1/9/2008	42	79
SLB	2/7/2008	43	75
SLB	3/6/2008	106	145
SLB	4/7/2008	134	186
SLB	5/14/2008	82.7	104
SLB	6/12/2008	41.1	48.7
SLB	7/15/2008	44.3	53.1
SLB	8/20/2008	75.7	93.6
SLB	9/10/2008	145	190
SLB	10/20/2008	93.8	128
SLB	11/12/2008	70.3	92.7
SLB	12/10/2008	89.8	106
SLB	1/21/2009	80.4	110
SLB	2/18/2009	51.2	60.9
SLB	3/11/2009	28.1	32.6
SLB	4/7/2009	58.1	64.6
SLB	5/13/2009	75.5	126
SLB	6/10/2009	31.9	37.9
SLB	7/8/2009	35.5	27.2
SLB	8/18/2009	38.9	67.6
SLB	9/10/2009	85	124

SLB	10/14/2009	67.5	132
SLB	11/4/2009	79.5	137
SLB	12/22/2009	62	167
SLB	1/12/2010	91.6	146
SLB	2/11/2010	78.4	105
SLB	3/9/2010	55.2	694
SLB	4/7/2010	101	143
SLB	5/17/2010	21.5	82.3
SLB	6/21/2010	29.9	27.7

		Dissolved Aluminum	Total Recoverable Aluminum
Station Name	**Date**	**ug/L**	**ug/L**
SLC	1/4/2006	58	60
SLC	2/8/2006	45	49
SLC	3/8/2006	30	43
SLC	4/5/2006	38	44
SLC	5/3/2006	62	125
SLC	6/7/2006	24	40
SLC	7/5/2006	22	45
SLC	8/2/2006	38	100
SLC	9/6/2006	57	256
SLC	9/21/2006	22	109
SLC	10/4/2006	133	537
SLC	1/3/2007	39	74
SLC	2/8/2007	21	33
SLC	3/28/2007	20	26
SLC	4/4/2007	19	22
SLC	5/9/2007	47	62
SLC	6/6/2007	38	44
SLC	7/2/2007	24	30
SLC	8/29/2007	24	35
SLC	9/5/2007	50	57
SLC	10/3/2007	82	107
SLC	11/7/2007	57	81
SLC	12/12/2007	36	55
SLC	1/9/2008	33	43
SLC	2/21/2008	69	98
SLC	3/6/2008	66	85
SLC	4/7/2008	90	119
SLC	5/14/2008	66.6	79.7
SLC	6/12/2008	37.6	39.9
SLC	7/15/2008	35.6	40.6
SLC	8/20/2008	51	62.4
SLC	9/18/2008	82.6	116
SLC	10/20/2008	73.6	98.4

SLC	11/12/2008	47.2	61.4
SLC	12/10/2008	76.1	84.3
SLC	1/21/2009	68.6	86.9
SLC	2/18/2009	31.8	36.6
SLC	3/11/2009	44.9	49
SLC	4/7/2009	46.9	50.6
SLC	5/13/2009	66.6	75.3
SLC	6/10/2009	28.8	33.9
SLC	7/8/2009	22.5	25.6
SLC	8/18/2009	44.2	58.5
SLC	9/10/2009	50	82.6
SLC	10/14/2009	46.5	75.8
SLC	11/4/2009	55.5	77.7
SLC	12/22/2009	38.8	67
SLC	1/12/2010	54	83.6
SLC	2/11/2010	44.2	58.3
SLC	3/9/2010	48.2	384
SLC	4/7/2010	68.8	84
SLC	5/17/2010	28.9	70.4
SLC	6/21/2010	18.5	25.1

7/8/16

SETTING TRIGGERS TO DETERMINE A STATISTICALLY SIGNIFICANT INCREASE FOR GROUNDWATER CONSTITUENTS

This guidance is intended to simplify ,clarify, and add consistency to determining if there is a statistically significant increase over background values in monitoring wells down gradient of operating "zero discharge" facilities in accordance with 18 AAC 60.830.

Steps for establishing "triggers" that initiate corrective action based on down gradient monitoring wells at "zero discharge" facilities such as tailings ponds and other potential sources of contamination:

1. Baseline data
   - 1.1. Collect all baseline data from down gradient wells. Data is considered baseline until wastes are placed in the impoundment.
   - 1.2. For each parameter at each well, the data set ought to span at least two years and contain at least 20 measurements.
   - 1.3. For each parameter, calculate the average and the standard deviation of the data set for each well. In doing this, replace non-detect readings with 0.5 times the Method Detection Limit (MDL).
   - 1.4. Calculate the tolerance interval at 95% probability and 95% coverage. Calculating the tolerance interval is a very simple process. The only statistical analysis that is required is calculating the mean ($\bar{x}$) and standard deviation (s) of the background data set. The upper limit of the tolerance interval (UTL) is then calculated as

$$\text{UTL} = \bar{x} + (s)(K)$$

   The value K is determined from the attached table and is based on the number of data points and the desired probability and coverage.

2. Pond water quality (actual impounded water quality)
   - 2.1. Calculate the averages of current water quality data for each parameter in the pond in the same manner as step 1.2.
   - 2.2. Search for maximum contrasts between impounded and monitoring well water chemistry. Select those parameters where the average concentration in the pond is significantly greater than in the wells considering both the magnitude and proportion of the differences.
   - 2.3. Select the parameters in the pond that are unique to the process, even if they are non-detect in the wells. Potassium, sodium, nitrogen, copper, TDS, sulfates, and WAD cyanide could be typical examples.

3. Choose trigger parameters and concentrations
   - 3.1. Choose the analytical parameters for each well based on being significantly higher in the pond or unique to the process from steps 2.2 and 2.3 above.
   - 3.2. For each analytical parameter in each well, establish the trigger for corrective action as the 95% upper tolerance interval even when that limit is less than the water quality standard. When the minimum level of quantification for a test method (ML) is greater than the tolerance interval, use the ML as the trigger level. Otherwise, use the tolerance interval as the trigger. This establishes statistically significant increase thresholds indicating leakage from the impoundment.

4. Implement the triggers in a permit, certification, or approval
   - 4.1. Revise the monitoring plan and associated reporting to focus on the selected suite of trigger parameters. Additional parameters will still be required for determining hardness, doing Piper plots, collecting field measurements, or for other reasons.
   - 4.2. If a well water sample exceeds the trigger concentration, it indicates a statistically significant increase, and the corrective action section of the permit must be initiated.

5. Another statistical method may be chosen in accordance with 18 AAC 60.830.

Tolerance Factors (K) for One-Sided Normal Tolerance Intervals
With 95% Probability Level and 95% Coverage
(From USEPA "Statistical Analysis of Monitoring Data, Interim Final Guidance", April 1989)

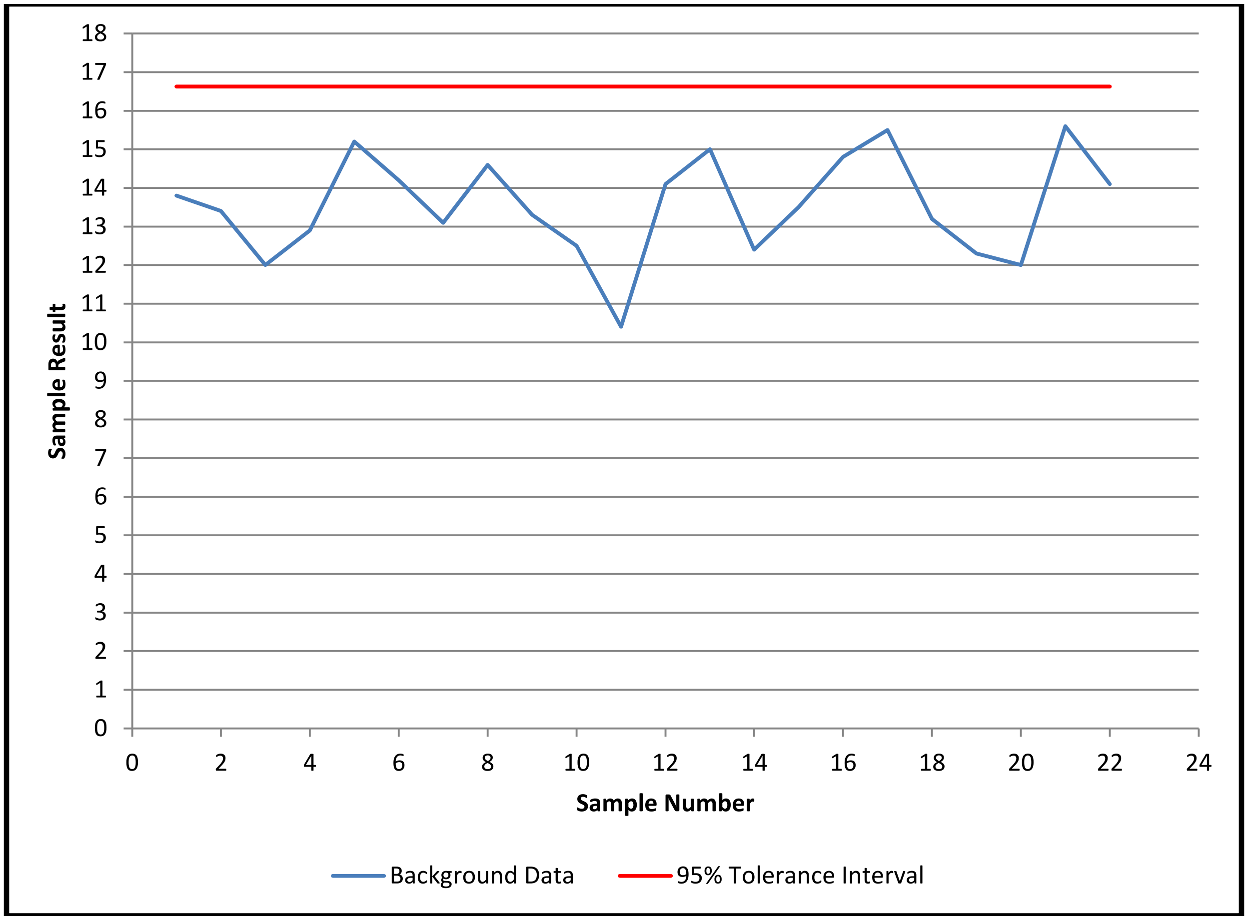
n	K	n	K
3	7.655	150	1.868
4	5.144	175	1.850
5	4.203	200	1.836
6	3.708	225	1.824
7	3.399	250	1.814
8	3.188	275	1.806
9	3.031	300	1.799
10	2.911	325	1.792
11	2.815	350	1.787
12	2.736	375	1.782
13	2.671	400	1.777
14	2.614	425	1.773
15	2.566	450	1.769
16	2.524	475	1.766
17	2.486	500	1.763
18	2.453	525	1.760
19	2.423	550	1.757
20	2.396	575	1.754
21	2.371	600	1.752
22	2.349	625	1.750
23	2.328	650	1.748
24	2.309	675	1.746
25	2.292	700	1.744
30	2.220	725	1.742
35	2.167	750	1.740
40	2.125	775	1.739
45	2.092	800	1.737
50	2.065	825	1.736
55	2.036	850	1.734
60	2.017	875	1.733
65	2.000	900	1.732
70	1.986	925	1.731
75	1.972	950	1.729
100	1.924	975	1.728
125	1.891	1000	1.727

Sources:

(a) For sample sizes ≤ 50: Lieberman, Gerald F., 1958. "Tables for One-sided Statistical Tolerance Limits." *Industrial Quality Control*, Vol. XIV, No. 10.

(b) For sample sizes > 50: K values were calculated from large sample approximation.

Upper Tolerance Limit versus Sample Measurements



Sample Data Set (n = 22)

Sample No.	Result
1	13.8
2	13.4
3	12.0
4	12.9
5	15.2
6	14.2
7	13.1
8	14.6
9	13.3
10	12.5
11	10.4
12	14.1
13	15.0
14	12.4
15	13.5
16	14.8
17	15.5
18	13.2
19	12.3
20	12.0
21	15.6
22	14.1

Wildlife Research Annual Progress Report

Mountain goat population monitoring and movement patterns near the Kensington Mine, Alaska

Kevin S. White

March 2021

Alaska Department of Fish and Game Division of Wildlife Conservation

Cover Photo: An adult female mountain goat (LG-35) in the upper Berners River, August 2006

Mountain goat population monitoring and movement patterns near the Kensington Mine, Alaska

Kevin S. White[1]

Alaska Department of Fish and Game, Division of Wildlife Conservation
P. O. Box 110024, Juneau, AK 99811

March 2021

Region 1, Division of Wildlife Conservation, Alaska Department of Fish and Game
P. O. Box 110024, Juneau, Alaska 99811

This report contains preliminary data and should not be cited without permission from the authors.

The Alaska Department of Fish and Game does not endorse or recommend any specific company or their products. Product names used in this publication are included for completeness but do not constitute product endorsement.

[1]Correspondence author: Alaska Department of Fish and Game, Division of Wildlife Conservation
P. O. Box 110024, Juneau, AK 99811, kevin.white@alaska.gov, 907-465-4102

Contents

INTRODUCTION

This report was prepared to meet the annual reporting requirements for Coeur Alaska, Inc.. Funding for this project was originally made available in September 2005 and this report summarizes activities completed by December 30, 2020.

Background

In 2005, Coeur Alaska, Inc. re-initiated development activities at the Kensington mine site, located a short distance northwest of Berners Bay. In addition, the Alaska Department of Transportation and Public Facilities (ADOT/PF) proposed construction an all-season highway between Echo Cove and the Katzehin River. In the context of these proposed industrial development activities, mountain goats were identified as an important wildlife species likely to be affected by mine development and road construction activities.

A small-scale study of mountain goats conducted in the vicinity of the Kensington mine by Robus and Carney (1995) showed that goats moved seasonally from high alpine elevations in the summer and fall to low, timbered elevations during winter months. One of the main objectives of the Robus and Carney (1995) study was to assess the impacts of the mine development activities on habitat use, movement patterns and, ultimately, productivity of mountain goats. However, the mine never became operational, thus these objectives could not be achieved, and by 1995 goat monitoring in the area wound down and eventually ended. In 2005, when the mine development activities were re-initiated, the Alaska Department of Fish and Game (ADFG) maintained that many of the same concerns that prompted the Robus and Carney (1995) study were still valid and needed to be addressed. In addition, large-scale plans for development of the Juneau Access road raised new and potentially more substantial concerns regarding not only the enlarged “footprint” of industrial development activities in eastern Lynn Canal, but also the cumulative impacts of both development projects on wildlife resources.

The potential effects of mining and road development activities on local mountain goat populations in the vicinity of the Kensington mine and eastern Lynn Canal have potentially important ramifications for management and conservation of the species in the area. Studies indicate that mountain goats can be negatively impacted by industrial development activities (NWSGC 2020). Such effects include temporary range abandonment, alteration of foraging behavior and population decline (Chadwick 1973, Foster and Rahs 1983, Joslin 1986, Cote and Festa-Bianchet 2003, Cote et al. 2013, White and Gregovich 2017). Consequently, information about the distribution of mountain goats proximate to the mine and road development corridor is critical for determining the extent to which populations may be affected by associated industrial activities. Information collected by Robus and Carney (1995), White et al. (2012) and White and Gregovich (2017), in the vicinity of Kensington mine, as well as Schoen and Kirchhoff (1982) near Echo Cove, suggest that spatial overlap between mountain goats and industrial activity are most pronounced when goats are over-wintering in low-elevation habitats.

In response to the above concerns, ADFG, with operational funding provided by ADOT/PF, Federal Highway Administration (FHWA) and Coeur Alaska, Inc., initiated monitoring and assessment activities to determine possible impacts of road construction and mine development on mountain goats and identify potential mitigation measures, to the extent needed. Assessment and monitoring work has included collection of vital rate, habitat use and movement data from a sample of radio-marked mountain goats, in addition to conducting annual aerial population abundance and productivity surveys. These efforts are aimed at providing the ADFG and stakeholders with information necessary to appropriately manage mountain goats and their habitat in the areas of development and provide guidance relative to mitigation measures, to the extent possible.

Implementation of field objectives were initiated in 2005 and consisted of a 5-year monitoring program (2005-2011) jointly funded by ADOT/PF, FHWA, Coeur Alaska, Inc. and ADFG. Beginning in 2007, the ADFG committed additional annual funding for a complementary aerial survey technique development project within and adjacent to the project area. In 2009, the USDA-Forest Service (Tongass National Forest) also began contributing funding to further support aerial survey technique development data collection efforts. And, in 2010, Coeur Alaska, Inc. resumed funding of mountain goat monitoring near the Kensington Mine and adjacent areas (as per the Kensington Plan of Operations, USFS 2005). In 2012, the project components funded by ADOT/PF and associated with the Juneau Access project were completed (see White et al. 2012). In 2017, at the requested on ADFG - Habitat Division (J. Timothy, pers. comm.) analyses were completed to assess the effects of mining development on mountain goat spatial use patterns (White and Gregovich 2017). Results indicated avoidance of mountain goat habitats in proximity to the mine and reinforced the importance of long-term monitoring of the population. Currently, mountain goat monitoring activities are focused on the area surrounding the Kensington mine and north to the Katzehin river, an area considerably smaller than the original Juneau Access/Kensington joint study area.

STUDY OBJECTIVES

Research efforts were designed to investigate the spatial relationships, vital rates, and abundance of mountain goats near the Kensington Mine and upper Lynn Canal. The research objectives were to:

1) determine seasonal movement patterns of mountain goats;

2) characterize mountain goat habitat selection patterns;

3) estimate reproductive success and survival of mountain goats; and

4) estimate mountain goat population abundance and composition.

STUDY AREA

Mountain goats were studied in a ca. 491 km^2 area located in a mainland coastal mountain range east of Lynn Canal, a marine fjord located between Juneau and Haines in southeastern Alaska (Figure 1 and 2). The study area was located in the Kakuhan Range and oriented along a north-south axis and bordered in the south by Berners Bay (58.76N, 135.00W) and the Katzehin River (59.27N, 135.14W) in the north. The Kensington Mine, a hard rock gold mine, is located at the southern end of the study area, immediately south of Lions Head mountain in the Johnson, Slate and Sherman creek watersheds. A majority of above ground mining activity occurs in four principal locations situated between 200–300 meters in elevation. The overall mine "footprint" comprises 56.6 km^2 of patented claims; a significant amount of activity is at low elevation (<300 m) and underground. This study has occurred during both construction and production phases of the mine and possible sources of disturbance to mountain goats in the vicinity included blasting, heavy equipment operation, helicopter operation, and vehicle traffic.

Elevation within the study area ranges from sea level to 2070 m. This area is an active glacial terrain underlain by late cretaceous-paleocene granodiorite and tonalite geologic formations (Stowell 2006). Specifically, it is a geologically young, dynamic and unstable landscape that harbors a matrix of perennial snowfields and small glaciers at high elevations (i.e. >1200 m) and rugged, broken terrain that descends to a rocky, tidewater coastline. The northern boundary of the area is defined by the Katzehin River, a moderate volume (ca. 1500 cfs; USGS, unpublished data) glacial river system (and putative barrier to mountain goat movement) that is fed by the Meade Glacier, a branch of the Juneau Icefield.

The maritime climate in this area is characterized by cool,

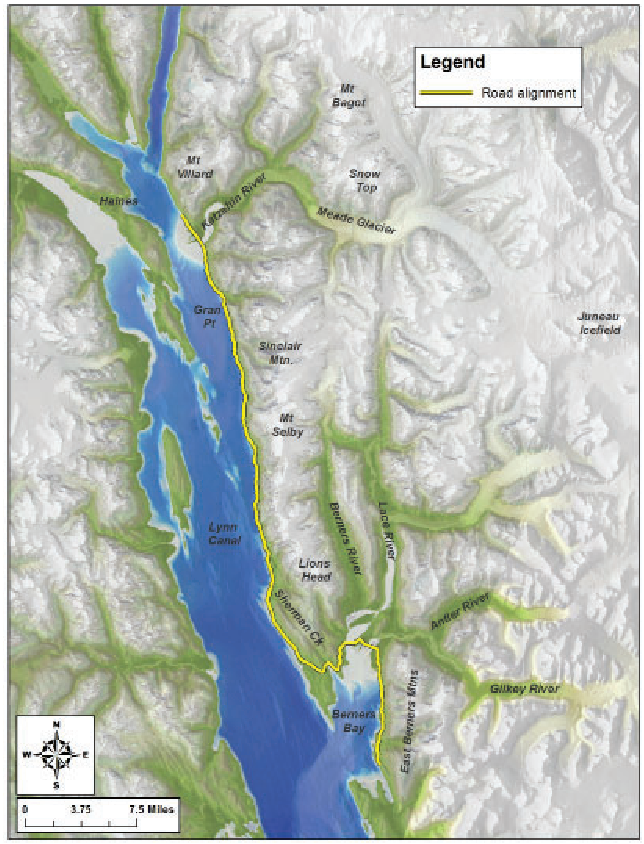


Figure 1: Map of the Lynn Canal and Berners Bay area. Local place names referenced in this report are identified. Mountain goats were studied in this area during 2005-2020.

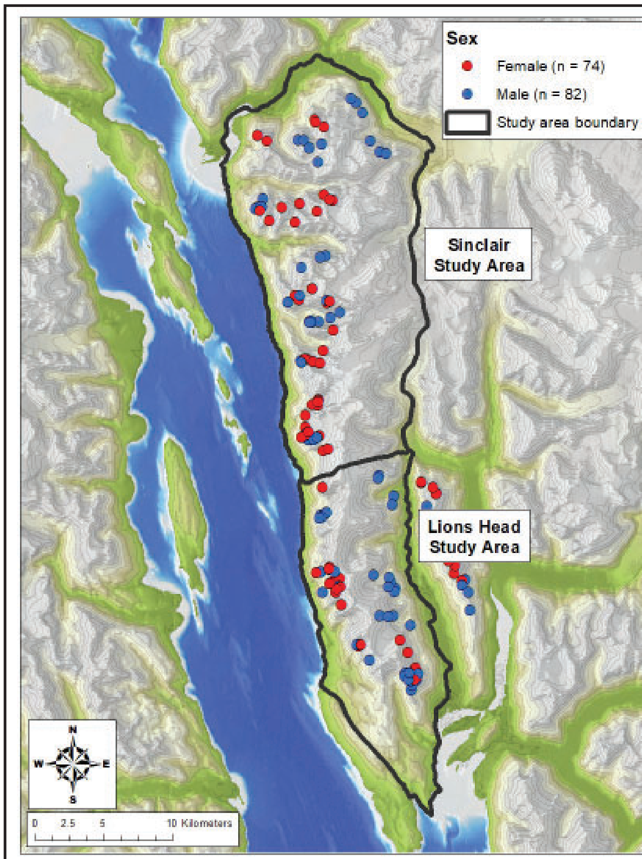


Figure 2: Locations of mountain goats captured and subsequently monitored in the Lynn Canal study area, 2005-2020.

wet summers and relatively warm snowy winters. Annual precipitation at sea-level averages 1.4 m and winter temperatures are rarely less than -15° C and average -1° C (Haines, AK; National Weather Service, Juneau, AK, unpublished data). Elevations at 790 m typically receive ca. 6.3 m of snowfall, annually (Eaglecrest Ski Area, Juneau, AK, unpublished data). Predominant vegetative communities occurring at low-moderate elevations (<460 m) include Sitka spruce (*Picea sitchensis*)-western hemlock (*Tsuga heterophylla*) coniferous forest, mixed-conifer muskeg and deciduous riparian forests. Mountain hemlock (*Tsuga mertensiana*) dominated 'krummholtz' forest comprises a subalpine, timberline band occupying elevations between ~460–760 meters. Alpine plant communities are composed of a mosaic of relatively dry ericaceous heathlands and moist meadows dominated by sedges, forbs and wet fens. Avalanche chutes are common in the study area and bisect all plant community types and often terminate at sea-level.

METHODS

Mountain Goat Capture

Mountain goats were captured using standard helicopter darting techniques and immobilized by injecting 2.4 - 3.0 mg of carfentanil citrate or 6.0 - 7.0 mg of thiafentanil oxalate via projectile syringe fired from a dart gun (Cap-Chur, Douglasville, GA or Pneudart, Williamsburg, PA) (Taylor 2000, White et al., in review). Carfentanil and thiafentanil are both effective chemical immobilization agents however, in recent years, commercial production of carfentanil has been discontinued and replaced by thiafentanil. Drug doses varied depending upon time of year to accommodate seasonal changes in body mass. During handling, all animals were carefully examined and monitored following standard veterinary procedures (Taylor 2000, White et al., in review) and routine biological samples and morphological data collected. Following handling procedures, the effects of the immobilizing agent was reversed with 100 mg of naltrexone hydrochloride per 1 mg of carfentanil citrate or 40 mg of naltrexone hydrochloride per 1 mg of thiafentanil (Taylor 2000, White et al., in review). All capture procedures were approved by the State of Alaska Animal Care and Use Committee.

Helicopter captures were attempted during periods when mountain goats were distributed at high elevations and weather conditions were favorable (i.e. high flight ceiling and moderate wind speed). Additionally, captures were scheduled to avoid periods within 8 weeks of parturition in order to avoid unnecessary disturbance of adult females and associated neonates. Captures were attempted in areas where mountain goat access to dangerously steep terrain could be reasonably contained.

Figure 3: Photograph of a chemically immobilized adult male mountain goat (LG213) following capture and handling, N of Met Point, Lynn Canal, September 2020.

GPS Location Data

Telonics TGW-3590 or TGW-4590 GPS radio-collars (Telonics, Inc., Mesa, AZ) were deployed on most animals captured (Figure 3). (Telonics MOD-500 VHF radio-collars were deployed on a subset (n = 23) of animals during 2009 to enable longer-term monitoring opportunities). During 2009-2020, animals were simultaneously marked with GPS and lightweight (Telonics MOD-410) VHF radio-collars (370 g)(Figure 3). Double-collaring animals was conducted to extend the period of time individual animals could be monitored (lifespan, GPS: 3 years, VHF: 6 years), thereby increasing the long-term opportunity to gather mountain goat survival, reproduction and mark-resight population estimation data and, ultimately, reducing the frequency that mountain goats must be captured. The combined weight of radio-collars attached to animals comprise 1.2% of average male body weight and 2.0% of average female body weight and is well within the ethical standards for instrument deployment on free-ranging wildlife.

GPS radio-collars were programmed to collect location data at 6-hour intervals (collar lifetime: 3 years). During each location attempt, ancillary data about collar activity (i.e. percent of 1-second switch transitions calculated over a 15 minute period following each GPS fix attempt) and temperature (degrees C) were simultaneously collected. Complete data-sets for each individual were remotely downloaded via satellite link and/or manually downloaded upon recovery collars from the field (i.e. following scheduled collar release or animal mortality). Location data were post-processed and filtered for "impossible" points and 2D locations with PDOP (i.e. position dilution of precision) values greater than 10, following D'Eon et al. (2002) and D'Eon and Delparte (2005).

Resource Selection and Movement Patterns

Diet Composition.—Fresh fecal pellets were collected from live-captured animals during the summer-fall period (late-July to mid-October). Fecal pellet samples were also collected opportunistically during winter reconnaissance and snow surveys. Samples were sent to Washington State University (Wildlife Habitat Analysis Lab, Pullman, WA) for dietary analyses. Specifically, microhistological analyses of plant cell fragments in pellet samples were conducted to provide an estimate of diet composition for individual mountain goats and a composite winter sample. Results of these analyses were reported in White et al. (2012).

Activity, Movement Patterns and Resource Selection.—Analyses of mountain goat GPS location data (i.e. data collected during 2005-2015) to characterize activity, movement and resource selection patterns were summarized in White (2006), Shafer et al. (2012), White et al. (2012) and White and Gregovich (2017). In 2018, further analyses of GPS radio-collar location data were initiated to characterize seasonal and sex-specific variation in home range size and site fidelity (Shakeri et al. 2018).

Snow and Winter Severity Monitoring.—
Winter distribution of mountain goats is strongly influenced by snow depth and distribution. Since patterns of snow accumulation vary at both small and large spatial scales it is often necessary to collect site-specific field data in order to accurately characterize these relationships within focal areas. Unfortunately, standardized snow depth monitoring information is extremely limited within the study area and additional information is needed in order to properly characterize spatial patterns of snow accumulation and, ultimately, mountain goat winter distribution. Consequently, in 2006 we initiated field efforts designed to create a snow depth database in order to generate spatially explicit snow depth models within the study area.

Standardized field surveys were conducted in order to estimate patterns of snow depth in relation to habitat type (i.e. forested/non-forested), altitude, and slope aspect. These efforts focused on four sites located in different mountain goat winter ranges in 2007 but consistent annual monitoring was conducted at only one site located on Echo Ridge, near Davies Creek. During surveys snow depth was measured at geo-referenced locations along an altitudinal gradient (beginning at sea level). Snow measurements were replicated at each sampling location (n = 5) and associated covariate information was collected. Sampling locations were spaced at regular (100-200 m) intervals, depending upon terrain complexity. Steep (>35 degrees), exposed slopes were, generally, not sampled due to safety considerations. In addition, daily climate information for reference weather stations was acquired from the National Weather Service (Haines COOP and Juneau Airport Weather Stations).

Figure 4: Remains of a male mountain goat (LG189, 6 years old) that died in avalanche on 1/3/2020, east of Independence Lake. The animal was subsequently scavenged by a black bear.

Reproduction and Survival

Kidding rates and subsequent survival were estimated by monitoring individual study animals during monthly surveys using fixed-wing aircraft (usually a Piper PA-18 Super Cub) equipped for radio-telemetry tracking or via ground-based observations. During surveys, radio-collared adult female mountain goats were observed (typically using 14X image stabilizing binoculars) to determine whether they gave birth to kids and, if so, how long individual kids survived. Monitoring kid production and survival was only possible during the non-winter months when animals could be reliably observed in open habitats. Consequently, we were only able to assess kid survival during the summer period (May-September). Cases in which kid status assessments were equivocal were filtered from the data set and not used for subsequent estimates.

Mortality of individual radio-collared mountain goats was determined by detecting radio-frequency pulse rate changes during monthly monitoring surveys. In cases where mortality pulse rates were detected, efforts were made to investigate sites as soon as possible via helicopter or boat. To the extent possible, all mortalities were thoroughly investigated to ascertain the cause of death and relevant biological samples collected (Figure 4). We determined date of mortalities via examination of activity sensor and location data logged on GPS radio-collars or, if not avaliable, VHF collar monitoring histories. Annual survival of radio-collared animals was estimated using the Kaplan-Meier procedure (Pollock et al. 1989). This procedure allows for staggered entry and exit of newly captured or deceased animals, respectively.


Figure 5: Photograph illustrating the character and juxtaposition of terrain and habitats observed during mountain goat aerial surveys, Katzehin Lake area, AK.

Population Abundance and Composition

Aerial Surveys.—Population abundance and composition surveys were conducted using fixed-wing aircraft (Heliocourier, PA-18 Super Cub, Bellanca Scout) and helicopter (Hughes 500) during August-October, 2005-2020. Aerial surveys were typically conducted when conditions met the following requirements: 1) flight ceiling above 5000 feet ASL, 2) wind speed less than 20 knots, 3) sea-level temperature less than 65 degrees F. Surveys were typically flown along established flight paths between 2500-3500 feet ASL and followed geographic contours (Figure 5). Flight speeds varied between 60-70 knots. During surveys, the pilot and experienced observers enumerated and classified all mountain goats seen as either adults (includes adults and sub-adults) or kids. In addition, each mountain group observed was checked (via 14X image stabilizing binoculars) to determine whether radio-collared animals were present.

Sightability Data Collection.—During aerial surveys, data were simultaneously collected to evaluate group-level sighting probabilities. These data were used to parameterize aerial survey "sightability" models which were subsequently used to convert minimum counts to actual population size (i.e. White et al. 2016). Specifically, we characterized behavioral, environmental and climatic conditions for each radio-collared animal seen and not seen (i.e. missed) during surveys. In cases where radio-collared animals were missed, it was necessary to back-track and use radio-telemetry techniques to locate animals and gather associated covariate information. Since observers had general knowledge of where specific individual radio-collared animals were likely to be found (i.e. ridge systems, canyon complexes, etc.), it was typically possible to locate missed animals within 5-15 minutes after an area was originally surveyed. In most cases, it was possible to completely characterize behavioral and site conditions with minimal apparent bias, however in some cases this was not possible (i.e. animals not seen in forested habitats, steep ravines, turbulent canyons) and incomplete covariate information was collected resulting in missing data.

Evaluation of Population Trends.—In order to assess how mountain goat abundance changed over space and time we delineated nine geographically distinct survey areas and summarized the maximum number of adult and kid mountain goats seen in each area, by year. The number of animals seen during aerial surveys is a commonly used metric of mountain goat population abundance; termed the "minimum count". Since the quantity does not account animals "missed" during surveys, the minimum count typically underestimates actual population size (i.e. by 30-45%, White et al. 2016). In order to account for variation in survey conditions and mountain goat aerial survey sighting probabilities we used a "sightability" model to derive population estimates based on aerial survey observations and associated covariate values (White et al. 2016). Specifically, the model is based on aerial survey mark-resight data collated in Lynn Canal and other areas of southeastern Alaska. The model accounts for variation in sky conditions, group size, terrain and habitat type and converts minimum counts to actual population size (White et al. 2016). In 2020, the White et al. (2016) sightability model was refined and also re-parameterized using new sightability field data collected since White et al. (2016). Consequently, all survey data (2005-2020) was re-analyzed to derive revised population estimates to ensure inter-annual consistency in methodology.

While the sightability model enables estimation of mountain goat abundance at relatively small survey area scales, it is possible to employ more robust "real-time" mark-resight procedures (i.e. Chapman 1954) to estimate population size at the study area scale. At the larger, study area scale a sufficiently large sample size of marked animals are available to be seen during a given survey thereby allowing estimation using this technique. Consequently, for evaluating trends over time we used mark-resight estimates to characterize trends at the broader, study area scale and sightability model derived estimates at the smaller, survey area scale. This complementary approach allows for multi-scale assessment of population trends using the best available estimates.

To assess population trends, estimates of population size and density (based on the amount of summer range habitat determined via RSF modeling; White and Gregovich 2017) were compiled across the entire time series (2005-2020) for all survey areas and scales. Examination of population estimates (and other ecologic data) at the study area scale suggested the population exhibited a significant decline following a period of severe winter conditions between 2006 - 2012. Thereafter, the population exhibited a stable or less distinct declining trajectory, following a period dominated by more favorable average or below-average winter conditions. To examine whether population trends differed across the time series in relation to these contrasting periods of differing winter conditions, segmented regression analyses were implemented treating the year 2006 as an a priori starting point (i.e. when the population was at its peak) and 2012 as the a priori breakpoint (i.e. the end of the severe winter period). Specifically, the rate of population change (number of mountain goats per year) was estimated during 2006-2012 and 2013-2020. Further analyses were conducted to determine whether trends differed between periods within each given area, and at the broader study area scale.

Figure 6: Photograph illustrating the use of a pulse oximeter (sensor attached to the tongue) used to monitor relative oxygen saturation and pulse rate during chemical immobilization of an adult male mountain goat. Vital rates, also including body temperature, respiration rate and central nervous system depression, are monitored throughout during post-capture handling procedures.

RESULTS AND DISCUSSION

Mountain Goat Capture and Handling

Capture Activities.—During August 2020, 6 animals (males, n = 3; females, n = 3) were captured in the Lions Head-Mt. Sinclair areas (Figure 6). All animals were simultaneously marked with GPS (TGW-4590) and lightweight VHF (Telonics MOD-410) radio-collars. Since 2005, 153 mountain goats have been radio-marked GPS = 130, VHF = 23) in the Lions Head and Sinclair Mountain study areas; GPS location data has been compiled for 99 animals within this area. Currently (as of 1/1/2021), 25 animals are marked in these two areas; all other previously deployed collars have either remotely released or animals have died. Annual capture activities are important for maintaining adequate sample sizes and compensating for natural or scheduled collar losses.

Biological Sample Collection.—During handling procedures, standard biological specimens were collected and morphological measures recorded. Specific biological samples collected from study animals included: whole blood (4 mL), blood serum (8 mL), red blood cells (8 mL), ear tissue, nasal swabs, hair and fecal pellets. Whole blood, serum, red blood cells and fecal pellet sub-samples were either sent to Dr. Kimberlee Beckmen (ADFG, Fairbanks, AK) for disease screening, submitted for trace mineral analysis (Iowa State University), or archived at ADFG facilities in Douglas, AK.

Disease Surveillance.—In 2010 and 2014, a subset of captured animals were tested (Washington Animal Disease Diagnostic Laboratory, Pullman, WA) for prevalence of respiratory bacteria associated with incidence of pneumonia (specifically *Mycoplasma ovipneumoniae*). Results of these analyses were summarized in White et al. (2012) and Lowrey et al. (2018). Further surveillance testing for *Mycoplasma ovipneumoniae* was conducted in 2016 - 2020 but analytical results are not yet available.

During 2005-2020, blood serum samples collected from captured animals have been tested each year for a suite of 15 different diseases relevant to ungulates (Appendix 1). With few exceptions, serology analyses indicated that mountain goats rarely show evidence of exposure to any of the diseases considered. Yet, of particular interest is contagious ecthyma (CE), a viral disease previously documented among mountain goats in Juneau, Haines and other areas of southeastern Alaska. Common symptoms of CE include presence of grotesque lesions on the face, ears, and nose which can lead to death of animals, primarily those in young or old age classes; healthy adults commonly survive the disease. Because of the regional prevalence of CE, most samples collected during 2005-2020 have been tested for this disease. Of the 86 animals successfully tested for CE in the Lions Head and Mt Sinclair areas, four animals (5%) tested positive for CE-specific antibodies; a level of prevalence comparable to other southeastern Alaska populations tested (Appendix 1).

Trace Mineral Testing.—In 2016-2020, whole blood and serum samples were analyzed to determine trace mineral concentration for 33 mountain goats in order to examine whether mineral deficiencies were prevalent in our study population (Appendix 2a). While experimental data is limited to assess deficiency threshold values for Selenium, a trace mineral that can influence pregnancy, values less than 0.08 ppm are generally considered low (based on domestic livestock). In the Lions Head/Sinclair study areas 45% of animals had blood Selenium values below this threshold (Appendix 2b); a proportion similar to the nearby Haines-Skagway population but higher than Baranof Island. Presumably, deficiencies are related to site productivity and geologic substrate. In the absence of species-specific studies it is unclear whether the observed degree of deficiency is sufficient to influence reproduction, as has been reported for domestic livestock.

Genetic Analyses.—Tissue samples from all mountain goats captured between 2005-2020 have been genotyped by Aaron Shafer (Trent University/University of Alberta). (Duplicate samples are archived at ADFG, Douglas, AK). A subset of these data were analyzed and included in continent-wide analyses of mountain goat population genetics (Shafer et al. 2010). Shafer et al. (2010) indicated that substantial genetic structuring exists among mountain goats in southeastern Alaska (and across the western North American range of the species). More recent analyses indicated that three genetically distinct mountain goat populations occur in our study area [east Berners mountains, Kakuhan range (including Lions Head and Sinclair Mountain), and Mt. Villard]; population boundaries generally coincide with our specific study area boundaries (Shafer et al. 2012). These findings indicate that gene flow between our study areas (with the exception of the Lion Head and Sinclair study areas, which are genetically indistinct) is limited. In 2016, a state-wide mountain goat population genetics project was initiated and will include more spatially extensive analyses that utilize both microsatelite and genomic techniques. This project is funded by ADFG and Trent University but will benefit our knowledge of mountain goat genetics in this study area as well.

GPS Location Data

GPS System Performance.—The performance of GPS radio-collars (Telonics TGW-3590) was evaluated for 124 collars deployed since the beginning of the study (see White et al. 2012). In general, the remote GPS data collection system used in this study worked as expected during 2005 - 2018. However, in 2019 a GPS collar manufacturing malfunction compromised location data collection for a sub-set of collars deployed. Specifically, 12 GPS radio-collars deployed during 2016-2018 stopped collecting location data in April 2019 (but could still be monitored via VHF telemetry). GPS radio-collars subsequently deployed during 2019-2020 have operated without problems.

Winter Severity and Snow Modeling

Snow Surveys.—Field-based snow surveys were conducted within 5 days of April 1 during 2007-2008, 2010-200 on Echo Ridge. Analyses of these data quantified the degree to which snow depth differs with increasing elevation between forested and non-forested sites (White et al. 2012). Overall, these data quantify the extent to which snow depth varied relative to elevation and habitat type (i.e. open vs. forest). Specifically, snow depth was 30-40 inches deeper in open relative to forested habitats, on average. Further, snow depth increased 2.3-2.7 inches per 100 foot gain in elevation, on average (White et al. 2012). Importantly, these data provide quantitative information about winter severity in areas representative of where mountain goats in our study area are wintering. Such data will be able to be used as covariates in future analyses of survival, reproduction and resource selection.

Climate Data.—Daily climate data were archived from the National Weather Service database to characterize broader scale climate patterns (Appendix 3a-e). Total annual snowfall, average daily temperature during July-August, and total precipitation (summer and annual) were summarized from data collected at the National Weather Service station in Haines, AK (Appendix 3a-e). Total annual snowfall and average temperature during July-August are important predictors of mountain goat survival (White et al. 2011). Mean snowfall in Haines during the study period (2005-2020) was 114% of the long-term normal (i.e. 1950-2020). Overall, snowfall in Haines during 5 of the 7 initial winters of the study was above normal (including 5 of the 10 highest snowfall winters on record; 41 years of data). However, 6 of the last 8 winters have been below average. During the winter of 2019/2020, a total 220 inches (145% of normal) of snowfall was recorded in Haines.

Reproduction and Survival

Kid Recruitment.—Kid recruitment of radio-marked female mountain goats was estimated by determining the percentage of radio-marked females seen with kids during

Table 1: Proportion of radio-marked adult female mountain goats observed with kids at heel during parturition in the Lynn Canal study area, 2005-2020. Data are also presented from other study areas, for comparative purposes.

Area	Year	Kids	AdF	Prop	SE
Lynn Canal					
	2005	8	12	0.67	0.14
	2006	16	25	0.64	0.10
	2007	20	32	0.63	0.09
	2008	19	33	0.58	0.09
	2009	15	25	0.60	0.10
	2010	18	26	0.69	0.09
	2011	18	27	0.67	0.09
	2012	9	15	0.60	0.13
	2013	9	13	0.69	0.13
	2014	8	14	0.57	0.13
	2015	15	17	0.88	0.08
	2016	14	17	0.82	0.09
	2017	13	17	0.76	0.10
	2018	12	15	0.80	0.10
	2019	13	18	0.72	0.11
	2020	9	14	0.64	0.13
	Total	216	320	0.68	0.03
Haines-Skagway					
	2010	5	10	0.50	0.16
	2011	8	10	0.80	0.13
	2012	8	11	0.73	0.13
	2013	10	12	0.83	0.11
	2014	10	17	0.59	0.12
	2015	14	18	0.78	0.10
	2016	11	15	0.73	0.11
	2017	6	11	0.55	0.15
	2018	8	14	0.57	0.13
	2019	12	18	0.67	0.11
	2020	14	22	0.64	0.10
	Total	106	158	0.67	0.04
Baranof					
	2010	4	4	1.00	0.00
	2011	5	6	0.83	0.15
	2012	3	5	0.60	0.22
	2013	5	10	0.50	0.16
	2014	9	12	0.75	0.13
	2015	7	14	0.50	0.13
	2016	8	12	0.67	0.14
	2017	4	11	0.36	0.15
	2018	8	12	0.67	0.14
	2019	5	12	0.42	0.14
	2020	7	16	0.44	0.12
	Total	65	114	0.57	0.05

May-June aerial telemetry surveys (Table 1). Since each radio-marked female was not observed daily during the kidding period, it was not possible to determine if kids were born and subsequently died prior to, or between, surveys. As such, estimates of kid production reported here are presumably lower than the actual percentage of females that gave birth. Nevertheless, our estimates of kid production were consistently collected each year and similar to estimates of kidding rates reported elsewhere

Table 2. Apparent survival of mountain goat kids associated with radio-marked females during summer (May - September) during 2006-2020 in Lynn Canal, AK. Data from other areas are summarized for comparison.

	Survival			
	At Risk	Alive	$\hat{S}$	SE
Lynn Canal	115	94	0.82	0.03
Haines-Skagway	71	51	0.72	0.05
Baranof	42	40	0.95	0.03
Lynn Canal + Haines-Skagway	186	145	0.78	0.03
All Areas	228	185	0.81	0.02

suggesting our methodology is subject to limited bias (Festa-Bianchet and Cote 2008).

Annual estimates of kid production in Lynn Canal ranged from 57-88% between 2005-2020 (Table 1). During 2020, 64% of radio-marked females (n = 14) had a kid at heel; four percent below average (Table 1). As described above, the previous winter snowfall was 145% of normal and likely contributed to the observed decrease in reproduction; preliminary analyses suggest that reproduction is negatively related to total snowfall during the preceding winter (White 2020).

Observations of individual mountain goat kids associated with attendant radio-marked females indicated that, on average, 72±5% of kids survived during the summer period (May-Sept, 2005 - 2020; Table 2). This estimate is intermediate, as compared to regional populations in the Haines-Skagway area and Baranof Island (Table 2), and similar to estimates reported from a long-term study in Alberta (Festa-Bianchet and Cote 2008).

Survival.—Mountain goats were monitored monthly during fixed-wing aerial telemetry flights and/or via GPS-telemetry. During 2019/2020 biological year, 7 radio-marked animals died. Overall, 74±8% of animals survived during 2019/2020; a relatively low proportion (i.e. 3% lower than the long term average; Table 3). Yet, this result is not surprising given that winter snowfall, an important determinant of winter survival (White et al. 2011), was 145% higher than normal. Avalanches were the cause of death in 2 of 7 mortality cases, and an additional animal died from documented wolf predation (the remaining 4 radiocollared animals died of unknown, but non-avalanche related, causes).

Adult survival, particularly adult females, can strongly influence population growth rate in mountain goats (Hamel

Table 3: Estimates of mountain goat survival for different sex classes during 2005-2020, Lynn Canal, AK. Data are also presented from other study areas, for comparative purposes.

	Males				Females				Total			
	At Risk	Died	Ŝ	SE	At Risk	Died	Ŝ	SE	At Risk	Died	Ŝ	SE
Lynn Canal												
2005/2006	11	2	0.82	0.12	11	1	0.91	0.09	22	3	0.86	0.07
2006/2007	33	11	0.67	0.08	25	4	0.84	0.07	58	15	0.74	0.05
2007/2008	36	7	0.77	0.08	31	4	0.83	0.08	67	11	0.80	0.05
2008/2009	36	10	0.66	0.09	34	6	0.73	0.09	70	16	0.69	0.06
2009/2010	28	4	0.86	0.07	26	4	0.85	0.07	54	8	0.85	0.05
2010/2011	25	3	0.88	0.06	24	2	0.91	0.06	49	5	0.90	0.04
2011/2012	23	6	0.72	0.10	23	3	0.85	0.08	46	9	0.77	0.07
2012/2013	19	8	0.56	0.11	16	7	0.60	0.11	34	15	0.58	0.08
2013/2014	14	4	0.71	0.12	11	2	0.83	0.11	25	6	0.76	0.08
2014/2015	12	5	0.60	0.13	14	1	0.93	0.07	26	6	0.77	0.08
2015/2016	9	1	0.88	0.10	17	2	0.88	0.08	26	3	0.88	0.06
2016/2017	14	6	0.57	0.13	17	3	0.82	0.09	31	9	0.71	0.08
2017/2018	12	1	0.92	0.08	18	6	0.67	0.11	30	7	0.77	0.08
2018/2019	13	3	0.76	0.12	14	0	1.00	0.00	27	3	0.89	0.06
2019/2020	12	4	0.67	0.13	17	3	0.80	0.10	29	7	0.74	0.08
All years	272	75	0.73	0.03	264	48	0.82	0.02	533	123	0.77	0.02
Haines-Skagway												
2010/2011	13	4	0.69	0.13	10	3	0.70	0.14	23	7	0.70	0.10
2011/2012	16	2	0.87	0.09	10	1	0.90	0.09	26	3	0.88	0.06
2012/2013	18	2	0.89	0.07	11	1	0.91	0.08	29	3	0.90	0.06
2013/2014	22	2	0.91	0.06	12	1	0.92	0.08	34	3	0.91	0.05
2014/2015	19	2	0.89	0.07	16	2	0.85	0.08	35	4	0.88	0.05
2015/2016	18	5	0.72	0.10	16	3	0.79	0.10	34	8	0.75	0.07
2016/2017	13	6	0.56	0.13	14	4	0.71	0.11	26	10	0.64	0.09
2017/2018	12	3	0.73	0.12	11	0	1.00	0.00	23	3	0.86	0.07
2018/2019	13	1	0.91	0.08	12	2	0.83	0.10	25	3	0.87	0.07
2019/2020	21	4	0.77	0.09	11	3	0.73	0.12	32	7	0.77	0.07
All years	162	31	0.80	0.03	119	20	0.83	0.03	281	51	0.82	0.02
Baranof Island												
2010/2011	8	1	0.88	0.11	4	0	1.00	0.00	12	1	0.92	0.08
2011/2012	12	0	1.00	0.00	6	0	1.00	0.00	18	0	1.00	0.00
2012/2013	17	3	0.82	0.09	6	0	1.00	0.00	23	3	0.87	0.07
2013/2014	17	3	0.82	0.09	10	0	1.00	0.00	27	3	0.89	0.06
2014/2015	17	3	0.82	0.09	12	1	0.92	0.08	29	4	0.86	0.06
2015/2016	14	0	1.00	0.00	13	2	0.84	0.11	27	2	0.92	0.06
2016/2017	23	3	0.85	0.08	13	2	0.82	0.12	36	5	0.84	0.06
2017/2018	21	5	0.76	0.09	11	2	0.80	0.13	32	7	0.77	0.07
2018/2019	18	1	0.94	0.06	13	1	0.90	0.09	31	2	0.93	0.05
2019/2020	19	8	0.47	0.10	12	2	0.82	0.11	31	10	0.63	0.08
All years	162	27	0.83	0.03	100	10	0.89	0.03	262	37	0.85	0.02

At Risk = maximum number of animals monitored per month (per time period) et al. 2006, Festa-Bianchet and Cote 2008, White et al. 2021). Consequently, the reduced survival documented in 2019/2020 suggests the population was unlikely to have sustained growth during the most recent biological year. Given the population has experienced relatively low overall survival (2005-2020, annual survival = 77±2%) and associated population decline it will be important to monitor the population for indication of recovery in future years.

Population Abundance and Composition

Aerial Surveys.—During September 2020, aerial surveys were conducted in nine different survey areas in the Lions Head and Sinclair Mountain study areas, and the Berners-Lace ridge area (Appendix 4, 5a-c). The Berners-Lace ridge was surveyed because seasonal movement (albeit limited) by male mountain goats has been documented from the Lions Head study area to this site in past years.

Evaluation of Population Trends.— Geographic and temporal trends were characterized using segmented regression for eight survey areas within the Lions Head and Sinclair study areas, the Berners-Lace ridge as well as the entire Kakuhan Range (Appendix 4, 5a-c). Analyses were based on population estimates derived using the White et al. (2016) aerial survey sightability model and aerial survey data collected during 2005-2020. At the broader, Kakuhan Range study area scale mark-resight estimates (i.e. Chapman 1954) were derived and used for analyses.

Winter snowfall, an important determinant of mountain goat survival (White et al. 2011) was above average during 5 of 6 winters during 2006 – 2012. However, winter snowfall was average, or below average, in 6 of 8 years during 2013-2020. Because of the contrasting periods of winter conditions and associated a priori expectations about how snowfall would differentially influence mountain goat survival and subsequently population abundance during these two periods, we used segmented regression techniques to independently characterize population trends during each period. This approach allowed for more detailed characterization of population trends, as compared to previous analyses which examined population trends across the entire time-series inclusively (i.e. White 2019).

At the Kakuhan Range (study area-wide) scale, population size declined significantly (-59±14 mountain goats/year) during 2006-2012, however during the following period of moderate, or below average, winter conditions (2013-2020) the population was stable, or slightly declining (-8±7 mountain goats/year)(Table 4, Figure 7). Overall, the population trends during the two periods were significantly different (P<0.01, Table 4, Figure 7). These analyses indicate that the population experienced a significant decline during the period of severe winter conditions and

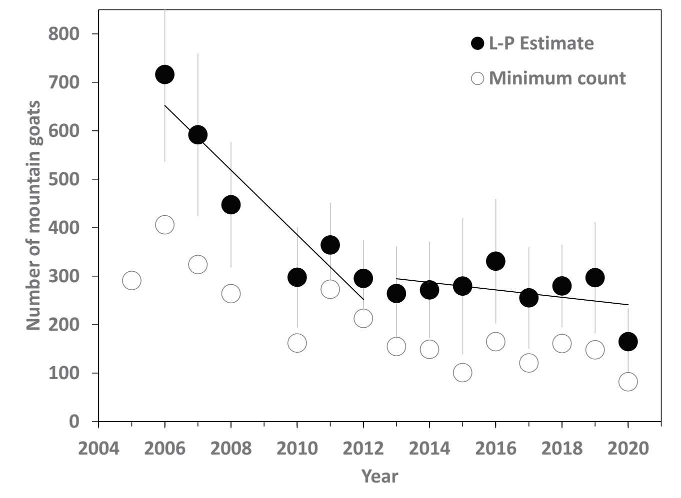


Figure 7. Number of mountain goats in the Kakuhan Range, AK (Lions Head and Mt. Sinclair study areas combined) during 2005 - 2020. White circles designate the number of mountain goats seen during aerial surveys, and the black circles represent the associated mark-resight population estimates. Due to small sample size, a mark-resight estimate was not calculated for 2005.

subsequently stabilized during the period of more moderate winter conditions. However, the population has not yet shown significant evidence of recovery despite the recent eight year period of largely favorable winter conditions.

Analyses at the smaller, survey area-scale provide insight about spatial and tempral patterns of abundance within the broader study area. Overall, similar patterns in population trajectories were evident between the 2006-2012 and 2013-2020 periods yet substantial variability was evident among survey areas. During the severe winter period (2006-2012), the most substantial declines occurred in the S Katzehin (-20±5 mountain goats/year), Yeldagalga (-14±6 mountain goats/year), Met (-7±3 mountain goats/year) and Kensington (-6±4 mountain goats/year) areas, as compared to surrounding areas (Table 4, Figure 8). During the moderate winter period (2013-2020), the abundance of mountain goats showed evidence of increase in the S Katzehin survey area (4±3 mountain goats/year) but in other key areas exhibited evidence of stability or slight, non-significant decline (Yeldagalga: -3±4 mountain goats/year, Met: 0±3 mountain goats/year, Kensington, 0±2 mountain goats/year)(Table 4, Figure 7). Differences in population trends between periods were most pronounced in the S Katzehin and Katzehin Lake areas, indicating trends in the initial decline and subsequent period of stability were most distinct in these areas (Table 4, Figure 7).

Despite the relatively long time series available for analyses (2006-2012 = 7 years, 2013-2020 = 8 years), it is important to recognize that inter-annual variability in population estimates within survey areas is evident and constrains precision of trend analyses. Utilization of

Table 4: Estimated change in population size minimum count densities, based on mountain goats observed during aerial surveys during 2005-2018, Lynn Canal, Alaska.

	2006-2012			2013-2020			Difference
Area	Slope	SE	P-value	Slope	SE	P-value	P-value
Study area:							
Kakuhan Range	-59.0	14.3	<0.01	-7.7	7.3	0.33	<0.01
Survey Areas:							
W Berners	-2.3	2.1	0.32	-1.5	1.6	0.39	0.76
Kensington	-6.0	4.0	0.19	-0.3	1.9	0.89	0.19
Met	-6.9	2.9	0.06	-0.1	2.7	0.96	0.12
Yeldagalga	-14.2	6.2	0.08	-2.5	3.8	0.54	0.12
S Katzehin	-19.5	5.2	0.02	3.5	3.0	0.29	0.00
Katzehin Lk	-4.7	1.9	0.07	-0.2	0.8	0.81	0.03
S Meade	-1.3	2.2	0.60	-0.8	1.1	0.50	0.84
U Lace	1.1	0.9	0.30	0.1	0.8	0.86	0.45
BL Ridge	-0.8	3.0	0.83	-1.9	0.9	0.08	0.63

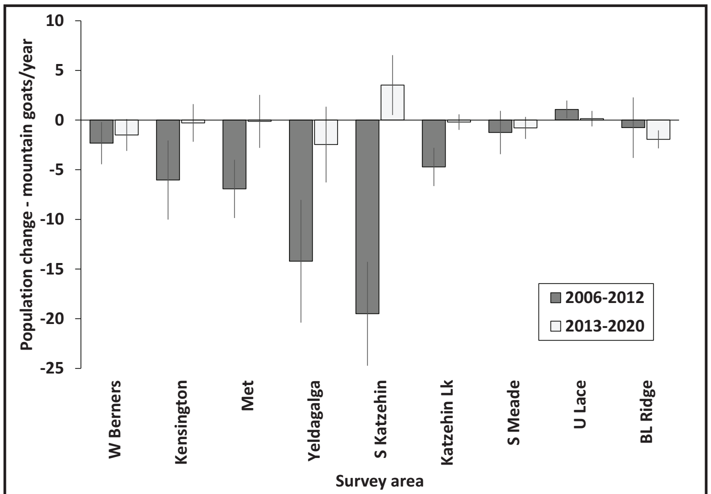


Figure 8: Estimated change in minimum count densities, based on mountain goats observed during aerial surveys during 2005-2018, Lynn Canal, Alaska.

aerial survey sightability models substantially increases the accuracy and precision of survey area-level population estimates, in comparison to raw, minimum count data. However, not all sources of variability are likely accounted for and confidence intervals overlap previous estimates, or zero (in the case of trend analyses), in some instances. Consequently, survey area-level analyses should be interpreted cautiously until additional data are collected in future years to assess current population trends and, ultimately, evidence of population recovery. However, study area-wide mark-resight population estimates are conducted in "real-time" and inherently integrate more variation in aerial survey conditions enabling more reliable assessments of population trends over time; yet, applications are constrained by the larger spatial scale of inference. In this regard, implementation of integrated population models (IPMs; sensu Johnson et al. 2010), that quantitatively integrate independent data streams (i.e. mark-resight and sightability estimates), offer a promising approach for further refining the accuracy and precision of survey-level population estimates and trends. Implementation of this approach could enable scaling down more accurate and precise broad-scale estimates to the survey area-level and offer an improvement in our ability to articulate spatial variation in population trends.

Sightability Modeling and Population Estimates.—During all surveys, data were collected for purposes of developing group-level aerial survey sighting probability models (2020, n = 25 trials). In addition, complementary aerial surveys were conducted in areas outside of the study area (Haines, Baranof Island) where mountain goats were marked as part of independent studies. Collection of data in other areas has enabled acquisition of additional sightability data resulting in opportunity to more accurately parameterize sightability models; however, a majority of the data used to develop models was collected in the Lynn Canal/Berners Bay study areas. Details of this modeling effort are summarized in White et al. (2016). During 2020 all newly acquired data collected since 2016 was used to refine and re-parameterize models, as well as re-analyze data to derive updated estimates for the entire 2005-2020 time-series (described above).

FUTURE WORK

The mountain goat population monitoring and assessment work in the vicinity of the Kensington Mine is planned to continue during the operational phase on mining operations. The project area for ongoing mine-related monitoring work encompasses the area between Slate cove and the Katzehin River (i.e. the "Lions Head" and "Sinclair" study areas). In this area, study animals (2020/21, n = 25) will continue to be monitored monthly to assess reproductive status and survival. Mortalities will be investigated during April - October, or as conditions allow. GPS location data will be downloaded from radio-collars following field recovery efforts or via satellite-link; GPS radio collars automatically release 3 years after capture/deployment (or at the time or mortality). GPS data will be post-processed and appended to the existing GPS location database. During late-summer, 6-8 mountain goats will be captured to ensure scientifically defensible sample sizes are maintained. Three replicate aerial surveys will be conducted in early-fall 2020, weather permitting, in order to estimate mountain goat sightability, population abundance and composition. During 2020-2021, efforts will continue to refine mountain goat aerial survey sightability models and, ultimately, derive population estimates. Results of project activities will be summarized and submitted to Coeur Alaska, Inc. and associated stakeholders as an annual research project report in spring 2022.

ACKNOWLEDGEMENTS

Primary funding for this project was provided by Coeur Alaska, the State of Alaska Department of Transportation and Public Facilities and the Federal Highway Administration. Additional funding was provided by the Alaska Department of Fish and Game and the USDA-Forest Service (Tongass National Forest). Reuben Yost (SOA, DOT/PF), Tim Haugh (FHWA), Carl Schrader (SOA/DNR), David Thomson (SOA/ADFG), Jackie Timothy (SOA/ADFG-DHR), Kate Kanouse (SOA/ADFG-DHR), Kevin Eppers (Coeur), Kyle Moselle (SOA/DNR) and Brian Logan (USFS) coordinated project funding. Neil Barten, Kimberlee Beckmen, Lem Butler, Roy Churchwell, Stephanie Crawford, John Crouse, Anthony Crupi, Dan Eacker, Dave Gregovich, Eran Hood, Jeff Jemison, Justin Jenniges, Jamie King, Carl Koch, Brian Lieb, Steve Lewis, Karin McCoy, Jeff Nichols, Grey Pendleton, Dale Rabe, Chad Rice, Ryan Scott, Stephanie Sell, Yasaman Shakeri, Greg Snedgen, Peter Strow, Mike Van Note, Mark Battian, Jason Waite, and Gordon Wilson-Naranjo provided field, lab and/or analytical support. Jason Waite provided critical biometric support with population estimation and trend analysis. Aaron Shafer conducted mountain goat genetic analyses and has contributed greatly to our understanding of the topic in the study area. Fixed-wing survey flights were conducted by Lynn Bennett, Mark Morris, Jacques Norvell, Chuck Schroth, Pat Valkenburg, Doug Larsen and Mark Pakila. Helicopter support was provided by Rey Madrid, Mitch Horton, Andy Hermansky, Eric Main, Christian Kolden, John Weeden (Temsco Helicopters), Chuck Schroth (Fjord Flying Service) and Coastal Helicopters. Coordination of ground work activities and administrative support was provided by Peter Strow, Kevin Eppers, Clyde Gillespie, Frank Bergstrom and Al Gillan (Coeur Alaska, Inc.).

PROJECT PUBLICATIONS

White, K. S., N. L. Barten and D. Larsen. 2006. Mountain goat assessment and monitoring along the Juneau Access road corridor and near the Kensington Mine, Southeast Alaska. Research Progress Report, Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK. 65pp.

White, K. S. 2006. Seasonal and sex-specific variation in terrain use and movement patterns of mountain goats in southeastern Alaska. Proceedings of the Biennial Symposium of the Northern Wild Sheep and Goat Council, 15: 183-193.

White, K. S., N. L. Barten and D. Larsen. 2007. Mountain goat assessment and monitoring along the Juneau Access road corridor and near the Kensington Mine, southeast Alaska. Research Progress Report, Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK. 16pp.

White, K. S. and N. L. Barten. 2008. Mountain goat assessment and monitoring along the Juneau Access road corridor and near the Kensington Mine, southeast Alaska. Research Progress Report, Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK. 15pp.

White, K. S. and N. L. Barten. 2009. Mountain goat assessment and monitoring along the Juneau Access road corridor and near the Kensington Mine, southeast Alaska. Research Progress Report, Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK. 16pp.

White, K. S. and G. Pendleton. 2009. Mountain goat population monitoring and survey technique development. Research Progress Report, Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK. 4pp.

White, K. S. 2010. Nutrition and reproduction of mountain goats in coastal Alaska. Proceedings of the 17th Biennial Symposium of the Northern Wild Sheep and Goat Council, 17: 78.

White, K. S. 2010. Mountain goat data summary: East Berners study area. Unpublished report. Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK.

White, K. S. and G. Pendleton. 2010. Mountain goat population monitoring and survey technique development. Research Progress Report, Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK.

White, K. S. and N. L. Barten. 2010. Mountain goat assessment and monitoring along the Juneau Access road corridor and near the Kensington Mine, southeast Alaska. Research Progress Report, Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK.

White, K. S., G. W. Pendleton, D. Crowley, H. Griese, K. J. Hundertmark, T. McDonough, L. Nichols, M. Robus, C. A.Smith and J. W. Schoen. 2011. Mountain goat survival in coastal Alaska: effects of age, sex and climate. Journal of Wildlife Management, 75: 1731-1744.

White, K. S. and G. Pendleton. 2011. Mountain goat population monitoring and survey technique development. Research Progress Report, Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK.

White, K. S. and N. L. Barten. 2011. Mountain goat assessment and monitoring along the Juneau Access road corridor and near the Kensington Mine, southeast Alaska. Research Progress Report, Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK.

Shafer, A. B. A., K. S. White, S. D. Cote and D. W. Coltman. 2011. Deciphering translocations from relicts in Baranof Island mountain goats: is an endemic genetic lineage at risk? Conservation Genetics, 12: 1261-1268.

Shafer, A. B. A., J. M. Northrup, K. S. White, M. S. Boyce, S. D. Cote and D. W. Coltman. 2012. Habitat selection predicts genetic relatedness in an alpine ungulate. Ecology, 93:1317-1329.

White, K. S. and G. Pendleton. 2012. Mountain goat population monitoring and survey technique development. Research Progress Report, Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK.

White, K.S., D. P. Gregovich, G. W. Pendleton, N. L. Barten, R. Scott, A. Crupi and D. N. Larsen. 2012. Moose population ecology and habitat use along the Juneau Access road corridor, Alaska. Research Final Report. Alaska Department of Fish and Game, Juneau, AK

White, K. S., D. P. Gregovich, G. W. Pendleton, N. L. Barten, A. Crupi, R. Scott and D. N. Larsen. 2012. Modeling resource selection of mountain goats in southeastern Alaska: applications for population management and highway development planning. Proceedings of the Northern Wild Sheep and Goat Council, 18: 32-42.

White, K. S., N. L. Barten, R. Scott and A. Crupi. 2013. Mountain goat population monitoring and movement patterns near the Kensington Mine, AK. Research Progress Report, Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK.

Richard, J. H., K. S. White and S. D. Cote. 2014. Mating effort and space use of an alpine ungulate during the rut. Behavioral Ecology and Sociobiology, 68: 1639-1648.

White, K. S., N. L. Barten, R. Scott and A. Crupi. 2014. Mountain goat population monitoring and movement patterns near the Kensington Mine, AK. Research Progress Report, Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK.

White, K. S., N. L. Barten, R. Scott and A. Crupi. 2015. Mountain goat population monitoring and movement patterns near the Kensington Mine, AK. Research Progress Report, Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK.

White, K. S. and D. P. Gregovich. 2016. Mountain goat resource selection and habitat use in relation to mining related disturbance, near the Kensington Mine, Alaska.Research Final Report, Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK.

White, K. S. 2016. Mountain goat population monitoring and movement patterns near the Kensington Mine, AK. Research Progress Report, Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK.

White, K. S., G. W. Pendleton and J. N. Waite. 2016. Development of an aerial survey population estimation technique for mountain goats in Alaska. Final Wildlife Research Report, Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK.

White, K. S. and D. P. Gregovich. 2017. Mountain goat resource selection and habitat use in relation to mining related disturbance. Wildlife Biology, doi: 10.2981/wlb.00277.

White, K. S. 2017. Mountain goat population monitoring and movement patterns near the Kensington Mine, AK. Research Progress Report, Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK.

White, K. S., D. P. Gregovich and T. Levi. 2018. Projecting the future of an alpine ungulate under climate change scenarios. Global Change Biology, 24: 1136-1149.

Lowrey, B., C. J. Butler, W. H. Edwards, M. E. Wood, S. R. Dewey, G. L. Fralick, J. Jenings-Gaines, H. Killion, D. E. McWhirther, H. M. Miyasaki, S. T. Stewart, K. S. White, P. J. White, and R. A. Garrott. 2018. A survey of bacterial respiratory pathogens in native and introduced mountain goats (*Oreamnos americanus*). Journal of Wildlife Diseases, 54: 852-858.

White, K. S. 2018. Mountain goat population monitoring and movement patterns near the Kensington Mine, AK. Research Progress Report, Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK.

Shakeri, Y. N. and K. S. White. 2018. Seasonal and sex-specific variation in space use and site fidelity of mountain goats in coastal Alaska. Conference Abstract. Northern Wild Sheep and Goat Council, Whitefish, MT.

White, K. S. 2019. Mountain goat population monitoring and movement patterns near the Kensington Mine, AK. Research Progress Report, Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK.

White, K. S. 2020. Mountain goat population monitoring and movement patterns near the Kensington Mine, AK. Research Progress Report, Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK.

REFERENCES

Chadwick, D.H. 1973. Mountain goat ecology: logging relationships in the Bunker creek drainage of western Montana. Montana Fish and Game Dept., P-R Project Report W-120-R-3,4. Helena, MT. Pp. 262.

Chapman, D. G. 1954. The estimation of biological populations. Annals of Mathematical Statistics 25:1–15.

Cote, S. D. 1996. Mountain goat response to helicopter disturbance. Wildlife Society Bulletin, 24: 681-685.

Cote, S. D., S. Hamel, A. St-Louis, and J. Mainguy. 2013. Do mountain goats habituate to helicopter disturbance? Journal of Wildlife Management, 77:1244-1248.

D'Eon, R. G. and D. Delaparte. 2005. Effects of radio-collar position and orientation on GPS radio-collar performance, and implications of PDOP in data screening. Journal of Applied Ecology, 42: 383-388.

D'Eon, R. G., R. Serrouya, G. Smith and C. O. Kochanny. 2002. GPS radiotelemetry error and bias in mountainous terrain. Wildlife Society Bulletin, 30: 430-439.

Festa-Bianchet, M. and S. D. Cote. 2008. Mountain goats: ecology, behavior, and conservation of an alpine ungulate. Island Press. Covelo, CA.

Foster, B.R. and E.Y Rahs. 1983. Mountain goat response to hydroelectric exploration in northwestern British Columbia. Environmental Management, 7:189-197.

Hamel, S., S. D. Côté, K. G. Smith, and M. Festa-Bianchet. 2006. Population dynamics and harvest potential of mountain goat herds in Alberta. Journal of Wildlife Management, 70:1044-1053.

Johnson, H. E., L. S. Mills, J. D. Wehausen, and T. R. Stephenson. 2010. Combining ground count, telemetry, and mark-resight data to infer population dynamics in an endangered species. Journal of Animal Ecology 47:1083–1093.

Joslin, G. 1986. Mountain goat population changes in relation to energy exploration along Montana's Rocky Mountain Front. Proceedings of the Fifth Biennial Northern Wild Sheep and Goat Council, 5:253-271.

Lowrey, B., C. J. Butler, W. H. Edwards, M. E. Wood, S. R. Dewey, G. L. Fralick, J. Jenings-Gaines, H. Killion, D. E. McWhirther, H. M. Miyasaki, S. T. Stewart, K. S. White, P. J. White, and R. A. Garrott. 2018. A survey of bacterial respiratory pathogens in native and introduced mountain goats (*Oreamnos americanus*). Journal of Wildlife Diseases, 54: 852-858.

Northern Wild Sheep and Goat Council. 2020. Northern Wild Sheep and Goat Council position statement on commercial and recreational disturbance of mountain goats: recommendations for management. Proceedings of the Biennial Symposium of the Northern Wild Sheep and Goat Council, 22: 1-15.

Pollock, K. H., S. R. Winterstein, C. M. Bunck and P. D. Curtis. 1989. Survival analysis in telemetry studies: the staggered entry design. Journal of Wildlife Management, 53: 7-15.

Robus, M. H. and B. L. Carney. 1995. Effects of Kensington mine development on black bears and mountain goats. Wildlife baseline studies and monitoring plan. Final report. Alaska Department of Fish and Game, Douglas, AK.

Schoen, J. W. and M. D. Kirchhoff. 1982. Habitat use by mountain goats in Southeast Alaska. Research Final Report. Alaska Department of Fish and Game, Juneau, AK. 67pp.

Shafer, A.B.A., S. D. Cote and D. W. Coltman. 2010. Hot spots of genetic diversity descended from multiple Pleistocene refugia in an alpine ungulate. Evolution, doi: 10.1111/j.1558-5646.2010.01109.x

Shafer, A. B. A., J. M. Northrup, K. S. White, M. S. Boyce, S. D. Cote and D. W. Coltman. 2012. Habitat selection predicts genetic relatedness in an alpine ungulate. Ecology, 93:1317-1329.

Taylor, W.P. 2000. Wildlife capture and restraint manual. Alaska Department of Fish and Game, Anchorage, AK.

White, K. S. 2006. Seasonal and sex-specific variation in terrain use and movement patterns of mountain goats in southeastern Alaska. Proceedings of the Biennial Symposium of the Northern Wild Sheep and Goat Council, 15: 183-193.

Stowell, H. H. 2006. Geology of Alaska: rock and ice in motion. University of Alaska Press. Fairbanks, AK.

White, K. S., G. W. Pendleton, D. Crowley, H. Griese, K. J. Hundertmark, T. McDonough, L. Nichols, M. Robus, C. A.Smith and J. W. Schoen. 2011. Mountain goat survival in coastal Alaska: effects of age, sex and climate. Journal of Wildlife Management, 75: 1731-1744.

White, K. S. and G. Pendleton. 2012. Mountain goat population monitoring and survey technique development. Research Progress Report, Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK.

White, K.S., D. P. Gregovich, G. W. Pendleton, N. L. Barten, R. Scott, A. Crupi and D. N. Larsen. 2012. Moose population ecology and habitat use along the Juneau Access road corridor, Alaska. Research Final Report. Alaska Department of Fish and Game, Juneau, AK

White, K. S. and D. P. Gregovich. 2016. Mountain goat resource selection and habitat use in relation to mining related disturbance, near the Kensington Mine, Alaska.Research Final Report, Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK.

White, K. S., G. W. Pendleton and J. N. Waite. 2016. Development of an aerial survey population estimation technique for mountain goats in Alaska. Final Wildlife Research Report, Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK.

White, K. S. and D. P. Gregovich. 2017. Mountain goat resource selection and habitat use in relation to mining related disturbance. Wildlife Biology, doi: 10.2981/wlb.00277.

White, K. S., T. Levi, J. Breen, M. Britt, J. Merondun, D. Martchenko, Y. N. Shakeri, B. Porter, and A. B. A. Shafer. 2021. Integrating genetic data and demographic modeling to facilitate conservation of small, isolated mountain goat populations. Journal of Wildlife Management, 85: 271-282.

White, K. S., D. Watts, and K. B. Beckmen. In review. Helicopter-based chemical immobilization of mountain goats in Alaska. Wildlife Society Bulletin.

Appendix 1: Incidence of disease prevalence of mountain goats in the Kakuhan Range (includes the Lions Head and Sinclair study areas combined) during 2005-2020. Results are also provided for three other populations in southeastern Alaska, for comparison.

	Baranof			Cleveland			Haines			Berners			Kakuhan			Villard			Total		
Disease	n	Pos.	Prop	n	Pos.	Prop	n	Pos.	Prop	n	Pos.	Prop	n	Pos.	Prop	n	Pos.	Prop	n	Pos.	Prop
Contagious Ecthyma	68	2	0.03	10	1	0.10	73	3	0.04	20	1	0.05	86	4	0.05	24	0	0.00	281	11	0.04
Chlamydia	34	1	0.01	12	0	0.00	44	1	0.02	27	0	0.00	49	3	0.06	30	1	0.03	196	6	0.03
Q Fever	54	0	0.00	11	0	0.00	66	0	0.00	29	0	0.00	80	3	0.04	32	1	0.03	272	4	0.01
Bluetongue	17	0	0.00	10	0	0.00	20	0	0.00	20	0	0.00	17	0	0.00	18	0	0.00	102	0	0.00
Bovine respiratory synctial virus (BRSV)	17	0	0.00	10	0	0.00	20	0	0.00	21	0	0.00	17	0	0.00	16	0	0.00	101	0	0.00
Infectious bovine rhinotrachetis (IBR)	17	0	0.00	10	0	0.00	20	0	0.00	21	0	0.00	17	0	0.00	17	0	0.00	102	0	0.00
Parainfluenza-3 (PI-3)	17	0	0.00	10	0	0.00	20	0	0.00	21	0	0.00	17	0	0.00	17	0	0.00	102	0	0.00
Epizootic hemorrhagic disease (EHD)	17	0	0.00	9	0	0.00	20	0	0.00	21	0	0.00	17	0	0.00	17	0	0.00	101	0	0.00
Caprinae arthritis encephalitis (CAE)	17	0	0.00	9	0	0.00	20	0	0.00	21	0	0.00	17	0	0.00	16	0	0.00	100	0	0.00
Malignant cataharral fever-ovine (MCF)	17	0	0.00	9	0	0.00	20	0	0.00	21	0	0.00	17	0	0.00	16	0	0.00	100	0	0.00
Leptospirosis cannicola	17	0	0.00	9	0	0.00	20	0	0.00	21	0	0.00	17	0	0.00	17	0	0.00	101	0	0.00
Leptospirosis grippo	17	0	0.00	9	0	0.00	20	1	0.05	21	0	0.00	17	1	0.06	17	1	0.06	101	3	0.03
Leptospirosis hardjo	17	0	0.00	9	0	0.00	20	0	0.00	21	0	0.00	17	0	0.00	17	0	0.00	101	0	0.00
Leptospirosis ictero	17	0	0.00	9	0	0.00	20	3	0.15	21	2	0.10	17	3	0.18	17	3	0.18	101	11	0.11
Leptospirosis pomona	17	0	0.00	9	0	0.00	20	0	0.00	21	0	0.00	17	0	0.00	17	0	0.00	101	0	0.00

Positive titers: PI3>1:120, IBR> 1:64, BRSV >1:32, Leptospirosis sp.>1:100

Appendix 2a: Blood serum trace mineral concentration documented for mountain goats in the Lions Head and Sinclair study areas, 2016-2020. Results are also provided for two other populations in southeastern Alaska in 2016-2020, for comparison. (Lynn Canal includes the Lions Head and Sinclair study areas combined).

	Selenium (ppm) (0.08 - 0.20)			Copper (ppm) (0.7 - 1.2)			Iron (ppm) (1.1 - 2.3)			Calcium (ppm) (87 - 101)			Zinc (ppm) (0.65 - 2.70)		
Area	**mean**	**SE**	**n**	**mean**	**SE**	**n**	**mean**	**SE**	**n**	**mean**	**SE**	**n**	**mean**	**SE**	**n**
Baranof	**0.12**	**0.00**	**40**	**1.0**	**0.0**	**40**	**3.6**	**0.3**	**40**	**104**	**1**	**40**	**0.80**	**0.02**	**40**
Lynn Canal	**0.10**	**0.01**	**33**	**1.0**	**0.0**	**33**	**3.9**	**0.4**	**33**	**106**	**1**	**33**	**0.82**	**0.02**	**33**
Haines	**0.11**	**0.01**	**41**	**0.9**	**0.0**	**41**	**4.8**	**0.5**	**41**	**107**	**1**	**41**	**0.83**	**0.03**	**41**
All Areas	**0.11**	**0.01**	**114**	**1.0**	**0.0**	**114**	**4.1**	**0.2**	**114**	**106**	**1**	**114**	**0.82**	**0.01**	**114**

Appendix 2b: Blood serum Selenium concentration for mountain goats in the Lions Head and Sinclair study areas, 2016-2020. Results are also provided for two other populations in southeastern Alaska in 2010-2014, for comparison. (Lynn Canal includes the Lions Head and Sinclair study areas combined). Bloos serum Selenium concentrations < 0.08 denote deficiency.

Area	**mean**	**SE**	**Min**	**Max**	**# <0.08**	**Prop <0.08**	**n**
Baranof	**0.117**	**0.003**	**0.077**	**0.162**	**8**	**0.20**	**40**
Lynn Canal	**0.095**	**0.007**	**0.034**	**0.195**	**15**	**0.45**	**33**
Haines[a]	**0.111**	**0.014**	**0.021**	**0.534**	**23**	**0.56**	**41**
All areas	**0.108**	**0.006**	**0.021**	**0.534**	**46**	**0.40**	**114**

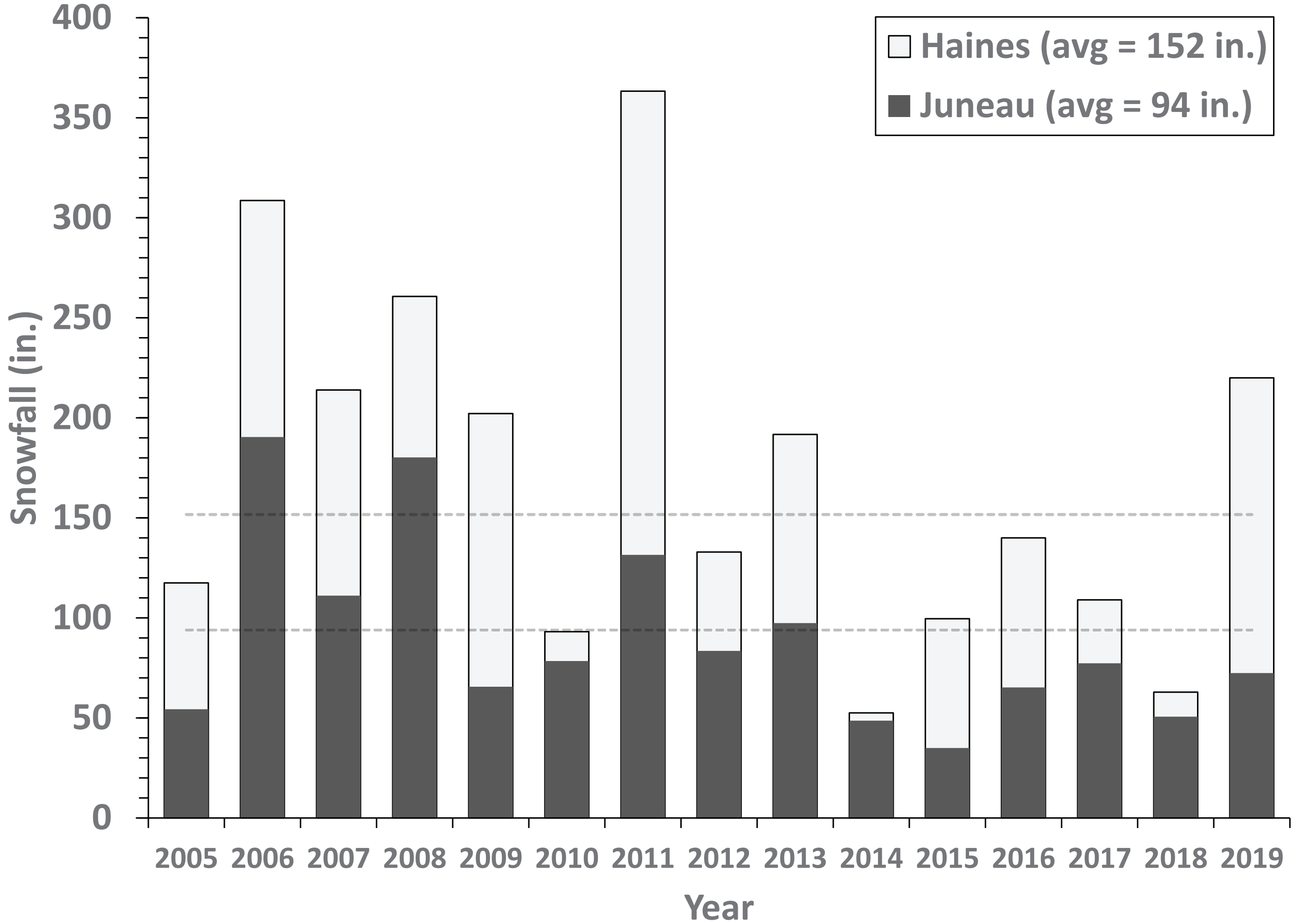
[a]3 above normal range (Porcupine area)

Appendix 3a: Monthly snowfall (in.) recorded at the Haines 2 COOP NWS Station in Haines, AK between 2005-2020.

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Total	% of normal
2005/2006	0	30	9	40	22	16	0	0	118	77%
2006/2007	0	42	78	81	28	78	3	0	309	203%
2007/2008	0	6	56	78	41	31	3	0	214	141%
2008/2009	22	24	56	62	45	43	9	0	261	172%
2009/2010	0	48	19	68	8	59	0	0	202	133%
2010/2011	0	24	25	19	20	3	3	0	93	61%
2011/2012	0	126	40	121	20	56	0	0	363	239%
2012/2013	4	20	41	21	23	10	14	1	133	88%
2013/2014	0	20	92	22	23	35	1	0	192	126%
2014/2015	0	0	5	14	18	16	0	0	53	35%
2015/2016	0	21	43	18	16	2	0	0	100	66%
2016/2017	13	11	43	22	19	33	0	0	140	92%
2017/2018	0	28	2	27	17	34	0	0	109	72%
2018/2019	0	15	28	5	11	3	1	0	63	41%
2019/2020	4	3	55	78	54	17	9	0	220	145%
Average, Study period	3	28	39	45	24	29	3	0	171	113%
Average, Long-term[1]	3	22	38	37	28	20	3	0	152	100%

[1]Haines Airport (1950-1955, 1973-1998) and Haines COOP NWS Station (1999-2019)

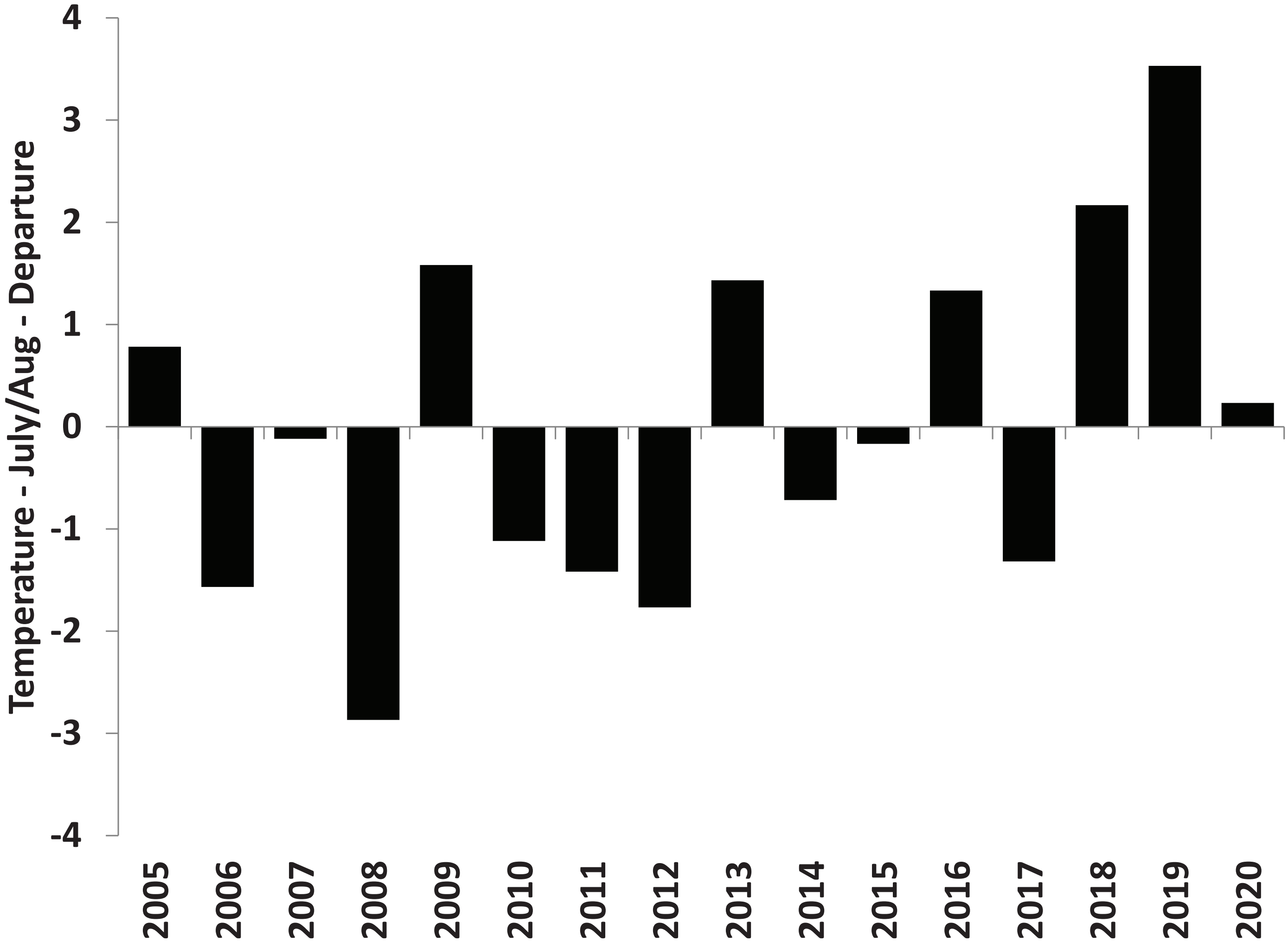
Appendix 3b: Total annual snowfall (in.) recorded at the Haines 2 COOP NWS Station in Haines, AK and the Juneau Airport between 2005-2020. The dashed lines designates the long-term average [upper line: Haines - Haines Airport (1950-1955, 1973-1998) and Haines 2 COOP NWS Station (1999-2020), lower line: Juneau - Juneau Airport (1950-2020)].



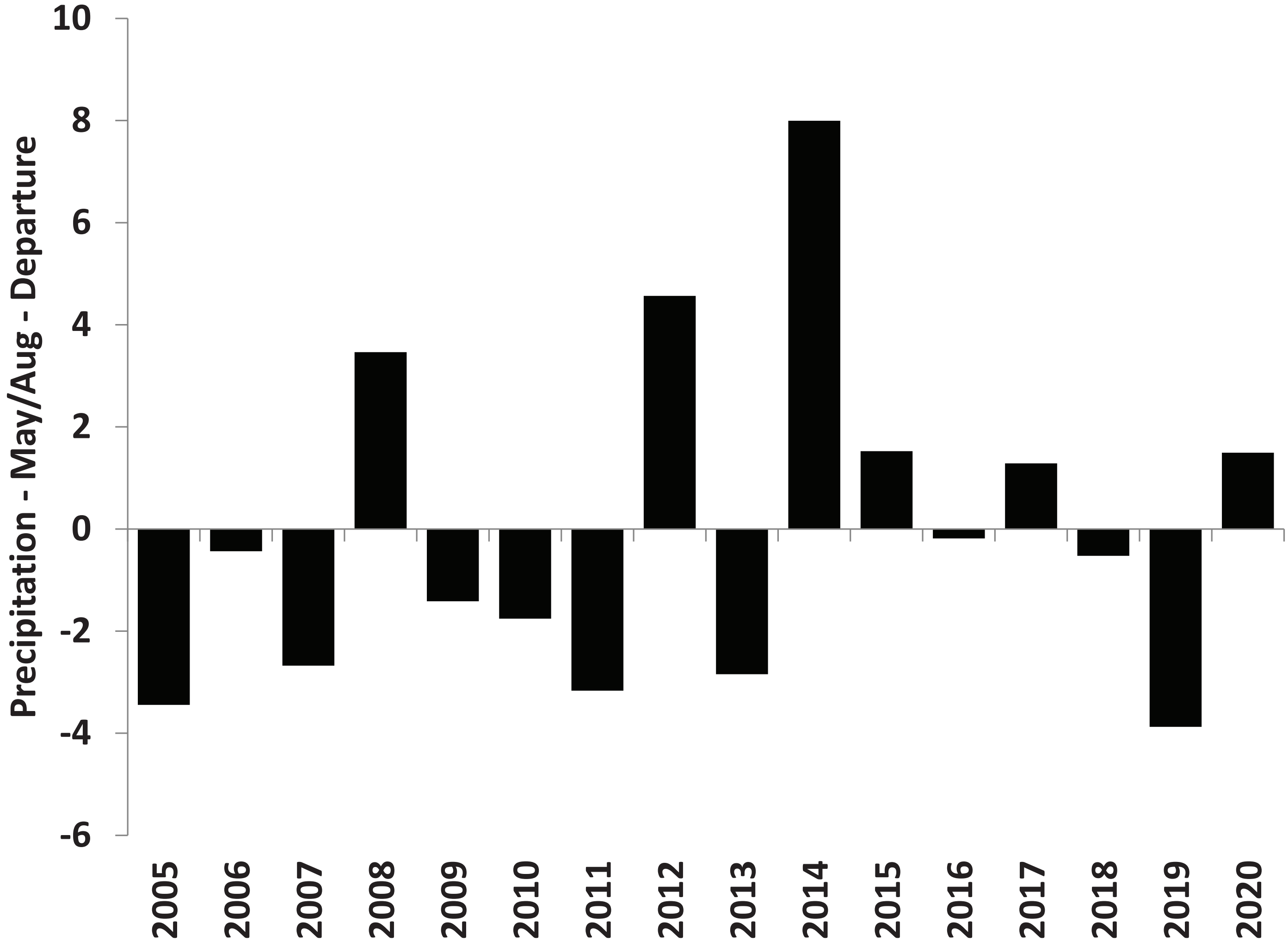
Appendix 3c: Summer temperature and precipitation (in.) recorded at the Haines 2 COOP NWS Station in Haines, AK between 2005-2020.

	Temperature - July/August						**Precipitation**				
	Farenheit			**Celcius**			**Inches**				
Year	**Mean - 0 ft.**	**Mean - 3000 ft.**[1]	**Departure**	**Mean - 0 ft.**	**Mean - 3000 ft.**[1]	**Departure**	**May/ June**	**July/ Aug**	**May- Aug**	**May-Aug Departure**	**Annual**[2]
2005/2006	**58.30**	**47.61**	**0.78**	**14.61**	**8.67**	**0.43**	**3.2**	**3.8**	**7.0**	**-3.4**	**64.1**
2006/2007	**55.95**	**45.26**	**-1.57**	**13.31**	**7.36**	**-0.87**	**6.4**	**3.6**	**10.0**	**-0.4**	**66.7**
2007/2008	**57.40**	**46.71**	**-0.12**	**14.11**	**8.17**	**-0.07**	**1.9**	**5.9**	**7.7**	**-2.7**	**56.5**
2008/2009	**54.65**	**43.96**	**-2.87**	**12.58**	**6.64**	**-1.59**	**4.6**	**9.3**	**13.9**	**3.5**	**62.6**
2009/2010	**59.10**	**48.41**	**1.58**	**15.06**	**9.11**	**0.88**	**0.7**	**8.3**	**9.0**	**-1.4**	**76.7**
2010/2011	**56.40**	**45.71**	**-1.12**	**13.56**	**7.61**	**-0.62**	**5.1**	**3.5**	**8.7**	**-1.8**	**49.1**
2011/2012	**56.10**	**45.41**	**-1.42**	**13.39**	**7.45**	**-0.79**	**1.3**	**5.9**	**7.2**	**-3.2**	**84.9**
2012/2013	**55.75**	**45.06**	**-1.77**	**13.19**	**7.25**	**-0.98**	**8.6**	**6.4**	**15.0**	**4.6**	**53.7**
2013/2014	**58.95**	**48.26**	**1.43**	**14.97**	**9.03**	**0.80**	**4.9**	**2.7**	**7.6**	**-2.8**	**54.4**
2014/2015	**56.80**	**46.11**	**-0.72**	**13.78**	**7.84**	**-0.40**	**6.6**	**11.8**	**18.4**	**8.0**	**69.2**
2015/2016	**57.35**	**46.66**	**-0.17**	**14.08**	**8.14**	**-0.09**	**3.0**	**9.0**	**11.9**	**1.5**	**73.4**
2016/2017	**58.85**	**48.16**	**1.33**	**14.92**	**8.98**	**0.74**	**6.8**	**3.4**	**10.2**	**-0.2**	**60.8**
2017/2018	**56.20**	**45.51**	**-1.32**	**13.44**	**7.50**	**-0.73**	**5.4**	**6.3**	**11.7**	**1.3**	**54.1**
2018/2019	**59.69**	**48.99**	**2.17**	**15.38**	**9.44**	**1.20**	**6.2**	**3.7**	**9.9**	**-0.5**	**50.1**
2019/2020	**61.05**	**50.35**	**3.53**	**16.14**	**10.20**	**1.96**	**3.4**	**3.1**	**6.5**	**-3.9**	**56.7**
2020/2021	**57.75**	**47.06**	**0.23**	**14.31**	**8.36**	**0.13**	**3.3**	**8.6**	**11.9**	**1.5**	**--**
Average, Study period	**57.52**	**46.82**	**0.00**	**14.18**	**8.24**	**0.00**	**4.4**	**6.0**	**10.4**	**0.0**	**62.2**

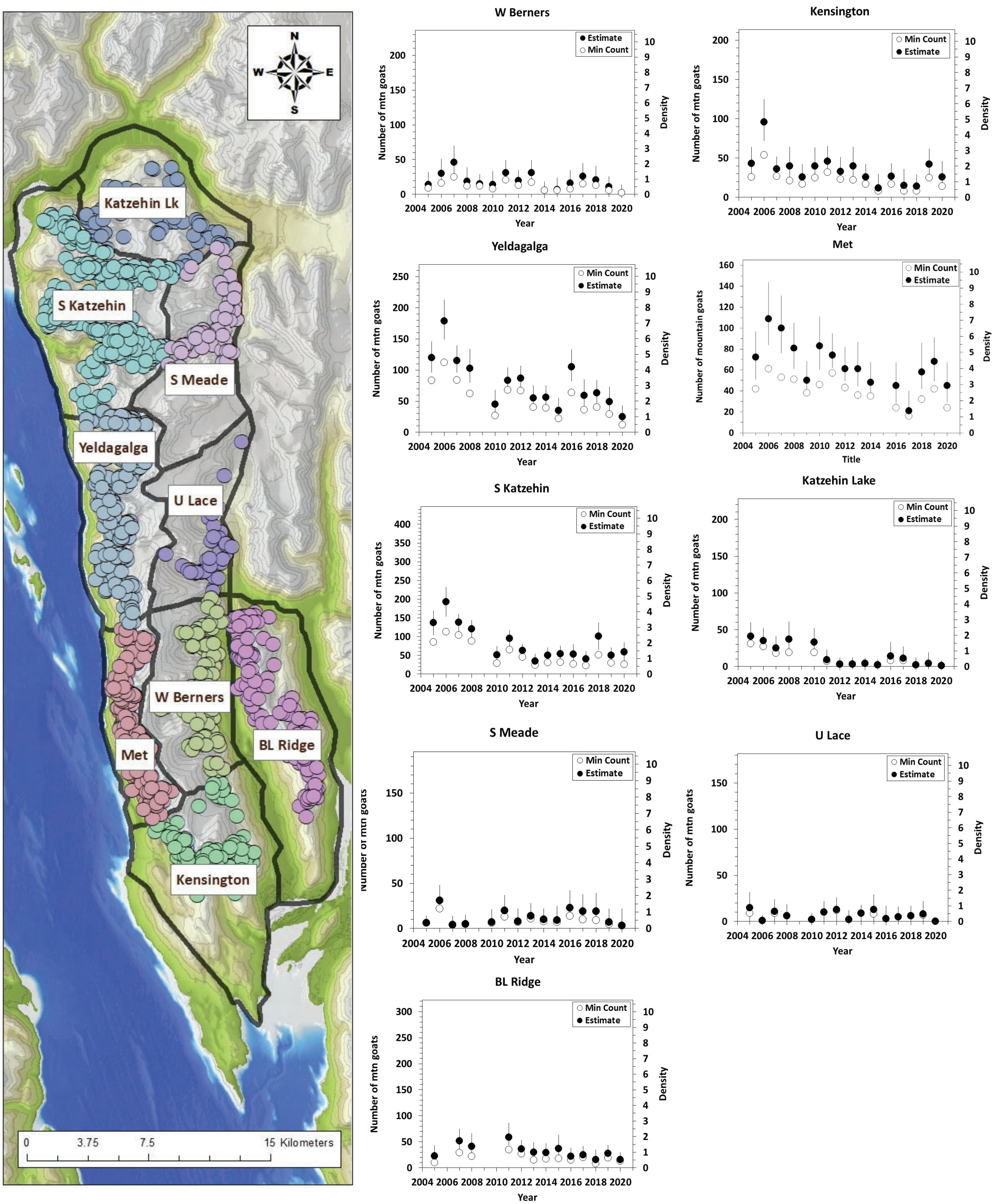
Appendix 3d: Departure from normal average temperature (F) during July-August recorded at the Haines 2 COOP NWS Station in Haines, AK between 2005-2020.



Appendix 3e: Departure from normal precipitation (in.) during May-August recorded at the Haines 2 COOP NWS Station in Haines, AK between 2005-2020.



Appendix 4: Mountain goat aerial survey areas in the Kakuhan Range (Lions Head, Sinclair and Berners-Lace Ridge study areas). Each area was surveyed by fixed- and/or rotor-wing aircraft during August-October, 2005-2020. Summer range population size and density (mountain goats/km²) estimates were derived using sightability and RSF modeling and described in associated figures.



Appendix 5a: Summary of mountain goat population composition, minimum count and population estimates based on data collected during aerial surveys on the Lions Head study area (and associated survey areas), 2005-2020. “Minimum counts” represent the number of mountain goats seen during aerial surveys and do not account for variation in sighting probabilities between surveys/years. Population estimates explicitly account for variation in group-level sighting probabilities among surveys/years.

				Minimum Count				Population Estimate				
Study Area	Survey Area	Year	Weather	Adults	Kids	Total	Prop. Kids	Total	LHPDI	UHPDI	Density	Area (km^2)
Lions Head	W Berners	2005	Clear	9	0	9	0.00	14	5	18	0.6	22.0
Lions Head	W Berners	2006	Partly Cloudy	16	0	16	0.00	30	12	21	1.4	22.0
Lions Head	W Berners	2007	Clear	18	7	25	0.28	46	17	24	2.1	22.0
Lions Head	W Berners	2008	Partly Cloudy	11	1	12	0.08	19	7	20	0.9	22.0
Lions Head	W Berners	2009	Overcast	9	3	12	0.25	15	3	14	0.7	22.0
Lions Head	W Berners	2010	Clear	7	1	8	0.13	14	6	19	0.6	22.0
Lions Head	W Berners	2011	Overcast	17	4	21	0.19	31	9	18	1.4	22.0
Lions Head	W Berners	2012	Overcast	11	2	13	0.15	20	7	15	0.9	22.0
Lions Head	W Berners	2013	Partly Cloudy	15	2	17	0.12	31	12	18	1.4	22.0
Lions Head	W Berners	2014	Overcast	5	1	6	0.17	6	0	12	0.3	22.0
Lions Head	W Berners	2015	Clear	5	1	6	0.17	7	1	17	0.3	22.0
Lions Head	W Berners	2016	Clear	7	1	8	0.13	16	8	19	0.7	22.0
Lions Head	W Berners	2017	Clear	14	1	15	0.07	26	11	19	1.2	22.0
Lions Head	W Berners	2018	Clear	10	3	13	0.23	21	8	20	1.0	22.0
Lions Head	W Berners	2019	Partly Cloudy	6	0	6	0.00	11	5	15	0.5	22.0
Lions Head	W Berners	2020	Clear	2	0	2	0.00	2	0	12	0.1	22.0
Lions Head	Kensington	2005	Clear	21	5	26	0.19	43	14	21	2.2	19.9
Lions Head	Kensington	2006	Partly Cloudy	48	6	54	0.11	96	24	29	4.8	19.9
Lions Head	Kensington	2007	Overcast	24	3	27	0.11	36	9	16	1.8	19.9
Lions Head	Kensington	2008	Clear	17	4	21	0.19	40	15	24	2.0	19.9
Lions Head	Kensington	2009	Overcast	13	4	17	0.24	26	9	16	1.3	19.9
Lions Head	Kensington	2010	Clear	18	7	25	0.28	40	12	23	2.0	19.9
Lions Head	Kensington	2011	Overcast	25	7	32	0.22	46	12	19	2.3	19.9
Lions Head	Kensington	2012	Overcast	20	3	23	0.13	33	9	18	1.7	19.9
Lions Head	Kensington	2013	Partly Cloudy	17	5	22	0.23	40	14	24	2.0	19.9
Lions Head	Kensington	2014	Overcast	16	1	17	0.06	26	9	16	1.3	19.9
Lions Head	Kensington	2015	Clear	6	2	8	0.25	12	4	18	0.6	19.9
Lions Head	Kensington	2016	Clear	13	4	17	0.24	27	10	16	1.4	19.9
Lions Head	Kensington	2017	Clear	8	0	8	0.00	15	7	21	0.8	19.9
Lions Head	Kensington	2018	Clear	7	1	8	0.13	14	6	15	0.7	19.9
Lions Head	Kensington	2019	Partly Cloudy	19	6	25	0.24	42	14	20	2.1	19.9
Lions Head	Kensington	2020	Clear	14	0	14	0.00	26	11	20	1.3	19.9
Lions Head	Met	2005	Clear	35	7	42	0.17	72	21	25	4.7	15.4
Lions Head	Met	2006	Clear	47	14	61	0.23	109	25	35	7.1	15.4
Lions Head	Met	2007	Clear	48	5	53	0.09	100	24	31	6.5	15.4
Lions Head	Met	2008	Clear	38	13	51	0.25	81	20	24	5.3	15.4
Lions Head	Met	2009	Overcast	29	9	38	0.24	50	11	18	3.3	15.4
Lions Head	Met	2010	Clear	32	14	46	0.30	83	23	28	5.4	15.4
Lions Head	Met	2011	Overcast	42	15	57	0.26	74	12	21	4.8	15.4
Lions Head	Met	2012	Overcast	36	7	43	0.16	61	12	21	4.0	15.4
Lions Head	Met	2013	Partly Cloudy	27	9	36	0.25	61	17	26	4.0	15.4
Lions Head	Met	2014	Overcast	26	9	35	0.26	48	11	19	3.1	15.4
Lions Head	Met	2015	--	--	--	--	--	--	--	--	--	15.4
Lions Head	Met	2016	Clear	17	7	24	0.29	45	17	22	2.9	15.4
Lions Head	Met	2017	Clear	12	4	16	0.25	21	5	19	1.4	15.4
Lions Head	Met	2018	Clear	25	7	32	0.22	58	16	28	3.8	15.4
Lions Head	Met	2019	Partly Cloudy	29	13	42	0.31	68	19	23	4.4	15.4
Lions Head	Met	2020	Clear	19	5	24	0.21	45	16	22	2.9	15.4

Appendix 5b: Summary of mountain goat population composition, minimum count and population estimates based on data collected during aerial surveys on the Mt. Sinclair study area (and associated survey areas), 2005-2020. "Minimum counts" represent the number of mountain goats seen during aerial surveys and do not account for variation in sighting probabilities between surveys/years. Population estimates explicitly account for variation in group-level sighting probabilities among surveys/years.

				Minimum Count				Population Estimate				
Study Area	Survey Area	Year	Weather	Adults	Kids	Total	Kids	Total	LHPDI	UHPDI	Density	Area (km^2)
Sinclair	Yeldagalga	2005	Clear	67	16	83	0.19	120	24	26	4.8	25.1
Sinclair	Yeldagalga	2006	Clear	95	17	112	0.15	179	30	34	7.1	25.1
Sinclair	Yeldagalga	2007	Overcast	69	15	84	0.18	115	19	24	4.6	25.1
Sinclair	Yeldagalga	2008	Clear	50	12	62	0.19	103	23	31	4.1	25.1
Sinclair	Yeldagalga	2009	--	--	--	--	--	--	--	--	--	25.1
Sinclair	Yeldagalga	2010	Clear	20	7	27	0.26	45	14	23	1.8	25.1
Sinclair	Yeldagalga	2011	Overcast	54	14	68	0.21	83	11	21	3.3	25.1
Sinclair	Yeldagalga	2012	Overcast	58	9	67	0.13	87	15	20	3.5	25.1
Sinclair	Yeldagalga	2013	Overcast	32	8	40	0.20	55	12	20	2.2	25.1
Sinclair	Yeldagalga	2014	Overcast	30	9	39	0.23	56	13	19	2.2	25.1
Sinclair	Yeldagalga	2015	Clear	15	7	22	0.32	35	12	20	1.4	25.1
Sinclair	Yeldagalga	2016	Clear	49	15	64	0.23	105	23	28	4.2	25.1
Sinclair	Yeldagalga	2017	Clear	26	10	36	0.28	59	16	26	2.4	25.1
Sinclair	Yeldagalga	2018	Clear	30	10	40	0.25	63	18	21	2.5	25.1
Sinclair	Yeldagalga	2019	Partly Cloudy	23	6	29	0.21	49	16	24	2.0	25.1
Sinclair	Yeldagalga	2020	Clear	10	2	12	0.17	25	11	18	1.0	25.1
Sinclair	S Katzehin	2005	Clear	72	13	85	0.15	137	26	33	3.3	41.6
Sinclair	S Katzehin	2006	Clear	94	19	113	0.17	193	33	39	4.6	41.6
Sinclair	S Katzehin	2007	Overcast	84	20	104	0.19	138	19	23	3.3	41.6
Sinclair	S Katzehin	2008	Overcast	69	19	88	0.22	121	20	23	2.9	41.6
Sinclair	S Katzehin	2009	--	--	--	--	--	--	--	--	--	41.6
Sinclair	S Katzehin	2010	Clear	23	6	29	0.21	51	16	24	1.2	41.6
Sinclair	S Katzehin	2011	Overcast	51	14	65	0.22	95	19	22	2.3	41.6
Sinclair	S Katzehin	2012	Overcast	39	6	45	0.13	63	14	18	1.5	41.6
Sinclair	S Katzehin	2013	Overcast	20	4	24	0.17	35	9	19	0.8	41.6
Sinclair	S Katzehin	2014	Overcast	26	5	31	0.16	50	14	21	1.2	41.6
Sinclair	S Katzehin	2015	Clear	25	7	32	0.22	54	16	22	1.3	41.6
Sinclair	S Katzehin	2016	Clear	21	6	27	0.22	53	20	27	1.3	41.6
Sinclair	S Katzehin	2017	Clear	22	1	23	0.04	40	15	21	1.0	41.6
Sinclair	S Katzehin	2018	Clear	38	13	51	0.25	101	25	36	2.4	41.6
Sinclair	S Katzehin	2019	Partly Cloudy	26	4	30	0.13	50	16	21	1.2	41.6
Sinclair	S Katzehin	2020	Clear	22	4	26	0.15	59	23	25	1.4	41.6
Sinclair	Katzehin Lk	2005	Clear	23	8	31	0.26	41	10	19	1.9	21.2
Sinclair	Katzehin Lk	2006	Overcast	25	2	27	0.07	35	7	17	1.6	21.2
Sinclair	Katzehin Lk	2007	Overcast	16	2	18	0.11	25	7	16	1.2	21.2
Sinclair	Katzehin Lk	2008	Clear	15	4	19	0.21	37	15	24	1.7	21.2
Sinclair	Katzehin Lk	2009	--	--	--	--	--	--	--	--	--	21.2
Sinclair	Katzehin Lk	2010	Clear	14	5	19	0.26	33	14	19	1.6	21.2
Sinclair	Katzehin Lk	2011	Overcast	6	1	7	0.14	9	2	14	0.4	21.2
Sinclair	Katzehin Lk	2012	Overcast	3	0	3	0.00	3	0	9	0.1	21.2
Sinclair	Katzehin Lk	2013	Overcast	2	1	3	0.33	3	0	9	0.1	21.2
Sinclair	Katzehin Lk	2014	Overcast	3	1	4	0.25	4	0	7	0.2	21.2
Sinclair	Katzehin Lk	2015	Clear	2	0	2	0.00	2	0	7	0.1	21.2
Sinclair	Katzehin Lk	2016	Clear	7	1	8	0.13	14	6	19	0.7	21.2
Sinclair	Katzehin Lk	2017	Clear	7	1	8	0.13	11	3	16	0.5	21.2
Sinclair	Katzehin Lk	2018	Clear	2	0	2	0.00	2	0	10	0.1	21.2
Sinclair	Katzehin Lk	2019	Partly Cloudy	4	0	4	0.00	4	0	15	0.2	21.2
Sinclair	Katzehin Lk	2020	Clear	1	0	1	0.00	1	0	7	0.0	21.2

Appendix 5c: Summary of mountain goat population composition, minimum count and population estimates based on data collected during aerial surveys on the Meade Icefield and Berners-Lace Ridge study areas (and associated survey areas), 2005-2020. "Minimum counts" represent the number of mountain goats seen during aerial surveys and do not account for variation in sighting probabilities between surveys/years. Population estimates explicitly account for variation in group-level sighting probabilities among surveys/years.

				Minimum Count				Population Estimate				
Study Area	Survey Area	Year	Weather	Adults	Kids	Total	Kids	Total	LHPDI	UHPDI	Density	Area (km^2)
Icefield	U Lace	2005	Clear	9	0	9	0.00	15	6	17	0.9	16.9
Icefield	U Lace	2006	Partly Cloudy	1	0	1	0.00	1	0	6	0.1	16.9
Icefield	U Lace	2007	Overcast	8	1	9	0.11	11	2	13	0.7	16.9
Icefield	U Lace	2008	Overcast	6	0	6	0.00	6	0	13	0.4	16.9
Icefield	U Lace	2009	--	--	--	--	--	--	--	--	--	16.9
Icefield	U Lace	2010	Clear	1	1	2	0.50	2	0	7	0.1	16.9
Icefield	U Lace	2011	Overcast	6	4	10	0.40	10	0	12	0.6	16.9
Icefield	U Lace	2012	Overcast	9	3	12	0.25	13	1	13	0.8	16.9
Icefield	U Lace	2013	Overcast	2	0	2	0.00	2	0	10	0.1	16.9
Icefield	U Lace	2014	Overcast	6	3	9	0.33	9	0	9	0.5	16.9
Icefield	U Lace	2015	Clear	7	1	8	0.13	13	5	16	0.8	16.9
Icefield	U Lace	2016	Clear	3	0	3	0.00	3	0	14	0.2	16.9
Icefield	U Lace	2017	Clear	3	2	5	0.40	5	0	11	0.3	16.9
Icefield	U Lace	2018	Clear	4	2	6	0.33	6	0	11	0.4	16.9
Icefield	U Lace	2019	Partly Cloudy	4	3	7	0.43	8	1	14	0.5	16.9
Icefield	U Lace	2020	Clear	0	0	0	0.00	0	0	0	0.0	16.9
Icefield	S Meade	2005	Clear	5	1	6	0.17	6	0	8	0.3	18.2
Icefield	S Meade	2006	Overcast	19	3	22	0.14	31	8	17	1.7	18.2
Icefield	S Meade	2007	Overcast	3	1	4	0.25	4	0	10	0.2	18.2
Icefield	S Meade	2008	Overcast	5	0	5	0.00	5	0	10	0.3	18.2
Icefield	S Meade	2009	--	--	--	--	--	--	--	--	--	18.2
Icefield	S Meade	2010	Clear	4	2	6	0.33	7	1	14	0.4	18.2
Icefield	S Meade	2011	Overcast	10	3	13	0.23	20	7	17	1.1	18.2
Icefield	S Meade	2012	Overcast	7	0	7	0.00	8	1	14	0.4	18.2
Icefield	S Meade	2013	Overcast	10	1	11	0.09	14	3	14	0.8	18.2
Icefield	S Meade	2014	Overcast	5	3	8	0.38	10	2	12	0.5	18.2
Icefield	S Meade	2015	Clear	5	2	7	0.29	9	2	16	0.5	18.2
Icefield	S Meade	2016	Clear	12	2	14	0.14	23	8	19	1.3	18.2
Icefield	S Meade	2017	Clear	9	1	10	0.10	19	9	19	1.0	18.2
Icefield	S Meade	2018	Clear	8	1	9	0.11	19	10	20	1.0	18.2
Icefield	S Meade	2019	Partly Cloudy	5	0	5	0.00	7	2	15	0.4	18.2
Icefield	S Meade	2020	Clear	3	0	3	0.00	3	0	19	0.2	18.2
BL Ridge	BL Ridge	2005	Clear	10	0	10	0.00	23	12	20	0.8	30.0
BL Ridge	BL Ridge	2006	--	--	--	--	--	--	--	--	--	30.0
BL Ridge	BL Ridge	2007	Clear	25	4	29	0.14	52	18	23	1.7	30.0
BL Ridge	BL Ridge	2008	Clear	19	3	22	0.14	41	15	25	1.4	30.0
BL Ridge	BL Ridge	2009	--	--	--	--	--	--	--	--	--	30.0
BL Ridge	BL Ridge	2010	--	--	--	--	--	--	--	--	--	30.0
BL Ridge	BL Ridge	2011	Clear	26	9	35	0.26	59	15	27	2.0	30.0
BL Ridge	BL Ridge	2012	Overcast	24	3	27	0.11	36	9	17	1.2	30.0
BL Ridge	BL Ridge	2013	Partly Cloudy	13	2	15	0.13	30	13	19	1.0	30.0
BL Ridge	BL Ridge	2014	Overcast	15	2	17	0.12	29	11	18	1.0	30.0
BL Ridge	BL Ridge	2015	Clear	15	3	18	0.17	37	14	26	1.2	30.0
BL Ridge	BL Ridge	2016	Overcast	13	2	15	0.13	22	7	16	0.7	30.0
BL Ridge	BL Ridge	2017	Overcast	16	4	20	0.20	25	5	17	0.8	30.0
BL Ridge	BL Ridge	2018	Clear	7	1	8	0.13	16	8	19	0.5	30.0
BL Ridge	BL Ridge	2019	Overcast	13	6	19	0.32	28	9	16	0.9	30.0
BL Ridge	BL Ridge	2020	Overcast	11	2	13	0.15	16	3	14	0.5	30.0

Appendix 6: Summary of mountain goats captured and monitored in the Lions Head and Mt. Sinclair study areas during 2005-2021, Lynn Canal, AK.

Mtn Goat ID	Date - Capture	Year	Sex	Est. Age	Kid	Weight (lbs.)	Fate	Date - Fate	Days Monitored
LG001	9/26/05	2005	M	9	--	308	Died	4/17/06	203
LG002	9/26/05	2005	F	11	1	140	Died	4/16/06	202
LG003	9/26/05	2005	F	7	1	180	Died	4/10/07	561
LG004	9/26/05	2005	F	7	1	196	Release	8/15/07	688
LG005	9/26/05	2005	M	9	--		Died	5/9/07	590
LG006	10/2/05	2005	M	8	--	347	Died	2/10/06	131
LG007	10/2/05	2005	M	2	--	163	Release	8/15/07	682
LG008	10/2/05	2005	F	5	0	171	Died	7/8/13	2836
LG008	8/15/10	2010	F	7	1	172	Died	7/8/13	1058
LG009	10/2/05	2005	F	10	0		Release	8/15/07	682
LG010	10/3/05	2005	F	7	?	187	Release	8/15/07	681
LG011	10/3/05	2005	M	9	--	335	Died	2/11/07	496
LG016	10/14/05	2005	M	5	--	273	Release	8/15/07	670
LG019	10/15/05	2005	M	5	--	273	Died	6/26/06	254
LG020	10/15/05	2005	M	8	--	285	Release	8/15/07	669
LG021	10/15/05	2005	F	4	0	194	Release	8/15/07	669
LG022	10/15/05	2005	F	8	?		Release	8/15/07	669
LG023	10/15/05	2005	M	9	--	221	Release	8/15/07	669
LG024	7/28/06	2006	M	3	--	134	Died	7/13/08	716
LG025	7/28/06	2006	F	6	?	130	Died	5/11/07	287
LG026	7/28/06	2006	M	6	--	251	Died	11/17/06	112
LG027	7/28/06	2006	M	10	--	274	Died	12/31/07	521
LG028	7/28/06	2006	M	8	--		Died	7/18/07	355
LG029	7/28/06	2006	F	7	?	160	Release	9/11/08	776
LG030	7/28/06	2006	F	8	?		Died	4/25/07	271
LG036	7/29/06	2006	M	6	--	308	Release	9/11/08	775
LG037	7/29/06	2006	M	4	--	216	Died	2/18/08	569
LG038	7/29/06	2006	F	4	?	141	Release	9/11/08	775
LG039	8/29/06	2006	F	10	0	165	Died	5/10/07	254
LG040	8/29/06	2006	M	8	--		Died	4/24/12	2065
LG040	9/24/08	2008	M	10	--	309	Died	4/24/12	1308
LG041	8/29/06	2006	F	5	1		Release	9/11/08	744
LG045	9/25/06	2006	F	6	0	185	Release	9/11/08	717
LG050	10/7/06	2006	M	8	--	250	Died	4/17/07	192
LG051	10/7/06	2006	F	2	0	145	Release	9/11/08	705
LG052	10/7/06	2006	F	3	0	160	Release	9/11/08	705
LG053	10/7/06	2006	M	3	--	171	Release	9/11/08	705
LG060	10/13/06	2006	M	5	--	287	Release	9/1/08	689
LG061	10/13/06	2006	M	10	--	350	Died	5/15/09	945
LG061	8/18/08	2008	M	12	--	301	Died	5/15/09	270
LG062	10/13/06	2006	M	10	--	310	Release	9/1/08	689
LG063	10/13/06	2006	M	10	--	297	Died	3/16/07	154
LG064	10/13/06	2006	M	4	--	281	Died	10/4/07	356
LG069	7/29/07	2007	M	1	--	95	Died	10/31/08	460
LG075	8/2/07	2007	M	3	--	141	Died	7/7/08	340
LG076	8/2/07	2007	F	4	1	155	Died	8/8/09	737
LG077	8/2/07	2007	M	6	--	249	Died	10/17/08	442

Appendix 6 (continued): Summary of mountain goats captured and monitored in the Lions Head and Mt. Sinclair study areas during 2005-2021, Lynn Canal, AK.

Mtn Goat ID	Date - Capture	Year	Sex	Est. Age	Kid	Weight (lbs.)	Fate	Date - Fate	Days Monitored
LG078	8/2/07	2007	F	9	1	175	Release	9/11/08	406
LG079	8/2/07	2007	M	11	--	269	Died	8/24/07	22
LG080	8/2/07	2007	M	6	--	281	Release	9/11/08	406
LG081	8/2/07	2007	M	4	--	217	Release	9/11/08	406
LG083	8/3/07	2007	M	5	--	258	Died	6/11/11	1408
LG084	8/3/07	2007	M	4	--	180	Died	4/12/11	1348
LG086	8/11/07	2007	M	4	--	223	Died	10/7/08	423
LG087	8/11/07	2007	M	5	--	233	Died	2/21/10	925
LG088	8/11/07	2007	F	8	0	160	Died	11/1/09	813
LG089	8/11/07	2007	M	4	--	240	Died	11/1/09	813
LG090	8/11/07	2007	F	3	0	157	Release	9/11/08	397
LG097	8/16/08	2008	F	5	1	151	Release	6/7/11	1025
LG098	8/16/08	2008	M	6	--	279	Died	2/15/14	2009
LG098	8/16/12	2012	M	10	--	302	Died	2/15/14	548
LG099	8/18/08	2008	M	6	--	266	Release	6/7/11	1023
LG100	8/18/08	2008	F	10	1	163	Died	10/6/08	49
LG101	8/18/08	2008	M	5	--	277	Died	10/8/09	416
LG102	8/18/08	2008	M	7	--	328	Died	4/3/13	1689
LG103	8/18/08	2008	F	7	0	185	Died	10/14/12	1518
LG103	9/10/11	2011	F	10	0		Died	10/14/12	400
LG104	8/18/08	2008	F	6	0	192	Release	6/7/11	1023
LG106	8/19/08	2008	M	5	--	242	Died	4/17/10	606
LG112	9/21/08	2008	F	11	1	199	Died	2/4/09	136
LG117	9/24/08	2008	F	3	0	170	Release	6/7/11	986
LG118	9/24/08	2008	F	3	0	166	Release	6/7/11	986
LG119	9/24/08	2008	M	4	--	237	Release	10/31/18	3689
LG120	9/24/08	2008	F	5	1	175	Died	3/22/09	179
LG124	8/5/09	2009	M	5	--	291	Died	3/2/12	940
LG125	8/5/09	2009	F	4	0	150	Died	4/11/14	1710
LG126	8/5/09	2009	F	6	1	175	Died	10/15/12	1167
LG127	8/5/09	2009	F	11	1	182	Died	3/9/10	216
LG128	8/5/09	2009	F	6	0	170	Died	7/27/10	356
LG136	9/1/09	2009	F	2	0	131	Died	10/18/09	47
LG137	9/1/09	2009	M	9	--	342	Died	6/19/12	1022
LG141	8/15/10	2010	M	7	--	307	Died	1/15/15	1614
LG143	8/15/10	2010	F	6	1	175	Died	5/7/13	996
LG144	8/15/10	2010	F	6	1	163	Died	6/14/11	303
LG145	8/15/10	2010	F	6	1	192	Release	9/20/17	2593
LG146	8/15/10	2010	M	2	--	134	Died	7/12/12	697
LG147	9/10/11	2011	F	3	0	145	Died	10/11/12	397
LG148	9/10/11	2011	F	6	0	182	Died	9/11/17	2193
LG149	9/10/11	2011	F	6	0	164	Died	8/28/12	353
LG150	9/10/11	2011	M	5	--	234	Died	5/19/13	617
LG151	9/10/11	2011	F	5	1	180	Died	6/24/12	288
LG152	9/10/11	2011	M	11	--	296	Died	5/21/12	254
LG153	9/10/11	2011	M	5	--	243	Died	11/8/16	1886
LG154	8/16/12	2012	F	2	0	151	Died	8/7/17	1817

Appendix 6 (continued): Summary of mountain goats captured and monitored in the Lions Head and Mt. Sinclair study areas during 2005-2021, Lynn Canal, AK.

Mtn Goat ID	Date - Capture	Year	Sex	Est. Age	Kid	Weight (lbs.)	Fate	Date - Fate	Days Monitored
LG155	8/16/12	2012	F	12	0	186	Died	5/8/13	265
LG156	8/16/12	2012	M	6	--	265	Died	1/24/14	526
LG157	8/16/12	2012	M	4	--	282	Died	1/18/18	1981
LG158	8/16/12	2012	M	4	--	192	Died	1/5/14	507
LG159	8/16/12	2012	M	3	--		Died	10/11/14	786
LG160	10/10/12	2012	F	2	0	172	Release	11/27/19	2604
LG161	10/10/12	2012	F	3	0	160	Release	2/11/20	2680
LG162	8/15/13	2013	M	8	--	325	Died	1/7/17	1241
LG163	8/15/13	2013	M	3	--	170	Died	7/7/15	691
LG164	8/15/13	2013	F	7	1	180	Died	2/10/17	1275
LG166	8/15/13	2013	M	2	--		Died	6/29/14	318
LG167	8/20/14	2014	F	11	0	208	Died	1/17/17	881
LG168	8/20/14	2014	F	5	1	193	Alive	3/8/21	2392
LG169	8/20/14	2014	F	9	0	155	Died	10/15/16	787
LG170	8/20/14	2014	M	7	--	254	Died	11/7/14	79
LG172	8/20/14	2014	M	3	--	174	Died	8/3/18	1444
LG173	8/20/14	2014	M	6	--	268	Died	11/19/16	822
LG174	8/20/14	2014	F	10	1		Died	11/7/17	1175
LG175	8/25/15	2015	F	4	0	202	Alive	3/8/21	2022
LG176	8/25/15	2015	M	6	--		Alive	7/5/20	1776
LG177	8/25/15	2015	F	11	1	211	Alive	10/30/19	1527
LG178	8/25/15	2015	M	6	--	300	Alive	11/14/20	1908
LG179	8/25/15	2015	F	4	1		Release	7/5/18	1045
LG180	8/25/15	2015	F	1	0		Died	4/15/16	234
LG181	9/2/16	2016	M	7	--	295	Died	12/28/16	117
LG182	9/2/16	2016	M	6	--	331	Died	4/5/17	215
LG183	9/2/16	2016	F	9	1	191	Died	10/10/17	403
LG184	9/2/16	2016	M	5	--	321	Died	12/2/18	821
LG185	9/2/16	2016	F	5	0	193	Died	8/7/17	339
LG186	9/2/16	2016	F	7	1	200	Alive	5/5/20	1341
LG187	9/2/16	2016	M	5	--		Died	10/23/16	51
LG188	9/2/16	2016	M	4	--		Alive	3/8/21	1648
LG189	8/10/17	2017	M	4	--	321	Alive	1/3/20	876
LG190	8/10/17	2017	M	3	--		Alive	3/8/21	1306
LG191	8/10/17	2017	F	6	1	170	Alive	3/8/21	1306
LG192	8/10/17	2017	F	6	1	172	Alive	6/3/20	1028
LG193	8/10/17	2017	M	9	--		Alive	5/5/20	999
LG194	8/10/17	2017	F	8	1	179	Alive	3/8/21	1306
LG195	8/10/17	2017	F	3	0	156	Alive	3/8/21	1306
LG196	8/10/17	2017	M	4	--	209	Alive	8/18/19	738
LG197	7/31/18	2018	M	4	--	261	Alive	3/13/20	591
LG198	7/31/18	2018	F	4	0		Alive	2/18/20	567
LG199	7/31/18	2018	M	2	--		Alive	3/8/21	951
LG200	7/31/18	2018	F	5	1	172	Alive	3/8/21	951
LG201	8/1/18	2018	M	2	--	168	Alive	3/8/21	950
LG202	8/1/18	2018	F	7	0	170	Alive	11/14/20	836

Appendix 6 (continued): Summary of mountain goats captured and monitored in the Lions Head and Mt. Sinclair study areas during 2005-2021, Lynn Canal, AK.

Mtn Goat ID	Date - Capture	Year	Sex	Est. Age	Kid	Weight (lbs.)	Fate	Date - Fate	Days Monitored
LG204	7/31/19	Makalu	M	5	--		Alive	3/8/21	586
LG205	8/2/19	Kame	F	3	0	158	Alive	3/8/21	584
LG206	8/2/19	Alicia	F	1	0	133	Alive	3/8/21	584
LG207	8/2/19	Lago	M	2	--	145	Alive	3/8/21	584
LG208	8/2/19	Wags	M	4	--	226	Alive	3/8/21	584
LG209	8/2/19	Moulin	F	2	0	127	Alive	3/8/21	584
LG210	8/2/19	Pika	F	3	1	151	Alive	3/8/21	584
LG211	8/20/20	Hogback	F	11	0	180	Alive	3/8/21	200
LG212	8/20/20	Rampart	M	2	--	157	Alive	3/8/21	200
LG213	9/11/20	Finn	M	3	--	226	Alive	3/8/21	178
LG214	9/11/20	Raindrop	F	4	1	182	Alive	3/8/21	178
LG215	9/11/20	Scout	M	2	--	172	Alive	3/8/21	178
LG216	9/11/20	Bolt	F	9	1	205	Alive	3/8/21	178