

June 27, 2016

By Electronic Mail and Certified Mail, Return Receipt Requested

The Honorable Sally Jewell
Secretary of the Interior
U.S. Department of the Interior
1849 C Street, N.W.
Washington, D.C. 20240
E: exsec@ios.doi.gov

Re: Petition for certification pursuant to 22 U.S.C. § 1978 of actions undertaken by Canadian nationals diminishing the effectiveness of the Convention on Nature Protection and Wild Life Preservation in the Western Hemisphere and the Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean.

Dear Secretary Jewell:

The undersigned groups submit this petition, pursuant to the Pelly Amendment to the Fishermen's Protective Act of 1967,¹ seeking an investigation and potential certification to the President of actions by Canadian nationals that are likely to result in takings that diminish the effectiveness of two international programs for endangered or threatened species. By developing and operating mines in the Taku, Stikine, and Unuk river watersheds in British Columbia, Canadian nationals are or will be engaging in conduct that is likely to cause takings that diminish the effectiveness of the protections of woodland caribou (*Rangifer tarandus caribou*) and grizzly bear (*Ursus arctos*) populations under the Convention on Nature Protection and Wild Life Preservation in the Western Hemisphere ("Western Hemisphere Convention"),² as well as takings that diminish the effectiveness of the protection of five species of Pacific salmon (*Oncorhynchus gorbuscha*, *O. keta*, *O. nerka*, *O. kisutch*, and *O. tshawytscha*) and steelhead trout (*O. mykiss*) under the Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean ("Anadromous Stocks Conservation Convention").³

In conjunction with the investigation you must undertake under the Pelly Amendment, we urge you to engage officials within the Federal Executive to request and secure a referral of the issue of harms from mines in the Taku, Stikine, and Unuk river watersheds to the International Joint Commission pursuant to the Boundary Waters Treaty between the United States and Canada.⁴ Under Article IX of this Treaty, the Commission may examine and report upon a dispute concerning rights, obligations, and interests of the countries along their common

¹ 22 U.S.C. § 1978.

² Convention on Nature Protection and Wild Life Preservation in the Western Hemisphere, Oct. 12, 1940, 56 Stat. 1354, 161 U.N.T.S. 193.

³ Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean, Feb. 11, 1992, 106 Stat. 5002, T.I.A.S. No. 11465.

⁴ Treaty Between the United States and Great Britain Relating to Boundary Waters, and Questions Arising Between the United States and Canada, U.S.-Gr. Brit., Jan. 11, 1909, 36 Stat. 2448 (Boundary Waters Treaty).

frontier upon referral.⁵ A referral of the issue of harms from the mines in British Columbia to the International Joint Commission would most directly and efficiently address the potential transboundary threats from these mines, and could obviate the need for further steps under the Pelly Amendment.

I. INTRODUCTION

Under the Pelly Amendment, the Secretary of the Interior must undertake an investigation when foreign nationals may be engaging in taking that diminishes the effectiveness of any international program for endangered or threatened species.⁶ When the Secretary's investigation finds that such taking is occurring, she must certify this finding to the President.⁷ Currently, Canadian nationals are developing several hard-rock mining operations upstream of the Canada–United States border, draining into three rivers—the Taku, Stikine, and Unuk rivers—that flow from British Columbia across the border into Southeast Alaska.⁸ The development and operation of the Tulsequah Chief Mine, Red Chris Mine, Schaft Creek Mine, Galore Creek Mine, Kerr-Sulphurets-Mitchell Mine (“KSM Mine”), and Brucejack Mine (collectively “the B.C. Mines”) are likely to result in takings that diminish the effectiveness of two international programs for endangered or threatened species.

The mines located in the Stikine and Unuk river watersheds, Red Chris, Schaft Creek, Galore Creek, KSM, and Brucejack mines, are likely to have significant adverse effects on two species protected under the Western Hemisphere Convention, namely woodland caribou and grizzly bears. As detailed below, the construction and operation of the mines and their associated access roads, and in some cases the cumulative impacts from increased mine-related traffic on the Cassiar-Stewart Highway (“Highway 37”)—cumulatively in excess of 1.5 million additional truck journeys—are likely to harm woodland caribou and grizzly bear populations both directly and indirectly. The mine access roads and the increase in traffic, are likely to increase direct mortality of woodland caribou and grizzly bears through vehicle collisions and increased predation and hunting. The mines could also indirectly cause population-level harms by displacing individuals or groups of animals, and by reducing the quantity and quality of habitat for both species. For these and other reasons, the development and operation of these mines are likely to amount to takings that diminish the effectiveness of the Western Hemisphere Convention.

Additionally, the B.C. Mines are likely to have significant adverse effects on all five species of Pacific salmon and steelhead trout that are protected under the Anadromous Stocks Conservation Convention. Construction and operation of the mines will generate billions of metric tons of toxic mine tailings and waste rock, and involve the discharge of waste water into waterbodies in which these species spawn, and in some cases rear. If allowed to operate as planned, these mines are likely to subject fish to acid mine drainage and heavy metals

⁵ *Id.* art. IX.

⁶ 22 U.S.C. § 1978(a)(3)(B).

⁷ *Id.* § 1978(a)(2).

⁸ *See* Fig. 1 (Map of Affected Transboundary Watersheds and Other Anadromous Streams).

pollution—resulting in potential population-level harms. For centuries after mine closures, these watersheds will exist precariously under the very real possibility that water treatment plants and tailings impoundments will not operate exactly as planned, and will cause chronic long-term leakage of acid mine drainage and heavy metals and might even experience catastrophic failure, as happened at British Columbia’s Mount Polley Mine in August 2014.⁹ Pollution of these watersheds with heavy metals and other mine pollutants can impair salmonids’ reproductive and survival functions, and can even be directly lethal to them at sufficient concentrations. For these and other reasons, the development and operation of the B.C. Mines are likely to amount to takings that diminish the effectiveness of the Anadromous Stocks Conservation Convention.

Communities downstream of the B.C. Mines rely on the ecological integrity of these watersheds for their economic wellbeing and ways of life. For millennia, indigenous peoples, including the Tlingit, Haida, Tsimshian, and Tahltan peoples, have resided in the British Columbia–Alaska region, and have integrated the transboundary watersheds into their customary and traditional practices. For example, salmon has been a key foundation for many communities’ socio-economic life for at least four thousand years,¹⁰ during which they have developed harvesting practices and riverine property regimes,¹¹ generating “a system of relational sustainability . . . to insur[e] salmon existence and abundance.”¹² Alaska Native communities and First Nations in British Columbia have successfully maintained their subsistence economies and cultural traditions, notwithstanding threats to their institutions and ways of life following the arrival of Europeans in the region.¹³ Today, however, the B.C. Mines proposed or already developed in the Taku, Stikine, and Unuk river basins threaten the continued health and broader integrity of the transboundary watersheds on which communities rely.¹⁴

The prospects of downstream businesses and the Alaskans employed in them are also tied to the health of the Taku, Stikine, and Unuk river watersheds. Southeast Alaska’s fisheries are among the world’s most precious and productive, generating hundreds of millions of dollars for

⁹ See British Columbia Ministry of Environment, *Mount Polley Mine Tailings Dam Breach, Likely, August 4, 2014*, <http://www.env.gov.bc.ca/epd/mount-polley/> (last visited June 3, 2016).

¹⁰ S. J. Langdon, *Traditional Knowledge and Harvesting of Salmon by Huna and Hinyaa Tlingit*, Fisheries Information Service Project 02-104 Final Report at viii (2006) (Langdon).

¹¹ *Id.* at viii, ix; A. W. Paige *et al.*, *Local Knowledge, Harvest Patterns, and Community Uses of Salmon in Wrangell, Alaska*, Alaska Department of Fish & Game Technical Paper No. 323 at 10-11 (2009) (Paige *et al.*).

¹² Langdon at viii.

¹³ See, e.g., Langdon at 7; Paige *et al.* at 11; T. F. Thornton, *BEING AND PLACE AMONG THE TLINGIT* at 9-10 (2008).

¹⁴ See F. Olsen Jr. & J. Mack, *Indigenous People ‘Sing’ For The Earth*, THE TIMES COLONIST (Mar. 26, 2016), <http://www.timescolonist.com/opinion/columnists/comment-indigenous-people-sing-for-the-earth-1.2217530> (“Our ancient indigenous homelands are located in present-day British Columbia and Alaska, considered part of the Arctic Nations. We are connected through water, culture, salmon, oral history and complex family bloodlines. As indigenous peoples, we now unite to address the urgent and far-reaching impacts of unbridled mining activities in B.C.”); see also, e.g., Letter from Sen. L. Murkowski *et al.* to Sec. J. Kerry (May 12, 2016) (“Alaska Native communities throughout Southeast are dependent on these same fishery resources, marine mammals, and waterfowl to meet their subsistence needs and to promote resilience in their communities. Tlingit, Haida and Tsimshian traditions and culture are tied to the bounty from the waters of the archipelago. Their food security and very survival depend on keeping these waters healthy.”).

Alaskans.¹⁵ Each of the three watersheds affected by the B.C. Mines contributes significantly to this sum. Economic activity in the Taku River watershed is estimated to generate \$32.9 million in total spending annually for Alaska, with \$4.2 million generated from the wholesale value of Taku River salmon and \$2.7 million in sport fishing.¹⁶ The Stikine River watershed is estimated to generate \$12.7 million in total spending annually for Alaska, with \$3.5 million in wholesale value of Stikine River salmon, and \$4.2 million in sport fishing.¹⁷ The Unuk River watershed is estimated to generate \$2.5 million in spending annually, with \$890,000 in wholesale value of Unuk River salmon, and at least \$880,000 on sport fishing.¹⁸ These three watersheds are thus economically vital to the region, to numerous Alaskan businesses, their workers, and to the families they support.

Pursuant to the Pelly Amendment, we petition the Secretary to undertake an investigation into whether the B.C. Mines will be, or are already, engaging in takings that diminish the effectiveness of the Western Hemisphere Convention and the Anadromous Stocks Conservation Convention.

In conjunction with the investigation the Secretary must undertake pursuant to the Pelly Amendment, we urge the Secretary to engage officials at the State Department and other relevant officials of the Federal Executive to request and secure a referral of the issue of harms to these transboundary watersheds resulting from the B.C. Mines to the International Joint Commission, pursuant to Article IX of the Boundary Waters Treaty executed between the United States and Canada.¹⁹ Such a referral would most directly address the potential transboundary threats from these mines, and could potentially obviate the need for further steps under the Pelly Amendment.

If, however, these potential harms remain unaddressed by an International Joint Commission referral, and if the Secretary's investigation reveals the takings we describe have occurred, are occurring, or will occur as a result of these mines, we request that the Secretary recommend to the President that he direct the Secretary of the Treasury to prohibit the importation of appropriate Canadian products into the United States until Canadian authorities have acted to prevent the harmful ecological impacts from the development and operation of the B.C. Mines.

¹⁵ See, e.g., Letter from Sen. L. Murkowski *et al.* to Sec. J. Kerry (May 12, 2016) (“Alaska has the world’s most productive and sustainable commercial fisheries. Southeast Alaska, and the transboundary rivers, are home to world-renowned salmon runs, supporting the commercial fishing industry, tourism, and subsistence lifestyles throughout the region. In 2013, there was a record harvest of 95 million pink salmon in Southeast Alaska, valued around \$220 million. In 2015, the statewide salmon harvest topped 263 million fish and was valued at around \$414 million.”).

¹⁶ The McDowell Group, Memorandum to T. Bristol, Salmon State, Re: Southeast Alaska Transboundary Watersheds: Economic Impact Analysis Preliminary Results at 1-2 (Apr. 18, 2016) (The McDowell Group, Memorandum).

¹⁷ *Id.*

¹⁸ *Id.*

¹⁹ Boundary Waters Treaty, art. IX.

II. THE PELLY AMENDMENT AND PREDICATE INTERNATIONAL PROGRAMS FOR ENDANGERED OR THREATENED SPECIES.

A. The Pelly Amendment

In 1971, Congress enacted the Pelly Amendment in response to concerns about the harmful effects of international salmon fishing in the Atlantic Ocean.²⁰ This legislation was passed in the recognition that international agreements often lack enforcement provisions necessary to effectively conserve species.²¹ Section 1978(a)(2) of the Pelly Amendment provides:

When the Secretary of Commerce or the Secretary of the Interior finds that nationals of a foreign country, directly or indirectly, are engaging in trade or taking which diminishes the effectiveness of any international program for endangered or threatened species, the Secretary making such finding shall certify such fact to the President.²²

The Pelly Amendment defines an “international program for endangered or threatened species” as “any ban, restriction, regulation, or other measure in effect pursuant to a multilateral agreement which is in force with respect to the United States, the purpose of which is to protect endangered or threatened species of animals.”²³

Revisions to the Pelly Amendment in 1992 define the term “taking” as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect” or to attempt any such conduct.²⁴ The term’s broad definition encompasses actions that kill or harm wildlife by modifying or degrading habitat so as to preclude essential behaviors and survival.²⁵

If the Secretary of the Interior finds that there may be cause for certification under Section 1978(a)(2), she must “promptly investigate . . . [the relevant] activity by foreign nationals.”²⁶ Upon investigation, she must “promptly conclude” whether there is cause for certification.²⁷ If she determines that there is cause, she has a mandatory duty to certify a foreign

²⁰ H. R. REP. No. 92-468 (1971) *reprinted in* 1971 U.S.C.C.A.N. 2409.

²¹ *See id.*

²² 22 U.S.C. § 1978(a)(2).

²³ *Id.* § 1978(h)(4).

²⁴ *Id.* § 1978(h)(5)(A), (B). This definition tracks the definition of “take” in the U.S. Endangered Species Act, 16 U.S.C. § 1532(19).

²⁵ The term “take” has been similarly interpreted in the context of the Endangered Species Act (ESA), where it includes “significant habitat modification or degradation where [conduct] actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.” 50 C.F.R. § 17.3 (1999); *Babbitt v. Sweet Home Chapter of Communities for a Great Or.*, 515 U.S. 687, 704 (1995).

²⁶ 22 U.S.C. § 1978(a)(3)(B).

²⁷ *Id.* § 1978(a)(3)(B).

national's diminishment of the effectiveness of an international program for endangered or threatened species to the President.²⁸

Within 60 days of certification, the President must notify Congress of any action taken pursuant to the certification.²⁹ The President may direct the Secretary of the Treasury to prohibit the importation of any products from the offending country for any duration the President deems appropriate, and to the extent that such prohibition is sanctioned by the World Trade Organization or multilateral trade agreements.³⁰

B. The Western Hemisphere Convention

The Western Hemisphere Convention is an international agreement to which the Pelly Amendment is applicable. The Convention is a multilateral agreement, negotiated under the auspices of the Organization of American States, and ratified by 15 states.³¹ It entered into force with respect to the United States on April 30, 1942.³²

The Convention's purpose is to "protect and preserve in their natural habitat representatives of all species and genera of their native flora and fauna, including migratory birds, in sufficient numbers and over areas extensive enough to assure them from becoming extinct through any agency within man's control."³³ In particular, the Convention creates an Annex identifying species the protection of which is "of special urgency and importance," and which therefore are to be protected "as completely as possible."³⁴ The hunting, killing, capture, or taking of these species is allowed only with governmental permission, granted only under special circumstances.³⁵ The Annex—entitled the "Listas de Especies de Fauna y Flora en Vias de Extincion en los Estados Miembros"—lists species threatened with extinction, including the woodland caribou and the grizzly bear.³⁶

²⁸ *American Cetacean Soc'y. v. Smart*, 673 F. Supp. 1102, 1105 (D.D.C. 1987) ("While the Secretary has discretion to make that determination [that conduct diminishes the effectiveness of an international conservation agreement], once it is made, certification is mandatory.").

²⁹ 22 U.S.C. § 1978(b).

³⁰ *Id.* § 1978(a)(4); 19 U.S.C. §§ 3501(4), 3511(d).

³¹ Western Hemisphere Convention, art. XII.

³² U.S. Department of State, *Treaties in Force: A List of Treaties and Other International Agreements of the United States in Force on January 1, 2013* at 352 (2013), <http://www.state.gov/documents/organization/218912.pdf> (U.S. Department of State, *Treaties in Force*).

³³ Western Hemisphere Convention, pmbl.

³⁴ *Id.* art. VIII.

³⁵ *Id.*

³⁶ See Organization of American States, *Listas de Especies de Fauna y Flora en Vias de Extincion en los Estados Miembros* (1967).

C. The Anadromous Stocks Conservation Convention

The Anadromous Stocks Conservation Convention is an international agreement to which the Pelly Amendment is applicable. The Convention is a multilateral agreement, ratified in 1992 by Canada, Japan, the Russian Federation, and the United States, and acceded to by the Republic of Korea in 2003.³⁷ The Convention entered into force with respect to the United States on February 16, 1993.³⁸

The Anadromous Stocks Conservation Convention's purpose is to protect threatened species, specifically "to promote the conservation of anadromous stocks in the North Pacific Ocean."³⁹ To this end, the Convention establishes a ban on the harvest of species listed within Part I of the Annex,⁴⁰ with respect to the area ("the Convention Area") of the Pacific Ocean "north of 33 degrees North Latitude beyond 200 nautical miles of the baselines from which the territorial sea is measured."⁴¹ Among the species listed, and therefore protected, by the Convention are chum salmon, pink salmon, Coho salmon, sockeye salmon, Chinook salmon, and steelhead trout that "migrate into the Convention Area."⁴² The Convention also requires the minimization of incidental taking of these species, and prohibits the retention of incidentally taken fish.⁴³ It also requires scientific collaboration on research concerning the conservation of the listed species.⁴⁴ Overall, the Convention's measures were intended to protect the Annex-listed species by coordinating states' policies to avoid depleting these anadromous fish populations.⁴⁵ Specifically, the Convention addressed the rapid decline in salmonid numbers due to the use of driftnets on the high seas by Asian fishing vessels, which was leading to "depletion

³⁷ See, e.g., North Pacific Anadromous Commission, NPAFC Convention, http://www.npafc.org/new/about_convention.html (last visited May 19, 2016).

³⁸ U.S. Department of State, *Treaties in Force*.

³⁹ Anadromous Stocks Conservation Convention, pmb. See also Sec. James A. Baker III, Letter of Submittal to the President, S. Treaty Doc. No. 102-30 at v (May 14, 1992) (Letter of Submittal from Sec. James A. Baker III to the President) ("The Convention . . . will protect valuable migrating U.S.-origin salmonids [and] . . . promote the conservation of anadromous stocks (primarily Pacific salmon) throughout their migratory range in the high seas area of the North Pacific Ocean and its adjacent seas, as well as ecologically related species that interact with these resources, including various marine mammals, seabirds, and non-anadromous fish species.").

⁴⁰ Anadromous Stocks Conservation Convention, art. III. "For the purposes of this Convention: . . . 'Anadromous fish' means the fish of anadromous species listed in Part I of the Annex which migrate into the Convention Area, and 'anadromous stocks' means the stocks thereof." *Id.* art. II(1).

⁴¹ *Id.* art. I.

⁴² *Id.* annex, sec. 1 & art. II.

⁴³ *Id.* art. III (1)(b)-(c).

⁴⁴ *Id.* art. VII.

⁴⁵ See Letter of Submittal from Sec. James A. Baker III to the President at vi ("The new Convention will establish such a forum to coordinate the conservation of Pacific salmon and ecologically related species, as well as efforts to discourage fishing activities of others that may adversely affect such conservation.").

of immature salmon,” a situation threatening these fish.⁴⁶ The Convention is thus a multilateral agreement the purpose of which is to protect threatened species of animals.

III. MINING IN TRANSBOUNDARY WATERSHEDS

A. The Taku River Watershed

The Taku River watershed measures 11,500 square miles (29,800 square kilometers)—an area larger than Massachusetts—and includes ice fields, tundra, and temperate forest landscapes.⁴⁷ The region is remote and accessible only by foot, air, or boat. The watershed is populated by several terrestrial mammals, including grizzly bear, wolf, woodland caribou, and moose, along with species of migratory birds, including trumpeter swans.⁴⁸ It is the largest unprotected wild river system on the western coast of North America.⁴⁹

Through the heart of the watershed runs the Taku River and its tributaries, weaving from headwaters in northwestern British Columbia, through three different biomes and terrestrial ecoregions, before emptying into the Pacific Ocean near Juneau, Alaska.⁵⁰ The Taku River watershed is inhabited by at least 32 fish species, including all five species of Pacific salmon, steelhead trout, arctic grayling, dolly varden, cutthroat trout, eulachon, longfin smelt, Pacific lamprey, round white fish, slimy sculpin, and threepine stickleback.⁵¹

⁴⁶ P. L. Walton, *Piracy of North Pacific Salmon: Economic Implications and Potential Solutions*, 25 GEO. WASH. J. INT’L L. & ECON. 581, 581-82, 584 (1991); see also C. C. Polychron, *Towards A Solution to the Problem of the Common Anadromous Stocks of the North Pacific*, 4 SAN DIEGO INT’L L. J. 543, 546-47 (2003) (describing the “problem of common anadromous stocks of the North Pacific” in which a “system of incentives tends inevitably towards the collapse of the [fisheries],” *id.* at 548-49, and describing the Convention as an attempt to “resolve the problem,” *id.* at 554); C. C. Joyner, *Biodiversity in the Marine Environment: Resource Implications for the Law of the Sea*, 28 VAND. J. TRANSNAT’L L. 635, 682 (1995) (describing the Anadromous Stocks Conservation Convention as a “treaty agreement[] specially designed to coordinate the international protection and preservation of select biological resources in the global marine environment”). Among the species protected by the Convention are fish listed as threatened or endangered under the U.S. Endangered Species Act. See, e.g., 64 Fed. Reg. 14,508 (Mar. 25, 1999) (listing chum salmon as threatened in Washington and Oregon); 62 Fed. Reg. 24,588 (May 6, 1997) (listing Coho salmon as threatened in Southern Oregon and the Northern California Coast); 80 Fed. Reg. 22,468 (Apr. 22, 2015) (determining that listing of Chinook salmon in the Snake River as threatened remained appropriate); 60 Fed. Reg. 25,201 (May 11, 1995) (rejecting petition to delist sockeye salmon in the Snake River as threatened).

⁴⁷ J. S. Richardson & A. M. Milner, *Pacific Coast Rivers of Canada and Alaska*, in RIVERS OF NORTH AMERICA 735, 772 (A. C. Benke & C. E. Cushing eds., 2005) (Richardson & Milner).

⁴⁸ K. Heinemeyer *et al.*, *A Conservation Area Design for the Territory of the Taku River Tlingit First Nation: Preliminary Analyses and Results* at 13-14 (2003); Rivers Canada, Wild Rivers Committee, *Imminent Threats to the Survival of a Wild Taku Rivershed* at PDF 10 (Nov. 12, 1996) (Rivers of Canada, *Imminent Threats*).

⁴⁹ Rivers Canada, *Imminent Threats*.

⁵⁰ Richardson & Milner at 760, 772.

⁵¹ *Id.* at 772.

The watershed is the traditional territory of the Taku River Tlingit First Nation,⁵² who have lived there for millennia.⁵³ According to the Tlingit, their communities' continued health and survival are rooted in the land. As one Tlingit leader described it: "The Taku River . . . [is] very sacred to the Tlingits . . . This river, the Taku . . . is a sacred place for our people. It is the heart of the Tlingit territory."⁵⁴

The Taku River is also hugely important to other communities in the region. The watershed accounts for \$32.9 million in annual spending in Southeast Alaska, with \$4.2 million in wholesale value from its salmon harvests and \$2.7 million in expenditures on sport fishing for Chinook and Coho salmon.⁵⁵

The Tulsequah Chief Mine Project

The Tulsequah Chief Mine is a project proposed by Chieftain Metals Corporation ("Chieftain Metals").⁵⁶ The project, which would produce gold, silver, copper, lead, and zinc, is situated on the Tulsequah property occupying 54 square miles (139 square kilometers) on the east side of the Tulsequah Valley, near the confluence of the Tulsequah and Taku rivers, ten miles (16 kilometers) upstream of the Canada–United States border, and 40 miles (64 kilometers) northeast of Juneau, Alaska.⁵⁷ This area encompasses two ore deposits, the Tulsequah Chief deposit and the Big Bull deposit, both of which Chieftain Metals plans to develop.⁵⁸ The project would be developed on the site of an earlier mine project operated by Cominco from 1951 until 1957.⁵⁹ The mine is expected to have an 11-year operating life, and to produce 4.4 million metric tons of total ore.⁶⁰

The project will include a barge site, a processing plant, a power generation facility, fuel storage facilities, a tailings impoundment, a limestone quarry, an effluent treatment facility, airstrip, a construction camp and a permanent camp, and an 11-mile (18-kilometer) road connecting the airstrip and camp to the barge site.⁶¹ Ore will be mined and crushed underground,

⁵² JDS Energy & Mining Inc., Feasibility Study Technical Report: Tulsequah Chief Project, Northern British Columbia, Canada at 1-14 (Nov. 27, 2014) (Tulsequah Chief 2014 Technical Report).

⁵³ McDowell Group, *The Taku River Economy: An Economic Profile of the Taku River Area: Final Report* at 5 (2004).

⁵⁴ *Aff. of Bryan Jack, Taku River Tlingit First Nation v. Ringstad* at ¶13 (Feb. 5, 1999).

⁵⁵ The McDowell Group, Memorandum at 1-2.

⁵⁶ Chieftain Metals is a company incorporated in Ontario and based on Toronto. *Chieftain Metals Incorporated*, SYSTEM FOR ELECTRONIC DOCUMENT ANALYSIS AND RETRIEVAL, <http://www.sedar.com/DisplayProfile.do?lang=EN&issuerType=03&issuerNo=00034516> (last visited May 10, 2016).

⁵⁷ SRK Consulting, *Big Bull Project, Tulsequah Chief Property, Technical Report Northern British Columbia* at 6 (2010) (Big Bull 2010 Technical Report); Tulsequah Chief 2014 Technical Report at 5-1; *see also* Fig. 2 (Map of the Tulsequah Chief Mine).

⁵⁸ Tulsequah Chief 2014 Technical Report at 1-1; Big Bull 2010 Technical Report at 6.

⁵⁹ Big Bull 2010 Technical Report at 11-12.

⁶⁰ Tulsequah Chief 2014 Technical Report at 1-20.

⁶¹ *Id.* at 18-1 to 18-23, 18-33 to 18-49.

then fed into a mill for grinding on site.⁶² Doré (gold-silver alloy) will be produced onsite, and the pulp will be sent into a sequential flotation circuit to extract copper, lead, and zinc.⁶³ For a few months a year, barges will transport concentrate and supplies on a 39-mile (62-kilometer) route down the Taku River to a transshipment site at the mouth of the Taku River, where material would be transferred to ocean-going barges for international shipment via Seattle.⁶⁴

The project is expected to produce over 2 million metric tons of tailings.⁶⁵ Most of these tailings, around 1.76 million metric tons,⁶⁶ will be impounded in a 45-hectare impoundment on the banks of Shazah Creek, 2.5 miles (4 kilometers) upstream of the creek's confluence with the Tulsequah River.⁶⁷ A compacted earth-fill dam, 1.4 miles (2.2 kilometers) long and ultimately up to 30 feet (9 meters) tall, will contain the tailings.⁶⁸ An on-site quarry would provide limestone, which will be crushed and used to neutralize waste water in order mitigate acid mine drainage.⁶⁹ On closure of the mine, the tailings impoundment will be drained, capped with soil, and re-vegetated.⁷⁰

Waste rock will be used to backfill the mine.⁷¹ Potentially acid-generating waste and pyrite tailings will be temporarily impounded at a site over one-half mile (one kilometer) south of the historic mine site behind earthen embankments, until the mine site is ready to be backfilled with this waste.⁷² Another portion of the waste rock will be mixed with cement, pyrite

⁶² JDS Energy & Mining Inc., Technical Report for the Tulsequah Chief Project of Northern British Columbia, Canada at 1-8, 1-10 (Jan. 22, 2013).

⁶³ *Id.* at 1-10.

⁶⁴ Tulsequah Chief 2014 Technical Report at 18-24 to 18-28. Barges can only operate when the gauge height of the river is at least 35 feet, but when the current is not too strong. *See id.* 18-26, Tbl. 18.5. Such conditions only exist for a few months between May and September. *See id.* 18-25 & 24-8, Tbl. 24.2. Chieftain's most recent technical report rules out the construction and use of the access road originally planned for the mine. *Id.* at 24-1 ("Construction and utilization of an all-weather access road as the primary method for deliveries is no longer a feasible option."). If this were to change, the access-road option would pose a major risk to the Atlin herd of woodland caribou, whose small size and low recruitment rate makes it particularly vulnerable to the multiple harms flowing from roads, and grizzly bears. Such a risk would then need to be included in a full investigation of the B.C. Mines.

⁶⁵ *Id.* at 18-38, Tbl. 18.10.

⁶⁶ *Id.* at 18-44.

⁶⁷ *Id.* at 18-38 ("The [tailings management facility] is located approximately 4 km upstream (north) of the main mine facilities on the east bank of the Shazah Creek"); *id.* 5-2 (describing the site as "on the Shazah Creek close to its confluence with the Tulsequah River").

⁶⁸ *Id.* at 18-38, 18-42.

⁶⁹ *Id.* at 18-49. An acid treatment plant was also designed to treat discharges of acid mine drainage from the old mine works. *Id.* at 18-33.

⁷⁰ *Id.* at 18-38.

⁷¹ *Id.* at 1-9.

⁷² *Id.* at 1-9, 1-12, 18-46, 20-3.

concentrate, and tailings to generate around 1.8 million metric tons of a paste fill to be pumped underground into the mine.⁷³

The Provincial Government of British Columbia (“B.C. Government”) issued a project approval certificate, pursuant to the Environmental Assessment Act, for the mine in 2002 (when the rights were held by Chieftain Metal’s predecessor in interest, Redfern Resources Limited).⁷⁴ Subsequently, all permits needed to start construction have been granted.⁷⁵

B. The Stikine River Watershed

The name of the Stikine River translates as “great river” from the Tlingit language.⁷⁶ The river runs 335 miles (539 kilometers) from its headwaters in the Coast Range Mountains, British Columbia, crossing the Canada–United States border upstream of its entrance to the Alaska panhandle near Wrangell, Alaska.⁷⁷ Among its tributaries are the Iskut River, joining the Stikine upstream of the border,⁷⁸ and the Klappan River, which drains a basin of 1,370 square miles (3,550 square kilometers)⁷⁹—an area larger than the state of Rhode Island. The Klappan River flows into the Stikine River above the “Grand Canyon of the Stikine,” a 59-mile (95-kilometer) stretch of cascades, chutes, and rapids.⁸⁰

The Tlingit people settled on the banks of the salmon-rich lower Stikine millennia ago.⁸¹ Their communities maintained trading ties with communities of the Tahltan people, who populated the upper Stikine watershed.⁸² Prehistoric cairns have been found on both sides of the river, indicating early human inhabitation.⁸³

Aside from Tlingit and Tahltan settlements, the Stikine River basin features very little development.⁸⁴ It is bordered by the Spatsizi Wilderness Area (often called “the Serengeti of

⁷³ *Id.* at 18-38, Tbl. 18.10.

⁷⁴ See British Columbia Ministry of Sustainable Resource Management and British Columbia Ministry of Energy and Mines, Project Approval Certificate M02-01 (Dec. 13, 2002), http://a100.gov.bc.ca/appsdata/epic/documents/p72/1069093215465_8c9c07a0449e4165b95fcc397ecdbf6f.pdf.

⁷⁵ Chieftain Metals Inc., Press Release, Chieftain Receives Final Permits for Tulsequah Chief: Project Now Construction Ready (Feb. 13, 2013), <http://www.chieftainmetals.com/wp-content/uploads/press-releases/2013-feb-12-Chieftain-Receives-Final-Permits-for-Tulsequah-Chief.pdf>.

⁷⁶ Richardson & Milner at 751.

⁷⁷ *Id.*

⁷⁸ *Id.* at 751, 753, 767, Fig. 16.15; Fig. 1.

⁷⁹ Richardson & Milner at 753; Red Chris Development Co. Ltd., Application for an Environmental Assessment Certificate: Red Chris Project, British Columbia, Canada at 4-188 (Oct. 2004) (Red Chris EA Application).

⁸⁰ Richardson & Milner at 753; Red Chris EA Application at 4-188.

⁸¹ Richardson & Milner at 751.

⁸² *Id.*

⁸³ D. A Brown *et al.*, *The Stikine Project: Geology Of Western Telegraph Creek Map Area, Northwestern British Columbia*, British Columbia Geological Survey Bulletin 95 (May 1996).

⁸⁴ Richardson & Milner at 751-53, 754.

Canada”⁸⁵), the Stikine River Recreation Area, the Mount Edziza Provincial Park, and, on the American-side of the border, the Stikine-LeConte Wilderness Area within the Tongass National Forest.⁸⁶ The watershed is also rich in biodiversity, life within the watershed “brimming full like the stream[,]” as John Muir described it a century ago.⁸⁷ The river and its margins are inhabited by, for example, black and grizzly bears, river otters, minks, beaver, muskrats, and moose, as well as bald eagles, dippers, kingfishers, mergansers, and osprey.⁸⁸ The waters of the Stikine, downstream of the grand canyon, are inhabited by all five species of Pacific salmon, steelhead, cutthroat, rainbow, bull, and lake trout, Dolly Varden, mountain whitefish, arctic grayling, lake chub, longnose sucker, burbot, Pacific lamprey, slimy sculpin, prickly sculpin, coast range sculpin, longfin smelt, eulachon, and three-spine stickleback.⁸⁹ The Stikine Flats, the river’s 11,000-hectare delta, is one of the largest intertidal wetlands in the United States, providing important habitat for migratory birds and marine mammals.⁹⁰

The Red Chris Porphyry Copper-Gold Mine

On the Todagin Plateau straddling two main Stikine tributary drainages, Imperial Metals Corporation (“Imperial Metals”)⁹¹ has opened a copper-gold mine, the Red Chris Porphyry Copper-Gold Mine Project.⁹² For approximately 25 years, the project expects to process around 30,000 metric tons of ore per day.⁹³ The project includes a new single-lane gravel access road cutting 14 miles (22.8 kilometers) from the mine site to Highway 37, along which the concentrate output will be hauled.⁹⁴ The project includes an open pit mine, ore mill, tailings impoundment, waste rock dump, stockpiles of low-grade ore, power lines, water works, mine camp, and a possible explosives manufacturing facility.⁹⁵

Two miles (three and one-half kilometers) northeast of the mine site, a Y-shaped valley has been dammed at each of its three arms by earth-fill embankments⁹⁶ to contain an expected

⁸⁵ See W. Davis, *Deep North: Canada’s Stikine River Valley*, NATIONAL GEOGRAPHIC (2004), <http://ngm.nationalgeographic.com/ngm/0403/feature5/fulltext.html>.

⁸⁶ Richardson & Milner at 754.

⁸⁷ J. MUIR, TRAVELS IN ALASKA at 56 (1915).

⁸⁸ Richardson & Milner at 754.

⁸⁹ Red Chris EA Application at 4-186, 4-188; J. D. McPhail, THE FRESHWATER FISHES OF BRITISH COLUMBIA 407 (2007); R. J. Behnke, TROUT AND SALMON OF NORTH AMERICA at 329 (2010); Richardson & Milner at 754, 767.

⁹⁰ See, e.g., U.S. Department of Agriculture, Alaska Region, Special Areas, Stikine Flats, http://www.fs.usda.gov/detail/r10/specialplaces/?cid=fsbdev2_038765 (last visited June 15, 2016).

⁹¹ Imperial Metals is incorporated in British Columbia and based in Vancouver. *Imperial Metals Corporation*, SYSTEM FOR ELECTRONIC DOCUMENT ANALYSIS AND RETRIEVAL, <http://www.sedar.com/DisplayProfile.do?lang=EN&issuerType=03&issuerNo=00017753> (last visited May 10, 2016).

⁹² Red Chris EA Application at 3-6, 4-186 to 4-187; see also Fig. 3 (Map of the Red Chris Mine).

⁹³ Environmental Assessment Office, Red Chris Porphyry Copper-Gold Project Assessment Report at 5 (2005) (Red Chris EA Report).

⁹⁴ Red Chris EA Application at 3-6 to 3-11.

⁹⁵ Red Chris EA Report at 6-7.

⁹⁶ Red Chris EA Application at 4-348.

300 million metric tons of mine tailings.⁹⁷ The valley straddles the Iskut and Klappan watersheds, both of which drain into the Stikine River.⁹⁸ The British Columbia Environmental Assessment Office predicts that seepage water with elevated concentrations of metals pollutants could potentially escape the impoundment and “enter the receiving environment.”⁹⁹ The mine’s environmental assessment certificate application enumerates “[p]otential impacts to aquatic habitat associated with the tailings impoundment” including the obvious direct loss of habitat within the tailings impoundment footprint, as well as decreased water quality in downstream bodies in the Klappan and Iskut drainage areas.¹⁰⁰ Though environmental authorities concluded that the mine’s precautionary measures would rule out significant environmental problems beyond the mine site,¹⁰¹ by December 2015 the mine had already experienced a tailings spill “caused by wear and tear” to a pipe weeks after the mine became operational, causing the mill to temporarily shut down.¹⁰²

Mining operations are expected to generate 338 million metric tons of waste rock, much of which will be deposited within a waste dump.¹⁰³ As the environmental assessment report explains, “over time a significant proportion of the waste rock in the North waste dump and in the exposed pit wall rock is expected to become acid-generating[,] releasing increased concentrations of metal contaminants.”¹⁰⁴ During the mine’s operation, drainage from the dump will flow directly into the tailings impoundment area.¹⁰⁵ Afterwards, however, the drainage “will require treatment to produce an acceptable quality of effluent for release to receiving waters.”¹⁰⁶ Thus, thereafter, for a period estimated “in excess of 200 years,” drainage from the dump will be directed back into the open pit, via either a rock trench or tunnel, where a treatment plant will operate to reduce its acidity.¹⁰⁷ From there, the treated drainage will be directed to the tailings impoundment. Although “[t]reatment will likely be required in perpetuity,”¹⁰⁸ there is currently

⁹⁷ Klohn Crippen Berger Limited, *Tahltan Central Council: Red Chris Mine Site Review of Tailings Impoundment Design* at 4 (Oct. 2014), <https://s3-us-west-2.amazonaws.com/fairholme/Klohn+Crippen+Berger+-+Review+of+Tailings+Impoundment+Design.pdf>.

⁹⁸ Red Chris EA Application at 4-348.

⁹⁹ Red Chris EA Report at 24.

¹⁰⁰ Red Chris EA Application at 4-349.

¹⁰¹ *See, e.g.*, Red Chris EA Report at 27 (“[E]nvironmental [A]ssessment [O]ffice is satisfied that proposed mitigation measures and related commitments will prevent or reduce to acceptable levels any potential significant adverse water quality or [acid mine drainage/metals leaching] effects as they relate to the Project.”).

¹⁰² Red Chris Development Company, Environmental Memorandum, Re: Red Chris Monitoring Committee Environmental Report Dec 1, 2015 – Dec 22nd, 2015 (Dec. 2015), <http://dnr.alaska.gov/commis/opmp/Canadian%20Mines/Attachments/Red%20Chris%20Monitoring%20Committee%20Environmental%20Report%20December%201-15%202015.pdf>.

¹⁰³ Red Chris EA Report at 81.

¹⁰⁴ *Id.* at 23.

¹⁰⁵ Red Chris EA Application at 4-347 (“The North dump has been sited so that all contaminated toe drainage from the dump will gravity flow into the tailings impoundment area during the mine’s operational life.”).

¹⁰⁶ Red Chris EA Report at 23; Red Chris EA Application at 4-347.

¹⁰⁷ Red Chris EA Application at 4-347.

¹⁰⁸ Red Chris EA Report at 23.

no guarantee that the mine proponent or any other party, including the B.C. Government, will provide the funding, personnel, access, or other resources to secure such treatment.

The B.C. Government issued an environmental assessment certificate to the mine proponent in 2005.¹⁰⁹ The mine began operations on February 15, 2015, producing its first copper concentrate two days later.¹¹⁰ The B.C. Government issued final permits to the mine on June 12, 2015.¹¹¹

The Schaft Creek Mine

Near the source of Schaft Creek, a tributary of the Stikine River by way of Mess Creek, Copper Fox Metals Incorporated (“Copper Fox Metals”)¹¹² and Teck Resources Limited (“Teck Resources”)¹¹³ have proposed an open pit copper, gold, molybdenum, and silver mine project.¹¹⁴ Over the course of the mine’s 15-23 year operating life, the project is expected to produce around 100,000 metric tons of ore per day.¹¹⁵ The project would include the construction and operation of a mine pit, ore processing mill, and waste rock dump on the banks of the Schaft Creek within the Mess Creek drainage, a tailings impoundment in one of the Schaft Creek tributaries, and an access road from the mine site to Galore Creek access road and then to Highway 37.¹¹⁶

Over the course of its operating life, the project could generate over 800 million metric tons of tailings.¹¹⁷ These tailings will be impounded by rockfill embankments within the watershed of Skeeter Creek, a tributary of Schaft Creek, and thus the Stikine River.¹¹⁸

¹⁰⁹ See British Columbia Ministry of Environment and Ministry of Energy, Mines and Petroleum, Environmental Assessment Certificate M05-02 (Aug. 24, 2005), http://a100.gov.bc.ca/appsdata/epic/documents/p238/1124988712862_7111ec0fb6c844f4b96ea79488c3fd2f.pdf (last visited June 23, 2016).

¹¹⁰ Imperial Metals Corporation, Annual Information Form for the Year Ended December 31, 2015 at 20 (Mar. 30, 2016), <https://www.imperialmetals.com/assets/docs/2015-aif.pdf>.

¹¹¹ Imperial Metals Corporation, Press Release, Imperial Reports Red Chris Mine Receives Environmental Management Act (EMA) Permit (June 15, 2015), http://www.imperialmetals.com/assets/docs/2015-06-15_nr.pdf (last visited May 11, 2016).

¹¹² Copper Fox Metals is incorporated in Alberta and based in Calgary. *Copper Fox Metals Incorporated*, SYSTEM FOR ELECTRONIC DOCUMENT ANALYSIS AND RETRIEVAL, <http://www.sedar.com/DisplayProfile.do?lang=EN&issuerType=03&issuerNo=00020511> (last visited May 11, 2016).

¹¹³ Teck Resources is incorporated in Canada and based in Vancouver. *Teck Resources Limited*, SYSTEM FOR ELECTRONIC DOCUMENT ANALYSIS AND RETRIEVAL, <http://www.sedar.com/DisplayProfile.do?lang=EN&issuerType=03&issuerNo=00001787> (last visited May 11, 2016).

¹¹⁴ P. W. Scannell, Stikine River Mining Activity Risk Assessment, Alaska Department of Fish and Game, Technical Report No. 10-06 at 74-75 (2012) (Scannell); see also Fig. 4 (Map of the Schaft Creek Mine).

¹¹⁵ Scannell at 75.

¹¹⁶ *Id.* at 75-76.

¹¹⁷ *Id.* at 75.

¹¹⁸ *Id.* at 75-76; Tetra Tech, Feasibility Study on the Schaft Creek Project, BC, Canada at 18-19, 18-24 (Jan. 23, 2013) (Schaft Creek 2013 Feasibility Study).

The project is also expected to generate over a billion metric tons of waste rock.¹¹⁹ Waste rock will be dumped at sites around the perimeter of the mine pit, “with the majority of the material placed on the east side of Schaft Creek.”¹²⁰ Ten percent of the waste, over 100 million metric tons, is expected to be potentially acid-generating.¹²¹ At this point, the proponent has not provided sufficient information to determine how and if it plans to treat wastewater to mitigate the effects of acid mine drainage and metals contamination.¹²²

The project would also involve the construction of an access road running 25 miles (40 kilometers) along Mess Creek from the mine site to the Galore Creek access road, which would then be used for 39 miles (65.2 kilometers) until the junction with Highway 37.¹²³

The Schaft Creek project had been in the early stages of the provincial environmental assessment process, however, the proponent has withdrawn from the current process while it continues to work on developing the project.¹²⁴

The Galore Creek Mine

In 2007, NovaGold Resources Incorporated (“NovaGold”)¹²⁵ acquired rights to a mine site situated in the Galore, Scud, Scotsimpson, Sphaler, More, Stikine, and Iskut drainages.¹²⁶ It entered an agreement with Teck Cominco Limited (“Teck Cominco”)¹²⁷ to undertake a joint venture to develop the mineral claims.¹²⁸ The proposed mine project consists of 264 mineral

¹¹⁹ Scannell at 76.

¹²⁰ *Id.*

¹²¹ *Id.*

¹²² *Id.*

¹²³ Schaft Creek 2013 Feasibility Study at 18-1, 18-6.

¹²⁴ See W. Yau, Teck Resources Ltd., Letter to S. Murphy, B.C. Environmental Assessment Office, Re: Environmental Assessment of the Schaft Creek Project (Mar. 22, 2016).

¹²⁵ NovaGold is incorporated in British Columbia and headquartered in Vancouver. *Novagold Resources Incorporated*, SYSTEM FOR ELECTRONIC DOCUMENT ANALYSIS AND RETRIEVAL, <http://www.sedar.com/DisplayProfile.do?lang=EN&issuerType=03&issuerNo=00000880> (last visited May 11, 2016).

¹²⁶ British Columbia Environmental Assessment Office *et al.*, Galore Creek Copper-Gold-Silver Project: Comprehensive Study Report at 65 (Jan. 19, 2007) (Galore Creek Comprehensive Study Report) (“The construction and operation of mine infrastructure has the potential to impact surface water flows in a number of watersheds including Galore, More, Sphaler, and Scotsimpson creeks. Impacts may also affect the major river systems lying downstream of these watersheds; namely the Scud, Iskut, and Stikine rivers.”).

¹²⁷ Teck Cominco is incorporated in Canada and headquartered in Vancouver. *Teck Cominco Metals Limited*, SYSTEM FOR ELECTRONIC DOCUMENT ANALYSIS AND RETRIEVAL, <http://www.sedar.com/DisplayProfile.do?lang=EN&issuerType=03&issuerNo=00000637> (last visited May 11, 2016).

¹²⁸ AMEC Americas Limited, Galore Creek Project, British Columbia, NI 43-101 Technical Report on Pre-Feasibility Study at 4-6 to 4-7 (July 2011) (Galore Creek Technical Report).

claims over 118,912 hectares¹²⁹ in the watersheds of Galore Creek and the Iskut River, both of which flow into the Stikine River.¹³⁰

The project will consist of a mine site featuring several pits,¹³¹ and a processing plant.¹³² The project will also include an 80-mile (128-kilometer) access road connecting the mine site to Highway 37.¹³³ Concentrate will be piped along a 44-mile (71-kilometer) slurry pipeline from the mine site to a dewatering plant in the Iskut River watershed near the junction of the access road and Highway 37.¹³⁴ Once processed, it will be loaded onto trucks bound for Stewart, British Columbia.¹³⁵ The mine is expected to produce 346.6 million metric tons of ore, yielding 3.23 billion pounds of copper, 2.7 million ounces of gold, and 47.73 million ounces of silver.¹³⁶

At the concentrate dewatering facility, waste water will be treated with lime to neutralize acidity and reduce metals concentrations.¹³⁷ After neutralization and filtration, concentrations are expected to be 20 µg/L for dissolved copper and 150 µg/L particulate copper.¹³⁸ In order to meet the receiving water quality criterion of 2 µg/L of copper, there will need to be dilution of approximately 120:1 during the critical low flow period; the project proposes use of a diffuser to bring about this dilution.¹³⁹ Treated effluent from the dewatering site will be discharged into the Iskut River.¹⁴⁰

More than a billion metric tons of waste rock will be generated over the operating life of the project.¹⁴¹ About a half of this waste will be deposited in dumps or in former mine pits.¹⁴² Potentially acid-generating waste rock will be stored under water alongside tailings in the

¹²⁹ *Id.* at 4-2.

¹³⁰ Galore Creek Comprehensive Study Report at vi, 6; *see also* Fig. 5 (Map of the Galore Creek Mine).

¹³¹ Galore Creek Comprehensive Study Report at 10 (“Mining at Galore Creek will be by conventional truck and shovel operation with one main pit (Central) and several satellite pits (Southwest, Junction, Middle and West Fork pits”); *see also id.* at 11, Fig. 5.2-3.

¹³² Galore Creek Technical Report at 17-1.

¹³³ Rescan Environmental Services Ltd., Galore Creek Project, Application for Environmental Assessment Certificate at 1-1 (June 2006) (Galore Creek EA Application).

¹³⁴ Scannell at 27; Galore Creek Technical Report at 17-13.

¹³⁵ *Id.*

¹³⁶ Galore Creek Technical Report at 14-13, Tbl. 14-4.

¹³⁷ Scannell at 29.

¹³⁸ *Id.*

¹³⁹ *Id.*

¹⁴⁰ Galore Creek Comprehensive Study Report at 14 (“After treatment, the clean water will be pumped . . . to the Iskut River where it will be discharged through a pipeline and diffuser system.”).

¹⁴¹ Scannell at 28.

¹⁴² *Id.*

tailings impoundment.¹⁴³ Tailings will be contained behind dams in a steep canyon.¹⁴⁴ Waste rock is expected to leach aluminum, antimony, boron, copper, fluoride, iron, lead, manganese, molybdenum, selenium, sulphate, and zinc into the impoundment water.¹⁴⁵ “Effluent from the mine site will be discharged from the tailings and waste rock impoundment into Galore Creek from mid-May to mid-October.”¹⁴⁶

The B.C. Government issued an environmental assessment certificate for the mine in 2007.¹⁴⁷ However, aspects of the current project (described above) differ from what had been planned and approved in 2007, for which reason a new environmental assessment process is anticipated.¹⁴⁸

C. The Unuk River Watershed

At around 80 miles (129 kilometers) in length, the Unuk River is small compared to the Stikine and Taku rivers, draining a watershed of 1,500 square miles (3,885 square kilometers).¹⁴⁹ Nonetheless, it is a place of geographical variety, and for this reason, important biodiversity. The Unuk watershed’s landscapes range from alpine tundra to coastal temperate rainforest.¹⁵⁰

The forests of the watershed are inhabited by wolf, lynx, grizzly and black bears, fisher, mountain goat, moose, and black-tail deer.¹⁵¹ The river teems with fish, including all five

¹⁴³ Galore Creek Comprehensive Study Report at 38; *see also* Galore Creek EA Application at 7-220 (“The effects of PAG waste rock will be controlled by submergence in the tailings and waste rock impoundment, adjacent to but separate from the tailings disposal area.”).

¹⁴⁴ Scannell at 28.

¹⁴⁵ Galore Creek Comprehensive Study Report at 76 (“Other variables indicated elevated concentrations of several elements known to be associated with specific minerals in the deposit. These included copper (chalcopyrite), zinc (sphalerite), lead (galena) and fluorine (fluorite). Initial results from kinetic tests demonstrated that most elements leach at low rates. However, copper, cadmium, fluoride, manganese, selenium, sulphate and zinc were leached at concentrations greater than typical water quality criteria. The water quality model determined that other variables, including calcium, barium, aluminium, iron, boron, molybdenum, lead and antimony, would have significant loadings from waste rock to the tailings facility.”).

¹⁴⁶ Galore Creek EA Application at 7-231.

¹⁴⁷ British Columbia Ministry of Environment and Ministry of Energy, Mines and Petroleum Resources, Environmental Assessment Certificate #M06-03 (Feb. 16, 2007), https://a100.gov.bc.ca/appsdata/epic/documents/p239/1172178206924_0b6f74c0ae6e4197bd4cf3a4596a1d0a.pdf.

¹⁴⁸ Galore Creek Technical Report at 20-1.

¹⁴⁹ Seabridge Gold, Application for an Environmental Assessment Certificate / Environmental Impact Statement: KSM Project at 15-45 (July 2013) (KSM EA Application); Transboundary Watershed Alliance, *The Unuk River Watershed of Southeast Alaska/Northwest British Columbia* at PDF 3 (2001) (Transboundary Watershed Alliance).

¹⁵⁰ Transboundary Watershed Alliance at PDF 3.

¹⁵¹ *Id.*

species of Pacific salmon and steelhead trout.¹⁵² The Unuk offers some of largest runs of Chinook salmon in Southeast Alaska.¹⁵³ The U.S. Federal government has protected the American half of the watershed within the Misty Fjords National Monument.¹⁵⁴ The Canadian federal government has also protected some areas of the watershed within the Border Lake Provincial Park.¹⁵⁵

The KSM Mine

Approximately 22 miles (35 kilometers) from the Canada–United States border, Seabridge Gold Incorporated (“Seabridge Gold”)¹⁵⁶ proposes a gold, silver, copper, and molybdenum mine, exploiting one of the largest undeveloped gold deposits and, by reserves, the largest undeveloped copper-gold deposit in the world.¹⁵⁷ The project is composed of two separate areas connected by two 14-mile (23-kilometer) tunnels: a mine site in the valleys of the Mitchell, McTagg, and Sulphurets creeks, and a processing and tailings management area in tributaries of the Teigen and Treaty creeks.¹⁵⁸ Sulphurets Creek drains into the Unuk River whereas Teigen and Treaty creeks drain into the Nass River.¹⁵⁹ Over the course of its anticipated 52-year operating life, the KSM Mine would extract about 130,000 metric tons of ore per day¹⁶⁰ from three open pits—the Mitchell, Sulphurets, and Kerr pits—and two underground cave mines,¹⁶¹ producing 2.16 billion metric tons of ore.¹⁶²

The Mitchell Pit is expected to cover 487 hectares immediately downstream of the Mitchell Glacier.¹⁶³ After 23 years of mining the pit, a block-cave mine, the Mitchell Block

¹⁵² Seabridge Gold, Application for an Environmental Assessment Certificate / Environmental Impact Statement: KSM Project at 15-42, tbl. 15.1-4 (July 2013) (KSM EA Application); *see also id.* at 15-20 (“The Unuk and Bell-Irving rivers are large river systems with diverse fish communities and cultural values. They provide spawning routes for Pacific salmon (*Oncorhynchus* spp.), anadromous steelhead (*O. mykiss*), and cutthroat trout (*O. clarkii clarkii*), and serve as habitat for resident rainbow and cutthroat trout, Dolly Varden (*Salvelinus malma*), bull trout (*S. confluentus*), and mountain whitefish (*Prosopium williamsoni*).”).

¹⁵³ Transboundary Watershed Alliance. *The Unuk River Watershed* at PDF 3.

¹⁵⁴ *Id.* at PDF 1 (“U.S. conservationists early on recognized its importance and worked hard to have the entire lower portion of it protected within Misty Fjords National Monument.”).

¹⁵⁵ *See id.* at PDF 4.

¹⁵⁶ Seabridge Gold is a company incorporated under the Canada Business Corporations Act and based in Toronto. *Seabridge Gold Incorporated*, SYSTEM FOR ELECTRONIC DOCUMENT ANALYSIS AND RETRIEVAL, <http://www.sedar.com/DisplayProfile.do?lang=EN&issuerType=03&issuerNo=00007531> (last visited May 11, 2016).

¹⁵⁷ Seabridge Gold, Featured Projects: KSM, <http://seabridgegold.net/projects.php> (last visited May 11, 2016); Seabridge Gold, Backgrounder, http://seabridgegold.net/pdf/KSM_fact_sheet.pdf (last visited May 11, 2016); *see also* Fig. 6 (Map of the Brucejack and KSM Mines).

¹⁵⁸ KSM EA Application at 4-1 to 4-2.

¹⁵⁹ *Id.* at 4-2.

¹⁶⁰ *Id.* at 4-5.

¹⁶¹ *Id.* at 4-21.

¹⁶² *Id.* at 4-5.

¹⁶³ *Id.* at 4-25.

Cave Mine, will open under the pit bed to mine the same deposit until the closure of the project.¹⁶⁴ The Sulphurets Pit is expected to cover 221 hectares between the Mitchell and Sulphurets creeks.¹⁶⁵ The Kerr Pit is expected to cover 203 hectares south of Sulphurets Lake.¹⁶⁶ Another underground block-cave mine, the Iron Cap Block Cave Mine, will be developed 32 years into the project at a location north of the Mitchell Pit to extract ore from the Iron Cap deposit.¹⁶⁷

Over the life of the mine, the project is estimated to produce over three billion metric tons of waste rock and overburden.¹⁶⁸ The vast majority of the waste rock—71 percent by weight—will be potentially acid-generating, and another 15 percent will be “uncertain” as to its potential to generate acidic waste.¹⁶⁹ Waste rock will be stored in dumps in the rock storage facilities in the Mitchell Creek and McTagg Creek valleys, and will be used to backfill the Sulphurets Pit once mining is completed there.¹⁷⁰ The Mitchell rock storage facility will store approximately 1.6 billion metric tons of waste rock.¹⁷¹ The McTagg rock storage facility will store 0.8 billion metric tons of waste rock.¹⁷² Water that has contacted disturbed areas or materials will be diverted to a 63-hectare water storage facility.¹⁷³ The water storage facility will be located in a dammed section of Mitchell Creek,¹⁷⁴ from which it will be pumped to the water treatment plant.¹⁷⁵ Once at the water treatment plant, waste water will be treated with a high-density sludge lime water process before it is released to the environment.¹⁷⁶ To mitigate pollution, the water treatment and water storage facilities will continue to operate after closure of the mine for a period “until discharge quality meets targets,” a period expected to be around 250 years.¹⁷⁷

¹⁶⁴ *Id.* at 4-31.

¹⁶⁵ *Id.* at 4-63.

¹⁶⁶ *Id.* at 4-68.

¹⁶⁷ *Id.* at 4-21, 4-73.

¹⁶⁸ *Id.* at 4-5.

¹⁶⁹ *Id.* at 4-22 (“[T]he majority of the KSM Project rock is potentially acid-generating (PAG), particularly in the vicinity of the ore deposits. Substantial volumes of non-ore (waste) PAG rock must be mined in order to access the ore.”).

¹⁷⁰ Seabridge Gold Inc., KSM Mine Project Environmental Effects Summary at 1 (July 2013) (“Mined waste rock will be stored in rock storage facilities (RFSs) in the Mitchell and McTagg creek valleys and placed as backfill in the mined-out Sulphurets Pit.”).

¹⁷¹ KSM EA Application at 4-97.

¹⁷² *Id.* at 4-104.

¹⁷³ *Id.* at 4-137. The storage facility will also receive effluent from a selenium treatment plant that will treat the selenium contaminated water that has been exposed to the waste rock from the Kerr Pit. *Id.* at 4-158.

¹⁷⁴ *Id.* at 4-137.

¹⁷⁵ *Id.* at 4-149.

¹⁷⁶ *Id.*

¹⁷⁷ Canadian Environmental Assessment Agency, KSM (Kerr-Sulphurets-Mitchell) Project: Comprehensive Study Report at 8 (July 2014), http://ksmproject.com/wp-content/uploads/2014/07/34-081-CEAA_KSM_EN_R4_X4.pdf.

Leaving the mine site by a conveyor, crushed ore will travel through a 14-mile (23-kilometer) tunnel out of the Unuk River watershed, east to the Nass River drainage.¹⁷⁸ At the eastern end of the tunnel, the project proposes a processing plant, tailings impoundment, camp, diesel power plant, and explosives factory.¹⁷⁹ The ore will be further crushed and ground at the mill, processed to produce concentrate, and then trucked to Stewart, British Columbia.¹⁸⁰ Tailings will be sent to an impoundment facility within the upper reaches of South Teigen Creek.¹⁸¹ The impoundment will hold 2.3 billion metric tons of tailings.¹⁸²

The proposal also includes two access roads.¹⁸³ Prior to their development, the area will remain accessible only by helicopter, snowmobile, or foot.¹⁸⁴ The Coulter Creek access road would entail a 22-mile (35-kilometer) extension of the Eskay Creek Mine road, and would be used for the transport of personnel, equipment, and supplies.¹⁸⁵ This road would cross the Unuk River and also run along Coulter and Sulphurets creeks to the mine site.¹⁸⁶ The Treaty Creek access road extends approximately 27 miles (44 kilometers), connecting the processing and tailings management area at the eastern part of the project with Highway 37, crossing the Bell-Irving River, and running parallel to Treaty Creek.¹⁸⁷ This road would be 26 feet (eight meters) wide and would also be designed to carry trucks traveling on a year-round basis at around 30 to 35 miles (50 to 60 kilometers) per hour.¹⁸⁸ It will provide access for personnel, equipment, and supplies, and be used for hauling concentrate to Stewart during the operating life of the mine.¹⁸⁹ An estimated 36 one-way journeys will be made on this road every day.¹⁹⁰

¹⁷⁸ See KSM EA Application at 4-165 (“Conventional road access between the Mine Site and the [processing and tailings management area] is not feasible due to the steep, glaciated terrain and undulating topography; therefore, two separate but interconnected tunnels will be constructed to provide access through the mountain . . . consist[ing] of two parallel 23-km long tunnels”).

¹⁷⁹ *Id.* at 4-176, 4-178 to 4-181.

¹⁸⁰ *Id.* at 4-185 to 4-189, 4-194.

¹⁸¹ *Id.* at 4-194.

¹⁸² *Id.*

¹⁸³ *Id.* at 4-2.

¹⁸⁴ *Id.*

¹⁸⁵ *Id.* at 4-227, 4-241.

¹⁸⁶ *Id.* at 4-227; Fig. 6.

¹⁸⁷ See Fig. 6; see also KSM EA Application at 4-242 (“The [Treaty Creek Access Road] will leave Highway 37 . . . and follow the north side of the Treaty Creek Valley for approximately 17 km . . . turn north and follow the west side of the North Treaty Creek/Teigen Creek Valley for approximately 12 km . . . [then] transition into the Treaty Saddle road and head east for 15 km to provide access to the Saddle portal of the [Mitchell-Treaty Twinned Tunnels]”).

¹⁸⁸ KSM EA Application at 4-246.

¹⁸⁹ *Id.* at 4-242.

¹⁹⁰ *Id.* at 4-194.

This project received an environmental assessment certificate in 2014,¹⁹¹ and is now in the permitting stage.

The Brucejack Mine

Running two and a half miles (four kilometers) upstream from Sulphurets Creek and the KSM Mine, Brucejack Creek leads to a lake, known as Brucejack Lake, 4,600 feet (1,400 meters) above sea level in the British Columbia's Boundary Range.¹⁹² Pretium Resources Incorporated ("Pretium Resources")¹⁹³ proposes development of a gold and silver mine at the lake. This project would entail an underground mine, a mineral processing plant, a waste rock and a tailings impoundment, an aerodrome, and an access road.¹⁹⁴ Doré and gold-silver concentrate would be produced on-site and then trucked away along a 45-mile (73-kilometer) access road¹⁹⁵ passing through the Bell-Irving River watershed.¹⁹⁶ Around 2,700 metric tons of ore will be produced per day over the mine's 22-year operating life,¹⁹⁷ for a total of almost 19 million metric tons of ore, yielding around 7.1 million ounces of gold and 32 million ounces of silver.¹⁹⁸

The mine is expected to generate 4.87 million metric tons of potentially acid-generating waste rock,¹⁹⁹ as well as 15.8 million tons of flotation tailings.²⁰⁰ "77 to 85% of waste rock generated at the mine site is likely [potentially acid-generating] material. There is also enrichment of Ag [silver], As [arsenic], Cd [cadmium], Mo [molybdenum], Pb [lead], Sb [antimony], Se [selenium], and Zn [zinc] in waste rock and As, Sb, Ag and Cd may be a concern for metal leaching when waste rock is exposed to water."²⁰¹ Approximately 1.6 million metric

¹⁹¹ See British Columbia Ministry of Environment and Ministry of Energy and Mines, Environmental Assessment Certificate #M14-01 (July 29, 2014), http://a100.gov.bc.ca/appsdata/epic/documents/p322/1406742060041_d06863835d7d060f2f2a9acb3ccbc887d3d1e3069271f707f01058f437a9b350.pdf.

¹⁹² Pretium Resources Inc., Brucejack Gold Mine Project: Application for an Environmental Assessment Certificate / Environmental Impact Statement at 1-23 (June 2014) (Brucejack EA Application). The mine site will sit on the Brucejack Property, a 3,199-hectare area comprised of eleven mineral claims. *Id.* at 1-13. However, Pretium owns claims covering a larger area including the Snowfield and Bowser properties. See *id.* at 1-13, Fig. 5.3-1.

¹⁹³ Pretium Resources is a company incorporated in British Columbia, and based in Vancouver. *Pretium Resources Incorporated*, SYSTEM FOR ELECTRONIC DOCUMENT ANALYSIS AND RETRIEVAL, <http://www.sedar.com/DisplayProfile.do?lang=EN&issuerType=03&issuerNo=00030613> (last visited May 12, 2016).

¹⁹⁴ Brucejack EA Application at 1-29; see also Fig. 6.

¹⁹⁵ Canadian Environmental Assessment Agency, Brucejack Gold Mine Project, Environmental Assessment Report at 7 (July 2015) (Brucejack EA Report).

¹⁹⁶ *Id.* at 22.

¹⁹⁷ *Id.* at 7, 11; Brucejack EA Application at 1-30.

¹⁹⁸ Brucejack EA Application at 1-40, Tbl. 1.9-5.

¹⁹⁹ *Id.* at 5-115 ("[I]t is estimated that about 0.67 million tonnes of PAG development rock will be produced from the underground mine during the construction stage 4.2 Mt of waste rock, assumed to be PAG, will be produced by the underground mining throughout the operating period").

²⁰⁰ *Id.* at 5-118 ("The Project is expected to create about 15.8 Mt of flotation tailings over the life of the mine.").

²⁰¹ *Id.* at 13-73 to 13-74.

tons of the waste rock and 7 million metric tons of tailings will be used to backfill the underground mine stopes at closure.²⁰² The stopes will then be flooded to prevent oxidation of the rock.²⁰³ The remainder of the waste rock and tailings will be piped to the bottom of Brucejack Lake, the tailings having been thickened to increase their solid content and mixed with a flocculant.²⁰⁴

The project will have a water treatment plant,²⁰⁵ though doubts have been raised as to its effectiveness.²⁰⁶ The project's environmental assessment report concedes that the project "may . . . result in exceedance of some B.C. Water Quality Guidelines and/or Canadian Environmental Quality Guidelines thresholds in Brucejack Creek."²⁰⁷ Brucejack Creek's levels of cadmium, silver, and zinc already exceed water quality guidelines.²⁰⁸ Waters downstream of Brucejack Lake—including Sulphurets Creek and waters at its confluence with the Unuk River—are also already "highly mineralized."²⁰⁹

IV. ESTABLISHMENT AND OPERATION OF THE B.C. MINES BY CANADIAN NATIONALS INVOLVES A SUBSTANTIAL RISK OF TAKINGS THAT DIMINISH THE EFFECTIVENESS OF CONSERVATION TREATIES TO WHICH THE UNITED STATES IS PARTY

A. Woodland Caribou

The caribou serves as a "socioecological cornerstone of circumpolar indigenous cultures," its uses ranging "from subsistence hunting of caribou by Aboriginal peoples in Canada, Greenland and Alaska, to reindeer husbandry by Sámi in Scandinavia and numerous herding cultures across Siberia."²¹⁰ In North America, caribou have a special spiritual and cultural significance to indigenous peoples, who, "[s]ince time immemorial . . . have searched out caribou for sustenance and nutrition."²¹¹ In Canada alone, the lands of hundreds of First Nation communities overlap with caribou ranges and habitats.²¹²

²⁰² *Id.* at 5-115 ("Over time, as appropriate voids become available underground, much of this rock will be used as backfill. About 37%, or 1.58 Mt, of waste rock generated from mining activities will be disposed of in the lake."); *id.* at 5-118 ("Approximately 7.1 Mt of the flotation tailings will be used in paste backfill in the underground workings, while the rest will be deposited in Brucejack Lake.").

²⁰³ Brucejack EA Report at 28.

²⁰⁴ *Id.*

²⁰⁵ *Id.* at 7.

²⁰⁶ *See id.* at 28, 30.

²⁰⁷ *Id.* at 27.

²⁰⁸ *Id.* at 20.

²⁰⁹ *Id.*

²¹⁰ L. S. Vors & M. S. Boyce, *Global declines of caribou and reindeer*, 15 GLOBAL CHANGE BIOLOGY 2626, 2626 (2009) (Vors & Boyce).

²¹¹ David Suzuki Foundation, *The Cultural and Ecological Value of Boreal Woodland Caribou Habitat* at exec. sum. (2013), <http://www.davidsuzuki.org/publications/downloads/2012/Report-Caribou.pdf>.

²¹² *Id.*

Conservation of woodland caribou is a growing concern in North America. Once ranging widely across the continent, this forest-dwelling caribou's range has been significantly reduced and many populations today survive in increasingly-isolated pockets and exhibit declining numbers.²¹³ In the United States, woodland caribou persist only in Alaska and in a small southern Selkirk Mountains subpopulation, whose international range spans from northeastern Washington and northwestern Idaho to southern British Columbia.²¹⁴ In Canada, several populations or "ecotypes" of caribou—Northern Mountain, Central Mountain, Southern Mountain, Boreal, Newfoundland, and Atlantic-Gaspésie populations—are irregularly distributed across the boreal forests and mountains of northern Canada.²¹⁵

In British Columbia, large-scale human development and settlement over the last 75 years have fragmented woodland caribou habitats and ranges, resulting in populations becoming "discontinuous, sometimes isolated, and increasingly vulnerable."²¹⁶ Caribou populations in the province have dropped from 30,000 to 40,000 before European settlement to just 16,500 today.²¹⁷ In southern British Columbia, several herds are facing extinction due to habitat loss and population declines.²¹⁸ The risk also exists for some of the caribou subpopulations in west-

²¹³ See, e.g., P. Zager et al., *Woodland Caribou: A Conservation Dilemma*, <http://www.umich.edu/~esupdate/library/95.10-11/zager.html> (last visited May 20, 2016) (describing woodland caribou's historic continental range and range decline); Biodivcanada.ca, Species of special interest, Caribou, <http://www.biodivcanada.ca/default.asp?lang=En&n=B11F5440-1&offset=4&toc=show#car2> (Biodivcanada) (last visited May 20, 2016) (showing current and historic range of woodland caribou and status of various populations); Environment Canada, Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal population, in Canada, Species at Risk Act Recovery Strategy Series at 8, Fig. 3 (2012) (Recovery Strategy for Boreal Population), https://www.registrelep-sararegistry.gc.ca/virtual_sara/files/plans/rs_caribou_boreal_caribou_0912_e1.pdf (showing several local populations of boreal woodland caribou that may no longer be self-sustaining); Vors & Boyce at 2626, 2628, Fig. 2 (showing population trajectories for major caribou and reindeer herds worldwide, including those in North America); J. C. Ray et al., *Conservation status of caribou in the western mountains of Canada: Protections under the Species At Risk Act, 2002-2014*, 23 RANGIFER (SPECIAL ISSUE) 49, 50, 51, Fig. 1 (2015) (Ray et al.) (detailing a 30 percent decline in caribou range in western Canada between early 1900s and 2000).

²¹⁴ See, e.g., Committee on the Status of Endangered Wildlife in Canada (COSEWIC), COSEWIC Assessment and Status Report on the Caribou *Rangifer tarandus*, Northern Mountain population, Central Mountain population and Southern Mountain population in Canada at v, 13, 57 (2014), http://www.registrelep-sararegistry.gc.ca/virtual_sara/files/cosewic/sr_Caribou_Northern_Central_Southern_2014_e.pdf (COSEWIC Assessment).

²¹⁵ See COSEWIC Assessment at iii-v & 9, Fig. 2; Recovery Strategy for Boreal Population at 2 & 3, Fig. 1; Biodivcanada (showing locations of the Newfoundland and Atlantic-Gaspésie populations). The Central Mountain, Southern Mountain, and Atlantic-Gaspésie populations are listed as endangered under the Canadian Species at Risk Act (SARA); the Boreal population is listed as threatened, and Northern Mountain population is listed as of special concern. COSEWIC Assessment at iii-v; Recovery Strategy for Boreal Population at 2. See also Ray et al. 49-55 (review of SARA and the taxonomy of the western mountain populations).

²¹⁶ British Columbia Ministry of Environment, Lands and Parks, *Caribou in British Columbia: Ecology, Conservation and Management* at PDF 2 (2000), http://www.env.gov.bc.ca/wld/documents/caribou_fs.pdf (Caribou in British Columbia). See also COSEWIC Assessment at 14, Fig. 3 (showing approximate historic and current ranges of Mountain caribou in western Canada); *id.* at vi ("Caribou habitat has declined in quality and extent on many ranges due to impacts from industrial activities, particularly in . . . British Columbia.").

²¹⁷ Caribou in British Columbia at PDF 3.

²¹⁸ C. J. Johnson et al., *Witnessing extinction – Cumulative impacts across landscapes and the future loss of an evolutionary significant unit of woodland caribou in Canada*, 186 BIOLOGICAL CONSERVATION 176, 179-177, 184 (2015) (Johnson et al.).

central and northern British Columbia, the area affected by the B.C. Mines, that belong to the Northern Mountain ecotype.²¹⁹ Many of the individual herds in this ecotype are generally small, in decline, and poorly understood, and some herds may not even be identified.²²⁰ Further declines in these herds, or their isolation from other caribou populations, raise significant questions regarding the long-term persistence of woodland caribou, especially in the face of a warming climate and continued anthropogenic landscape change.²²¹

Harms to Woodland Caribou Generally

Woodland caribou have “inherent sensitivity to human activities.”²²² They depend on “large areas of contiguous suitable habitat, with little or no disturbance or vehicle access, in order to spread out and avoid predators,”²²³ unrestricted access to sufficient quantities of their primary food, lichens,²²⁴ and areas that provide security from predators and insects.²²⁵ In search of seasonally changing habitats, woodland caribou move across mature, lichen-bearing forests, open muskeg and bogs, and alpine and subalpine environments, involving both horizontal and altitudinal shifts.²²⁶ Human disturbance that interferes with these habitat uses and movements

²¹⁹ See COSEWIC Assessment at 9, Fig. 2 (map showing Northern Mountain caribou herds). The map shows both delineated seasonal ranges of the individual herds and areas of “trace occurrence” where caribou are also found and which “may include some smaller local populations that have not yet been identified.” British Columbia Conservation Data Centre, *Conservation Status Report: Rangifer tarandus* pop. 15 at PDF 2 (2016), <http://a100.gov.bc.ca/pub/eswp/esr.do?id=15648> (Caribou Conservation Status Report). The Northern Mountain ecotype, including all the herds that belong to it, was designated as a species of concern in 2014, meaning that it is a “species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats,” under SARA. COSEWIC Assessment at iii, viii, xxii, 57.

²²⁰ COSEWIC Assessment at iii, vii, 15; see also Caribou Conservation Status Report (detailing the status of the Northern Mountain Population); Environment Canada, Management Plan for the Northern Mountain Population of Woodland Caribou (*Rangifer tarandus caribou*) in Canada at 55-57, App. 2 & 68-71, App. 5 (2012) (Caribou Management Plan) (providing population and trend information for herds in the Northern Mountain population).

²²¹ COSEWIC Assessment at vii, 19; 53; C. D. Apps & B. N. McLellan, *Factors influencing the dispersion and fragmentation of endangered mountain caribou populations*, 130 BIOLOGICAL CONSERVATION 84, 95 (2015) (Apps & McLellan); Vors & Boyce at 2626. See also Fig. 7 (Map of Northern Mountain Woodland Caribou Ranges) (showing now extirpated caribou range south of the KSM and Brucejack mines).

²²² Johnson *et al.* at 177. See also *id.* at 183 (woodland caribou “is widely accepted as being sensitive to human disturbance”).

²²³ Caribou in British Columbia at PDF 4. See also Caribou Conservation Status Report (range requirements for Northern Mountain population include “access to relatively undisturbed summer calving areas” and “large tracts of winter range where [they] can exist at low densities as an anti-predator strategy.”); COSEWIC Assessment at vi (“[C]aribou require large tracts of range where they can separate themselves (horizontally and altitudinally) from other prey and predators”).

²²⁴ COSEWIC Assessment at 19, 27; Caribou Conservation Status Report at 6.

²²⁵ Caribou Management Plan at 7; Caribou in British Columbia at PDF 4; R. B. Anderson *et al.*, Development of a Threshold Approach for Assessing Industrial Impacts on Woodland Caribou in Yukon, Draft Report at 6 (Nov. 2002) (Anderson *et al.*).

²²⁶ See, e.g., Caribou in British Columbia at PDF 4, 5 (describing Northern Mountain caribou’s seasonal habitat uses and movement patterns); D. Cichowski *et al.*, *Caribou Rangifer tarandus*, in Accounts and Measures for Managing Identified Wildlife at 1, 5-6 (2004), http://www.env.gov.bc.ca/wld/frpa/iwms/documents/Mammals/m_caribou.pdf (Cichowski *et al.*) (same); Caribou Management Plan at 7 (same).

can lead to serious consequences, including reduced survival.²²⁷ Moreover, woodland caribou's short breeding season (typically lasting only one week), low reproductive rate, and calves' low survival rate also render them vulnerable, since any negative population-level effect cannot be offset quickly by reproduction.²²⁸

Human development poses one of the greatest threats to woodland caribou in British Columbia, both through direct mortality and indirect harms caused by disturbance and habitat loss and avoidance.²²⁹ The development of roads, for example, increases direct mortalities due to vehicle collisions as well as increased access for hunters and predators.²³⁰ While caribou are generally known to avoid roads, studies have found that caribou may use roads as travel corridors²³¹ and are also attracted to salt on road surfaces.²³² When caribou venture onto roads, mortalities follow by way of vehicle collisions. For example, one caribou population in Alberta lost between 15 to 20 percent of its members in some years from collisions with vehicles.²³³ In Yukon, caribou were the species most frequently involved in vehicle collisions, representing 27 percent of total vehicle collisions with wildlife.²³⁴ The prevalence of vehicle-collision mortalities extends to British Columbia, where authorities have recognized that in some instances trucks on highways pose a “[r]eal risk of a large group of caribou being killed[.]”²³⁵

²²⁷ See, e.g., Caribou Management Plan at 7-8 (ability to move between seasonal ranges is “vitally important” to caribou; human barriers and disturbance affecting these movements may limit access to important food sources, which can directly affect the body condition of female caribou and in turn calf survivorship); COSEWIC Assessment at 19 (lower survival rates are associated with human disturbance and access to suitable habitats); J. L. Polfus *et al.*, *Identifying indirect habitat loss and avoidance of human infrastructure by northern mountain woodland caribou*, 144 *BIOLOGICAL CONSERVATION* 2637, 2637, 2643 (2011) (Polfus *et al.* 2011).

²²⁸ Caribou in British Columbia at PDF 3; COSEWIC Assessment at vi, 25-26; Anderson *et al.* at 6; B. L. Horejsi, Report on the Proposed Tulsequah Chief Mine Road: Its Expected Impacts on Wildlife and prospects for Mitigation at 14 (1999) (Horejsi).

²²⁹ COSEWIC Assessment at vii, 23. See also Caribou Conservation Status Report at PDF 4 (major threats to Northern Mountain caribou include “access [] resulting in disturbance and mortality, and increased predator efficiency, [and] industrial development (threat to winter food supply, increase in early seral habitat supporting alternate prey species, access for hunting and human disturbance, and habitat fragmentation)”); J. Polfus *et al.*, *Atlin Northern Mountain Caribou Habitat Modeling and Cumulative Human Impact Assessment* at 2 (June 2010) (Polfus *et al.* 2010) (“[H]unter overharvest, habitat loss and fragmentation from forestry and energy development, human-induced changes to predator-prey communities and proliferation of road and snowmobile networks have, to varying degrees, contributed to population declines.”).

²³⁰ See, e.g., COSEWIC Assessment at 49.

²³¹ S. C. Trombulak & C. A. Frissell, *Review of Ecological Effects of Roads on Terrestrial and Aquatic Communities*, 14 *CONSERVATION BIOLOGY* 18, 20 (2000) (Trombulak & Frissell).

²³² *Endangered caribou become road kill on B.C. mountain highway*, CBC NEWS (Mar. 30, 2009), <http://www.cbc.ca/news/canada/british-columbia/endangered-caribou-become-road-kill-on-b-c-mountain-highway-1.822336>; see also Trombulak & Frissell at 24 (increased concentrations of salt along roads attract large mammals).

²³³ COSEWIC, COSEWIC Assessment and Status Report on the Woodland Caribou *Rangifer tarandus caribou*, Atlantic-Gaspésie Population, Boreal Population, Southern Mountain Population, Northern Mountain Population, Newfoundland Population in Canada at 47 (2002) (COSEWIC Assessment 2002).

²³⁴ EDI Environmental Dynamics Inc., *Large Mammal-Vehicle Collisions: Overview of Mitigations and Analysis of Collisions in Yukon* at 29, 32 (Mar. 2015).

²³⁵ COSEWIC Assessment at 110.

Caribou also experience indirect mortality when roads increase hunters' access to previously roadless habitat. Resource roads, including those associated with mining projects, are particularly problematic in this regard: "New road development and subsequent off-road trails often accompany industrial activity and facilitate hunting access."²³⁶ Access roads have been associated with the decline or extinction of local populations of caribou from both illegal and legal hunting.²³⁷ The effect is compounded by other habitat dislocations, which can push caribou closer to roads and make caribou locations more predictable to hunters.²³⁸

Development of roads also increases the access of predators to caribou populations, resulting in mortalities. "Predation is considered the primary limiting factor for forest-dwelling caribou."²³⁹ Predation disproportionately affects calves and cows whose ability to avoid predators is critical to maintaining healthy caribou populations.²⁴⁰ To reduce predation risk, woodland caribou separate themselves spatially from other ungulate species and the predator populations associated with these species.²⁴¹ Anthropogenic changes in the landscape can hinder this separation by creating habitats that attract moose and wolves into an area.²⁴² In fact, roads and other linear features related to industrial development can "serv[e] as a catalyst . . . creating efficient travel corridors for gray wolves (*Canis lupus*), a primary predator of caribou in the boreal forest."²⁴³ "As the density of these features continues to increase across the landscape, caribou will find it more challenging to find refuge from wolves."²⁴⁴ The increased predation pressure and mortality in the wake of development can have significant population-level effects:

²³⁶ Caribou Management Plan at 11; *see also* Anderson *et al.* at 9 ("Human access into previously remote areas can cause significant hunting mortality to caribou populations") (citations omitted).

²³⁷ L. Webster, The Effects of Human Related Harassment on Caribou (*Rangifer tarandus*) at 15-16, 20-21 (Aug. 1997) (Webster); COSEWIC Assessment at 49; Horejsi at 7-8.

²³⁸ Polfus *et al.* 2010 at 22-23.

²³⁹ Anderson *et al.* at 6.

²⁴⁰ *See, e.g.*, Caribou in British Columbia at PDF 3 ("[P]redators often kill more than half of the calves during the first few months"); Anderson *et al.* at 6 (most calf mortalities occur within the first ten days post birth and "cow's ability to avoid encounters with predators during this sensitive period has the greatest influence on calf survival").

²⁴¹ Vors & Boyce at 2629.

²⁴² Caribou in British Columbia at PDF 4. *See also* Anderson *et al.* at 10 (expansion of moose populations into caribou habitat provides an alternative prey for wolves and sustains high wolf numbers).

²⁴³ W. Ehlers *et al.*, *Movement ecology of wolves across an industrial landscape supporting threatened populations of woodland caribou*, 29 LANDSCAPE ECOL. 451, 452 (2014) (Ehlers) (internal references omitted). *See also* A. R. James & A. K. Stuart-Smith, *Distribution of Caribou and Wolves in Relation to Linear Corridors*, 64 J. WILDLIFE MGMT. 154, 158 (2000) (James & Stuart-Smith) (risk of predation from wolves higher with proximity to linear corridors); H. U. Wittmer *et al.*, *Changes in landscape composition influence the decline of a threatened woodland caribou population*, 76 J. ANIMAL ECOLOGY 568, 576 (2007) ("[C]aribou population declines may be precipitated by increased predator abundance and efficiency following . . . increased roading . . .").

²⁴⁴ Ehlers *et al.* at 463.

“Wolves may reduce or even eliminate caribou populations in areas where habitat has been significantly altered.”²⁴⁵

Industrial mining is a prime example of an anthropogenic activity with potentially adverse effects on woodland caribou,²⁴⁶ and mining activities “likely contribute to reducing woodland caribou populations and ranges.”²⁴⁷ The development and operation of mine infrastructure, including roads, within caribou ranges results in habitat loss and herd displacement, with potential population-level effects.²⁴⁸ Studies have shown that caribou “avoid industrial sites” in general,²⁴⁹ with calving females being especially intolerant of such disturbances.²⁵⁰ “As a minimum, most large mammals are dislocated from mine sites and associated facilities.”²⁵¹ However, the area of displacement can far exceed the actual physical footprint of a mine.²⁵² Mineral exploration and development infrastructure and activities can result in broad-scale disturbances to caribou, varying spatially (*e.g.*, winter and summer grazing areas) and temporally (*e.g.*, pre-calving and calving seasons), and also changing depending on the phase of the mining activity.²⁵³ Such disturbances can occur during all phases of mining,

²⁴⁵ COSEWIC Assessment 2002 at 48. *See also id.* at 43-44 (“While predators cause most deaths of forest-dwelling caribou, and predation is of great concern, it is a proximate factor that is influenced significantly by the effect of human developments. Access and disturbance, fragmentation (isolation), and low caribou numbers are of high concern and all are increasingly a result of development and human activities rather than natural causes.”) (internal references omitted); Vors & Boyce at 2629 (shifts in shift in predator-prey dynamics can significantly increase predation pressure and caribou mortality); Caribou in British Columbia at PDF 6 (listing changes in prey/predator relationships among the principal management concerns for caribou).

²⁴⁶ *See, e.g.*, COSEWIC Assessment at vii, 23, 47-48; T. M. Herrmann *et al.*, *Effects of mining on reindeer/caribou populations and indigenous livelihoods: community-based monitoring by Sami reindeer herders in Sweden and First Nations in Canada*, 4 THE POLAR J. 28, 29 (2014) (Herrmann *et al.*); J. N. Weir *et al.*, *Effects of Mine Development on Woodland Caribou Rangifer Tarandus Distribution*, 13 WILDLIFE BIOLOGY 66-74 (2007) (Weir *et al.*).

²⁴⁷ E. Jones, Seasonal habitat use and selection by woodland caribou herds in the South Peace region, central British Columbia at 53 (Jan. 2008) (Jones); *see also* D. C. Heard & K. L. Vagt, *Caribou in British Columbia: A 1996 Status Report*, 10 RANGIFER (SPECIAL ISSUE) 117, 122 (1998) (“[M]ining . . . and associated road building . . . contributes to population declines and reduced home ranges”).

²⁴⁸ *See, e.g.*, COSEWIC Assessment at vii, 23, 47; Herrmann *et al.* at 29.

²⁴⁹ Herrmann *et al.* at 29.

²⁵⁰ Weir *et al.* at 67. *See also* COSEWIC Assessment at 48; Herrmann *et al.* at 29; R. Wilson *et al.*, *Effects of roads on individual caribou movements during migration*, 195 BIOLOGICAL CONSERVATION 2, 7 (2016) (Wilson *et al.*) (discussing studies that found parturient female caribou in northern Alaska exhibiting stronger avoidance of industrial infrastructure than non-parturient females and males).

²⁵¹ Environment Canada, Environmental Code of Practice for Metal Mines at 39 (2009), <https://www.ec.gc.ca/lcpe-cepa/documents/codes/mm/mm-eng.pdf> (Environment Canada).

²⁵² Anderson *et al.* at 10; *see also* J. Edmonds, *Status of woodland caribou in Alberta*, 10 RANGIFER (SPECIAL ISSUE) 111, 112 (1996) (Edmonds) (direct loss of habitat from industrial developments may not itself always be huge but associated access can cause significant disturbance on caribou).

²⁵³ *See, e.g.*, Herrmann *et al.* at 29; Weir *et al.* at 66, 70-72; Polfus *et al.* 2010 at v-vi; S. J. Dyer *et al.*, *Avoidance of Industrial Development by Woodland Caribou*, 65 J. OF WILDLIFE MGMT. 531 (2001).

from exploration,²⁵⁴ to construction,²⁵⁵ and operation.²⁵⁶ For example, in Newfoundland, a woodland caribou herd was displaced by, and exhibited significant avoidance of, a gold mine following initiation of the construction phase.²⁵⁷ The caribou's disturbance responses were observed during all seasons, but were most prominent during pre-calving and calving seasons.²⁵⁸ In this study, the abundance of caribou "increased linearly with distance to the mine" in all seasons;²⁵⁹ only 17 to 27 percent of the caribou remained in the study area during the operation of the mine.²⁶⁰ Compared to the pre-disturbance phase, "most caribou avoided the area within [2.5 miles] 4 [kilometers] of the mine cent[er] during mine construction and operation."²⁶¹ The avoidance response was most pronounced during winter, late winter, and pre-calving seasons.²⁶² Notably, females and calves were reported absent near the mine site.²⁶³ A study on the Atlin woodland caribou herd in British Columbia found that caribou avoided mine sites by over one mile (two kilometers) during the summer.²⁶⁴

In addition to causing displacement from pre-existing habitat, human development can create barriers to caribou movement. Roads and infrastructure associated with mines can function as semi-permeable barriers and render habitats unsuitable to caribou thus altering caribou's seasonal movements, restricting their access to critical food sources, and reducing their ability to take refuge from insects and predators.²⁶⁵ Manmade barriers may also lead to

²⁵⁴ Environment Canada at 33 & 34, Tbl. 3.1 (describing typical disturbances, including noise, associated with the exploration phase); COSEWIC Assessment at 19, 47 (naming mineral exploration as human disturbance affecting caribou); Anderson *et al.* at 1 ("[M]ining (both exploration and production) negatively impact woodland caribou.").

²⁵⁵ See, e.g., Environment Canada at 34 & 35, Tbl. 3.2 (describing typical activities and disturbances associated with the mine construction phase); Weir *et al.* at 66, 70-72 (documenting caribou avoidance of a mine during construction phase).

²⁵⁶ See, e.g., Environment Canada at 34, 36-39 (describing typical disturbances during mining operation); Weir *et al.* at 66, 70-72 (documenting caribou avoidance to mining operations); Herrmann *et al.* at 29 (discussing adverse effects from mineral extraction on caribou and reindeer).

²⁵⁷ Weir *et al.* at 66, 70-72.

²⁵⁸ *Id.*

²⁵⁹ *Id.* at 72.

²⁶⁰ *Id.* at 70.

²⁶¹ *Id.*

²⁶² *Id.*

²⁶³ *Id.* at 73.

²⁶⁴ Polfus *et al.* 2010 at 15.

²⁶⁵ See, e.g., Caribou Management Plan at 7 ("Barriers restricting [] seasonal movements (e.g. roads, fences, pipelines, settlements, unsuitable habitat) may adversely affect [woodland caribou's] access to seasonally important food sources and areas used as refugia from predators and insects."); Wilson *et al.* at 2 (roads and other semipermeable infrastructure can affect caribou even when they are still capable of moving between seasonal ranges).

fragmentation and demographic isolation of herds,²⁶⁶ and limit caribou's home ranges.²⁶⁷ These changes can undermine the caribou's long-term viability.²⁶⁸

Barrier effects have been associated with various kinds of roads, including resource roads.²⁶⁹ These effects may stem from caribou's "aversion to the physical barrier presented by a road and associated forest opening, vehicle traffic, or predation by humans."²⁷⁰ Even a single road with a relatively low volume of traffic can alter caribou's movements,²⁷¹ and partial restriction of migration routes can have negative population-level effects.²⁷² A study in Newfoundland, for example, found that "cent[er]s of caribou activity were 'maximum distances' possible from roads," a distribution attributed "to a combination of hunting and disturbance associated with transportation corridors."²⁷³ "Studies in Newfoundland and Alaska indicate that traffic levels as low as 15 vehicles per hour cause behavioural changes in caribou, supporting the argument that even roads with very low human use cause displacement effects."²⁷⁴ Avoidance of areas adjacent to roads can result in overutilization of habitats elsewhere, "effectively diminish[ing] the capacity of the area to support caribou."²⁷⁵

Habitat displacement, fragmentation, and disturbance come at a high cost to caribou. Most immediately, the actual flight from human-related disturbance can harm caribou by forcing

²⁶⁶ Apps & McLellan at 85 ("[D]emographic isolation may be the result of potential human barriers, such as settled and agricultural landscapes, major highways, and hydro-electric impoundments.").

²⁶⁷ See, e.g., British Columbia, Ministry of Water, Land and Air Protection, *Caribou Rangifer tarandus*, in Accounts and Measures for Managing Identified Wildlife – Accounts V 2004 at 7 (2004), http://www.env.gov.bc.ca/wld/frpa/iwms/documents/Mammals/m_caribou.pdf (BC MWLAP 2004) (explaining that Northern Mountain caribou home ranges change throughout an animal's life and the size of the range can depend on, for example, the local population size); Dyer *et al.* at 845 (roads as semipermeable barriers that could exacerbate the reduction in availability of caribou habitat caused by avoidance effects).

²⁶⁸ Apps & McLellan at 85; see also Land Management Plan at 45 (in the Stikine-Iskut area, "[t]he long-term viability of caribou . . . populations is dependent on maintaining opportunities for movement between adjacent plateaus and mountains.").

²⁶⁹ See, e.g., BC MWLAP 2004 at 20 ("Highways and roads may . . . limit caribou movements, particularly [] female and young caribou moving between seasonal ranges."); Wilson *et al.* at 6 (mining road affected movements of approximately 30 percent of collared caribou in northwest Alaska); R. D. Cameron *et al.*, *Central Arctic Caribou and Petroleum Development: Distributional, Nutritional, and Reproductive Implications*, 58 ARCTIC 1, 1 (2005) (Cameron *et al.* 2005) ("[C]aribou were relatively unsuccessful in crossing road/pipeline corridors in [oil development area in Arctic Alaska]."); see also *id.* at 93 ("[A] feature such as the Trans-Canada Highway may represent a barrier, with permeability that varies depending on season, time of day, and adjacent habitat.").

²⁷⁰ S. J. Dyer *et al.*, *Quantifying Barrier Effects of Roads and Seismic Lines on Movements of Female Woodland Caribou in Northeastern Alberta*, 80 CAN. J. ZOOL. 839, 842 (2002) (Dyer *et al.*).

²⁷¹ Wilson *et al.* at 6.

²⁷² See, e.g., *id.* at 2 ("[S]emi-permeable barriers to movement, such as roads, can affect animals even though they are still capable of moving between seasonal ranges.").

²⁷³ Anderson *et al.* at 10.

²⁷⁴ *Id.* at 11 (internal references omitted); see also R. D. Cameron *et al.*, *Redistribution of Calving Caribou in Response to Oil Field Development on the Arctic Slope of Alaska*, 45(4) ARCTIC 338, 340 (1992) (Cameron *et al.* 1992) (finding that barren-ground caribou exhibited significant avoidance of an oil field access road).

²⁷⁵ Cameron *et al.* 1992 at 340.

them to exhaust energy that would normally be allocated to growth, maintenance, or reproduction.²⁷⁶ “Severe or repeated human harassment could . . . result in reduced growth rates, poor body condition and decreased reproductive rates[] that may in turn increase adult and calf mortality.”²⁷⁷ Avoidance of preferred habitats during winter can be particularly costly to caribou: “[s]trong avoidance of human developments during winter . . . can exacerbate the already high energetic costs associated with movement in snow, poor winter nutrition and female gestation.”²⁷⁸ The “nutritional or stress cost of responding to human disturbance may have cumulative implications for individual fitness and population productivity.”²⁷⁹ Displacement “has the potential to influence individuals’ ability to obtain forage or circumvent harsh snow conditions.”²⁸⁰ Avoidance of preferred habitats can also lead to crowding and overgrazing, and may render caribou locations more predictable for predators and hunters.²⁸¹ A pure quantitative assessment of lost habitat will not capture the detrimental effect of displacement: the true effect will depend on the locations and uses of the lost habitat.²⁸² In sum, the adverse effects of roads and industrial infrastructure are “likely [to] contribute to reducing woodland caribou populations and ranges,”²⁸³ and therefore compromise the caribou’s viability in the long term.²⁸⁴

Woodland Caribou and the B.C. Mines

The B.C. Mines include the kinds of industrial infrastructure and activities that are known to harm woodland caribou through direct mortality, habitat loss and fragmentation, and other disturbance effects. Four of the transboundary mine projects addressed in this petition, Red Chris, Schaft Creek, Galore Creek, and KSM mines, are located within the range of the Northern Mountain woodland caribou population.²⁸⁵ The mine site infrastructure for the Red Chris and

²⁷⁶ Polfus *et al.* 2011 at 2643; Webster at 2-3; Anderson *et al.* at 12.

²⁷⁷ Webster at 2. *See also* Caribou Management Plan at 9 (“Disturbance resulting from noise, infrastructure development, and linear features may result in increased stress, changes to activity budgets, physical injury or death of adults, unborn fetuses or calves and changes in movement patterns resulting in functional habitat loss through avoidance behaviour.”); Webster at 7 (low-level aircraft flights can result in “immediate physical injury or death, increased energy expenditures that may reduce survival or reproductive rates and long term behavioural changes such as displacement from traditional ranges.”).

²⁷⁸ Polfus *et al.* 2011 at 2643.

²⁷⁹ Herrmann *et al.* at 29; *see also* Cameron *et al.* 2005 at 1 (finding that increasing industrial infrastructure caused a shift in high-density calving of caribou to areas of lower forage biomass, resulting in “poorer body condition at breeding and lower parturition rates for [] females . . . which depressed the productivity of the herd”).

²⁸⁰ Polfus *et al.* 2011 at 2643.

²⁸¹ Polfus *et al.* 2010 at 22-23.

²⁸² Weir *et al.* at 73 (suggesting that habitat lost along a migration route would have a particularly substantial impact).

²⁸³ Jones at 53.

²⁸⁴ *See, e.g.,* Apps & McLellan at 85 (finding that caribou persistence may be influenced by the distribution and juxtaposition of suitable landscapes satisfying caribou’s seasonal habitat requirements, as well as demographic isolation resulting from human barriers).

²⁸⁵ *See* Fig. 7. The Tulsequah Chief mine also located in the vicinity of woodland caribou ranges. As described above, *see supra* note 64, the current plan for the mine does not call for an access road from the mine site to Atlin. This road option, should it materialize in the future, would pose a major risk to the Atlin caribou herd.

Schaft Creek mines will directly displace herds from what had previously been functional habitat, and all four mines will transect caribou range with their access roads.²⁸⁶ In addition, the cumulative effect of several mines in the Stikine and Unuk river watersheds will significantly increase traffic running through a known caribou range along Highway 37, causing increased displacement and mortalities.

In the Stikine River watershed, the Red Chris Mine sits entirely within the range of woodland caribou, including within the western boundary of the Spatsizi herd's range.²⁸⁷ The Spatsizi herd consists of between 2,300 and 3,000 caribou,²⁸⁸ representing "approximately one quarter of the provincial population."²⁸⁹ During pre-construction surveys, caribou were found within the project's wildlife study area, including at the mine site.²⁹⁰ The Red Chris property, located west of the Spatsizi Plateau,²⁹¹ encompasses two connected "zones" recognized by the B.C. Government for their value to caribou and other species. The first, "Todagin zone," comprises the Todagin Plateau and the Tsatia Mountain,²⁹² and extends east to "the treeline of the Klappan drainage."²⁹³ This drainage is the location of the second, "Klappan zone," which is "ecologically sensitive, providing low elevation winter habitat for ungulates . . . in the Spatsizi predator-prey system."²⁹⁴ With construction of the mine, the previously-undeveloped Todagin Plateau will be fragmented with a network of haul roads, pipelines, processing plants, and other mining infrastructure, destroying these areas as caribou habitat.²⁹⁵ Notwithstanding the mine proponent's conclusion that "development of the mine is not expected to have a significant effect on the availability of [caribou] habitat,"²⁹⁶ detrimental effects on the caribou, including the Spatsizi herd, from mining infrastructure and activities will displace caribou, form barriers to their movements, harass them, and potentially reduce the herd size and range.²⁹⁷

²⁸⁶ Fig. 7. This petition does not address in detail impacts on woodland caribou from the KSM Mine, which may also harm the species. As shown on the map, the eastern portion of the mine is located adjacent to the southern edge of the Northern Mountain woodland caribou range and the Couter Creek Access Road transects caribou range near the road's junction with Highway 37. The Secretary's investigation should include the potential adverse impacts that this mine may have on caribou.

²⁸⁷ *Id.*

²⁸⁸ Caribou Management Plan, App. 2 at 57; COSEWIC Assessment at 33 (estimating 2258 mature animals); British Columbia, Cassiar Iskut-Stikine Land and Resource Management Plan at 2 (2000, Rev. 2006) (estimating 2500 animals) (Land Management Plan).

²⁸⁹ Land Management Plan at 2.

²⁹⁰ Red Chris EA Application at 4-240.

²⁹¹ *Id.* at 4-369, Fig. 4.2.11.

²⁹² Land Management Plan at 105.

²⁹³ *Id.*

²⁹⁴ *Id.* at 96; Red Chris EA Application at 4-369, Fig. 4.2.11.

²⁹⁵ See, e.g., Red Chris Technical Report at 1-13, Fig. 1.4 (showing overall site layout); *Red Chris Mine, Photo Gallery*, IMPERIAL METALS, <http://www.imperialmetals.com/our-operations-and-projects/operations/red-chris-mine/photo-gallery> (last visited May 13, 2016) (photographs of the various infrastructure associated with the mine).

²⁹⁶ Red Chris EA Report at 65.

²⁹⁷ See *supra* pp. 25-30 (caribou impacts from infrastructure).

The impacts on woodland caribou will be, and possibly already have been, aggravated by the Red Chris access road. This 14.2-mile (22.8-kilometer) road cuts through woodland caribou range, including the designated Spatsizi herd's range, and into Todagin Plateau, an area known for its ecological importance to woodland caribou.²⁹⁸ The access road not only could lead to direct mortality by vehicle collision, but also would provide increased access to the plateau, with potential adverse impacts on caribou from changes in predator-prey dynamics, as well as increased hunter pressure, and other human disturbances.²⁹⁹ Like other mining infrastructure, the access road could sever connections between caribou habitats, including adjacent plateaus and mountains: in the Stikine-Iskut area, which includes several plateaus used by caribou, loss of connectivity between the plateaus and mountains has the potential to affect the long-term viability of the populations.³⁰⁰

The proposed Schaft Creek Mine site is located within the range of the Edziza herd.³⁰¹ The Edziza herd is one of the smallest British Columbian sub-populations of the Northern Mountain ecotype, last estimated at only 151 animals,³⁰² and occupying a range of less than 500 square miles (1,300 square kilometers).³⁰³ The Schaft Creek report confirmed that over half of the project area was modeled to offer either "High" or "Moderately High" late winter habitat for caribou; 15 percent of the area was similarly rated for early winter habitat.³⁰⁴ Habitat will obviously be destroyed within the footprint of the mine infrastructure. Moreover, construction and year-round operation of the mine will include industrial activities typical of open-pit mining: use of large-scale equipment, drilling and blasting, crushing and milling, and trucking and hauling³⁰⁵—all of which would displace the Edziza herd from the general vicinity of these activities.³⁰⁶ Other infrastructure, including a network of haul roads and an on-site airport³⁰⁷ will create the potential for further displacement of and impediments to the Edziza herd's movements across what had formerly been its habitat.

²⁹⁸ Red Chris EA Application at 4-345; Land Management Plan at 45, 105 (identifying Todagin Plateau as important habitat for caribou); Fig. 7.

²⁹⁹ See *supra* pp. 25-30 (caribou impacts from roads); Land Management Plan at 45 (“[E]ntire plateau areas become accessible to ATVs once . . . access [is provided] by road or trail”). While unauthorized access to the road corridor and plateau may be restricted with control measures, see Red Chris Technical Report at 18-166, these will not mitigate other adverse impacts from the mine access road, such as vehicle collisions, avoidance, disturbance, and changes in prey-predator dynamics.

³⁰⁰ Land Management Plan at 45.

³⁰¹ Rescan Tahltan Environmental Consultants, Schaft Creek Project: Wildlife Habitat Suitability Baseline at 2-7 (Nov. 2010) (Schaft Creek Habitat Suitability Baseline); Rescan Tahltan Environmental Consultants, Schaft Creek: Mountain Ungulate Baseline, 2006 and 2008 at 5-1 (Sept. 2010) (Schaft Creek Ungulate Baseline); Fig. 7.

³⁰² COSEWIC Assessment, App. 2 at 88.

³⁰³ Caribou Conservation Status Report at 2.

³⁰⁴ Schaft Creek Wildlife Habitat Suitability Baseline at i, Tbl. 1; *id.* at 4-43, 4-45.

³⁰⁵ Schaft Creek 2013 Feasibility Study at 1-15.

³⁰⁶ See *supra* pp. 24-30 (impacts from industrial disturbance).

³⁰⁷ *Id.* at 1-16.

Access roads for the proposed Galore Creek and Schaft Creek projects will transect caribou habitat.³⁰⁸ At Schaft Creek Mine, ore concentrate will be hauled from the mine site along a new 25-mile (40-kilometer) road running through the previously unroaded Mess Creek valley, and then along the Galore Creek access road for the remaining 40.5 miles (65.2 kilometers) to Highway 37.³⁰⁹ At Galore Creek Mine, ore concentrate will be piped along a 44-mile (71-kilometer) slurry pipeline from the mine site to a dewatering plant in the Iskut River watershed near the junction of the access road and Highway 37.³¹⁰ The project's 80-mile (128-kilometer) access road, which connects the mine site to Highway 37, transects caribou range in the eastern half of its route.³¹¹

The access roads associated with these two mines are likely to adversely affect woodland caribou.³¹² The traffic level associated with concentrate hauling from Schaft Creek alone is expected to be nearly 100 trucks per day, seven days a week, amounting to nearly 550,000 truck journeys total over the 15-year operating life of the mine.³¹³ The roads will pose significant risks to caribou from collisions and intensified hunting and predation pressure, as well as indirect harms by means of habitat loss and fragmentation.³¹⁴ Such changes could have particularly pronounced adverse impacts on the Edziza herd due to its small size, which renders it susceptible to stochastic events.³¹⁵

While each of these three mine projects individually will cause woodland caribou mortality, displacement, and disturbance, even more concerning are the mines' potential cumulative effects, including those that flow from transportation of ore. The mines will use Highway 37 to move ore concentrate to the port of Stewart, British Columbia. Highway 37, also known as the Stewart-Cassiar Highway, spans 725 kilometers, "begin[ning] in the lush forests of the Skeena River valley and follow[ing] the Kitwanga River north into the Nass River drainage . . . [follow[ing] the Bell-Irving River . . . into the Ningunsaw River valley in the Iskut River watershed," climbing to the headwaters of the Iskut near Spatsizi Plateau and mount Edziza before "descend[ing], twisting into the valley of the Stikine River."³¹⁶ These are lands of

³⁰⁸ See Fig. 7.

³⁰⁹ Schaft Creek 2013 Feasibility Study at 1-17. An additional linear disturbance will be created by the 287 kV power transmission line. *Id.* at 18-51 to 158-52.

³¹⁰ Scannell at 35-36.

³¹¹ See Fig. 7.

³¹² See *id.*; Schaft Creek Habitat Suitability Baseline at 2-7; Schaft Creek Ungulate Baseline at 5-1.

³¹³ Environmental Assessment Office & Canadian Environmental Assessment Agency, Schaft Creek Mine Project: Application Information Requirements / Environmental Impact Statement Guidelines at vi (2011) (Schaft Creek Application Guidelines).

³¹⁴ See *supra* pp. 25-30.

³¹⁵ See, e.g., Caribou Conservation Status Report at 3 (Edziza herd's viability risk higher due to the small number of adults in the population); see also Johnson *et al.* at 184 (in southern British Columbia, "[t]he rate of development and resulting loss of contiguous habitat is pushing already small populations of caribou to low numbers that are susceptible to stochastic events."); Apps & McLellan at 95 (small populations subject to genetic and stochastic threats).

³¹⁶ R. Cannings & S. Cannings, THE NEW B.C. ROADSIDE NATURALIST: A GUIDE TO NATURE ALONG B.C. HIGHWAYS at 171-72 (2013).

“otherwise roadless wilderness,” where “[n]orthern wildlife is rich.”³¹⁷ The ore transport route on Highway 37 cuts through woodland caribou range, including areas near the ranges of the Spatsizi and Edziza herds.³¹⁸

The use of Highway 37 for ore transport will result in a net increase of traffic on the highway. Notably,

- Red Chris Mine is expected to contribute an 7 to 10 truck journeys per day,³¹⁹ meaning an additional 2,555 to 3,650 journeys annually or an additional 71,540 to 102,200 journeys over the mine’s 28-year operating life.³²⁰
- Schaft Creek Mine is expected to contribute 96 truck journeys per day, meaning an additional 36,500 journeys annually, or an additional 550,000 journeys over the mine’s 15-year operating life.³²¹
- Galore Creek Mine is expected to contribute at least 19 truck journeys per day,³²² meaning an additional 6,935 journeys annually, or an additional 138,700 journeys over the mine’s 20-year operating life.³²³

The net effect of just ore transportation from these three mines will be an increase of roughly 129 truck journeys a day, or between 760,240 and 790,900 additional truck journeys over the mines’ operating lives. This addition will involve large trucks often carrying hundreds of tons of material. The figure excludes traffic associated with the transportation of employees and construction equipment and materials, and the provision of supplies, not least diesel fuel, to the mine sites during operation.³²⁴ All of this means that Highway 37 will in fact experience an even more extreme increase in traffic than the ore transportation figures suggest. The increase in traffic will likely lead to further caribou mortalities from vehicle collisions, as well as further displacement of woodland caribou from the area around Highway 37.³²⁵

³¹⁷ *Id.* at 171.

³¹⁸ Fig. 7; TranBC, Ministry of Transportation and Infrastructure Online, *Highway 37 Stewart-Cassiar – Scenic Road to Northern Adventure*, <http://tranbc.ca/2013/07/16/highway-37-stewart-cassiar-scenic-road-to-northern-adventure/#sthash.RNMkCGDy.dpbs> (“It’s common to see . . . caribou . . . along the highway, especially in the late spring and early summer, when adults cross the road with their young.”).

³¹⁹ Red Chris 2012 Technical Report at 21-251.

³²⁰ *Id.* at 18-161.

³²¹ Schaft Creek Application Guidelines at vi.

³²² Galore Creek Comprehensive Study Report at 14 (“A traffic study suggests that maximum supply traffic on the road will be about 19 vehicles each way per day once the mine is in operation. There will be additional traffic for maintenance and monitoring.”).

³²³ *Id.* at 16.

³²⁴ This figure also excludes any traffic contributed by the KSM Mine’s Coulter Creek Access Road.

³²⁵ As shown in Figure 7, woodland caribou has already been extirpated along Highway 37 just south of the KSM and Brucejack mines.

Relevance under the Western Hemisphere Convention and the Pelly Amendment

Both individually and collectively, the establishment and operation of the Red Chris, KSM, Schaft Creek, and Galore Creek mines are likely to result in takings of woodland caribou. The mortality, displacement, and disturbance (all with potential population-level effects) that woodland caribou will likely suffer as a result of the mines would entail “harass[ment], harm, . . . [or] kill[ing]” of caribou,³²⁶ either directly or by means of habitat destruction and modification. These acts constitute “takings” under the Pelly Amendment.

Such takings would diminish the effectiveness of the international conservation program established by the Western Hemisphere Convention. The Convention seeks to “protect and preserve in their natural habitat representatives of all species . . . in sufficient numbers and over areas extensive enough to assure them from becoming extinct through any agency within man’s control.”³²⁷ Protection of the woodland caribou, named in the Convention’s Annex,³²⁸ is “of special urgency and importance” under the Convention.³²⁹ The Convention’s conservation program entails protection of the woodland caribou “as completely as possible.”³³⁰ Given that the woodland caribou’s range elsewhere has been dramatically decreased—with consequent reductions in population—further reduction as a consequence of mine development would be irreconcilable with the solicitous concern and regime of careful conservation established among parties to the Convention. Canada is not a party to the Convention, and therefore takings by its sovereign or nationals would not constitute direct breaches. However, the Pelly Amendment does not specify that only breaches trigger certification. The efforts of Convention parties to protect the woodland caribou would be offset—and thus the Convention’s conservation purpose diminished—if caribou range were contracted and populations were directly or indirectly reduced by the harmful effects of mine development. Thus, by taking woodland caribou, Canadian nationals—the Red Chris, Schaft Creek, KSM, and Galore Creek mine proponents and the governmental authorities who permit these mine developments—would be diminishing the effectiveness of the conservation program of the Western Hemisphere Convention. The likely takings of woodland caribou resulting from existing and future mine projects justify an investigation of these projects pursuant to the Pelly Amendment. If that investigation determines that a taking has or will occur, this conclusion must be certified to the President.

³²⁶ 22 U.S.C. § 1978(h)(5)(A).

³²⁷ Western Hemisphere Convention, pmb1.

³²⁸ See Organization of American States, *Listas de Especies de Fauna y Flora en Vías de Extinción en los Estados Miembros* (1967).

³²⁹ Western Hemisphere Convention, art. VIII.

³³⁰ *Id.*

B. Grizzly Bear

Like other large carnivores, grizzly bears have many traits that render them vulnerable to extirpation in the face of exposure to human development.³³¹ The grizzly bear has low population densities and large home ranges.³³² In British Columbia, grizzly bear ranges have been observed at 25 to 200 square kilometers for females and 60 to 700 square kilometers for males.³³³ Males have wider ranges, often overlapping with the ranges of several female bears, due to grizzly bears' mating patterns.³³⁴ The grizzly bear also has a low reproduction rate³³⁵—one of lowest of all terrestrial mammals³³⁶ and the lowest of all animals in British Columbia.³³⁷ Females reach sexual maturity at between 4 and 7 years and males at around 5.5 years.³³⁸ Mating occurs during 6 to 7 weeks in late spring and early summer.³³⁹ Bears reproduce around one to three cubs every three years.³⁴⁰ The cubs remain with the mother for 2-4 years before leaving.³⁴¹ A low reproductive rate makes any significant population declines difficult to reverse.³⁴² Quality of habitat is of great importance to grizzly bears, since their active season is only 5 to 7 months, during which time they must consume sufficient calories to supply the following denning cycle.³⁴³

Harms to Grizzly Bears Generally

Following the receding of ice sheets, the grizzly bear inhabited the span of North America, from Mexico in the south to Ontario in the northeast and Alaska in the northwest.³⁴⁴ Today, they only inhabit about half of this area.³⁴⁵ Human activity accounts for up to 90 percent

³³¹ B. Ruediger, *THE RELATIONSHIP BETWEEN RARE CARNIVORES AND HIGHWAYS 2* (1996) (Ruediger).

³³² *Id.*; D. A. Blood, British Columbia Ministry of Water, Land and Air Protection, *Grizzly Bears in British Columbia: Ecology, Conservation and Management* 4 (2002) (Blood).

³³³ Blood at 4; *see also* J. W. Schoen, *Bear Habitat Management: A Review and Future Perspective*, in 8 INT'L CONF. BEAR. RES. & MGMT. 143, 146 (1990) (Schoen) ("Clearly, the normal movements of bears are so extensive that bear habitat must be evaluated and managed on a landscape scale often exceeding thousands of square kilometers.").

³³⁴ C. C. Schwartz *et al.*, *Grizzly Bear*, in *WILD MAMMALS OF NORTH AMERICA: BIOLOGY, MANAGEMENT, AND CONSERVATION* 565 (G. A. Feldhammer *et al.* eds., 2d ed. 2003) (Schwartz *et al.*).

³³⁵ Ruediger at 2.

³³⁶ Schoen at 144.

³³⁷ Horejsi at 19.

³³⁸ Schwartz *et al.* at 562, 564.

³³⁹ Blood at 3.

³⁴⁰ Schwartz *et al.* at 562.

³⁴¹ *Id.* at 562.

³⁴² Schoen at 144.

³⁴³ Schwartz *et al.* at 564-65.

³⁴⁴ *Id.* at 557-58.

³⁴⁵ Blood at 3; Schoen at 145.

of all recorded mortalities for adult grizzly bears,³⁴⁶ and unsurprisingly, human-bear interactions are the main cause of declines in grizzly bear populations.³⁴⁷ Since European settlement of the continent, their range has dwindled. Grizzly bears have been eliminated from 98 percent of the 48 contiguous American states;³⁴⁸ in Canada, grizzly bears have been extirpated in parts of Manitoba, Saskatchewan, and Alberta, and populations were reduced in other parts of Alberta and British Columbia.³⁴⁹ Before European settlement there were about 25,000 grizzly bears in British Columbia, a number that has declined by about 45 percent to the current population of around 13,800.³⁵⁰

In addition to industrial areas, like open pit mine sites,³⁵¹ the primary means of human access to grizzly bear habitat is transportation corridors, especially roads.³⁵² “[H]uman action on roads rarely is beneficial to bears.”³⁵³ Habitat-transecting roads pose several threats to grizzly bears, the most obvious being direct and indirect mortality.³⁵⁴ “Roads increase access for hunters and poachers, the probability of vehicle-bear collisions, and the frequency of energy-costly flight responses by the bears.”³⁵⁵ The majority of human-caused grizzly bear mortalities occur near

³⁴⁶ Schwartz *et al.* at 571.

³⁴⁷ R. D. Mace *et al.*, *Relationships Among Grizzly Bears, Roads and Habitat in the Swan Mountains, Montana*, 33 J. APPLIED ECOLOGY 1395, 1402 (1996) (Mace *et al.*); G. MacHutchon & M. Proctor, *The Effect of Road and Human Action on Grizzly Bears and their Habitat*, in TRANS-BORDER GRIZZLY BEAR PROJECT 1 (2015) (MacHutchon & Proctor); see also B. N. McLellan & D. M. Shackleton, *Grizzly Bears and Resource-Extraction Industries: Effects of Roads on Behaviour, Habitat Use and Demography*, 25 J. APP. ECOLOGY 451, 459 (1988) (McLellan & Shackleton) (explaining the negative effect of roads on grizzly bear habitats); Horejsi at 20 (“Outside of human population and agricultural centers most contact between bears and human is road induced.”).

³⁴⁸ Schwartz *et al.* at 558; M. Proctor *et al.*, *Population Fragmentation and Inter-Ecosystem Movements of Grizzly Bears in Western Canada and the Northern United States*, 180 WILDLIFE MONOGRAPHS 1, 5 (2012) (Proctor *et al.*, *Population Fragmentation*) (“The North American range of grizzly bears (*Ursus arctos*) has contracted in the past century and a half because of human caused mortality, habitat loss, and population fragmentation.”).

³⁴⁹ Schwartz *et al.* at 558.

³⁵⁰ Blood at 5, 2.

³⁵¹ B. N. McLellan, *Relationships Between Human Industrial Activity and Grizzly Bears*, in 8 INT’L CONF. BEAR. RES. & MGMT. 57, 61 (1990) (“Open pit mines and tailings also destroy bear habitat”) (McLellan).

³⁵² MacHutchon & Proctor at 1; Schwartz *et al.* at 571 (“Because most bears are killed by humans, proximity of kills to human facilities and access routes . . . are common.”).

³⁵³ MacHutchon & Proctor at 1.

³⁵⁴ Ruediger at 3-4.

³⁵⁵ McLellan & Shackleton at 451; see also B. Benn *et al.*, *Grizzly Bear Mortality and Human Access in the Central Rockies Ecosystem of Alberta and British Columbia, 1972/1976-2002*, in BIOLOGY, DEMOGRAPHY, ECOLOGY, AND MANAGEMENT OF GRIZZLY BEARS IN AND AROUND BANFF NATIONAL PARK AND KANANASKIS COUNTRY 91 (2005) (Benn *et al.*) (“Spatial analyses clearly showed that most grizzlies died within a narrow zone along roads and trails, and around human settlements.”).

roads, either due to vehicle collisions or from legal or illegal kills.³⁵⁶ This has been confirmed by several studies.³⁵⁷

Even where the intrusion of roads into bear habitats does not result in bear mortalities, roads can subject bear populations to indirect harms. Human activity on roads can displace bears from the area, leading to habitat loss.³⁵⁸ “[E]ven a little traffic is sufficient to displace them.”³⁵⁹ Moreover, the removal of vegetative cover renders the road corridor as a whole “unfriendly or dangerous to grizzly bears.”³⁶⁰ The spatial displacement caused by roads can range from 100 meters up to 4 kilometers.³⁶¹ Adult male bears display avoidance behavior,³⁶² as do female bears, which select home ranges to minimize road exposure.³⁶³ Studies have indicated that avoidance occurs even on roads closed to traffic.³⁶⁴

Hand-in-hand with displacement is the reluctance of bears to cross roadways, resulting in the division of what were previously continuous habitats and ranges.³⁶⁵ Bear crossings are

³⁵⁶ MacHutchon & Proctor at 3; Proctor *et al.*, *Population Fragmentation* at 35 (“Where monitored, traffic-related mortality data for grizzly bears exists.”); Horejsi at 21 (“Bears die at a disproportionate rate when they are within 1.2 km (1 mile) of a drivable road.”).

³⁵⁷ MacHutchon & Proctor at 3 (listing studies); Benn *et al.* at 84 (study in British Columbia finding that 53 percent of recorded human-caused grizzly bears mortalities occurred along roadways); Horejsi at 21 (study in northwest Alberta finding that 75 to 89 percent of legal and 71 to 90 percent of illegal bear kills occurred within 1 to 2 kilometers of roads).

³⁵⁸ Ruediger at 4; Proctor *et al.*, *Population Fragmentation*. at 35 (“[G]rizzly bears avoid areas of high human influence and generally avoid use of habitat around busy highways, even in areas where human settlement is low” (citation omitted)); McLellan & Shackleton at 451 (“Indirect population constraints can result from long-term displacement of bears from areas adjacent to roads. . . . If roads do displace bears, it leads either to increased pressure on similar habitats in undisturbed regions, or to the ‘loss’ of these essential but limited habitats.”).

³⁵⁹ McLellan & Shackleton at 458; *see also* McLellan at 59 (“Bears simply avoid locations where human activities are common, such as roads and active industrial sites, by enough distance that they won’t be disturbed by a passing vehicle or an additional machine starting up.”); Horejsi at 23 (“Dispersed nonmotorized activity . . . can displace bears from a distance of 3 km and alter their activity for at least 24 hours.”).

³⁶⁰ M. L. Gibeau & S. Herrero, *Roads, Rail, and Grizzly Bears in the Bow River Valley, Alberta*, in PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON ECOLOGY AND TRANSPORTATION 104 (G. L. Evink ed., 1998) (Gibeau & Herrero).

³⁶¹ MacHutchon & Proctor at 5; W. F. Kasworm & T. L. Manley, *Road and Trail Influences on Grizzly Bears and Black Bears in Northwest Montana*, in 8 INT’L CONF. BEAR. RES. & MGMT. 79, 84 (1990) (describing a 78 per cent decline in female brown bear use of habitat within 150 meters of logging roads during log hauling operations); McLellan & Shackleton at 458 (finding a 58 per cent habitat loss within 100 meters of roads).

³⁶² Gibeau & Herrero at 105 (“[A]voidance behavior is strongest in the adult segment of the population where we believe males select for high quality habitats and an absence of humans.”).

³⁶³ MacHutchon & Proctor at 7.

³⁶⁴ Horejsi at 23 (reporting a study in Western Montana which found that bear use of areas near roads closed to traffic was 58% less than expected had there not been a road).

³⁶⁵ Proctor *et al.*, *Population Fragmentation* at 35 (“Vehicle traffic, a by-product of large-scale patterns of settlement across southern Canada, was negatively associated with inter-area movement across the entire continuum of settlement”); Ruediger at 4 (“Highways [] and other human developments tend to create boundaries for both individuals and populations.”).

unsurprisingly inversely correlated with vehicle traffic.³⁶⁶ Populations can become fragmented, with consequences on genetic diversity.³⁶⁷ In general, the fragmentation of wildlife populations is “a major force underlying the recent extinction crisis.”³⁶⁸ Impediments to the dispersal of a population can prevent the salutary increase of genetic diversity, as well as the colonization or re-colonization of suitable habitat.³⁶⁹ This threat is a serious one for large carnivores, including grizzly bears. Studies have found that human activity along transportation corridors fragments grizzly bear populations because female bears in particular avoid crossing such corridors.³⁷⁰ A genetic sampling study demonstrated that anthropogenic influence has separated previously interconnected populations.³⁷¹ The same study observed that “female immigration is needed to augment a dwindling population or recolonize one that has been extirpated.”³⁷² Fragmented, small, and isolated populations face an increased probability of extirpation.³⁷³

Over time a “dynamic tension” can develop between bears and roadways, wherein, depending on context, bears experience “both attraction to roads and alienation from roads”³⁷⁴ with an increase in mortality risk. Bears may become habituated to roads.³⁷⁵ This is especially the case where the road is in an area,

... where grizzly bears have small home ranges, or in areas where area-concentrated food sources of limited distribution are within the activity zone [such that] exclusion could limit access to important food sources. If there is a survival cost associated with avoiding this zone, grizzly bears will probably move into it and become habituated to the disturbance.³⁷⁶

³⁶⁶ J. S. Waller & C. Servheen, *Effects of Transportation Infrastructure on Grizzly Bears in Northwestern Montana*, 69 J. WILDLIFE MGMT. 985, 996 (2005); Gibeau & Herrero at 105 (finding that the Trans Canada Highway in Alberta functions as a barrier to grizzly bear movement).

³⁶⁷ MacHutchon & Proctor at 8.

³⁶⁸ Proctor *et al.*, *Population Fragmentation* at 5.

³⁶⁹ *Id.*

³⁷⁰ M. Proctor *et al.*, *Genetic Analysis Reveals Demographic Fragmentation of Grizzly Bears Yielding Vulnerably Small Populations*, 272 PROC. ROYAL SOC. B. 2409, 2414 (2005) (Proctor *et al.*, *Genetic Analysis*); Proctor *et al.*, *Population Fragmentation* at 35 (“Traffic and settlement reduce movements of male and female bears. Although each sex seems to be affected by the same fracturing forces, their thresholds differ,” with females more susceptible to fragmentation.).

³⁷¹ Proctor *et al.*, *Population Fragmentation* at 28.

³⁷² *Id.* at 27.

³⁷³ Proctor *et al.*, *Genetic Analysis* at 2409; *see also* Proctor *et al.*, *Population Fragmentation* at 5 (“At broad temporal and spatial scales, smaller population fragments have a higher likelihood of succumbing to unfavorable demographic forces.”).

³⁷⁴ Gibeau & Herrero at 104.

³⁷⁵ MacHutchon & Proctor at 4; D. J. Mattson, *Human Impacts on Bear Habitat Use*, in 8 INT’L CONF. BEAR. RES. & MGMT. 33, 47 (1990).

³⁷⁶ W. R. Archibald *et al.*, *Responses of Grizzly Bears to Logging Truck Traffic in the Kimsquit River Valley, British Columbia*, 7 INT’L CONF. BEAR RES. & MGMT. 251, 255 (1987).

Bears may also venture to roadways due to the availability of plant foods there—specifically berry plants³⁷⁷—or due to the ease of travel along cleared roadways.³⁷⁸ Female bears with cubs may use roads to avoid adult male bears, due to the danger males pose to young cubs.³⁷⁹ Adult male bears will avoid roadways.³⁸⁰ For this reason, despite a general aversion to roads, females with cubs will disproportionately frequent areas near roads.³⁸¹ However, habituation increases the risk of direct mortality documented above,³⁸² particularly for cubs.³⁸³ “[N]ear road environments cause grizzly bears to make difficult choices with little opportunity to learn successful behaviors if they die in the process.”³⁸⁴

Both direct mortality and indirect harms via displacement and population fragmentation are heightened where roads are situated in valleys and along rivers. “In mountainous terrain throughout the world, valley bottoms are the preferred habitats for both humans and wildlife.”³⁸⁵ “Roads often follow valley bottoms and pass through riparian areas which are frequently used by grizzly bears.”³⁸⁶ Bears also tend to select habitats near avalanche chutes, which often terminate near roads.³⁸⁷ The “types of habitat most often associated with roads are especially valuable to bears, because they contain high-quality foods in spring and autumn.”³⁸⁸ At a minimum, low-elevation roads create “a significant conflict relative to displacement of bears and disruption of [their] activity.”³⁸⁹

In conclusion, as a general matter, “[o]nce roads are developed in any grizzly habitat, the population is placed in a precarious position.”³⁹⁰ For this reason, “[r]oad construction in remote

³⁷⁷ See Benn *et al.* at 90 (“In BC there are diverse berry feeding opportunities. In addition to buffaloberry (*Shepherdia canadensis*) berries in particular of the genus *Vaccinium* occur at lower and mid elevations, often along roads and in close proximity to people.”).

³⁷⁸ MacHutchon & Proctor at 4; B. Benn & S. Herrero, *Grizzly Bear Mortality and Human Access in Banff and Yoho National Parks, 1971-98*, 13 *URSUS* 213, 214 (2002); Gibeau & Herrero at 104.

³⁷⁹ McLellan & Shackleton at 458.

³⁸⁰ *Id.*

³⁸¹ Gibeau & Herrero at 105 (“Adult females select areas with a high degree of security for raising cubs, which in some cases means avoiding adult males.”); Benn *et al.* at 88 (“Adult females may preferentially use habitats near people, presumably to avoid adult males. Thus, they are prone to habituation to humans . . . increasing their mortality risk relative to males.”); McLellan & Shackleton at 458.

³⁸² See *supra* p. 39; MacHutchon & Proctor at 4.

³⁸³ McLellan at 62 (“Attracting bears to . . . roadsides with grasses and clover while leaving road access intact, can also make bears vulnerable to hunters and poachers and collisions with traffic.”).

³⁸⁴ Gibeau & Herrero at 106.

³⁸⁵ *Id.* at 104; Schoen at 144.

³⁸⁶ McLellan & Shackleton at 451; Horejsi at 22 (“Riparian areas and the lower reaches of avalanche chutes contain important and preferred bear habitats but most roads are built in these valley bottom habitats, creating significant conflict relative to displacement of bears and disruption of activity (and, of course, mortality).”).

³⁸⁷ Mace *et al.* at 1403.

³⁸⁸ McLellan & Shackleton at 458.

³⁸⁹ Horejsi at 22.

³⁹⁰ McLellan & Shackleton at 459.

areas appears to be the major long term impact of resource extraction industries and the most significant problem facing grizzly bears in most locations.”³⁹¹

Grizzly Bears and the Transboundary Mines

The environmental assessment documents for the B.C. Mines provide limited evidence with respect to the presence of grizzly bears. The British Columbia Ministry of Environment data, however, make abundantly clear that all six B.C. Mines are situated in the habitats of three grizzly bear management units: the Taku, Edziza-Lower Stikine, Spatsizi, and Stewart units.³⁹² The five projects that include access roads are within the least-roaded grizzly-inhabited areas in British Columbia,³⁹³ which, as of 2011, had recorded only two road-kill grizzly mortalities since 1975.³⁹⁴

The mines operating or planned in the Stikine and Unuk river watersheds—the Red Chris, Schaft Creek, Galore Creek, KSM, and Brucejack mines—are situated in the habitats of the Edziza-Lower Stikine, Spatsizi, and Stewart units.³⁹⁵ These mines do or will include access roads that transect these units’ habitat range, often running through the preferred valley-bottom habitat areas.

The Schaft Creek Mine project plans a 25-mile (40-kilometer) access road, running from the mine site to the Galore Creek Access Road along which ore concentrate would be transported to Highway 37.³⁹⁶ The road would run through previously undeveloped grizzly bear habitat along the valley bottom of the Mess Creek watershed,³⁹⁷ which, besides grizzly bears, supports a variety of aquatic and terrestrial species, including salmon.³⁹⁸

The Galore Creek Mine’s ore body is situated in a high-elevation area with grizzly bear denning habitat.³⁹⁹ Its access road—an 80-mile (128-kilometer) route connecting the mine site to Highway 37⁴⁰⁰—will extend the Schaft Creek project’s effects into additional prime grizzly bear habitat. The Galore Creek mine proponent expects its project to inflict “habitat alternation,” “disruption, blockage and impediment to movements,” and both direct and indirect mortality to grizzly bear populations, specifically from use of its access road.⁴⁰¹ Much of the Galore Creek

³⁹¹ McLellan at 62.

³⁹² See British Columbia Ministry of Environment, *Grizzly Bear Population Status in BC* at 2 (2012) (*Grizzly Bear Population Status in BC*); Fig. 8 (Map of Affected Grizzly Bear Management Units).

³⁹³ *Id.* at 6-7 (each having 2 percent of their areas with more than 0.6 kilometers of road per square kilometer).

³⁹⁴ See *id.* at App. 44, 47, 59.

³⁹⁵ See Fig. 8.

³⁹⁶ Schaft Creek 2013 Feasibility Study at 18-1.

³⁹⁷ Schaft Creek Habitat Suitability Baseline at ii.

³⁹⁸ Scannell at 75.

³⁹⁹ *Id.* at 62.

⁴⁰⁰ Galore Creek EA Application at 1-1.

⁴⁰¹ *Id.* at 7-482 to 7-483.

access road tracks grizzly bear habitat,⁴⁰² crossing 120 avalanche paths en route, such that 17.8 percent of the total route is subject to avalanche risk.⁴⁰³ The mine proponent expects grizzly bear mortalities along this road.⁴⁰⁴

The KSM Mine's environmental assessment study found that upwards of 38 percent of the project's regional study area—a 338,000 hectare area around the project's infrastructure⁴⁰⁵—contained “Moderately High” and “High” grizzly bear habitat,⁴⁰⁶ with evidence of at least 31, and possibly 58, grizzly bears living in the area.⁴⁰⁷ The local study area—a 0.9-mile (1.5-kilometer) buffer area around project infrastructure⁴⁰⁸—was identified as suitable grizzly bear denning habitat, particularly near the tailings impoundment site.⁴⁰⁹ Areas overlapping the processing and tailings management area were candidates for designation as “essential habitat necessary to sustain” the grizzly bear.⁴¹⁰ The KSM Mine project will include two access roads. First, the Coulter Creek access road will be a 22-mile (35-kilometer) road running west along Coulter and Sulphurets creeks, crossing the Unuk River and then proceeding north where it joins the preexisting Eskay Creek Mine road and from there to Highway 37.⁴¹¹ This road will be used to transport personnel and supplies to the mine site.⁴¹² It will bear 2,883 one-way journeys, averaging about eight per day.⁴¹³ Second, the Treaty Creek access road will run 18 miles (29 kilometers), connecting the processing and tailings management area at the eastern part of the project with Highway 37, crossing the Bell-Irving River, and running parallel to Treaty Creek.⁴¹⁴ The road will traverse several avalanche chutes along the way.⁴¹⁵ It will be used for hauling concentrate to Stewart, British Columbia, during the operating life of the mine. About 41 return trips will be made on this road every day.⁴¹⁶

Uphill from the KSM mine site, the Brucejack Mine plans to upgrade an existing 45-mile (73-kilometer) exploration road, to create a mine access road running from the mine site and processing plant to Highway 37.⁴¹⁷ The road would transect grizzly habitat, traversing the

⁴⁰² Galore Creek Comprehensive Study Report at 162.

⁴⁰³ Galore Creek EA Application at 5-222 to 5-223.

⁴⁰⁴ *Id.* at 7-595.

⁴⁰⁵ KSM EA Application at 18-49.

⁴⁰⁶ *Id.* at 18-13.

⁴⁰⁷ *Id.* at 18-14.

⁴⁰⁸ *Id.* at 18-49.

⁴⁰⁹ *Id.* at 18-13 to 18-14.

⁴¹⁰ *Id.* at 18-41.

⁴¹¹ *Id.* at 4-227; Fig. 6.

⁴¹² KSM EA Application at 4-227.

⁴¹³ *Id.* at 4-241.

⁴¹⁴ *Id.* at 4-242.

⁴¹⁵ *Id.* at 4-259.

⁴¹⁶ *Id.* at 4-260.

⁴¹⁷ Brucejack EA Report at 8; Fig. 6.

Knipple Glacier before running along the valley bottom parallel to the Bowser River to Bowser Lake,⁴¹⁸ then along Scott Creek and Wildfire Creek to Highway 37, crossing fourteen avalanche chutes along the way.⁴¹⁹ The project's environmental assessment report listed grizzly bear mortality from vehicle collisions, disruption of movement and increased poaching, as well as habitat loss, fragmentation, and alternation as "predicted effects" of the project.⁴²⁰

Further north, on the east side of Highway 37, the Red Chris Mine includes a mine site and an access road in the Spatsizi management unit's habitat. The Spatsizi unit numbers around 666 individuals distributed over 8,283 square miles (21,454 square kilometers).⁴²¹ The Red Chris project involves a new gravel access road cutting 14.2 miles (22.8 kilometers) from the mine site to Highway 37.⁴²² The road transects high-value habitat, where grizzly bears have been sighted.⁴²³

Serious harms to grizzly bear populations are likely to result from the establishment of the five mines in the Stikine River and Unuk River watersheds. Each of the five mine projects establishes mine infrastructure—not least, access roads—transecting grizzly bear habitat, often in the areas most valued by grizzly bears, that is, valley bottoms and the bases of avalanche chutes. These access roads will be traversed hundreds of thousands of times by massive trucks loaded with ore concentrate and mining equipment. As the scientific literature establishes, the roads would likely lead to bear mortalities by way of vehicle collisions and legal or illegal shootings—the rates of both rising as some bears become habituated to the roadways and traffic. Traffic on these roads will also displace grizzly bears from the areas, denying them high value habitat, and fragmenting the population with concomitant losses to genetic diversity in the grizzly bear population.

The harms described above do not exhaust the detrimental risks that the B.C. Mines pose to grizzly bears in the transboundary watersheds. In addition to the threats posed by access roads, bears may also face disturbance from industrial activities during construction and operation at the mine site.⁴²⁴ Mine project infrastructure might displace bears from denning habitats, or other areas important to their life cycles. A full investigation of the extent to which the B.C. Mines individually harm grizzly bear populations should encompass all such harms.

Moreover, cumulative effects are also certain to follow, not least from the mines' use of Highway 37 to move ore concentrate to the port of Stewart, British Columbia. Highway 37 has been described as "the best road in Canada for viewing bears," including grizzly bears,⁴²⁵ and

⁴¹⁸ Brucejack EA Report at 22; Brucejack Feasibility Study at 18-3, Fig. 18.1.

⁴¹⁹ Brucejack Feasibility Study at 18-19.

⁴²⁰ Brucejack EA Report at 39.

⁴²¹ *Grizzly Bear Population Status in BC* at 3.

⁴²² Red Chris EA Application at 4-345; Fig. 3.

⁴²³ Red Chris EA Application at 4-242.

⁴²⁴ Such disturbances would implicate the Tulsequah Chief Mine, which sits in grizzly bear habitat (*see* Fig. 8), even though it does not presently include plans for an access road.

⁴²⁵ V. Dinets, *PETERSON FIELD GUIDE TO FINDING MAMMALS IN NORTH AMERICA* at 111 (2015).

anecdotal evidence confirms that grizzly bears frequent the roadway.⁴²⁶ Such sightings make sense, since the stretch Highway 37 that is or will be travelled by hauling trucks divides the habitats of the Spatsizi and Edziza-Lower Stikine management units from each other, and bisects the Stewart management unit's habitat further south.⁴²⁷

The increases in traffic from ore-concentrate hauling along Highway 37 from the Red Chris, Schaft Creek and Galore Creek mines to Stewart, British Columbia, have been discussed above in connection with their effects on woodland caribou herds.⁴²⁸ In addition to this increase in traffic, grizzly bear populations near Highway 37 will also be subject to the impacts of increased traffic from the KSM and Brucejack mines:

- KSM Mine is expected to contribute 36 truck journeys per day, meaning an additional 13,140 journeys annually, or an additional 676,710 journeys over the mine's 51.5-year operating life.⁴²⁹
- Brucejack Mine is expected to contribute 6 to 10 truck journeys per day,⁴³⁰ meaning an additional 2,190 to 3,650 journeys annually, or an additional 48,180 to 80,300 journeys over course of the mine's 22-year operating life.⁴³¹

The net effect of ore transportation alone from the five mines would be an additional 61,320 to 63,875 truck journeys annually, and an additional 1,485,139 to 1,547,910 truck journeys in total over the lifetimes of the mines, running on Highway 37 to Stewart. According to the most recent figures, the relevant section of Highway 37 averages around 88,300 vehicle journeys annually,⁴³² meaning that ore transportation alone will generate a 70 percent increase in traffic on the highway.⁴³³ This addition will involve trucks often carrying hundreds of tons of material. The figure excludes traffic associated with the transportation of employees, construction equipment and materials during construction, and then the provision of supplies, not least diesel fuel, to the mine sites during operation—meaning that Highway 37 will in fact experience an even more extreme increase in traffic.

⁴²⁶ Arrow Transportation Systems, *Red Chris Mine Opens*, ARROW LIFE at 1 (June 2015) (“Driving the 320 kilomet[er]s on Highway 37 from Stewart to Red Chris Mine you’ll be lucky if you see more than a dozen cars during the day and half that at night. On the other hand, there are plenty of bears. You’re likely to see more than 30 of them on or near the road,” laughed Andy Wichary, Stewart’s Division Manager.”).

⁴²⁷ Fig. 8.

⁴²⁸ See *supra* pp. 33-34.

⁴²⁹ KSM EA Application at 4-194.

⁴³⁰ Brucejack EA Report at 109.

⁴³¹ *Id.* at 11.

⁴³² British Columbia Ministry of Transportation and Infrastructure, 10 Year Annual Summary for 2015: Stikine River Bridge - 47-026NS, Kitimat Cassiar, <https://prdoas3.pub-apps.th.gov.bc.ca/tig-public/Report.do?pdbSiteId=22892> (last visited Apr. 4, 2016).

⁴³³ See also Brucejack EA Report at 119 (“With all the projects projected within the Cumulative Effects Assessment boundaries, traffic may double to approximately 40 Vehicles/Hour, and a residual cumulative effect was predicted.”).

The increase in traffic disturbance will further displace grizzly bears from the area around Highway 37. As the Canadian authorities recognize, the western Canadian grizzly bear population, including the units affected by the five mines, is “highly sensitive to human disturbance and is subject to high mortality risk in areas of human activity and where roads create access.”⁴³⁴ Those bears that are already habituated—such as those frequently sighted from the roadway—will face a heightened risk of mortality from collisions when upwards of 1.5 million truck journeys will run along the highway, all by multi-ton, super-bed trucks that likely will be unable to stop or maneuver around crossing bears. Bear mortalities and displacement can be expected to result.

Relevance under the Western Hemisphere Convention and the Pelly Amendment

Both individually and collectively, the establishment and permitting of the five Stikine River and Unuk River mines is likely to result in takings of grizzly bears. The mortality, displacement, and population fragmentation to which grizzly bears will likely be subject as a result of the mines entails “harass[ment], harm [or] kill[ing]” of grizzly bears,⁴³⁵ either directly or indirectly by means of habitat destruction and modification. These acts would be “takings” under the Pelly Amendment.

Such takings of grizzly bears would diminish the effectiveness of the international conservation program established by the Western Hemisphere Convention. The Convention seeks to “protect and preserve in their natural habitat representatives of all species . . . in sufficient numbers and over areas extensive enough to assure them from becoming extinct through any agency within man’s control.”⁴³⁶ Protection of the grizzly bear, named in the Convention’s Annex,⁴³⁷ is “of special urgency and importance” under the Convention.⁴³⁸ The Convention’s conservation program requires protection of the grizzly bear “as completely as possible.”⁴³⁹ Given that the grizzly bear is extirpated elsewhere or dwindling in numbers, attrition as an incidental consequence of mining development would not be possible to square with the solicitous concern and regime of careful conversation established among parties to the Convention. The efforts of Convention parties to protect the grizzly bear would be offset—and thus undermined—if grizzly bear populations were directly or indirectly reduced by the harmful effects of mine development. Thus, by taking grizzly bears, Canadian nationals—both the mine proponents and the governmental authorities who permit the mine developments—would diminish the effectiveness of the conservation program of the Western Hemisphere Convention. The likely takings of grizzly bears resulting from existing and future mining projects justify an

⁴³⁴ COSEWIC, *Grizzly Bear Western Population*, SPECIES AT RISK PUBLIC REGISTRY, http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=1195 (last visited May 11, 2016).

⁴³⁵ 22 U.S.C. § 1978(h)(5)(A), (B) (2012), as amended by Pub. L. No. 102-582, 106 Stat. 494 (Nov. 2, 1992).

⁴³⁶ Western Hemisphere Convention, pmbl.

⁴³⁷ See Organization of American States, *Listas de Especies de Fauna y Flora en Vias de Extincion en los Estados Miembros* (1967).

⁴³⁸ Western Hemisphere Convention, art. VIII.

⁴³⁹ *Id.*

investigation of these projects pursuant to the Pelly Amendment. If that investigation determines that a taking has or will occur, this conclusion must be certified to the President.

C. Salmonids

The Pacific Ocean is inhabited by several species of salmonids, including pink, chum, sockeye, Coho, and Chinook salmon,⁴⁴⁰ as well as steelhead trout.⁴⁴¹ These fish are anadromous species, meaning that they spawn, and, in some cases rear, in freshwater, migrate to the ocean as they mature, and then return to spawn and die in their natal freshwater streams.⁴⁴² Salmon spawn in freshwater bodies “ranging from tiny creeks above waterfalls in the mountains, or streams discharging straight into saltwater, to large rivers . . . from small beaver ponds and ephemeral wetlands to the largest lakes of the region.”⁴⁴³ Steelhead also spawn in freshwater streams, and typically remain in freshwater for one to three years before migrating to sea.⁴⁴⁴ Steelhead are iteroparous, meaning that they spawn several times in their lives.⁴⁴⁵ Pacific salmon, however, are semelparous, meaning that they spawn once, shortly before dying in their natal streams.⁴⁴⁶ All six of these salmonid species spawn in the waters of the Taku, Stikine, and Unuk river watersheds, annually repeating a process that has sustained and defined these watersheds. These fish contribute hugely to the ecological richness of the watersheds, representing “a unique way to move nutrients upstream” from the ocean to riparian areas.⁴⁴⁷ After salmon return from the North Pacific to streams to spawn, the nutrients in their carcasses are taken-up by birds and mammalian predators, thus fertilizing forest soils and feeding the in-stream plankton populations on which young salmonids will prey in the coming seasons.⁴⁴⁸

Harms to Salmonids from Hard-Rock Mining Generally

“Salmon and steelhead need cool, clean water in adequate supply to grow, migrate, and spawn in freshwater systems.”⁴⁴⁹ In many cases, their continued reproductive success and survival conflicts with the externalities of hard-rock mining. Mining processes often lead to the leaching of toxic heavy metals from waste rock and tailings into the surrounding environment.

⁴⁴⁰ T. P. Quinn, *THE BEHAVIOR AND ECOLOGY OF PACIFIC SALMON AND TROUT* 13-16 (2005).

⁴⁴¹ *Id.* at 18-20. Some steelhead trout do not migrate to the ocean; they are called rainbow trout. *Id.* at 19.

⁴⁴² *Id.* at 5, 19.

⁴⁴³ *Id.* at 10.

⁴⁴⁴ *Id.* at 20.

⁴⁴⁵ *Id.* at 19.

⁴⁴⁶ *Id.* at 20.

⁴⁴⁷ C. J. Cederholm *et al.*, *Pacific Salmon Carcasses: Essential Contributions of Nutrients and Energy for Aquatic and Terrestrial Ecosystems*, 24 *FISHERIES* 6, 6 (Oct. 1999) (Cederholm); *see also* D. J. Rinella *et al.*, *Seasonal Persistence of Marine-Derived Nutrients in South-Central Alaskan Salmon Streams*, 4 *ECOSPHERE*, No. 122, at 1 (Oct. 2013).

⁴⁴⁸ Cederholm at 7.

⁴⁴⁹ D. H. Baldwin *et al.*, *Sublethal Effects of Copper on Coho Salmon: Impacts on Non-Overlapping Receptor Pathways in the Peripheral Olfactory Nervous System*, 22 *ENV. TOX. & CHEM.* 2266, 2266 (2003) (Baldwin *et al.*).

Leaching occurs naturally when sulfide rock is exposed to air and water; mines accelerate the process by increasing the surface area of the waste rock during mining and processing.⁴⁵⁰ Acidic water, also resulting from oxidation of mine wastes, then exacerbates the natural rate of metals leaching.⁴⁵¹ As a result, “[l]ogarithmic increases in metal levels in waters from sulfide-rich mining environments are common where surface or groundwater pH is depressed by acid generation from sulfide minerals.”⁴⁵² For this reason, acid mine drainage and elevated dissolved metals levels are “inextricably linked.”⁴⁵³ This combination is a common environmental consequence of hard-rock mining.⁴⁵⁴

The harms from mining-waste contamination to fish, including salmonids, are well-known. Several dissolved heavy metals are known to have harmful effects on salmonids when present in the waters they inhabit or in foods they consume.⁴⁵⁵ The specific detrimental effects suffered vary by the pollutant in question and level of concentration, as elaborated in the following illustrative discussion of six metals.

Aluminum

Aluminum is soluble when exposed to acidic waters,⁴⁵⁶ and, once dissolved, becomes harmful to salmonids. Even at low concentrations, aluminum degrades fish health, including gill function,⁴⁵⁷ and “reduce[s] the ability of salmonids to adequately deal with other stressors,” especially when the solvent waters are acidic.⁴⁵⁸ In acidic waters, exposures to even low concentrations of aluminum, as low as 27 micrograms per liter (“µg/L”), can impair growth in juvenile salmonids.⁴⁵⁹ Low-level aluminum exposure can also impair the survival of juvenile

⁴⁵⁰ S. R. Jennings *et al.*, ACID MINE DRAINAGE AND EFFECTS ON FISH HEALTH AND ECOLOGY: A REVIEW 1-4 (2008) (Jennings *et al.*).

⁴⁵¹ *Id.*

⁴⁵² *Id.* at 4.

⁴⁵³ *Id.* at 4 n.2.

⁴⁵⁴ *Id.* at 3-4.

⁴⁵⁵ *Id.* at 5.

⁴⁵⁶ I. F. Dennis & T. A. Clair, *The Distribution of Dissolved Aluminum in Atlantic Salmon (Salmo Salar) Rivers of Atlantic Canada and Its Potential Effect on Aquatic Populations*, 69 CAN. J. FISH & AQUATIC SCI. 1174, 1175 (2012) (Dennis & Clair).

⁴⁵⁷ *Id.* at 1174-75 (“Al_i affects fish when positively charged Al_i species bind with the negatively charged fish gill epithelium, causing irritation that results in excessive mucous production, which then clogs gill membranes. The excess mucous can eventually lead to severe respiratory reduction in the fish.”).

⁴⁵⁸ M. H. H. Price, *Sub-Lethal Metal Toxicity Concerns for Unuk Watershed Salmonids from Seabridge Gold’s Proposed KSM Mine 7* (Mar. 8, 2014) (Price).

⁴⁵⁹ *Id.* at 7; K. Sadler & S. Lynam, *Some Effects on the Growth of Brown Trout from Exposure to Aluminium at Different pH Levels*, 31 J. FISH BIO. 209, 214 (1987).

salmon during their downstream migration,⁴⁶⁰ and reduce chances of survival at sea.⁴⁶¹ It can cause a “delayed response” on salmon smolt, “leading to mortality and population effects after the fish [have] left freshwater and entered seawater.”⁴⁶²

Cadmium

Cadmium is toxic to all life, including salmonids.⁴⁶³ “Cadmium accumulates in the kidney, liver, and gills of freshwater fish.”⁴⁶⁴ Cadmium exposure can be fatal at a concentration of 0.786 µg/L.⁴⁶⁵ In salmonids specifically, chronic exposure to cadmium at levels around 0.5 µg/L has resulted in reduced predation success.⁴⁶⁶ Salmonids also experience impaired growth at exposure to levels starting around 0.47 µg/L.⁴⁶⁷ However, even lower levels can harm fish: they generally avoid waters with cadmium concentrations of 0.2 µg/L and experience disorientation once exposed.⁴⁶⁸ Salmonid eggs are even more sensitive: concentrations of cadmium as low as 0.05 µg/L result in premature hatching of eggs.⁴⁶⁹

Copper

Copper is one of the most harmful metals for salmonids. Where even low levels of copper are dissolved in waters— as low as 0.7 µg/L for juveniles—salmon and trout will avoid an area entirely.⁴⁷⁰ “As a consequence, low levels of copper pollution could serve as a barrier to migration or exclude salmon from habitats that are otherwise productive.”⁴⁷¹ Adult Chinook

⁴⁶⁰ F. Kroglund *et al.*, *Water Quality Limits for Atlantic Salmon (Salmo Salar L.) Exposed to Short Term Reductions in pH and Increased Aluminum Simulating Episodes*, 4 HYDRO. & EARTH SYS. SCI. DISCUSS. 3317, 3333 (2007) (Kroglund) (finding that dissolved aluminum levels as low as 5–10 µg/L may cause a 25%–50% reduction in salmon smolt survival during migration into the open ocean).

⁴⁶¹ Price at 7; Dennis & Clair at 1174 (“[R]educed smolt fitness in fresh waters has also been shown to lead to increased mortality at sea.”).

⁴⁶² Kroglund at 3322, 3331-32.

⁴⁶³ S. M. Levit, A LITERATURE REVIEW OF EFFECTS OF CADMIUM ON FISH 2 (2010), <https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/alaska/sw/cpa/Documents/L2010CadmiumLR122010.pdf> (last visited May 11, 2016).

⁴⁶⁴ *Id.* at 7.

⁴⁶⁵ J. A. Hansen *et al.*, *The Effects of Long-Term Cadmium Exposure on the Growth and Survival of Juvenile Bull Trout (Salvelinus Confluentus)*, 58 AQUATIC TOX. 165, 170 (2002); Price at 10.

⁴⁶⁶ Price at 9.

⁴⁶⁷ *Id.*; P. J. Rombough & E. T. Garside, *Cadmium Toxicity and Accumulation in Eggs and Alevins of Atlantic Salmon Salmo Salar*, 60 CANADIAN J. OF ZOOLOGY 2006, 2010-11 (1982).

⁴⁶⁸ Price at 9.

⁴⁶⁹ *Id.* at 10; H. M. Lizardo-Daudt & C. Kennedy, *Effects of cadmium chloride on the development of rainbow trout *Oncorhynchus mykiss* early life stages*, 73 J. FISH BIO. 702, 707 (2008) (“Embryos exposed to 0.25 [µg/L] Cd began hatching earlier than all the other groups.”).

⁴⁷⁰ C. A. Woody, COPPER EFFECTS ON FRESHWATER FOOD CHAINS AND SALMON: A REVIEW 12 (2007) (Woody, *Copper Effects*); *see id.* at 3 (“[C]oncentrations just over that required for growth and reproduction can be highly toxic to aquatic species and cause irreversible harm.”).

⁴⁷¹ Baldwin *et al.* at 2272.

salmon are known to avoid waters with concentrations of copper less than or equal to 2.4 µg/L or possibly as low as 0.91 µg/L.⁴⁷² Avoidance allows the salmonids to survive, though it renders the waters avoided lost as habitat.⁴⁷³ Avoidance of contaminated water might disturb migrations to and from spawning streams;⁴⁷⁴ studies have found such effects with Chinook salmon at concentrations of 10 µg/L,⁴⁷⁵ and as low as 0.7 µg/L.⁴⁷⁶ Coho salmon smolt also demonstrated similar disruption, and experienced reduced survival at sea after exposure to levels of copper of 5 µg/L.⁴⁷⁷

Salmonids suffer impaired sensory capacities when exposed to dissolved copper, losing their abilities to perceive and elude predators.⁴⁷⁸ Impairment has been found at concentration levels as low as 2 µg/L; at 20 µg/L the response to odorants is almost completely eliminated.⁴⁷⁹ “Copper-induced loss of olfactory function occurs very quickly . . . on a timescale of minutes.”⁴⁸⁰ Exposure at levels lower than 10 µg/L of copper can result in impaired swimming and feeding behavior, reduced growth, increased stress, and vulnerability to pathogens.⁴⁸¹ Where levels are higher or exposure longer, salmonids may lose the sensory capacity to avoid contaminated waters, leading to harmful, even lethal, effects.⁴⁸² Juvenile Chinook salmon exposed to copper at concentrations of 2 µg/L for 25-30 days lost the avoidance response to much higher concentrations of copper, failing to avoid waters with 21 µg/L copper, even though

⁴⁷² Price at 10; J. S. Meyer & W. J. Adams, *Relationship Between Biotic Ligand Model-Based Water Quality Criteria and Avoidance and Olfactory Responses to Copper by Fish*, 29 ENV. TOX. & CHEM. 2096, 2096 (2010).

⁴⁷³ Price at 10; Baldwin *et al.* at 2272.

⁴⁷⁴ Woody, *Copper Effects* at 12 (“Salmonids avoid waters with low levels of dissolved Cu contamination, disrupting their normal migration patterns.”).

⁴⁷⁵ Price at 11; S. C. Hecht *et al.*, *An Overview of Sensory Effects on Juvenile Salmonids Exposed to Dissolved Copper: Applying a Benchmark Concentration Approach to Evaluate Sublethal Neurobehavioural Toxicity*, NOAA Technical Memorandum NMFS-NWFSC-83 at 27-28 (2007).

⁴⁷⁶ Woody, *Copper Effects* at 12 (“Salmonids avoid waters with low levels of dissolved Cu contamination, disrupting their normal migration patterns. . . . Chinook avoided at least 0.7 µg Cu/L”).

⁴⁷⁷ Price at 11.

⁴⁷⁸ *Id.*; Baldwin *et al.* at 2266; D. H. Baldwin *et al.*, *Copper-induced olfactory toxicity in salmon and steelhead: extrapolation across species and rearing environments*, 101 AQUATIC TOX. 295, 295 (2011); J. F. Sandahl *et al.*, *Odor-Evoked Field Potentials as Indicators of Sublethal Neurotoxicity in Juvenile Coho Salmon (Oncorhynchus kisutch) Exposed to Copper, Chlorpyrifos, or Esfenvalerate*, 61 CAN. J. FISHERIES AQUATIC SCI. 404, 410 (2004); J. K. McIntyre *et al.*, *Low-Level Copper Exposures Increase Visibility and Vulnerability of Juvenile Coho Salmon to Cutthroat Trout Predators*, 22 ECO. APPLICATIONS 1460, 1468 (2012).

⁴⁷⁹ J. F. Sandahl *et al.*, *A Sensory System at the Interface between Urban Stormwater Runoff and Salmon Survival*, 41 ENV. SCI. & TECH. 2998, 3001 (2007) (Sandahl *et al.*, *Sensory System*).

⁴⁸⁰ N. Scholz *et al.*, NOAA Fisheries, IMPACTS OF COPPER ON THE SENSORY BIOLOGY AND BEHAVIOR OF SALMON 16 (2010); Sandahl *et al.*, *Sensory System* at 2998 (“[D]issolved copper damages the olfactory sensory epithelium, and . . . interferes with the ability of fish to detect and respond to chemical signals in aquatic environments.”).

⁴⁸¹ Woody, *Copper Effects* at 6 (“Lethal and sublethal effects to fish and the aquatic food chain can occur below 9 µg Cu/L.”).

⁴⁸² L. Trasky, ANALYSIS OF THE POTENTIAL IMPACTS OF COPPER SULFIDE MINING ON THE SALMON RESOURCES OF THE NUSHAGAK AND KVICHAK WATERSHEDS 17 (Jan. 10, 2008) (Trasky); Woody, *Copper Effects* at 11 (“Copper can impair or destroy a fish’s ability to smell (olfaction), which can be fatal. Salmon use their keen sense of smell to identify predators, prey, kin, and mates - mixing up any of these relationships can be detrimental or fatal.”).

they had avoided these waters previously.⁴⁸³ Impaired olfaction also renders salmonids unable to find their ways back to natal streams to spawn.⁴⁸⁴ “Alteration of natural adaptive behaviors such as homing, migration and spawning due to water pollution can reduce wild salmon survival and change population structure.”⁴⁸⁵

Salmonids experience chronic toxicity when exposed to dissolved copper levels of as low as 12 µg/L, and acute toxicity when exposed to dissolved copper levels of between 22 and 53 µg/L.⁴⁸⁶ Acute toxic reactions to copper include ion-regulatory and respiratory problems via gill tissue damage.⁴⁸⁷ Concentrations as low as 6.4 µg/L impaired Chinook salmon’s immune response to bacterial infections.⁴⁸⁸ Juvenile Chinook salmon and steelhead trout experienced acute toxic reactions at levels as low as 17 µg/L.⁴⁸⁹ The exposure can become fatal through the failure of the fish’s heart.⁴⁹⁰ Dissolved copper can be lethal at 37-78 µg/L for sockeye salmon, as low as 26 µg/L for Chinook salmon, and 25 µg/L for pink salmon.⁴⁹¹ The levels of dissolved copper at which fish experience toxicity is influenced by the hardness, pH, and temperature of the solvent water, as well as synergistic effects with other metals such as zinc.⁴⁹²

Lead

Lead is also harmful to salmonids resulting in developmental abnormalities at exposure to levels around 7.6 µg/L.⁴⁹³

Silver

Dissolved silver can also harm salmonids. Juvenile salmonids have shown reduced growth and premature hatching at levels of 0.17 µg/L.⁴⁹⁴

⁴⁸³ Price at 11.

⁴⁸⁴ Woody, *Copper Effects* at 12 (“If salmon cannot smell, or if the chemical signature of a salmon’s natal stream changes, then fish returning to spawn will not recognize their natal stream.”).

⁴⁸⁵ *Id.*

⁴⁸⁶ *Id.*

⁴⁸⁷ D. H. Evans, *The Fish Gill: Site of Action and Model for Toxic Effects of Environmental Pollutants*, 71 ENV. HEALTH PERSPECTIVES 47, 51 (1987).

⁴⁸⁸ Woody, *Copper Effects* at 13.

⁴⁸⁹ Trasky at 19.

⁴⁹⁰ *Id.*

⁴⁹¹ *Id.*

⁴⁹² *Id.* at 17; K. L. Barry *et al.*, *Impacts of Acid Mine Drainage on Juvenile Salmonids in an Estuary Near Britannia Beach in Howe Sound, British Columbia*, 57 CAN. J. FISHERIES & AQUAT SCI. 2032, 2038 (2000) (Barry *et al.*) (“Toxicity of [Acid Mine Drainage] . . . is influenced by many factors besides salinity, including pH, water hardness, and the amount of organic matter.”).

⁴⁹³ Price at 13.

⁴⁹⁴ *Id.*

Zinc

Salmonids are also harmed by zinc. At concentrations as low as 8.6 µg/L, juvenile salmonids avoid waters where this metal is present.⁴⁹⁵

Rather than exposure to each of the above metals in isolation, the B.C. Mines will expose salmonids to a cocktail of dissolved metals, which can have synergistic effects.⁴⁹⁶ “Synergy occurs when chemicals interact in a way that increases their joint toxicity beyond that expected if their effects were additive.”⁴⁹⁷ The above descriptions do not account for synergistic effects of elevated metals levels, which have not been adequately researched, but which are likely to exacerbate the harms associated with exposure to each individual metal. Synergistic harms have been seen with combinations of metals, such as zinc and copper.⁴⁹⁸

Nonmetal contaminants

Nonmetal contaminants are also a threat for salmonids. In addition to intensifying the harmful release of metals, acidity itself is directly harmful to fish. Although salmon can survive in waters with a sub-neutral pH, at lower pH levels, gill membranes are damaged, leading to death by hypoxia.⁴⁹⁹ At pH levels below 5.0, homeostatic electrolyte and osmotic mechanisms are impaired.⁵⁰⁰ Streams with acidic pollution are generally less rich in biodiversity and taxa abundance.⁵⁰¹ Salmon populations have been found to decline in regions affected by mine drainage acidity.⁵⁰²

Another prominent non-metal contaminant is selenium. Selenium is found as an elemental component in many deposits mined for precious metal ores.⁵⁰³ When ore is disturbed and exposed to water as waste rock or tailings, selenium will be released.⁵⁰⁴ This leaching creates a risk of concentration and bioaccumulation in downstream waters.⁵⁰⁵ Although selenium is an essential micronutrient for normal animal nutrition, concentrations not greatly

⁴⁹⁵ *Id.* at 14.

⁴⁹⁶ *Id.* at 16; see R. S. Boyd, *Heavy Metal Pollutants and Chemical Ecology: Exploring New Frontiers*, 36 J. CHEM. ECOL. 46, 54 (2010) (Boyd).

⁴⁹⁷ *Id.*

⁴⁹⁸ Price at 15; J. B. Sprague, *Avoidance of Copper-Zinc Solutions by Young Salmon in the Laboratory*, 36 J. WATER POLLUTION CONTROL FED. 990, 1002 (1964); U.S. Department of the Interior, GUIDELINES FOR INTERPRETATION OF THE BIOLOGICAL EFFECTS OF SELECTED CONSTITUENTS IN BIOTA, WATER, AND SEDIMENT, National Irrigation Water Quality Program Information Report No. 3 at 52 (1998) (Department of Interior, *Guidelines*).

⁴⁹⁹ Jennings *et al.* at 5.

⁵⁰⁰ *Id.*

⁵⁰¹ *Id.* at 6.

⁵⁰² Barry *et al.* at 2038.

⁵⁰³ A. D. Lemly, SELENIUM ASSESSMENT IN AQUATIC ECOSYSTEMS 7 (2002) (Lemly, SELENIUM ASSESSMENT).

⁵⁰⁴ A. D. Lemly, *Aquatic selenium pollution is a global environmental safety issue*, 59 ECOTOXICOLOGY & ENV'TL SAFETY 44, 47 (2004) (Lemly, *Aquatic selenium*).

⁵⁰⁵ Lemly, SELENIUM ASSESSMENT at 7.

exceeding those required may produce toxic effects.⁵⁰⁶ Selenium can quickly bioaccumulate and become toxic to fish.⁵⁰⁷ Selenium exposure via diet can cause fish to experience developmental problems, and, at sufficiently high levels, mortality.⁵⁰⁸ Exposure to selenium-contaminated water can also directly cause salmon mortality, albeit at much higher concentrations (around 69 µg/L).⁵⁰⁹ There is no research that defines the lowest level at which selenium concentrations are safe for salmonids.⁵¹⁰ Once selenium has been introduced to an aquatic system, it has long lasting effects as it is cycled back into the biota, “remain[ing] at elevated levels for years,”⁵¹¹ or even decades.⁵¹² For example, more than a decade after the cessation of selenium pollution of Belews Lake in North Carolina, biological effects of selenium were still present in fish, such that restocking efforts were unable to re-establish fish populations.⁵¹³

Salmonids and the KSM Mine’s Expected Water-Quality Impacts

All six B.C. Mines will drain into downstream salmonid streams, but at this point, only the KSM Mine has compiled predictive data describing concentration levels at downstream salmonid reaches. At KSM Mine, the mine proponent predicts a “potential for fish or aquatic habitat exposure to acidic water or metals . . . during all phases of the Project,” including “[e]xposure of fish . . . to extremes in pH or metals . . . lead[ing] to both lethal and sub-lethal effects.”⁵¹⁴ This alarming prediction is in fact a best case scenario: it assumes that mine operations, closure, and treatment would “occur under normal operating conditions.”⁵¹⁵ The project alone is expected to generate levels of aluminum, cadmium, copper, lead, silver, zinc, and selenium sufficient to generate concentrations that are harmful—in some cases directly lethal—to salmon within the waters of the Unuk River. The mine proponent’s estimates are summarized in the following:

- Aluminum

Aluminum pollution is predicted to rise to a level significantly higher than that harmful to salmonids. In waters inhabited by sockeye, Chinook, and Coho salmon, and steelhead trout⁵¹⁶ at and downstream of the confluence of Sulphurets Creek and the Unuk

⁵⁰⁶ Lemly, *Aquatic selenium* at 44.

⁵⁰⁷ Lemly, SELENIUM ASSESSMENT at 3.

⁵⁰⁸ S. J. Hamilton, *Review of Selenium Toxicity in the Aquatic Food Chain*, SCI. TOTAL ENV. 1, 4 (2004).

⁵⁰⁹ *Id.*

⁵¹⁰ Price at 17.

⁵¹¹ A. D. Lemly, *AQUATIC CYCLING OF SELENIUM: IMPLICATIONS FOR FISH AND WILDLIFE* 1 (1987).

⁵¹² Lemly, SELENIUM ASSESSMENT at 6.

⁵¹³ A. D. Lemly, *Environmental Implications of Excessive Selenium: A Review*, 10 BIOMEDICAL & ENV’T’L SCI. 415, 422 (1997).

⁵¹⁴ KSM EA Application at 15-126.

⁵¹⁵ *Id.* at 15-125.

⁵¹⁶ *Id.* at 15-42, Tbl. 15.1-4; *see also id.* at 15-46 (“[S]pawning and rearing of sockeye, chinook, and coho salmon were known to extend as far upstream as Storie Creek, which is approximately 15 km upstream of the confluence of Sulphurets Creek and the Unuk River.”).

River,⁵¹⁷ the KSM Mine proponent expects an average dissolved aluminum concentration of 1,790 µg/L during the mine's operation⁵¹⁸—66 times the level at which juvenile salmonids experience impaired growth⁵¹⁹—with a potential maximum level of 11,970 µg/L during operation of the mine⁵²⁰—443 times the level at which juvenile salmonids experience impaired growth.⁵²¹ For 50 years after the mine's closure (the mine proponent's predictions stop at that point⁵²²), aluminum concentrations are expected to be on average 1,820 µg/L, with a maximum of 12,760 µg/L.⁵²³ Even further downstream, at the Unuk River's crossing of the Canada–United States border, aluminum concentrations are expected to be on average 1,440 µg/L (with a maximum of 6,350 µg/L) during the mine's operation, and 1,460 µg/L (with a maximum of 6580 µg/L) five decades after the mine is closed.⁵²⁴

- Cadmium

Cadmium pollution is predicted to rise in excess of levels at which salmonids avoid waters entirely or experience impaired growth and reproductive harms. At and downstream of the confluence of Sulphurets Creek with the Unuk River, in waters inhabited by sockeye, Chinook, and Coho salmon and steelhead trout,⁵²⁵ the KSM Mine proponent expects an average dissolved cadmium concentration of 0.231 µg/L⁵²⁶—in excess of levels at which fish avoid waters entirely, and levels at which eggs hatch prematurely.⁵²⁷ The proponent expects a potential maximum level of 0.727 µg/L during operation of the mine⁵²⁸—well above the level at which salmonids' predator-avoidance functions suffer, and only a few parts per billion below levels that are directly lethal to fish.⁵²⁹ Even for 50 years after the mine's closure, cadmium levels are expected to be on average 0.234 µg/L, with a maximum of 0.738 µg/L.⁵³⁰

Further downstream, where the Unuk River crosses the Canada–United States border, cadmium levels are expected to be on average 0.060 µg/L (with a maximum of 0.229

⁵¹⁷ KSM EA Application at 15-46.

⁵¹⁸ *See id.* at 14-160 to 14-163.

⁵¹⁹ *See supra* pp. 47-48 (harms of aluminum generally).

⁵²⁰ *See* KSM EA Application at 14-160 to 14-161.

⁵²¹ *See supra* pp. 47-48 (harms of aluminum generally).

⁵²² KSM EA Application at 14-35.

⁵²³ *Id.* at 14-168.

⁵²⁴ *Id.* at 14-176, 14-184.

⁵²⁵ *See supra* note 516.

⁵²⁶ *See* KSM EA Application at 14-159 to 14-170.

⁵²⁷ *See supra* p. 48 (harms of cadmium generally).

⁵²⁸ *See* KSM EA Application at 14-159 to 14-170.

⁵²⁹ *See supra* p. 48 (harms of cadmium generally).

⁵³⁰ *See* KSM EA Application at 14-168.

µg/L) during the mine's operation, and 0.061 µg/L (with a maximum of 0.229 µg/L) five decades after the mine is closed.⁵³¹

- Copper

Copper pollution is expected at times to rise well above levels lethal for salmonids, to average a concentration at which salmonids can be expected to suffer harms of chronic toxicity such as ion-regulatory, respiratory, gill-tissue, and circulatory harms. At and downstream of the confluence of Sulphurets Creek with the Unuk River, in waters inhabited by sockeye, Chinook, and Coho salmon, and steelhead,⁵³² the KSM Mine proponent expects an average dissolved copper concentration of 21.7 µg/L⁵³³—almost ten times the level at which adult Chinook salmon will avoid waters, over four times the level at which salmonids suffer impaired perception and predator avoidance, and less than one part per billion from the level at which salmon suffer acute toxicity.⁵³⁴ The mine proponent expects a potential maximum level of 83.5 µg/L⁵³⁵—over three times the level at which waters become directly lethal to Chinook and pink salmon, and around seven times the level at which salmon experience chronic toxicity.⁵³⁶ Even for 50 years after the mine's closure, copper levels are expected to be on average 21.9 µg/L, with a maximum of 86.1 µg/L.⁵³⁷ This would create a *de facto* migratory barrier to all habitat upstream of the confluence of Sulphurets Creek with the Unuk River through salmonids' avoidance behavior.

Further downstream, at the Canada–United States border, copper levels are expected to be on average 7.6 µg/L (with a maximum of 31.1 µg/L) during the mine's operation,⁵³⁸ and 7.7 µg/L (with a maximum of 31.4 µg/L) five decades after the mine is closed.⁵³⁹

- Lead

Lead pollution is expected to rise above levels at which salmonids experience developmental abnormalities. At and downstream of the confluence of Sulphurets Creek with the Unuk River, in waters inhabited by sockeye, Chinook, and Coho salmon, and steelhead,⁵⁴⁰ the KSM Mine proponent expects an average dissolved lead concentration of

⁵³¹ *Id.* at 14-176, 14-184.

⁵³² *See supra* note 516.

⁵³³ *See* KSM EA Application at 14-160.

⁵³⁴ *See supra* pp. 48-50 (harms of copper generally).

⁵³⁵ *See* KSM EA Application at 14-160.

⁵³⁶ *See supra* pp. 48-50 (harms of copper generally).

⁵³⁷ *See id.* at 14-168.

⁵³⁸ *Id.* at 14-176.

⁵³⁹ *Id.* at 14-184.

⁵⁴⁰ *See supra* note 516.

1.6 µg/L, with a potential maximum of 8.2 µg/L, during operation of the mine⁵⁴¹—above the level at which salmonids suffer developmental abnormalities.⁵⁴² Even 50 years after the mine’s closure, lead levels are expected to be on average 1.62 µg/L, with a maximum of 8.72 µg/L.⁵⁴³ Further downstream, at the Unuk River’s crossing of the Canada–United States border, lead levels are expected to be on average 1.23 µg/L (with a maximum of 5.22 µg/L) during the mine’s operation,⁵⁴⁴ increasing to 1.25 µg/L (with a maximum of 5.4 µg/L) five decades after the mine is closed.⁵⁴⁵

- Silver

Silver pollution is expected to rise at times to levels at which salmonids will experience impaired development and growth. At and downstream of the confluence of Sulphurets Creek with the Unuk River, in waters inhabited by sockeye, Chinook, and Coho salmon and steelhead,⁵⁴⁶ the KSM Mine proponent expects an average dissolved silver concentration of 0.043 µg/L, with a potential maximum of 0.274 µg/L⁵⁴⁷—a maximum well above the level at which juvenile salmon would experience reduced growth and eggs would hatch prematurely.⁵⁴⁸ Even for 50 years after the mine’s closure, silver concentrations are expected to be on average 0.043 µg/L, with a maximum of 0.291 µg/L.⁵⁴⁹ Further downstream, at the Unuk River’s crossing of the Canada–United States border, silver concentrations are expected to be on average 0.024 µg/L (with a maximum of 0.104 µg/L) during the mine’s operation,⁵⁵⁰ and 0.025 µg/L (with a maximum of 0.107 µg/L) five decades after the mine is closed.⁵⁵¹

- Zinc

Zinc pollution is expected to rise above levels at which salmonids avoid waters entirely. At and downstream of the confluence of Sulphurets Creek with the Unuk River, in waters inhabited by sockeye, Chinook, and Coho salmon, and steelhead,⁵⁵² the KSM Mine proponent expects an average dissolved zinc concentration of 22.3 µg/L—2.5 times the level at which juvenile salmonids avoid waters⁵⁵³—with a potential maximum of 61.0

⁵⁴¹ See KSM EA Application at 14-160.

⁵⁴² See *supra* p. 50 (harms of lead generally).

⁵⁴³ KSM EA Application at 14-168.

⁵⁴⁴ *Id.* at 14-176.

⁵⁴⁵ *Id.* at 14-184.

⁵⁴⁶ See *supra* note 516.

⁵⁴⁷ See KSM EA Application at 14-160.

⁵⁴⁸ See *supra* p. 50 (harms of silver generally).

⁵⁴⁹ KSM EA Application at 14-168.

⁵⁵⁰ *Id.* at 14-176.

⁵⁵¹ *Id.* at 14-184.

⁵⁵² See *supra* note 516.

⁵⁵³ See *supra* p. 51 (harms of zinc generally).

µg/L during operation of the mine.⁵⁵⁴ Even for 50 years after the mine's closure zinc concentration are expected to be on average 22.5 µg/L, with a maximum of 64.9 µg/L.⁵⁵⁵ Further downstream, at the Unuk River's crossing of the Canada–United States border, zinc levels are expected to be on average 9 µg/L (with a maximum of 28 µg/L) both during the mine's operation,⁵⁵⁶ and five decades after the mine is closed.⁵⁵⁷

- Selenium

The KSM Mine project expects a management problem regarding selenium pollution. As mentioned above, because the main threat selenium poses to salmon comes from bioaccumulation via diet, as opposed to direct exposure via waterborne selenium, there is no data regarding safe levels of selenium. With this in mind, at and downstream of the confluence of Sulphurets Creek with the Unuk River, in waters inhabited by sockeye, Chinook, and Coho salmon, and steelhead,⁵⁵⁸ the proponent of KSM Mine expects an average selenium concentration of 2.0 µg/L, with a potential maximum of 3.4 µg/L during operation of the mine.⁵⁵⁹ This level factors in the project's use of a selenium treatment plant (feed water without treatment has a selenium concentration of 100 µg/L).⁵⁶⁰ Even for 50 years after the mine's closure, selenium levels are expected to be on average 1.9 µg/L, with a maximum of 3.2 µg/L.⁵⁶¹ The mine proponent recognizes that these levels constitute a “degradation of water quality”:

Selenium concentrations . . . are predicted to be greater than both the background concentrations and water quality guidelines at site UR1 below the confluence [of the Unuk River] with Sulphurets Creek, indicating degradation of water quality in the operation, closure, and post-closure phases of the Project. . . . [T]he magnitude of the effect is high Effects are predicted to extend into the far-future in post-closure. . . . Qualitatively, an increase in concentration of selenium in the water may increase the concentration of the metal in fish tissue; however, there is a high degree of uncertainty evaluating the effect of increased concentrations of selenium in water.⁵⁶²

⁵⁵⁴ See KSM EA Application at 14-160.

⁵⁵⁵ *Id.* at 14-168.

⁵⁵⁶ *Id.* at 14-176.

⁵⁵⁷ *Id.* at 14-184.

⁵⁵⁸ See *supra* note 516.

⁵⁵⁹ See KSM EA Application at 14-160.

⁵⁶⁰ *Id.* at 4-157 to 4-158.

⁵⁶¹ *Id.* at 14-168.

⁵⁶² *Id.* at 14-267 to 14-268.

The effect of selenium pollution is expected to be detectable 22 miles (35 kilometers) downstream of the mine site on the Alaskan side of the border.⁵⁶³ At the Unuk River's crossing of the Canada–United States border, selenium levels are expected to be on average 1.1 µg/L (with a maximum of 1.9 µg/L) during the mine's operation,⁵⁶⁴ and 1.1 µg/L (with a maximum of 1.7 µg/L) five decades after the mine is closed.⁵⁶⁵ In addition, the mine proponent expects that total cumulative selenium loading once the effect of the Brucejack Mine is included “could result in a cumulative effect of a greater magnitude in the Unuk River at the [British Columbia]–Alaska border.”⁵⁶⁶

The B.C. Mines' Potential Impacts on Salmonids

The KSM Mine's expectations are illustrative of the threats posed to downstream salmonid-populated waters by each of the B.C. Mines. In fact, the threats from each of these mines might be much greater than the example of the KSM Mine suggests.

The B.C. Mines will also pose the threat of harmful synergies that may result from the simultaneous presence of different pollutants in the same waters. “Few studies exist on the effects that multiple metal ‘cocktails’ have on fish and aquatic food chains, and combined effects can be more toxic than any single element.”⁵⁶⁷ It is known that the combination of copper and zinc “can be more than additive, with mixtures of the two metals causing higher rates of mortality in fish than expected based on each element alone.”⁵⁶⁸ Mine proponents are aware of these risks, but have not modeled their effects.⁵⁶⁹

Harms expected from the B.C. Mines will also have a cumulative effect, given that in many cases more than one mine and its waste materials drain into a single watershed. In KSM's case, water quality predictions understate harms by failing to account for cumulative effects when KSM's pollution is combined with that of the upstream Brucejack Mine project. Canadian federal and provincial authorities, as well as the United States Environmental Protection Agency and the Alaska Department of Environmental Conservation have expressed concerns that metals (particularly chromium and zinc) and nonmetal (selenium and arsenic) pollution from Brucejack Mine will cause harm to downstream fish and fish habitat.⁵⁷⁰ The Brucejack Mine proponent

⁵⁶³ *Id.* at 14-268.

⁵⁶⁴ *Id.* at 14-176.

⁵⁶⁵ *Id.* at 14-184.

⁵⁶⁶ *Id.* at 14-273.

⁵⁶⁷ Woody, *Copper Effects* at 14.

⁵⁶⁸ *Id.*

⁵⁶⁹ See e.g., Galore Creek EA Application at 7-382 (“[S]ome metals have an additive, or synergistic, effect when combined in aqueous solution. Waterborne solutions of zinc-cadmium mixtures have been found to be additive in toxicity to aquatic organisms, including freshwater fish, amphipods, marine fish, and copepods. Similarly, mixtures of copper and zinc are generally acknowledged to be more-than-additive in toxicity to a wide variety of aquatic organisms. There is a slight probability that combinations of these metals, even though they are not predicted to have significant impacts on the productive capacity of aquatic habitat on their own, may combine to affect productivity downstream of the mine; however, these effects have not been modeled.”).

⁵⁷⁰ Brucejack EA Report at 33.

concedes that “[t]here is a potential for change to surface water quality due to Project activities in the headwaters of the Sulphurets/Unuk watersheds” and that “[p]otential effects on the Unuk River may have international transboundary implications.”⁵⁷¹ A full understanding of the threats posed by the B.C. Mines would need to account for cumulative impacts.

Information about the B.C. Mine projects indicates that each one poses threats to downstream waters inhabited by salmonids. In the Taku River watershed, the Tulsequah Chief Mine lacks predictions for the concentrations of toxic metals and acidity that it will generate in downstream waters inhabited by salmonids. The old mine sites on its property have already “left a residual acid mine drainage [] problem,” with “acidic waters carrying dissolved metals draining into the Tulsequah River,”⁵⁷² and from there into the Taku River. Like other mines, the Tulsequah Chief Mine assures regulators that it will sequester or mitigate the contamination of contact waters by acid mine drainage and metal leaching.⁵⁷³ Extrapolation from the example of the KSM Mine indicates harmful impacts on downstream waters. Moreover, the Tulsequah Chief Mine proponent, Chieftain Metals, has already substantiated doubts as to the efficacy of its mitigation measures and the veracity of its assurances. When it took over the project, Chieftain Metals committed to addressing the residual acid mine drainage problem at the site, and constructed a treatment plant.⁵⁷⁴ But the plant stopped operations in June 2012 “in contravention of the Fisheries Act and the [Environmental Management Act] permit,” and Chieftain Metals will not restart its operations until the project receives further financing,⁵⁷⁵ renegeing on its commitments.⁵⁷⁶ British Columbia’s mining minister has conceded that concern about extant acidic drainage from historic mines in the area is “a most legitimate criticism of us by those folks in Alaska who don’t like it.”⁵⁷⁷

In the Stikine River drainage, none of the mines—Red Chris, Schaft Creek, or Galore Creek—have measured or predictively estimated their water-quality impacts from operations with regard to downstream salmonids and their habitats.⁵⁷⁸ Even before development, the waters downstream of some of these mine projects were naturally high in levels of dissolved metals,

⁵⁷¹ Brucejack EA Application at 13-64.

⁵⁷² Big Bull 2010 Technical Report at 8.

⁵⁷³ Tulsequah Chief 2014 Technical Report at 20-7 to 20-8 (averring that its model, which “represents the proposed site-wide water management system,” and which “was run for a realistic range of operational and environmental conditions,” demonstrates “a robust system able to meet the dynamic conditions that may be experienced during operations”).

⁵⁷⁴ Tulsequah Chief 2014 Technical Report at 4-7, 20-1.

⁵⁷⁵ *Id.*

⁵⁷⁶ One Alaska legislator explained, “[w]e had the head of Chieftain talking to us, and everything was rosy, and they were going to do this and going to do that for environmental controls—they didn’t do any of it.” C. Kelly, *It’s Back to Barging for Chieftain Metals’ Tulsequah Project*, KTOO PUBLIC MEDIA (Nov. 13, 2014), <http://www.ktoo.org/2014/11/13/back-barging-chieftain-metals-tulsequah-project/> (last visited May 11, 2016).

⁵⁷⁷ E. Schoenfeld, *B.C. minister: Tulsequah Mine Leak Should Be Fixed*, KFSK COMMUNITY RADIO (Aug. 25, 2015), <http://www.kfsk.org/2015/08/25/b-c-minister-tulsequah-mine-leak-should-be-fixed/> (last visited May 11, 2016).

⁵⁷⁸ See Richardson & Milner at 754 (describing salmonids inhabiting the Stikine River).

including aluminum, cadmium, and copper.⁵⁷⁹ For this reason, even slight marginal increases in dissolved metals could raise levels above harm thresholds for salmonids.

In this context, the Red Chris Mine project expects that “[a]ctivities associated with construction, operation and reclamation of the mine may potentially impact existing fisheries resources within local and regional surface waterbodies.”⁵⁸⁰ As Red Chris’s Environmental Assessment Report describes, “[t]he primary water quality issues of concern . . . are . . . aluminum, cadmium, and selenium. . . . The metals will come from milling operations and from precipitation runoff and groundwater draining through the North waste dump and across and through the exposed rock in the open pit walls.”⁵⁸¹ The mine proponent itself predicted that “under non-acidic conditions concentrations of most elements in drainage waters can be expected to be relatively low,” but “[t]he onset of acidic conditions can be expected to destabilize all these sinks resulting in elevated concentrations of these elements in drainage.”⁵⁸²

In the same watershed, the Schaft Creek Mine threatens the lower reaches of Mess Creek, a salmon spawning ground,⁵⁸³ as well as a habitat for steelhead trout.⁵⁸⁴

The proponent of the Galore Creek predicts that “[d]uring operation of the mine, tailings decant water will be discharged into Galore Creek,” and will be “expected to increase the concentrations of a selection of metals and nutrients in Galore Creek and the Scud River.”⁵⁸⁵ It expects tailings and waste-rock facilities to cause “habitat loss” and “habitat degradation” to the downstream species of Pacific salmon.⁵⁸⁶ Even though the mine proponent did not complete detailed predictions of effects downstream, it concedes that “potential effects of mine components on the Stikine River” include “habitat loss” and “habitat degradation.”⁵⁸⁷ The organization contracted to complete the predictive studies nonetheless “conservatively estimated that effects could potentially extend” further downstream, even if the volume of the creek was insufficient to independently render the Stikine River unviable for salmon.⁵⁸⁸ The mine did not present information regarding the total magnitude of metals release from ore at the project’s dewatering site, only stating that it would be “minimal.”⁵⁸⁹ While the Schaft and Galore creeks

⁵⁷⁹ Red Chris EA Report at 22; *see* Scannell at 107 (recommending continued monitoring of copper, lead, molybdenum, zinc, selenium, and aluminum levels in the Stikine River).

⁵⁸⁰ Red Chris EA Application at 4-342.

⁵⁸¹ Red Chris EA Report at 23.

⁵⁸² Red Chris EA Application at 4-153.

⁵⁸³ Scannell at 75, 95.

⁵⁸⁴ Schaft Creek Feasibility Study at 20-14.

⁵⁸⁵ Galore Creek EA Application at 7-381; *id.* at 7-412 (“The release of surface water decants from the tailings and waste rock facility will likely cause an increase in the concentrations of certain metals downstream of the dam.”).

⁵⁸⁶ *Id.* at 7-376.

⁵⁸⁷ *Id.* at 7-378.

⁵⁸⁸ Scannell at 71.

⁵⁸⁹ *Id.* at 74.

collectively contribute a small volume to the total flow of the Stikine River,⁵⁹⁰ pollution of these streams could nonetheless materially affect salmon viability, especially when taken cumulatively with the pollution contributed by the Red Chris Mine.

All of these predictions, however, understate risks, because they presume the veracity and foresight of mine proponents' claims that all control and mitigation measures will work perfectly as planned. In order to reduce exposure to air, and thus oxidation, mine wastes and tailings can be stored underwater or included within a cement-like paste, which is then used to backfill a mine. Additionally, tailings water and contact water can be impounded and released to the environment combined with neutralizing additives such as crushed limestone. But studies have shown that these methods are of limited efficacy: "much uncertainty remains in the ability of scientists and engineers to predict the ultimate drainage quality years in the future, as many complex variables influence acid generation and neutralization."⁵⁹¹ Of 56 mines examined in one study, 11 percent did not conform to the expected results based on neutralization-potential to acid-potential ratios.⁵⁹² Predictions are often flawed because they result from misidentification of certain rocks as neutralizing when they in fact add no alkalinity to the water to offset the acidity of oxidizing sulfide rock.⁵⁹³ Similarly, studies have demonstrated that "conventional analytical methods fail[] to accurately characterize acid-forming minerals."⁵⁹⁴

Moreover, "[m]itigation frequently fails to perform according to plan."⁵⁹⁵ A study of all permitted mines from 1975 to 2006 for which environmental impact statements were completed in the United States revealed that 64 percent had mining-related exceedances of water quality standards (and hence also of predicted pollutant concentrations).⁵⁹⁶ Of mines that had predicted low impacts to surface water resources with the use of mitigation measures, 73 percent developed exceedances of water quality standards.⁵⁹⁷ Of mines that predicted a low potential for the development of acid mine drainage, 89 percent eventually developed problems with acid mine drainage pollution.⁵⁹⁸ Perhaps most telling of all, of mines in close proximity to surface water that predicted no exceedances, 91 percent had developed exceedances of surface water standards and elevated acid mine drainage potential by the time of the study.⁵⁹⁹ The study

⁵⁹⁰ *Id.* at 101-02 ("The water in Galore Creek contributes only 0.3% and Schaft Creek about 0.7% to the total flow in the Stikine River near Wrangell. It is unlikely that an increase in metals concentrations in either of these creeks will have a detectable effect on water quality of the Stikine River in Alaska. However, water quality in the Stikine River upstream and downstream of the mine receiving waters is a critical component of the long-term monitoring program.").

⁵⁹¹ Jennings *et al.* at 7.

⁵⁹² *Id.* at 8.

⁵⁹³ *Id.* at 9.

⁵⁹⁴ *Id.*

⁵⁹⁵ J. R. Kuipers *et al.*, COMPARISON OF PREDICTED AND ACTUAL WATER QUALITY AT HARDROCK MINES at ES-15 (2006).

⁵⁹⁶ *Id.* at ES-8.

⁵⁹⁷ *Id.* at ES-9.

⁵⁹⁸ *Id.*

⁵⁹⁹ *Id.* at ES-11.

concluded that pre-mining predictions of mitigation efficacy are likely to mischaracterize the hydrology of the mine location (by overestimating dilution of pollutants, for example), as well as the geochemical qualities of their pollutants.⁶⁰⁰ It is also likely that mitigation measures will fail to work as planned: in 64 percent of cases mitigation measures failed.⁶⁰¹

The risks that these studies demonstrate are only compounded by the timescale on which treatment must be sustained: centuries, even millennia. For example, mines dating from the Roman Empire still discharge acidic waste water today.⁶⁰² Tellingly, proponents of the KSM Mine conclude: “[t]he proposed mitigation cannot eliminate the Project-related residual effect on water quality. . . [including] degradation of surface water quality due to sedimentation and erosion, [metals leaching and acid mine drainage] and dissolution of blasting residues near access corridors, and increased selenium concentrations due to effluent discharge.”⁶⁰³ These effects only pertain to the first 100 years post construction, including around 50 years of mine operation and 50 years post-closure. Thereafter, “[p]redictive water quality modeling into the far-future has an inherent level of uncertainty.”⁶⁰⁴

Risks also arise with respect to the integrity and efficacy of tailings dams. As the Galore Creek Mine proponent states regarding its own dam:

[I]ntegrity of the tailings dam will be of importance. A tailings dam failure would result in a very large pulse of water travelling downstream. The force of the water may result in the destruction or alteration of habitat for kilometres downstream of the mine, possibly as far as the Stikine River. . . . Contaminated sediment from the tailings pond would . . . potentially cause mortality among primary and secondary producers. . . . This may have catastrophic effects on the productivity of the river, affecting not only fish species, but also wildlife and humans. Productive capacity would likely be altered for years as newly-exposed potentially acid-generating (PAG) rock begins to leach acid, and contaminated sediment settles onto the substrate of the river.⁶⁰⁵

Proponents for the B.C. Mines downplay the likelihood of a dam failure,⁶⁰⁶ but in truth tailings dam failures are not a rare occurrence. During the 1968 to 2006 period, globally, there

⁶⁰⁰ *Id.* at ES-13.

⁶⁰¹ *Id.*

⁶⁰² Jennings *et al.* at 4.

⁶⁰³ KSM EA Application at 14-276.

⁶⁰⁴ *Id.*

⁶⁰⁵ Galore Creek EA Application at 7-382, 7-392 to 7-393.

⁶⁰⁶ *See, e.g., id.* at 7-392 (“[A]n event such as this is classified as catastrophic and beyond any best engineering practices for earth-filled hydroelectric reservoirs.”).

were 3.76 tailings dam failures per year.⁶⁰⁷ In fact, one of the Red Chris Mine proponent's own engineers⁶⁰⁸ has published a study concluding that dam failures often follow a "mining boom"⁶⁰⁹—"in the manner of a hangover after a good party."⁶¹⁰ The study hypothesizes a number of causes for this pattern, including "permit haste," pressure to cut costs, incompetence of personnel, and a general "[d]isconnect between design expectations and operational realities"—all of which are endemic to the practice of building tailings dams.⁶¹¹ This general finding is especially pertinent because the British Columbia regulatory context has proved not only unable to address the risks of catastrophic dam failure, but also generally deficient in overseeing the mining sector as a whole. In the words of the Auditor General of British Columbia, the Ministry of Energy and Mines and the Ministry of the Environment's

[C]ompliance and enforcement activities of the mining sector are inadequate to protect the province from significant environmental risks. . . . Both ministries lack sufficient resources and tools to manage environmental risks from mining activities. . . . Neither ministry uses a permitting approach that reduces the likelihood taxpayers will have to pay costs associated with the environmental impacts of mining activities (known as the polluter-pays principle). . . . Both [ministries'] enforcement responses have significant deficiencies [T]he two ministries are not informing the public and legislators about the long-term risks from mining, the effectiveness of the agencies' regulatory oversight, and the overall performance of the companies being regulated.⁶¹²

Less than two years ago, a tailings dam collapsed at the Mount Polley copper and gold mine, a project owned by Red Chris Mine proponent Imperial Metals. Mount Polley released millions of cubic meters of tailings into downstream waters, sending much of this waste into the waters of Quesnel Lake.⁶¹³ Considering that the B.C. Mines come to fruition as elements of a classic mining boom, and in a regulatory context that has by no means precluded catastrophic dam failures, the risks to downstream waters are heightened.

⁶⁰⁷ See M. Davies & T. Martin, *Mining Market Cycles and Tailings Dam Incidents* 1 (2009) (Davies & Martin) ("In total, from December 1968 through to August 2009, there were 143 tailings dam incidents that were available to evaluate in terms of their trends.").

⁶⁰⁸ P. Kiernan, *Mining Dams Grow to Colossal Heights, and So Do Risks*, WALL STREET JOURNAL (Apr. 5, 2016), <http://www.wsj.com/articles/brazils-samarco-disaster-mining-dams-grow-to-colossal-heights-and-so-do-the-risks-1459782411> (last visited May 11, 2016) (identifying Davies as a current employee of Teck Resources Ltd.).

⁶⁰⁹ Davies & Martin at 5 ("From the available information, there appears to be a lag of between 2 and 2.5 years from the end of a mining boom to the start of a two-year period of increased frequency of tailings dam incidents.").

⁶¹⁰ *Id.* at 8.

⁶¹¹ *Id.* at 7-8.

⁶¹² See Auditor General of British Columbia, AN AUDIT OF COMPLIANCE AND ENFORCEMENT OF THE MINING SECTOR 6-7 (May 2016), http://www.bcauditor.com/sites/default/files/publications/reports/FINAL_CE_Mining.pdf (last visited May 11, 2016).

⁶¹³ See G. Hoekstra, *Sediment from Mount Polley Mine Dam Collapse Found Deep in Quesnel Lake*, VANCOUVER SUN (Oct. 7, 2014), <http://www.vancouversun.com/Sediment+from+Mount+Polley+mine+collapse+found+deep+Quesnel+Lake/10274733/story.html> (last visited May 11, 2016).

The harms described above do not exhaust the detrimental risks that the B.C. Mines pose to salmonids in the Taku, Stikine, and Unuk river watersheds. The particular contaminants addressed above could harm salmonids in additional ways not discussed in this petition. For example, metals and other contaminants from the B.C. Mines could directly or indirectly harm the smaller aquatic species on which Pacific salmon and steelhead prey; changes in the quality or quantity of the salmonids' food source could harm the salmonids. Beyond the particular metals and non-metals examined above, numerous other contaminants will leach from mine wastes and tailings; each of these could have detrimental effects on downstream salmon and steelhead, as well as their habitats. Pollution and other adverse changes originating from each mine's infrastructure and, where applicable, access roads are also likely to harm salmon and trout populations by interfering with the hydrological and biotic processes of riverine ecosystems. For example, the projects will use vast quantities of water in their operations, all of which will be drawn from the surrounding environment. This is likely to result in changes in downstream flow velocity, as well as increases in sediment, turbidity (suspended sediment), and temperature—all of which could have adverse impacts on salmonids. Mine proponents have already conceded that such variations in flow are real concerns.⁶¹⁴ Each hydrological and biotic change, both individually and cumulatively, could potentially harm salmonids and their habitats in the Taku, Stikine, and Unuk watersheds. A full investigation of the extent to which the B.C. Mines harm Pacific salmon and steelhead trout should encompass all such harms.

A full investigation should also examine the extent to which the B.C. Mines will affect other river systems that, though not traversing the Canada–United States border, implicate the populations of anadromous salmonids protected by the Anadromous Stocks Conservation Convention. For example, the Nass River flows 236 miles (380 kilometers) within the Canadian border, from headwaters in the Coast Range and Hazelton mountains to the Portland Canal, a fjord of the Pacific Ocean.⁶¹⁵ The Nass River is inhabited by all five species of Pacific salmon and steelhead trout.⁶¹⁶ The drainage of the Bell-Irving River, a major tributary of the Nass,⁶¹⁷ supports populations of steelhead, with five percent of all steelhead in the Nass River system spawning in this watershed, including in Teigen and Treaty creeks.⁶¹⁸ Coho, Chinook, and sockeye salmon are also present in these creeks or their tributaries;⁶¹⁹ Teigen Creek alone accounts for eight percent of the total Nass Chinook salmon stock.⁶²⁰ As has been described

⁶¹⁴ See KSM EA Application at 13-41 (“Alaska state departments and federal US agencies identified potential changes in flow (increase or decrease) within the Unuk River as a concern.”); *id.* at 13-154 (“The potential residual effects on streamflows within the [regional study area] include changes in annual flow volumes, monthly flow distribution, and peak and low flows. . . . This assessment is based on the local extent of these effects, and considers a far-future duration for these effects, which are continuous in nature, reversible in long-term, and neutral in context. The likelihood of occurrence of these changes is high . . .”).

⁶¹⁵ Richardson & Milner at 760, 763.

⁶¹⁶ *Id.* at 763.

⁶¹⁷ *Id.*

⁶¹⁸ KSM EA Application at 15-43 to 15-44.

⁶¹⁹ *Id.* at 15-44.

⁶²⁰ *Id.* at 15-45.

above, the KSM Mine's ore processing plant and tailings impoundment sit in Teigen and Treaty creek drainages, within the Bell-Irving watershed and the Nass River drainage.⁶²¹ The mine proponent plans to have these facilities discharge waters into the Treaty and Teigen creeks.⁶²² These discharges are likely to impose harms on populations of salmonids. For example, during operations, in South Teigen Creek, inhabited by steelhead,⁶²³ the expected mean concentrations of aluminum, copper, and selenium are 330 µg/L, 1.1 µg/L, and 0.07 µg/L, respectively.⁶²⁴ In Teigen Creek, inhabited by Chinook, Coho, and sockeye salmon, and steelhead,⁶²⁵ the expected mean concentrations of aluminum, copper, and selenium are 210 µg/L, 0.9 µg/L, and 0.4 µg/L, respectively.⁶²⁶ In Treaty Creek, inhabited by Chinook, Coho, and sockeye salmon, and steelhead,⁶²⁷ the expected mean concentrations of aluminum, copper, selenium, and zinc are 3,200 µg/L, 9 µg/L, and 1.0 µg/L, and 25 µg/L, respectively.⁶²⁸ These concentrations are in excess—in some cases by several hundred-fold—of concentrations at which salmonids can safely spawn and rear.⁶²⁹ Thus, a full picture of the effects of the B.C. Mines on the salmonid species protected under the Anadromous Stocks Conservation Convention should also encompass other affected watersheds, even if they do not straddle the international boundary.

As a general matter, metals mining operations routinely contaminate waters inhabited by fish—specifically salmonids—due to the oxidation of sulfide deposits in which ores are often found. The KSM Mine, the only project that compiled water-quality predictions with respect to downstream salmon waters, expects the levels of aluminum, cadmium, copper, lead, silver, zinc, and selenium—to say nothing of other materials—to rise to levels that will cause harmful effects to the reproductive, developmental, and survival capacities of salmonids. The other five mines have failed to predict precise water-quality levels in downstream salmon waters, instead inducing Canadian regulators to rely on assurances that mitigation measures will work perfectly for the indefinite future—timeframes often counted in the centuries. These assurances are unrealistic, contradicted by scientific literature, and cannot be credited. Establishing and permitting the B.C. Mines pose a substantial threat of directly reducing populations of Pacific salmon and steelhead trout, and are likely to harm them by modifying or degrading habitat so as to preclude essential behaviors and survival in the Taku, Stikine, and Unuk river watersheds, with detrimental outcomes for the communities and enterprises that rely on these watersheds.

⁶²¹ *Id.* at 15-1 (“The eastern area of the Project is situated within the Bell-Irving River watershed, which discharges into the Nass River.”); *see also* 15-7 to 15-8 (describing watersheds).

⁶²² *Id.* at 14-73, Fig. 14.7-8 & 14-75.

⁶²³ *Id.* at 15-42, Tbl. 15.1-4.

⁶²⁴ *Id.* at 14-233, Tbl. 14.7-47.

⁶²⁵ *Id.* at 15-42, Tbl. 15.1-4.

⁶²⁶ *Id.* at 14-245, Tbl. 14.7-50.

⁶²⁷ *Id.* at 15-42, Tbl. 15.1-4.

⁶²⁸ *Id.* at 14-206, Tbl. 14.7-44.

⁶²⁹ *See supra* pp. 47-51.

Relevance under the Anadromous Stocks Conservation Convention and the Pelly Amendment

The establishment, operation, and post-closure effects of the six B.C. Mines are likely to result in takings of Pacific salmon and steelhead trout. The mines can be expected to pollute and otherwise harm the downstream salmon waters of the Taku, Stikine, and Unuk river watersheds, likely resulting in habitat destruction, sub-lethal developmental and reproductive harms, and in some instances direct lethality to chum, pink, Coho, sockeye, and Chinook salmon and steelhead trout. The mines therefore pose a substantial threat of directly reducing populations of each of these species, and are likely to harm them by modifying or degrading habitat so as to preclude essential behaviors and survival. They would thus constitute takings under the Pelly Amendment.

The B.C. Mines' likely destruction of habitat and direct harm to Pacific salmon and steelhead would diminish the effectiveness of the Anadromous Stocks Conservation Convention. The United States executed the Convention in order to promote conservation of Pacific salmon and steelhead trout populations, which otherwise would have been over-exploited and depleted.⁶³⁰ Accordingly, all parties to the Convention agreed to refrain from high seas fishing in order to preserve populations of anadromous fish returning to their waters.⁶³¹ Their preservation would benefit domestic ecology by allowing salmon to return to their natal waters and ecosystems, and in turn allow sustainable commercial harvests and subsistence uses by indigenous peoples.⁶³² By establishing and operating the B.C. Mines, Canadian nationals are likely to materially harm the very anadromous fish populations protected under the Convention—this time in spawning and rearing habitats. The net effect of the permitting and establishment of the B.C. Mines would thus diminish the effectiveness of the Anadromous Stocks Conservation Convention. The likely takings of Pacific salmon and steelhead trout resulting from existing and future mining projects justify an investigation of these projects pursuant to the Pelly Amendment. If that investigation determines that a taking has or will occur, this conclusion must be certified to the President.

⁶³⁰ See *supra* pp. 7-8.

⁶³¹ See Letter of Submittal from Sec. James A. Baker III to the President at viii (“As the Convention will provide greater protection to migrating U.S.-origin Pacific salmon on the high seas, it should go far in helping U.S. interests accrue the fullest possible economic, social and recreational benefits from the Pacific salmon produced in U.S. waters.”); *Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean (Treaty Doc. 102-30): Hearing Before the S. Comm. on Foreign Relations*, 102nd Cong. 2 (2d Sess. 1992) (statement of Sen. Murkowski) (explaining that the United States would ratify the Convention to protect the salmon runs of Alaska and the Western United States); *id.* at 3 (statement of Sen. Packwood) (“The prohibition of high seas fishing for North Pacific salmon will have the direct effect of protecting United States-origin salmon species. . . . Ratification of this convention will insure that the United States receives the fullest possible economic, social and recreational benefits from the salmon produced in our waters.”).

⁶³² K. R. Bryan, *Swimming Upstream: Trying to Enforce the 1992 North Pacific Salmon Treaty*, 28 CORNELL INT’L L.J. 241, 243 (1995).

V. CONCLUSION

The development of the six B.C. Mines addressed above—the Tulsequah Chief, Red Chris, Schaft Creek, Galore Creek, KSM, and Brucejack mines—pose a substantial risk of significant detrimental population-level impacts on woodland caribou, grizzly bears, and six species of Pacific salmonids. Both the direct mortality increases and adverse modification of habitat resulting from the projects would constitute “takings” as the term is defined in the Pelly Amendment. Canadian nationals have developed or are preparing to construct these six projects in ways likely to cause takings of these important populations, and in so doing diminish the effectiveness of the Western Hemisphere Convention and the Anadromous Stocks Conservation Convention.

Under the Pelly Amendment, once the Secretary is of the opinion that there may be cause for certification under Section 1978(a)(2), she must “promptly investigate . . . [the relevant] activity by foreign nationals.”⁶³³ The facts set forth in the foregoing petition establish that such an investigation should now be undertaken.

The Secretary should simultaneously engage with officials at the State Department and other relevant officials within the Federal Executive to secure a referral of the issue of harms to the transboundary watersheds resulting from the B.C. Mines to the International Joint Commission. Such a referral would be the most direct means of addressing this issue, and could potentially obviate the need for further steps under the Pelly Amendment.

Accordingly, the undersigned groups respectfully request that the Secretary commence an investigation pursuant to the Pelly Amendment, and engage officials within the Federal Government to secure a referral of the issue of harms to the transboundary watersheds resulting from the B.C. Mines to the International Joint Commission.

Sincerely yours,

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The Hon. Byron Mallott, Lt. Governor, State of Alaska;

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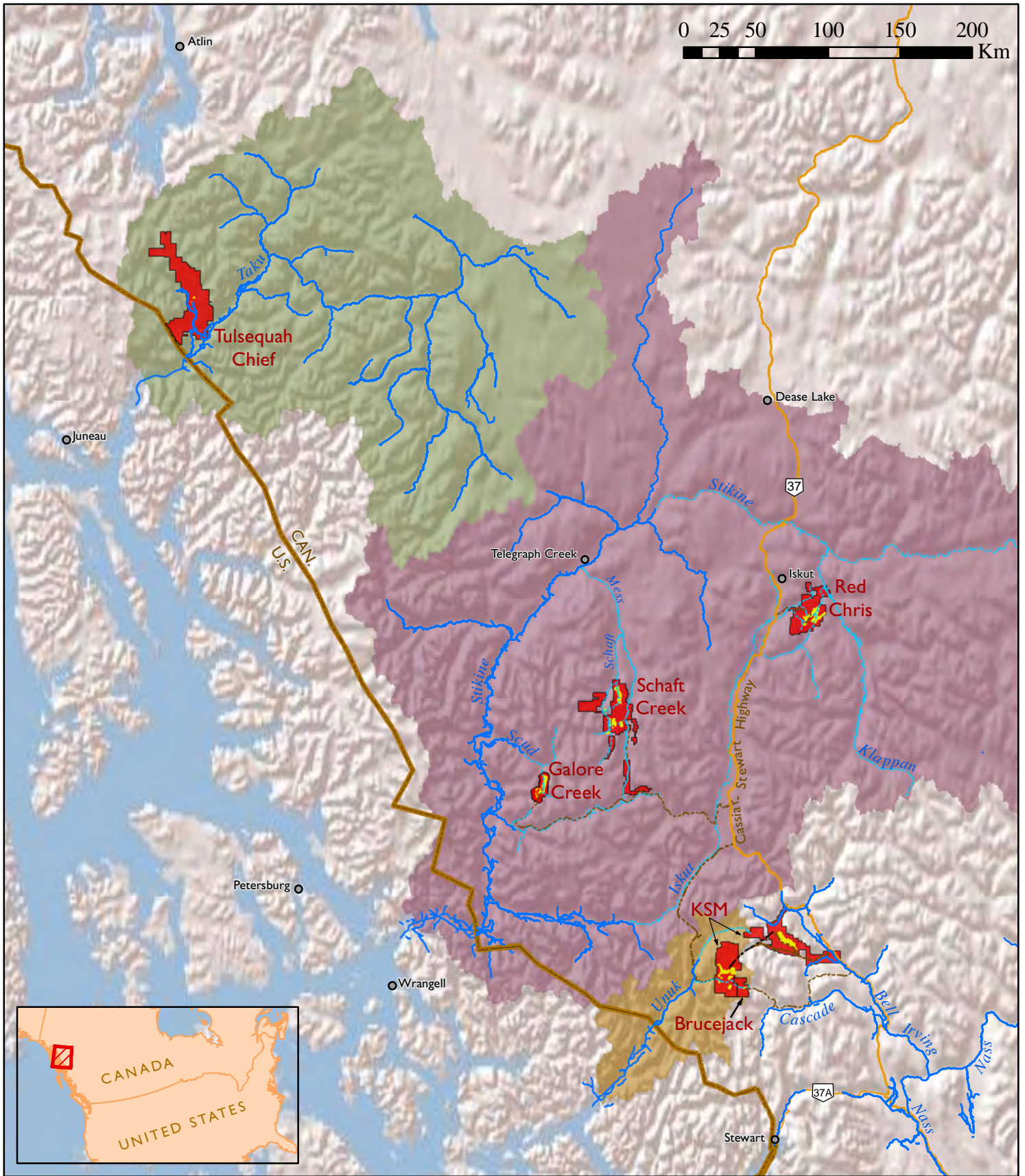
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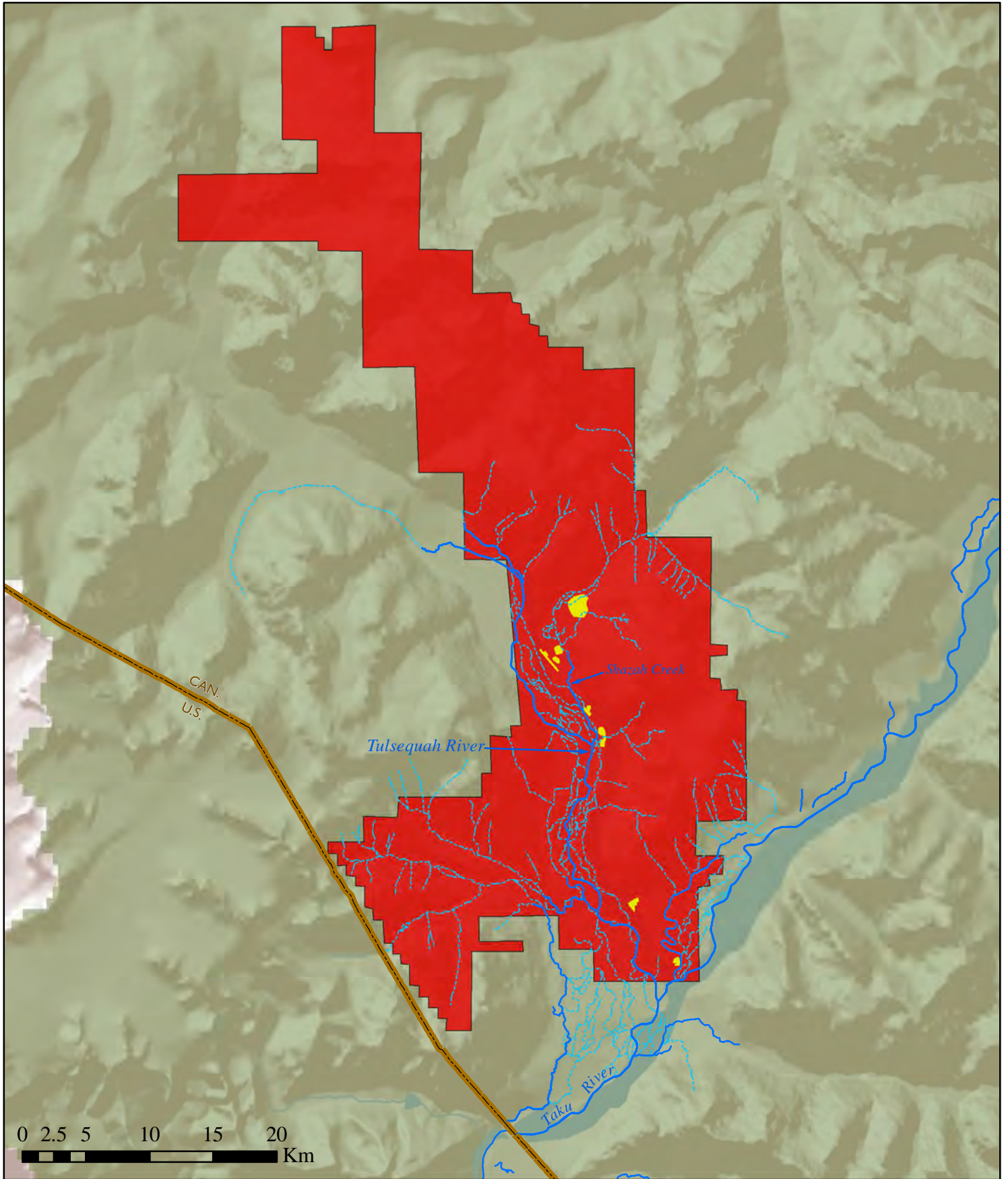
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Figure I. Affected Transboundary Watersheds and Other Anadromous Streams



- Affected Anadromous River Segments
- - - Affected Other River Segments
- Stikine Watershed
- Taku Watershed
- Unuk Watershed
- - - Mine Access Road
- - - - Mitchell Treaty Tunnel
- Mine Facilities Footprint
- Mine Project Area

Figure 2. Tulsequah Chief Mine






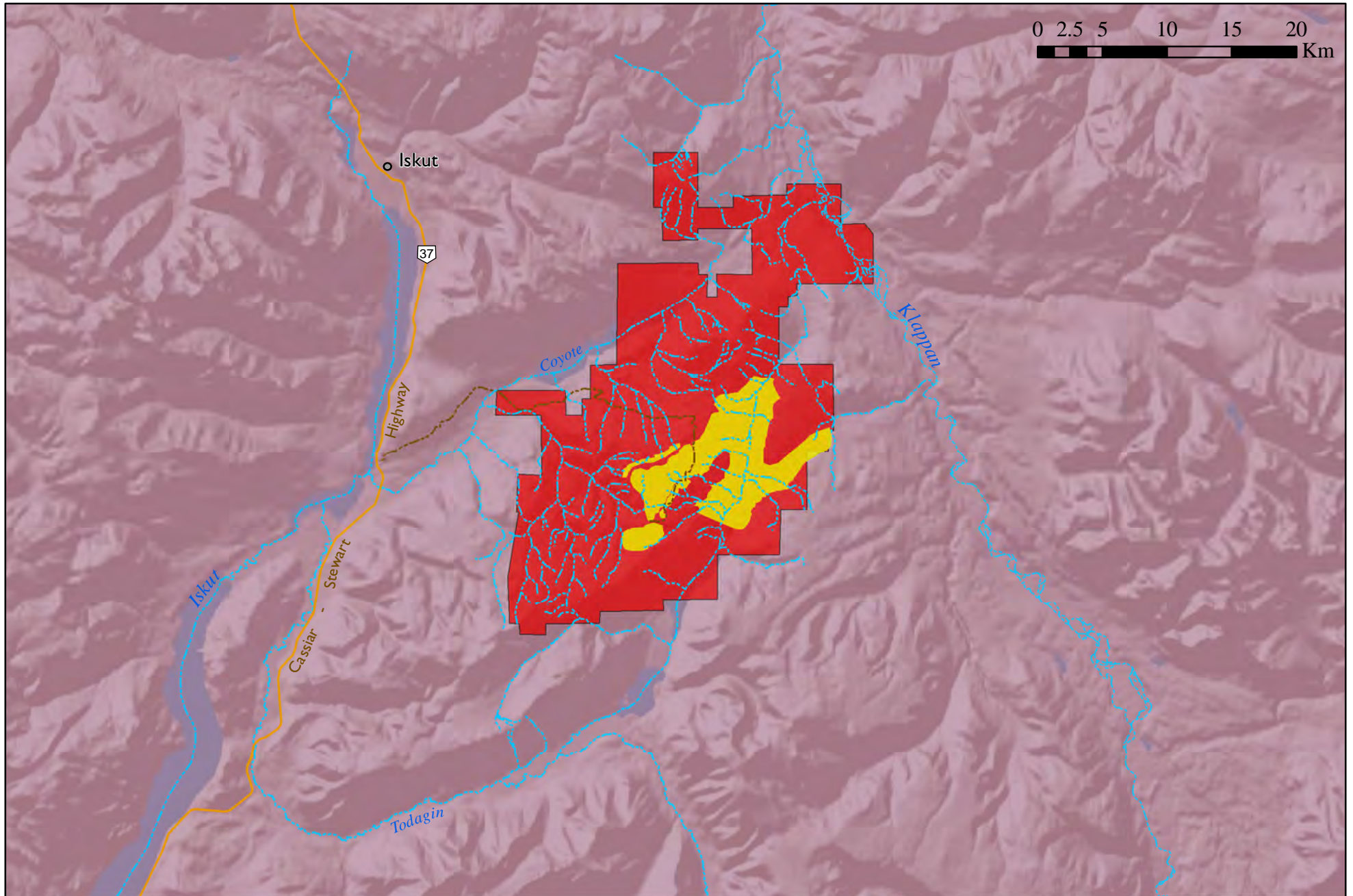
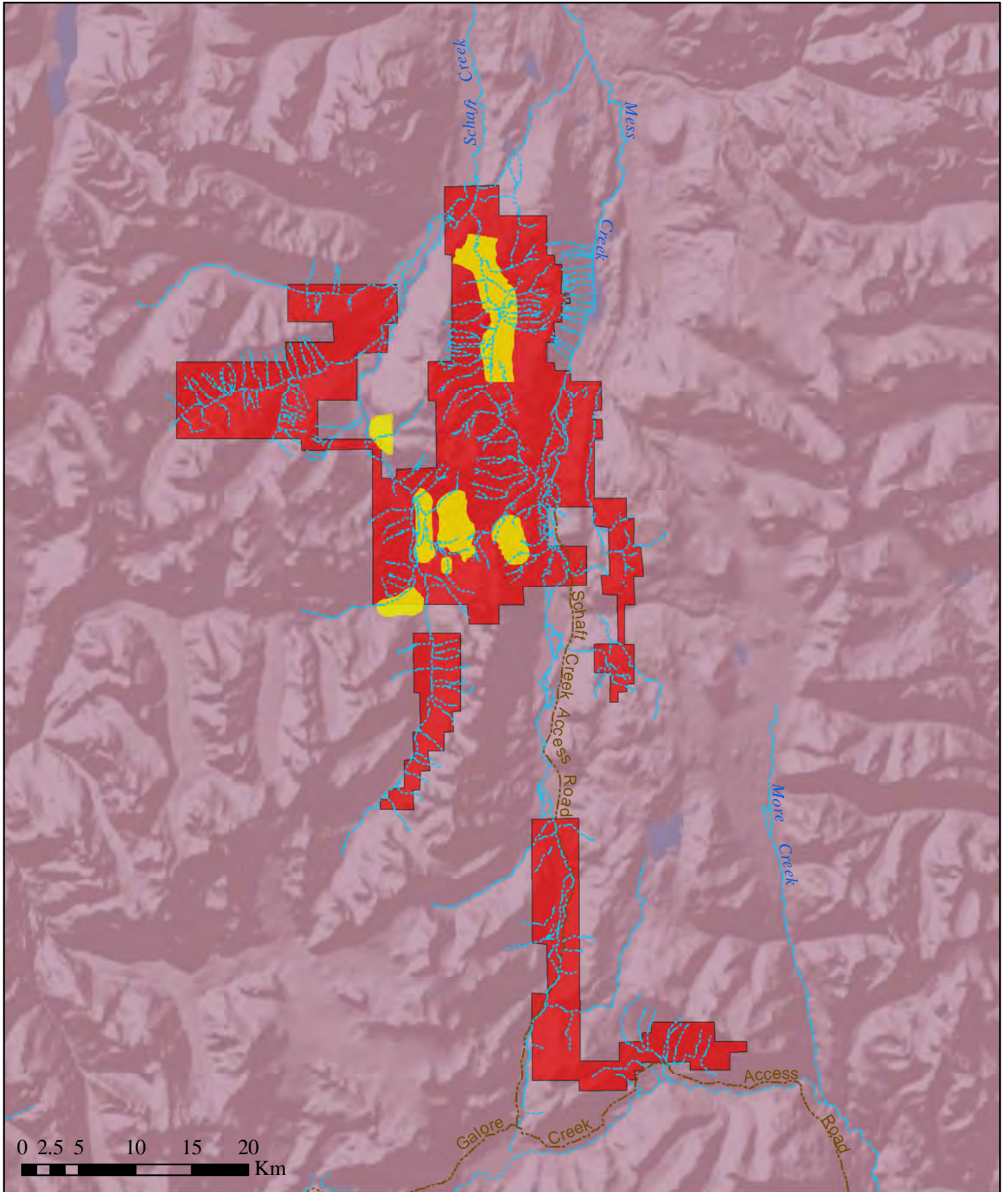
-  Mine Facilities Footprint
-  Mine Project Area
-  Affected Anadromous River Segments
-  Affected Other River Segments
-  Taku Watershed



Figure 3. Red Chris Mine



- Red Chris Access Road
- Mine Facilities Footprint
- Mine Project Area
- Affected River Segments
- Stikine Watershed

Figure 4. Schaft Creek Mine



 Mine Facilities Footprint
 Mine Project Area



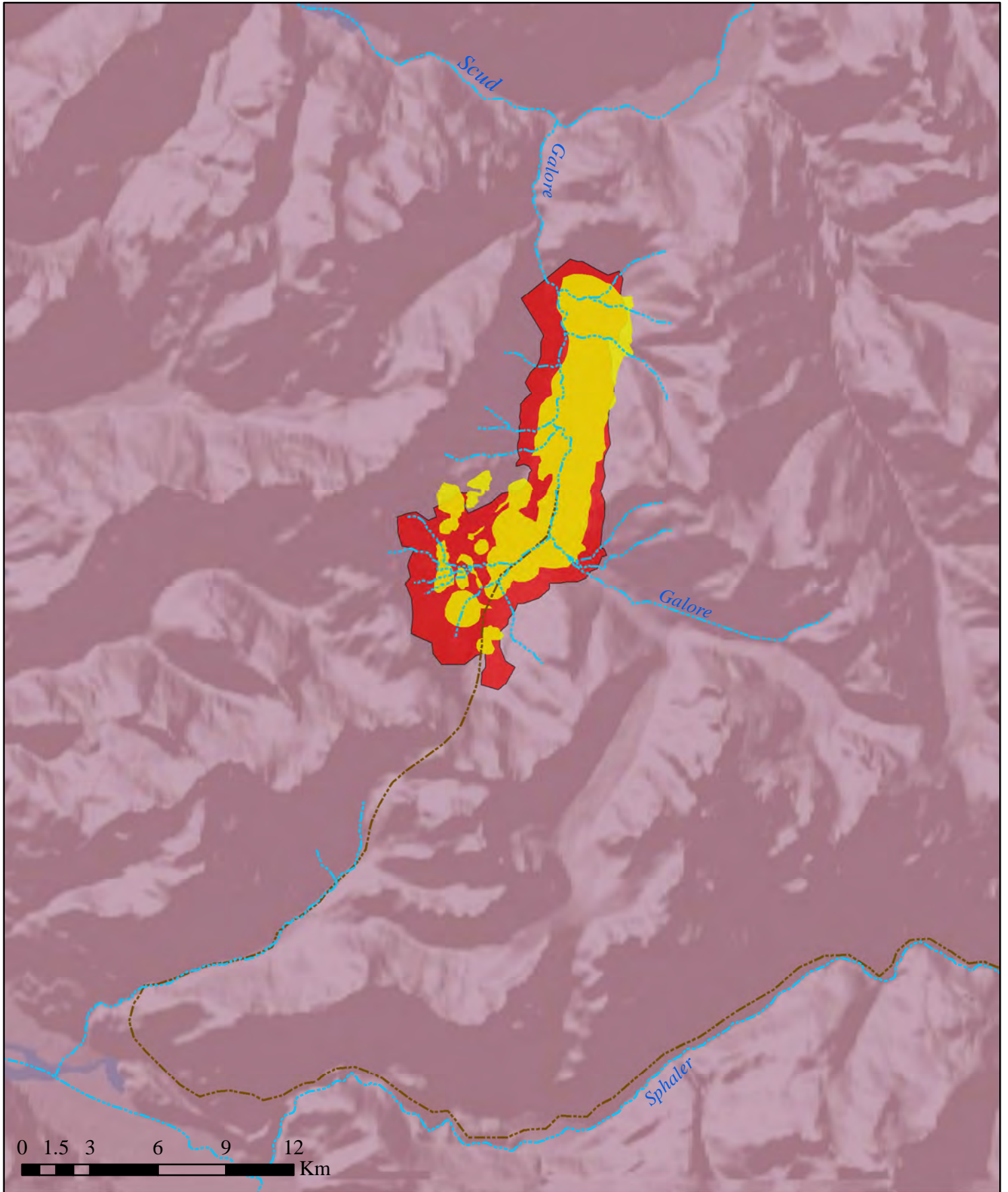
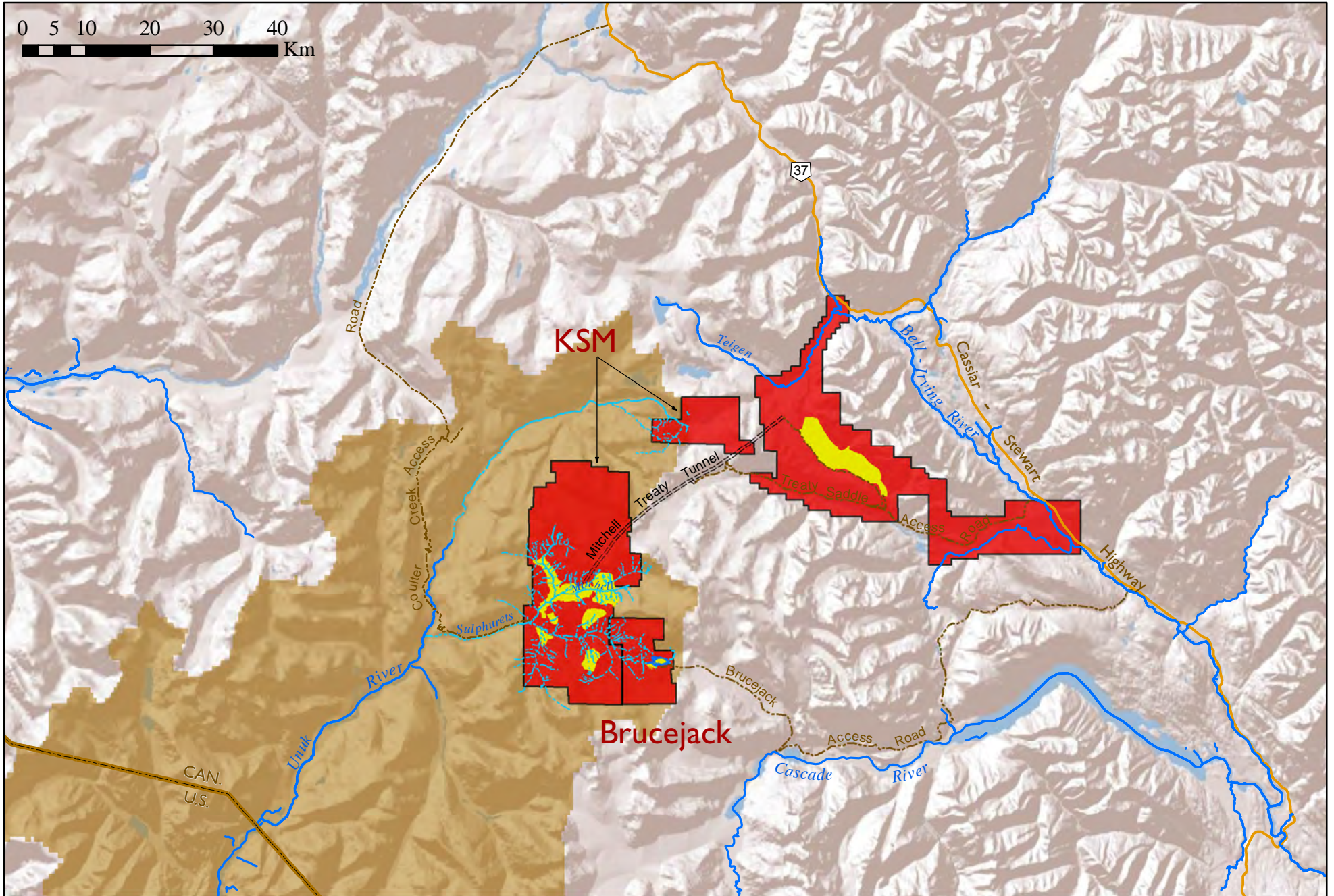
 Affected River Segments
 Stikine Watershed

Figure 5. Galore Creek Mine



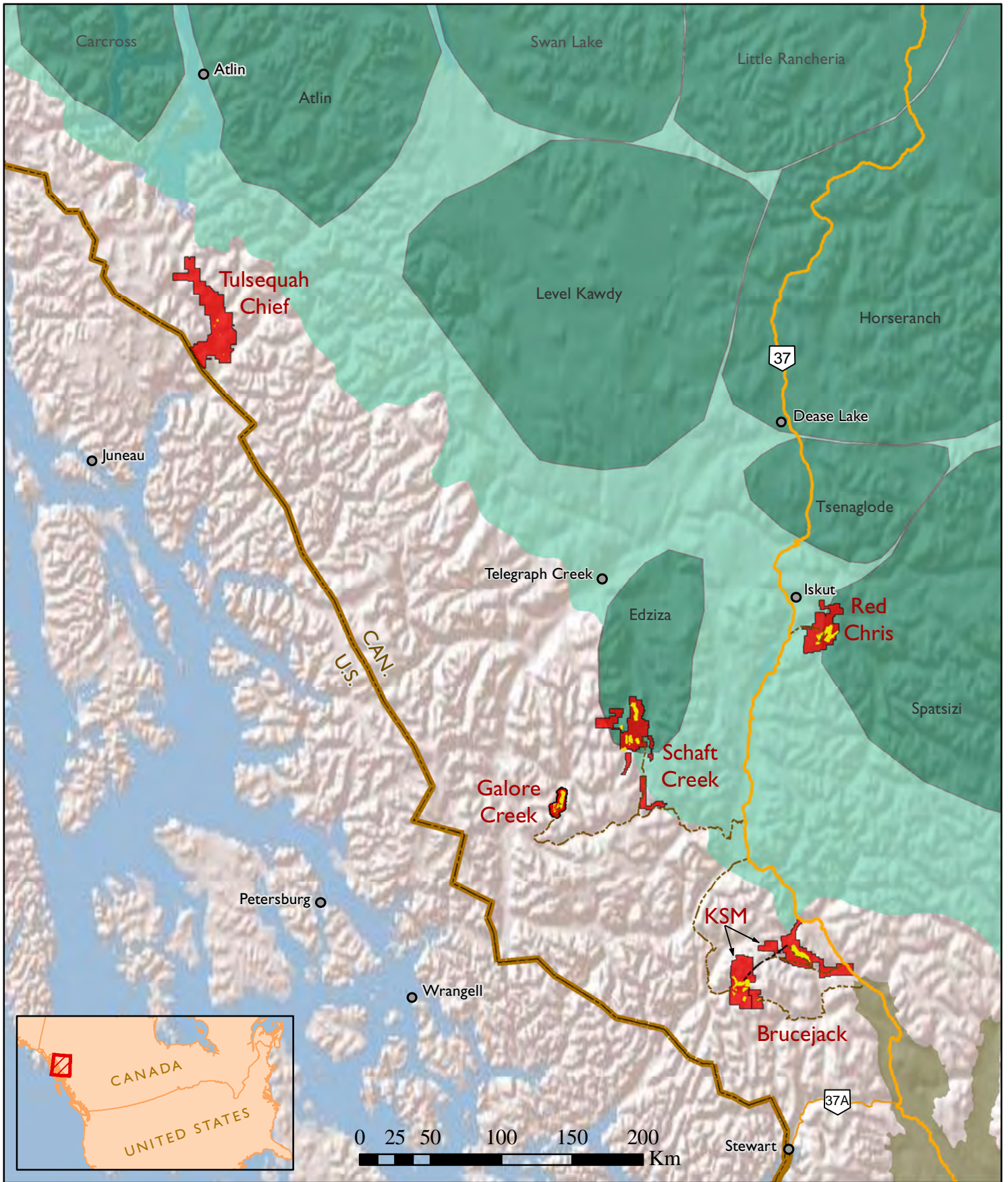
- Galore Creek Access Road
- Affected River Segments
- Mine Facilities Footprint
- Stikine Watershed
- Mine Project Area

Figure 6. Brucejack and KSM Mines



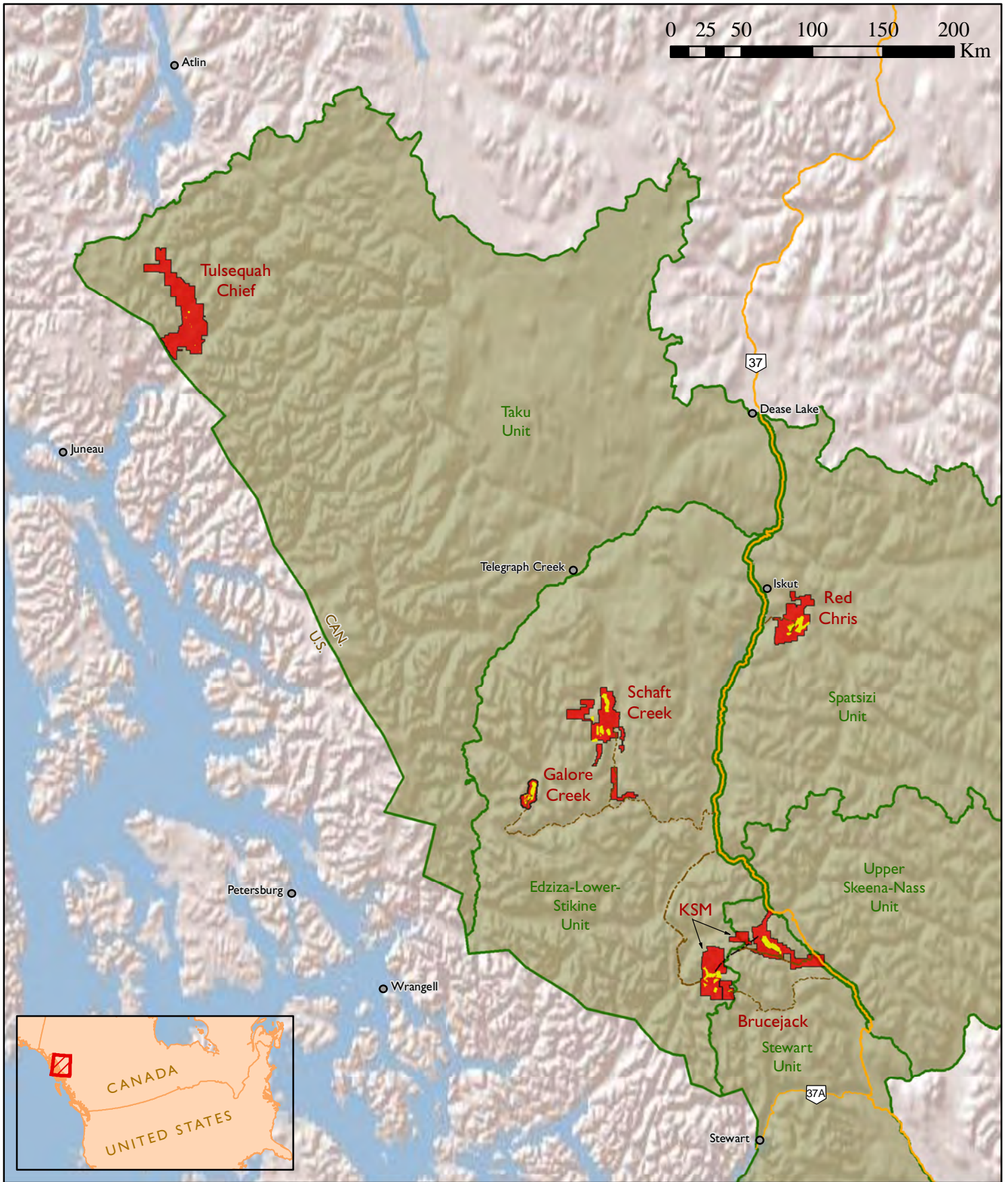
-  Mine Facilities Footprint
-  Mine Project Area
-  Affected Anadromous River Segments
-  Affected Other River Segments
-  Unuk Watershed

Figure 7. Northern Mountain Woodland Caribou Ranges



- Mine Access Road
- Mitchell Treaty Tunnel
- Mine Facilities Footprint
- Mine Project Area
- Identified Herds
- Other Caribou Range
- Extirpated Herd Range

Figure 8. Affected Grizzly Bear Management Units



- Mine Facilities Footprint
- Mine Project Area
- Grizzly Bear Habitat Population Unit

- Mine Access Road
- Mitchell Treaty Tunnel