

**AVIAN SURVEYS, HABITAT MAPPING AND BREEDING BIRD  
IMPACT ASSESSMENTS FOR THE PROPOSED ROCK CREEK  
AND BIG HURRAH MINE DEVELOPMENTS,  
SEWARD PENINSULA, ALASKA, 2005**

Draft Report

Prepared for

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## **SECTION 1: ROCK CREEK MINE DEVELOPMENT**

### **INTRODUCTION**

Alaska Gold Company is proposing a gold mining operation along the Rock Creek drainage near Nome, Alaska. Current plans call for developing roughly 618 acres along the upper reaches of Rock Creek, which would include an open-pit mine, plant site, tailings and waste rock storage areas, water diversion channels, and overburden storage areas. To determine baseline conditions and assess the potential impacts on breeding birds and wildlife habitats in the Rock Creek area, ABR, Inc., was asked to conduct pre-development field surveys in the region of the proposed mine site and adjacent lands. Field surveys for breeding birds were designed to determine species occurrence, abundance and habitat use, and wildlife habitat mapping was designed to quantify the distribution of wildlife habitats in the project area (with a focus on breeding bird habitats). Assessments of the direct impacts of the proposed mine on breeding birds were conducted by quantifying the amounts of breeding bird habitats that would be removed by development. This was done for each species recorded in the study area. Determining the actual number of breeding pairs for each species that could be affected by development would require a longer-term field study to determine densities along with a literature review to estimate densities for less common species. Those tasks were beyond the scope of this work. The possibility of indirect impacts on breeding birds from construction and operations activities at the mine site was not studied. This baseline survey work was conducted to assist with the evaluation of environmental conditions in the mine site area and to support NEPA documentation and applications for environmental permits. These survey data also can be used in developing long-term databases for post-construction monitoring of breeding birds and wildlife habitats within the mine area.

The specific objectives of this study were to:

- (1) Classify, map, and quantify the acreage of wildlife habitats in the area of the proposed mine and adjacent areas;
- (2) Quantify the abundance and habitat use of breeding birds in the area; and
- (3) Assess the direct impacts on breeding bird habitats from development of the proposed mine site.

## STUDY AREA

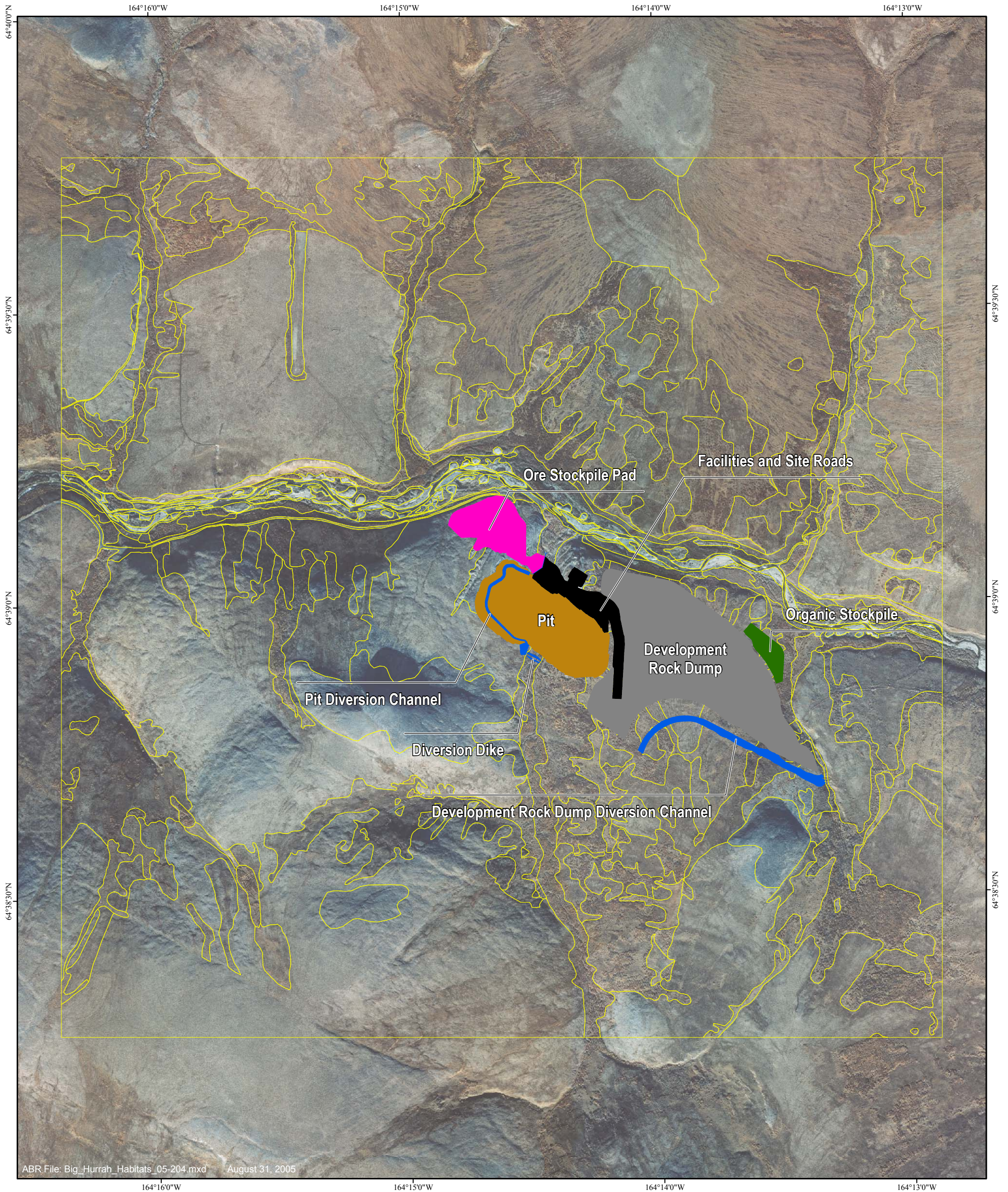
Rock Creek is one of many small drainages on the eastern side of the Snake River valley in the foothills of the Kigluaik Mountains, approximately 7 air miles north of Nome on the Seward Peninsula, Alaska (Figure 1.1). Rock Creek runs southwest and drains the gradual slopes below Mount Brynteson before entering lower and relatively flat terrain in the floodplain of the Snake River. Overall the area is typified by gently-rolling and gradually sloping terrain, but on the lower slopes of Mount Brynteson there are local and steep cut-bank slopes above the small creek beds, and farther down slope, a broad, flat floodplain occurs in the confluence area of Rock Creek, Glacier Creek, and the Snake River. The Glacier Creek Road traverses the area along the lower portions of the Rock Creek drainage and currently all mining development is planned for the eastern (uphill) side of the Glacier Creek Road, above the Snake River floodplain.

A rectangular area of 3092 acres surrounding the proposed mine site (an area about 4-times larger than the size of the proposed development) was selected as the study area for this work (Figure 1.1). The study area was centered roughly on the proposed location of the mine site facilities. A relatively large area was studied to evaluate the distribution of wildlife habitats and breeding bird use of those habitats both in the proposed mine area as well as in the region surrounding the proposed mine. Vegetation in the area is a mixture of dwarf shrub and graminoid-dominated tundra ( $\leq 0.2$  m tall) and patches of low willow (*Salix* spp.) and low shrub birch (*Betula nana*) thickets. Tall willow thickets also occur in patches on slopes, but are most common in the lower riparian areas where the plants range from 2–3 m in height. The breeding bird community in the area, like most montane areas in arctic and subarctic Alaska, is dominated by landbirds and shorebirds.

## METHODS

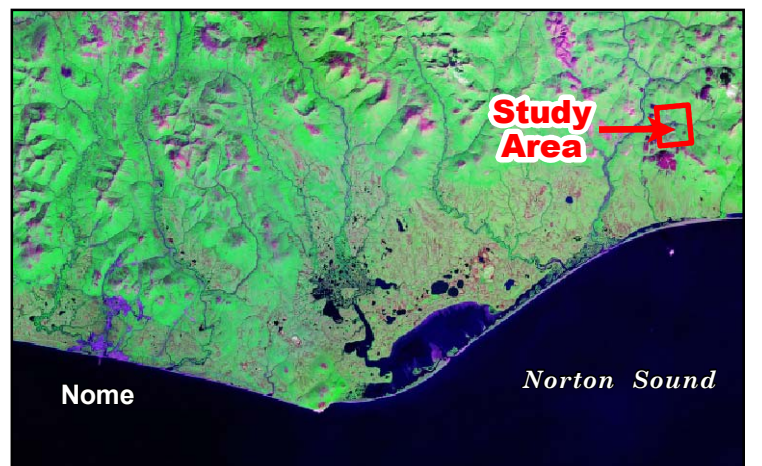
### WILDLIFE HABITAT MAPPING

Preliminary mapping of wildlife habitats was conducted in May 2004 using 29 August 1993 true-color, digital aerial photography for the Rock Creek area. The 3092-acre study area was mapped on-screen over the digital aerial photography using ArcView 3.2 software (*ESRI, Inc.*,

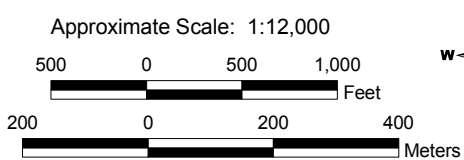


ABR File: Big\_Hurrah\_Habitats\_05-204.mxd August 31, 2005

- Mapped Big Hurrah Mine study area
- Big Hurrah Mine development footprint**
- Development Rock Dump
- Diversion Channels and Dike
- Facilities and Site Roads
- Ore Stockpile Pad
- Organic Stockpile
- Pit



**Mapped area and development footprint in the Big Hurrah Mine study area, Alaska.**



Projection: UTM Zone 3  
 Datum: NAD83  
 Wildlife habitats mapped from  
 October 2004 aerial photography



*Redlands, California*). We identified different photo signatures on the aerial photography within the study area boundary and assigned them land cover types based on vegetation, surface form, and landscape physiographic characteristics, following a modification of the land cover classification system of Jorgenson et al. (1989). This classification system was derived from a synthesis of Level IV vegetation categories of Viereck et al. (1992; modified by ABR), surface form types defined by Washburn (1973) for periglacial microtopography (also modified by ABR), and general landscape physiographic categories. The system has been successfully used to map wildlife habitats in tundra regions on the North Slope and in northwestern Alaska, including the Seward Peninsula (Schick et al. 2004; USAF 2004a, b).

Field verification of the wildlife habitat map for the Rock Creek Mine study area was conducted on 10 and 11 August 2004. In this effort, we sampled a total of 27 plots, in which we attempted to sample each mapped habitat type in order to (1) evaluate the mapped polygons for accuracy, (2) determine the landscape physiography and surface form(s) present, and (3) describe plant communities. We located field plots by navigating on foot (using a field copy of the aerial photography and habitat map) until we felt our location was representative of the polygon mapped. At each sample plot, we recorded physiography, local surface form, and local vegetation type within a 10-m radius surrounding the selected point. Surface form types were recorded following a modification of the microtopography classification system developed by Washburn (1973) and vegetation types following a modification of the Level IV categories of Viereck et al. (1992). We also recorded all vascular plants present in a 10-m radius of the sample point and estimated percent aerial cover for each. To reduce subjectivity in cover estimates, the percent cover of individual plant species was visually estimated in the 10-m radius using modified Daubenmire cover class categories (<1%, 1–5%, 5–25%, 25–50%, 50–75%, 75–95%, and >95%; Daubenmire 1959). Most plants were identified in the field but samples of all unknown taxa were collected and pressed for later identification. GPS coordinates and digital photos were taken at each sample plot. We attempted to sample all naturally-vegetated land cover types present in the Rock Creek Mine study area at least once. Because our field time was limited, we did not sample waterbodies, disturbed sites, or artificial sites (i.e., gravel fill). We focused on naturally-vegetated areas because these were suspected to be used more often by

breeding birds. After field verification surveys, we edited the wildlife habitat map to correct all errors in both boundary delineation and determination of land cover types.

As a final step in developing wildlife habitats, we aggregated selected land cover types into broader habitat types that represent combinations of vegetation structure, surface form, and physiography relevant to wildlife use, particularly by avian species. These wildlife habitat types were then used in the analyses of habitat use by breeding birds and in the assessment of impacts to those habitats.

## **BREEDING BIRD SURVEYS**

We conducted breeding bird surveys in the Rock Creek Mine study area from 7–11 June 2004. Survey timing was selected to coincide with the peak of the passerine breeding season on the Seward Peninsula (Kessel 1989). We used point count methods (Ralph et al. 1995) to collect quantitative data on breeding bird abundance and habitat use. This survey method (which is typically used to detect singing male passerine birds defending territories) was chosen because it is an effective method for characterizing use of habitats by breeding passerines and other vocal species, such as shorebirds, which engage in display activities during the breeding season. Based on previous field experience in the area of the Rock Creek Mine, we expected passerines and shorebirds to be the most numerous avian groups occurring in the Rock Creek area.

In the field, our goal was to conduct point counts at multiple, independent locations in as many of the mapped wildlife habitat types as possible. We used a random point generator in the AlaskaPak extension for ArcView 3.2 (*Alaska Support Office, National Park Service, Anchorage, Alaska*) to select random point count locations within each habitat type mapped at the Rock Creek Mine study area. We navigated to each pre-selected point count location on foot using a hand-held GPS receiver. In total, 55 point counts were conducted in the field. Because our field time was limited, not all mapped habitats were surveyed. The unsurveyed habitats, however, cumulatively comprised <5% of the acreage in the Rock Creek Mine study area. Some open habitats not sampled with point counts, such as water, marsh, and barren gravels, were scanned for birds when these habitats were encountered and any observations of birds were included in the habitat use analyses (see below).

At each location, a single observer documented all birds detected by sight or sound within a 10-minute observation period. The sample period was broken into 3 time intervals (0–3, 4–5, and 6–10 minutes) following standard point count methods (Ralph et al. 1995). For each observation, the approximate distance of the bird from the observer was estimated in 50-m increments up to 200 m, and recorded as >200 m for all observations estimated over 200 m. The detection method (singing, calling, aerial display, visual, flying, or hunting) and the habitat type the bird was using (when known) also were recorded.

Because point counts are not effective at surveying all bird species (e.g., silent waterfowl and feeding shorebirds can be missed), we also scanned waterbodies and adjacent shorelines when encountered and recorded any species observed along with the habitats they were using. In addition, when in transit between sample points, we recorded any uncommon bird species encountered and/or those species that are more difficult to detect with point counts, along with the habitat(s) the birds were using. This was done to record all bird species observed in the Rock Creek Mine study area and to enhance our bird/habitat association information beyond what was collected with point count sampling.

## **BIRD HABITAT-USE ANALYSES**

We analyzed habitat-use information for breeding birds in the Rock Creek Mine study area to determine the direct impacts of development of the proposed mine on breeding bird habitats in the area. First, we summarized bird species observations by the mapped wildlife habitats they occurred in, and then ranked the habitats by greatest use for each species. We assessed which habitats cumulatively accounted for  $\geq 75\%$  of the observations for that species and designated those habitat types as preferred breeding habitats. These preferred breeding habitats were those most frequently used for displaying, nesting, and/or foraging and presumably their use is necessary for successful reproduction. When there were ties in habitat-use percentages among the additional habitats to add to reach 75% of the total observations, we selected the next habitat to include that had vegetation structure and/or physiography most similar to the most commonly used habitat for that species. When we could not use vegetation structure and/or physiography as a guide (this problem occurred for only 1 species, Wilson's Warbler), we added both the habitats with tied percentages that were needed to get to a total of  $\geq 75\%$  of the observations.

## **BIRD HABITAT IMPACT ANALYSES**

Once preferred breeding habitats were determined for each bird species surveyed, we used the wildlife habitat map in GIS to calculate the total acreage of preferred breeding habitats for each species in the study area. A “footprint” of the proposed mine, derived from CAD engineering drawings supplied by Alaska Gold Company, was overlaid on the wildlife habitat map and the acreage of preferred breeding habitats for each bird species expected to be directly removed by mine development was calculated. (Two small sections of the upper diversion channel, totaling 6 acres in size, lie outside the area mapped for wildlife habitats [see Figure 1.1]. We made no corrections for this but expect that any such corrections would not alter the overall assessment of impacts to breeding bird habitats.) We also calculated the acreage of preferred breeding habitat for each bird species within the surrounding study area that would not be directly affected by the proposed mine development.

In these analyses, no corrections were made for patchiness in bird occurrence on the landscape. That is, we assumed that each map polygon representing a preferred habitat type did in fact serve as preferred habitat for the species in question. In actuality, and this is especially true for the less common species, some patches of preferred habitat may never be occupied for a variety of reasons related to subtle differences in habitat quality that are not reflected in aerial photography (from which the habitats in this study were mapped). This lack of correction for patchiness in bird occurrence means that the expected impacts determined here are liberal estimates (i.e., all preferred habitats in the study area are assumed to be occupied and functioning as preferred habitats when in fact some may not be occupied). At present, we do not have enough data points to conduct a spatial analysis to try to correct for this problem.

## **BIRD SPECIES OF CONSERVATION CONCERN**

During field surveys at the Rock Creek Mine study area, no federally threatened or endangered bird species were observed but several species that are of increasing conservation concern were recorded (see Results and Discussion sections below). The production of lists of North American birds of conservation concern is an ongoing process and was given greater attention over the last decade with the implementation of the vulnerability ranking system



developed by the Partners in Flight program (Hunter et al. 1993). There are now numerous agency and working group lists in use in the United States (see below), all of which are independent of the U.S. Fish & Wildlife Service's listing of species as federally threatened or endangered under the Endangered Species Act. The concept behind the Partners in Flight program, and the other listing programs that followed, is to identify species that are still common but may be undergoing population declines and/or facing population threats. The goal is to stimulate proactive conservation actions now to avoid sharp declines in populations of these species in the future and avoid the need for listing under the Endangered Species Act. There also is an explicit recognition, for Neotropical migrant species, that conservation efforts must be international in scope and focused on habitats used during breeding, migration, and wintering. For this study, we used several lists to identify species of conservation concern that occur at the Rock Creek Mine study area during the breeding season. We evaluated both continental-level lists (Kushlan et al. 2001; Audubon Society 2002; USFWS 2002; Rich et al. 2004; USSCP 2004; ABC 2005) and lists at the state level (ADFG 1998; BPIFWG 1999; ASWG 2000; BLM 2001; Audubon Alaska 2002). These lists were produced by federal and state regulatory agencies and continental- and state-level working groups that consider the conservation of birds in Alaska. Further discussion of the species of conservation concern recorded at the Rock Creek Mine is presented in the Discussion section below.

## **RESULTS**

### **WILDLIFE HABITATS**

During the mapping of wildlife habitats, we identified 39 land cover classes within the 3092-acre Rock Creek Mine study area. These land cover classes were then collapsed into 24 wildlife habitat types (Table 1.1; Appendix A). The primary aggregations involved combining open and closed scrub habitats and combining gravel land cover categories (both artificial and excavated). Open and closed scrub habitats were combined because both types occurred in patches across the study area and contained similar "edge" habitats, and both appeared to be used similarly by breeding birds. The gravel land cover categories were combined because these land cover types had similar characteristics and were rarely used by breeding birds. We maintained the differences

among land cover classes in landscape physiography because the different physiographic classes within a given vegetation structure type (e.g., upland, lowland, and riverine tall willow scrub) can be used differently by breeding birds.

Upland habitats in the study area comprised 2141 acres and were the most predominant type (69% of the acreage; Table 1.2). Lowland and riverine types were the next most common, comprising 677 acres (22%) and 189 acres (6%) of the study area, respectively. Lacustrine waterbodies were rare in the study area, comprising only 6 acres (0.21%) of the study area. On the 1993 aerial photography, approximately 79 acres (<3%) of the study area showed evidence of disturbance (mining excavations and artificial gravel road surfaces).

Dwarf ericaceous scrub types dominated the area, covering 1377 acres or 45% of the study area (Table 1.2). Tall willow scrub habitats of various types (upland, lowland, riverine) are the next most common habitats, covering 780 acres (25% of the study area). Low shrub birch and low birch-willow habitats (both upland and lowland) comprise 616 acres (20% of the study area). Poorly-drained wet and marsh habitats, lacustrine water, and riverine types, as well as artificial habitats, comprise only about 80 acres, or <3% of the study area, each (Table 1.2).

The proposed footprint of the Rock Creek Mine occurs largely in upland areas and would primarily impact these types, removing 537 acres or 25% of the total upland habitat within the study area (Figure 1.2, Table 1.2). Few other natural landscape types would be as strongly affected by the mine development, as the footprint would impact <13% of the riverine and lowland habitats in the study area (8 acres and 55 acres, respectively; Table 1.2). The primary wildlife habitat types that would be removed by the mine development include Upland Dwarf Birch-Ericaceous-Sedge Scrub, Upland Dwarf Birch-Ericaceous Scrub, and Upland Tall Willow Scrub (154, 136, and 186 acres of each, respectively). The mine would remove 18%, 37%, and 33%, respectively, of these types within study area.

## **BREEDING BIRDS AND HABITAT USE**

We conducted 55 point counts in 14 wildlife habitat types within the study area during 7–11 June 2004 (Table 1.2, Figure 1.2). Including the observations made in transit between sample points, we were able to sample 16 of the 24 the mapped wildlife habitats in the study area.

Habitats not sampled included Stream or River, Riverine Low Willow Scrub, Lowland Aquatic Sedge Marsh, Lowland Low Willow–Sedge Scrub, Lowland Tall Willow–Grass Scrub, Upland Low Willow–Sedge Scrub, Upland Dwarf Ericaceous Scrub, and Gravel Fill (which provides limited breeding bird habitat; Table 1.2). Cumulatively these unsurveyed habitats comprised <5% of the acreage in the Rock Creek Mine study area.

During the field sampling, we recorded 704 observations of 41 bird species in the Rock Creek Mine study area (Table 1.3). Most species were observed during point count sampling but additional species were observed as we traveled between sampling points in the field. Ten of these 41 bird species are considered species of conservation concern for western Alaska (Red-throated Loon, American Golden-Plover, Pacific Golden-Plover, Whimbrel, Arctic Tern, Arctic Warbler, Gray-cheeked Thrush, Blackpoll Warbler, Golden-crowned Sparrow, and Hoary Redpoll). More details on these species and the reasons for conservation concern are presented in Table 1.4 and the Discussion section (see below).

The most frequently recorded species in the study area were Common/Hoary Redpoll (species identification was often impossible with flying birds so all redpoll observations were combined), American Tree Sparrow, Gray-cheeked Thrush, Wilson’s Snipe, Golden-crowned Sparrow, Fox Sparrow, Orange-crowned Warbler, Yellow Warbler, and Savannah Sparrow (Table 1.5). We recorded over 40 observations for each of these species (>5% of all observations) and considered these species to be abundant in the study area. Nine other species were less frequently observed, recorded 8–28 times each (1–4% of all observations), and these were considered common in the study area (Table 1.5). The remainder of the species (23) were observed 1–6 times (<1% of all observations) and were considered uncommon (Table 1.5).

The use of habitats by breeding birds at the Rock Creek Mine was quite variable (Tables 1.6 and 1.7). Eleven of the less common species that were observed more than once used only 3 or fewer habitat types, whereas 11 of the more common and abundant passerine species, and Wilson’s Snipe, used 5–12 different habitat types for breeding activities (Table 1.6). Of the species documented, the Arctic Warbler and Northern Waterthrush were the most specialized in their habitat use; both with  $\geq 65\%$  of their breeding use in Riverine Tall Willow Scrub (Table 1.7). The Savannah Sparrow displayed the greatest diversity in habitat use (i.e., a habitat

generalist species) with 41 individuals documented using 12 different habitat types during the breeding season.

Willow scrub habitats and dwarf and low birch scrub habitats were the most commonly used wildlife habitats in the study area. Riverine Tall Willow Scrub and Upland Tall Willow Scrub were each used by 15 different avian species (43% of species with habitat associations), and most of those species used these habitats  $\geq 25\%$  of the time. These habitats also were used by 4 of the 9 avian species of conservation concern with habitat associations (Table 1.7). Lowland Tall Willow Scrub and the Lowland and Upland Low Willow Scrub types also were preferred breeding habitats, each observed being used by 12–13 different avian species. Additionally, Upland Dwarf Birch–Ericaceous–Sedge Scrub was an important habitat in the Rock Creek Mine area that was used by 12 different species, 7 of which used it  $\geq 33\%$  of the time, and 5 of which were species of conservation concern (Table 1.7).

## **EXPECTED IMPACTS TO BREEDING BIRD HABITATS**

Of the 41 bird species observed in the Rock Creek Mine study area, 34 were recorded using habitats at the site (8 species were observed only in transit over the area). The amount of preferred breeding habitat that would be lost to development of the Rock Creek Mine varies widely among the 34 bird species recorded using habitats in the study area, ranging from 0 to 415 acres (Tables 1.8). Savannah Sparrows would lose the largest amount of preferred breeding habitat (415 acres) from the proposed development, substantially more than any other avian species (Table 1.8). This loss represents 20% of their total available preferred breeding habitats mapped within the study area. At the other end of the range, waterfowl, loons, and some shorebirds will lose no preferred breeding habitats to development (Table 1.8) because no lacustrine waterbodies or wet sedge or aquatic sedge habitats fall within the development footprint (Table 1.2). Wilson’s Snipes would lose the second highest amount of preferred breeding habitat (385 acres) within the mine development footprint. Ten species (Whimbrel, Lapland Longspur, Wilson’s Warbler, Golden-crowned Sparrow, Orange-crowned Warbler, White-crowned Sparrow, American Tree Sparrow, Gray-cheeked Thrush, Fox Sparrow, and Yellow Warbler) would lose over 200 acres of preferred breeding habitats from the proposed development. Other species (primarily passerines and shorebirds) would lose variable amounts of

preferred breeding habitats to development, with seven species losing over 100 acres (Table 1.8). Bluethroats are expected to lose only 38 acres due to development of the proposed mine, but this represents 22% of the habitats considered important to them for breeding in the study area (Table 1.8). Six species (American Robin, Arctic Warbler, Northern Waterthrush, Gray-cheeked Thrush, Fox Sparrow, and Yellow Warbler) are expected to lose between 25% and 30% of their preferred breeding habitat within the 3092-acre study area. The remainder of the species will lose less than 25% of their preferred breeding habitats from mine development.

Of the 10 species of conservation concern observed at the Rock Creek Mine study area, 2 species (Red-throated Loon and Arctic Tern) would lose no preferred breeding habitats to development (Table 1.8). Of the species of conservation concern, Whimbrel would lose the largest amount of preferred breeding habitat to development (290 acres or 24% of that available in the study area) while Blackpoll Warbler would lose only 21 acres of preferred breeding habitat (6% of that available in the study area; Table 1.8). Five of the remaining 6 species of conservation concern would lose over 100 acres of preferred breeding habitat from development of the Rock Creek Mine, and the sixth species (Common/Hoary Redpoll) would lose 75 acres. Considering only the 10 species of conservation concern, the percentages of available preferred breeding habitat within the study area that would be removed by development range from 0 to 28% (Table 1.8).

## **DISCUSSION**

The Rock Creek Mine study area is situated predominately in upland terrain at the base of Mount Brynteson and encompasses 24 different wildlife habitat types. The bird species found in the Rock Creek Mine area are typical for the habitat types documented (primarily passerine and shorebird species in upland scrub and tundra and riverine scrub habitat types) and are known to be associated with these habitats across the larger Seward Peninsula area (Kessel 1989). Most of the species documented in the Rock Creek Mine study area, except waterfowl and loons, for which habitat does not exist in the mine development footprint, were listed by Kessel (1989) as abundant, common, or fairly common breeders on the Seward Peninsula, with the exception of Rock Ptarmigan (uncommon), Northern Harrier (uncommon), Semipalmated Plover (uncommon), Spotted Sandpiper (uncommon), Pectoral Sandpiper (rare), Bluethroat

(uncommon), and Orange-crowned Warbler (uncommon). Kessel conducted her field work on the Seward Peninsula in the late 1960s and 1970s, and subsequently declines in some populations of some of the species noted at the Rock Creek Mine site have been documented, although it is often unknown if declines are occurring in populations in western Alaska or on the Seward Peninsula (see Table 1.4).

The most heavily-used avian breeding habitats in the Rock Creek Mine study area are the willow scrub types (in riverine, lowland, and upland situations) and one upland moist tundra type (Upland Dwarf Birch–Ericaceous–Sedge Scrub). Of these habitats, tall willow scrub is the most important: 17 (50%) of the 34 avian species documented using habitats in the area were observed in Riverine Tall, Lowland Tall or Upland Tall Willow Scrub (Table 1.6). Riverine Tall Willow Scrub is the one of the most preferred habitats of habitat-specific species such as the Arctic Warbler and Northern Waterthrush. Upland Dwarf Birch–Ericaceous–Sedge Scrub was the most prevalent mapped habitat in the study area (Table 1.2) and was used by 12 avian species. These 4 habitats, along with Lowland Low Willow Scrub and Upland Low Willow Scrub, were considered preferred breeding habitats for 22 (65%) of the 34 avian species documented using habitats in the study area; these habitats comprise 2128 acres (69%) of the study area and 414 acres (68%) of the proposed mine development footprint.

Of the 41 species recorded in the Rock Creek Mine study area, preferred breeding habitat exists for 25 species within the footprint of the proposed mine. Nineteen of these 25 species would lose >100 acres of breeding habitat due to development of the mine site, which is equivalent to 16–28% of their available preferred breeding habitats within the entire study area (Table 1.8). It is unknown how many breeding pairs of each species could be affected by this removal of habitat. To derive information on bird densities (by habitat type) in an effort to determine bird numbers affected would require a more detailed field study, along with a literature review, and those activities were beyond the scope of this work. It is also important to keep in mind that all occurrences of a species' preferred habitat may not actually support breeding activities by that species, especially in the case of less-common birds. For example, the Whimbrel (which was categorized as uncommon in the Rock Creek Mine study area; Table 1.5), is listed as having 290 acres of preferred breeding habitat that will be removed by development of the mine (Table 1.8). During our field visit, however, this species was not observed using

those patches of preferred habitat within the footprint of the proposed mine, but was only observed near the point count site, RC021, in the northern portion of the study area (see Figure 1.2). At the other extreme, abundant species (e.g., American Tree Sparrow, Gray-cheeked Thrush, Golden-crowned Sparrow) are expected to occur regularly in their preferred breeding habitats.

During our study, we documented the presence of 10 species in the Rock Creek Mine study area that are considered species of conservation concern for western Alaska by one or more agencies or specialist groups (see Table 1.4). The species of conservation concern designation does not carry legal status as does the listing of a species as federally threatened or endangered, but the designation does indicate there is concern over the potential for population declines and interest in maintaining healthy breeding populations of these species in Alaska. The 10 species of conservation concern can be of concern for one or more reasons: (1) populations in some part of the species' range have shown declines in recent years, usually on the breeding grounds; (2) relative abundance is low; (3) threats have been documented on the breeding grounds and/or in nonbreeding areas; (4) the breeding and/or nonbreeding distributions are small and therefore more susceptible to threats; (5) the species may be common but a large proportion of the worldwide breeding range occurs in Alaska (global stewardship species); or (6) the species may be widespread but Alaska represents a large proportion of the North American breeding range (North American stewardship species) (see Table 1.4). Eight of the 10 species of conservation concern recorded in the Rock Creek Mine study area were found to favor breeding habitats that would be directly affected by development of the mine (important breeding habitats for Red-throated Loons and Arctic Terns do not occur within the area proposed for mine development). Below are brief summaries of the reasons for conservation concern for those 8 species expected to be affected by development of the mine and a listing of the expected direct impacts.

## **HOARY REDPOLL**

In many cases Hoary Redpolls could not be separated from Common Redpolls in the field because the birds were often observed in flight well overhead. Both species, however, were identified at the Rock Creek Mine when observation conditions were suitable. There are no known imminent threats to Hoary Redpoll breeding or wintering populations and the prospect for

human-induced alterations of their remote arctic and boreal habitats is low (BPIFWG 1999). No population trend data are available for this species in North America (Sauer et al. 2005) and the difficulty of separating this species from Common Redpoll during surveys makes monitoring efforts nearly impossible. Because a large percentage of the species' North American breeding range is concentrated in the Arctic Avifaunal Biome, and especially northern and western Alaska (BPIFWG 1999), the Hoary Redpoll is considered a North American stewardship species for the Arctic Avifaunal Biome and for arctic Alaska (see Table 1.4). The primary concern for stewardship species is on maintaining breeding populations as these species are considered characteristic of a particular region; conservation concerns do not address specific population threats or declines (Rich et al. 2004). Considering Hoary and Common Redpolls together, the species pair was categorized as abundant in the Rock Creek Mine study area; the species pair was the most numerous of the species recorded during the study (Table 1.5). Of the seven agency or working group lists that were evaluated that consider landbird conservation issues, only two ([National] Partners in Flight and Boreal Partners in Flight) listed Hoary Redpoll as a priority species for conservation (Table 1.4). The lack of representation on other priority species lists is likely due to the fact that the species is currently common and widespread and because declines in population numbers of Hoary Redpolls have not been noted. Development of the Rock Creek Mine would remove 75 acres of preferred breeding habitats for this species and this represents 13% of the preferred habitats available in the Rock Creek Mine study area (Table 1.8).

### **GRAY-CHEEKED THRUSH**

The Gray-cheeked Thrush is of conservation concern because there are indications, from an analysis of Breeding Bird Survey (BBS) data, that declines in breeding populations in eastern North America occurred from 1978 to 1988 (Sauer and Droege 1992). A longer time-period analysis of BBS data for Canada only, where this species is more common, shows a statistically significant population decline of 8.8% per year from 1967 to 2000 (although these results apply to only a small portion of the breeding range; Dunn 2005). Similar population trend data for Alaska are not available (Sauer et al. 2005). On their tropical wintering grounds, the species is considered vulnerable to deforestation of broadleaf forests (Petit et al. 1993). Because Gray-cheeked Thrushes breed largely in relatively remote and undisturbed boreal forest and arctic



environments where population threats are minimal, it is possible that declines in breeding populations may be driven primarily by the effects of tropical deforestation on the wintering grounds. Still there are concerns that breeding populations in Alaska should be monitored and maintained because a large percentage of the species' global breeding range is concentrated in Alaska (BPIFWG 1999). The Gray-cheeked Thrush is listed as a priority species for conservation in Alaska on three of the seven agency or working group lists that consider landbird conservation issues in the state (Table 1.4). Gray-cheeked Thrushes are known to be common in appropriate habitats in Alaska during the breeding season and they were found to be abundant breeders in the Rock Creek Mine study area where they were the third most frequently recorded species (Table 1.5). Development of the mine would remove 224 acres of preferred breeding habitats for this species (25% of the preferred habitats available in the Rock Creek Mine study area; Table 1.8).

### **GOLDEN-CROWNED SPARROW**

There are concerns that increasing urbanization in wintering areas in western North America may reduce availability of nonbreeding habitat for this species (BPIFWG 1999) but no declines in wintering populations in North America have been noted (Norment et al. 1998). No data are available on population trends for breeding birds in North America (Sauer et al. 2005). Golden-crowned Sparrow is considered a stewardship species for the Pacific Avifaunal Biome and for Alaska because large percentages of the species' global breeding range are concentrated in these two regions (see Table 1.4). For stewardship species, conservation concerns are focused on maintaining breeding populations because these species are considered characteristic of a particular region (Rich et al. 2004). The primary concern for this species in Alaska is focused on monitoring and maintaining breeding populations in the state (BPIFWG 1999). In the Rock Creek Mine study area, Golden-crowned Sparrows were categorized as abundant breeders; the species was the fifth most frequently recorded during the 2004 breeding season (Table 1.5). Golden-crowned Sparrows are listed as a priority species for conservation in Alaska on only two agency or working group lists ([National] Partners in Flight and Boreal Partners in Flight), out of the seven lists evaluated that consider landbird conservation issues (Table 1.4). The lack of representation on other priority species lists is likely due to the fact that the species is currently common and because declines in breeding population numbers are not known. Golden-crowned

Sparrows are well known to be common throughout their breeding range in Alaska in appropriate habitat and they were abundant in the Rock Creek Mine study area. Development of the mine would remove 246 acres of preferred breeding habitats for this species (23% of the preferred habitats available in the Rock Creek Mine study area; Table 1.8).

### **ARCTIC WARBLER**

The Arctic Warbler is considered as a species of conservation concern on only one (USFWS 2002) of the seven agency or working group lists that consider landbird conservation issues in the state (Table 1.4). The subspecies that breeds in Alaska, *P. b. kennicotti*, is of concern because it is endemic to the state (i.e., 100% of the world population of this subspecies breeds in Alaska); there also are indications of declines in numbers in the 1990s on BBS routes on the Seward Peninsula (Brad Andres, USFWS, pers. comm.). There are, however, no known broad-scale population threats for this subspecies. Arctic Warblers are patchy and locally common in their occurrence across their range in Alaska. In the Rock Creek Mine study area, they were categorized as common breeders but their numbers were relatively low and just over the threshold to be categorized as common; the species also could be considered somewhat uncommon in the area (see Table 1.5). Development of the Rock Creek Mine would remove 192 acres of important breeding habitats for this species and this represents 28% of the preferred habitats available in the Rock Creek Mine study area (Table 1.8).

### **BLACKPOLL WARBLER**

Blackpoll Warblers are of conservation concern because BBS data show a steady decline of 9.5% per year between 1980 and 2004 in breeding populations across North America; population numbers increased from 1966 to 1979 but declined thereafter (Sauer et al. 2005). Data from Alaska also show a decline in breeding populations, in this case 3.0% per year, between 1980 and 2004 (Sauer et al. 2005). On the wintering grounds in South America, the species is considered highly vulnerable to the removal of tropical forests (Petit et al. 1993, 1995) and there are suggestions that heavy mortality can occur during trans-oceanic fall migration flights because of tropical storms (Butler 2000). Because Blackpoll Warblers in Alaska breed largely in relatively remote and undisturbed boreal forest regions (i.e., areas with few population threats),

the implication is that declines in breeding populations may be primarily driven by the combined effects of mortality during migration and tropical deforestation on the wintering grounds. Conservation concerns in Alaska are that breeding populations should be monitored and maintained because a large percentage of the species' global breeding range is concentrated in Alaska (BPIFWG 1999). Blackpoll Warblers were listed as a priority species for conservation in Alaska on five of the seven agency or working group lists that consider landbird conservation issues in the state (Table 1.4). Blackpoll Warblers are known to be patchy in their occurrence in appropriate habitat in Alaska and were categorized as uncommon breeders in the Rock Creek Mine study area (only 5 observations were recorded during the study; Table 1.5). Development of the Rock Creek Mine would remove 21 acres of preferred breeding habitats for this species (6% of the preferred habitats available in the Rock Creek Mine study area (Table 1.8).

#### **AMERICAN GOLDEN-PLOVER**

The American Golden-Plover is considered a species of High Concern for conservation in the U.S. Shorebird Conservation Plan (USSCP 2002) because substantial population declines, from 1970s levels, have been noted on the breeding grounds in the Northwest Territories (Gratto-Trevor et al. 1998). Population levels at another Nearctic breeding site, however, show no declines and no significant declines have been noted at migration staging areas on the North American east coast (Morrison et al. 1994). Caution is expressed that because of the broad and largely inaccessible breeding range of this species, little is known about the population trends during breeding. Population threats on the wintering grounds in South America are of concern (see Audubon Society 2002), and because this species breeds in remote and relatively undisturbed arctic regions, any population declines are generally suspected to occur from increased mortality during the nonbreeding seasons. American Golden-Plovers are widely dispersed across arctic regions in Alaska, they defend large territories and breed at low densities. In the Rock Creek Mine study area, American Golden-Plovers were found to be uncommon (only 4 observations were recorded; Table 1.5). Development of the Rock Creek Mine would remove 154 acres of preferred breeding habitats for this species and this represents 16% of the preferred habitats available in the Rock Creek Mine study area (Table 1.8).

## **WHIMBREL**

Significant population declines in the Hudson Bay population of Whimbrels (Skeel and Mallory 1996) are the primary reason this species is considered of High Concern in the U.S. Shorebird Conservation Plan (USSCP 2002). An overall low population size for this species and a restricted breeding distribution in North America also are of concern (USSCP 2002). Over 65% of the world population of one subspecies, *N. p. rufiventris*, breeds in Alaska and conservation measures are recommended to maintain populations of this subspecies in the state (ASWG 2000). Habitat loss on the wintering grounds and at migration stop-over sites also has been noted (Audubon Society 2002). Because this species breeds in remote and relatively undisturbed arctic regions, it is possible that population declines stem from increased mortality during the nonbreeding seasons. Whimbrels are widely dispersed across tundra regions in Alaska and breed at low densities. In the Rock Creek Mine study area, Whimbrels were found to be uncommon (only 2 observations were recorded; Table 1.5). Development of the Rock Creek Mine would remove 290 acres of preferred breeding habitats for this species and this represents 24% of the preferred habitats available in the Rock Creek Mine study area (Table 1.8).

## **PACIFIC GOLDEN-PLOVER**

In North America, the Pacific Golden-Plover occupies a naturally small breeding range in western and northwestern Alaska and has a small population size; the Alaskan birds also are considered to have a restricted wintering range in the tropical Pacific (Johnson and Connors 1996). Because of these reasons, it is considered of Moderate Priority for conservation in the U.S. Shorebird Conservation Plan (USSCP 2002). This species makes long-distance trans-oceanic flights from Alaska to wintering sites in the tropical Pacific. It is actually widely dispersed throughout the tropical Pacific during the winter but because the range consists largely of littoral habitats and cleared areas on small islands, it is considered to have a restricted winter range in terms of habitat availability. Threats to populations on the wintering grounds in the tropical Pacific are of concern (Audubon Society 2002) and the species also is considered vulnerable on the breeding grounds because of the small population size and restricted breeding distribution (ASWG 2000; USSCP 2002). Pacific Golden-Plovers breed at low densities in western Alaska and in the Rock Creek Mine study area, the species was found to be uncommon

(only 1 observation was recorded; Table 1.5). Development of the Rock Creek Mine would remove 154 acres of preferred breeding habitats for this species and this represents 18% of the preferred habitats available in the Rock Creek Mine study area (Table 1.8).

## CONCLUSION

The expected impacts and habitat loss percentages discussed here have so far been considered only on a local scale (within the Rock Creek Mine study area). The percentages of important breeding habitats expected to be removed by development are based on the relative abundance of habitats within the mine footprint as compared to the surrounding study area. The local study area used was only about 4-times the area of the proposed mine development, which compares to the local study area for the Big Hurrah Mine (see Section 2) which was about 20-fold larger than the proposed mine footprint. Local-scale impacts were far less at the Big Hurrah Mine (see Section 2), which indicates that the assessment of local scale impacts is highly dependent on the size of the local study area. From a broader, regional perspective, the bird species assemblage documented in the Rock Creek Mine study area is similar to species assemblages found in similar habitats across the Seward Peninsula (Kessel 1989). Moreover, the important breeding habitats used by these species, including those of conservation concern, are not unique to the Rock Creek Mine area, but are widespread across low mountainous areas of the Seward Peninsula, including the Nome area (Kessel 1989). As a case in point, 20 (or 77%) of the bird species documented using habitats at the Rock Creek Mine study area also were found at the Big Hurrah Mine near Solomon, which shares many of the same habitats (see Section 2); this comparison omits waterfowl that prefer lacustrine waterbodies and the shorebirds that prefer wet tundra, because lacustrine waterbodies are very rare and wet tundra habitats are not present at the Big Hurrah Mine.

The Seward Peninsula, outside of the Nome area and the scattered small villages, is relatively undeveloped, which means that largely undisturbed avian habitats will be available for use by breeding birds throughout the peninsula. Considering this widespread availability of common habitats at the regional scale of the Seward Peninsula, the direct impacts to breeding bird habitats from development of the Rock Creek Mine would be expected to be of much less magnitude than the impacts expected at the local scale of the Rock Creek Mine study area. In the

language of the National Environmental Policy Act (NEPA), the impacts at the local scale are probably best considered significant (considering the removal of relatively large amounts of breeding habitats for several species of conservation concern) whereas the impacts at the regional scale would be nearly negligible. If the assessments at the two spatial scales were melded, an overall determination of moderately significant impacts might be most appropriate.

Table 1.1. Aggregation used to collapse mapped landcover classes into wildlife habitat types at the Rock Creek Mine study area, Alaska.

Wildlife Habitat Type	Mapped Landcover Class
Shallow Open Water	Shallow Open Water
Stream or River	Lower Perennial Stream
	Upper Perennial Stream
River Gravel	Barren River Gravel
	Partially Vegetated River Gravel
Riverine Low Willow Scrub	Riverine Closed Low Willow Scrub
	Riverine Open Low Willow Scrub
Riverine Tall Willow Scrub	Riverine Closed Tall Willow Scrub
	Riverine Open Tall Willow Scrub
	Riverine Open Tall Willow Scrub–Mine Tailings
Lowland Aquatic Sedge Marsh	Lowland Aquatic Sedge Marsh
Lowland Wet Sedge Tundra	Lowland Wet Sedge Tundra
	Lowland Wet Sedge-Willow Tundra
Lowland Dwarf Birch-Ericaceous-Sedge Scrub	Lowland Dwarf Birch-Ericaceous-Sedge Scrub
Lowland Low Birch-Ericaceous-Sedge Bog	Lowland Open Low Birch-Ericaceous-Sedge Bog
Lowland Low Birch Scrub	Lowland Closed Low Birch Scrub
	Lowland Open Low Birch Scrub
Lowland Low Birch-Willow Scrub	Lowland Open Low Birch-Willow Scrub
Lowland Low Willow Scrub	Lowland Closed Low Willow Scrub
	Lowland Open Low Willow Scrub
Lowland Low Willow-Sedge Scrub	Lowland Open Low Willow-Sedge Scrub
Lowland Tall Willow Scrub	Lowland Closed Tall Willow Scrub
	Lowland Open Tall Willow Scrub
Lowland Tall Willow-Grass Scrub	Lowland Open Tall Willow-Grass Scrub
Upland Dwarf Ericaceous Scrub	Upland Dwarf Ericaceous Scrub
Upland Dwarf Birch-Ericaceous Scrub	Upland Dwarf Birch-Ericaceous Scrub
Upland Dwarf Birch-Ericaceous-Sedge Scrub	Upland Dwarf Birch-Ericaceous-Sedge Scrub
Upland Low Birch-Willow Scrub	Upland Open Low Birch-Willow Scrub
Upland Low Willow Scrub	Upland Closed Low Willow Scrub
	Upland Open Low Willow Scrub
Upland Low Willow-Sedge Scrub	Upland Open Low Willow-Sedge Scrub
Upland Tall Willow Scrub	Upland Closed Tall Willow Scrub
	Upland Open Tall Willow Scrub
Excavated Gravel & Tailings	Barren Excavated Gravel
	Partially Revegetated Excavated Gravel
	Revegetated Excavated Gravel
Gravel Fill	Maintained Gravel Fill
	Partially Revegetated Gravel Fill
	Unmaintained Gravel Fill

Table 1.2. Mapped wildlife habitat types at the Rock Creek Mine study area, Alaska, 2004: number of point count surveys conducted, acreage mapped, percent of total study area mapped, acreage expected to be removed by mine development footprint, and percent of habitats in total study area expected to be removed by mine development footprint.

Class	Wildlife Habitat Type	No. Point Counts	Acres Mapped	% of Study Area	Acres in Mine Footprint	% of Habitat in Footprint
Lacustrine	Shallow Open Water	0	6.44	0.21	0.00	0.00
	<b>Lacustrine subtotal</b>	<b>0</b>	<b>6.44</b>	<b>0.21</b>	<b>0.00</b>	<b>0.00</b>
Riverine	Stream or River	0	16.43	0.53	0.67	4.08
	River Gravel	0	23.37	0.76	0.23	0.98
	Riverine Low Willow Scrub	0	30.93	1.00	1.08	3.49
	Riverine Tall Willow Scrub	9	118.40	3.83	6.38	5.39
	<b>Riverine subtotal</b>	<b>9</b>	<b>189.13</b>	<b>6.12</b>	<b>8.36</b>	<b>4.42</b>
Lowland	Lowland Aquatic Sedge Marsh	0	1.97	0.06	0.00	0.00
	Lowland Wet Sedge Tundra	1	2.23	0.07	0.00	0.00
	Lowland Dwarf Birch-Ericaceous-Sedge Scrub	3	125.12	4.05	0.52	0.42
	Lowland Low Birch-Ericaceous-Sedge Bog	2	71.24	2.30	7.26	10.19
	Lowland Low Birch Scrub	2	38.97	1.26	0.00	0.00
	Lowland Low Birch-Willow Scrub	1	1.29	0.04	0.00	0.00
	Lowland Low Willow Scrub	4	206.81	6.69	14.27	6.90
	Lowland Low Willow-Sedge Scrub	0	15.32	0.50	1.24	8.09
	Lowland Tall Willow Scrub	3	212.77	6.88	31.48	14.80
	Lowland Tall Willow-Grass Scrub	0	0.77	0.02	0.00	0.00
	<b>Lowland subtotal</b>	<b>16</b>	<b>676.50</b>	<b>21.88</b>	<b>54.77</b>	<b>8.10</b>
Upland	Upland Dwarf Ericaceous Scrub	0	50.29	1.63	0.00	0.00
	Upland Dwarf Birch-Ericaceous Scrub	5	366.00	11.84	136.36	37.26
	Upland Dwarf Birch-Ericaceous-Sedge Scrub	9	835.96	27.03	153.65	18.38
	Upland Low Birch-Willow Scrub	3	131.91	4.27	38.30	29.03
	Upland Low Willow Scrub	5	188.27	6.09	22.39	11.89
	Upland Low Willow-Sedge Scrub	0	2.17	0.07	0.00	0.00
	Upland Tall Willow Scrub	6	566.06	18.31	185.82	32.83
	<b>Upland subtotal</b>	<b>28</b>	<b>2140.66</b>	<b>69.23</b>	<b>536.52</b>	<b>25.06</b>
Artificial	Excavated Gravel & Tailings	2	60.88	1.97	11.45	18.81
	Gravel Fill	0	18.54	0.60	0.77	4.15
	<b>Artificial subtotal</b>	<b>2</b>	<b>79.43</b>	<b>2.57</b>	<b>12.22</b>	<b>15.38</b>



Table 1.3. Avian species observed at the Rock Creek Mine study area, Alaska, 7–11 June 2004.

Avian Group	Common name	Scientific name
Geese	Canada Goose	<i>Branta canadensis</i>
Ducks	American Wigeon	<i>Anas americana</i>
	Northern Shoveler	<i>Anas clypeata</i>
	Northern Pintail	<i>Anas acuta</i>
Grouse	Willow Ptarmigan	<i>Lagopus lagopus</i>
	Rock Ptarmigan	<i>Lagopus muta</i>
Loons	Red-throated Loon	<i>Gavia stellata</i>
Raptors	Northern Harrier	<i>Circus cyaneus</i>
Shorebirds	American Golden-Plover	<i>Pluvialis dominica</i>
	Pacific Golden-Plover	<i>Pluvialis fulva</i>
	Semipalmated Plover	<i>Charadrius semipalmatus</i>
	Spotted Sandpiper	<i>Actitis macularius</i>
	Whimbrel	<i>Numenius phaeopus</i>
	Western Sandpiper	<i>Calidris mauri</i>
	Pectoral Sandpiper	<i>Calidris melanotos</i>
	Wilson's Snipe	<i>Gallinago delicata</i>
	Red-necked Phalarope	<i>Phalaropus lobatus</i>
	Jaegers, Gulls & Terns	Parasitic Jaeger
Long-tailed Jaeger		<i>Stercorarius longicaudus</i>
Mew Gull		<i>Larus canus</i>
Glaucous Gull		<i>Larus hyperboreus</i>
Corvids	Arctic Tern	<i>Sterna paradisaea</i>
	Common Raven	<i>Corvus corax</i>
Passerines	Arctic Warbler	<i>Phylloscopus borealis</i>
	Bluethroat	<i>Luscinia svecica</i>
	Gray-cheeked Thrush	<i>Catharus minimus</i>
	American Robin	<i>Turdus migratorius</i>
	Eastern Yellow Wagtail	<i>Motacilla tschutschensis</i>
	Orange-crowned Warbler	<i>Vermivora celata</i>
	Yellow Warbler	<i>Dendroica petechia</i>
	Blackpoll Warbler	<i>Dendroica striata</i>
	Northern Waterthrush	<i>Seiurus noveboracensis</i>
	Wilson's Warbler	<i>Wilsonia pusilla</i>
	American Tree Sparrow	<i>Spizella arborea</i>
	Savannah Sparrow	<i>Passerculus sandwichensis</i>
	Fox Sparrow	<i>Passerella iliaca</i>
	White-crowned Sparrow	<i>Zonotrichia leucophrys</i>
	Golden-crowned Sparrow	<i>Zonotrichia atricapilla</i>
Lapland Longspur	<i>Calcarius lapponicus</i>	
Common Redpoll	<i>Carduelis flammea</i>	
Hoary Redpoll	<i>Carduelis hornemanni</i>	

Table 1.4. Avian species of conservation concern observed at the Rock Creek Mine study area, Alaska, 7–11 June, 2004, and the reasons for management agency or conservation group concern.

Avian species of concern	Organization <sup>a</sup>	Reasons for concern <sup>b</sup>
Red-throated Loon	USFWS	Research indicates large population declines for this species in Alaska that are most pronounced in western Alaska. Global threats to habitat during the nonbreeding season and human disturbance during breeding are suspected as primary factors causing the population declines.
	NAWCP	Species not evaluated in Version 1 of the NWACP.
	BLM	Listed as a sensitive species. <sup>c</sup>
	AUD-AK	Western Alaska is noted as a major breeding and minor nonbreeding area for this species. Surveys indicate population declines of >50% in nesting birds over the last 20 years. The species is of conservation concern because of declining population trends and threats during the nonbreeding season (Red-throated Loons are known to be vulnerable to marine oil spills).
American Golden-Plover	USFWS	Research suggests population declines in this species and threats to nonbreeding habitats. The species is concentrated in Alaska during breeding and maintenance of populations in the state is of concern.
	ABC	Although a moderately abundant species, it is of concern because of apparent population declines and high threats to nonbreeding populations.
	USSCP	Listed as a species of High Concern (for global populations) because of apparent population declines and high threats to nonbreeding populations.
	AUD-N	Same concerns as ABC and USSCP.
Pacific Golden-Plover	USFWS	A naturally small range in North America and a small breeding population, restricted to western and northwestern Alaska, may make this species susceptible to threats on the breeding grounds. Because of this, conservation measures on the breeding grounds are considered important.
	ABC	Of concern because the species has a restricted distribution (both breeding and nonbreeding ranges) and a low overall population size.
	USSCP	Listed as a species of Moderate Concern because of low overall population size and small breeding and nonbreeding distributions.
	AUD-N	Concerns are focused on threats to populations on the wintering grounds in the tropical South Pacific.
	ASWG	This species has concentrated breeding and migration areas in western Alaska. It is of conservation importance to the U.S. and within Alaska because of its small population size (~ 16,000) and because its North American breeding range is restricted to Alaska.
	AUD-AK	Same concerns as ABC and USSCP.
Whimbrel	USFWS	Research suggests population declines for this species, a naturally small range and population size in North America, and substantial habitat loss in migration and wintering areas.
	ABC	Although a moderately abundant species, it is of concern because of apparent population declines.

	USSCP	Listed as a species of High Concern (for North American populations) because of apparent population declines, relatively low population size, and a restricted breeding distribution.
	AUD-N	Same concerns as USSCP.
	ASWG	Populations in Alaska are considered of conservation importance because a majority of the population of the subspecies, <i>Numenius phaeopus rufiventris</i> , breeds in Alaska. The species' total population in North America is estimated at ~ 60,000 birds, of which as many as 40,000 occur in Alaska.
Arctic Tern	USFWS	Research suggests population declines for this species and that it is susceptible to disturbance and habitat destruction during breeding.
	NAWCP	Listed as a species of high concern (for North American populations) because of apparent population declines and potential threats to breeding populations.
Arctic Warbler	USFWS	Of conservation concern in Alaska because the subspecies that breeds in Alaska, <i>P. b. kennicotti</i> , is endemic to the state (i.e., 100% of the world population of this subspecies breeds in Alaska).
Gray-cheeked Thrush	BLM	Listed as a sensitive species. <sup>c</sup>
	ADFG	Listed as a State of Alaska Species of Special Concern. <sup>d</sup>
	BPIF	Breeding Bird Survey data suggest this species has suffered population declines on breeding grounds in eastern North America between 1978–1988 (Sauer and Droege 1992), and the species is considered vulnerable to tropical deforestation on the wintering grounds (Petit et al. 1993). Because a large proportion of the species' worldwide breeding range occurs in Alaska, there is global concern (stewardship responsibility) for maintaining population numbers in Alaska.
Blackpoll Warbler	USFWS	Research indicates population declines for this species on the breeding grounds and threats during wintering and migration.
	BLM	Listed as a sensitive species. <sup>c</sup>
	ADFG	Listed as a State of Alaska Species of Special Concern. <sup>d</sup>
	AUD-AK	Western Alaska is considered a major breeding area for this species, and there is concern about broad declines occurring across North America. Primary concerns are due to declining population trends and threats during the nonbreeding season.
	BPIF	Breeding Bird Survey data indicate breeding population declines of 2.4% per year between 1966–1996 in North America outside Alaska (Sauer et al. 1997). The primary factors driving the population decline are suspected to occur during nonbreeding because this species is considered highly vulnerable to tropical deforestation on the wintering grounds (Petit et al. 1993) and is also susceptible to mortality during migration. Because a large proportion of the species' worldwide breeding range occurs in Alaska, there is global concern (stewardship responsibility) for maintaining population numbers in Alaska.
Golden-crowned Sparrow	PIF	This species is common throughout its range in appropriate habitat, but because significant portions of the worldwide breeding and wintering populations occur in a single biome (Pacific Avifaunal Biome, which includes south coastal Alaska), it is considered a

		stewardship species for that biome. Conservation concern is focused on maintaining populations of this biome-characteristic species.
	BPIF	Because a large proportion of the species' worldwide breeding range occurs in Alaska, there is global concern (stewardship responsibility) for maintaining breeding population numbers in Alaska.
Hoary Redpoll	PIF	This species is widespread in the arctic, but because significant portions of the western hemisphere's breeding and wintering populations occur in a single biome (Arctic Avifaunal Biome), it is considered a stewardship species for that biome. Conservation concern is focused on maintaining populations of this biome-characteristic species.
	BPIF	Because Alaska represents a large proportion of the species' breeding range in North America, there is North American concern (stewardship responsibility) for maintaining breeding populations in Alaska.

<sup>a</sup> ABC = American Bird Conservancy; ADFG = Alaska Department of Fish & Game; ASWG = Alaska Shorebird Working Group; AUD-AK = Audubon Alaska; AUD-N = National Audubon Society; BLM = U.S. Department of the Interior, Bureau of Land Management; BPIF = Boreal Partners in Flight; PIF = [National] Partners In Flight; NAWCP = North American Waterbird Conservation Plan (cooperative council of numerous organizations); USFWS = U.S. Fish & Wildlife Service; USSCP = U.S. Shorebird Conservation Plan (cooperative council of numerous organizations).

<sup>b</sup> American Bird Conservancy Green List (ABC 2005); State of Alaska Species of Special Concern (ADFG 1998); Alaska Shorebird Working Group Species of Concern (ASWG 2000); Audubon Alaska Watch List (Audubon Alaska 2002); National Audubon Society Watch List (Audubon Society 2002); Bureau of Land Management (BLM 2001); Boreal Partners in Flight Working Group Priority Species of Concern for western Alaska (BPIFWG 1999); Partners In Flight North American Landbird Conservation Plan (Rich et al. 2004); North American Waterbird Conservation Plan (Kushlan et al. 2001); U.S. Fish & Wildlife Service Species of Conservation Concern for western Alaska (USFWS 2002); U.S. Shorebird Conservation Plan (USSCP 2004).

<sup>c</sup> BLM (2001) defines sensitive species as those: (1) under status review by the FWS/NMFS; or (2) whose numbers are declining so rapidly that Federal listing may become necessary; or (3) with typically small and widely dispersed populations; or (4) inhabiting ecological refugia or other specialized or unique habitat.

<sup>d</sup> State of Alaska Species of Special Concern (ADFG 1998), "is any species or subspecies of...bird native to Alaska that has entered a long-term decline in abundance or is vulnerable to a significant decline due to low numbers, restricted distribution, dependence on limited habitat resources, or sensitivity to environmental disturbance."

Table 1.5. Number observed, percent of total observations, and abundance category for birds recorded at the Rock Creek Mine study area, Alaska, 7–11 June 2004. Observations from point count data and incidental sightings. Species in bold are of conservation concern (see Table 1.4).

Species	No. Observed	% of Total Observations	Abundance Category <sup>a</sup>
Common and <b>Hoary Redpoll</b> <sup>b</sup>	102	14.49	A
American Tree Sparrow	69	9.80	A
<b>Gray-cheeked Thrush</b>	59	8.38	A
Wilson's Snipe	57	8.10	A
<b>Golden-crowned Sparrow</b>	48	6.82	A
Fox Sparrow	47	6.68	A
Orange-crowned Warbler	46	6.53	A
Yellow Warbler	46	6.53	A
Savannah Sparrow	41	5.82	A
Wilson's Warbler	28	3.98	C
Northern Waterthrush	27	3.84	C
Lapland Longspur	22	3.13	C
White-crowned Sparrow	16	2.27	C
Willow Ptarmigan	13	1.85	C
American Robin	10	1.42	C
Long-tailed Jaeger	9	1.28	C
<b>Arctic Warbler</b>	8	1.14	C
Canada Goose	8	1.14	C
Bluethroat	6	0.85	U
<b>Blackpoll Warbler</b>	5	0.71	U
<b>American Golden-Plover</b>	4	0.57	U
<b>Red-throated Loon</b>	4	0.57	U
Unidentified Golden-Plover	4	0.57	U
Common Raven	3	0.43	U
<b>Arctic Tern</b>	2	0.28	U
Mew Gull	2	0.28	U
Northern Pintail	2	0.28	U
Parasitic Jaeger	2	0.28	U
<b>Whimbrel</b>	2	0.28	U
American Wigeon	1	0.14	U
Eastern Yellow Wagtail	1	0.14	U
Glaucous Gull	1	0.14	U
Northern Harrier	1	0.14	U
Northern Shoveler	1	0.14	U
<b>Pacific Golden-Plover</b>	1	0.14	U
Pectoral Sandpiper	1	0.14	U
Red-necked Phalarope	1	0.14	U
Rock Ptarmigan	1	0.14	U
Semipalmated Plover	1	0.14	U
Spotted Sandpiper	1	0.14	U
Western Sandpiper	1	0.14	U

- <sup>a</sup> Species were considered Abundant (A) if they comprised >5% of the total observations, Common (C) if they were 1-5% of the observations, and Uncommon (U) if they were <1% of the observations.
- <sup>b</sup> Both species were observed in the study area but because many redpolls were observed in flight and could not be identified to species, the records for both species were combined.

Table 1.6. Numbers of bird species observed in mapped wildlife habitats at the Rock Creek Mine study area, Alaska, 7–11 June 2004. Species of conservation concern are in bold (see Table 1.4).

Avian Species	Wildlife Habitat															
	Shallow Open Water	River Gravel	Riverine Tall Willow Scrub	Lowland Wet Sedge Tundra	Lowland Low Birch-Ericaceous-Sedge Bog	Lowland Dwarf Birch-Ericaceous-Sedge Scrub	Lowland Low Birch Scrub	Lowland Low Birch-Willow Scrub	Lowland Low Willow Scrub	Lowland Tall Willow Scrub	Upland Dwarf Birch-Ericaceous Scrub	Upland Dwarf Birch-Ericaceous-Sedge Scrub	Upland Low Birch-Willow Scrub	Upland Low Willow Scrub	Upland Tall Willow Scrub	Excavated Gravel & Tailings
<b>American Golden-Plover</b>						1						2	1			
American Robin			5											2	2	
American Tree Sparrow			8				4	17	5		2	5	6	17		
American Wigeon	1															
<b>Arctic Tern</b>	1															
<b>Arctic Warbler</b>			5							1					1	
<b>Blackpoll Warbler</b>			2					2								
Bluethroat							4	1				1				
Canada Goose	2			1												
Fox Sparrow			11					5	8				5	13		
<b>Golden-crowned Sparrow</b>			4					2	2	2	1	2	9	11	1	
<b>Gray-cheeked Thrush</b>			21					4	8			1	7	14	1	
Lapland Longspur					1	3				6	10	2				
Long-tailed Jaeger						2					1					
Northern Pintail	2															
Northern Shoveler	1															
Northern Waterthrush			13						2					5		
Orange-crowned Warbler			6					6	8			1	7	12		
<b>Pacific Golden-Plover</b>											1					
Parasitic Jaeger						1										
Pectoral Sandpiper				1												
Red-necked Phalarope	1															
Common and <b>Hoary Redpoll</b>							3	2	4	2	1	3	3	2	1	
<b>Red-throated Loon</b>	1															
Rock Ptarmigan			1													
Savannah Sparrow			1	3	4	1	1	9	1	3	6	4	4	4		
Spotted Sandpiper		1														
Unknown Golden-Plover											2					
Western Sandpiper				1												
<b>Whimbrel</b>										1	1					
White-crowned Sparrow			2					1	2			1	1	1		
Willow Ptarmigan											3		2	1		
Wilson's Snipe			1	1				8	4	3		1	6	1		
Wilson's Warbler			9					3	4			1	3	7		
Yellow Warbler			16					3	4				5	17	1	

Table 1.7. Percentage of total observations for each bird species in mapped wildlife habitats at the Rock Creek Mine study area, Alaska, 7–11 June 2004. Species in bold are of conservation concern (see Table 1.4).

Avian Species	Wildlife Habitat															
	Shallow Open Water	River Gravels	Riverine Tall Willow Scrub	Lowland Wet Sedge Tundra	Lowland Low Birch-Ericaceous-Sedge Bog	Lowland Dwarf Birch-Ericaceous-Sedge Scrub	Lowland Low Birch Scrub	Lowland Low Birch-Willow Scrub	Lowland Low Willow Scrub	Lowland Tall Willow Scrub	Upland Dwarf Birch-Ericaceous Scrub	Upland Dwarf Birch-Ericaceous-Sedge Scrub	Upland Low Birch-Willow Scrub	Upland Low Willow Scrub	Upland Tall Willow Scrub	Excavated Gravel & Tailings
<b>American Golden-Plover</b>						25						50	25			
American Robin			56											22	22	
American Tree Sparrow			13				6	27	8		3	8	9	27		
American Wigeon	100															
<b>Arctic Tern</b>	100															
<b>Arctic Warbler</b>			71								14				14	
<b>Blackpoll Warbler</b>			50					50								
Bluethroat							67	17				17				
Canada Goose	67			33												
Fox Sparrow			26					12	19				12	31		
<b>Golden-crowned Sparrow</b>			12					6	6	6	3	6	26	32	3	
<b>Gray-checked Thrush</b>			38					7	14			2	13	25	2	
Lapland Longspur					5	14					27	45	9			
Long-tailed Jaeger						67						33				
Northern Pintail	100															
Northern Shoveler	100															
Northern Waterthrush			65						10					25		
Orange-crowned Warbler			15					15	20			3	18	30		
<b>Pacific Golden-Plover</b>												100				
Parasitic Jaeger						100										
Pectoral Sandpiper			100													
Red-necked Phalarope	100															
Common and <b>Hoary Redpoll</b>							14	10	19	10		5	14	14	10	5
<b>Red-throated Loon</b>	100															
Rock Ptarmigan			100													
Savannah Sparrow			2		7	10	2	2	22	2	7	15	10	10	10	
Spotted Sandpiper		100														
Unknown Golden-Plover												100				
Western Sandpiper				100												
<b>Whimbrel</b>											50	50				
White-crowned Sparrow			25					13	25			13	13	13		
Willow Ptarmigan											50		33	17		
Wilson's Snipe			4		4			32	16		12		4	24	4	
Wilson's Warbler			33					11	15			4	11	26		
Yellow Warbler			35					7	9				11	37	2	



Table 1.8. Acres of preferred breeding bird habitats<sup>a</sup> expected to be removed by development of the Rock Creek Mine compared to acres of surrounding preferred breeding habitats that will not be directly affected by mine development. Species in bold are of conservation concern (see Table 1.4).

Avian Species	Total Acres Expected Removed	Total Acres Not Directly Affected	% Acres Removed of Total Mapped Area
American Robin	192.20	492.35	28.08
<b>Arctic Warbler</b>	192.20	492.35	28.08
Northern Waterthrush	192.20	492.35	28.08
<b>Gray-cheeked Thrush</b>	223.67	673.67	24.93
Fox Sparrow	223.67	673.67	24.93
Yellow Warbler	214.59	658.25	24.59
<b>Whimbrel</b>	290.00	912.09	24.12
<b>Golden-crowned Sparrow</b>	246.06	839.57	22.67
Orange-crowned Warbler	246.06	839.57	22.67
Bluethroat	38.30	132.59	22.41
Lapland Longspur	290.53	1036.71	21.89
White-crowned Sparrow	237.94	866.23	21.55
American Tree Sparrow	228.86	850.81	21.20
Wilson's Snipe	385.21	1436.61	21.14
Savannah Sparrow	414.95	1639.42	20.20
Wilson's Warbler	260.33	1032.13	20.14
<b>Pacific Golden-Plover</b>	153.65	682.41	18.38
Willow Ptarmigan	176.03	848.31	17.18
<b>American Golden-Plover</b>	154.17	807.02	16.04
Long-tailed Jaeger	154.17	807.02	16.04
Common & <b>Hoary Redpoll</b>	74.96	492.35	13.21
<b>Blackpoll Warbler</b>	20.65	304.60	6.35
Rock Ptarmigan	6.38	112.04	5.39
Spotted Sandpiper	0.23	23.14	0.98
Parasitic Jaeger	0.52	124.61	0.42
<b>Red-throated Loon</b>	0.00	6.44	0.00
Canada Goose	0.00	8.68	0.00
Northern Pintail	0.00	6.44	0.00
American Wigeon	0.00	6.44	0.00
Northern Shoveler	0.00	6.44	0.00
Pectoral Sandpiper	0.00	2.23	0.00
Western Sandpiper	0.00	2.23	0.00
Red-necked Phalarope	0.00	6.44	0.00
<b>Arctic Tern</b>	0.00	6.44	0.00

<sup>a</sup> Habitat types used for displaying, foraging, and nesting that cumulatively sum to  $\geq 75\%$  use by that avian species (see text).

## **SECTION 2: BIG HURRAH MINE DEVELOPMENT**

### **INTRODUCTION**

Alaska Gold Company is proposing a gold mining operation in the historical Big Hurrah Mine area near Solomon, Alaska. Current plans call for developing roughly 95 acres along the upper reaches of Big Hurrah Creek located in the Solomon River watershed. The proposed mine would include an open-pit mine, a non-acid generating rock dump, a run-off mine ore stockpile, water diversion channels, and a facilities and fuel storage area. The Big Hurrah Mine will be operated in conjunction with the Rock Creek Mine near Nome, where the rock from the Big Hurrah Mine will be processed. To determine baseline conditions and assess the potential impacts on breeding birds and wildlife habitats in the Big Hurrah Mine area, ABR, Inc., was hired to conduct pre-development field surveys at the historical mine site and in adjacent environments. Field surveys for breeding birds were designed to determine species occurrence, abundance and habitat use, and wildlife habitat mapping was designed to quantify the distribution of wildlife habitats in the project area (with a focus on breeding bird habitats). Assessments of the direct impacts of the proposed mine on breeding birds were conducted by quantifying the amounts of breeding bird habitats that would be removed by development. This was done for each species recorded in the study area. Determining the actual number of breeding pairs for each species that could be affected by development would require a longer-term field study to determine densities along with a literature review to estimate densities for less common species. Those tasks were beyond the scope of this work. The possibility of indirect impacts on breeding birds from construction and operations activities at the mine site was not studied. This baseline survey work was conducted to assist with the evaluation of environmental conditions in the mine site area and to support NEPA documentation and applications for environmental permits. These survey data also can be used in developing long-term databases for post-construction monitoring of breeding birds and wildlife habitats within the mine area.

The specific objectives of this study were to:

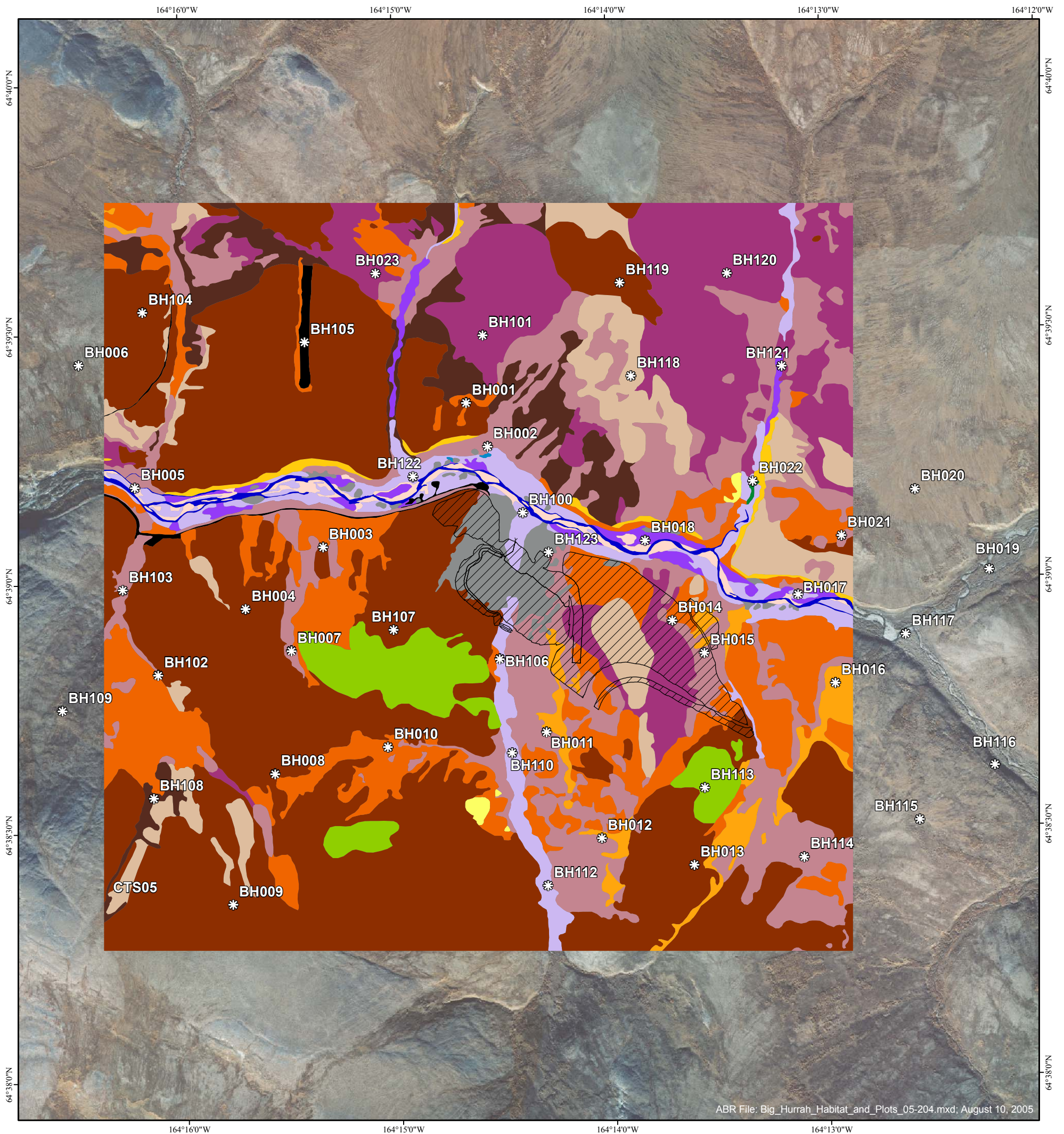
- (4) Classify, map, and quantify the acreage of wildlife habitats in the area of the proposed mine and adjacent areas;

- (5) Quantify the abundance and habitat use of breeding birds in the area; and
- (6) Assess the direct impacts on breeding bird habitats from development of the proposed mine site.

## **STUDY AREA**

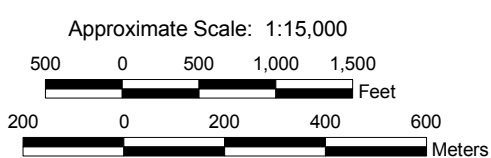
Big Hurrah Creek is a small drainage in the Solomon River watershed located approximately 25 air miles (40 km) northeast of Nome, Alaska, in the foothills of the Kigluaik Mountains (Figure 2.1). Big Hurrah Creek runs west draining the slopes north and east of Uncle Sam Mountain before joining with the Solomon River. Currently all mining development is planned to occur on the southern side of Big Hurrah Creek near its confluence with Little Hurrah Creek. Little Hurrah Creek is a tributary of Big Hurrah Creek that drains the northeast flanks of Uncle Sam Mountain. The Big Hurrah Mine site is located approximately 2.5 mi (4 km) up a gravel access road from where the Council Highway crosses the confluence of Big Hurrah Creek and the Solomon River.

We mapped wildlife habitats in a 1919-acre square study area (an area about 20 times the size of the proposed development; Figure 2.1). The study area was centered roughly on the proposed location of the mine site facilities. A large area was studied to evaluate the distribution of wildlife habitats and breeding bird use of those habitats both in the proposed mine area as well as in the region surrounding the proposed mine. The study area is typified by rolling foothills terrain with mostly gradual slopes that are steeper near small drainages and especially near Little Hurrah and Big Hurrah Creeks. Some steep creek banks (nearly bluffs) collect large amounts of snow and were still snow-covered during our visit in early June. Vegetation in the area is dominated by dwarf shrub tundra ( $\leq 0.2$  m tall) with rocky fell-field areas on some of the higher ridge tops and hillcrests. Patches of low willow thickets and low willow–sedge openings often occur on drainage swales and terraced hillslopes. Tall willow thickets also occur in patches on slopes, but are most common in the riparian areas where the plants range from 2–3 m in height. The breeding bird community in the area, like most montane areas in arctic and subarctic Alaska, is dominated by landbirds and shorebirds.



**Wildlife Habitat Type**

- |   |   |  |
|---|---|--|
| Shallow Open Water                        | Upland Dwarf Birch-Ericaceous Scrub       | Big Hurrah Mine Development Footprint                |
| Streams & Rivers                          | Upland Low Birch-Willow Scrub             | Breeding Bird Point Count and Habitat Plot Locations |
| River Gravels                             | Upland Low Willow Scrub                   |  |
| Riverine Low Willow Scrub                 | Upland Low Willow-Sedge Scrub             |  |
| Riverine Tall Willow Scrub                | Upland Tall Alder Scrub                   |  |
| Lowland Low Willow Scrub                  | Upland Tall Willow Scrub                  |  |
| Upland Dry Bluejoint-Herb Tundra          | Upland Partially Vegetated Rock and Scree |  |
| Upland Dwarf Ericaceous Scrub             | Excavated Gravel & Tailings               |  |
| Upland Dwarf Birch-Ericaceous-Sedge Scrub | Gravel Fill                               |  |



Projection: UTM Zone 3  
 Datum: NAD83  
 Wildlife habitats mapped from  
 October 2004 aerial photography

**Wildlife habitats, breeding bird  
 point count and habitat plot locations,  
 in the Big Hurrah Mine study area, Alaska.**

## METHODS

### WILDLIFE HABITAT MAPPING

We collected field data on wildlife habitats and ground-truthed aerial photosignatures at the Big Hurrah Mine study area during 3–7 June 2005, prior to the mapping of wildlife habitats. During these surveys we attempted to sample all distinct photosignatures (suspected distinct land cover types) within the study area using true-color, digital aerial photography taken October 2004 (Kodiak Mapping, Inc, Wasilla, Alaska). Using a field copy of the aerial photography, we navigated by foot to locations that were representative of each different photosignature. In total, 45 plots were sampled for wildlife habitat data. At each sample plot, we recorded physiography, local surface form, and local vegetation type in a 10-m radius surrounding the selected sample point. Surface form types were recorded following a modification of the system developed by Washburn (1973) for periglacial microtopography, and vegetation types following a modification of the Level IV categories of Viereck et al. (1992). We also recorded all vascular plants present in a 10-m radius of the sample point and estimated percent aerial cover for each. To reduce subjectivity in cover estimates, the percent cover of individual plant species was estimated visually in the 10-m radius using modified Daubenmire cover class categories (<1%, 1–5%, 5–25%, 25–50%, 50–75%, 75–95%, and >95%; Daubenmire 1959). Most plants were identified in the field but samples of all unknown taxa were collected and pressed for later identification. GPS coordinates and digital photos were taken at each sample plot. Because field time was limited, we were not able to obtain replicate samples in all potential habitat types. We did, however, attempt to sample all non-water and non-artificial wildlife habitats present in the Big Hurrah study area at least once.

Mapping of wildlife habitats in the 1919-acre Big Hurrah study area was conducted in July 2005. Boundary delineation was performed on-screen over the digital aerial photography using ArcGIS 9.0 software (*ESRI, Inc., Redlands, California*). We mapped wildlife habitat types in the study area by using field plot data for specific photosignatures and extrapolating those data to similar photosignatures observed across the study area. First, we identified land cover types based on vegetation, surface form, and landscape physiographic characteristics, following a modification of the landcover classification system of Jorgenson et al. (1989). This classification

system was derived from a synthesis of Level IV vegetation categories of Viereck et al. (1992; modified by ABR), the surface form types defined by Washburn (1973) for periglacial microtopography (also modified by ABR), and general landscape physiographic categories. This system has been successfully used to map wildlife habitats in tundra regions on the North Slope and in northwest Alaska, including the Seward Peninsula (Schick et al. 2004; USAF 2004a, b).

As a final step in developing wildlife habitats, we aggregated selected land cover types into broader habitat types that represent combinations of vegetation structure, surface form, and physiography relevant to wildlife use, particularly by avian species. These wildlife habitat types were then used in the analyses of habitat use by breeding birds and in the assessment of impacts to those habitats.

## **BREEDING BIRD SURVEYS**

We conducted breeding bird surveys in the Big Hurrah Mine study area from 3–7 June 2005. Survey timing was selected to coincide with the peak of the passerine breeding season on the Seward Peninsula (Kessel 1989). Plant phenology in the spring and early summer of 2005 was a bit delayed due to cold weather and most shrub leaves were only partly developed during most of our field visit. Nevertheless, breeding birds were in the area and were actively nesting or in the early stages of nest initiation.

We used point count methods (Ralph et al. 1995) to collect quantitative data on bird abundance and habitat use. This survey method (which is typically used to detect singing male passerine birds defending territories) was chosen because it is an effective method for characterizing use of habitats by breeding passerines and other vocal species, such as shorebirds, which engage in display activities during the breeding season. Based on previous field experience in similar habitats in the Nome area, we expected passerines and shorebirds to be the predominant avian groups (in terms of bird numbers) occurring in the Big Hurrah area.

In the field, our goal was to conduct point counts at multiple, independent locations in as many habitat types (i.e., photosignatures) as possible. In order to make efficient use of our field time, we collected point count data at the same locations where we obtained wildlife habitat data. In total, 46 point counts were conducted in the field. We did not conduct point counts in water-

oriented habitats, such as Shallow Open Water, Stream or River, and River Gravel. These areas were scanned for birds, however, when we came upon them in transit between point count locations and any observations of birds were included in the habitat use analyses (see below).

At each point count location, a single observer documented all birds detected by sight or sound within a 10-minute observation period. The sample period was broken into 4 time intervals (0–3, 3–5, 5–8, and 8–10 minutes). For each observation, the approximate distance of the bird from the observer was estimated in 10-m increments up to 150 m, and recorded as >150 m for all observations estimated at over 150 m. The detection method (singing, calling, aerial display, visual, drumming, flying, hunting, or nesting) and the habitat type the bird was using (when known) were also recorded.

Because point counts are not effective at surveying all bird species (e.g., waterfowl and feeding shorebirds can be missed), we also scanned waterbodies, adjacent shorelines, and creeks when we encountered them and recorded any species observed along with the habitats they were using. In addition, when in transit between sample points, we recorded any uncommon bird species encountered and/or those species that are more difficult to detect with point counts, along with the habitat(s) the birds were using. This was done to record all bird species observed in the Big Hurrah Mine study area and to enhance our bird/habitat association information beyond what was collected with the point count sampling.

## **BIRD HABITAT-USE ANALYSES**

We analyzed habitat-use information for breeding birds in the Big Hurrah Mine study area to determine the direct impacts of development of the proposed mine on breeding bird habitats in the area. First, we summarized bird species observations by the mapped wildlife habitats they occurred in, and then ranked the habitats by greatest use for each species. We assessed which habitats cumulatively accounted for  $\geq 75\%$  of the observations for that species and designated those habitat types as preferred breeding habitats. These preferred breeding habitats were those most frequently used for displaying, nesting, and/or foraging and presumably their use is necessary for successful reproduction. When there were ties in habitat-use percentages among the additional habitats to add to reach 75% of the total observations, we selected the next habitat to include that had vegetation structure and/or physiography most similar to the most commonly

used habitat for that species. When we could not use vegetation structure and/or physiography as a guide (this problem occurred for 2 species, Arctic Warbler and Bank Swallow), we added all the habitats with tied percentages that were needed to get to a total of  $\geq 75\%$  of the observations.

## **BIRD HABITAT IMPACT ANALYSES**

Once preferred breeding habitats were determined for each bird species surveyed, we used the wildlife habitat map in GIS to calculate the total acreage of preferred breeding habitats for each species in the study area. A “footprint” of the proposed mine, derived from CAD engineering drawings supplied by Alaska Gold Company, was overlaid on the wildlife habitat map and the acreage of preferred breeding habitats for each bird species expected to be directly removed by mine development was calculated. We also calculated the acreage of preferred breeding habitat for each bird species within the surrounding study area that would not be directly affected by the proposed mine development.

In these analyses, no corrections were made for patchiness in bird occurrence on the landscape. That is, we assumed that each map polygon representing a preferred habitat type did in fact serve as preferred habitat for the species in question. In actuality, and this is especially true for the less common species, some patches of preferred habitat may never be occupied for a variety of reasons related to subtle differences in habitat quality that are not reflected in aerial photography (from which the habitats in this study were mapped). This lack of correction for patchiness in bird occurrence means that the expected impacts determined here are liberal estimates (i.e., all preferred habitats in the study area are assumed to be occupied and functioning as preferred habitats when in fact some may not be occupied). At present, we do not have enough data points to conduct a spatial analysis to try to correct for this problem.

## **BIRD SPECIES OF CONSERVATION CONCERN**

During field surveys at the Big Hurrah Mine study area, no federally threatened or endangered bird species were observed but several species that are of increasing conservation concern were recorded (see Results and Discussion sections below). The production of lists of North American birds of conservation concern is an ongoing process and was given greater attention over the last decade with the implementation of the vulnerability ranking system



developed by the Partners in Flight program (Hunter et al. 1993). There are now numerous agency and working group lists in use in the United States (see below), all of which are independent of the U.S. Fish & Wildlife Service's listing of species as federally threatened or endangered under the Endangered Species Act. The concept behind the Partners in Flight program, and the other listing programs that followed, is to identify species that are still common but may be undergoing population declines and/or facing population threats. The goal is to stimulate proactive conservation actions now to avoid sharp declines in populations of these species in the future and avoid the need for listing under the Endangered Species Act. There also is an explicit recognition, for Neotropical migrant species, that conservation efforts must be international in scope and focused on habitats used during breeding, migration, and wintering. For this study, we used several lists to identify species of conservation concern that occur at the Big Hurrah Mine study area during the breeding season. We evaluated both continental-level lists (Kushlan et al. 2001; Audubon Society 2002; USFWS 2002; Rich et al. 2004; USSCP 2004; ABC 2005) and lists at the state level (ADFG 1998; BPIFWG 1999; ASWG 2000; BLM 2001; Audubon Alaska 2002). These lists were produced by federal and state regulatory agencies and continental- and state-level working groups that consider the conservation of birds in Alaska. Further discussion of the species of conservation concern recorded at the Big Hurrah Mine is presented in the Discussion section below.

## **RESULTS**

### **WILDLIFE HABITATS**

During the mapping of wildlife habitats, we identified 26 land cover classes within the 1919-acre Big Hurrah Mine study area. These 26 land cover were then collapsed into 18 wildlife habitats (Table 2.1). The primary aggregations involved (1) combining open and closed scrub habitats and combining gravel land cover categories (both artificial and excavated). Open and closed scrub habitats were combined because both types occurred in patches across the study area and contained similar "edge" habitats, and in addition, the two types appeared to be used similarly by breeding birds. The gravel land cover categories were combined because these land cover types had similar characteristics and were rarely used by breeding birds. We maintained

the differences among land cover classes in landscape physiography because the different physiographic classes within a given vegetation structure type (e.g., upland and riverine tall willow scrub) can be used differently by breeding birds.

The Big Hurrah Mine study area occurs primarily in upland habitats, which comprise 1761 acres (92% of the acreage; Figure 2.2, Table 2.2). Riverine types were the second most common habitats, comprising 112 acres (6% of the acreage). Lacustrine water, lowland, and artificial habitats (mining excavations and gravel fill) were uncommon, and cumulatively, comprise <5% of the overall mapped area (Figure 2.2, Table 2.2). Dwarf scrub habitats which cover 1055 acres (55%) of the study area were the most common habitat types. Tall scrub habitats (riverine and upland) and low scrub habitats (riverine, lowland, and upland) cover 361 and 366 acres, respectively, and each type comprises 19% of study area. No other vegetative structure categories covered more than 3% of the study area (Table 2.2).

The proposed footprint of the Big Hurrah Mine occurs largely in upland areas, and would remove 69 acres of habitat in the uplands. This acreage represents 4% of the upland habitat available within the study area (Figure 2.2, Table 2.2). The artificial landscape class, disturbed areas from earlier mining operations at Big Hurrah, such as Excavated Gravel & Tailings and Gravel Fill, would be the second most common landscape class removed by development (23 acres or 51% of these types mapped in the study area would be affected). Few other landscape classes would be affected by the mine development (Figure 2.2, Table 2.2). The primary wildlife habitat types that would be directly affected by mine development include Upland Tall Willow Scrub and Upland Low Willow Scrub (16 acres and 18 acres, respectively; 13% of these types combined within study area), and 3 forms of upland dwarf scrub (Upland Dwarf Ericaceous Scrub, 6 acres; Upland Dwarf Birch–Ericaceous Scrub, 10 acres; and Upland Dwarf Birch–Ericaceous–Sedge Scrub, 16 acres; 17% of these types combined within study area; Table 2.2).

## **BREEDING BIRDS AND HABITAT USE**

We conducted 46 point counts in 12 wildlife habitat types mapped within the study area during 3–7 June 2005 (Table 2.2, Figure 2.2). Including the observations made in transit between sample points, we were able to sample 15 of the 18 mapped wildlife habitats. We were unable to sample Shallow Open Water, Upland Partially Vegetated Rock and Scree, and Upland Dry

Bluejoint–Herb Tundra (mostly covered with snow banks during our sampling). Together these unsampled habitats comprise <4% of the acreage in the Big Hurrah Mine study area.

During the field sampling, we recorded 511 observations of 42 bird species in the Big Hurrah Mine study area (Table 2.3). Most species were observed during point count sampling but additional species were observed as we traveled between sampling points in the field. Ten of these 42 bird species are considered species of conservation concern for western Alaska (Yellow-billed Loon, American Golden-Plover, Pacific Golden-Plover, Wandering Tattler, Whimbrel, Arctic Warbler, Gray-cheeked Thrush, Varied Thrush, Golden-crowned Sparrow, and Hoary Redpoll). More details on these species and the reasons for conservation concern are presented in Table 2.4 and the Discussion section (see below).

The most frequently recorded species in the study area were Common/Hoary Redpoll (species identification was often impossible with flying birds so all redpoll observations were combined), Golden-crowned Sparrow, Gray-cheeked Thrush, Fox Sparrow, Wilson's Warbler, Lapland Longspur, and Yellow Warbler (Table 2.5). We recorded over 25 observations for each of these species (>5% of all observations) and considered these species to be abundant in the study area. Ten other species were less frequently observed, recorded 6–24 times each (1–4% of all observations), and these were considered common in the study area (Table 2.5). An additional 25 species were recorded 1–5 times each (<1% of all observations) and were considered uncommon (Table 2.5). Two other species (Tundra Swan and Tree Swallow) were observed in flight while we were in transit between point count locations, but the number of individuals was not documented and abundance in the area was not determined (Table 2.5).

The use of habitats used by breeding birds at the Big Hurrah Mine was quite variable (Tables 2.6 and 2.7). Five of the less common species that were observed more than once (American Pipit, Northern Waterthrush, and 3 shorebird species) used only a single habitat type, whereas 9 of the more common and abundant passerine species used 5–8 different habitat types for breeding activities (Table 2.6). Of the species documented, Northern Waterthrush was the most specialized in habitat use, with 14 individuals using only Riverine Tall Willow Scrub (Table 2.6). Savannah Sparrow was the most generalist species with 21 individuals using 8 different habitat types.

Willow scrub types were the most commonly used wildlife habitats in the study area. Upland Tall Willow Scrub was used by 16 avian species (50% of species with habitat associations), and 10 of those species used this habitat  $\geq 30\%$  of the time (Table 2.7). Riverine Tall Willow Scrub was used by 15 species (47% of species with habitat associations), 10 of which used this habitat  $\geq 30\%$  of the time. Upland Low Willow Scrub was used  $\geq 30\%$  of the time by 12 different species (Table 2.7). Another important habitat was Upland Dwarf Ericaceous Scrub, which was used by 10 species, 3 of which used it exclusively. Riverine Tall Willow Scrub, Upland Low Willow Scrub, and Upland Tall Willow Scrub were used by 4 of the 9 species of conservation concern with habitat associations (Table 2.6 and 2.7).

### **EXPECTED IMPACTS TO BREEDING BIRD HABITATS**

Of the 42 bird species documented at the Big Hurrah Mine study area, 36 were recorded using habitats at the site (6 species were observed only in transit over the area). The amount of preferred breeding habitat that would be lost to development of the Big Hurrah Mine varies among the 36 bird species recorded using habitats in the study area, ranging from 0 to 53 acres (Tables 2.8 and 2.9). Savannah Sparrows would lose the largest amount of preferred breeding habitat (53 acres) from the proposed development (Table 2.8). This loss represents 6% of their total available preferred breeding habitats mapped within the study area. At the other end of the range, Harlequin Duck, Red-breasted Merganser, Semipalmated Plover, Spotted Sandpiper, Western Sandpiper, and Wandering Tattler will lose no preferred breeding habitats to development (Table 2.8) because no portions of larger stream or river gravel habitats (i.e., no portions of Big Hurrah Creek) fall within the development footprint (Table 2.2). (The Little Hurrah Creek drainage was too small to map on the aerial photography.) Bank Swallows would lose 25 acres of preferred breeding habitat and the second highest percentage of habitat relative to total available acreage within the study area (21% of the mapped area; Table 2.8). Say's Phoebe, which was observed only in Excavated Gravel & Tailings around buildings at the historic mine site, would lose 23 acres to development and 63% of that disturbed habitat will be altered by development (Table 2.8). All other avian species would lose  $< 37$  acres from development and  $< 8\%$  of their total available important breeding habitats in the study area (Table 2.8).

Of the 10 species of conservation concern observed at the Big Hurrah Mine study area, 1 species (Yellow-billed Loon) was only observed flying over the site, and another (Wandering Tattler) would lose no preferred breeding habitats to development (Table 2.8). Of the species of conservation concern that would lose habitat to development, Hoary Redpoll would lose the largest amount (36 acres or 6% of that available), while American Golden-Plover and Pacific Golden-Plover would lose only 6 acres each or <1% of that available. The remaining 5 species of conservation concern would lose from 16–34 acres of preferred breeding habitat from development of the Big Hurrah Mine. This represents 5–7% of their preferred breeding habitats available in the study area.

## DISCUSSION

The Big Hurrah Mine study area is situated predominately in upland terrain below the northeast flanks of Uncle Sam Mountain and encompasses 18 different wildlife habitat types. The bird species found in the Big Hurrah Mine area are typical for the habitat types documented (primarily passerine and shorebird species in upland scrub and tundra, and riverine scrub habitat types) and are known to be associated with these habitats across the larger Seward Peninsula area (Kessel 1989). Twenty-six (72%) of the 36 species documented using habitats at the Big Hurrah Mine study area were listed by Kessel (1989) as abundant, common, or fairly common breeders on the Seward Peninsula and 10 species (28%) were listed as uncommon breeders. Kessel conducted her field work on the Seward Peninsula in the late 1960s and 1970s, and subsequently declines in some populations of some of the species noted at the Big Hurrah Mine site have been documented, although it is often unknown if declines are occurring in populations in western Alaska or on the Seward Peninsula (see Table 2.4).

The most heavily-used avian habitats in the Big Hurrah Mine study area are the willow scrub types (in upland, lowland, and riverine situations). Of these habitats, tall willow scrub is the most important: 20 (55%) of the 36 avian species documented using habitats in the area were observed using Riverine or Upland Tall Willow Scrub (Table 2.6). Riverine Tall Willow Scrub was used exclusively by habitat specialist species such as the Northern Waterthrush. In contrast, low willow scrub (upland, lowland, and riverine types combined) were used by 12 (33%) of the avian species documented using habitats in the area. Upland Dwarf Ericaceous Scrub also was a

common and important habitat type, and was used by 10 avian species. These 6 habitats were considered important breeding habitats to 26 (72%) of the avian species documented; these habitats comprise 1332 acres (69%) of the study area and 42 acres (44%) of the proposed mine development footprint.

Of the 42 avian species recorded in the Big Hurrah Mine study area, preferred breeding habitat exists for 30 species within the area proposed for development of the mine. With development of the Big Hurrah Mine, none of these 30 species, with the exception of Say's Phoebe and Bank Swallow, would lose more than 8% of the total study area habitats considered important for breeding. Fourteen species would lose over 20 acres of preferred breeding habitat, and 8 species would lose between 10 and 20 acres (Table 2.8). It is unknown how many breeding pairs of each species could be affected by this removal of habitat. To derive information on bird densities (by habitat type) in an effort to determine bird numbers affected would require a more detailed field study, along with a literature review, and those activities were beyond the scope of this work.

During our study, we documented the presence of 10 species in the Big Hurrah Mine study area that are considered species of conservation concern for western Alaska by one or more agencies or specialist groups (see Table 2.4). The species of conservation concern designation does not carry legal status as does the listing of a species as federally threatened or endangered, but the designation does indicate there is concern over the potential for population declines and interest in maintaining healthy breeding populations of these species in Alaska. The 10 species of conservation concern can be of concern for one or more reasons: (1) populations in some part of the species' range have shown declines in recent years, usually on the breeding grounds; (2) relative abundance is low; (3) threats have been documented on the breeding grounds and/or in nonbreeding areas; (4) the breeding and/or nonbreeding distributions are small and therefore more susceptible to threats; (5) the species may be common but a large proportion of the worldwide breeding range occurs in Alaska (global stewardship species); or (6) the species may be widespread but Alaska represents a large proportion of the North American breeding range (North American stewardship species) (see Table 2.4). Eight of the 10 species of conservation concern recorded in the Big Hurrah Mine study area were found to favor breeding habitats that would be directly affected by development of the mine (preferred breeding habitats for Yellow-

billed Loons and Wandering Tattlers do not occur within the area proposed for mine development). Below are brief summaries of the reasons for conservation concern for those 8 species expected to be affected by development of the mine and a listing of the expected direct impacts.

## **HOARY REDPOLL**

In many cases Hoary Redpolls could not be separated from Common Redpolls in the field because the birds were often observed in flight well overhead. Both species, however, were identified at the Big Hurrah Mine when observation conditions were suitable. There are no known imminent threats to Hoary Redpoll breeding or wintering populations and the prospect for human-induced alterations of their remote arctic and boreal habitats is low (BPIFWG 1999). No population trend data are available for this species in North America (Sauer et al. 2005) and the difficulty of separating this species from Common Redpoll during surveys makes monitoring efforts nearly impossible. Because a large percentage of the species' North American breeding range is concentrated in the Arctic Avifaunal Biome, and especially northern and western Alaska (BPIFWG 1999), the Hoary Redpoll is considered a North American stewardship species for the Arctic Avifaunal Biome and for arctic Alaska (see Table 2.4). The primary concern for stewardship species is on maintaining breeding populations as these species are considered characteristic of a particular region; conservation concerns do not address specific population threats or declines (Rich et al. 2004). Considering Hoary and Common Redpolls together, the species pair was categorized as abundant in the Big Hurrah Mine study area; the species pair was the most numerous of the species recorded during the study (Table 2.5). Of the seven agency or working group lists that were evaluated that consider landbird conservation issues, only two ([National] Partners in Flight and Boreal Partners in Flight) listed Hoary Redpoll as a priority species for conservation (Table 2.4). The lack of representation on other priority species lists is likely due to the fact that the species is currently common and widespread and because declines in population numbers of Hoary Redpolls have not been noted. Development of the Big Hurrah Mine would remove 36 acres of preferred breeding habitats for this species and this represents 6% of the preferred habitats available in the Big Hurrah Mine study area (Table 2.8).

## **GOLDEN-CROWNED SPARROW**

There are concerns that increasing urbanization in wintering areas in western North America may reduce availability of nonbreeding habitat for this species (BPIFWG 1999) but no declines in wintering populations in North America have been noted (Norment et al. 1998). No data are available on population trends for breeding birds in North America (Sauer et al. 2005). Golden-crowned Sparrow is considered a stewardship species for the Pacific Avifaunal Biome and for Alaska because large percentages of the species' global breeding range are concentrated in these two regions (see Table 2.4). For stewardship species, conservation concerns are focused on maintaining breeding populations because these species are considered characteristic of a particular region. The primary concern for this species in Alaska is focused on monitoring and maintaining breeding populations in the state (BPIFWG 1999). In the Big Hurrah Mine study area, Golden-crowned Sparrows were categorized as abundant breeders; the species was the second most frequently recorded during the 2005 breeding season (Table 2.5). Golden-crowned Sparrows are listed as a priority species for conservation in Alaska on only two agency or working group lists ([National] Partners in Flight and Boreal Partners in Flight), out of the seven lists evaluated that consider landbird conservation issues (Table 2.4). The lack of representation on other priority species lists is likely due to the fact that the species is currently common and because declines in breeding population numbers are not known. Golden-crowned Sparrows are well known to be common throughout their breeding range in Alaska in appropriate habitat and they were abundant in the Big Hurrah Mine study area. Development of the mine would remove 34 acres of preferred breeding habitats for this species (7% of the preferred habitats available in the Big Hurrah Mine study area; Table 2.8).

## **GRAY-CHEEKED THRUSH**

The Gray-cheeked Thrush is of conservation concern because there are indications, from an analysis of Breeding Bird Survey (BBS) data, that declines in breeding populations in eastern North America occurred from 1978 to 1988 (Sauer and Droege 1992). A longer time-period analysis of BBS data for Canada only, where this species is more common, shows a statistically significant population decline of 8.8% per year from 1967 to 2000 (although these results apply to only a small portion of the breeding range; Dunn 2005). Similar population trend data for



Alaska are not available (Sauer et al. 2005). On their tropical wintering grounds, the species is considered vulnerable to deforestation of broadleaf forests (Petit et al. 1993). Because Gray-cheeked Thrushes breed largely in relatively remote and undisturbed boreal forest and arctic environments where population threats are minimal, it is possible that declines in breeding populations may be driven primarily by the effects of tropical deforestation on the wintering grounds. Still there are concerns that breeding populations in Alaska should be monitored and maintained because a large percentage of the species' global breeding range is concentrated in Alaska (BPIFWG 1999). The Gray-cheeked Thrush is listed as a priority species for conservation in Alaska on three of the seven agency or working group lists that consider landbird conservation issues in the state (Table 2.4). Gray-cheeked Thrushes are known to be common in appropriate habitats in Alaska during the breeding season and they were found to be abundant breeders in the Big Hurrah Mine study area where they were the third most frequently recorded species (Table 2.5). Development of the mine would remove 18 acres of preferred breeding habitats for this species (5% of the preferred habitats available in the Big Hurrah Mine study area; Table 2.8).

## **ARCTIC WARBLER**

The Arctic Warbler is considered as a species of conservation concern on only one (USFWS 2002) of the seven agency or working group lists that consider landbird conservation issues in the state (Table 2.4). The subspecies that breeds in Alaska, *P. b. kennicotti*, is of concern because it is endemic to the state (i.e., 100% of the world population of this subspecies breeds in Alaska); there also are indications of declines in numbers in the 1990s on BBS routes on the Seward Peninsula (Brad Andres, USFWS, pers. comm.). There are, however, no known broad-scale population threats for this subspecies. Arctic Warblers are patchy and locally common in their occurrence across their range in Alaska. In the Big Hurrah Mine study area, they were categorized as common breeders but their numbers were relatively low and just over the threshold to be categorized as common; the species also could be considered somewhat uncommon in the area (see Table 2.5). Development of the Big Hurrah Mine would remove 18 acres of important breeding habitats for this species and this represents 5% of the preferred habitats available in the Rock Creek Mine study area (Table 2.8).

## **AMERICAN GOLDEN-PLOVER**

The American Golden-Plover is considered a species of High Concern for conservation in the U.S. Shorebird Conservation Plan (USSCP 2002) because substantial population declines, from 1970s levels, have been noted on the breeding grounds in the Northwest Territories (Gratto-Trevor et al. 1998). Population levels at another Nearctic breeding site, however, show no declines and no significant declines have been noted at migration staging areas on the North American east coast (Morrison et al. 1994). Caution is expressed that because of the broad and largely inaccessible breeding range of this species, little is known about the population trends during breeding. Population threats on the wintering grounds in South America are of concern (see Audubon Society 2002), and because this species breeds in remote and relatively undisturbed arctic regions, any population declines are generally suspected to occur from increased mortality during the nonbreeding seasons. American Golden-Plovers are widely dispersed across arctic regions in Alaska, they defend large territories and breed at low densities. In the Big Hurrah Mine study area, American Golden-Plovers were found to be uncommon (only 3 observations were recorded; Table 2.5). Development of the Big Hurrah Mine would remove 6 acres of preferred breeding habitats for this species and this represents <1% of the preferred habitats available in the Big Hurrah Mine study area (Table 2.8).

## **PACIFIC GOLDEN-PLOVER**

In North America, the Pacific Golden-Plover occupies a naturally small breeding range in western and northwestern Alaska and has a small population size; the Alaskan birds also are considered to have a restricted wintering range in the tropical Pacific (Johnson and Connors 1996). Because of these reasons, it is considered of Moderate Priority for conservation in the U.S. Shorebird Conservation Plan (USSCP 2002). This species makes long-distance trans-oceanic flights from Alaska to wintering sites in the tropical Pacific. It is actually widely dispersed throughout the tropical Pacific during the winter but because the range consists largely of littoral habitats and cleared areas on small islands, it is considered to have a restricted winter range in terms of habitat availability. Threats to populations on the wintering grounds in the tropical Pacific are of concern (Audubon Society 2002) and the species also is considered vulnerable on the breeding grounds because of the small population size and restricted breeding

distribution (ASWG 2000; USSCP 2002). Pacific Golden-Plovers breed at low densities in western Alaska and in the Big Hurrah Mine study area, the species was found to be uncommon (only 2 observations were recorded; Table 2.5). Development of the Big Hurrah Mine would remove 6 acres of preferred breeding habitats for this species and this represents <1% of the preferred habitats available in the Big Hurrah Mine study area (Table 2.8).

## **WHIMBREL**

Significant population declines in the Hudson Bay population of Whimbrels (Skeel and Mallory 1996) are the primary reason this species is considered of High Concern in the U.S. Shorebird Conservation Plan (USSCP 2002). An overall low population size for this species and a restricted breeding distribution in North America also are of concern (USSCP 2002). Over 65% of the world population of one subspecies, *Numenius phaeopus rufiventris*, breeds in Alaska and conservation measures are recommended to maintain populations of this subspecies in the state (ASWG 2000). Habitat loss on the wintering grounds and at migration stop-over sites also has been noted (Audubon Society 2002). Because this species breeds in remote and relatively undisturbed arctic regions, it is possible that population declines stem from increased mortality during the nonbreeding seasons. Whimbrels are widely dispersed across tundra regions in Alaska and breed at low densities. In the Big Hurrah Mine study area, Whimbrels were found to be uncommon (only 2 observations were recorded; Table 2.5). Development of the Big Hurrah Mine would remove 16 acres of preferred breeding habitats for this species and this represents 7% of the preferred habitats available in the Big Hurrah Mine study area (Table 2.8).

## **VARIED THRUSH**

The Varied Thrush is considered vulnerable to forestry management practices because its primary habitat is coniferous forests on the North American west coast and in Alaska (BPIFWG 1999). BBS data also indicate statistically significant population declines of 1.1% per year in western North America from 1980 to 2004 (Sauer et al. 2005). No significant declines have been found in Alaskan populations over the same time period (Sauer et al. 2005). Similar to the Golden-crowned Sparrow, the Varied Thrush is considered a stewardship species for the Pacific Avifaunal Biome and for Alaska because large percentages of the Varied Thrush's global

breeding range are concentrated in these two regions (see Table 2.4). For stewardship species, conservation concerns are focused on maintaining breeding populations because these species are considered characteristic of a particular region (Rich et al. 2004). The primary concern for this species in Alaska is focused on monitoring and maintaining breeding populations in the state (BPIFWG 1999). Varied Thrushes on the Seward Peninsula are near the limit of their range in Alaska, and in non-forested areas, are using tall scrub habitats not typical of the species elsewhere; they are common in mixed forests in the interior and coastal coniferous forests in the southern part of the state. In the Big Hurrah Mine study area, Varied Thrushes were categorized as uncommon breeders (only 1 observation was recorded; Table 2.5). Varied Thrushes are listed as a priority species for conservation in Alaska on only two agency or working group lists ([National] Partners in Flight and Boreal Partners in Flight), out of the seven lists evaluated that consider landbird conservation issues (Table 2.4). The lack of representation on other priority species lists is likely due to the fact that the species is currently common throughout much of its range. Development of Big Hurrah the mine would remove 16 acres of preferred breeding habitats for this species (6% of the preferred habitats available in the Big Hurrah Mine study area; Table 2.8).

## CONCLUSION

The expected impacts and habitat loss percentages discussed here have so far been considered only on a local scale (within the Big Hurrah Mine study area). The percentages of important breeding habitats expected to be removed by development are based on the relative abundance of habitats within the mine footprint as compared to the surrounding study area. The local study area used was about 20-times the area of the proposed mine development, which compares to the much smaller local study area for the Rock Creek Mine (see Section 1) which was only about 4-fold larger than the proposed mine footprint. Local-scale impacts are expected to be far less at the Big Hurrah Mine than at Rock Creek (see Section 1), which indicates that the assessment of local scale impacts is highly dependent on the size of the local study area. From a broader, regional perspective, the bird species assemblage documented in the Big Hurrah Mine study area is similar to species assemblages found in similar habitats across the Seward Peninsula (Kessel 1989). Moreover, the important breeding habitats used by these species,

including those of conservation concern, are not unique to the Big Hurrah Mine area, but are widespread across low mountainous areas of the Seward Peninsula (Kessel 1989). As a case in point, 27 (or 82%) of the bird species documented using habitats at the Big Hurrah Mine study area also were found at the Rock Creek Mine near Nome, which shares many of the same habitats (see Section 1); this comparison omits waterfowl that prefer lacustrine waterbodies and the shorebirds that prefer wet tundra because lacustrine waterbodies are very rare and wet tundra habitats are not present at the Big Hurrah Mine.

The Seward Peninsula, outside of the Nome area and the scattered small villages, is relatively undeveloped, which means that largely undisturbed avian habitats will be available for use by breeding birds throughout the peninsula. Considering this widespread availability of common habitats at the regional scale of the Seward Peninsula, the direct impacts to breeding bird habitats from development of the Big Hurrah Mine would be expected to be of much less magnitude than the impacts expected at the local scale of the Big Hurrah Mine study area. In the language of the National Environmental Policy Act (NEPA), the impacts at the local scale are probably best considered moderately significant (considering the removal of small amounts of breeding habitats for several species of conservation concern) whereas the impacts at the regional scale would be nearly negligible. If the assessments at the two spatial scales were melded, an overall determination of marginally significant impacts might be most appropriate.

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Table 2.1. Aggregation used to collapse mapped land cover classes into wildlife habitat types at the Big Hurrah Mine area, Alaska.

Wildlife Habitat Type	Mapped Land Cover Class
Shallow Open Water	Shallow Open Water
Stream or River	Lower Perennial Stream
	Upper Perennial Stream
	Barren River Gravels
River Gravels	Barren River Gravels
Riverine Low Willow Scrub	Riverine Closed Low Willow Scrub
	Riverine Open Low Willow Scrub
	Riverine Closed Tall Willow Scrub
Riverine Tall Willow Scrub	Riverine Closed Tall Willow Scrub
	Riverine Open Tall Willow Scrub
	Lowland Open Low Willow Scrub
Lowland Low Willow Scrub	Lowland Open Low Willow Scrub
Upland Dry Bluejoint-Herb Tundra	Upland Dry Bluejoint-Herb Tundra
Upland Dwarf Ericaceous Scrub	Upland Dwarf Ericaceous Scrub
Upland Dwarf Birch-Ericaceous Scrub	Upland Dwarf Birch-Ericaceous Scrub
Upland Dwarf Birch-Ericaceous-Sedge Scrub	Upland Dwarf Birch-Ericaceous-Sedge Scrub
Upland Low Birch-Willow Scrub	Upland Open Low Birch-Willow Scrub
Upland Low Willow Scrub	Upland Closed Low Willow Scrub
	Upland Open Low Willow Scrub
	Upland Open Low Willow-Sedge Scrub
Upland Low Willow-Sedge Scrub	Upland Open Low Willow-Sedge Scrub
Upland Tall Alder Scrub	Upland Tall Open Alder Scrub
Upland Tall Willow Scrub	Upland Closed Tall Willow Scrub
	Upland Open Tall Willow Scrub
	Upland Partially Vegetated Rock and Scree
Excavated Gravel & Tailings	Upland Partially Vegetated Rock and Scree
	Barren Excavated Gravel
	Partially Revegetated Excavated Gravel
Gravel Fill	Maintained Gravel Fill
	Unmaintained Airstrip Fill
	Partially Revegetated Airstrip Fill

Table 2.2. Mapped wildlife habitat types at the Big Hurrah Mine study area, Alaska, 2005: number of point count surveys conducted, acreage mapped, percent of total study area mapped, acreage expected to be removed by mine development footprint, and percent of habitats in total study area expected to be removed by mine development footprint.

Class	Wildlife Habitat Type	No. Point Counts	Acres Mapped	% of Study Area	Acres in Mine Footprint	% of Habitat in Footprint
Lacustrine	Shallow Open Water	0	0.18	0.01	0.00	0.00
	<b>Lacustrine subtotal</b>	<b>0</b>	<b>0.18</b>	<b>0.01</b>	<b>0.00</b>	<b>0.00</b>
Riverine	Stream or River	0	10.85	0.57	0.00	0.00
	River Gravels	0	13.54	0.71	0.00	0.00
	Riverine Low Willow Scrub	4	19.55	1.02	0.00	0.00
	Riverine Tall Willow Scrub	6	68.39	3.56	2.42	3.54
	<b>Riverine subtotal</b>	<b>10</b>	<b>112.33</b>	<b>5.85</b>	<b>2.42</b>	<b>2.15</b>
Lowland	Lowland Low Willow Scrub	1	0.44	0.02	0.00	0.00
	<b>Lowland subtotal</b>	<b>1</b>	<b>0.44</b>	<b>0.02</b>	<b>0.00</b>	<b>0.00</b>
Upland	Upland Dry Bluejoint-Herb Tundra	0	11.72	0.61	0.00	0.00
	Upland Dwarf Ericaceous Scrub	9	718.64	37.45	6.10	0.85
	Upland Dwarf Birch-Ericaceous Scrub	3	108.14	5.64	10.09	9.33
	Upland Dwarf Birch-Ericaceous-Sedge Scrub	3	228.19	11.89	15.56	6.82
	Upland Low Birch-Willow Scrub	1	77.34	4.03	0.00	0.00
	Upland Low Willow Scrub	5	234.50	12.22	17.97	7.66
	Upland Low Willow-Sedge Scrub	2	33.95	1.77	3.76	11.08
	Upland Tall Alder Scrub	1	2.74	0.14	0.00	0.00
	Upland Tall Willow Scrub	9	290.06	15.12	15.89	5.48
	Upland Partially Vegetated Rock and Scree	0	55.74	2.91	0.00	0.00
	<b>Upland subtotal</b>	<b>33</b>	<b>1761.03</b>	<b>91.78</b>	<b>69.37</b>	<b>3.94</b>
Artificial	Excavated Gravel & Tailings	1	36.47	1.90	22.83	62.60
	Gravel Fill	0	8.25	0.43	0.00	0.00
	<b>Artificial subtotal</b>	<b>1</b>	<b>44.72</b>	<b>2.33</b>	<b>22.83</b>	<b>51.05</b>

Table 2.3. Avian species observed at the Big Hurrah Mine study area, Alaska, 3–7 June 2005.

Avian Group	Common name	Scientific name
Waterfowl	Tundra Swan	<i>Cygnus columbianus</i>
	Harlequin Duck	<i>Histrionicus histrionicus</i>
	Red-breasted Merganser	<i>Mergus serrator</i>
Grouse	Willow Ptarmigan	<i>Lagopus lagopus</i>
Loons	Yellow-billed Loon	<i>Gavia adamsii</i>
Raptors	Northern Harrier	<i>Circus cyaneus</i>
	Rough-legged Hawk	<i>Buteo lagopus</i>
	Merlin	<i>Falco columbarius</i>
Shorebirds	American Golden-Plover	<i>Pluvialis dominica</i>
	Pacific Golden-Plover	<i>Pluvialis fulva</i>
	Semipalmated Plover	<i>Charadrius semipalmatus</i>
	Wandering Tattler	<i>Heteroscelus incanus</i>
	Spotted Sandpiper	<i>Actitis macularius</i>
	Whimbrel	<i>Numenius phaeopus</i>
	Western Sandpiper	<i>Calidris mauri</i>
Jaegers & Gulls	Wilson's Snipe	<i>Gallinago delicata</i>
	Long-tailed Jaeger	<i>Stercorarius longicaudus</i>
	Mew Gull	<i>Larus canus</i>
	Say's Phoebe	<i>Sayornis saya</i>
Corvids	Common Raven	<i>Corvus corax</i>
Passerines	Tree Swallow	<i>Tachycineta bicolor</i>
	Bank Swallow	<i>Riparia riparia</i>
	Arctic Warbler	<i>Phylloscopus borealis</i>
	Bluethroat	<i>Luscinia svecica</i>
	Northern Wheatear	<i>Oenanthe oenanthe</i>
	Gray-cheeked Thrush	<i>Catharus minimus</i>
	American Robin	<i>Turdus migratorius</i>
	Varied Thrush	<i>Ixoreus naevius</i>
	Eastern Yellow Wagtail	<i>Motacilla tschutschensis</i>
	American Pipit	<i>Anthus rubescens</i>
	Orange-crowned Warbler	<i>Vermivora celata</i>
	Yellow Warbler	<i>Dendroica petechia</i>
	Northern Waterthrush	<i>Seiurus noveboracensis</i>
	Wilson's Warbler	<i>Wilsonia pusilla</i>
	American Tree Sparrow	<i>Spizella arborea</i>
	Savannah Sparrow	<i>Passerculus sandwichensis</i>
	Fox Sparrow	<i>Passerella iliaca</i>
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>	
Golden-crowned Sparrow	<i>Zonotrichia atricapilla</i>	
Lapland Longspur	<i>Calcarius lapponicus</i>	
Common Redpoll	<i>Carduelis flammæa</i>	
Hoary Redpoll	<i>Carduelis hornemanni</i>	

Table 2.4. Avian species of conservation concern observed at the Big Hurrah Mine study area, Alaska, 3–7 June, 2004, and the reasons for management agency or conservation group concern.

Avian species of concern	Organization <sup>a</sup>	Reasons for concern <sup>b</sup>
Yellow-billed Loon	USFWS	Concerns are focused on the naturally small breeding populations and small breeding range, and known threats during breeding and nonbreeding.
	ABC	Of concern because the species has a restricted distribution (both breeding and nonbreeding ranges) and a low overall population size.
	NAWCP	Species not evaluated in Version 1 of the NWACP.
	AUD-N	Same concerns as ABC.
	BLM	Listed as a sensitive species. <sup>c</sup>
	AUD-AK	Of concern because of a small total population size and known threats to breeding and nonbreeding populations. Most of the world population of this species nests on the North Slope of Alaska, where disturbance in oilfields is of concern. It also is considered vulnerable to marine oil spills during migration and nonbreeding in coastal Alaska.
American Golden-Plover	USFWS	Research suggests population declines in this species and threats to nonbreeding habitats. The species is concentrated in Alaska during breeding and maintenance of populations in the state is of concern.
	ABC	Although a moderately abundant species, it is of concern because of apparent population declines and high threats to nonbreeding populations.
	USSCP	Listed as a species of High Concern (for global populations) because of apparent population declines and high threats to nonbreeding populations.
	AUD-N	Same concerns as ABC and USSCP.
Pacific Golden-Plover	USFWS	A naturally small range in North America and a small breeding population, restricted to western and northwestern Alaska, may make this species susceptible to threats on the breeding grounds. Because of this, conservation measures on the breeding grounds are considered important.
	ABC	Of concern because the species has a restricted distribution (both breeding and nonbreeding ranges) and a low overall population size.
	USSCP	Listed as a species of Moderate Concern because of low overall population size and small breeding and nonbreeding distributions.
	AUD-N	Concerns are focused on threats to populations on the wintering grounds in the tropical South Pacific.
	ASWG	This species has concentrated breeding and migration areas in western Alaska. It is of conservation importance to the U.S. and within Alaska because of its small population size (~ 16,000) and because its North American breeding range is restricted to Alaska.
	AUD-AK	Same concerns as ABC and USSCP.
Wandering Tattler	USSCP	Listed as a species of Moderate Concern largely because of its low world population size.
	ASWG	This species is of particular concern in western Alaska because

		western Alaska is the principal breeding area and the species' total population is small (probably <10,000 individuals), thus making it one of the least populous shorebird species worldwide. Another compounding factor is that little scientific information is known about this species.
	AUD-AK	Western Alaska is a major breeding area for this species. Its estimated world population may be as low as 10,000 birds and there are concerns about its relative abundance worldwide.
Whimbrel	USFWS	Research suggests population declines for this species, a naturally small range and population size in North America, and substantial habitat loss in migration and wintering areas.
	ABC	Although a moderately abundant species, it is of concern because of apparent population declines.
	USSCP	Listed as a species of High Concern (for North American populations) because of apparent population declines, relatively low population size, and a restricted breeding distribution.
	AUD-N	Same concerns as USSCP.
	ASWG	Populations in Alaska are considered of conservation importance because a majority of the population of the subspecies, <i>Numenius phaeopus rufiventris</i> , breeds in Alaska. The species' total population in North America is estimated at ~ 60,000 birds, of which as many as 40,000 occur in Alaska.
Arctic Warbler	USFWS	Of conservation concern in Alaska because the subspecies that breeds in Alaska, <i>P. b. kennicotti</i> , is endemic to the state (i.e., 100% of the world population of this subspecies breeds in Alaska).
Gray-cheeked Thrush	BLM	Listed as a sensitive species. <sup>c</sup>
	ADFG	Listed as a State of Alaska Species of Special Concern. <sup>d</sup>
	BPIF	Breeding Bird Survey data suggest this species has suffered population declines on breeding grounds in eastern North America between 1978–1988 (Sauer and Droege 1992), and the species is considered vulnerable to tropical deforestation on the wintering grounds (Petit et al. 1993). Because a large proportion of the species' worldwide breeding range occurs in Alaska, there is global concern (stewardship responsibility) for maintaining population numbers in Alaska.
Varied Thrush	PIF	This species is common throughout its range in appropriate habitat, but because significant portions of the worldwide breeding and wintering populations occur in a single biome (Pacific Avifaunal Biome, which includes south coastal Alaska), it is considered a stewardship species for that biome. Conservation concern is focused on maintaining populations of this biome-characteristic species.
	BPIF	Because a large proportion of the species' worldwide breeding range occurs in Alaska, there is global concern (stewardship responsibility) for maintaining breeding population numbers in Alaska.
Golden-crowned Sparrow	PIF	This species is common throughout its range in appropriate habitat, but because significant portions of the worldwide breeding and wintering populations occur in a single biome (Pacific Avifaunal Biome, which includes south coastal Alaska), it is considered a stewardship species for that biome. Conservation concern is focused on maintaining

		populations of this biome-characteristic species.
	BPIF	Because a large proportion of the species' worldwide breeding range occurs in Alaska, there is global concern (stewardship responsibility) for maintaining breeding population numbers in Alaska.
Hoary Redpoll	PIF	This species is widespread in the arctic, but because significant portions of the western hemisphere's breeding and wintering populations occur in a single biome (Arctic Avifaunal Biome), it is considered a stewardship species for that biome. Conservation concern is focused on maintaining populations of this biome-characteristic species.
	BPIF	Because Alaska represents a large proportion of the species' breeding range in North America, there is North American concern (stewardship responsibility) for maintaining breeding populations in Alaska.

<sup>a</sup> ABC = American Bird Conservancy; ADFG = Alaska Department of Fish & Game; ASWG = Alaska Shorebird Working Group; AUD-AK = Audubon Alaska; AUD-N = National Audubon Society; BLM = U.S. Department of the Interior, Bureau of Land Management; BPIF = Boreal Partners in Flight; PIF = [National] Partners In Flight; NAWCP = North American Waterbird Conservation Plan (cooperative council of numerous organizations); USFWS = U.S. Fish & Wildlife Service; USSCP = U.S. Shorebird Conservation Plan (cooperative council of numerous organizations).

<sup>b</sup> American Bird Conservancy Green List (ABC 2005); State of Alaska Species of Special Concern (ADFG 1998); Alaska Shorebird Working Group Species of Concern (ASWG 2000); Audubon Alaska Watch List (Audubon Alaska 2002); National Audubon Society Watch List (Audubon Society 2002); Bureau of Land Management (BLM 2001); Boreal Partners in Flight Working Group Priority Species of Concern for western Alaska (BPIFWG 1999); Partners In Flight North American Landbird Conservation Plan (Rich et al. 2004); North American Waterbird Conservation Plan (Kushlan et al. 2001); U.S. Fish & Wildlife Service Species of Conservation Concern for western Alaska (USFWS 2002); U.S. Shorebird Conservation Plan (USSCP 2004).

<sup>c</sup> BLM (2001) defines sensitive species as those: (1) under status review by the FWS/NMFS; or (2) whose numbers are declining so rapidly that Federal listing may become necessary; or (3) with typically small and widely dispersed populations; or (4) inhabiting ecological refugia or other specialized or unique habitat.

<sup>d</sup> State of Alaska Species of Special Concern (ADFG 1998), "is any species or subspecies of...bird native to Alaska that has entered a long-term decline in abundance or is vulnerable to a significant decline due to low numbers, restricted distribution, dependence on limited habitat resources, or sensitivity to environmental disturbance."

Table 2.5. Number observed, percent of total observations, and abundance category for birds recorded at the Big Hurrah Mine study area, Alaska, 3–7 June 2005. Observations from point count data and incidental sightings. Species in bold are of conservation concern (see Table 2.4).

Species	No. Observed	% of Total Observations	Abundance Category <sup>a</sup>
Common & <b>Hoary Redpoll</b> <sup>b</sup>	76	14.87	A
<b>Golden-crowned Sparrow</b>	53	10.37	A
<b>Gray-cheeked Thrush</b>	49	9.59	A
Fox Sparrow	40	7.83	A
Wilson's Warbler	36	7.05	A
Lapland Longspur	36	7.05	A
Yellow Warbler	27	5.28	A
Savannah Sparrow	24	4.70	C
Wilson's Snipe	20	3.91	C
Northern Waterthrush	20	3.91	C
American Tree Sparrow	19	3.72	C
Orange-crowned Warbler	16	3.13	C
American Robin	13	2.54	C
Long-tailed Jaeger	10	1.96	C
American Pipit	8	1.57	C
<b>Arctic Warbler</b>	6	1.17	C
Bluethroat	6	1.17	C
Willow Ptarmigan	5	0.98	U
Bank Swallow	4	0.78	U
Eastern Yellow Wagtail	4	0.78	U
White-crowned Sparrow	4	0.78	U
Red-breasted Merganser	3	0.59	U
<b>American Golden-Plover</b>	3	0.59	U
Unidentified golden-plover	3	0.59	U
<b>Wandering Tattler</b>	3	0.59	U
Common Raven	3	0.59	U
Unidentified swallow	3	0.59	U
Unidentified sparrow	3	0.59	U
<b>Yellow-billed Loon</b>	2	0.39	U
Harlequin Duck	2	0.39	U
<b>Pacific Golden-Plover</b>	2	0.39	U
<b>Whimbrel</b>	2	0.39	U
Mew Gull	2	0.39	U
Northern Harrier	1	0.20	U
Rough-legged Hawk	1	0.20	U
Merlin	1	0.20	U
Semipalmated Plover	1	0.20	U
Spotted Sandpiper	1	0.20	U
Western Sandpiper	1	0.20	U
Say's Phoebe	1	0.20	U
Northern Wheatear	1	0.20	U
<b>Varied Thrush</b>	1	0.20	U
Tundra Swan	x	x	x
Tree Swallow	x	x	x

<sup>a</sup> Species were considered Abundant (A) if they comprised >5% of the total observations, Common (C) if they were 1-5% of the observations, or Uncommon (U) if they were <1% of the observations; "x" used for species observed at least once in flight during incidental sightings but numbers of individuals are unknown.



<sup>b</sup> Both species were observed in the study area but because many redpolls were observed in flight and could not be identified to species, the records for both species were combined.



Table 2.6. (Continued).

Avian Species	Wildlife Habitat														
	Stream or River	River Gravels	Riverine Low Willow Scrub	Riverine Tall Willow Scrub	Lowland Low Willow Scrub	Upland Dwarf Ericaceous Scrub	Upland Dwarf Birch-Ericaceous Scrub	Upland Dwarf Birch-Ericaceous-Sedge Scrub	Upland Low Birch-Willow Scrub	Upland Low Willow Scrub	Upland Low Willow-Sedge Scrub	Upland Tall Alder Scrub	Upland Tall Willow Scrub	Excavated Gravel & Tailings	Gravel Fill
<b>Varied Thrush</b>													1		
<b>Wandering Tattler</b>		2													
Western Sandpiper		1													
<b>Whimbrel</b>							2								
White-crowned Sparrow				1											
Willow Ptarmigan							2						1		
Wilson's Snipe					1								4		
Wilson's Warbler			2	9	1					10			11		
Yellow Warbler				17		1					1		4	1	

<sup>a</sup> The observation for Semipalmated Plover was recorded in a map polygon coded as Riverine Tall Willow Scrub but the bird was using a patch of open River Gravels in that map polygon that was too small to map; for the assessment of impacts from mine development, the important breeding habitat for Semipalmated Plover was treated as River Gravels (see Table 2.8).

Table 2.7. Percentage of total observations for each bird species in mapped wildlife habitats at the Big Hurrah study area, Alaska, 3–7 June 2005. Species in bold are of conservation concern (see Table 2.4).

Avian Species	Wildlife Habitat														
	Stream or River	River Gravels	Riverine Low Willow Scrub	Riverine Tall Willow Scrub	Lowland Low Willow Scrub	Upland Dwarf Ericaceous Scrub	Upland Dwarf Birch-Ericaceous Scrub	Upland Dwarf Birch-Ericaceous-Sedge Scrub	Upland Low Birch-Willow Scrub	Upland Low Willow Scrub	Upland Low Willow-Sedge Scrub	Upland Tall Alder Scrub	Upland Tall Willow Scrub	Excavated Gravel & Tailings	Gravel Fill
<b>American Golden-Plover</b>						33			67						
American Pipit						100									
American Robin				33		33								33	
American Tree Sparrow			6	25	6			6		6	6			44	
<b>Arctic Warbler</b>			20		20				20	40					
Bank Swallow		25		50											25
Bluethroat									17	50	17			17	
Common & <b>Hoary Redpoll</b>			9	23		5				23	9	23	9		
Eastern Yellow Wagtail			33	33						33					
Fox Sparrow				30					4	22		4	39		
<b>Golden-crowned Sparrow</b>				4		4	4		4	42		4	38		
<b>Gray-cheeked Thrush</b>				44						12			44		
Harlequin Duck	100														
Lapland Longspur						57	30	4							9
Long-tailed Jaeger							25	50							25
Mew Gull				100											
Northern Harrier								50					50		
Northern Waterthrush				100											
Northern Wheatear						100									
Orange-crowned Warbler				7	7					7		7	71		
<b>Pacific Golden-Plover</b>						100									
Red-breasted Merganser	100														
Savannah Sparrow			5			10	5	14	10	24	14		19		
Say's Phoebe															100
Semipalmated Plover		100													
Spotted Sandpiper		100													
<b>Varied Thrush</b>													100		
<b>Wandering Tattler</b>		100													
Western Sandpiper		100													
<b>Whimbrel</b>								100							
White-crowned Sparrow				100											
Willow Ptarmigan								67					33		
Wilson's Snipe					20								80		
Wilson's Warbler			6	27	3					30			33		
Yellow Warbler				71		4					4		17	4	

Table 2.8. Acres of preferred breeding bird habitats<sup>a</sup> expected to be removed by development of the Big Hurrah Mine compared to acres of surrounding preferred breeding habitats that will not be directly affected by mine development. Species in bold are of conservation concern (see Table 2.4).

Avian Species	Total Acres Expected Removed	Total Acres Not Directly Affected	% Acres Removed of Total Mapped Area
Say's Phoebe	22.83	13.64	62.60
Bank Swallow	25.25	93.16	21.33
Long-tailed Jaeger	25.65	311.93	7.60
<b>Whimbrel</b>	15.56	213.89	6.78
<b>Golden-crowned Sparrow</b>	33.86	490.69	6.46
Eastern Yellow Wagtail	20.39	302.04	6.32
Bluethroat	21.73	324.06	6.28
Savannah Sparrow	53.18	812.12	6.15
American Tree Sparrow	36.28	556.66	6.12
Common & <b>Hoary Redpoll</b>	36.28	556.66	6.12
Wilson's Warbler	36.28	556.66	6.12
Fox Sparrow	36.28	559.40	6.09
Northern Harrier	31.45	488.05	6.05
Willow Ptarmigan	31.45	488.05	6.05
<b>Varied Thrush</b>	15.89	274.16	5.48
Wilson's Snipe	15.89	274.16	5.48
<b>Arctic Warbler</b>	17.97	313.86	5.42
<b>Gray-cheeked Thrush</b>	18.31	340.13	5.11
Orange-crowned Warbler	18.31	340.13	5.11
Yellow Warbler	18.31	340.13	5.11
Mew Gull	2.42	65.97	3.54
Northern Waterthrush	2.42	65.97	3.54
White-crowned Sparrow	2.42	65.97	3.54
American Robin	24.41	1052.67	2.27
Lapland Longspur	16.19	810.59	1.96
<b>American Golden-Plover</b>	6.10	712.54	0.85
American Pipit	6.10	712.54	0.85
Northern Wheatear	6.10	712.54	0.85
<b>Pacific Golden-Plover</b>	6.10	789.89	0.77
Harlequin Duck	0.00	13.54	0.00
Red-breasted Merganser	0.00	13.54	0.00
Semipalmated Plover	0.00	10.85	0.00
<b>Wandering Tattler</b>	0.00	10.85	0.00
Spotted Sandpiper	0.00	10.85	0.00
Western Sandpiper	0.00	10.85	0.00

<sup>a</sup> Habitat types used for displaying, foraging, and nesting that cumulatively sum to  $\geq 75\%$  use by that avian species (see text).

Appendix A. Descriptions of wildlife habitat types identified and mapped at the Rock Creek Mine, Alaska, 2004.

Wildlife Habitat	Description
Shallow Open Water	Ponds and small lakes <1.5 m deep with emergent vegetation covering <5% of the waterbody surface. Due to the shallow depth, water freezes to the bottom during winter and thaws in summer. These ponds are only found west of the Glacier Creek Road in lowland terrain of the Snake River floodplain and often are surrounded by wet sedge or mixed shrub and sedge-dominated habitats.
Stream or River	This class refers to the mappable sections of Glacier Creek, Rock Creek, Lindblom Creek, and a small section of the Snake River.
River Gravel	Barren (<5% cover) and partially vegetated river gravel, sand, and silt (5–30% cover) found along the streams and rivers noted above. Characterized by scattered forbs such as <i>Artemisia tilesii</i> , <i>Aster sibiricus</i> , <i>Epilobium latifolium</i> , <i>Equisetum variegatum</i> , <i>Parnassia palustris</i> , <i>Wilhemsia physodes</i> ; graminoids such as <i>Festuca rubra</i> and <i>Juncus</i> spp.; and small willows such as <i>Salix alexensis</i> and <i>S. pulchra</i> .
Riverine Low Willow Scrub	Low (<1.5 m tall) willow scrub habitats adjacent to rivers and streams, which are regularly flooded during high water periods. Occurs as a closed canopy type and an open canopy type. Both types are dominated <i>Salix pulchra</i> with associated shrub species such as <i>Vaccinium uliginosum</i> and <i>Potentilla fruticosa</i> . In wetter sites, <i>Salix richardsonii</i> also occurs. Common forbs in these areas include <i>Anemone richardsonii</i> , <i>Equisetum arvense</i> , <i>Mertensia paniculata</i> , <i>Petasites frigidus</i> , <i>Rubus arcticus</i> , and <i>Viola epipsila</i> . The dominant graminoid in openings and under the shrub canopy is <i>Calamagrostis canadensis</i> .
Riverine Tall Willow Scrub	Similar in occurrence to Riverine Low Willow Scrub, but the willows are taller (>1.5 m). In addition, <i>Salix alexensis</i> is often co-dominant with <i>S. pulchra</i> and <i>S. richardsonii</i> , especially in areas immediately adjacent to streams. As with Riverine Low Willow Scrub, this type also occurs in a closed and open canopy form. In some open tall willow stands areas, there is a thick, low willow understory of <i>S. pulchra</i> and <i>S. richardsonii</i> , and in others, the openings are dominated by <i>Calamagrostis canadensis</i> . In closed tall stands, <i>S. alexensis</i> often shares dominance with with tall <i>S. pulchra</i> and <i>S. richardsonii</i> . The associated forbs and graminoids are very similar to Riverine Low Willow Scrub.
Lowland Aquatic Sedge Marsh	Permanently flooded waterbodies or margins of waterbodies dominated by <i>Carex aquatilis</i> and occasionally co-dominated by <i>C. saxatilis</i> . Typically, emergent sedges occur in water ≤0.3 m deep. Water and bottom sediments of this shallow habitat freeze completely during winter.
Lowland Wet Sedge Tundra	Sedge-dominated tundra occurring along margins of receding waterbodies or in fully drained ponds. The surface generally is flooded during early summer (depth <0.3 m) and drains later in the season, but remains saturated within 15 cm of the surface throughout the growing season. <i>Carex aquatilis</i> and <i>Eriophorum russeolum</i> usually dominate but <i>E. angustifolium</i> also can occur as a co-dominant. Other sedges also may be present. The dwarf willow, <i>Salix fuscescens</i> , is often present and in better-drained areas it may share dominance with the sedges.

Appendix A. (Continued).

Wildlife Habitat	Description
Lowland Dwarf Birch-Ericaceous-Sedge Scrub	Dwarf shrub (<20 cm tall) and sedge tundra community occurring in lowland areas similar to Lowland Low Birch-Ericaceous-Sedge Bog but on better-drained sites. Dwarf shrubs are dominated by <i>Betula nana</i> , <i>Vaccinium uliginosum</i> , <i>V. vitis-idaea</i> , and <i>Ledum decumbens</i> . Associated dwarf shrub species include <i>Empetrum nigrum</i> and <i>Rubus chamaemorus</i> . Sedges are scattered throughout the habitat and are dominated by <i>Carex aquatilis</i> , <i>Eriophorum angustifolium</i> , and <i>E. russeolum</i> . A nearly complete moss mat covers the ground.
Lowland Low Birch-Ericaceous-Sedge Bog	This habitat is a mosaic of Lowland Wet Sedge Tundra (see description above) and raised shrub islands in shallow colluvial basins. The lower, wet areas are dominated by wet sedge tundra and the elevated shrub islands are dominated by low (<1.5 m tall) <i>Betula nana</i> , with associated low and dwarf ericaceous shrubs including <i>Ledum decumbens</i> , <i>Vaccinium uliginosum</i> , <i>V. vitis-idaea</i> , <i>Empetrum nigrum</i> , and <i>Oxycoccus microcarpus</i> . The shrub islands are covered with a nearly continuous cushion of moss where <i>Sphagnum</i> spp. Dominate.
Lowland Low Birch Scrub	Occurs on moderately-drained (moist) sites west of the Glacier Creek Road in lowland terrain of the Snake River floodplain. In both closed and open canopy forms, this type is strongly dominated by low <i>Betula nana</i> (<1.5 m tall). Associated low and dwarf shrubs include <i>Empetrum nigrum</i> , <i>Salix pulchra</i> , <i>S. glauca</i> , and <i>Vaccinium uliginosum</i> . Various forbs occur, including <i>Petasites frigidus</i> , <i>Arctostaphylos eticu</i> , <i>Artemisia arctica</i> , <i>Valeriana capitata</i> , <i>Galium boreale</i> , and <i>Solidago multiradiata</i> . Common graminoids include <i>Carex bigelowii</i> , <i>Festuca altaica</i> , and <i>Calamagrostis eticulate</i> .
Lowland Low Birch-Willow Scrub	Similar to Lowland Low Birch Scrub in occurrence, but found on slightly more well-drained sites where the dominant low shrubs (<1.5 m tall) are <i>Betula nana</i> and <i>Salix pulchra</i> , and sometimes <i>S. glauca</i> . This type is always in an open canopy form, with just over 25% shrub cover, and there is usually a substantial cover of fruticose lichens in the openings. Associated dwarf shrubs include <i>Salix eticulate</i> , <i>Empetrum nigrum</i> , <i>Vaccinium uliginosum</i> , and <i>Ledum decumbens</i> . Scattered forbs are conspicuous but provide little cover, and include <i>Arnica lessingii</i> , <i>Valeriana capitata</i> , <i>Parnassia palustris</i> , <i>Pedicularis labradorica</i> , and <i>Arctostaphylos eticu</i> . Graminoids are usually sparse and can include <i>Carex bigelowii</i> , <i>Carex microchaeta</i> , <i>Luzula multiflora</i> , and <i>Arctagrostis latifolia</i> .
Lowland Low Willow Scrub	Scrub habitats dominated by low willows (<1.5 m tall) eticulat in low-lying sites where water moves only slowly through the area. This type occurs in both an open and closed canopy form and is dominated by <i>Salix pulchra</i> and <i>S. richardsonii</i> . Openings in this type are dominated by <i>Calamagrostis eticulate</i> , and in wetter sites, <i>Carex aquatilis</i> . Other common graminoids include <i>Carex podocarpa</i> , <i>Carex bigelowii</i> , and <i>Carex membranacea</i> . Associated forbs include <i>Equisetum arvense</i> , <i>Petasites frigidus</i> , <i>Saxifraga hirculus</i> , <i>Valeriana capitata</i> , <i>Rumex arcticus</i> , <i>Iris setosa</i> , and <i>Sedum integrifolia</i> . There are few dwarf shrubs, but <i>Vaccinium uliginosum</i> , <i>Salix eticulate</i> , and <i>Empetrum nigrum</i> can occur.
Lowland Low Willow-Sedge Scrub	Similar to Lowland Low Willow Scrub but always in an open canopy form and found in wetter sites. The typically large openings in this type often include patches of Lowland Aquatic Sedge Marsh (with standing water) and Lowland Wet Sedge Tundra, and are dominated by <i>Carex aquatilis</i> and <i>Eriophorum</i> spp. (see description above).

Appendix A. (Continued).

Wildlife Habitat	Description
Lowland Tall Willow Scrub	Very similar to Lowland Low Willow Scrub in occurrence and vegetation structure but the willows are taller (>1.5 m). Occurs in an open and closed canopy form. This type tends to be strongly dominated by <i>Salix pulchra</i> and, in contrast to Lowland Low Willow Scrub, <i>S. richardsonii</i> occurs only sporadically. Associated species are similar to those occurring in Lowland Low Willow Scrub.
Lowland Tall Willow-Grass Scrub	Similar to Lowland Tall Willow Scrub with tall <i>Salix pulchra</i> dominating, but this type is found on better-drained sites and is always characterized an open canopy. Thick stands of the grass, <i>Calamagrostis canadensis</i> , dominate the openings. Other graminoids and forbs occurring in this type are similar to those in Lowland Low Willow Scrub.
Upland Dwarf Ericaceous Scrub	Found on well-drained upland slopes and mostly occurring in alpine areas, this type is dominated by (>25% cover) dwarf ericaceous shrubs ( <i>Empetrum nigrum</i> , <i>Vaccinium uliginosum</i> , <i>V. vitis-idaea</i> , <i>Ledum decumbens</i> , and <i>Arctostaphylos rubra</i> ). Mosses and dwarf willows may also be common, but trees and shrubs > 20cm are absent or mostly so. This habitat type sometimes has a large component (>50% cover) of lichen ( <i>Cladina</i> spp.) occurring within it.
Upland Dwarf Birch-Ericaceous Scrub	Found on well-drained upland slopes, this type is dominated by dwarf birch, <i>Betula nana</i> , and dwarf ericaceous shrubs ( <i>Empetrum nigrum</i> , <i>Vaccinium uliginosum</i> , <i>V. vitis-idaea</i> , and <i>Ledum decumbens</i> ). Occurs in a well-vegetated mesic form with substantial cover of moss and fruticose lichens under and between the shrubs and in a drier form, on more exposed sites, where gravel can be present at the surface. On steeper slopes, gelifluction lobes can occur in this type and at the base of these lobes are often small, linear stands of low willows ( <i>Salix pulchra</i> and <i>S. glauca</i> ). Graminoids are sparse but <i>Carex bigelowii</i> , <i>C. microchaeta</i> , <i>Hierochloe alpina</i> , and <i>Arctagrostis latifolia</i> often occur. Associated forbs also are sparse but can include <i>Arnica lessingii</i> , <i>Pedicularis labradorica</i> , <i>Dryas octopetala</i> , and <i>Campanula lasiocarpa</i> .
Upland Dwarf Birch-Ericaceous-Sedge Scrub	Dwarf shrub and sedge-dominated communities very similar to Lowland Birch-Ericaceous-Sedge Scrub but this type occurs on somewhat better-drained and gradually-sloping terrain, mostly east of the Glacier Creek Road. The dominant dwarf shrubs are the same as those in Lowland Dwarf Birch-Ericaceous Sedge Scrub, but the sedge component in these upland communities is dominated by <i>Carex bigelowii</i> instead of <i>C. aquatilis</i> and <i>Eriophorum</i> spp.
Upland Low Birch-Willow Scrub	Very similar to Lowland Low Birch-Willow Scrub in vegetation structure and species composition, but this type occurs on more well-drained and sloping sites.
Upland Low Willow Scrub	Very similar to Lowland Low Willow Scrub in vegetation structure and species composition, but this type occurs on slightly better-drained and shallow sloping sites (convex slope shapes) in the uplands. Occurs in both a closed and open canopy form.
Upland Low Willow-Sedge Scrub	Very similar to Lowland Low Willow-Sedge Scrub in vegetation structure and species composition, but this type occurs on shallow sloping sites in the uplands. Drainage is poorer than in Upland Low Willow Scrub and the large openings in this type are typically wet sedge communities, dominated by <i>Carex aquatilis</i> and <i>Eriophorum</i> spp. Standing water is not present.



Appendix A. (Continued).

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Wildlife Habitat	Description
Upland Tall Willow Scrub	Very similar to Lowland Tall Willow Scrub in vegetation structure and species composition, but this type occurs on slightly better-drained and shallow sloping sites (convex slope shapes) in the uplands. Occurs in both a closed and open canopy form.
Excavated Gravel & Tailings	Excavated gravel and fines remaining from placer mining operations that are barren (<5% cover), partially vegetated (5–30% cover), or revegetated (>30% cover). These sites are typically characterized by scattered forbs ( <i>Epilobium latifolium</i> , <i>Oxytropis maydelliana</i> , <i>Dryas octopetala</i> ), dwarf shrubs ( <i>Empetrum nigrum</i> , <i>Vaccinium uliginosum</i> , <i>Betula nana</i> , <i>Salix reticulata</i> ), and forbs, such as <i>Poa glauca</i> . Some of the more vegetated sites have low willows ( <i>S. pulchra</i> , <i>S. glauca</i> ) and in riverine situations, even <i>S. alexensis</i> .
Gravel Fill	Maintained and unmaintained gravel fill (roads and gravel pads).

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Appendix B. Descriptions of wildlife habitat types identified and mapped at the Big Hurrah Mine study area, Alaska, 2005.

Wildlife Habitat	Description
Shallow Open Water	Ponds and small lakes <1.5 m deep with emergent vegetation covering <5% of the waterbody surface. Due to the shallow depth, water freezes to the bottom during winter and thaws in summer. These ponds are only found in the Big Hurrah Creek drainage and are surrounded by riverine shrub habitats.
Stream or River	This class refers to the mappable sections of Big Hurrah Creek and its tributaries.
River Gravel	Barren (<5% cover) and partially vegetated (5–30% cover) river gravel, sand, and silt found along the streams and rivers noted above. Characterized by scattered forbs such as <i>Artemisia tilesii</i> , <i>Aster sibiricus</i> , <i>Epilobium latifolium</i> , <i>Equisetum variegatum</i> , <i>Parnassia palustris</i> , <i>Wilhemsia physodes</i> ; graminoids such as <i>Festuca rubra</i> and <i>Juncus</i> spp.; and small willows such as <i>Salix alexensis</i> and <i>S. pulchra</i> .
Riverine Low Willow Scrub	Low (<1.5 m tall) willow scrub habitats adjacent to rivers and streams, which are regularly flooded during high water periods. Occurs as a closed canopy type and an open canopy type. Both types are dominated <i>Salix pulchra</i> with associated shrub species such as <i>Vaccinium uliginosum</i> and <i>Potentilla fruticosa</i> . In wetter sites, <i>Salix richardsonii</i> also occurs. Common forbs in these areas include <i>Anemone richardsonii</i> , <i>Equisetum arvense</i> , <i>Mertensia paniculata</i> , <i>Petasites frigidus</i> , <i>Rubus arcticus</i> , and <i>Viola epipsila</i> . The dominant graminoid in openings and under the shrub canopy is <i>Calamagrostis canadensis</i> .
Riverine Tall Willow Scrub	Similar in occurrence to Riverine Low Willow Scrub, but the willows are taller (>1.5 m). In addition, <i>Salix alexensis</i> is often co-dominant with <i>S. pulchra</i> and <i>S. richardsonii</i> , especially in areas immediately adjacent to streams. As with Riverine Low Willow Scrub, this type also occurs in a closed and open canopy form. In some open tall willow stands areas, there is a thick, low willow understory of <i>S. pulchra</i> and <i>S. richardsonii</i> , and in others, the openings are dominated by <i>Calamagrostis canadensis</i> . In closed tall stands, <i>S. alexensis</i> often shares dominance with with tall <i>S. pulchra</i> and <i>S. richardsonii</i> . The associated forbs and graminoids are very similar to Riverine Low Willow Scrub.
Lowland Low Willow Scrub	Scrub habitats dominated by low willows (<1.5 m tall) occurring in low-lying sites where water moves only slowly through the area. This type occurs in both an open and closed canopy form and is dominated by <i>Salix pulchra</i> and <i>S. richardsonii</i> . Openings in this type are dominated by <i>Calamagrostis canadensis</i> , and in wetter sites, <i>Carex aquatilis</i> . Other common graminoids include <i>Carex podocarpa</i> , <i>Carex bigelowii</i> , and <i>Carex membranacea</i> . Associated forbs include <i>Equisetum arvense</i> , <i>Petasites frigidus</i> , <i>Saxifraga hirculus</i> , <i>Valeriana captitata</i> , <i>Rumex arcticus</i> , <i>Iris setosa</i> , and <i>Sedum integrifolia</i> . There are few dwarf shrubs, but <i>Vaccinium uliginosum</i> , <i>Salix reticulata</i> , and <i>Empetrum nigrum</i> can occur.
Upland Dry Bluejoint-Herb Tundra	Found on well-drained upland slopes, this type is dominated by bluejoint grass ( <i>Calamagrostis canadensis</i> ) and various herbs, commonly including <i>Epilobium angustifolium</i> , <i>Angelica lucida</i> , <i>Athyrium filix-femina</i> , <i>Equisetum arvense</i> , <i>E. fluviatile</i> . Feathermosses and other grasses and sedges may also be present. Cover is usually complete or nearly so, and the canopy can be up to 1.5 m tall.

Appendix B. (Continued).

Wildlife Habitat	Description
Upland Dwarf Ericaceous Scrub	Found on well-drained upland slopes and mostly occurring in alpine areas, this type is dominated by (>25% cover) dwarf ericaceous shrubs ( <i>Empetrum nigrum</i> , <i>Vaccinium uliginosum</i> , <i>V. vitis-idaea</i> , <i>Ledum decumbens</i> , and <i>Arctostaphylos rubra</i> ). Mosses and dwarf willows may also be common, but trees and shrubs > 20cm are absent or mostly so. This habitat type sometimes has a large component (>50% cover) of lichen ( <i>Cladina</i> spp.) occurring within it.
Upland Dwarf Birch-Ericaceous Scrub	Found on well-drained upland slopes, this type is dominated by dwarf birch, <i>Betula nana</i> , and dwarf ericaceous shrubs ( <i>Empetrum nigrum</i> , <i>Vaccinium uliginosum</i> , <i>V. vitis-idaea</i> , and <i>Ledum decumbens</i> ). Occurs in a well-vegetated mesic form with substantial cover of moss and fruticose lichens under and between the shrubs and in a drier form, on more exposed sites, where gravel can be present at the surface. On steeper slopes, gelifluction lobes can occur in this type and at the base of these lobes are often small, linear stands of low willows ( <i>Salix pulchra</i> and <i>S. glauca</i> ). Graminoids are sparse but <i>Carex bigelowii</i> , <i>C. microchaeta</i> , <i>Hierochloa ommun</i> , and <i>Arctagrostis latifolia</i> often occur. Associated forbs also are sparse but can include <i>Arnica lessingii</i> , <i>Pedicularis labradorica</i> , <i>Dryas octopetala</i> , and <i>Campanula lasiocarpa</i> .
Upland Dwarf Birch-Ericaceous-Sedge Scrub	Dwarf shrub and sedge-dominated communities very similar to Lowland Birch-Ericaceous-Sedge Scrub but this type occurs on somewhat better-drained and gradually-sloping terrain, mostly east of the Glacier Creek Road. The dominant dwarf shrubs are the same as those in Lowland Dwarf Birch-Ericaceous Sedge Scrub, but the sedge component in these upland communities is dominated by <i>Carex bigelowii</i> instead of <i>C. aquatilis</i> and <i>Eriophorum</i> spp.
Upland Low Birch-Willow Scrub	Very similar to Lowland Low Birch-Willow Scrub in vegetation structure and species composition, but this type occurs on more well-drained and sloping sites.
Upland Low Willow Scrub	Very similar to Lowland Low Willow Scrub in vegetation structure and species composition, but this type occurs on slightly better-drained and shallow sloping sites (convex slope shapes) in the uplands. Occurs in both a closed and open canopy form.
Upland Low Willow-Sedge Scrub	Very similar to Lowland Low Willow-Sedge Scrub in vegetation structure and species composition, but this type occurs on shallow sloping sites in the uplands. Drainage is poorer than in Upland Low Willow Scrub and the large openings in this type are typically wet sedge communities, dominated by <i>Carex aquatilis</i> and <i>Eriophorum</i> spp. Standing water is not present.
Upland Tall Alder Scrub	Tall (>1.5 m) alder scrub habitats occurring in well-drained upland areas. This habitat occurs as either a closed canopy type or open canopy type. Both types are dominated by <i>Alnus crispa</i> , and can include scattered tall willow scrub. Understory species often include low willow, dwarf ericaceous shrub species, or graminoids. Closed alder stands typically have few understory species.
Upland Tall Willow Scrub	Very similar to Lowland Tall Willow Scrub in vegetation structure and species composition, but this type occurs on slightly better-drained and shallow sloping sites (convex slope shapes) in the uplands. Occurs in both a closed and open canopy form.

Appendix B. (Continued).

Wildlife Habitat	Description
Upland Partially Vegetated Rock and Scree	Partially vegetated (5–30% cover) scree and boulder fields typically occurring in well-drained upland and alpine areas. The vegetation at these sites is typically characterized by scattered dwarf shrubs ( <i>Ledum decumbens</i> , <i>Loiseleuria procumbens</i> , <i>Empetrum nigrum</i> , <i>Vaccinium uliginosum</i> , <i>Salix</i> spp.), and grasses such as <i>Poa glauca</i> .
Excavated Gravel & Tailings	Excavated gravel and fines remaining from placer mining operations that are barren (<5% cover), partially vegetated (5–30% cover), or revegetated (>30% cover). These sites are typically characterized by scattered forbs ( <i>Epilobium latifolium</i> , <i>Oxytropis maydelliana</i> , <i>Dryas octopetala</i> ), dwarf shrubs ( <i>Empetrum nigrum</i> , <i>Vaccinium uliginosum</i> , <i>Betula nana</i> , <i>Salix reticulata</i> ), and grasses, such as <i>Poa glauca</i> . Some of the more vegetated sites have low willows ( <i>S. pulchra</i> , <i>S. glauca</i> ) and in riverine situations, even <i>S. alexensis</i> .
Gravel Fill	Maintained and unmaintained gravel fill (roads, gravel pads, and airstrips).