Draft Environmental Impact Statement

Resurrection Creek Phase II Stream and Riparian Restoration Project and Hope Mining Company Proposed Mining Plan of Operations

Seward Ranger District, Chugach National Forest

Kenai Peninsula Borough, Alaska

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Seward Ranger District, Chugach National Forest
Kenai Peninsula Borough, Alaska

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Abstract: Resurrection Creek was severely impacted by early 20th-Century hydraulic placer mining, which left large tailings piles along the banks and straightened the stream channel, resulting in poor aquatic and riparian habitat conditions. The Forest Service completed Phase I of the Resurrection Creek Stream Restoration Project between 2005 and 2008, restoring a 1-mile section of Resurrection Creek about 5 miles upstream of Hope, Alaska.

The Chugach National Forest is now proposing the Resurrection Creek Phase II Stream and Riparian Restoration Project. This project is a large-scale restoration effort along a 2-mile long section of Resurrection Creek, located about 2 to 4 miles upstream of the community of Hope, Alaska. Proposed activities within the Phase II project area include stream and riparian restoration within a 200 to 500-foot wide restoration corridor.

Hope Mining Company (HMC) has existing approved mining operations on federal mining claims in the area proposed for the Phase II restoration project. In December of 2007, an agreement was made between the Forest Service and HMC to follow a process in which the Forest Service would conduct environmental analysis on the proposed stream restoration activities, a supplement to the existing mining operations to exclude mining operations within the proposed stream restoration corridor, and proposed mining operations in areas outside of the restoration corridor. The Forest Service received a proposed mining plan of operations from HMC on December 12, 2007 which describes the new proposed mining operations outside the proposed restoration

corridor on existing federal mining claims. This proposal is connected to and supports the proposed Phase II restoration project along Resurrection Creek by excluding most existing approved mining operations from a designated restoration corridor.

The purpose of this project is to restore the degraded stream channel, floodplains, and habitat conditions along a 2-mile segment of Resurrection Creek, and to approve or require modifications to the proposed mining plan of operations with appropriate requirements for surface resource protection.

The Forest Service identified two significant issues during scoping: (1) the extent to which any alternative would result in increased turbidity that adversely affects water quality; and (2) the extent to which any alternative would result in adverse impacts to salmon populations. These issues are discussed in detail in the aquatic resources section of Chapter 3.

Three alternatives are analyzed in this Draft Environmental Impact Statement (DEIS). Under Alternative 1, the No Action alternative, no restoration would occur, and existing recreation and approved mining activities would continue to take place in the project area. Alternative 2, the Proposed Action, would restore 2 miles of Resurrection Creek's channel, floodplain, and streamside vegetation within a designated restoration corridor and make available for approval 264 acres of mining areas and operational areas outside of the restoration corridor. Alternative 3 would not restore any portion of Resurrection Creek, but would make available for approval 267 acres of mining areas and operational areas throughout the project area.

This DEIS is organized into the following chapters: Chapter 1 describes the purpose and need for action and the legal and regulatory framework; Chapter 2 provides detailed descriptions and maps of the alternatives and mitigation and monitoring measures; Chapter 3 provides descriptions of the affected environment and effects by resource area; and Chapter 4 provides details of project consultation and coordination.

The Forest Service is seeking comments on this DEIS. Reviewers should provide the Forest Service with their comments during the review period of the DEIS. The review period begins the day the Notice of Availability is published in the Federal Register. Comments must be postmarked, faxed, or emailed within 45 days, beginning on the first day after publication in the Federal Register (36 CFR §215.6). The submission of timely and specific comments can affect a reviewer's ability to participate in subsequent administrative review or judicial review. Comments received in response to this solicitation, including names and addresses of those who comment, will be part of the public record for this proposed action. Comments submitted anonymously will be accepted and considered; however, anonymous comments will not provide the respondent with standing to participate in subsequent administrative review or judicial review.

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SUMMARY

Background

Resurrection Creek was the site of Alaska's first gold rush. Early 20th-Century hydraulic and heavy equipment placer mining adversely impacted much of the lower 6 miles of Resurrection Creek, leaving a straightened stream channel with tailings piles along the banks, poor aquatic habitat conditions, poor riparian conditions, and little natural recovery potential. The analysis area is located along Resurrection Creek, between 2 and 4 miles upstream of the community of Hope, Alaska, on Alaska's Kenai Peninsula. Resurrection Creek drains a 161-square mile watershed and flows north into Turnagain Arm of Cook Inlet.

Phase I of the Resurrection Creek Stream and Riparian Project was completed between 2005 and 2008. A 1-mile section of Resurrection Creek about 5 miles upstream of Hope was restored to its natural condition, greatly improving stream channel condition and habitat conditions for all 5 species of Pacific salmon as well as other wildlife. The proposed Resurrection Creek Phase II restoration project would extend upon the Phase I project.

The proposed Phase II stream restoration project would occur on National Forest System lands, within federal mining claims owned by Hope Mining Company (HMC). Approximately 95 acres within the project area are currently approved for mining operations through mining plans of operations approved between 1986 and 2010. Evidence of human disturbance from past and recent mining in the project area is apparent, and mining operations are currently ongoing. However, the majority of the stream channel impacts in the project area are the result of early 20th-Century hydraulic placer mining.

In order to accomplish the proposed restoration, the Forest Service reached a conceptual agreement with HMC in December of 2007 to establish a proposed restoration corridor along Resurrection Creek. Approval of the proposed mining plan of operations submitted to the Forest Service by HMC would provide the necessary protection for the proposed Resurrection Creek restoration efforts by eliminating existing approved mining operations within the restoration corridor with the exception of minimal maintenance type mining operations. The proposed mining plan includes proposed mining operations for approximately 264 acres adjacent to the proposed corridor. These proposed mining operations are analyzed concurrently with the proposed stream restoration activities in this DEIS.

Purpose and Need for Action and Proposed Action

The purpose of this project is to restore the degraded stream channel, floodplains, and habitat conditions within a 76-acre, 2-mile long corridor of Resurrection Creek, and approve or require modifications to the proposed mining plan of operations with appropriate requirements for surface resource protection.

Under the Proposed Action, the Forest Service would do the following:

- Restore the stream channel, riparian areas, and fish and wildlife habitat of a 2-mile segment of Resurrection Creek on National Forest System lands, within a designated restoration corridor.
- Approve a supplement to the existing mining plans of operations in order to exclude most existing approved mining activities from the proposed restoration corridor.
- Approve new mining operations within proposed mining areas outside of the restoration corridor only after HMC defines specific operations and provides acceptable reclamation bonds.

The Notice of Intent (NOI) was published in the Federal Register on January 28, 2008, and public scoping occurred between January 4, 2008 and June 13, 2009. Using comments from the public and other agencies, the interdisciplinary team developed a list of issues to address. The Forest Service identified two significant issues for this project. The first issue deals with the impacts of increased turbidity related to suspended sediment from restoration and/or mining activities on water quality. The second issue deals with the impacts of the proposed activities on fish during critical periods of salmon development.

The Forest Service developed three alternatives. Under Alternative 1, the No Action alternative, no restoration would occur, and existing approved mining activities would continue to take place in the project area. Alternative 2, the Proposed Action, would restore 2 miles of Resurrection Creek's channel, floodplain and streamside vegetation within a designated restoration corridor and make available for approval 264 acres of mining areas and operational areas outside of the restoration corridor, pending HMC defining discrete operations and providing acceptable reclamation bonding. Alternative 3 would not restore any portion of Resurrection Creek, and no restoration corridor would be established. This alternative would make 267 acres of mining areas and operational areas throughout the project area available for approval pending HMC defining specific operations and providing acceptable reclamation bonding.

This EIS evaluates site-specific management proposals, presents alternatives, and analyzes the effects of the activities proposed in the alternatives. The extent to which any alternative achieves ecosystem-scale restoration objectives will be important to any decision. It will also be important to the decision to approve a mining plan of operations that is consistent with Forest Service regulations (36 CFR Part 228) that require mining operations on National Forest System lands to be conducted so as, where feasible, to minimize adverse environmental impacts on National Forest surface resources. The deciding official will make the decision whether to undertake restoration activities on Resurrection Creek and the nature, magnitude, and extent of those activities; and what, if any modifications to the proposed mining plan of operations are necessary to minimize adverse environmental impacts on National Forest surface resources, including any resources that may benefit from the restoration of Resurrection Creek.

Affected Environment

Mine tailings produced by placer mining nearly a century ago occupy the majority of the valley floor in the project area. These tailings piles have greatly altered fish and wildlife habitat within the project reach by confining and straightening the stream, creating a nearly continuous riffle with few pools or spawning gravel for fish. These tailings piles essentially function as dikes that cut off flood flows from the original floodplain. Water velocities accelerate as they are compressed through the constricted channel concentrating the stream's energy on the streambed, simplifying substrate and degrading the channel. Sediment and nutrients are transported through the project area, depriving riparian areas of soil and nutrients, which in turn retard disturbance recovery and natural succession. The tailings piles prevent fine sediment and organics carried by floods from being deposited on the floodplain, preventing natural fertilization and soil augmentation needed to reestablish vigorous riparian communities.

Both anadromous and resident fish utilize Resurrection Creek. All five species of anadromous salmonids are present in Resurrection Creek, though presence and productive habitats are rare within the proposed restoration section. The species include pink (*Oncorhynchus gorbuscha*), chum (*O. keta*), coho (*O. kisutch*), Chinook (*O. tshawytscha*), and sockeye salmon (*O. nerka*). No federal or state listed, proposed, or candidate aquatic species are located in the project area.

The project area contains few pools, few side channels, and very little large woody debris (LWD) compared to an unmined reference reach. These natural channel components are important for providing spawning and rearing habitat for salmon, as well as cover and nutrients. LWD is also important in the creation of a diverse range of habitats, from pool formation to areas of high flow refuge, and contributes to channel stability. Because of the dominant riffle habitat and the confined nature of the floodplain, the project area is very limited in spawning and rearing habitat.

The early 20th-Century tailings piles within the project area are composed of extremely well-drained large cobbles, which for the most part prevent the growth of vascular plants, eliminating the development of a duff layer and soil formation, and leaving the piles barren of most vegetation growth other than crustose lichens and mosses. Some piles support individual scattered black cottonwood trees or shrubs. Lack of soil and soil nutrients has contributed to the lack of re-establishment of normal overstory and understory vegetation. The project area contains a mixture of primarily pole size to large hardwoods (cottonwood, birch) and seedling/sapling to large conifers (white spruce and mountain hemlock).

The current habitat provides a diversity of vegetation types and structures for a variety of species. Still, habitat loss or degradation has occurred throughout the area due to vegetation removal for roads, mining operations, and equipment storage. The spruce bark beetle has killed the majority of large spruce in the area. Many bird species and beaver use the ponds created by mining activity. Animal travel corridors occur adjacent to the creek banks and along roads created by mining activity. Ducks use Resurrection Creek and adjacent ponds. Bear scat and travel corridors and moose scat are evident throughout the project

area. No threatened, endangered, sensitive or proposed species are likely to occur in the project area. Management Indicator Species that occur in and adjacent to the project area are moose and brown bear. Species of Special Interest with existing or potential habitat are the gray wolf, lynx, river otter, Townsend's warbler, wolverine, bald eagle, and northern goshawk.

The boundary of the Resurrection Inventoried Roadless Area (IRA) begins approximately 1/4 mile from the Seward Highway, Sterling Highway, Palmer Creek Road, and Resurrection Creek Road. Approximately 53% of the project area falls within the Resurrection IRA. There are also non-National Forest Lands adjacent to the Resurrection IRA near the communities of Hope, Sunrise, and Cooper Landing and near the junction of the Seward and Hope Highways, and the Summit Lakes area. The above lands adjacent to the highways and non-National Forest System lands have been subject to more than a century of human influences and development, including historic mining, powerline developments, and other aspects associated to settlement.

As evidence of human influence and development are more apparent in some areas adjacent to the Resurrection IRA, the presence of roadless area characteristics within these adjacent portions of the Resurrection IRA are somewhat diminished. Human influences that are noticeable from the portion of the project area within the Resurrection IRA include ongoing placer mining and traffic along Resurrection Creek Road.

Hope and Sunrise were Alaska's first gold rush towns. Gold was discovered in Resurrection Creek in 1889, about eight years before the larger Klondike gold rush to Dawson and Nome. Both towns grew to include stores, hotels, social halls, community councils, post offices, and saloons. With the start of the Klondike Gold Rush in 1897, the population in both communities dwindled as miners left for the richer strike to the north (Hope Chamber of Commerce 2008). Hope is located approximately 88 miles by road from Anchorage on the south shore of the Turnagain Arm of Cook Inlet. Several historic buildings are still present and continue to serve Hope residents (Hope Chamber of Commerce 2008). The school and local retail businesses provide the only employment in Hope. Some mining activity continues to occur. There is also a small sawmill used by the community.

The National Historic Preservation Act (NHPA) and Executive Order 11593 require archaeological inventory to be completed prior to implementation of any undertaking. Numerous Euro-American historic properties are currently documented within the Resurrection Creek watershed. Of the area that would be directly impacted by this phase of stream restoration and proposed mining, a majority of the acreage has been surveyed. Historic mining resources constitute the greatest part of the known cultural resources in and near the project area. Of these sites, one lies within this current proposed project area, the Hope Mining Company Historic Mining District. This site has been properly documented and is eligible for inclusion on the National Register of Historic Places.

Cultural landscapes are a type of historic property addressed in the Secretary of the Interior's Standards and Guidelines, as revised in 1992. A cultural landscape is defined as "a geographic area, including both cultural and natural resources

and the wildlife or domestic animals therein, associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values" (Birnhaum 1994). The associated mining landscapes fall under the category of historic vernacular landscape, "a landscape that evolved through uses by the people whose activities or occupancy shaped the landscape" (Birnhaum 1994). Specifically, the features that contribute to the historic character of the cultural landscape include the mining areas, living areas, tailing piles, ponds and ditches, the historic cabins and outbuildings, and trails and roads.

Currently, little recreation use occurs within the project area. The majority of the recreation use that occurs in the area is generally concentrated within Porcupine Campground, the Resurrection Pass National Recreation Trail, and on other non-federal lands. Also, this section of Resurrection Creek does not provide fishing opportunities that are desired by a majority of sport anglers.

Environmental Consequences

The effects of two action alternatives are analyzed in this EIS. The following summarizes and compares the effects of implementing Alternative 2 (the Proposed Action) and Alternative 3.

Summary of Effects by Resource Area

Air Quality/ Climate Change

Air pollutants: Alternatives 2 and 3 would both produce localized sources of air pollutants. Any pollutants would generally dissipate quickly, resulting in minimal direct, indirect, or cumulative effects on air resources.

Greenhouse gas emissions: Alternatives 2 and 3 would produce comparable amounts of greenhouse gas emissions as a result of fossil fuel combustion. This project is very small in terms of greenhouse gas emissions that would contribute to climate change in a global context.

Climate Change: Although the effects on climate change cannot currently be quantified, Alternative 2 is not expected to meaningfully or noticeably influence climate change through emissions or vegetation removal because of the relatively small amount of emissions on a global context, the limited area that would be actively mined at any one time, and the benefits of restoring vegetation within the riparian ecosystem. Alternative 3 would have similar effects to climate change as Alternative 2, but without the benefits of restoring the vegetation within the riparian ecosystem.

Carbon sequestration: Under Alternative 2, restoration would reestablish the riparian corridor in the long term, increasing the capacity to sequester carbon dioxide. Under Alternative 3, slower riparian regeneration and poorer riparian conditions would result in lower capacity to sequester carbon dioxide

Resiliency to effects of climate change: Under Alternative 2, restoration of the stream corridor would make the ecosystem more resilient to impacts associated with climate change such as floods. Under Alternative 3, the stream channel would remain impaired with limited floodplain widths, similar to the existing channel and less likely to withstand impacts associated with climate change.

Minerals

Amount of Ore: Alternative 2 would have less ore to mine than Alternative 3. Alternative 3 would have the greatest amount of ore available for mining.

Soils

Acres of Soil Disturbance: Under Alternative 2, loss of soil productivity in the mined area would be variable, both because not all of the 264 acres would necessarily be mined or not all mechanically mined, and because the resulting mixed regolith/soil following reclamation would be highly variable in quality and productive potential. About 22 acres of the disturbance outside the restoration corridor would be permanently degraded without future active restoration. The estimated surface area over which soil disturbance would occur within the restoration corridor is about 27 acres. Based on results in Phase I, about 2.3 acres of the disturbance would be permanent due to flooding, compaction, and the nature of the coarse substrate. This alternative is not expected to cause more than 15% or 51 acres out of 340 activity area acres of long-term detrimental impacts to soil resources at the Resurrection Creek Phase II activity area. Under Alternative 3, soil quality would be degraded by more than 15% (estimated 217 acres) compared to either current condition or an undisturbed reach. Adverse effects (37.6 acres) that cannot be avoided are expected to be permanent because natural processes would not be able to counter or restore them within human timeframes.

Noise

Decibel Level of noise from Mining Activities: Under Alternatives 2 and 3, noise generated by mining equipment is expected to produce decibel levels in the range of 65 to 80 dB at active mining sites. The persistent equipment noise is likely to disturb and displace wildlife and annoy some people living near HMC claims during the months of April through October over the 20 years of operation. The noise stemming from mining activities may impact private landowners within one mile of mining operations. Recreation users at the Resurrection Pass North Trailhead could be directly affected by mining noise only when mechanical mining is occurring at the extreme southern end of the project area in Areas 8, 9 and 22. The majority of mining proposed within the middle and northern sections of the project area is not expected to affect recreational users at the trailhead due to the white noise masking effect of Resurrection Creek.

Decibel Level of noise from Restoration Activities: Under Alternative 2, noise levels generated by restoration equipment would be identical in nature and level to that of mining operations and are expected to mask each other rather than detectably add or increase noise levels. Restoration activities would occur from May 15 through July 15. Recreation users at the Resurrection Pass North Trailhead could be directly affected by restoration noise only when machines are operating at the extreme southern end of the project area. The majority of restoration in the southern section of the project area is estimated to be completed in two to four weeks with impacts to any recreational users at the trailhead limited to that time period. The remainder of restoration proposed in Alternative 2 (within the middle and northern sections of the project area) is not

expected to affect recreational users at the trailhead due to the white noise masking effect of Resurrection Creek. Under Alternative 3, restoration activities would not occur, so there would be no additional sources of noise.

Hydrology & Fisheries

Sediment/ Turbidity: Under Alternative 2, during restoration activities (May 15 to July 15 for up to 4 years), 6 to 10 short, controlled turbidity events of over 300 NTU would occur. Up to 10 turbidity pulses per day of up to 150 NTU would also occur while equipment is working in the channel. Minimal impacts to turbidity would occur from mining and equipment crossings. A low potential would exist for catastrophic water quality impacts from settling pond failure or erosion. Under Alternative 3, during relocation of channel segments for mining (May 15 to July 15), 2 to 4 turbidity events of over 300 NTU would occur, as would the potential for continued increased turbidity levels. Minimal impacts to turbidity would occur from mining and equipment crossings. A moderate to high potential for catastrophic water quality impacts would exist from settling pond failure or erosion.

Aquatic Species: Under Alternative 2, direct mortality of aquatic species could occur at equipment crossings and during channel construction throughout the entire reach. Indirect mortality of aquatic species would be possible from high turbidities in the entire reach and 2 miles downstream during restoration. Under Alternative 3, direct mortality of aquatic species could occur at equipment crossings and during channel relocation. Fish mortality would occur from stranding in the old channel. Indirect mortality of aquatic species would be possible from high turbidities in lower third of reach and 2 miles downstream during channel relocation.

Channel Morphology: Under Alternative 2, hydrologic function of the stream channel would be restored to natural conditions. Functional floodplains would promote riparian vegetation and stable banks. The restored corridor would provide an adequate riparian buffer zone. Under Alternative 3, the stream channel would remain an impaired confined channel with few pools and a disconnected floodplain. Relocated channel segments would be similar to the existing condition, but with decreased stability. A 20-foot wide buffer zone would not be adequate for channel protection and natural function.

Aquatic Habitat: Under Alternative 2, aquatic habitat would be greatly improved in the short term and long term. Improved aquatic habitat would promote aquatic populations. Under Alternative 3, no improvement to aquatic habitat or populations would occur. Limited pools, woody debris, spawning areas, and off-channel habitat would remain.

Vegetation Ecology

Amount of re-vegetation: Under Alternative 2, restoration would initiate trends towards Forest Plan desired future conditions for vegetation and re-establish native vegetation in the restoration corridor where it is currently lacking. There would be a change in the forested structure and composition of the project area by the removal of various tree species. The successional pathway of the project area's forested stands would be altered by the removal of different tree species

than what would develop over time if no mining and subsequent harvesting took place. These changes may linger in the mining areas if species composition is mainly non-native species. Under Alternative 3, the valley floor would remain in a disturbed condition. Vegetation cover typical of South-central Alaskan stream systems would not return to the tailing pile areas. Further, the tailings would continue to prevent flood flows from delivering fine sediment to the floodplain areas, thereby limiting riparian vegetation growth. Changes in the forested structure and composition of the project area would be the same as in Alternative 2, except that it would cover an additional 3 acres.

Sensitive Plants: Under Alternatives 2 and 3, implementation is not expected to adversely affect sensitive plants.

Non-native species: Under Alternative 2, restored areas re-vegetated to native species would reduce the overall presence of non-natives. Disturbances associated with restoration and mining have the potential to increase non-native plant abundance in the project area through influx of non-native species on equipment and by providing bare soil conditions. Under Alternative 3, the increase of non-native plant abundance in the project area would be the same as Alternative 2.

Wildlife

Habitat Disturbed by Mining and Restoration Activities: Under Alternative 2, mining operations would cause short and long term habitat loss of conifer, hardwood and riparian forest types on up to 264 acres spread out over a 20 year time period. Some patches of trees would remain on steeper slopes that preclude mining, however these areas would provide low quality habitat due to adjacent vegetation removal and disturbance. Proposed actions would cause varying degrees of soil productivity loss up to 264 acres, with 24.3 acres of permanent loss. Loss of soil productivity on those 24.3 acres would permanently inhibit growth of vegetation and associated wildlife habitat. Mature forest composition and structure containing large trees important to wildlife habitat for various species may be delayed forty or more years in developing due to loss of site productivity on the 264 acres. Similar habitat loss and disturbance would occur within the 76 acre restoration corridor up to a 4 year period and during restoration operations. Restoration of 54 acres of floodplain, riparian vegetation, and development of 8,000 feet of new side channels would create new habitat favoring species that feed on spawning or rearing salmon, breed or forage in side channels, den or nest in riparian vegetation, or forage for vegetation or for prey species in riparian areas. Under Alternative 3, actions would cause varying degrees of soil productivity loss up to 267 acres, with 37.6 acres of permanent loss. Mature forest composition and structure containing large trees, which is important wildlife habitat for a variety of species may take an additional 40 or more years to develop due to loss of site productivity. Sub-optimal foraging habitat for bald eagles, river otters, and bears due to poor quality salmon spawning and rearing habitat would continue. A minimal amount of cover and poor riparian vegetation conditions would remain adjacent to Resurrection Creek. There would also be poor upland habitat quality for otters. Since there would not be any stream restoration, no additional wildlife habitat would be created.

Effects to Wildlife (Management Indicator Species, Species of Special Interest and Migratory Birds): Under Alternative 2, disturbance to wildlife from noise, people, and machinery may cause habitat abandonment or avoidance in restoration area (short term- up to 4 year period on 76 acres) and mining areas (long term- 20 year operating period), or within one mile of the project area due to noise disturbance. Despite mitigation measures, direct mortality to individuals of a variety of birds and small mammals is possible in areas of mining and restoration activities. Noise has the potential to disturb wildlife in the project area at decibel levels from 65 to 80 dB at active mining sites or within the restoration corridor, and adjacent to the project area up to one mile out at decibel levels up to 55 dB. Noise levels would be variable based on topography and vegetation. Persistent equipment noise may disturb and displace wildlife during the months of April through October over the 20 years of operation. Wildlife species would have a beneficial effect from improved foraging, nesting habitat, or prey habitat, and cover after restoration in the long term. Under Alternative 3, effects to wildlife from mining activities are the same as Alternative 2, except the effects would occur on an additional 3 acres. Since there would not be any stream restoration, no additional wildlife habitat would be created.

Heritage Resources

Historic District: The loss of historic district contributing elements (tailings) would occur under Alternatives 2 and 3. However, interpretive displays would be used to mitigate the loss of the historic district contributing elements.

Recreation

Scenic Resources and Recreation Setting: Under Alternative 2, the scenic integrity objective (SIO) of "low" for the project area would decrease to "very low" for up to 20 years or longer based on the success of reclamation from mining activities. Restoration activities over time, however, are expected to bring the SIO up to at least "moderate" in the restoration corridor. Alternative 3 would have the same effects as Alternative 2 regarding mining activities that would take place, but the long-term beneficial effects of restoration would not occur.

Noise impacts to Recreation Visitors: See the noise section above.

Recreation Experience: Under Alternatives 2 and 3, visitor expectations may be different than the actual experiences of driving to and accessing the Resurrection Pass National Historic Trail due to sights and sounds created by the use of heavy equipment in various projects, smoke from pile burning lingering in the area, development on private land in the area, sights and sounds from small scale suction dredging mining operations within the recreational mining area on Resurrection Creek, and increased highway traffic from the various projects.

Recreation Opportunities: The Porcupine Campground is slated for reconstruction in 2010 and will affect recreation users under Alternatives 2 and 3 due to the lack of camping facilities in the vicinity during the time of construction. This may cause additional dispersed camping due to displacement of the recreation users. Upon completion of all these projects, these effects would subside.

Sport Fishing: The effects of Alternative 2 on sport fishing cannot be accurately predicted with the information currently available. There is no evidence that an increase in fish populations resulting from restoration activities would cause an increase in sport fishing. The effects of Alternative 3 on sport fishing cannot be accurately predicted with the information currently available. An increase in fish populations is not expected to occur from implementation of mining activities.

Roadless Areas

Natural Appearing Landscape and Wilderness Suitability: Under Alternative 2, 141 acres, or less than one percent of the total acres of Resurrection IRA, would appear more unnatural and would be less capable of being suitable for Wilderness designation because evidence of mining would be apparent. After 20 years or at the completion of mining activities, the area would be reclaimed. After reclamation, the affected portion of the Resurrection IRA would appear more natural. Resurrection Creek would more closely represent natural conditions because it would appear and function as it did before mining channelized Resurrection Creek over time after restoration. Under Alternative 3, the effects associated with mining activities would be the same as in Alternative 2. However, Resurrection Creek would remain channelized, fish habitat would continue to be poor, and evidence of human disturbance would be apparent. Resurrection Creek would continue to be less capable of being suitable for Wilderness designation.

Social and Economic Resources

Net Present Value: Under Alternative 2, the net present value (NPV) in 2009 dollars is negative $2,694,761. A variety of ecological benefits would occur with this alternative. To be considered economically efficient, benefits from the project must outweigh the total costs. However, the ecological benefits are not quantifiable. Under Alternative 3, the only direct costs assumed by the Forest Service would be those associated with minerals administration. The NPV of this alternative would be negative $689,736, which is simply the discounted sum of total costs because there are no benefits that can be displayed in dollar values.

Employment: Under Alternative 2, restoration activities could allow for some jobs to be performed by local residents. Under Alternative 3, employment levels would be the same as the existing condition.

Recreation Capacity and Visitor Days: There is no evidence that recreation visits to the study area would increase as a result of Alternative 2. Therefore, it is not possible to predict the associated economic impacts. Hope is likely to experience greater proportional social and economic consequences from forest management. Under Alternative 3, there would be no anticipated benefits for aquatic life, and therefore no expected increase in fishing pressure as a direct result of this alternative.

Community Isolation: Under Alternative 2, restoration of Resurrection Creek would improve natural amenities, but the public concern is that increases in tourism could result in decreased quality of life for many residents. Conversely, some local residents may view improving ecosystem health as an opportunity to expand economic wellbeing by marketing goods and services to visitors. Hope is

likely to experience greater proportional social and economic impacts from forest management due to low economic diversity scores, low median incomes and subsistence preference (Crone et al. 2002). Under Alternative 3, the use of existing infrastructure would remain low, and the communities of Hope and Sunrise would remain isolated.

Unavoidable Adverse Effects

Under Alternative 2, the following unavoidable adverse effects would occur:

- Permanent loss of soil productivity on 24.3 acres.
- Noise from mining or restoration activities may be a nuisance for some area residences within one mile of the project area.
- Limited adverse impacts to aquatic populations from short-term increases in turbidity.
- Direct mortality to aquatic populations would likely occur during equipment crossings and channel construction.
- Adverse effects to wildlife habitat on 264 acres would occur due to removal of the majority of vegetation during mining operations.
- Despite mitigation measures, direct mortality to individuals of a variety of birds and small mammals is possible in areas of mining and restoration activities.
- Modified topography and vegetation removal would affect the landscape and decrease the scenic quality for 20 years or more.

Under Alternative 3, the following unavoidable adverse effects would occur:

- Permanent loss of soil productivity on 37.6 acres.
- Noise from mining or restoration activities may be a nuisance for some area residences within one mile of the project area.
- Limited adverse impacts to aquatic populations from short-term increases in turbidity.
- Direct mortality to aquatic populations would likely occur during equipment crossings and channel relocation.
- Moderate to high potential for mining settling pond failure.
- Adverse effects to wildlife habitat on 267 acres would occur due to removal of the majority of vegetation during mining operations.
- Despite mitigation measures, direct mortality to individuals of a variety of birds and small mammals is possible in areas of mining and restoration activities.
- Modified topography and vegetation removal would affect the landscape and decrease the scenic quality for 20 years or more.

Irreversible and Irretrievable Commitments of Resources

Irreversible is a term that describes the loss of future actions. The term applies primarily to the effects of use of nonrenewable resources. Irretrievable is a term that applies to the loss of production, harvest, or use of natural resources.

Alternative 2 would result in the following irreversible and irretrievable commitments of resources:

- The extraction of gold would occur over 200 acres (3,226,700 cubic yards would be mined).
- About 24.3 acres of the estimated disturbance of soils would likely be permanent.
- Direct mortality to aquatic populations would likely occur during equipment crossings and channel construction.
- There would be a change in the forested structure of the project area by the removal of trees. The successional pathway of the project area's forested stands would be altered.
- There would be a change in the forested composition of the project area by the removal of different tree species than what would develop over time if no mining and subsequent harvest took place. These changes may linger in the mining areas if species composition is mainly non-native species.
- The permanent soil productivity loss on 24.3 acres would permanently inhibit growth of vegetation and associated wildlife habitat. Mature forest composition and structure containing large trees, which is important wildlife habitat for a variety of species may be delayed by 40 or more years in developing due to loss of site productivity on the 264 acres.
- Despite mitigation measures, direct mortality to individuals of a variety of birds and small mammals is possible in areas of mining and restoration activities.
- Loss of portions of the historic landscape would occur. However, not all portions of the contributing elements (tailings) would be lost, and portions that are removed would be captured by data recording and would be mitigated by displays.
- Modified topography and vegetation removal would affect the landscape and decrease the scenic quality for 20 years or more.

Alternative 3 would result in the following irreversible and irretrievable commitments of resources:

- The extraction of gold would occur over 193 acres (3,114,000 cubic yards would be mined).
- About 37.6 acres of the estimated disturbance of soil resources, including roads, would likely be permanent.

- Direct mortality to aquatic species would likely occur during equipment crossings and relocation of the Resurrection Creek channel.
- There would be a change in the forested structure of the project area by the removal of trees. The successional pathway of the project area's forested stands would be altered.
- There would be a change in the forested composition of the project area by the removal of different tree species than what would develop over time if no harvest took place. These changes may linger in the mining areas if species composition is mainly non-native species.
- Actions would cause varying degrees of soil productivity loss up to 267 acres, with 37.6 acres of permanent loss. Mature forest composition and structure containing large trees, which is important wildlife habitat for a variety of species, may take an additional 40 or more years to develop due to loss of site productivity.
- Despite mitigation measures, direct mortality to individuals of a variety of birds and small mammals is possible in areas of mining and restoration activities.
- Loss of portions of the historic landscape would occur. However, not all portions of the contributing elements (tailings) would be lost, and portions that are removed would be captured by data recording and would be mitigated by displays.
- Modified topography and vegetation removal would affect the landscape and decrease the scenic quality for 20 years or more.

CHAPTER 1. PURPOSE AND NEED FOR ACTION

Document Structure

The Chugach National Forest has prepared this Environmental Impact Statement (EIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This EIS discloses the direct, indirect, and cumulative environmental impacts that would result from the Forest Service's proposal and alternatives to that proposal (described below). The document is organized into four chapters:

- *Chapter 1. Purpose and Need for Action:* This chapter includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- *Chapter 2. Alternatives, including the Proposed Action:* This chapter provides a more detailed description of the agency's proposal as well as alternative methods for achieving the stated purpose. This chapter also includes a discussion on measures taken to reduce adverse environmental impacts. Finally, this section provides a summary table of the environmental consequences associated with the proposal and each alternative.
- *Chapter 3. Affected Environment and Environmental Consequences*: This chapter describes the environmental effects of implementing the proposal and other alternatives. This analysis is organized by resource area.
- *Chapter 4. Consultation and Coordination:* This chapter provides a list of preparers and agencies consulted during the development of the EIS.
- *Index:* The index provides page numbers by document topic.
- *Literature Cited:* This section lists the various literature cited in the EIS.
- *Glossary:* The glossary provides definitions to terms commonly used in this EIS.
- *Appendices:* The appendices provide more detailed information, including maps, to support the analyses presented in the EIS.

Additional documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at the Seward Ranger District.

Location

The analysis area is located along Resurrection Creek on the northern end of the Kenai Peninsula, on the Seward Ranger District of the Chugach National Forest. The town of Hope, Alaska lies adjacent to the mouth of Resurrection Creek on Turnagain Arm. The project area begins at river mile 2.1 (upstream from tidewater) and extends upstream to river mile 4.0. Refer to Figure 1 for a vicinity map of the project area. The project area is located in Sections 4, 9, and 16 of T9N, R2W on the Seward Meridian. The project area lies within federal mining claims of the Hope Mining Company (HMC).

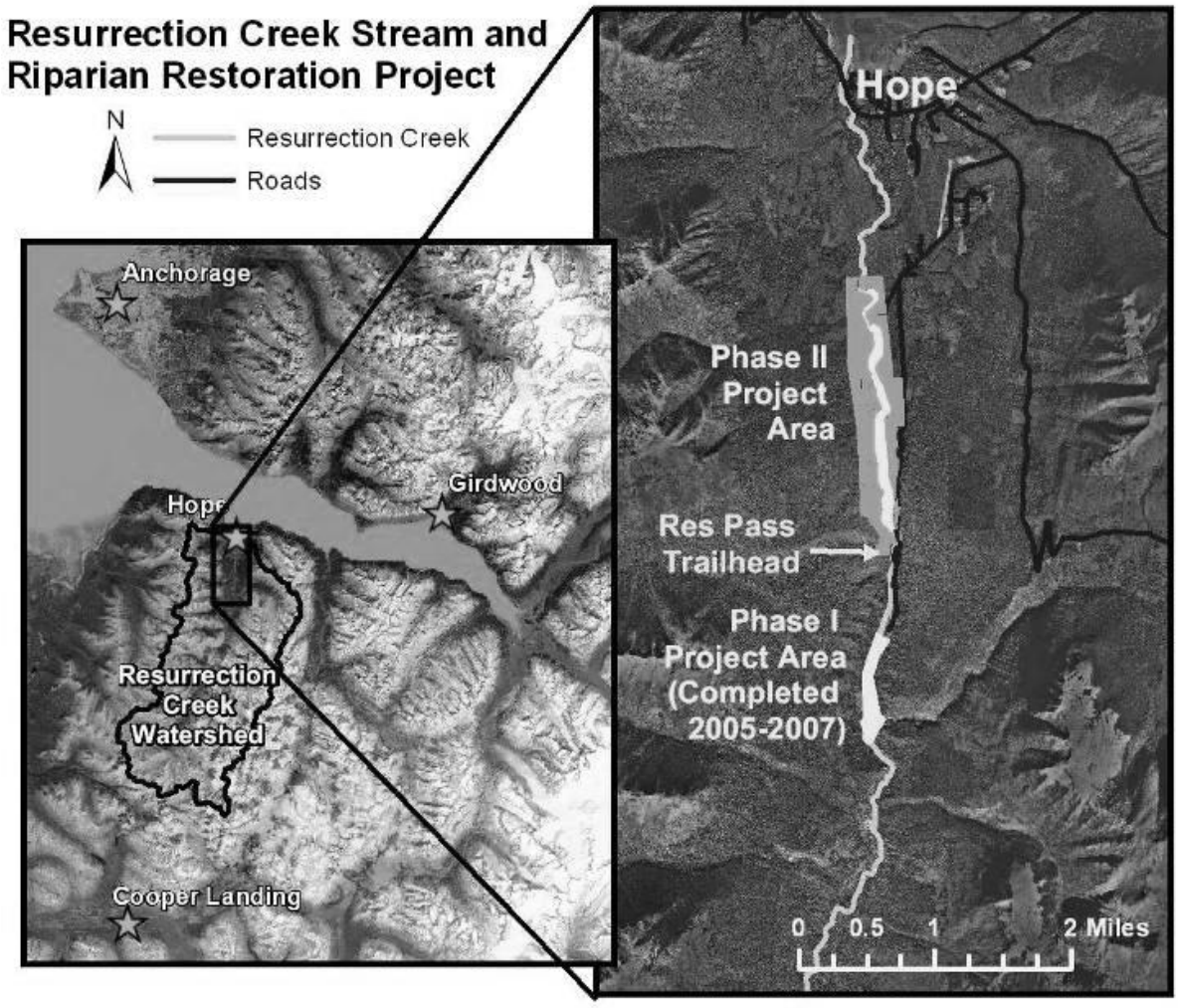

Figure 1 Vicinity map

Figure 2 Tailing piles along Resurrection Creek

Background

The Resurrection Creek watershed drains 161 square miles on the north side of the Kenai Peninsula. The community of Hope, Alaska is located at the mouth of Resurrection Creek. Resurrection Creek was the site of Alaska's first gold rush over a century ago, and placer mining continues today. Early 20th-Century hydraulic and heavy equipment placer mining adversely impacted much of the lower six miles of Resurrection Creek (Hart Crowser, Inc. 2002). Tailings have disconnected or buried the historic complex of stream channels and wetlands that provided high quality habitat for salmon, bears, bald eagles, moose and other fish and wildlife species. Natural hydrologic processes in Resurrection Creek have done little to alter the condition of the tailing piles over the last century. The mine tailings resulted in entrenchment of the stream and cut off access from the historic floodplain. The direct impact of disturbance and loss of the stream's ability to access the floodplain have severely altered aquatic habitat and riparian vegetation composition (Bair et al. 2002).

Evaluation of Resurrection Creek Fisheries

Anadromous fish distribution has been identified up to river mile-19 of Resurrection Creek, with the lower 6 miles identified as critical habitat for spawning and rearing habitat for coho (*Oncorhynchus kisutch)*, chum (*O. keta)*, pink (*O. gorbuscha)* and Chinook salmon (*O. tshawytscha)* (Hart Crowser Inc. 2002). The project area lies within this critical habitat. A 1990-1992 study evaluated juvenile salmon distributions, smolt out-migrations, and stream habitat (Blanchet and Wenger 1993). This analysis is incorporated by reference. The results showed that Resurrection Creek coho smolts were considerably smaller by age class (about 30%) than on three other study streams on the Kenai

Peninsula. In addition, virtually all Resurrection Creek coho smolts were emigrating at age 1; however 90% of coho smolts on the other streams emigrated at age 2 and 3. The lack of growth and early age at which coho smolts emigrate from the watershed indicate that rearing within the system is severely limited. The tailings piles within the placer-mined reaches have disconnected the stream from the historic floodplains and side channel habitat, which historically provided the flood flow refugia and over-wintering habitat which were critical to salmonids, especially coho.

Resurrection Creek Landscape Analysis (2002)

In order to respond to damaged resources and degraded land, and to enable future decision-making regarding the uses of the watershed and its resources, the Chugach National Forest completed a landscape analysis for the Resurrection Creek watershed (Hart Crowser, Inc. 2002). The complete analysis is incorporated by reference. The three main restoration and management components outlined in the 2002 Landscape Analysis were aquatic habitat restoration, vegetation restoration and management, and heritage resources/human uses management. The completed Phase I and proposed Phase II restoration projects are among several projects identified in this analysis.

Previous Stream Restoration

Between 2004 and 2008, the Forest Service undertook large scale restoration efforts on a one-mile mining-impacted portion of Resurrection Creek (Resurrection Creek Phase I) about 5 miles upstream of Hope (figure 1). Monitoring indicates that the restoration activities conducted under the Phase I restoration project are resulting in a more complex stream channel structure, connectivity with the floodplain and improvement of aquatic and riparian habitat (MacFarlane et al. 2009). The proposed Resurrection Creek Phase II restoration project would extend upon the Phase I project. The Environmental Impact Statement for the Resurrection Creek Phase I Stream Restoration Project (USDA Forest Service, Chugach National Forest 2004) provided environmental documentation for the project area and is incorporated by reference.

Mercury Studies

Mercury was identified as a potential concern prior to conducting restoration activities in Resurrection Creek. Historic gold mining operations may have used mercury to help extract gold from Resurrection Creek. To address this concern, fish tissue and sediment samples taken from the project area in 2008 were analyzed for mercury concentrations to determine if mercury may be present within the project area. Results of this study indicated that mercury concentrations throughout the project reach were relatively low, and the risk of encountering historic deposits of mercury during future stream restoration activities is low (MacFarlane and Olegario 2008). Similar results came out of a pair of mercury studies prior to the Phase I Restoration project in 2004 (MacFarlane 2004a; MacFarlane 2004b) (see the Aquatic Resources and Hydrology affected environment section of Chapter 3).

Existing Mining Operations

The proposed Phase II stream restoration project would occur on National Forest System lands, within federal mining claims owned by Hope Mining Company. Approximately 95 acres within the project area are currently approved for HMC mining operations through mining plans of operations approved between 1986 and 2010. This includes operations in Areas 1-12, 14 -19, and 20a. Evidence of human disturbance from past and recent mining in the project area is apparent, and mining operations are currently ongoing. The majority of the valley floor within the project area has been previously mined at least once over the past century. With a few exceptions, existing approved mining operations require a 20-foot wide "no mining" buffer along the banks of Resurrection Creek. Both mechanized and hand-mining occur. Numerous existing mining roads within the project area and one approved equipment ford across Resurrection Creek provide access for mining operations. Existing operational areas include settling pond systems and nine mining camps.

Agreement between Forest Service and HMC

Because the proposed stream restoration would occur within federal mining claims held by HMC, the Forest Service reached a conceptual agreement with HMC on December 3, 2007 that establishes a designated restoration corridor, identifies procedures for replacing existing settling ponds and mining roads that are within the restoration corridor, stipulates use of a temporary bridge over Resurrection Creek, and identifies areas outside of the restoration corridor that are suitable for restoration source materials. Under the conceptual agreement, HMC would submit a proposed mining plan of operations that would exclude mining operations from the restoration corridor, with the exception of survey line maintenance, survey monument maintenance, water extraction to replenish settling ponds, bridge and equipment crossings, and operations associated with the patenting process. The proposed plan of operations would also propose mining operations on additional areas outside of the proposed restoration corridor. Because the proposed plan of operations would support and protect the restoration activities by excluding mining from the restoration corridor, this EIS analyzes the proposed stream restoration activities as well as the proposed mining plan of operations.

Purpose and Need for Action

This project has two primary purposes:

1. Restore the degraded stream channel, floodplains, and habitat conditions along a 2-mile segment of Resurrection Creek.
2. Approve or require modifications to the proposed mining plan of operations with appropriate requirements for surface resource protection.

Legal and Regulatory Framework

1955 Multiple Use Mining Act (30 USC 612)

Mining claim holders on National Forest System lands have certain rights related to their claims. Mining claim holders generally have the following rights [See Forest Service Manual 2813.13(b) and FSM 2813.14]:

1. Occupancy and use necessary for prospecting, mining, and processing;
2. Reasonable access for purposes of prospecting, locating, and mining; and,
3. The right to use timber from the claims for mining purposes and necessary clearing.

Mining claimant rights are subject to applicable federal and state laws and regulations; including 36 Code of Federal Regulations (CFR) 228 Subpart A and the 1955 Multiple Use Mining Act (30 United States Code (USC) 612). "[All] operations shall be conducted so as, where feasible, to minimize adverse environmental impacts on National Forest surface resources" (36 CFR § 228.8). In addition, the 1955 Multiple Use Mining Act restricts mining operators to using reasonable methods of surface disturbance that are appropriate to their stage of operation (see Forest Service Handbook (FSH) 2809.15, Section 10.1).

Organic Administration Act

The Organic Administration Act requires the Forest Service, as the land manager, to minimize environmental impacts without materially interfering with a mining claimant's rights under the General Mining Laws. The 1872 Mining Law, as amended, confers a statutory right upon a mining claimant to enter upon public lands to prospect, develop and mine valuable minerals. Federal mining claims exist throughout all of the project area, and care must be taken to respect the claimant's property by avoiding claim corner markers, excavations, and mining equipment. The claimant should also be provided reasonable access routes in order to carry out necessary mineral associated activities.

Forest Plan Goals and Objectives

The following goals and objectives from the Chugach National Forest Revised Land Management Plan (USDA Forest Service, Chugach National Forest 2002a) are relevant to the proposed project:

Ecological Systems Management

Goal: Maintain a full range of naturally occurring ecological processes and flora native to South-central Alaska including a variety of vegetation types, patterns and structural components.

Objectives

- Develop a baseline estimate of current vegetation types, patterns and structural components on the Chugach National Forest. Monitor changes to these components to determine how well the plan is maintaining desired landscape conditions.

- Restore vegetation on landscapes affected by activities, natural events or processes to meet desired conditions.

Fish and Wildlife Habitat

Goal: Maintain habitat to produce viable and sustainable wildlife populations that support the use of fish and wildlife resources for subsistence and sport hunting and fishing, watching wildlife, conservation, and other values.

Objectives

- Implement standards and guidelines to protect species and their habitats through protection, conservation and restoration of important terrestrial and aquatic habitats.
- Create early to mid-successional habitat for moose and other early and mid-seral dependent wildlife species.
- Provide educational information for recreationists and others traveling in and through the Chugach National Forest on appropriate actions to avoid disruption to wildlife species.
- Improve fish habitat quality on streams, lakes and ponds at selected areas on the Chugach National Forest for sport, subsistence and personal uses.

Heritage Resources

Goal: Protect heritage resources.

Objectives

- Implement management area direction for protection and data recovery from heritage resources.
- Work with the State Historic Preservation Officer and tribal governments to develop programmatic agreements addressing management activities common to the Chugach National Forest, including special use permits, small-scale mining, forest restoration activities, recreation and trail developments, and fish and wildlife habitat manipulation.
- Implement the programmatic agreement between the Forest Service and the State of Alaska Historic Preservation Officer.
- Work cooperatively with Native groups, local communities and the State Historic Preservation Officer to enhance historic and prehistoric values on the Forest.

Recreation Resources

Goal: Provide recreation opportunities for interpretation and education as related to all Forest resources.

Objective

- Provide user education, resource interpretation; leave no trace principles, and visitor information through a variety of means both on and off the Forest.

Soil Resources

Goal: Improve soil conditions where they have been degraded.

Objectives

- Where monitoring identifies areas of degraded soil conditions, apply site-specific restoration measures or recreational closures to improve the conditions.
- Accomplish watershed restoration activities where degraded watershed conditions exist.

Water, Wetland and Riparian Areas

Goal: Provide for the proper functioning of streams, riparian areas, lakes, and wetlands.

Objectives

- Determine the current condition of aquatic ecosystems.
- Restore riparian habitat and near stream vegetation where it has been determined that the stream's proper functioning condition is outside the historic range of variability.

Minerals

Goal: Provide opportunities to develop minerals for personal and commercial uses.

Objectives

- Provide exploration and development opportunities in areas with moderate to high locatable mineral potential (gold, silver and copper).
- Mining locations with an approved plan of operations will have their sites managed with the Minerals Management Area prescription (521) which was designed to facilitate environmentally sound mining operations.

Forest Plan Desired Conditions

The following describes the desired conditions, as stated for the Kenai Peninsula Geographic Area and Forest-wide in the Chugach National Forest Revised Land and Resource Management Plan (USDA Forest Service, Chugach National Forest 2002a):

Fish and Wildlife: Natural processes with active management in selected locations will sustain fish and wildlife habitat. The productivity of habitat supporting salmon and other aquatic organisms throughout the Forest will be maintained. Anadromous fish runs of sockeye, pink, coho, and king salmon, along with Dolly Varden char and eulachon are abundant in the waters of the Kenai Peninsula. Resident populations of rainbow trout, lake trout and Dolly Varden char along with grayling and whitefish are sustained in the waters of the Chugach National Forest. Degraded fish habitat in Resurrection Creek will have restored productivity. Wildlife species such as lynx, gray wolf, river otter, bald eagle, and northern goshawk will be present throughout the Kenai Peninsula in sufficient numbers that their populations are considered secure.

Recreation and Tourism: A mix of motorized and non-motorized recreational opportunities (primarily non-motorized in the summer and motorized in winter) will exist across the Forest. During the winter season, snow-machine and other winter motorized recreation will occur over most of the Kenai Peninsula. During the summer season (May 1 through November 30), non-motorized use will predominate across the area. Improvements such as bridges, trails, trailheads, expanded campgrounds, and new cabins will extend the ability of the Kenai Peninsula to accommodate increased summer recreation use without diminishing the area's natural quality. Non-motorized use will predominate across the area during the summer season (May 1 through November 30).

Inventoried Roadless Areas

A portion of the proposed project area lies within the Resurrection Inventoried Roadless Area (IRA), defined as greater than ¼-mile from the Resurrection Creek Road (see figure 11 and the Inventoried Roadless Area analysis in Chapter 3). Road building and timber harvest in Inventoried Roadless Areas are only allowed with prior approval by the Secretary of Agriculture. The restoration of Resurrection Creek will require timber cutting. Timber cutting for the restoration is exempted under the 2001 Roadless Rule at 36 CFR 294.13(b)(1)(ii) because the restoration project restores ecosystem characteristics that were adversely affected by historic mining. The mining plan of operations will require both timber cutting and road building. Timber cutting and road building for mining activities are exempted under the 2001 Roadless Rule at 36 CFR 294.12(b)(3) because of a prior existing mineral right. This right was established in 1974.

Proposed Action

Under the Proposed Action, the Forest Service would do the following:

- Restore the stream channel, riparian areas, and fish and wildlife habitat of a 2-mile segment of Resurrection Creek on National Forest System lands, within a designated restoration corridor.
- Approve a supplement to the existing mining plans of operations in order to exclude most existing approved mining activities from the proposed restoration corridor.
- Approve new mining operations within proposed mining areas outside of the restoration corridor only after HMC defines specific operations and provides acceptable reclamation bonds.

Proposed Restoration Activities

The following activities are proposed to restore 2 miles of Resurrection Creek's channel, floodplain, and streamside vegetation to pre-mining conditions, and to enhance fish and riparian wildlife habitat:

1. Access for heavy equipment used during restoration activities, including a temporary bridge over Resurrection Creek.
2. Mechanical manipulation and grading of up to approximately 200,000 cubic yards of mine tailings to recover floodplain width and elevations.

3. Construction of a meandering river channel and adjacent side channels that mimic natural conditions, provide abundant habitat, and promote a self-sustaining riparian ecosystem.
4. Selective removal of beetle killed spruce and cottonwood trees to be used for stream bank protection, habitat improvement, and floodplain stabilization.
5. Placement of nutrient-rich, weed-free soils and organics on the newly constructed floodplains and riparian areas to improve growing conditions for native plant communities.
6. Natural re-vegetation and planting of native plant species on constructed floodplains and riparian areas.

Proposed Mining Activities

The Forest Service received a proposed mining plan of operations from HMC on December 12, 2007. This proposal is connected to and supports the proposed restoration project along Resurrection Creek by excluding most mining operations from a designated restoration corridor. The plan of operations also proposes mining in additional areas outside of the restoration corridor.

The proposed plan of operations proposes mining areas as well as operational areas. Mining areas are proposed for active mining of the mineral content; whereas operational areas are proposed for use to support mining activities (such as mining camps, settling ponds and ditches). These two types of areas are not mutually exclusive and there is some overlap. The proposed mining plan of operations proposes 200 acres of mechanized mining and 41 acres of hand mining with some mechanical preparation, all of which are located outside of the restoration corridor. Mechanized mining activities generally include the use of heavy equipment, such as bulldozers, excavators, yard loaders, and shaker plants. Hand mining activities generally include shoveling material into a small sluice, and hand-panning the sluice concentrate after a site has been prepared with mechanized equipment. In addition, approximately 23 acres of operational areas are also proposed.

Decision Framework

This EIS evaluates site-specific management proposals, presents alternatives for consideration, and analyzes the effects of the activities proposed in the alternatives in order for the deciding official to make the following decisions:

1. Whether to undertake restoration activities on Resurrection Creek, and if so, what will be the nature, magnitude, and extent of those activities;
2. What, if any modifications to the proposed mining plan of operations are necessary to minimize adverse environmental impacts on National Forest surface resources, including any resources that may benefit from the restoration of Resurrection Creek.

The following considerations will be important to the decision:

1. The objectives of the Resurrection Creek Phase II restoration project are to achieve a more complex stream channel structure, restore connectivity with

the floodplain, and improve aquatic and riparian habitat. The extent to which any alternative achieves these objectives will be important to any decision.

2. Forest Service regulations (36 CFR Part 228A), require that mining operations on National Forest System lands be conducted so as, where feasible, to minimize adverse environmental impacts on National Forest surface resources. It will be important to the decision to approve a mining plan of operations that is consistent with this requirement.

Public Involvement

The Notice of Intent (NOI) was published in the Federal Register on January 28, 2008. A scoping letter was sent to the public on January 4, 2008, and public comments were accepted until February 21, 2008. Public meetings were held on February 12, 2008 in Hope, Alaska, and on February 13, in Anchorage, Alaska. An informative public meeting was held on June 13, 2009 in Hope, Alaska with a site visit to the project area. Using the comments from the public and other agencies, the interdisciplinary team developed a list of issues to address.

Issues

The Forest Service identified issues as either significant or non-significant. Significant issues were defined as those directly or indirectly caused by implementing the proposed action. Non-significant issues were identified as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality (CEQ) NEPA regulations explain this delineation in Sec. 1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)…" A list of non-significant issues and reasons regarding their categorization as non-significant may be found in the project record.

The Forest Service identified the following significant issues during scoping:

1. **Water Quality**: Restoration and mining activities have the potential to increase turbidity in Resurrection Creek. Turbidity, measured in Nephelometric Turbidity Units (NTU), is a measure of the cloudiness of water, typically the result of the transport of suspended sediment. The extent to which any alternative would result in increased turbidity that adversely affects water quality will be important to any decision.
2. **Salmon Populations**: Restoration and mining activities have the potential to harm salmon populations in Resurrection Creek as a result of use of equipment in the channel and short term increases in turbidity. The extent to which any alternative would result in adverse impacts to salmon populations, particularly during critical periods of salmon development, will be important to any decision.

Public Comment Period for the Draft EIS

Reviewers should provide the Forest Service with their comments during the review period of the draft environmental impact statement. The review period begins the day the Notice of Availability is published in the Federal Register. Comments must be postmarked, faxed, or emailed within 45 days, beginning on the first day after publication in the Federal Register (36 CFR 215.6). The submission of timely and specific comments can affect a reviewer's ability to participate in subsequent administrative review or judicial review.

Comments received in response to this solicitation, including names and addresses of those who comment, will be part of the public record for this proposed action. Comments submitted anonymously will be accepted and considered; however, anonymous comments will not provide the respondent with standing to participate in subsequent administrative review or judicial review.

Permits, Licenses, and other Entitlements

The following permits and agency reviews may be needed for the Resurrection Creek Phase II Stream and Riparian Restoration Project:

Alaska Department of Natural Resources

Alaska Coastal Zone Management Program (ACMP): The Alaska Department of Natural Resources (ADNR) Division of Coastal and Ocean Management coordinates and compiles the State, Federal, and Borough permit reviews by various agencies and develops a final consistency response based on reviewer comments. The project area lies within the "Coastal Zone," and project activities must be consistent with the intent of the ACMP (11 AAC 110). A Project Consistency Determination generally requires that all relevant permits will be approved by the permitting agencies involved with the project.

ADNR Temporary Water Use Permit: The ADNR Division of Mining, Land, and Water oversees applications for water rights and temporary water use permits for use or diversion of the waters of the State of Alaska. Proposed diversions of Resurrection Creek will need to be reviewed by the Division of Water and may require a temporary water use permit for stream water diversions.

ADNR Temporary Land Use Permit: A temporary land use permit may be required from ADNR prior to implementation.

Alaska Department of Fish and Game (ADF&G) Title 16 Fish Habitat Permit

The ADF&G Division of Habitat enforces Alaska Statute 16.05.871 (Anadromous Fish Act), which requires prior notification and permit approval to "construct a hydraulic project, or use, divert, obstruct, pollute, or change the natural flow or bed" of a specified waterbody. The Division of Habitat will review the project and issue the permit. Project approval may be given subject to additional terms or conditions as stated in the permit.

U.S. Army Corps of Engineers, Regulatory Division (ACOE)

This project falls under the regulations of Section 404 of the Clean Water Act as concerns dredge and fill within wetlands. The restoration project will need a jurisdictional determination by ACOE to determine if it qualifies under a nationwide permit (#27 – for restoration of fish and wildlife habitat) or will require an individual permit. In either case, project construction would need to follow ACOE practices for minimizing impacts to wetland areas. This Section 404 permitting process requires approval of a Section 401 (Water Quality) permit from the Alaska Department of Conservation (ADEC). Both ADEC and the ACOE will need to review proposed practices for the project to assure minimization of project impacts to water quality.

Alaska Department of Environmental Conservation (ADEC)

The ADEC enforces the water quality standards of the State of Alaska. ADEC must approve a Clean Water Act Section 401 permit to assure the project complies with State Water Quality Standards. The permit can place stipulations on techniques used during project construction. ADEC works with the ACOE to evaluate Section 401 compliance. The US Environmental Protection Agency (EPA) can oversee the Section 401 Permitting if they see the necessity.

Kenai Peninsula Borough

ACMP consistency requires that the project meet the policies of the Kenai Peninsula Coastal Management Plan. During the project consistency review, the Borough reviews the proposed project to assure it meets Borough policies. Lacking consistency, the Borough can ask for modifications to the plan. The Kenai Peninsula Borough also requires a Floodplain Development Permit for all development within a mapped floodplain or floodway.

U.S. Fish and Wildlife Service, Ecological Services (USF&WS)

Because Resurrection Creek is an anadromous stream, USF&WS is involved in the ACMP Permitting Process and can submit comments and recommendations to OPMP during project review.

National Marine Fisheries Service (NMFS)

Because Resurrection Creek is anadromous, NMFS is involved in the ACMP Permitting Process and can submit comments and recommendations during project review regarding Essential Fish Habitat (EFH). In 2004, NMFS determined that the Resurrection Creek Phase I restoration project would have "no more than a minimal impact and will not result in any substantive adverse effect to EFH." A determination would need to be made for the Phase II project.

Figure 3 Settling pond and tailings pile on HMC claims.

CHAPTER 2. ALTERNATIVES, INCLUDING THE PROPOSED ACTION

Introduction

This chapter describes and compares the alternatives considered for the Resurrection Creek Phase II Stream and Riparian Restoration Project and Hope Mining Company Proposed Plan of Operations. It includes a description of each alternative considered and presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice among options by the decision maker. Some of the information used to compare the alternatives is based upon the design of the alternative (e.g. the length of stream to be restored and the associated amount of material to be mechanically manipulated) and the environmental, social and economic effects of implementing each alternative.

Alternatives Considered in Detail

The Forest Service developed three alternatives, including the No Action and Proposed Action in response to issues raised internally and by the public. A comparison of the alternatives is presented in Table 1, and maps of Alternatives 2 and 3 are provided in Appendix B.

Alternative 1 – No Action

Under the No Action alternative, current management would continue in the project area. Under this alternative, no restoration activities would take place in the project area, and mining on existing claims would still occur within the project area under existing approved mining plans of operations. Under the current approved plans of operations, mining would occur on 95 acres in Areas 1-12, 14 -19, and 20a.

HMC has submitted a proposed mining plan of operations, which includes new mining areas as well as modifications to existing approved plans of operations. The Forest Service has a statutory requirement to act on the proposed mining plan of operations under the 1955 Multiple Use Mining Act (30 USC 612) and a regulatory obligation to approve or require modifications to any proposed plan of operations (36 CFR 228.5). For this reason, the selection of the No Action alternative is not possible because taking no action would conflict with these legal and regulatory requirements. However, the No Action alternative is required by NEPA. The “Affected Environment” section for each resource in Chapter 3 provides a description of the environmental consequences of taking “no action,” describes the existing condition of the project area, and serves to make a comparison between the Proposed Action and the No Action Alternative.

Alternative 2- Proposed Action

The Proposed Action would conduct full restoration of the stream channel, floodplain, and riparian areas within a 200 to 500-foot wide restoration corridor. Approximately 2 miles of Resurrection Creek's channel, floodplain and streamside vegetation would be restored to pre-mining stream channel and riparian conditions. The restoration would enhance fish and riparian wildlife habitat.

The Proposed Action would also determine the conditions necessary to approve mining operations in a total of 264 acres in specified areas outside of the restoration corridor. The Forest Service received a proposed mining plan of operations from HMC on December 12, 2007. This proposal to mine and subsequently reclaim areas on federal mining claims owned by HMC is connected to and supports the proposed restoration project along Resurrection Creek by also excluding most mining activities from within the designated restoration corridor as defined in the December 3, 2007 conceptual agreement between the Forest Service and HMC. Refer to the Alternative 2 Map in Appendix B for locations of the restoration corridor, roads, mining areas, settling ponds, ditches, and mining camps.

Proposed Restoration Activities

Restoration would occur within a 2-mile long, 200 to 500-foot wide, 76-acre restoration corridor, as specified in the December 3, 2007 conceptual agreement between the Forest Service and HMC. The majority (greater than 90%) of the channel and floodplain construction would be conducted out of flowing water. Restoration activities would include the following components:

- Up to 220,000 cubic yards of placer mine tailings would be mechanically redistributed to re-contour the floodplain and recover floodplain elevations and widths. Substrate within the mine tailings would be graded and contoured to increase average floodprone width to bankfull width ratios from 1:1 to 4:1 to allow flood flows access to the historic floodplain and off-channel fish habitat. Wetland areas with ponds would be created in the floodplains, and floodplains and riparian areas would be re-vegetated.
- Tracked excavators and bulldozers would be used to reconstruct the stream channel, stream banks, and gravel bars. A new meandering pool-riffle channel would be constructed, created to mimic a naturally formed channel. Segments of the existing channel would be used as part of the new channel wherever feasible. New channel segments would be constructed to final grade "in the dry" before diverting water into the new segment. After new channel segments are completed, "push-up" dams composed of native boulders and substrate would be constructed to divert water into the newly constructed channels.
- By creating the new meandering channel, channel length would be increased by approximately 1,500 feet, channel slope would be decreased from about 1.5% to 1.3%, and channel sinuosity would be increased from about 1.1 to 1.3. Aquatic habitat features would be constructed in the restored channels

by creating pools, off-channel areas, rock structures, rock and log structures, constructed logjams, and spawning areas.

- New side channels and ponds would be constructed in floodplain areas and in some of the abandoned sections of the existing channel. Side channels, wetland complexes, and off-channel rearing ponds would be designed and constructed to maintain between 5 and 20% of the perennial flow.

Restoration Objectives

Short-term restoration objectives (2 to 3 years after the construction) include the following:

1) Restore about 54 acres of floodplains.
2) Increase floodprone width to bankfull width ratio (entrenchment ratio) from 1:1 to greater than 4:1.
3) Decrease average channel slope from 1.5% to 1.3%.
4) Increase channel length by 15% (1,500 feet) and sinuosity from 1.1 to 1.3.
5) Increase the number of pools with residual pool depths greater than 3 feet from less than 5 pools per mile to about 20 pools per mile.
6) Construct approximately 8,000 feet of new side channels, and increase perennial side channel flow from less than 1% to 5-20%.
7) Increase the aerial extent of spawning gravel from 600yd^2 to 3,600yd^2.
8) Increase large in-stream woody debris from 12 pieces per river mile to about 340 pieces per river mile.
9) Restore topsoil and fines to greater than 80% of the active floodplain.
10) Increase floodplain coarse woody material from 16 to about 120 pieces per acre.
11) Restore riparian tree species composition to 50% spruce, 40% cottonwood, and 10% poplar/hemlock with a *calamagrostis* understory.
12) Increase snags from 4 to about 40 snags per acre.

Long-term restoration objectives (beyond 30 years of project completion) include restoration of the riparian stand structure to 20% large trees (greater than 24 inches in diameter), 15% small trees (24 to 16 inches in diameter), 20% poles (16 to 12 inches in diameter), and 45% seedling/saplings.

Source of Materials for Restoration

Restoration materials such as boulders for construction of the restored channel, trees for logjam construction, and soil for spreading on restored floodplain areas to enhance re-vegetation efforts would be obtained from within the restoration corridor and adjacent mining areas within the project area, as described in the December 3, 2007 conceptual agreement between the Forest Service and HMC. This would include harvesting up to 2,000 trees, with and without root wads, for use as bank and floodplain stabilization on the new stream channel and floodplain. The source for some of these materials is from areas that would be mined in the future. Within the project area, approximately 50% of medium to large spruce and cottonwood would be retained during harvest. Additional trees

may come from nearby fuels reduction projects that have been analyzed in separate environmental analysis.

Re-vegetation

The proposed re-vegetation of the newly constructed floodplains would create a mosaic of vegetation of different species and ages. Soils and organics stripped away during historic placer mining operations would be replaced to enhance re-vegetation efforts. Soil enhancement would improve growing conditions for native plant communities in constructed floodplains and riparian areas. Soil and sod would be gathered from source areas within the project area. Some thinning of existing overstocked riparian sapling spruce and cottonwood stands adjacent to Resurrection Creek may occur. Constructed floodplains and riparian areas would be planted with native species. Natural re-vegetation (without planting) would occur where seed sources and site conditions are favorable. Where such conditions are lacking, the site would be planted.

Restoration Access

A temporary bridge over Resurrection Creek would be constructed near the middle of the project area for use during restoration implementation. The bridge would be designed to pass fuel trucks and repair trucks and would be rated to pass 40,000 pounds. Public foot traffic would be permitted over the bridge, but may be restricted during periods of heavy equipment operation associated with construction or mining.

For stream restoration in the long term, the temporary bridge would have limited use following the restoration construction and re-vegetation. The Forest Service has agreed that HMC could use the bridge as specified in the proposed mining plan of operations. HMC would have specific responsibilities for the bridge, such as gating the bridge from use by the public vehicles, conducting any needed maintenance measures on the bridge, and allowing access over the bridge by the Forest Service for administrative purposes. The Forest Service would make routine bridge inspections to evaluate the bridge safety. When these inspections deem the bridge no longer safe, the bridge would be decommissioned, removed, or in the case of a log-stringer bridge, left to decay in place. HMC could use and would be responsible for maintaining the bridge as approved in the plan of operations. If the bridge is damaged beyond repair or becomes unsafe due to age, use, or neglect and fails inspection by a qualified Forest Service engineer, the bridge would be decommissioned.

HMC currently has access routes developed on both sides of Resurrection Creek for accessing different parts of the claim block. The Forest Service would use the established roads and trails for restoration site access during construction. Use of these roads would be coordinated between the restoration contractor, HMC and the Forest Service.

Mining road or trails within the restoration corridor removed during restoration would be relocated outside of the corridor by the Forest Service, as outlined in the 2007 conceptual agreement. Replacement roads and trails would be of at least equal quality so that HMC can maintain access to their claims. About 1.7

miles of replacement road construction would be required to relocate existing sections of HMC roads out of the restoration corridor.

Existing Mining Settling Ponds within the Restoration Corridor

Within the valley floor, HMC has in place a number of settling ponds used for mining operations. Settling ponds within the restoration corridor would be removed during restoration. The Forest Service would replace any decommissioned ponds with new ponds outside the restoration corridor on a water volume for water volume basis, as outlined in the December 3, 2007 conceptual agreement between HMC and the Forest Service. Some of the segments of the Resurrection Creek channel outside of the restoration corridor that are abandoned and unfilled following restoration would also become replacement settling ponds that could be utilized by HMC.

Proposed Mining Operations

Under the Proposed Action, mining activities would occur on a total of 264 acres. There are two types of areas described as part of the proposed mining. *Mining areas* include areas where predominant activities include preparation of the area for mining (establishing access, establishing ditch and settling pond systems, clearing mining areas of vegetation and soil), active mining of mineral content (mechanical mining, hand mining, suction dredging, etc), and reclamation activities. *Operational areas* include activities such as development and use of camps, and maintenance of settling ponds, ditches, and roads. Many of these operational areas were previously mined and are now primarily being used for operational support for mining. These two types of areas are not mutually exclusive, as operational activities do overlap with mining areas.

Proposed Mining

Mining and subsequent reclamation would occur sequentially over 241 acres, pending HMC defining discrete operations and providing acceptable reclamation bonding. A supplement to the existing plans of operations would exclude existing approved mining operations from the restoration corridor with the exception of minimal maintenance-type operations as defined in the 2007 conceptual agreement between the Forest Service and HMC. The proposed mining plan of operations includes two types of mining; mechanized mining and hand mining. Mechanized mining would occur on approximately 200 acres, and hand mining would occur on approximately 41 acres.

Mechanized mining

Proposed mechanized mining activities generally include the use of heavy equipment, such as a bulldozers, excavators, front end loaders, and wash/shaker plants. This type of mining activity would occur on areas with flat terrain or shallow slopes. The general mining process begins with preparing the mining area by 1) establishing access routes to the area if needed and not already existing, 2) clearing brush and vegetation and stockpiling overburden and soil by using dozers, excavators, and/or loaders, and 3) establishing drainage ditches and ponds when necessary for reducing water content in gravels in the mining

area to keep water used in the mining process separate from streams and other surface waters and to allow sediment to settle.

Mining would consist of trenching across an area with an excavator, washing the gravels from the trench through the wash/shaker plant and through the sluice, and depositing resulting tailings adjacent to the trench. The next pass through the area would include digging a trench adjacent to the first trench, and tailings from the sluice and shaker plant are deposited in the first trench cut. Operational variations may occur from this basic process depending on terrain, materials, and other conditions that affect mining methodology. No mining would occur within the restoration corridor or within 20 feet of stream banks.

After an area has been mined, reclamation activities would include re-contouring tailings and redistributing stockpiled soil and overburden. Where practicable soil would be stockpiled prior to mining and then re-spread back over the disturbed area following mining operations. Ponds and ditches no longer needed for mining activities in adjacent or upstream areas would be filled in, re-contoured, and covered with soil. Roads no longer needed for mining or operational activities would be re-contoured and closed.

Hand mining with Mechanized Preparation

Proposed hand mining may occur in areas identified as having slopes too steep for mechanized mining and other areas not feasible for mechanized mining. This type of mining would consist of utilizing mechanized equipment where possible for clearing and stockpiling topsoil and moving large boulders, and to maintain good drainage into existing ditch lines and pond systems. Hand mining would include shoveling material into a small sluice, and hand panning the sluice concentrate. A small water pump circulating water from ditch/settling pond system would be used to wash material through the sluice. Again, operational variations may occur from this basic process depending on terrain, materials, and other conditions that affect mining methodology.

Operational Areas

Operational areas are subject to ongoing surface use determinations that define the scope of operational needs in the context of the mining operations. Approximately 23 acres of operational areas are proposed.

Mining Camps

There are 10 existing mining camps. The term “camp” broadly refers to operational areas that include camping areas, fuel storage, equipment repair, and equipment storage. No new camps are proposed, but Camp 5 would expand in size to cover about 2 acres and would expand the scope of the facilities. Fuel is proposed to be stored at Camp 5 and would continue to be stored at Camp 2.

Ponds/Ditches

New drainage ditches and/or ponds would be established where necessary to allow ample opportunity for settling of suspended sediment from processed waters. All new and existing settling ponds and ditches would be maintained over time until no longer needed for mining operations. HMC could also set up

pipe and withdraw water from Resurrection Creek in various places within the restoration corridor if needed to fill ponds located outside the corridor.

All the ditches and ponds on the west side of Resurrection Creek would be connected to one drainage system from Area 22 downstream to Area 15b. All ponds and ditches on the east side of Resurrection Creek would be part of one drainage system from Area 8 downstream to Area 16. Locations of new ponds and ditches are conceptual and would be field-fit in the most logical location for the topography and for proper drainage and located to ensure they do not fail in the event of flooding. Properly located and maintained drainage systems would prevent turbid, sediment laden water from entering Resurrection Creek.

Roads/Trails to Access Mining Areas

Some proposed mining operations in Areas 1, 14, 16, 20, 21, 23, 24, and 25 would need new access routes to be established for truck and equipment passage. The remaining areas have existing road and trail access. These may need brush clearing and leveling of the travel surface. Approximately 1.5 miles of new mining roads would be constructed on the east side of the restoration corridor, and 1.5 miles of new mining roads would be constructed on the west side of the corridor. The Forest Service may use these new roads during restoration as long as restoration operations do not interfere with mining operations.

The restoration corridor would eliminate some existing access. Replacement roads/trails would be re-established in kind by the Forest Service for mining access. Routes into mining areas would be used for access with mining equipment (dozers, excavators, loader), pickup trucks, and ATV's. There are two main roads leading into mining areas from Resurrection Creek Road. These two roads currently are gated to prevent unauthorized vehicle access, and this would continue under this proposal. HMC would maintain routes by keeping brush cleared, grading of surface, filling potholes, resurfacing roads with gravels from a gravel pit on claims on the north end of project area or from existing mining operations in approved areas, and keeping culverts clear and functional. HMC would also utilize three equipment fords across Resurrection Creek. One would be in the vicinity of Areas 11 and 12. The second would be in the vicinity of Areas 20 and 10. The third would be at the north end of the project area outside of the proposed restoration corridor in Areas 15a and 15b.

Timing of Project Implementation

Project implementation of the restoration work would be phased over a period of up to 4 years to accomplish restoration of the entire reach. Instream channel work would be conducted between May 15 and July 15 of each construction season to minimize the impacts on fish populations, and re-vegetation would occur in June of the year following completion of construction in each area.

The proposed mining and subsequent reclamation would occur sequentially over a period of approximately 20 years, and would be conducted between May and October of each year.

Alternative 3- No Restoration (Mining Operations Only)

The Forest Service has a regulatory obligation to approve or require modifications to a submitted mining plan of operations (36 CFR 228.5). For this reason, the Forest Service has an obligation to consider the proposed mining plan of operations submitted by HMC; irrespective of whether any restoration of Resurrection Creek occurs. Although the Forest Service has a regulatory obligation related to submitted mining plans of operation, the right to the mineral estate is subject to applicable Federal and states laws and regulations; including 36 CFR 228 Subpart A and the 1955 Multiple Use Mining Act (30 USC 612). 36 CFR 228.8 states that [a]ll operations shall be conducted so as, where feasible, to minimize adverse environmental impacts on National Forest surface resources" (36 CFR § 228.8). In addition, the 1955 Multiple Use Mining Act restricts mining operators to using reasonable methods of surface disturbance that are appropriate to their stage of operation (see FSH 2809.15, Section 10.1). For the above reasons, Alternative 3 is considered in this analysis.

Alternative 3 was also developed to respond to the two significant issues identified in Chapter 1, which include impairment of water quality and potential harm to salmon populations. Increases in turbidity and impacts from channel relocation resulting from restoration activities would not occur under this alternative.

Alternative 3 would determine the conditions necessary to approve mining operations in a total of 267 acres in specified areas throughout the project area. No restoration corridor would be established, and no stream and riparian restoration activities would occur as in the Proposed Action. Many of the mining areas under Alternative 3 would be similar in nature and size to those shown and described in the Proposed Action. The nature of operational activities within these areas under Alternative 3 would be the same as the Proposed Action, but the total acreage of operational acres would be greater than in the Proposed Action. Much of the area along the existing Resurrection Creek channel (identified as the restoration corridor in the Proposed Action) has been mined in recent years or is already approved for mining and contains much of the existing settling pond system and road system. The following description highlights the differences between Alternatives 2 and 3. Refer to the Alternative 3 map in Appendix B for locations of roads, mining areas, settling ponds, ditches, and mining camps.

Proposed Mining Areas

Under Alternative 3, mining and reclamation would occur sequentially over 234 acres, pending HMC defining discrete operations and providing acceptable reclamation bonding. Because no restoration corridor would be established under this alternative, no mining activities would be excluded from any previously existing approved mining operations. No mining would occur within 20 feet of stream banks. Mining area boundaries for Alternative 3 are defined by a 20-foot wide buffer zone along Resurrection Creek. Two types of mining are proposed in this alternative. Mechanized mining would occur on 193 acres. Hand mining would occur on 41 acres.

Mechanized mining

The nature of the proposed mechanized mining would be the same as the activities described in the Proposed Action. Alternative 3 would have approximately 7 fewer acres of mechanized mining than Alternative 2.

Hand mining with Mechanized Preparation

The nature and size of the proposed hand mining operations would be the same as the activities described in the Proposed Action.

Resurrection Creek Re-Alignment

HMC would move Resurrection Creek from its current alignment in two locations. A 2500-foot long section of the stream channel between mining Areas 16 and 18 would be moved east approximately 300 feet. The relocated channel would re-enter the existing alignment before it enters the steeper walled valley near Sourant's Camp location in Area 18. The abandoned stream channel would then be mined and utilized for part of the settling pond/ditch system on the west side of the valley. Also, an 850-foot long section of the stream channel between mining Areas 15a and 15b would be moved 200 to 300 feet to the east. The relocated section of stream channel would re-enter its existing alignment where it enters the narrow canyon to the north. The abandoned creek channel would be mined as part of Area 15b.

Operational Areas

Under Alternative 3, approximately 33 acres of operational areas are proposed.

Mining Camps

The camps would be the same as those described in the Proposed Action.

Ponds/Ditches

The existing drainage ditches and settling ponds located on either side of Resurrection Creek would be kept intact for the most part. Some existing ponds would need to be expanded for greater capacity for settling of suspended sediment from processed waters. New settling ponds and ditches would be needed for some of the proposed mining areas. All new and existing settling ponds and ditches would be maintained over time until no longer needed for mining operations.

As with the Proposed Action, all the ditches and ponds on the west side of Resurrection Creek would be connected to one drainage system from Area 22 downstream to Area 15b. All ponds and ditches on the east side of Resurrection Creek would be part of one drainage system from Area 8 downstream to Area 16. Locations of new ponds and ditches are conceptual and would be field-fit in the most logical location for the topography and for proper drainage. Properly located and maintained drainage systems would prevent turbid, sediment laden water from entering Resurrection Creek.

Roads/Trails to Access Mining Areas

Many of the existing access routes would be maintained in this alternative. Some proposed mining operations in Areas 1, 14, 16, 20, 21, 23, 24, and 25

would need new access routes to be established for truck and equipment passage. The remaining areas have pre-existing roads and trail access. These may need brush clearing and leveling of the travel surface. A new road alignment would also be needed in both areas where the creek would be moved in the northern end of the project area. Approximately 3.5 miles of new mining roads would be constructed.

Routes into mining areas would be used for access with mining equipment (dozers, excavators, loader), pickup trucks, and ATVs. There are two main roads leading into mining areas from Resurrection Creek Road. These two roads currently are gated to prevent unauthorized vehicular access, and this would continue under this alternative. HMC would maintain routes by keeping brush cleared, grading of surface, filling potholes, resurfacing roads with gravels from a gravel pit on claims on the north end of project area or from existing mining operations in approved areas, and keeping culverts clear and functional.

HMC would build a bridge at the northern end of existing approved area 5. HMC is already approved for building a bridge in this location and would need it to access existing approved mining area and new proposed mining areas. HMC would also utilize three equipment fords across Resurrection Creek at the same locations as the fords described under the Proposed Action.

Timing of Project Implementation

The proposed mining and subsequent reclamation would occur over a period of approximately 20 years. Mining would be conducted between May and October of each year.

Table 1 Comparison of the Alternatives

Component	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 No Restoration
Amount of Restoration	None	Restore 2 miles of Resurrection Creek within the 76 acre restoration corridor, construct ~8,000 feet of side channels, and create ~54 acres of new floodplain within the restoration corridor.	None
Aquatic Habitat Enhancement	None	Increase sinuosity, decrease channel slope, increase pool frequency, increase LWD, increase off-channel habitat	None (channel relocation for mining would not improve aquatic habitat)
Bridges	HMC retains approval to construct bridge	Forest Service constructs temporary modular or log stringer bridge	HMC constructs bridge
Equipment Crossings	One equipment ford for mining access	3 equipment fords for restoration and mining	3 equipment fords for mining
Road Relocation & Construction	None	~ 1.8 miles of existing roads decommissioned (within restoration corridor) ~ Forest Service constructs 1.7 miles of replacement roads ~ HMC constructs an additional 3.0 miles of new mining roads	HMC constructs ~3.5 miles of new mining roads, utilizes existing roads
Total area of existing approved mining areas retained	95 acres	50 acres outside of restoration corridor	95 acres
Total area of proposed new mining areas	0 acres total	264 acres total outside of the restoration corridor, including: ~ 200 acres mechanical mining ~ 41 acres hand mining ~ 23 acres operational areas - limited mining operational activities occur within restoration corridor	267 acres total, including: ~ 193 acres mechanical mining ~ 41 acres hand mining ~ 33 acres operational areas
Mining Operations	- 9 camps covering 3.3 acres - 17 settling ponds - 1.6 miles of settling ponds and ditches	- 10 camps covering approx. 5 acres - 58 settling ponds ~ 6.2 miles of settling ponds and ditches	- 10 camps covering ~ 5 acres - 63 settling ponds ~ 6.4 miles of settling ponds and ditches ~ 3,350 feet of Resurrection Creek channel relocated for access to mining areas

Mitigation Measures common to Alternatives 2 and 3

Restoration Activities	Mining Activities	Mitigation Measure
		Fisheries/ Hydrology
X	**X**	Apply Best Management Practices (BMPs) (USDA Forest Service, Alaska Region 2006) during implementation of all activities for the protection of water quality, floodplains, wetlands, and riparian areas. Specific BMPs that may apply to this project include those in Chapter 12 (Watershed), Chapter 14 (Transportation and Other Facilities), Chapter 17 (Minerals), and Chapter 18 (Fish and Wildlife Habitat).
	X	Any surface water outflow from settling pond systems must meet all State of Alaska water quality standards, including the standard for turbidity (Alaska Department of Environmental Conservation 2006). The Forest Service will monitor turbidity conditions in Resurrection Creek during weekly inspections of the mining operations. If State water quality standards are exceeded, the Forest Service will work with HMC to take appropriate corrective actions and notify ADEC as defined in the Memorandum of Agreement between the Forest Service and ADEC (USDA Forest Service, Alaska Region 1992b).
X	**X**	Access roads will be designed and constructed to limit the concentration of runoff on the road surfaces and establish adequate water conveyance for side slope cross drainages.
X	**X**	Excavation of new stream channels should be done “in the dry” wherever possible. Construction berms or silt fences should be used to minimize sediment runoff where excavation and grading work takes place immediately adjacent to water bodies. Water diversions, temporary settling ponds, and check dams should also be used to minimize downstream sedimentation and turbidity.
X	**X**	Restoration activities that require the use of designated stream crossings will be permitted under the Alaska Coastal Zone Management Program and the Alaska Department of Fish and Game permitting process. Restoration-related stream crossings will be held to a minimum and will occur from May 15 to July 15. Mining activities that require the use of stream crossings will be permitted separately by the applicable state agencies to minimize disturbance to aquatic habitat and populations.

Restoration Activities	Mining Activities	Mitigation Measure
X	X	Exposed earthwork resulting from mining or restoration activities on steep slopes prone to erosion and the banks of Resurrection Creek and its side channels should be stabilized to prevent erosion and sedimentation. Erosion control methods such as coarse mulch, willow cuttings, and native grass should be applied to these areas in order to reduce soil erosion and sedimentation.
X	X	A spill prevention plan will be required for heavy equipment working in all approved mining areas and within the restoration corridor. This plan will include provisions for hydrocarbon spills that comply with Alaska State requirements.
X	X	Any above-ground storage tank for petroleum products must be located a minimum of 100 feet from anadromous waters and must meet EPA and ADEC standards. A Spill Prevention, Control and Countermeasure Plan must be prepared and must be available on site for inspection prior to fuel storage tanks becoming operational.
	X	If any concentrations of mercury are encountered or observed during mining operations, Hope Mining Company will notify the Forest Service immediately and minimize disturbance of the mercury. The Forest Service will coordinate with Hope Mining Company to safely implement established protocols for mercury cleanup (US Environmental Protection Agency 2007; US Environmental Protection Agency 2009).
	X	A mining reclamation plan will be developed that includes stockpiling soil and overburden prior to mining where feasible, spreading of tailings material evenly over the mined area and the redistribution of soils and organic debris across the area following final contouring.
X	X	Bridge design should include a clear-span structure with abutments offset from the ordinary high water line. The bridge should be positioned to minimize changes in streamflow direction or velocity.
X	X	The number of stream diversions and the magnitude and duration of turbidity plumes should be minimized. All stream diversions and instream work must occur during the Alaska Department of Fish and Game instream construction window (May 15 to July 15) to minimize impacts to salmon. All stream channel modifications will comply with all State and Federal permitting requirements.

Restoration Activities	Mining Activities	Mitigation Measure
		Air/Climate Change
X	**X**	During the proposed activities, efforts should be made to retain as much existing forested area as possible in order to maximize the capacity for carbon sequestration. Trees and vegetation should be left undisturbed in areas where restoration, mining, and associated operational activities are not planned to occur.
		Noise
X	**X**	Maintain a 20-foot vegetative noise control buffer from the edge of the northern Forest Service boundary in mining Areas 15a and 15b to minimize the impacts of noise from mining and restoration activities on permanent residences near the project area.
		Heritage
X	**X**	If undocumented cultural resources are discovered during project activities, all work in the immediate vicinity will cease until the District Archaeologist is notified, with the following exception. If the artifact is a single, isolated find, such as a single section of riveted pipe, chain segments, or similar artifacts commonly used in hydraulic placer mining, these items may be set aside and mining or restoration activities may continue. However, the District Archaeologist must be immediately be notified of the discovery.
X	**X**	Effects to historic properties from mining operations and restoration activities will be mitigated through the use of interpretive and interactive designs and displays.
		Scenic Resources
	X	Maintain a 20-foot vegetative screening from the edge of Resurrection Creek Road in mining Areas 14 and 21 to retain scenic values for visitors and residents driving Resurrection Creek Road.
		Recreation
	X	Install signing indicating potential hazards from mining operations when operating near Resurrection Pass National Recreation Trail and trail bridge.

Restoration Activities	Mining Activities	Mitigation Measure
X	X	Dust abatement through the use of water trucks is required during dry conditions when making multiple daily trips on Resurrection Creek Road using large equipment or large trucks related to restoration or mining activities.
		Soils
X	X	Region 10 Best Management Practices (USDA Forest Service, Alaska Region 2006) will be applied, particularly to control chemical and sewage contamination of soil and to protect the finished ground surface as natural seedbeds. Use BMPs for 1) petroleum storage and delivery; 2) servicing and refueling equipment; 3) sanitary guidelines for temporary labor camps; 4) control of refuse disposal; and 5) soil protection from erosion and compaction, where applicable.
		Vegetation Ecology
X	X	All materials brought from off-site to be used for mulching, erosion control, rehabilitation, soil establishment, fill, or other uses should be free of invasive plant species, seeds, or parts.
X	X	Clean all mechanized equipment off-site, including wheel wells, undercarriages, tires, and tools before it is brought into the project area so that it is free of all foreign plant materials and soil.
X	X	Use natural re-vegetation where seed source and site conditions are favorable towards achieving re-vegetation or reclamation objectives and, as a guideline, use native plant species in re-vegetation/ restoration projects when natural re-vegetation conditions are not favorable (USDA Forest Service, Chugach National Forest 2002a, page 3-25). Preference should be given to plant materials from the local environment of the project area to maximize adaptation to that environment and maintain local genetic composition.
X	X	If sensitive plant species are found during the implementation of this project, appropriate avoidance or mitigation measures will be developed by the Forest Service.

Restoration Activities	Mining Activities	Mitigation Measure
		Wildlife
X	**X**	If bald eagles, northern goshawks, or trumpeter swans or their nests are discovered during mining operations or restoration activities, the Forest Service will work with the mine operator and/or restoration contractor to maintain nest sites and/or important habitat areas for these species during implementation.
X	**X**	Food, fuel, and garbage should be stored in a manner that bears cannot obtain them (bear proof containers, vehicles, container storage units) to reduce potential for negative bear/human interactions or bear habituation. All garbage must be removed regularly (weekly) from the site.

Mitigation Measures specific to Alternatives 2

Restoration Activities	Mining Activities	Mitigation Measure
		Fisheries/Hydrology
X		Excavation of clay layers during restoration should be minimized to avoid the release of any mercury that might be within the substrate and may have settled down to the clay layer. A mercury cleanup kit should be on site in order to remove any concentrations of elemental mercury discovered during construction. If any mercury is encountered during restoration activities, the Forest Service will safely implement established protocols for mercury cleanup (US Environmental Protection Agency 2007; US Environmental Protection Agency 2009).
X		The use of mechanized equipment within the ordinary high-water mark should be held to a minimum. Approved equipment GVW should be limited to no greater than 140,000 lbs. Heavy equipment should be cleaned and free of leaks before use on the restoration channel construction.

Restoration Activities	Mining Activities	Mitigation Measure
	X	HMC will be allowed to mine historic tailings piles that are within the existing 20-foot stream buffer as approved by the Forest Service in the mining operating plan approval prior to the restoration corridor being constructed. HMC would be allowed to remove the tailings piles down to the natural bank height only, as specified by the Forest hydrologist, but no equipment would be allowed to work in the active stream channel.
		Air/Climate Change
X		During the stream restoration work, the contractors should make efforts to reduce fuel use and emissions wherever possible. Contractors should turn equipment off rather than idling for long periods of time. Work should be properly sequenced, with appropriate staging areas, to avoid unnecessary idling of machinery and to minimize travel distance by the machinery. Contractors should use only equipment that is less than 10 years old and properly maintained to optimize running efficiency. Contractors should use equipment that is properly sized for the work being conducted.
X		Wherever possible, stream restoration materials, including boulders, gravel, trees, and soil, should come from on-site sources to minimize emissions associated with hauling the materials from off-site. Materials may be brought in from off-site sources if all available and practical on-site sources are exhausted, or if deemed necessary for success of the restoration project.
		Minerals
X		Protect all known mining operations improvements (such as claim corner monuments, camps, equipment, and survey monuments, etc), during restoration activities by adding specifications to the restoration contracts.
X		Keep reasonable access available to mine operator in order to carry out necessary activities.
		Heritage
X		If heritage resources are found during restoration channel construction, then construction would cease in that specific area until a plan is developed to protect the heritage resource.

Restoration Activities	Mining Activities	Mitigation Measure
		Recreation/ Scenery
X		Appropriate signing or other cautionary measures will be implemented in conjunction with all management activities to notify the public of restoration activities. Implementation of these measures will be the responsibility of the person initiating the action (e.g., equipment contractor, logging contractor, etc.)
X		No equipment associated with the restoration project will be staged at the Resurrection Pass North Trailhead or the dispersed camping area upstream from the trailhead.
		Soils
X		During restoration activities, discovery of unsuitable material such as buried clay layers or materials determined by the soil scientist to be unsuitable for surface placement, will either be placed two or more feet below the finished surface or will be wasted by burying in a constructed landform such as a terrace or pond bottom.
X		During restoration activities, any material at the surface either prone to or exhibiting surface crusting will be ripped with an appropriate piece of equipment (e.g., winged subsoil ripper) as approved by the soil scientist as the final equipment operation.
X		Finish slope grade compaction is not necessary and should not be done.
X		Soil particle size and layers in the valley bottom must approximate the reference reach to facilitate restoration. If adequate amounts of suitable soil is not salvaged on-site, weed-seed- free soil will be brought in.
X		Mulch newly exposed ground as early as possible after completion of the finished placement and/or exposure. Organic mulch such as weed seed free straw, fine wood chips, or moderately ground plant material is recommended. A single layer of mulch is expected to be sufficient (approximately 1 ton per acre). Tackifier may be recommended by the soil scientist depending on expected conditions during and after application.

Restoration Activities	Mining Activities	Mitigation Measure
		Wildlife
X		Retain clumps of largest old cottonwoods and spruce for bald eagle nesting/roosting habitat in the existing flood plain in Area 19, the Interpretive Area and downstream and NW of existing equipment crossing to maintain diverse wildlife habitat components.

Mitigation Specific to Alternative 3

Fisheries/ Hydrology - Mitigation for mining activities
HMC will be allowed to mine historic tailings piles that are within the 20-foot stream buffer as approved by the Forest Service in the mining plan of operations approval. HMC would be allowed to remove the tailings piles down to the natural bank height only, but no equipment would be allowed to work in the stream channel. Removal of tailings piles along the bank will help allow the banks along Resurrection Creek to functional more naturally and provide additional floodplain.
Where feasible, any new settling ponds and long-term drainage ditches connecting these settling ponds would be required to be a minimum of 70 feet from either bank of Resurrection Creek. This is equivalent to the average channel width of Resurrection Creek. A minimum buffer of 1 channel width is needed to minimize the risk of channel capture of the settling ponds.

Monitoring Common to All Action Alternatives

Resource	Monitoring Measure
Mining	The Forest Service will conduct weekly inspections to ensure compliance with the approved mining plan of operations.
Hydrology	Effectiveness of mitigation techniques for the restoration and/or mining activities would be reviewed at the end of each construction season with the permitting agencies, and any improvements would be incorporated into plans for the next season.
	Turbidity should be monitored in the main channel using a hand-held turbidimeter during and after each stream channel diversion to determine the maximum turbidity levels and the duration of each turbidity plume. At a minimum during the course of each diversion, turbidity should be monitored upstream of the diversion, at the diversion, and about ½-mile downstream of the diversion at ½-hour intervals. Data would be used to help determine the best methods for minimizing turbidity during construction.
	On a weekly basis during mining activities, Forest Service personnel should visually inspect all settling ponds for any outflow from all settling pond systems for turbidity. If turbidity is observed in the outflow, turbidity levels should be measured in the outflow using a hand-held turbidimeter. If these measurements indicate violations of State water quality standards (Alaska Department of Environmental Conservation 2006), the Forest Service will work with HMC to take appropriate corrective actions and notify ADEC.
Ecology	Monitoring for introduction of new populations or increases of known existing non-native species populations will help in determining if project activities are affecting these populations. Monitoring will occur annually until a determination has been made on how project activities are affecting non-native plant populations. In the restoration areas, monitoring will occur until successful control of invasive species has taken place (five consecutive years with no occurrences)
Wildlife	General wildlife surveys (standard surveys for all projects which identify existing and potential habitat for threatened, endangered, sensitive, management indicator, and species of special interest) would be conducted yearly for the first three years and then every 5 years for twenty years.
Recreation	Evaluate conflicts between the proposed activities and recreational trail users periodically throughout the project to assure user safety. If conflicts occur between trail users and restoration or mining activities, appropriate avoidance or mitigation measures will be developed by the Forest Service.

Monitoring specific to Alternative 2 (Proposed Action)

Resource	Monitoring Measure
Hydrology/ Fisheries	Effectiveness monitoring of the stream and riparian restoration work should be conducted at year-1, year-2, year-5, and year-8 following completion of the restoration project. This includes monitoring of photo points, channel profile, channel dimensions, substrate, aquatic habitat, and vegetation growth. Methodology would be similar to the channel and vegetation monitoring conducted for the Phase I restoration project (MacFarlane et al. 2009), and a report would be compiled after each monitoring season. Data would be used to evaluate achievement of objectives, identify any concerns that need to be addressed, and improve upon methodologies.
Fisheries	Adult salmon redd, carcass, and ocular counts should be conducted throughout the project reach on a yearly basis from July to September during and for at least 4 years following completion of the restoration to monitor restoration effectiveness and habitat usage. These data would be compared to the 2 years of data collected prior to implementation of the restoration project, and a monitoring report would be compiled.
Soils	Implementation monitoring of mitigation measures will occur during each week of the construction phase to insure that restoration mitigation is proceeding as designed. Effectiveness monitoring of mitigation measures and restoration success will occur at the end of each construction season and during years five and ten following project completion. The monitoring data will help determine whether the mitigation measures worked as intended, and whether the restoration is trending towards the reference reach condition.

Monitoring specific to Alternative 3 (No Restoration)

Resource	Monitoring Measure
Fisheries	Adult salmon redd, carcass, and ocular counts should be conducted throughout the project reach on a yearly basis from July to September during and for at least 4 years following the channel relocation to monitor the impacts of these activities on aquatic populations. These data would be compared to the 2 years of data collected prior to implementation of the project, and a monitoring report would be compiled.

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by the National Environmental Policy Act (NEPA) to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the Proposed Action provided suggestions for alternative methods for achieving the purpose and need. Some of these alternatives may have been outside the scope of the need to restore Resurrection Creek and the associated riparian, aquatic and wildlife habitats, duplicative of the alternatives considered in detail, or determined to be components that would cause unnecessary environmental harm. Alternatives were considered but dismissed from detailed consideration for reasons summarized below.

Alternative 4- Full channel restoration of the entire valley floor

Full channel and floodplain restoration of the 2-mile reach could be conducted within the constraints of the entire valley floor, both inside and outside of the proposed restoration corridor. A meandering channel could be constructed with numerous side channels and abundant floodplains. However, this restoration alternative would not be in accordance with the existing conceptual agreement between HMC and the Forest Service. Approximately 60% of the restoration would occur outside of the agreed upon corridor, therefore, this portion of the restored areas would not be protected from future mining and could potentially conflict with or impede ongoing/future mining operations. This alternative was dropped from further consideration because of the lack of protection for the restoration investment and potential conflicts between restoration and mining activities.

Alternative 5- Restoration Excluding State Selected Lands

This alternative proposed to conduct channel, floodplain, and riparian restoration of only the upper 1-mile section of the project reach, within the restoration corridor. The lower 1-mile section of the project reach, which exists on State selected National Forest lands, would not be restored. Restoration components, including stream channel creation, floodplain development, side channel creation, habitat development, and re-vegetation would be the same as the restoration activities described in the Proposed Action, but only on the upper 1 mile of the project reach.

This alternative was conceptualized to address concerns associated with the potential development of the State Selected Lands in the lower half of the project reach. Although conveyance of these lands to the State in the future could potentially jeopardize the restoration investments, these lands would still be protected by the State of Alaska's laws and statutes regarding development in floodplains and along salmon bearing waters. Furthermore, conveyance of these lands cannot occur while federal mining claims exist on the land. Because possible conveyance of these lands is not likely to affect the proposed restoration, this alternative is not needed and has been dropped from further

consideration. Correspondence with the State of Alaska relative to the project and State Selected Lands is ongoing at this time.

Alternative 6- Limited Restoration

This alternative addressed any potential negative effects to water quality and salmon populations that would occur during stream restoration activities such as stream channel construction and relocation. Only the upper mile of the project reach would be restored, using a minimalist approach to channel and floodplain restoration. The main channel would not be moved, but the tailings piles along the banks would be pulled back from the stream channel to create at least a channel width of floodplain along one or both sides of the channel. Restoration would not occur in the lower mile of the reach because that portion of the existing channel is not within the restoration corridor agreed upon by the Forest Service and HMC, and restoration along the lower mile and any restoration efforts in this area would be subject to future mining operations. This alternative is not in accordance with the December 3, 2007 conceptual agreement with HMC and will not be analyzed in further detail.

Alternative 7- Restoration Outside of Inventoried Roadless Areas

Approximately half of the project area lies within the Resurrection Inventoried Roadless Area (IRA) (see figure 11 and the Inventoried Roadless Area analysis in Chapter 3). An alternative that would only conduct restoration and respond to the proposed mining plan of operations outside of the boundary of the Resurrection IRA was considered but eliminated from detailed study for the following reasons:

1. A portion (approximately 5 acres) of Resurrection Creek that is in need of restoration is located within the Resurrection IRA. In order for restoration to be effective, the channel in this portion of Resurrection Creek must be moved or modified. No options exist for alternate locations of the stream channel outside of the Resurrection IRA because over half of the available valley width at this location is within the Resurrection IRA boundary.
2. To accomplish restoration of Resurrection Creek, it would be necessary to construct 0.12 miles of temporary access roads in the Resurrection IRA in order to move equipment to the restoration areas. As the location for the road is confined by the location of the stream corridor, no option exists to locate this road outside of the Resurrection IRA.
3. HMC is proposing to construct 0.94 miles of temporary mining roads in the Resurrection IRA for access to conduct mining activities on 134 acres of mining claims located within the Resurrection IRA. No alternatives exist that would allow for the proposed mining plan of operations to occur completely outside of the Resurrection IRA because the HMC mining claims are located within the Resurrection IRA boundary.

Comparison of Effects by Alternative

This section provides a summary of the effects of implementing each alternative. Information is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Air Quality/ Climate Change

Air pollutants: Alternatives 2 and 3 would both produce localized sources of air pollutants. Any pollutants would generally dissipate quickly, resulting in minimal direct, indirect, or cumulative effects on air resources.

Greenhouse gas emissions: Alternatives 2 and 3 would produce comparable amounts of greenhouse gas emissions as a result of fossil fuel combustion. This project is very small in terms of greenhouse gas emissions that would contribute to climate change in a global context.

Climate Change: Although the effects on climate change cannot currently be quantified, Alternative 2 is not expected to meaningfully or noticeably influence climate change through emissions or vegetation removal because of the relatively small amount of emissions on a global context, the limited area that would be actively mined at any one time, and the benefits of restoring vegetation within the riparian ecosystem. Alternative 3 would have similar effects to climate change as Alternative 2, but without the benefits of restoring the vegetation within the riparian ecosystem.

Carbon sequestration: Under Alternative 2, restoration would reestablish the riparian corridor in the long term, increasing the capacity to sequester carbon dioxide. Under Alternative 3, slower riparian regeneration and poorer riparian conditions would result in lower capacity to sequester carbon dioxide

Resiliency to effects of climate change: Under Alternative 2, restoration of the stream corridor would make the ecosystem more resilient to impacts associated with climate change such as floods. Under Alternative 3, the stream channel would remain impaired with limited floodplain widths, similar to the existing channel and less likely to withstand impacts associated with climate change.

Minerals

Amount of Ore: Alternative 2 would have less ore to mine than Alternative 3. Alternative 3 would have the greatest amount of ore available for mining.

Soils

Acres of Soil Disturbance: Under Alternative 2, loss of soil productivity in the mined area would be variable, both because not all of the 264 acres would necessarily be mined or not all mechanically mined, and because the resulting mixed regolith/soil following reclamation would be highly variable in quality and productive potential. About 22 acres of the disturbance outside the restoration corridor would be permanently degraded without future active restoration. The estimated surface area over which soil disturbance would occur within the restoration corridor is about 27 acres. Based on results in Phase I, about 2.3 acres of the disturbance would be permanent due to flooding, compaction, and the nature of the coarse substrate. This alternative is not expected to cause

more than 15% or 51 acres out of 340 activity area acres of long-term detrimental impacts to soil resources at the Resurrection Creek Phase II activity area. Under Alternative 3, soil quality would be degraded by more than 15% (estimated 217 acres) compared to either current condition or an undisturbed reach. Adverse effects (37.6 acres) that cannot be avoided are expected to be permanent because natural processes would not be able to counter or restore them within human timeframes.

Noise

Decibel Level of noise from Mining Activities: Under Alternatives 2 and 3, noise generated by mining equipment is expected to produce decibel levels in the range of 65 to 80 dB at active mining sites. The persistent equipment noise is likely to disturb and displace wildlife and annoy some people living near HMC claims during the months of April through October over the 20 years of operation. The noise stemming from mining activities may impact private landowners within one mile of mining operations. Recreation users at the Resurrection Pass North Trailhead could be directly affected by mining noise only when mechanical mining is occurring at the extreme southern end of the project area in Areas 8, 9 and 22. The majority of mining proposed within the middle and northern sections of the project area is not expected to affect recreational users at the trailhead due to the white noise masking effect of Resurrection Creek.

Decibel Level of noise from Restoration Activities: Under Alternative 2, noise levels generated by restoration equipment would be identical in nature and level to that of mining operations and are expected to mask each other rather than detectably add or increase noise levels. Restoration activities would occur from May 15 through July 15. Recreation users at the Resurrection Pass North Trailhead could be directly affected by restoration noise only when machines are operating at the extreme southern end of the project area. The majority of restoration in the southern section of the project area is estimated to be completed in two to four weeks with impacts to any recreational users at the trailhead limited to that time period. The remainder of restoration proposed in Alternative 2 (within the middle and northern sections of the project area) is not expected to affect recreational users at the trailhead due to the white noise masking effect of Resurrection Creek. Under Alternative 3, restoration activities would not occur, so there would be no additional sources of noise.

Hydrology & Fisheries

Sediment/ Turbidity: Under Alternative 2, during restoration activities (May 15 to July 15 for up to 4 years), 6 to 10 short, controlled turbidity events of over 300 NTU would occur. Up to 10 turbidity pulses per day of up to 150 NTU would also occur while equipment is working in the channel. Minimal impacts to turbidity would occur from mining and equipment crossings. A low potential would exist for catastrophic water quality impacts from settling pond failure or erosion. Under Alternative 3, during relocation of channel segments for mining (May 15 to July 15), 2 to 4 turbidity events of over 300 NTU would occur, as would the potential for continued increased turbidity levels. Minimal impacts to turbidity would occur from mining and equipment crossings. A moderate to high potential for

catastrophic water quality impacts would exist from settling pond failure or erosion.

Aquatic Species: Under Alternative 2, direct mortality of aquatic species could occur at equipment crossings and during channel construction throughout the entire reach. Indirect mortality of aquatic species would be possible from high turbidities in the entire reach and 2 miles downstream during restoration. Under Alternative 3, direct mortality of aquatic species could occur at equipment crossings and during channel relocation. Fish mortality would occur from stranding in the old channel. Indirect mortality of aquatic species would be possible from high turbidities in lower third of reach and 2 miles downstream during channel relocation.

Channel Morphology: Under Alternative 2, hydrologic function of the stream channel would be restored to natural conditions. Functional floodplains would promote riparian vegetation and stable banks. The restored corridor would provide an adequate riparian buffer zone. Under Alternative 3, the stream channel would remain an impaired confined channel with few pools and a disconnected floodplain. Relocated channel segments would be similar to the existing condition, but with decreased stability. A 20-foot wide buffer zone would not be adequate for channel protection and natural function.

Aquatic Habitat: Under Alternative 2, aquatic habitat would be greatly improved in the short term and long term. Improved aquatic habitat would promote aquatic populations. Under Alternative 3, no improvement to aquatic habitat or populations would occur. Limited pools, woody debris, spawning areas, and off-channel habitat would remain.

Vegetation Ecology

Amount of re-vegetation: Under Alternative 2, restoration would initiate trends towards Forest Plan desired future conditions for vegetation and re-establish native vegetation in the restoration corridor where it is currently lacking. There would be a change in the forested structure and composition of the project area by the removal of various tree species. The successional pathway of the project area's forested stands would be altered by the removal of different tree species than what would develop over time if no mining and subsequent harvesting took place. These changes may linger in the mining areas if species composition is mainly non-native species. Under Alternative 3, the valley floor would remain in a disturbed condition. Vegetation cover typical of South-central Alaskan stream systems would not return to the tailing pile areas. Further, the tailings would continue to prevent flood flows from delivering fine sediment to the floodplain areas, thereby limiting riparian vegetation growth. Changes in the forested structure and composition of the project area would be the same as in Alternative 2, except that it would cover an additional 3 acres.

Sensitive Plants: Under Alternatives 2 and 3, implementation is not expected to adversely affect sensitive plants.

Non-native species: Under Alternative 2, restored areas re-vegetated to native species would reduce the overall presence of non-natives. Disturbances associated with restoration and mining have the potential to increase non-native

plant abundance in the project area through influx of non-native species on equipment and by providing bare soil conditions. Under Alternative 3, the increase of non-native plant abundance in the project area would be the same as Alternative 2.

Wildlife

Habitat Disturbed by Mining and Restoration Activities: Under Alternative 2, mining operations would cause short and long term habitat loss of conifer, hardwood and riparian forest types on up to 264 acres spread out over a 20 year time period. Some patches of trees would remain on steeper slopes that preclude mining, however these areas would provide low quality habitat due to adjacent vegetation removal and disturbance. Proposed actions would cause varying degrees of soil productivity loss up to 264 acres, with 24.3 acres of permanent loss. Loss of soil productivity on those 24.3 acres would permanently inhibit growth of vegetation and associated wildlife habitat. Mature forest composition and structure containing large trees important to wildlife habitat for various species may be delayed forty or more years in developing due to loss of site productivity on the 264 acres. Similar habitat loss and disturbance would occur within the 76 acre restoration corridor up to a 4 year period and during restoration operations. Restoration of 54 acres of floodplain, riparian vegetation, and development of 8,000 feet of new side channels would create new habitat favoring species that feed on spawning or rearing salmon, breed or forage in side channels, den or nest in riparian vegetation, or forage for vegetation or for prey species in riparian areas. Under Alternative 3, actions would cause varying degrees of soil productivity loss up to 267 acres, with 37.6 acres of permanent loss. Mature forest composition and structure containing large trees, which is important wildlife habitat for a variety of species may take an additional 40 or more years to develop due to loss of site productivity. Sub-optimal foraging habitat for bald eagles, river otters, and bears due to poor quality salmon spawning and rearing habitat would continue. A minimal amount of cover and poor riparian vegetation conditions would remain adjacent to Resurrection Creek. There would also be poor upland habitat quality for otters. Since there would not be any stream restoration, no additional wildlife habitat would be created.

Effects to Wildlife (Management Indicator Species, Species of Special Interest and Migratory Birds): Under Alternative 2, disturbance to wildlife from noise, people, and machinery may cause habitat abandonment or avoidance in restoration area (short term- up to 4 year period on 76 acres) and mining areas (long term- 20 year operating period), or within one mile of the project area due to noise disturbance. Despite mitigation measures, direct mortality to individuals of a variety of birds and small mammals is possible in areas of mining and restoration activities. Noise has the potential to disturb wildlife in the project area at decibel levels from 65 to 80 dB at active mining sites or within the restoration corridor, and adjacent to the project area up to one mile out at decibel levels up to 55 dB. Noise levels would be variable based on topography and vegetation. Persistent equipment noise may disturb and displace wildlife during the months of April through October over the 20 years of operation. Wildlife species would have a beneficial effect from improved foraging, nesting habitat, or prey habitat,

and cover after restoration in the long term. Under Alternative 3, effects to wildlife from mining activities are the same as Alternative 2, except the effects would occur on an additional 3 acres. Since there would not be any stream restoration, no additional wildlife habitat would be created.

Heritage Resources

Historic District: The loss of historic district contributing elements (tailings) would occur under Alternatives 2 and 3. However, interpretive displays would be used to mitigate the loss of the historic district contributing elements.

Recreation

Scenic Resources and Recreation Setting: Under Alternative 2, the scenic integrity objective (SIO) of "low" for the project area would decrease to "very low" or "unacceptably low" SIO's for up to 20 years or longer based on the success of reclamation from mining activities. Restoration activities over time, however, are expected to bring the SIO up to at least "moderate" in the restoration corridor. Alternative 3 would have the same effects as Alternative 2 regarding mining activities that would take place, but the long-term beneficial effects of restoration would not occur.

Noise impacts to Recreation Visitors: See the noise section above.

Recreation Experience: Under Alternatives 2 and 3, visitor expectations may be different than the actual experiences of driving to and accessing the Resurrection Pass National Historic Trail due to sights and sounds created by the use of heavy equipment in various projects, smoke from pile burning lingering in the area, development on private land in the area, sights and sounds from small scale suction dredging mining operations within the recreational mining area on Resurrection Creek, and increased highway traffic from the various projects.

Recreation Opportunities: The Porcupine Campground is slated for reconstruction in 2010 and will affect recreation users under Alternatives 2 and 3 due to the lack of camping facilities in the vicinity during the time of construction. This may cause additional dispersed camping due to displacement of the recreation users. Upon completion of all these projects, these effects would subside.

Sport Fishing: The effects of Alternative 2 on sport fishing cannot be accurately predicted with the information currently available. There is no evidence that an increase in fish populations resulting from restoration activities would cause an increase in sport fishing. The effects of Alternative 3 on sport fishing cannot be accurately predicted with the information currently available. An increase in fish populations is not expected to occur from implementation of mining activities.

Roadless Areas

Natural Appearing Landscape and Wilderness Suitability: Under Alternative 2, 141 acres, or less than one percent of the total acres of Resurrection IRA, would appear more unnatural and would be less capable of being suitable for Wilderness designation because evidence of mining would be apparent. After 20 years or at the completion of mining activities, the area would be reclaimed.

After reclamation, the affected portion of the Resurrection IRA would appear more natural. Resurrection Creek would more closely represent natural conditions because it would appear and function as it did before mining channelized Resurrection Creek over time after restoration. Under Alternative 3, the effects associated with mining activities would be the same as in Alternative 2. However, Resurrection Creek would remain channelized, fish habitat would continue to be poor, and evidence of human disturbance would be apparent. Resurrection Creek would continue to be less capable of being suitable for Wilderness designation.

Social and Economic Resources

Net Present Value: Under Alternative 2, the net present value (NPV) in 2009 dollars is negative $2,694,761. A variety of ecological benefits would occur with this alternative. To be considered economically efficient, benefits from the project must outweigh the total costs. However, the ecological benefits are not quantifiable. Under Alternative 3, the only direct costs assumed by the Forest Service would be those associated with minerals administration. The NPV of this alternative would be negative $689,736, which is simply the discounted sum of total costs because there are no benefits that can be displayed in dollar values.

Employment: Under Alternative 2, restoration activities could allow for some jobs to be performed by local residents. Under Alternative 3, employment levels would be the same as the existing condition.

Recreation Capacity and Visitor Days: There is no evidence that recreation visits to the study area would increase as a result of Alternative 2. Therefore, it is not possible to predict the associated economic impacts. Hope is likely to experience greater proportional social and economic consequences from forest management. Under Alternative 3, there would be no anticipated benefits for aquatic life, and therefore no expected increase in fishing pressure as a direct result of this alternative.

Community Isolation: Under Alternative 2, restoration of Resurrection Creek would improve natural amenities, but the public concern is that increases in tourism could result in decreased quality of life for many residents. Conversely, some local residents may view improving ecosystem health as an opportunity to expand economic wellbeing by marketing goods and services to visitors. Hope is likely to experience greater proportional social and economic impacts from forest management due to low economic diversity scores, low median incomes and subsistence preference (Crone et al., 2002). Under Alternative 3, the use of existing infrastructure would remain low, and the communities of Hope and Sunrise would remain isolated.

CHAPTER 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the physical, biological, and social environments of the project area and the effects of implementing each alternative on that environment. It also presents a basis for the comparison of alternatives presented in the Chapter 2.

Physical Environment

Air Quality and Climate Change

Affected Environment

Air quality in south-central Alaska is relatively undisturbed from human sources as a result of sparse populations and large distances from major pollution sources. However, some regional sources of air quality impairment include smoke from forest fires, glacial dust, volcanic ash, urban pollution, and haze from global sources. Adjacent to the project area and near Hope, sources of air pollution include road dust, wood stove smoke, and vehicle combustion. Road dust from the gravel-surface Resurrection Creek Road is a localized source of particulates in the air during dry spells in the summer when traffic levels are highest. In addition, existing mining operations in the project area produce a minimal amount of air pollutants. Local sources of greenhouse gas emissions, a contributor to climate change, include smoke and vehicle combustion.

The effects of climate change are evident in Alaska and on the Kenai Peninsula. Average temperatures have risen by as much as several degrees F over the past 60 years on portions of the Kenai Peninsula (Alaska Climate Research Center 2009). This warming trend is also evident in the rapid rates of recession and thinning of most glaciers in south-central Alaska over the past century (Molnia 2008). It is likely that climate change is causing changes in regional weather patterns and the frequency and magnitude of extreme precipitation and flooding events. Changes in climatic patterns on the Kenai Peninsula are contributing to ecosystem changes as well as catastrophic events such as spruce bark beetle infestation and increased wildfire occurrence. Refer to the Aquatic Resources and Hydrology affected environment section in this chapter for additional information on the existing climate.

Environmental Consequences

Issues

No significant issues for this project are related to air resources or climate change.

Measurement Indicators

Qualitative assessments based on professional judgment are used to discuss the effects of the proposed project on air resources and climate change.

Methodology

The effects of the project on air resources are determined through past observations. It is not currently possible to quantifiably determine the effects of the proposed project on climate change because of the global nature of this issue. Alternatives are compared primarily using qualitative indicators.

Alternative 2 – Proposed Action

Short and Long-term Direct and Indirect Effects

Air Resources

The Proposed Action would result in minimal short term increases in air pollutants in the area surrounding the project area. Sources of air pollutants would be seasonal and localized, and pollutants would quickly dissipate under most weather conditions. Air pollutants would not likely exceed Alaska State air quality standards (Alaska Department of Environmental Conservation 2009).

The primary source of air pollutants would be from exhaust emissions from heavy equipment, producing fine particulates, nitrogen oxides, and carbon monoxide. The stream restoration work would involve an average of 5 pieces of heavy equipment and an estimated total of about 2,500 machine-hours per season (May 15 through July 15) for up to 4 years. The proposed mining activities would likely involve a variable number of pieces of heavy equipment and an estimated total of 1,000 to 10,000 machine-hours per season (May through October) for 20 years.

A secondary source of fine particulates would be dust from vehicles and equipment traveling on access roads during dry periods. Although heavy equipment would be primarily confined to the project area, access vehicles would also utilize the gravel-surfaced Resurrection Creek Road, which currently receives moderate traffic during the summer from residents, recreationists, and miners. The additional large truck traffic as a result of the Proposed Action would only slightly increase dust levels because dust abatement through the use of water trucks would be required. Earth-moving activities during restoration and mining would cause little or no dust because of the course nature of the primarily gravel and cobble substrate. Placer mining operations utilize water to process the material, resulting in no dust.

Climate Change

Fossil fuel combustion is a source of greenhouse gas emissions that can contribute to climate change. Emission sources for restoration activities would include heavy equipment, mobilization of equipment, and transportation of personnel and supplies. Emissions from these activities are expected to occur for 2 months per year for up to 4 years. Emission sources for the mining activities, occurring for up to 6 months per year for 20 years, would include heavy

equipment, mining equipment, mobilization of equipment, transportation of personnel and supplies, and generation of electricity. The effects of this project would be very small in terms of greenhouse gas emissions in a global context. Currently, it is not possible to quantify the effects of greenhouse gas emissions from this project on climate change.

The proposed stream restoration work would reestablish the riparian area in 54 acres within the restoration corridor in the long term. Much of this area is currently bare ground or covered by only sparse vegetation and little soil as a result of past mining activities. In the long term, restoration would provide a healthy, diverse riparian area that would help offset the impacts of climate change by increasing the capacity to sequester carbon dioxide. However, the proposed mining activities outside of the restoration corridor would remove vegetation from the proposed mining areas outside of the restoration corridor. It is expected that because operations would be sequenced and reclamation would be ongoing, only a portion of the 264 acres proposed for mining would have vegetation removed at any one time, and these disturbed areas would lose their capacity to sequester carbon. These effects would diminish over time as the land is reclaimed. Taken together, alterations in vegetation from the restoration and mining activities are expected to have very little or no influence on climate change on a global context because of the limited area that would be actively mined at any one time and the benefits of restoring the riparian ecosystem.

Effects of Climate Change on the Project

Stream and riparian restoration within the restoration corridor would make this ecosystem more resilient to the impacts associated with climate change. Climate change is likely to increase the magnitude of peak flows in Resurrection Creek as a result of changes in precipitation, snowmelt, and weather patterns. Reconstructing the stream channel, floodplains, and riparian areas to accommodate and dissipate the energy of flood flows would improve the resiliency of the system to floods as compared to the confined nature of the existing stream channel. The restored channel would be constructed to be semi-dynamic, allowing the channel to change under natural processes as it constantly adjusts to changing environmental conditions. Climate change is not likely to affect the proposed mining activities.

Cumulative Effects

The cumulative effects of the Proposed Action and all other activities occurring in the Hope area on air resources would be minimal. A number of activities are being conducted in the Hope area that could increase or decrease the effects of climate change. While increased development of Kenai Peninsula Borough lands in the area can result in increased greenhouse gas emissions and decreased carbon sequestration, hazardous fuel reduction projects in the area reduce the risk of catastrophic wildfire that would otherwise produce huge carbon dioxide emissions. The activities occurring in this watershed are very small in terms of greenhouse gas emissions in a global context, and because climate change functions on a global scale, it is not possible to quantify the cumulative effects of any number of particular projects on climate change.

Irreversible and Irretrievable Commitments of Resources

The Proposed Action would have no irreversible and irretrievable commitments of resources.

Adverse Environmental Effects that cannot be avoided or mitigated

The Proposed Action would have no adverse environmental effects.

Compliance or conflicts with the Chugach National Forest Land and Resource Management Plan (CNF LRMP)

The Proposed Action complies with the standards and guidelines, goals, and objectives for air quality in the Chugach National Forest Land and Resource Management Plan. The Forest Plan does not specifically address climate change.

Consistency with Regulatory Framework (i.e. Clean water Act, ESA, Clean Air Act, NFMA, NEPA, FS manual, State Laws, etc…)

The Proposed Action is consistent with the regulatory framework. The Proposed Action is not likely to result in violations of the Clean Air Act or the Alaska State air quality standards (Alaska Department of Environmental Conservation 2009).

Alternative 3 – No Restoration

Short and Long-term Direct and Indirect Effects

Air Resources

Alternative 3 would result in minimal short term increases in air pollutants in the area surrounding the project area. Sources of air pollutants would be seasonal and localized, and pollutants would quickly dissipate under most weather conditions. Air pollutants would be comparable to those of the Proposed Action. Air pollutants would not likely exceed Alaska State air quality standards (Alaska Department of Environmental Conservation 2009).

The primary source of air pollutants would be from exhaust emissions from heavy equipment, producing fine particulates, nitrogen oxides, and carbon monoxide. The mining activities proposed under Alternative 3 would likely involve a variable number of pieces of heavy equipment and an estimated total of 1,000 to 10,000 machine-hours per season (May through October) for 20 years, with additional equipment time needed to move the stream channel as proposed.

A secondary source of fine particulates would be dust from vehicles and equipment traveling on access roads during dry periods. Although heavy equipment would be primarily confined to the project area, access vehicles would also utilize the gravel-surfaced Resurrection Creek Road, which currently receives moderate traffic during the summer from residents, recreationists, and miners. The additional large truck traffic as a result of Alternative 3 would only slightly increase dust levels because dust abatement through the use of water trucks would be required. Earth-moving activities during mining would cause little or no dust because of the course nature of the primarily gravel and cobble substrate. Placer mining operations utilize water to process the material, resulting in no dust.

Climate Change

Fossil fuel combustion is a source of greenhouse gas emissions that can contribute to climate change. Emission sources for the mining activities, occurring for up to 6 months per year for 20 years, would include heavy equipment, mining equipment, mobilization of equipment, transportation of personnel and supplies, and generation of electricity. Greenhouse gas emissions as a result of Alternative 3 would be comparable to those of the Proposed Action. The effects of Alternative 3 would be very small in terms of greenhouse gas emissions in a global context. It is not possible to quantify the effects of greenhouse gas emissions from this project on climate change.

The proposed mining activities outside of the restoration corridor would remove vegetation from active mining areas. It is expected that because operations would be sequenced and reclamation would be ongoing, only a portion of the 267 acres proposed for mining would have vegetation removed at any one time, and these disturbed areas would lose their capacity to sequester carbon. These effects would diminish over time as the land is reclaimed. In the long term, less vegetation would be available for carbon sequestration than under the Proposed Action because riparian restoration would not occur and the reestablishment of riparian vegetation along Resurrection Creek would be slower. Vegetation removal from mining activities is expected to have very little influence on climate change on a global context because of the limited area that would be actively mined at any one time.

Effects of Climate Change on the Project

Climate change is not likely to affect the proposed mining activities.

Cumulative Effects

Alternative 3 would have the same cumulative effects as the Proposed Action.

Irreversible and Irretrievable Commitments of Resources

Alternative 3 would have no irreversible and irretrievable commitments of resources.

Adverse Environmental Effects that cannot be avoided or mitigated

Alternative 3 would have no adverse environmental effects.

Compliance or conflicts with the CNF LRMP

Alternative 3 complies with the standards and guidelines, goals, and objectives for air quality in the Chugach National Forest Land and Resource Management Plan. The Forest Plan does not specifically address climate change.

Consistency with Regulatory Framework (i.e. Clean water Act, ESA, Clean Air Act, NFMA, NEPA, FS manual, State Laws, etc…)

Alternative 3 is consistent with the regulatory framework. Alternative 3 is not likely to result in violations of the Clean Air Act or the Alaska State air quality standards (Alaska Department of Environmental Conservation 2009).

Conclusion

The minimal effects of this project on air resources and climate change are similar between the Proposed Action and Alternative 3. Effects are primarily analyzed qualitatively, examining the effects of the project on air quality, the effects of the project on climate change, and the effects of climate change on the project.

Minerals

Affected Environment

Geology

Resurrection Creek flows northward from its headwaters through a broad valley 21 miles in length, floored with a thick deposit of gravels and then enters Turnagain Arm at the town of Hope. High bench gravels flank the floodplain along both sides of the valley.

Bedrock in the drainage is slate and greywacke of the Upper Cretaceous Valdez Group. Stream and bench gravels consist of sandstone, slate, conglomerate, granite, and minor amounts of clayey matrix. Boulders are common up to three feet wide and are much larger locally. Greywacke boulders predominate while granite and conglomerate boulders are less abundant. The productive gold-bearing gravels overlay bluish-yellow clay “bedrock” and average seven feet in thickness. The gravels below the clay layer have been found to be non-productive (Tuck 1933). Production grades of 0.01 ounces per cubic yard have been reported although higher gold grades occur locally (Jansons et al. 1984).

Mining History

Placer gold mining operations on Resurrection Creek began in 1888. Extensive hydraulic and hand placer mining began in 1895 and continued intermittently into the 1950s (Jansons et al. 1984). There was an unsuccessful attempt to use a hydraulic elevator on Resurrection Creek which failed due to lack of water and presence of large boulders (Moffit 1906). The productive portion of Resurrection Creek is from its junction with Palmer Creek to Turnagain Arm.

The town of Hope was established in 1895 during the gold rush to the Turnagain Arm field. In 1896 about 3,000 people came into the Turnagain Arm area. It was estimated that 2,000 to 2,500 people came to the adjacent Sunrise District. The initial surge of gold production and mining activity decreased quickly. This was due to the fact that the deposits which could be easily worked profitably by hand methods were exhausted and also due to the small size of higher grade deposits which were usually confined to the channels of the present day stream courses. Substantial amounts of lower grade stream placer and low-grade glacial deposits remained but these required the development of hydraulic mining systems and considerable capital investment.

By 1908 there were approximately 50 people working on claims in the area. In 1931, only 20 people worked mines in the Moose Pass and Hope Mining Districts. The adjacent town of Sunrise had dwindled to a population of two people by 1930. During the 1930s, 60 to 70 people lived between Hope and Moose Pass and in the summer an additional 25 miners came into the area. Historic mining that took place after 1942 is not well documented; mining regulations were subsequently published which required operators to submit plans in order to mine on Forest Service managed lands.

The US Bureau of Mines estimated total placer gold production from Resurrection Creek and including the mouth of Palmer Creek, since 1895 to be 30,000 to 40,000 ounces. They estimated that approximately 2,000 to 3,000 ounces have been produced since 1980 (Jansons et al. 1984).

Mining Laws and Regulations

The 1872 Mining Law, as amended, confers a statutory right upon a mining claimant to enter upon public lands to prospect, develop and mine valuable minerals. Forest Service projects implemented in the Resurrection Creek watershed must not materially interfere with bona fide mining activities, or "uses reasonably incident thereto." Both BLM and the Forest Service have the same management authority under the Surface Resources Act, which is highly relevant to Forest Service authority to manage and improve fisheries habitat in the Resurrection Creek drainage, where unpatented federal mining claims exist.

The Forest Service has a regulatory obligation to approve or require modifications to a submitted mining plan of operations (36 CFR 228.5). For this reason, the Forest Service has a regulatory obligation to consider the mining plan of operations submitted by HMC; irrespective of whether any restoration of Resurrection Creek occurs. Although the Forest Service has a regulatory obligation related to submitted mining plans of operation, the right to the mineral estate is subject to applicable Federal and states laws and regulations; including 36 CFR 228 Subpart A and the 1955 Multiple Use Mining Act (30 USC 612). 36 CFR 228.8 states that [a]ll operations shall be conducted so as, where feasible, to minimize adverse environmental impacts on National Forest surface resources" (36 CFR § 228.8). In addition, the 1955 Multiple Use Mining Act restricts mining operators to using reasonable methods of surface disturbance that are appropriate to their stage of operation (see FSH 2809.15, Section 10.1). For the above reasons in addition to the significant issues described in Chapter 1, Alternative 3 is considered in this analysis.

The claimant has the right to dispose of all locatable minerals on their claims. Rights to common variety mineral materials depend upon the status of the claim on July 23, 1955 and on subsequent actions taken under 30 USC 613. Pre-1955 claims may have "surface rights." This means that the claimant would have exclusive possession of the surface of the mining claim. There are no mining claims in the Resurrection Creek drainage with "surface rights."

The Forest Service must respect claims and claimants' property by taking precautions to avoid damage to claim corner markers, excavations, and other

mining improvements and equipment. The claimant has a number of other rights including reasonable access to the claim; the right to use the surface for prospecting, mining, and processing (but not exclusive possession); the use of timber as necessary for the mining operation; and the right to clear timber as necessary for mining (claimant cannot sell the timber).

Mining Plans of Operation

Claimants exercise certain rights acquired under the 1872 Mining Law under an approved plan of operations. Any minerals operations that may cause surface disturbance require at least a notice of intent and operations that may cause significant surface disturbance require an approved plan of operations. Requirements for a notice of intent and plan of operations are found in 36 CFR 228 Subpart A, Locatable Minerals regulations.

Unpatented Mining Claims

There are 14 unpatented mining claims that overlay the restoration corridor and many other unpatented mining claims that overlay the greater project area or portions of the project area. HMC has submitted a proposed plan of operations to the Forest Service for mining activities to be conducted along a section of the Resurrection Creek corridor and would involve re-working areas that have previously been mined and mining areas of previously un-mined gravel.

Environmental Consequences

Issues

There are no significant issues regarding minerals.

Measurement Indicators

The differences in alternatives will be addressed by evaluating the amount of ore available for mining

Methodology and Assumptions

The temporal bounds used for this analysis is 20 years, the duration of the proposed mining plan of operations. This analysis assumes that mechanical mining activities would occur down to a 10 foot depth.

Alternative 2 – Proposed Action

Short and Long-term Direct and Indirect Effects

The Proposed Action includes mining in a logically sequenced order with restoration of a 2 mile section of Resurrection Creek. The total area of proposed mining is about 264 acres of which 200 acres would be available for mechanical mining. Assuming an average mining depth of 10 feet, about 3,226,700 cubic

yards of placer ore would be available for mining. The direct effect is that gold would be extracted from these areas.

Cumulative Effects

There are a total of 126 existing mining claims within Resurrection Creek, Bear Creek and Palmer Creek drainages. There are nine known active mining operations occurring in Bear Creek and Palmer Creek in addition to those existing operations occurring in Resurrection Creek on Hope Mining Company claims. These nine operations entail both suction dredging within the active creek channel and mining of gravels away from the creek edge with hand tools or heavy equipment.

These operations add cumulatively to the amount of gold being extracted in the vicinity of the proposed project area however information is not known as to volume of material ore being available or processed in these operations. Many of these operations have been approved for a number of years and would be expected to continue through time.

Irreversible and Irretrievable Commitments of Resources

The extraction of gold is an irreversible commitment of resources. In Alternative 2, approximately 200 acres (3,226,700 cubic yards) would be mined.

Consistency with Regulatory Framework (i.e. Clean water Act, ESA, Clean Air Act, NFMA, NEPA, FS manual, State Laws, etc…)

This alternative is consistent with mining regulations and all applicable state and federal laws.

Alternative 3 – No Restoration

Short and Long Term Direct and Indirect Effects

The total acres considered for mining is about 267 acres, of which 193 acres would be available for mechanical mining. Assuming an average mining depth of 10 feet, about 3,114,000 cubic yards of placer ore would be available for mining.

Cumulative Effects

Cumulative effects would be the same as Alternative 2.

Irreversible and Irretrievable Commitments of Resources

The extraction of gold is an irreversible commitment of resources. In Alternative 3 approximately 193 acres (3,114,000 cubic yards) would be mined.

Consistency with Regulatory Framework (i.e. Clean water Act, ESA, Clean Air Act, NFMA, NEPA, FS manual, State Laws, etc…)

This alternative is consistent with mining regulations and all applicable state and federal laws.

Soils

Affected Environment

The lower Resurrection Creek valley has been heavily mined for gold since the late 1890's. Hence, the soils that make up the bottom of the valley are highlighted by the fact that there are very few locations of undisturbed soils. The soils developed in sediments deposited in glacial outwash, lakes or small ponds during the recession of the glaciers in the late Wisconsin glacial period that ended about 10,000 years ago. Since that time there has been the erosion from Resurrection Creek and side tributaries that have cut down through the glacial outwash and lake deposits to an incised depth about 75 to 100 feet below the historic glacial age valley bottom. The erosion from these tributary creeks has deposited soil and rock in numerous stream terraces and alluvial fans. Much of this alluvium has since been manipulated beyond recognition by gold mining.

The lowest section of Resurrection Valley, at Hope, AK, is an alluvial fan developed by Resurrection Creek as it flows out of the more confined canyon up stream. The remainder of the landscape in the bottom of Resurrection Creek valley consists of an elevated stream terrace or bench incised down about seventy-five to one-hundred feet to a recent stream terrace and flood plain. The upper and lower levels are separated by a steep (forty-five to sixty-five percent) stream-cut side-slope.

The valley bottom has two major soils for which a short description is found below. Soils that are located below the confluence with Palmer Creek have been disturbed by mining. Those soils found for a short distance above the confluence of Palmer Creek do not appear to have been disturbed by mining. Refer to the soils report in the project record for more detail on soil units in the project area.

The glacial history of the valley is marked by at least three lake/pond deposits where glacial water was dammed by other glaciers, moraines, or some landform for a period long enough for the silt and clay size particles to settle out of the water. Two of these lake deposits are represented by the yellow and blue clays normally found just below the present valley bottom. The gold miners have typically excavated thru the overburden to mine the gold that settled down through the coarse cobbles to the surface of these lake sediments. The third deposit is found in many of the soils on the elevated stream terrace. It is easily located where it occurs on relatively level surfaces because its slow permeability reduces the water drainage through the soil which ponds water to create a wetland fen. This lake deposit appears to be quite extensive on the higher terrace in the lower portion of the valley. It is masked on the steeper slopes because of better drainage, which allows for the presence of more facultative vegetation that is consistent with more freely drained soils.

There are numerous places along the edge of the upper terrace where ground water that flows along the surface of the lake deposits comes to the surface. During the spring snow melt or periods of long duration rain storms that tend to saturate the soil this extra water has and will induce landslides. There are numerous locations of past and present slides that have started at the top of the cut slope and slid part or all the way down the slope to the present valley bottom

(Davidson 1984). Almost every slide can be traced to a source of water, other than rain, flowing on the top of the buried lake deposits. These sites can also be located by an increase in the frequency of cottonwood trees that form a line down the slope similar to that which occurs adjacent to streams.

Environmental Consequences

Introduction and Summary

A major portion of the soil disturbance that would occur in the Resurrection Creek Phase II restoration project would be with soils that have previously been disturbed by placer gold mining activities at numerous times throughout the twentieth century. There has been no active restoration except for the latter 20 years, particularly Resurrection Creek Restoration Project Phase I. About half of the area previously mined has vegetative cover of mostly cottonwood, birch and some spruce but with a relatively limited understory and ground cover. The rest of the disturbed area has not returned to a vegetated state. Most of the disturbed areas, regardless of the current vegetation condition, are not similar to the productivity of the soil prior to the original mining disturbance as determined by comparison to otherwise similar undisturbed area. By comparison, the Resurrection Creek Phase I project area currently has varying degrees of soil and vegetative restoration. None of the Phase I area is currently comparable to the condition or productivity of undisturbed similar area. Because of the nature of the regolith and soil materials, and the manner and degree to which they were reworked during the Phase I project, it would take many years to many decades to approach normal productivity and function. Before the Phase I restoration project, the area was unlikely to approach normal productivity and function in human time frames at all.

Similarly, the Resurrection Creek Phase II project provides the opportunity to establish, enhance, or accelerate the cover and the rate of reestablishment of vegetation and soil productivity on recently mined sites and older mining disturbed sites. Soil productivity and function changes would result from the following types of construction/restoration disturbances in the project area under the Proposed Action:

- Soil removed during construction from selected sites would reduce the productivity for the long term of any remaining subsoil. Where these areas are seasonally or permanently flooded, hydric soils would develop. Their productivity would vary by mineralogy, particle size, and organic matter creating a different environmental potential than present. On wetted sites where subsoil is unsuitable for hydric soil development, e.g., cobble and coarse material, productivity potential would be reduced and would remain that way.
- Those areas disturbed but where topsoil is replaced could ultimately be as functional as the original and approach the productivity of undisturbed areas. Some areas currently undisturbed that do not have topsoil replacement of

similar physical, chemical, and biological properties would have a net reduction of productivity and functional attributes.

- Construction of permanent roads would result in permanent, complete loss of soil productivity.

Issues

There were no significant issues identified regarding soils.

Measurement Indicators

The indicator is the number of acres that are affected that are not at least eighty five percent in high similarity compared to the functional reference. The benchmark reference will be a similar reach in minimally disturbed, functional condition on Resurrection Creek. This indicator will meet the intent of the national soil quality protocol (Page-Dumeroese et al. 2009)

Methodology

Potential impacts to soils would be described regarding the following components: soil type (particle size distribution and stratigraphy), soil quality, and valley bottom function. Valley bottom soils and the channel interact, with flow moving seasonally into and out of the soils. The soil sponge is an important contributor to lateral flows and maintains the hydraulic connectivity between channel, riparian, and upland land forms. This whole-slope connectivity helps maintain soil chemistry and soil biological attributes (quality), and can alter near-stream hydraulics and delivery of water, pressures, and solutes to the channel (McNamara et al. 2005). Disruption, reworking, or displacement of valley bottom soils may reduce ecological soil function and geomorphic function of the valley bottom.

It is the intent of the Proposed Action to ultimately restore the reach to its full functional resource capacity (channel, fish, soil, wildlife, vegetation). Therefore, comparing the expected changes to both the existing reach and a reach that has the desired conditions is a useful way to determine how the project would affect the valley bottom. The National Soil Disturbance Protocol allows that up to 15% of the soil resource in an activity area may be detrimentally disturbed as the result of a project. Using Resurrection Phase I as an example of how an actual valley bottom restoration can go, the estimation of effects should be relatively accurate.

The direct and indirect effects analysis area for soils is the project activity area, which includes up to two miles and 54 acres of potential floodplain. For cumulative effects, the activity area, plus the upland land types (one polygon deep) adjacent to the valley bottom is considered. Foreseeable projects that are far outside of this zone are not expected to affect either valley bottom or upland soils either directly or cumulatively.

Resurrection Phase I will not be fully functional until the soils stabilize, banks build, and vegetation fully establishes and move beyond a very early seral

condition. In Phase I, this process will probably take about twenty years. With improvements in techniques from experience in Phase I, Phase II time to full function should take as little as ten years.

Alternative 2– Proposed Action

Short and Long-Term Direct and Indirect Effects

Loss in soil productivity would result from the construction of 2.9 net miles of new road (approximately 3.9 acres would be disturbed as roads outside the Phase II restoration corridor), and mining disturbance, including temporary features such as camps, up to an estimated 264 acres of surface area both in and outside of the restoration corridor. Loss of productivity is total and permanent in the road prism as long as it exists. Loss of soil productivity in the mined area would be variable, both because not all of the 264 acres would necessarily be mined or not all mechanically mined (USDA Forest Service, Chugach National Forest 2009), and because the resulting mixed regolith/soil following reclamation would be highly variable in quality and productive potential. About 22 acres of the disturbance outside the restoration corridor is estimated to be permanently degraded without active restoration.

Much of the material at and near the surface following the mining is expected to be boulder, cobble, and coarse sand. Relatively little soil with the pore space, surface area/reactive surface, organic matter and biology to support wetland or facultative wetland plants would be concentrated and near enough to the surface to be productive. Because of these attributes plus excessive drainage, it is expected that hydric soils would develop slowly or would not occur at all on a large portion of the disturbed area following mining. In relatively small areas where soil happens to collect during mining and mining reclamation, soil and vegetation development would be similar to those existing areas that have been mined earlier in the Phase II corridor and that currently have moderately good soil and vegetation cover.

Inside the restoration corridor (76 acres), some of the area has already been mined at sometime during the twentieth century. Changes in soil potential, valley bottom function, and productivity within the restored corridor is expected to be less variable than in the mined area outside the corridor. This is because the Phase II project can control to a greater extent the manner of reclamation/ restoration and thus the variability of the substrate compared to the mining reclamation outside the corridor. The expected impacts and restoration potential of the corridor is based in large part on the experience in the Resurrection Phase I project. In Phase I, anoxic clay from several feet below the surface and below the hyporheic zone was placed at or near surface over a large part of the project area. This material is unsuitable as a valley bottom surface soil or for plant growth due to a range of unsuitable physical, chemical, and biological soil attributes. Further, during construction placement, the clay was inadvertently compacted making planting very difficult and retarding natural tree/shrub/grass establishment and growth. In the Phase II project, if this material is encountered it would be placed below the hyporheic zone or approximately wherever else it naturally occurs, thus avoiding the unfavorable substrate conditions.

Through reconstruction of 2.0 miles of stream channel, about 54 acres would be new floodplain (bankfull flow expected every 1 to 2 years), and about 76 acres would be newly flood-prone and would be floodplain about every 50 to 100 years. Some of these 76 acres would become newly flood-prone. Most of these 76 acres have been disturbed and partially restored through passive processes since the time mining was abandoned. About a third or 27 acres of this area is estimated to be re-disturbed during channel reconstruction. An estimated minimum of 14,375 cubic yards of topsoil would be necessary to cover to a depth of four inches this disturbed area for restoration. An area of soil extraction proportional to the amount of topsoil necessary to meet the re-vegetation objectives is not expected. While the raw quantities needed may appear to be available, the logistics and mechanics of handling and moving it results in considerable loss of suitable material. Perhaps up to half of the topsoil needed would thus need to be brought in. Weed seed free suitable topsoil sources have been identified. There would be some soil erosion and sedimentation to the stream for a short period of time once water is initially put back into the new channel.

The estimated surface area over which soil disturbance would occur is about 27 acres. Based on results in Phase I, about 2.3 acres of the disturbance would be permanent due to flooding, compaction, and the nature of the coarse substrate. The remainder would be re-vegetated to meet the desired future condition of adjacent riparian stands.

Cumulative Effects

By adding more flood-prone area in the valley bottom and directly replacing soils into the flood-prone area, Alternative 2 would have short and long term benefit to soil, vegetation, and riparian function in the Resurrection Creek valley bottom. This would reduce the mining related cumulative effects, including the valley bottom and floodplain disconnection from the channel. This soil/vegetation benefit would be enhanced over time by the deposition of sediments and organics on the floodplain during flood events. The completion of mining within the restoration corridor of the project area would eliminate future adverse impacts to riparian soils.

Alternative 2 would extract soil from upland and valley bottom source sites for use on newly created floodplain areas. This, along with road area development would adversely impact soil productivity and function at these sites, and would be an irretrievable commitment of resources (see Irreversible or Irretrievable Commitments of Resources, below); however, the net floodplain area restored by the soil restoration would be more than that impacted. This alternative is not expected to cause more than 15% or 51 acres out of 340 activity area acres of long-term detrimental impacts to soil resources at the Resurrection Creek Phase II activity area.

At the watershed scale (5th hydrologic unit code scale), existing and foreseeable projects include developed and dispersed recreation, including recreational gold mining which has been known to impact streambanks on Resurrection Creek; campground reconstruction (2010); other mining operations upstream; and subdivision development on private lands in 2009 and beyond (~626 ac). While

these disturbances include long-term or permanent detrimental soil quality impacts, their cumulative area is far below the 15% by area considered to be a threshold condition in FS soil quality standards, by activity area and watershed.

Outside the watershed, soil would be mined from private, commercial sources and brought to Resurrection Creek valley bottom. These commercial sites would have degraded soil and watershed resources due to soil removal. It is assumed that these areas would remain in commercial business or be converted to residential developments.

Irreversible and Irretrievable Commitments of Resources

As determined earlier under *Direct Effects,* about 24.3 acres of the estimated disturbance would likely be permanent due to flooding and compaction, and the placement of coarse substrate which cannot be avoided and mitigated.

Adverse Environmental Effects that cannot be avoided or mitigated

Adverse effects that cannot be avoided are expected to be permanent because natural processes would not be able to counter or restore them within human timeframes. These are the same acres determined and reported under *Irreversible and Irretrievable* for this alternative.

Compliance or conflicts with the CNF LRMP

This alternative and its mitigation measures meet all standards and guidelines for soils in the Chugach Forest Plan.

Consistency with Regulatory Framework (i.e. Clean water Act, ESA, Clean Air Act, NFMA, NEPA, FS manual, State Laws, etc…)

This alternative meets the National Forest Management Act (NFMA) for long-term soil productivity and does not allow significant impairment of soil quality. The National Soil Quality Protocol as applied in this project also meets the requirements of all laws where soil or land productivity responsibility is included:

- Organic Administration Act 1897.
- Multiple Use-Sustained Yield Act 1960.
- Forest and Rangelands Renewable Resources Planning Act 1974, as amended by the National Forest Management Act 1976.
- National Forest Management Act 1976
- National Environmental Policy Act 1969.
- Bankhead Jones Farm Tenant Act, as amended 1937.
- Watershed Protection and Flood Protection Act 1954.
- Week Act, 1911.

Alternative 3- No Restoration

Short and Long-Term Direct and Indirect Effects

Loss in soil productivity would result from the construction of 3.5 miles of new road, and mining disturbance up to 267 acres. There would not be a source area of soil extraction proportional to the amount of topsoil necessary to meet the restoration objectives as in Alternative 2, nor would it be required, as only tailings

regrading would normally be expected. No suitable soil would be imported to the site for restoration.

It is possible that all of the mining claims would be mined, and that is assumed for the effects estimation of this alternative (267 acres). It is not known what time frames this would occur in over the twenty-year life of the proposed operation, so it is assumed that the roads, settling ponds, ditches, and camps would exist as permitted for the 20 year duration of the permit.

It is likely that at least some of the area proposed would be mined. Regardless of the amount, while reclamation which includes recontouring disturbed material is required, it is not likely that the area would be put back so that natural processes will reclaim the area to pre-mining conditions in human time frames. The underlying soil and regolith is too coarse and chemically and biologically too unsuitable for passive restoration in decadal time frames with just recontouring.

The surface area over which soil disturbance will occur is about 267 acres. About 31 acres of the disturbance is estimated to be permanent without active restoration. The remainder would be re-vegetated to varying degrees over several decades. The channel would remain functionally disconnected from the valley bottom, preventing the full potential for hydric soils and riparian vegetation.

Cumulative Effects

It is not known when mining and mine reclamation would take place over the twenty-year life of the proposal. Following the mining or re-mining of claims, only standard reclamation would occur. About 6.6 acres in roads would likely remain even after recontouring and this would be a permanent loss of soil productivity as long as the roads exist. Some additional area is likely to remain impaired through flooding, compaction, improper substrate placement, and the nature of the tailings.

Alternative 3 would retain the separation of Resurrection Creek from the floodplain through the Project Area, continuing the cumulative impact to the riparian soils across the Resurrection Creek valley bottom.

Recreational mining along Resurrection Creek and small commercial mining operations along Palmer Creek would likely continue to degrade streambank soils along some stream sections. The effect would be small related to the whole of the historic mining effects, but would act cumulatively in further degrading riparian soils.

The Resurrection Phase I project would have little effect on the floodplain and riparian resources of Resurrection Creek in the Phase II project.

Other areas of current or proposed mining on Resurrection and Palmer Creeks would have little effect on soil ecological conditions and the valley bottom in the project area.

Activities on other lands, such as new subdivision development would have little effect on soil ecological conditions and the valley bottom in the project area.

Irreversible and Irretrievable Commitments of Resources

About 37.6 acres of disturbance including roads in this alternative are estimated to be an irreversible or irretrievable commitment of soil resources.

Adverse Environmental Effects that cannot be avoided or mitigated

The existing approved mining plan of operations would continue on this reach along with a new plan of mining operations. The sites actually mined would be graded to the original shape and reclaimed with any soil that was stockpiled prior to mining, but no further restoration would occur. The current valley bottom soils and vegetation would be overturned and not likely replaced in any fashion similar to an undisturbed reach. The hydraulic connection between the channel, valley bottom, and adjacent uplands would possibly be disrupted. Soil quality would be degraded by more than 15% (estimated 217 acres) compared to either current condition or an undisturbed reach. Adverse effects (37.6 acres) that cannot be avoided are expected to be permanent because natural processes would not be able to counter or restore them within human timeframes.

Compliance or conflicts with the CNF LRMP

This alternative would comply with existing Forest Plan objectives and standards for soils in mining claims.

Consistency with Regulatory Framework (i.e. Clean water Act, ESA, Clean Air Act, NFMA, NEPA, FS manual, State Laws, etc…)

Since this is a mining claim, the minimum legal reclamation is considered suitable, thus this alternative is in compliance with NFMA for soil and land productivity for valid mining claims.

Noise

This section addresses noise effects expected in the local vicinity of the project area. The impacts of noise on recreation visitors, private residences, and wildlife were identified as concerns during scoping. Commercial mining currently occurs within the project area and would continue under all alternatives.

Affected Environment

Existing Condition

Mining operations and noise generated from mining within and around the project area have been ongoing since 1890. The intensity of mining and noise has varied greatly over the years ranging from no mining activity to large scale heavy equipment operations. Currently, heavy equipment mining operations are occurring within the project area and recreational gold panning, sluicing, and dredging are occurring upstream of the project area, just upstream of the Resurrection Pass North Trailhead.

Recreational activities, including camping, hiking, mountain biking, backpacking, sightseeing, skiing, and motorized sports occur along trails such as the Resurrection Pass National Recreation Trail and local road corridors near Hope.

These recreational activities draw visitors and economic activity to Hope. Currently, there is limited recreation use that occurs within the project area. The majority of the recreation use that occurs in the area is generally concentrated within Porcupine Campground, the Resurrection Pass National Recreation Trail, and on other non-federal lands (refer to the recreation analysis in this chapter).

Many people choose to live in Hope because of its isolation and high amenity values such as “peace and quiet”. Many of the residents and local businesses are dependent on recreation related tourism for income (refer to the social-economics analysis in this chapter).

Background

The following information describes various aspects of noise to provide a baseline to understand and determine the potential effects that noise created by mining and restoration activities may have on wildlife, recreation visitors, and property owners within or near the project area. The majority of the following discussion defining various types and measurement of noise was taken in large part from Reed (2007).

Noise levels or energy are often measured in decibels (dB). Decibels are units of sound pressure reported on a logarithmic scale (similar to the measurement of earthquake intensity on the Richter scale) (Engineering Tool Box 2009a, 2009b). Each 10 dB increment is a ten-fold increase in sound pressure. A sound level of 10 dB is therefore 10 times the acoustic energy as 0 dB, 20 dB is 100 times the acoustic energy as 0 dB, and 30 dB is 1,000 times the acoustic energy of 0 dB (Ludwig 1996). By definition, 1 dB is the smallest change in volume the human ear can detect (US Department of Transportation, Federal Highway Administration 2009). Decibels will be the units of measure used to describe and compare relative effects of noise on wildlife, recreation users and private landowners by alternative.

Understanding the implications of noise outputs as reported by decibel is best understood when accompanied by charts providing representative noise levels associated with frames of reference that are more common. Table 2 shows a compendium of five different tables showing decibel noise levels in terms of more understandable environments.

A short review of the table illustrates the difficulty of using it as a meaningful and accurate predictor for the types of noise expected to be generated during the mining and restoration activities at the site. That is, those activities will not make the same noise as many of the reference noise sources in the table and will only be about as loud. For example, a running excavator and a vacuum cleaner may produce similar decibel levels however may not be a satisfactory comparison for some. It is important to consider that a person’s perception of “noise” may differ from that of “sound,” and that simple decibel measurement alone is likely insufficient to describe what is acceptable and unacceptable. For example, is the noise of a freight locomotive acceptable? It may depend upon the setting where the noise is experienced as well as the volume. According to the Federal Highway Administration, “sound” (considered as a neutral concept) may become

"noise" (considered as a negative concept) when it is too loud, unexpected, and uncontrollable, occurs unexpectedly or has pure tone components.

Table 2 Decibel ranges and representative noise levels of common noises

Decibel (dB) Ranges	Representative Noise Levels
121+	150 dB – Jet engine (at 100')[7] 140 dB – Jet engine (at 100')[4] 140 dB – Low caliber rifle (at 3')[4] 136 dB – 50 hp siren (at 100')[6] 130 dB – Jet plane (at 100')[7] 126 dB – Jet take-off (at 200')[6] 125 dB – Pain begins[5]
111-120	120 dB – Space shuttle launch (at miles)[8] 120 dB – Amplified rock and roll (at 6')[7] 117 dB – Chainsaw (at 3')[7] 116 dB – Loud rock music[6] 115 dB – Pneumatic riveter (at 3')[7] 112 dB – Hammering on a steel plate (at 2')[6]
101-110	110 dB – Power saw[5] 110 dB – Football stadium during kickoff[8] 108 dB – Thunder[6] 107 dB – Power mower[5,7]
91-100	100 dB – Diesel truck (at 30')[7] 100 dB – Jackhammer (at 7')[8] 98 dB – Heavy truck[6] 95 dB – Subway train (at 200')[5] 90-95 dB – Level at which sustained exposure may result in hearing loss[5]
81-90	90 dB – Train whistle (at 500')[5] 90 dB – Food blender (at 3')[7,8] 90 dB – Loud factory, heavy truck (at 3')[8] 88 dB – Motorcycle (at 30')[7] 86 dB – Heavy street traffic[6] 87 dB – Average day-night sound level for apartment next to freeway[9] 86 dB – Average day-night sound level for ¾ mile from runway at major airport[9] 85 dB – City traffic (inside car)
71-80	80 dB – Telephone dial tone[5] 80 dB – Automobile (at 25')[7] 80 dB – Vacuum cleaner (at 3')[8] 79 dB – Average day-night sound level for downtown with construction activity[9] 75 dB – Average factory[6] 75 dB – Loud singing (at 3')[7]

Decibel (dB) Ranges	Representative Noise Levels
61-70	70 dB – Inside car[7] 70 dB – Busy traffic (at 16')[8] 68 dB – Average automobile[6] 64 dB – Noisy office[6] 60-70 dB – Normal conversation (at 3-5')[5] 60 dB – Office or restaurant inside[8] 60 dB – Normal conversation[7]
51-60	59 dB – Average day-night sound level for old urban residential area[9] 57 dB – Average office[6] 54 dB – Quiet residential street[6] 52 dB – Average day-night sound level for wooded residential[9]
41-50	50 dB – Quiet street[7] 50 dB – Quiet restaurant inside[8] 46 dB – Average residence[6] 44 dB – Average day-night sound level for agricultural crop land[9] 44 dB – Minimum street nosie[6]
31-40	40 dB – Quiet home[7] 40 dB – Residential area at night[8] 39 dB – Average day-night sound level for rural residential[9] 35 dB – Average day-night sound level for wilderness ambient[9] 32 dB – Very soft music[6]
21-30	30 dB – Theater, no talking[8] 25 dB – Quiet auditorium[6]
11-20	20 dB – Rustling leaves[7] 20 dB – Whispering[8] 18 dB –Quiet whisper (at 5")[6]
0-10	10 dB – Leaves rustling[6] 10 dB – Human breathing[8] 0 dB – Threshold of hearing[6,7,8] 0 dB – Weakest sound heard[5]

Source: [4] Carol (2007)
[5] Ludwidg (1996)
[6] Cambridge Street Publishing (1999)
[7] Martin (1929) and Stevens (1957)
[8] Engineering Tool Box (2009a, 2009b)

Ambient Noise

As shown in Table 2, even wooded residential areas such as Hope have ambient (or environmental background) noise levels. Ambient noise levels will vary throughout the day and year given the vegetative cover, flowing water of the creek, insects and wildlife, and other normal climatic conditions (wind, rain and occasional thunder). Forests and "wilderness" areas are estimated to have ambient noise levels in the range of 35 to 45 dB (Table 2) (EDAW Inc. 2009; USDA Forest Service, Chugach National Forest 2002a).

Actual studies conducted by the National Park Service (NPS) in Denali National Park between 2001 and 2003 measured ambient noise throughout the year in

several locations. They found that "natural ambient sound levels" varied by habitat type, ranging from a mean of 20.0 (and range of 18.6 to 21.7) dB in low shrub to a mean of 32.9 (and range of 30.5 to 36.3) dB in open needle leaf types (Hults 2004).

Decibel levels recorded in the fall of 2009 on the stream bank of Resurrection Creek near the Resurrection Pass North Trailhead exceeded 60 dB. Ambient noise levels in and around the project area would vary somewhat throughout the day and year given the vegetative cover, river noise, insects and wildlife, and other normal climatic conditions (flowing water of the river, wind, rain and occasional thunder). In addition, other human caused noise including vehicle traffic, aircraft over-flight, and recreational user-generated activity noise ranging from snow-machines in the winter to a simple conversation from a group of hikers.

White Noise

There is some commercial market for electronic devices that play back various natural environmental sounds such as river/ running water, wind, rain, ocean surf, brooks and birds (Pure White Noise 2009). Termed "white noise," these sounds are regarded to have a therapeutic effect and to assist with insomnia when played electronically. Some vacation locations tout the availability of such noises as a part of their setting's charm, including the noise of nearby running water or ocean waves (Brandon 2009). Within the project area examples of white noise include the running water of Resurrection Creek, wind through the trees, and the sounds of birds.

Existing Noise Levels

Under the existing plan of operations, 95 acres of mining with 9 mining camps totaling 3.3 acres to support activities are currently approved. During the mining period of the months of April through October, the following activities create various levels of noise: excavation of tailings, sluicing with a wash plant, material stockpiling, diesel water pumps and power generation.

On September 25, 2009, Forest Service personnel recorded decibel levels at five sites in and around the project area during active mechanical mining operations conducted by HMC. At the time, active mining was only occurring at one location in the southern portion of the project area, at Area 5, and one excavator, a diesel water pump and a sluice with a washer plant were in operation. The decibel reading locations included the following sites (see Figure 4):

1. 400 feet away from the equipment
2. "Bench" site on Resurrection Creek Road 0.2 mile south and east of the mining operations
3. Resurrection Pass North Trailhead
4. Resurrection Creek road at the National Forest boundary near private residences 0.8 miles from the active mining
5. Resurrection Creek Road/ Palmer Creek Road intersection 2.9 miles south of the active mining.

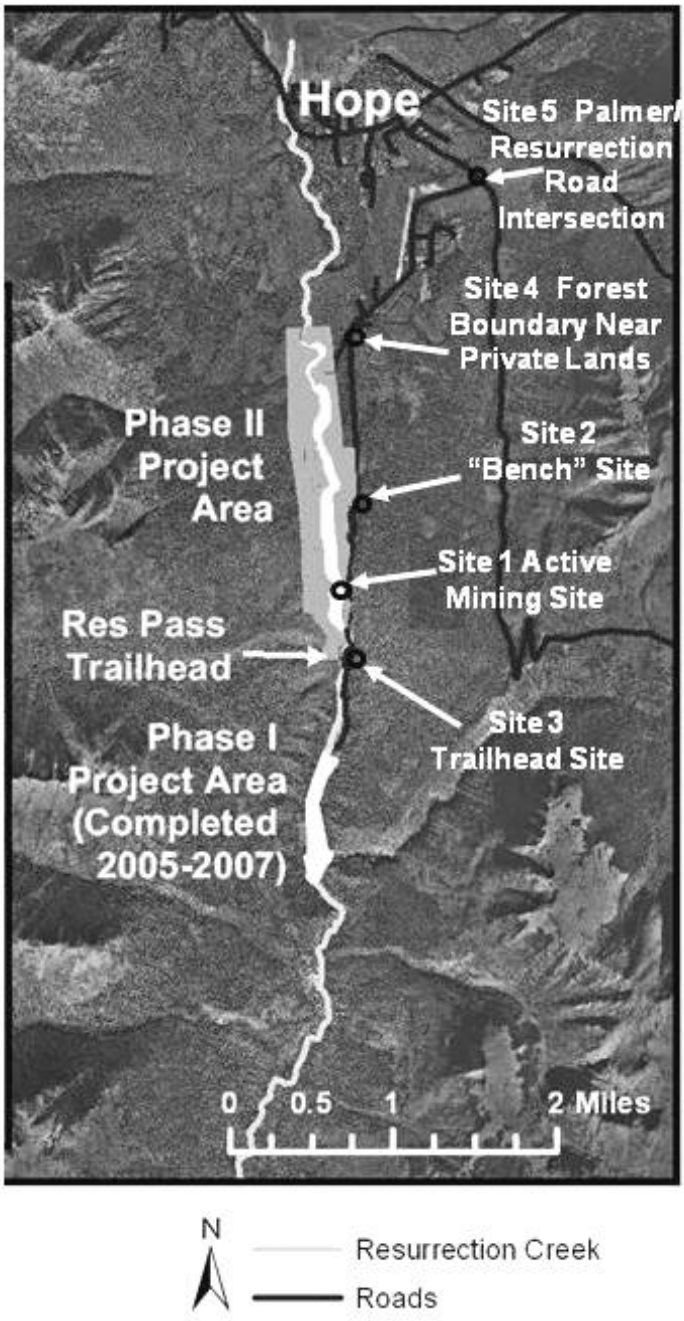

Figure 4 Decibel reading locations

Decibel readings taken 400 feet away from the equipment ranged from 64 to 68 dB. One spike of 80 dB occurred when a six-wheel ATV passed the decibel reader. Decibel readings taken at the "Bench" site on Resurrection Creek road 0.2 mile south and east of the mining operations ranged from 55 to 60 dB with one spike of 68 dB. The dominant noise recorded at this site was mining equipment. Decibel readings taken at the Resurrection Pass North Trailhead ranged from 57 to 62 dB. However, Resurrection Creek (cascading water) was the only discernable sound that could be heard. The equipment noise at the

project site could not be heard. Decibel readings taken on Resurrection Creek road at the forest boundary near private residences 0.8 miles from the active mining ranged from 35 to 40 dB with a high of 60 dB when two motor vehicles passed by. Equipment noise from mining operations could not be heard at the time of the recording; however it was also raining during this time and may have been masked by white noise. Decibel readings taken at the Resurrection Creek Road/ Palmer Creek Road intersection 2.9 miles south of the active mining ranged from 35 to 40 dB, and no mechanical noise was detected.

On October 1, 2009 decibel readings were repeated at four of the previous five sites during active mining. One excavator, a diesel water pump and a power sluice were all again operating at this time. Readings were taken approximately 200 feet away from the operating equipment with decibel levels ranging from 67 to 72 dB with one recorded spike of 79 dB. Decibel readings were not taken at the "bench" site on Resurrection Creek road 0.2 mile from active mining. Measurements taken at the Resurrection Pass North Trailhead ranged from 55 to 60 dB and again were the result of the noise generated by Resurrection Creek flowing water, and mining equipment noise could not be heard. Decibel readings taken on Resurrection Creek Road at the forest boundary near private residences 0.8 miles from the active mining averaged 53 dB, however this time mining equipment noise could be heard. Measurements taken at the intersection of Palmer Creek Road and Resurrection Creek Road averaged 51 dB with no mining equipment noise detected. Table 3 summarizes the recorded decibel levels within and near the project area.

Based on the data collected above, mining equipment produced noise levels in the range of 65 to 80 dB at active mining sites in the project area. Mining equipment noise may be detectable to over one mile from the active mining site with decibel levels potentially reaching 50 to 55 dB. Current ambient and mining noise levels within and around the project area are presented in table 3.

Table 3 Decibel readings in and around the project area

Existing Noise Sources	**Evaluation Sites**				
	Site 1 Active Mining Site	Site 2 Road Above and Adjacent to Project Area	Site 3 Resurrection Pass North Trailhead	Site 4 Forest Boundary near Private Land (North)	Site 5 Intersection of Palmer Creek Road & Resurrection Creek Road
Ambient Environment	35-40	35-40	55	35-40	35-40
Resurrection Creek	---	---	55-60	---	---
Non-motorized Recreation	---	---	55-60	---	---
Existing Mining Activity	65-80	55-70	55	53	---

Source: Decibel readings in the project area (September – October, 2009).

Environmental Consequences

Methodology

General Health Effects of Noise

While the Environmental Protection Agency (EPA) does not regulate noise, it has established guidelines for protecting human health as it may be affected by noise. EPA suggests that noises greater than 55 dB will interfere with outdoor activities and cause annoyance, and noises greater than 70 dB will result in hearing disruption. Noises greater than 90 dB may result in hearing loss, long before actual pain is experienced as noise approaches levels in excess of 120 dB (US Environmental Protection Agency, 1974).

Note that EPA seems to place as much emphasis on duration of noise levels, or total noise exposure, as on peak levels. An individual's total noise exposure is evaluated by an "equal energy" rule, stating that two noise exposures are expected to produce equal hearing loss if the product of exposure intensity and exposure time are equal. This rule suggests a 3 dB decrease in sound pressure level (expressed in decibels) for each doubling of the duration. Thus, an exposure of 76 dB for one hour is equivalent to 73 dB for two hours, or 70 dB for four hours. This procedure is probably accurate for exposures of 30 minutes or more. It is also more protective for very short exposures and for noise that fluctuates greatly in level.

Perception of Noise

Research into the effect of noise has largely been centered on flight paths of commercial aircraft and impacts to private residences and business areas. In regard to recreational users, the majority of studies has focused on backcountry settings and has been limited to aircraft and helicopter overflights within congressionally designated wilderness areas and national parks. Several studies are sufficient to describe the general state of knowledge.

While these results may be limited to the effects of aircraft and helicopters it is not beyond reason that comparable noise sources might yield similar reactions on the part of recreation users and private landowners to the unwanted sounds of mining and restoration activities.

Gramann (1999) points out that the National Park Service (NPS) does not rely principally on acoustical approaches to assessing noise impacts, largely because there are no widely used noise exposure standards. Accordingly, much discussion of the effects of noise is based on psycho-acoustical survey and experimental approaches that focus on human perceptions and preferences rather than on strict decibel measurement. One of the major points of the author is that ambient noise (that is noise resulting from the forces of nature) is generally not regarded as objectionable to recreational users (and to some extent they are viewed as restorative). Further, noise may be associated with visual evaluation in that the presence of objectionable noise may tend to reduce one’s perception of the aesthetic quality of an area.

Mace et al. (1999) report that unwanted helicopter and other low-flying aircraft noise interferes with the quality of the visitor experience and as well as the perceived aesthetic quality of landscapes. Higher flying commercial aircraft are perceived to be less of an intrusion in part due to lower noise levels but also to the greater vertical and horizontal distance separation. Many backcountry users especially seek out opportunities for solitude if not for the tranquility of the absence of daily mechanical noise and activity. The authors do note that the negative effects may be somewhat less when the recreational user is expecting to hear the noise and that the noise is associated with their particular form of recreation (e.g., snowmachining).

Grau (2005) reviewed other sources referencing the impact of noise on recreational experiences in wilderness settings. Grau's literature review generally supports the contention that noise may have a negative effect on the recreation experience. Even low levels of noise (for example, human conversation in the 55 dB range) can be annoying under prolonged circumstances, and may have a detrimental effect on visitors' sense of tranquility and solitude.

People's expectation of noise clearly appears to be a key determinant in the perception and acceptability of noise impacts. Unexpected noise, or noise types and levels not viewed as consistent with a specific setting, is likely to be considered more undesirable than similar but expected noise outputs. Dissatisfaction with project noise levels at the Resurrection Pass North Trailhead by visitors might be reduced somewhat through modifying their expectations for tranquility before arriving at the site.

Noise is more of a concern for non-motorized recreational users than for motorized recreational users, as loud noises are a part of many motorized activities such as snow-machining, boating, and off-road driving. At least one National Forest, the Deschutes-Ochoco in Oregon, will not issue a warning to OHV users until the decibel output exceeds 99 dB and will not issue a ticket unless a threshold of 101 dB is reached.

Factors and Assumptions

The following key points from this review have particular relevance for the noise impact analysis:

- True noise measurement can be complex and there are a number of subtle differences in reported noise measurement metrics.
- Decibel reference noise levels may provide less than satisfactory mental approximations from which to judge expected noise levels.
- Noise associated with multiple activities is likely to add only incrementally to the noise level of the loudest single activity.
- Based on literature and data collected in the project area, it is not unreasonable to assume that peak ambient natural or "white" noise levels at the Resurrection Creek project site may be as high as 62 dB.

- In general, unwanted mechanical noise, especially noise of long duration (even if at low levels) and especially if unexpected, tends to have a negative effect on the experiences of non-motorized recreational users which can also be correlated to private landowners.
- Restoration noise effects are negative in the short term, one to four years.
- The levels of noise disturbance of both mining and restoration activities are similar.
- It is assumed that mining activities and the associated noise impacts on wildlife, recreation and private landowners would occur in all alternatives for the next 20 years.

Scope of Analysis

The geographic bounds for direct and indirect effects are within and 1 mile surrounding the project area. The geographic bounds for cumulative effects are on the watershed scale.

The temporal scale for short and long term effects is 1 to 4 years during the May 15 through July 15 operating season, and 3 to 20 years respectively.

Measurement Indicators

- Level of noise created by mining activities
- Level of noise created by restoration activities

Alternative 2– Proposed Action

Direct and Indirect Short and Long Term Effects

This alternative proposes to restore a 76 acre restoration corridor along a two mile section of Resurrection Creek within the Hope Mining Company Claims. Proposed mining activities include 200 acres of mechanical mining, 41 acres of hand mining, 23 operational acres and 10 mining camps totaling five acres. Under Alternative 2, mechanical mining operations and noise generated from mining are expected be similar to the existing condition described above.

Approximately 98 privately owned parcels are within a mile from the project area (Kenai Peninsula Borough 2009). Some of the parcels have residences and others do not. The level of noise reaching individual parcels would vary greatly due to proximity of mining or restoration activities, topography and vegetation.

Level of Noise created by Mining Activities

Under Alternative 2, the noise generated from mechanical mining operations is expected to be similar to the noise generated from mechanical mining operations described in the existing condition above. The direct short and long term effects are that the decibel levels generated by mining equipment are expected to produce noise levels in the range of 65 to 80 dB at active mining sites. Mining in Areas 15a, 16 and 21 would produce noise levels in the range of 65 to 80 dB causing the greatest impacts of noise to private residences in close proximity to

these areas. Mining equipment noise may be detectable up to 1 mile from the active mining site with decibel levels potentially reaching 50 to 55 dB. Although the levels recorded near private residences 0.8 mile from active mining were near ambient levels, the EPA suggests that noises greater than 55 dB will interfere with outdoor activities and cause annoyance to recreation visitors (US Environmental Protection Agency 1995). Therefore the persistent equipment noise is likely to annoy some individuals living near HMC claims during the months of April through October over the 20 years of operation.

Recreation users at the Resurrection Pass North Trailhead would potentially be directly affected by mining noise only when mechanical mining is occurring at the extreme southern end of the project area in Areas 8, 9 and 22. The majority of mining proposed under this alternative (within the middle and northern sections of the project area) is not expected to affect recreational users at the trailhead due to the white noise masking effect of Resurrection Creek.

Level of Noise created by Restoration Activities

Under Alternative 2, restoration activities could be occurring simultaneously with mining operations during the period of May 15 to July 15 for up to four years. Noise levels generated by restoration equipment would be identical in nature and level to that of mining operations and are expected to mask each other rather than detectably add or increase noise levels. Restoration activities would be spread out over a greater area and would likely involve more equipment. During restoration there would potentially be 10 machines (dump trucks, excavators, front-end loaders, bull dozers, chain saws, service trucks and personnel carriers) operating at the peak of restoration. Therefore in the short term (one to four years during the May 15 to July 15 operating season), restoration equipment would generate the majority of noise throughout the project area and would likely be the dominant source of noise.

The direct short term effects would be increased noise generated by restoration equipment within the project area. Typical equipment, such as a large bulldozer (D9) that would be used for restoration would likely produce decibel readings of 65 to 80 dB (US Environmental Protection Agency 1995). Restoration equipment noise would likely be detectable to over one mile from the project area with decibel levels potentially reaching 50 to 55 dB. The restoration equipment noise is likely to disturb and displace wildlife and annoy some individuals living near the project area during the months of May 15 through July 15 in the short term.

Recreation users at the Resurrection Pass North Trailhead would potentially be directly affected by restoration noise only when machines are operating at the extreme southern end of the project area. The majority of restoration in the southern section of the project area is estimated to be completed in two to four weeks with impacts to any recreational users at the trailhead limited to that time period. The remainder of restoration proposed under this alternative (within the middle and northern sections of the project area) is not expected to affect recreational users at the trailhead due to the white noise masking effect of Resurrection Creek.

Cumulative Effects

The cumulative effects of the Proposed Action and all other activities occurring in the Hope area on noise would be minimal. As described above, the other sources of noise at the site besides the mining and restoration operations include running water from Resurrection Creek, vehicle traffic and human activity associated with fishing, recreational mining or hiking. The noise generated by running water from Resurrection Creek, vehicle traffic and human activity associated with fishing, recreational mining, hiking, and mountain biking probably do not constitute much of a cumulative effect above that generated by mining and restoration activities; mining and restoration activity noise would likely simply mask other noises rather than detectably add to those noise levels. Noise generated from mining combined with that of restoration would likely be a source of nuisance for some residents living within one mile of the project area and potentially make some parcels of land less suitable for some uses. Resurrection Creek would likely mask the majority of restoration, mining and other noises near the Resurrection Pass North Trailhead.

Irreversible and Irretrievable Commitments of Resources

There would be no irreversible and irretrievable commitments of resources.

Adverse Environmental Effects that cannot be avoided or mitigated

Noise from mining or restoration activities may be a nuisance for some area residences within one mile of the project area.

Compliance or conflicts with the Forest LRMP

This project complies with the standards and guidelines, goals, and objectives for the Chugach National Forest Revised Land Management Plan. The Forest Plan does not specifically address noise within mining areas.

Consistency with Regulatory Framework (i.e. Clean water Act, ESA, Clean Air Act, NFMA, NEPA, FS manual, State Laws, etc…)

This alternative is consistent with the regulatory framework. While the EPA does not regulate noise, it has established guidelines for protecting human health as it may be affected by noise. EPA suggests that noise greater than 55 dB will interfere with outdoor activities and cause annoyance, and noise greater than 70 dB will result in hearing disruption.

Alternative 3– No Restoration

Direct and Indirect Short and Long Term Effects

Restoration would not occur under this alternative. Proposed mining activities include 193 acres of mechanical mining, 41 acres of hand mining, 33 operational acres and 10 mining camps totaling five acres.

Mechanical mining operations and noise generated from mining are expected to be the same as described in Alternative 2. The rate of mining in Alternative 3 is expected to be approximately the same as Alternative 2. Alternative 3 would mechanically mine 3 acres more than Alternative 2. The duration of the mining is 20 years.

Approximately 98 privately owned parcels are within a mile from the project area (Kenai Peninsula Borough 2009). Some of the parcels have residences and others do not. The level of noise reaching individual parcels would vary greatly due to proximity of mining activities, topography and vegetation.

Cumulative Effects

The cumulative effects of Alternative 3 are the same as Alternative 2 with the exception of that there would not be any noise created by restoration activities.

Irreversible and Irretrievable Commitments of Resources

There would be no irreversible and irretrievable commitments of resources.

Adverse Environmental Effects that cannot be avoided or mitigated

Noise from mining activities may be a nuisance for some area residences within one mile of the project area.

Compliance or conflicts with the Forest LRMP

Same as Alternative 2.

Consistency with Regulatory Framework (i.e. Clean water Act, ESA, Clean Air Act, NFMA, NEPA, FS manual, State Laws, etc…)

Same as Alternative 2.

Biological Environment

Aquatic Resources and Hydrology

Affected Environment

Watershed Morphology

At its mouth, Resurrection Creek drains 161 square miles (103,230 acres) into Turnagain Arm of Cook Inlet. The proposed project area drains 149 square miles (95,400 acres). Resurrection Creek drains to the south through a large, glacially formed, U-shaped valley. Steep valley sides lead to elevations up to about 5,000 feet, with the majority of the watershed at elevations between 1,000 and 4,000 feet. The project area lies at elevations of about 190 to 350 feet, located about 2 to 4 miles from the mouth of Resurrection Creek at Hope (figure 5).

Quaternary glaciation covered most of the Kenai Peninsula, with the last peak of glacial activity occurring approximately 20,000 to 25,000 years ago. Glaciers began to retreat about 15,000 years ago, and remnant alpine glaciers, valley glaciers, and icefields now remain scattered throughout the high peaks of the central Kenai Mountains. Glaciers are no longer present within the Resurrection Creek watershed.

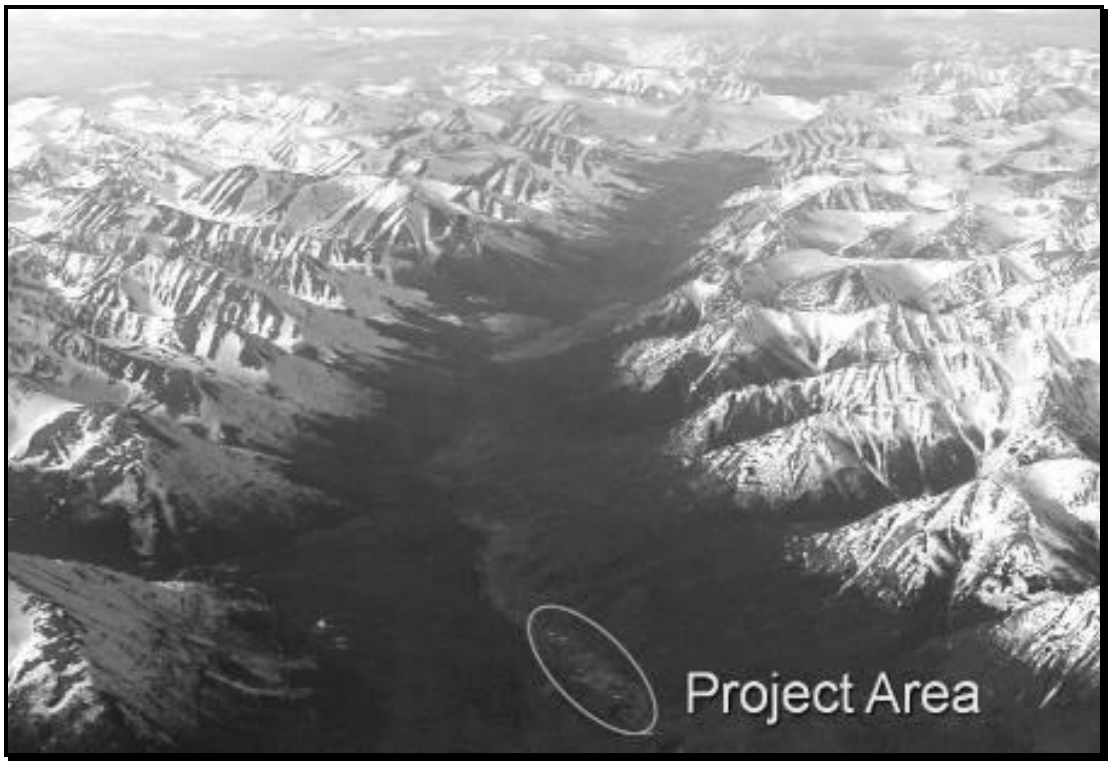

Figure 5 Aerial oblique photo looking south up the Resurrection Creek valley

Topography of the Resurrection Creek watershed consists of rounded, frost churned mountaintops separated by valleys shaped by alpine glaciers, as characterized by the Western Kenai Mountains Ecosection (Davidson 1999). Deposition of alluvial gravels in the watershed occurred during glacial recession, when it is likely that the lower valley floor was a glacial outwash plain. Following glacial retreat, Resurrection Creek carried much smaller sediment loads, allowing it to incise 50 to 100 feet over much of its length into the alluvial gravels and in some areas bedrock. High terraces are seen on both sides of the Resurrection Creek valley. Where only alluvial gravels exist, Resurrection Creek developed a wide floodplain between the high terraces. Where the downcutting stream encountered resistant bedrock, V-shaped canyons were cut, with very little floodplain. Three short bedrock canyons exist on the lower 8 miles of Resurrection Creek. The lower canyon is located just downstream of the Hope Mining Company claims, and the middle canyon is located just upstream of the Phase I restored reach.

Climate

The climate in the Resurrection Creek watershed reflects a marine influence, with generally cool temperatures. The average annual temperature in Hope is 37 degrees F (Western Regional Climate Center 2007). Maximum July temperatures average 67 degrees F, and minimum January temperatures average 13 degrees F. Storms in this area generally circulate in a counterclockwise direction in Prince William Sound and move toward the west. This causes a rain shadow effect in the Resurrection Creek watershed and the western Kenai Mountains. This area is relatively dry compared to the much wetter and more glaciated regions of the Kenai Mountains to the east. Hope receives an average of 22 inches of annual precipitation (Western Regional Climate Center 2007). Precipitation increases with elevation. About half of the annual precipitation falls as snow, and snow generally falls from late October to early April. Maximum winter snowpacks average about 23 inches in Hope and about 36 inches in the upper watershed. Maximum annual snowpacks generally occur in early April. The most precipitation generally falls between August and December, and April and May are the driest months.

Aquatic Species

Both anadromous and resident fish utilize Resurrection Creek. Five species of anadromous salmonids are present in Resurrection Creek, including pink (*Oncorhynchus gorbuscha*), chum (*O. keta*), coho (*O. kisutch*), Chinook (*O. tshawytscha*) and sockeye salmon (*O. nerka*). Pink salmon are the most abundant species with runs estimated at 20,000 to 35,000 returning adults in even-numbered years. Chum salmon are much less numerous, with about 200 adults returning yearly. Annual coho peak counts in Resurrection Creek range from 100 to 500 returning adults. Chinook counts range from less than 100 to upwards of 500 returning adults.

Resident fish include Dolly Varden (*Salvelinus malma*), whitefish (*Prosopium sp.*), sculpin (*Cottidae spp*.), and stickleback (*Gasterosteidae spp*.). While Dolly

Varden is known to be present, there is no information about their population status in the Resurrection Creek watershed. There are no population data on rainbow trout. The lower six river miles of Resurrection Creek have been identified as critical habitat for spawning and rearing habitat for coho, chum, pink and Chinook salmon (Hart Crowser, Inc. 2002).

The response of fish and wildlife to the Phase I Resurrection Creek Stream Restoration Project conducted in 2005-2006 has been very positive. All five species of Pacific salmon have been observed in the restored channel and side channels, with nearly 70 Chinook, over 4000 pinks, 175 coho, and nearly 100 chums spawning in this reach following restoration in 2006 (figure 6). These salmon transport marine-derived nutrients to the floodplains, supporting the riparian vegetation and promoting a naturally functioning, self maintaining ecosystem. Numerous harlequin ducks have moved into the Phase I project area, in the areas around the deep pools that hold fish.

Listed, Proposed and Candidate Species

There are no federal or state listed, proposed or candidate aquatic species located in the project area.

Figure 6 Pink salmon in a Phase I restored side channel (2006)

Channel Morphology

Resurrection Creek was home to Alaska's first gold rush. Portions of Resurrection Creek and its tributaries have been mined for gold using various techniques. The majority of impacts to the stream channels and riparian areas in the project reach arose from hydraulic placer mining, which occurred mostly in the first two decades of the 1900's. Miners during this period physically moved

Resurrection Creek to accommodate mining activities, and in many places the channel does not lie within it original location. Tailings generated from hydraulic mining rise as high as 20 feet and occupy the majority of the alluvial valley floor within the project area (Figure 7).

Figure 7 Tailings piles along Resurrection Creek in the project area

Through the project reach, most of Resurrection Creek is a Low Gradient Floodplain Channel (FP4) or a Wide Low Gradient Floodplain Channel (FP5), as classified using the Tongass National Forest channel classification system (USDA Forest Service, Alaska Region 1992a). These types of channels are generally low gradient (less than 2%), sinuous, alluvial channels with wide floodplains. This channel acts as a depositional reach, although high flows will mobilize sediment. Large woody debris is an important consideration for the maintenance of channel form and habitat, and these channels are sensitive to sediment inputs from the watershed or bank erosion. Riparian and floodplain protection is important for the off-channel features that provide important aquatic habitat. The lower half-mile of the project reach is a Moderate Gradient Contained Narrow Valley Channel (LC2), with limited floodplain development and a slightly steeper gradient than upstream. As classified by the Rosgen classification system (Rosgen 1996), Resurrection Creek was most likely a C3 channel prior to disturbance by mining. While portions of the project reach presently fit the C3 classification, much of the reach is an F3 channel as a result of the lateral confinement by the tailings piles on the banks and the low sinuosity.

The valley floor created by Resurrection Creek throughout the project reach, excluding the lower half-mile through the canyon, ranges from 400 to 1100 feet wide. The lower half-mile of the project area is partially confined by bedrock in the canyon, with valley widths ranging from 70 to 450 feet. Throughout the project reach, the channel of Resurrection Creek is confined by tailings piles along the edges of both banks, confining the available floodplain to a very narrow corridor. The entrenchment ratio is the ratio of the floodprone width to the bankfull width. Entrenchment ratios in the project reach are in many places less than 2:1, whereas entrenchment ratios in the undisturbed reference reach upstream of the project reach are about 7:1. Typical entrenchment ratios for C

channels are generally greater than 2.2:1 (Rosgen 1996). Because high flows are not able to spread out onto the floodplain in the existing channel, flood flows are confined to the channel, causing increased shear stress, increased bank erosion, and diminished habitat. The lack of overbank flows to provide sediment and nutrients to the floodplain results in slow rates of re-vegetation and poor riparian health.

Sinuosity is a measure of the channel length divided by the valley length. Hydraulic mining and relocation of the Resurrection Creek channel over the last 100 years has resulted in a very straight stream channel with a low sinuosity of 1.1. Sinuosity in a reference site upstream on Resurrection Creek was measured to be 1.7 (Bair et al. 2002). The lack of meanders results in a straight channel with little complexity. The existing channel does not have the point bars and scour pools typical of a meandering channel.

The majority of the bed of Resurrection Creek through the project reach consists of cobble and gravel-sized material. However, numerous boulders are also present within the substrate. These boulders are the result of mining activities as well as historically higher streamflow conditions that were able to transport larger sediment. Bed sediment measured in typical riffles within the project area has a median particle size (D50) ranging from 140 to 180mm (large cobbles). The limited pools within the project reach contain pockets of gravel deposition. The small point bars that exist are composed of predominantly small cobbles.

The existing channel has a relatively high channel gradient, as compared to the reference reach and pre-mining conditions. The steeper channel slope results in increased stream velocity and increased shear along the bed and banks. These high velocity flows can transport larger material and have caused an increase in substrate size. The channel gradient through the project reach averages 1.5%. This is higher than the 1.2% slope measured in the reference reach of Resurrection Creek. The average valley slope of the project reach is 1.7%.

Over 95% of the project reach consists of riffle habitat, and the reach has little complexity in terms of bedforms and habitat features. Pools are very limited within the project reach. Small pools exist downstream of several large boulders that were placed in the channel in the past as habitat enhancement features. Small pools have formed on the complex meander bend at “Pond O,” a settling pond that was captured by the main channel. A small pool also exists in the channel constriction where a new channel was blasted through bedrock 500 feet upstream of the entrance to the canyon.

Aquatic Habitat

Spawning gravel typically exists in the pool tails of ‘C’ type channels. Because of the limited pools in this reach, spawning gravel is very limited, with the majority of the channel substrate containing cobble sized material that is too large for spawning.

The project reach presently contains little off-channel habitat that is accessible to fish. Although much of the valley floor is covered by settling ponds used for modern mining operations, these ponds are cut off from the main channel by

tailings piles, and less than 1% of the flow of Resurrection Creek flows through these pond networks. However, a portion of Resurrection Creek flows through the previous location of "Pond O," where habitat features are plentiful. Beaver dams exist on many of the settling pond outlets throughout the valley floor. In comparison with the reference reach, the project reach is a simplified channel with little high flow refugia and limited suitable rearing habitat for fish.

Large woody debris (LWD) is an important component for fish habitat. It has important roles in trapping and slowing sediment movement, creating a diverse range of habitats, and forming pools and cover. The physical effects LWD has on streams include changes in stability of stream banks and channels, storage of sediment, dissipation of stream energy, and alteration of channel flows (Bryant 1983; Everest and Meehan 1981; Harmon et al. 1986). LWD is limited within the project area. Recruitment of large wood from the banks is limited because of the lack of large trees in the riparian areas. High tailings piles along the banks limit the growth of cottonwoods. LWD is important for hydrologic function and habitat features in this type of channel.

Hydrology

The US Geological Survey collected 18 years of flow data on Resurrection Creek at a gauging station near the end of the project reach. The drainage area at this location is 149 square miles. Data were collected between 1968 and 1986 (US Geological Survey 2007).

Peak flows on Resurrection Creek are typically generated by summer snowmelt. Snowmelt runoff generally starts in early May, with peak flows averaging about 800 cubic feet per second (cfs) in mid- to late June (figure 8). Large peak flow events can occur during summer warm spells as well as during heavy fall rainstorms that create short duration, high water events lasting 1 to 3 days. Winter flows from December through April are generally less than 200 cfs, as snowpack covers most of the watershed.

The stream gauge was located at the downstream end of the project reach, and no major tributaries enter Resurrection Creek within the project reach. Therefore, flow data from the gauge can be used to characterize flows within the entire project reach. The peak flow of record on Resurrection Creek was 3380 cfs on July 12, 1980. This corresponds to about a 25-year flood. The bankfull discharge, generally thought to be approximately equal to the 1.5-year flood event, is estimated to be about 980 cfs. Calculated as weighted values of the observed gauge data and data from regional regression equations, the 10-year flood is approximately 2480 cfs, and the 100-year flow is approximately 4780 cfs (Curran et al. 2003). The lowest recorded flow on Resurrection Creek was 38 cfs in early April, 1985.

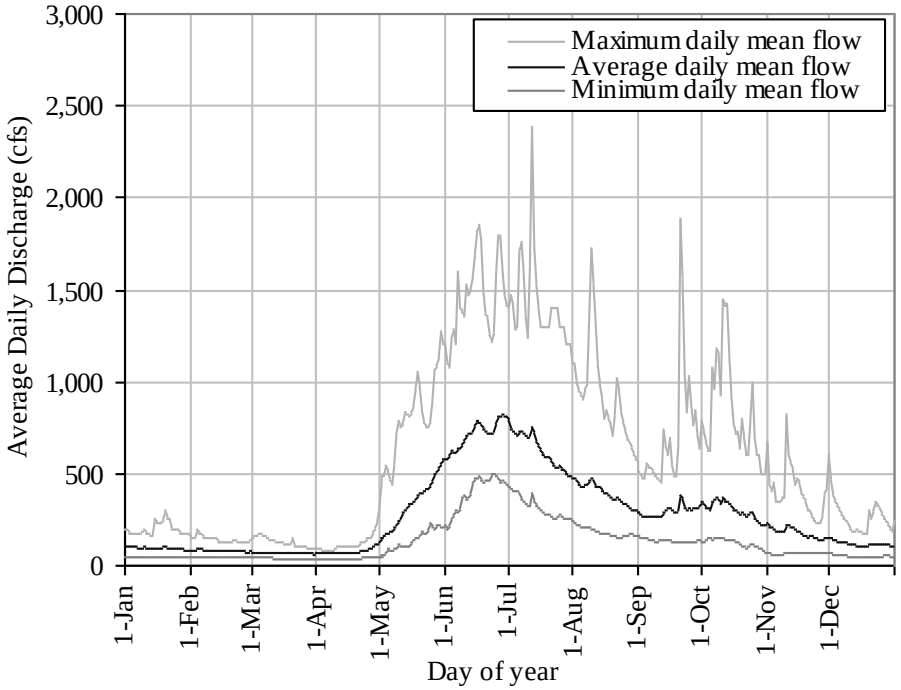

Figure 8 Resurrection Creek hydrograph, 1968-1986. Data from US Geological Survey (2007)

Water Quality

Water quality data are available from two US Geological Survey gauging stations on Resurrection Creek (US Geological Survey 2007). Data were recorded at the Hope Highway Bridge from 1950 to 1959, and at the downstream end of the project area from 1968 to 1971. These data show no violations of State of Alaska water quality standards established for the growth and propagation of fish, shellfish, other aquatic life, and wildlife (Alaska Department of Environmental Conservation 2006). No streams within the project area are listed on the Clean Water Act Section 303(d) list of impaired waterbodies.

Sediment loads and turbidity generally increase during high flows, as finer particles become suspended. The source of these fine sediments can be from sediment naturally delivered to the stream as a result of landslides or bank erosion, or from disturbance related to activities such as mining, road construction, bank trampling, or channel alterations. Turbidities on Resurrection Creek are generally low during low and moderate flow levels.

Mercury was likely used during historic placer mining operations on Resurrection Creek, although the extent to which this occurred is unknown. Placer mining operations used elemental mercury for separating fine gold particles from the "black sands" that remain after material is washed through a sluice box. Mercury bonds with gold, forming a gold/mercury amalgam that can be easily sorted out. The gold can then be separated from the mercury through a distilling process. In this process, the mercury vapor is cooled and condenses back to liquid mercury that can be reused.

It is unknown if mercury was used at the Resurrection Creek project site. Some Alaskan miners in the early 1900s were known to pour mercury directly into their sluice riffles during the sluicing process. It is likely that if it was used on Resurrection Creek, some mercury was spilled, and some mercury vapor may have been deposited during the gold processing. Because of their high density, beads of mercury are likely to have worked their way through the alluvial gravels until they reached a layer of bedrock or clay.

Mercury is a highly toxic substance, particularly when in a methyl-mercury compound. Mercury can pose a threat to the survival of fish eggs and younger life phases, being more susceptible to mercury toxicity. In order to exist in water, mercury must be attached to organic or inorganic particles suspended in the water, as elemental mercury is insoluble in water.

To address concerns of mercury contamination and release during construction prior to the Phase I Resurrection Creek Restoration Project, the Forest Service conducted a series of mercury studies in the Phase I project area (MacFarlane 2004a; MacFarlane 2004b). A similar study was conducted on both the restored reach and the proposed restoration reach in 2008 (MacFarlane and Olegario 2008). These studies found low levels of mercury within resident fish, sediment, and water in Resurrection Creek. Mercury levels in fish captured in off-channel habitats were slightly higher than those caught in the main channel and reference reach, suggesting that a small amount of mercury may be present in these areas, but all fish tissue sampled remained below the "action level" set by the Environmental Protection Agency for human consumption of fish. Mercury levels in water in Resurrection Creek were well below the Alaska State drinking water standards. Mercury levels in sediment samples were low, and similar to published results from unmined streams in the Cook Inlet area.

Heavy and trace metals were measured in Resurrection Creek by the Forest Service in 1980 (Blanchet 1981). These data showed five occasions where concentrations exceeded State of Alaska water quality standards. Manganese concentrations exceeded State standards in wash water on Resurrection and Palmer Creeks. Lead concentrations exceeded the State standards in wash water and downstream of mining on Resurrection Creek. Lead concentrations violating State standards were measured upstream of a mining site on Palmer Creek. Samples collected in 1994 in mining areas on Resurrection Creek indicated no presence of arsenic, copper, lead, or zinc above detection levels (Kalli and Blanchet 2001).

Riparian Areas and Wetlands

Much of the riparian area along the Resurrection Creek project area has been disturbed by past mining activities. Much of the vegetation growing on the banks and streamside tailings piles consists of early seral hardwoods. Riparian vegetation along the project reach has little diversity.

About 31 acres of mapped wetlands exist within the Resurrection Creek project area. About 13 acres of these wetlands are riverine wetlands in the Resurrection Creek channel within the proposed restoration corridor. About 18 acres of these

wetlands are palustrine wetlands comprising the existing ponds and low areas within the valley floor. Most of the areas where palustrine wetlands have been identified are areas that have been previously mined.

Groundwater

Most homes in Hope use wells for their water source. Approximately 100 wells exist in the area. Numerous springs are found throughout the watershed, most commonly along lower portions of the valley side slope, below long slopes. Groundwater on the sideslopes trickles through the soil layers and the fractured bedrock below, and emerges lower on the slopes. The greywacke and shale bedrock geology of this area is not porous enough to create significant aquifers. Alluvial gravels within the Resurrection Creek valley floor are porous and can contain a sizeable aquifer. Most wells in Hope tap into this aquifer. In the project area, the depth of the alluvial gravels is limited in some places by clay layers and bedrock near the surface.

Environmental Consequences

Comparison of alternatives in terms of hydrology and aquatic resources is based on the following parameters:

- Water Quality / Sediment / Turbidity
- Aquatic Species
- Stream Channel Morphology
- Aquatic Habitat

Issues

The two significant issues presented in this EIS are both related to aquatic resources and hydrology. These issues include the impacts to water quality from increased turbidity and the impacts to fish populations from increased turbidity and proposed activities.

Measurement Indicators

The impacts of the project on water quality and the impact of turbidity on fish populations are evaluated by comparing the potential levels of turbidity anticipated to be caused by each alternative. Short term increases in turbidity levels would occur as a result of stream channel modifications during restoration and/or mining activities. The transport of fine sediment during these activities is the primary cause of these turbidity increases, and turbidity is the primary water quality parameter affected by this project. Turbidity is measured in Nephelometric Turbidity Units (NTU). Indicators to compare the impacts of each alternative on channel morphology and aquatic habitat include channel gradient, channel sinuosity, number of pools per mile, the ratio of floodplain width to channel width, area of spawning habitat, pieces of large woody debris (LWD) per mile, and length of off-channel habitat.

Methodology

Turbidity can be measured in streams and rivers in the field using a turbidimeter, which measures the transmission of light through a small sample of water taken in a sampling jar and reports the turbidity in NTU. Turbidity levels created as a result of this project are projected for this analysis based on past data from similar projects. Turbidity levels measured during channel diversions in the Phase I Resurrection Creek Stream Restoration Project in 2005 and 2006 are used to help estimate the magnitude and duration of the turbidity pulses generated from this project (MacFarlane 2005). The substrate in the Phase II project area is very similar to that of the Phase I project area, and with similar restoration methods, it is assumed that the Phase II project would create similar turbidity levels as the Phase I project. The effects of high turbidities on fish populations are determined through literature review of past studies on this subject.

The effects of the project on channel morphology and aquatic habitat are determined based on conceptual and desired restoration design parameters (Bair et al. 2002) and monitoring data from the Phase I project (MacFarlane et al. 2009). Methodologies are established to measure channel morphology and habitat parameters (Harrelson et al. 1994; USDA Forest Service, Alaska Region 2001; Rosgen 2006). It is assumed that the final design of the stream restoration would be similar to the design of the Phase I restoration project. The effects of mining activities on aquatic resources and hydrology are determined through pre-restoration analysis (Bair et al. 2002) and past field visits to active mining areas.

The scale of analysis for direct and indirect effects of this project is the project area and all downstream reaches of Resurrection Creek. The scale of analysis for cumulative effects is the Resurrection Creek watershed. The temporal scale of the effects of the project on turbidities and aquatic populations is short term, over the length of the project and the duration of a salmon life cycle (5 years). The temporal scale of the effects of the project on channel morphology and aquatic habitat is both short term (5 years) and long term (5 to 50 years).

Alternative 2- Proposed Action

Short and Long-Term Direct and Indirect Effects

Water Quality/ Sediment/ Turbidity

Under the Proposed Action, stream channel restoration activities would create a number of short-term increases in turbidity and suspended sediment loads in Resurrection Creek. These short-term plumes of fine-grained sediment produced during the diversion of Resurrection Creek into newly created channel segments are the primary water quality concern for this project. Approximately 6 to 10 individual stream channel diversions on Resurrection Creek would be created over 2 to 4 years during the proposed stream channel restoration. Because Resurrection Creek is not a source of drinking water for nearby residents, these impacts would not affect drinking water quality.

These short term turbidity plumes would occur within the ADF&G instream construction window (May 15 to July 15), minimizing the effects of sediment on

emerging and spawning salmon. This period also corresponds to a period of naturally elevated turbidities during snowmelt runoff. Each stream channel diversion would create a turbidity plume that would temporarily exceed the Alaska State water quality standard for the growth and propagation of fish, shellfish, other aquatic life, and wildlife (5 NTU above background conditions) (Alaska Department of Environmental Conservation 2006). Background conditions in Resurrection Creek vary depending on flow levels, generally from 0 to about 10 NTU.

Each new channel segment would be constructed "in the dry." Channel grade and specifications, channel substrate, and all structures would be constructed prior to diverting water into the channel segment. This practice of completing the channel construction "in the dry" minimizes the amount of sedimentation created. Using "push-up" dams to quickly divert the flow into the newly constructed channel segment minimizes the duration of the turbidity plumes.

During channel diversions, suspended sediment and turbidity would increase considerably in Resurrection Creek directly downstream of the diversion site as the flow picks up loose particles, dirt, silt, and clay in the newly constructed channel. Based on observations and turbidity monitoring during the Resurrection Creek Phase I Restoration Project in 2005 (MacFarlane 2005), turbidity levels immediately downstream of the diversion site are likely to exceed 300 NTU for up to 30 minutes during each channel diversion, returning quickly to normal levels once the equipment stops working in the channel. Turbidity levels would decrease with distance from the diversion site as particles settle out of suspension. The highest turbidities would occur within 1 mile of the diversion site, but moderate turbidity levels (up to 150 NTU) would be expected after each diversion for up to 1 hour all the way to the mouth of Resurrection Creek.

Smaller, more frequent pulses of turbidity would also occur throughout the project area during other in-stream restoration activities. These include modifications of the channel profile (shaping the banks), logjam construction, side channel construction, filling the old channel segments, equipment crossings, and bridge construction. Groundwater seepage into the newly constructed channels is likely to also cause increased turbidity as a result of equipment working in wet conditions. These turbidity pulses would quickly decrease to background levels shortly after equipment stops working. These activities are likely to create up to 10 small pulses of turbidity per day (if equipment is working in the channel) of up to 150 NTU, dissipating with distance downstream.

Other restoration activities occurring outside of the stream channel, including construction of access roads, floodplain construction, and spreading of soil on the floodplains, have the potential to cause small increases in turbidity in Resurrection Creek. These effects are not likely to cause turbidity to exceed the State water quality standards.

Some of the stream banks along the project reach are high, actively eroding tailings piles that cause small, localized increases in sedimentation and turbidity. The proposed restoration would improve long term water quality conditions by redistributing these tailings piles and creating stable stream banks that are not

likely to have persistent erosion issues. In the long term, these banks would also be stabilized by healthy riparian vegetation in the restoration corridor.

Channel and floodplain restoration would require the redistribution of old tailings piles, increasing the potential for the release of mercury into the environment. The potential that any large concentrations of mercury would be found is low (MacFarlane and Olegario 2008). If elemental mercury is disturbed during restoration activities, mitigation measures would minimize its spread into the environment. If released, mercury would likely just settle further into the sediment and would not likely be carried downstream.

The mining activities under the Proposed Action would occur outside of the restoration corridor. Although substantial ground disturbance would occur as a result of mining, turbidity levels in Resurrection Creek would not increase as a result of normal mining operations because settling pond systems would be used to capture all sediment created during the mining process, and no mining would occur within the active Resurrection Creek stream channel. Any outflow from the settling pond systems would be required to meet State of Alaska water quality standards.

Of the limited mining activities that would be allowed to occur within the restoration corridor, the equipment fords would have the potential to create small turbidity increases. However these pulses would be very short in duration and would not likely cause turbidity to exceed the State water quality standards. The banks and channel at the equipment ford areas would be hardened using larger substrate in order to minimize any water quality impacts.

Despite the buffer provided by the restoration corridor, a low potential would exist for water quality and stream channel impacts to occur as a result of mining activities occurring outside of the restoration corridor. Settling ponds, ditches, and roads in the valley floor adjacent to the restoration corridor could fail in the event of major future channel changes or high flow events. This risk would be low throughout the reach because of channel restoration design considerations and the adequate riparian buffer along Resurrection Creek provided by the restoration corridor. Stream channel design would incorporate additional measures to minimize the risk of such dynamic changes in areas where the valley floor is narrowest, such as between the proposed Areas 21 and 26. This is a location where the restoration corridor is only 200 feet wide, and some settling ponds, ditches, and roads would be located within 70 feet of the Resurrection Creek channel.

The clearing of any portion of the proposed 264 acres of mining area surrounding the restoration corridor would also increase the risk that a large scale precipitation event could cause large scale erosion of cleared mining areas and subsequently deliver large amounts of sediment to the stream channel. This risk is lowest in the previously mined flat valley floor where substrates are primarily gravel and cobble, and highest on the high terraces and hillslope areas where soils are undisturbed and substrates are finer. Runoff from a large precipitation event through a disturbed mining area could potentially deliver large amounts of sediment to the stream channel. However, the wide riparian buffer zone along the channel provided by the restoration corridor would capture sediment and

protect the channel from these impacts in most places. Fuel and oil spills from mining equipment operating adjacent to Resurrection Creek could also potentially impact water quality. However, the potential for these water quality impacts would be minimal under the Proposed Action because of mitigation measures and the presence of the wide vegetative stream buffers that would be part of the restoration corridor.

Aquatic Species

Direct mortality of fishes may occur during the proposed stream restoration as a result of heavy equipment crossing the stream, excavation of the streambed, and channel diversions. However, the impacts to fish would be minimized because pink, chum, coho, and Chinook salmon, resident Dolly Varden char, mountain whitefish, and sculpin are all outside of their susceptible early life stages (egg to fry) during the June 15 to July 15 instream construction window.

Indirect fish mortality may also occur as a result of increased turbidity. High turbidities have been shown to cause gill abrasion and reduce the feeding ability of salmonids and could kill juvenile coho and Chinook salmon, resident Dolly Varden char, and sculpin within and downstream of the project area (Sigler 1980; Sigler et al. 1984; Lloyd 1987). However, many studies have shown that fish can tolerate sediment exposure for short periods (McLeay et al. 1987). When duration is considered as well as concentration, a duration time exposure limit appears to apply to most fish (Newcombe and MacDonald 1991).

Adverse effects to fish would be short term, occurring during channel construction activities. The impact to the overall populations is expected to be very small and limited to resident fish and two cohorts of anadromous fish within and downstream of the project reach. The instream restoration work would occur after the fry and smolt have emigrated. Channel construction “in the dry” would allow adult pink, Chinook, and coho salmon to immigrate through the project area unimpeded and spawn upstream, and stranded fish in the de-watered sections would be captured and relocated to portions of the stream not affected by construction. Direct impacts within the project reach would be limited to age 0 and 1+ Chinook and coho salmon, resident Dolly Varden, and sculpin. Direct and indirect mortality of fish are not expected to occur as a result of bridge or road construction.

Because salmon fry will have emerged from stream gravels before any stream diversions are initiated, the previous winter’s eggs would not be threatened by losses from sedimentation of the spawning gravels. Also, because streamflows and flow velocities generally peak during the instream construction window from snowmelt runoff, fine-grained sediments that could potentially deposit in salmon redds (nests) are much more likely to stay in suspension.

Direct mortality of aquatic macroinvertebrates within the project area would be expected. This impact would be brief (12 hours) after disturbance and would be limited to the restored reach and approximately 1 mile downstream. Based on research by Novotny and Faler (1982), re-colonization of aquatic invertebrates from upriver reaches could occur rapidly due to species dispersal from in-river

drift. Gersich and Brusven (1981) estimated that full aquatic insect colonization of rock substrates within disturbed areas would take 47 days.

Stream Channel Morphology

Under the Proposed Action, Resurrection Creek would be reconstructed into a meandering pool-riffle channel, increasing the main channel length by about 1800 feet (15%), decreasing the average channel slope from 1.5% to about 1.3%, and increasing the channel sinuosity from 1.1 to about 1.3. Pool frequency would be increased from less than 5 pools per mile to about 20 pools per mile. By redistributing tailings piles, wide floodplains would be created, increasing the average floodprone width to bankfull width ratios from 1:1 to at least 4:1. These floodplains would allow normal flood flows access to the historic floodplain. About 8,000 feet of new side channels and ponds would be constructed as part of the floodplain to provide additional channel function and habitat.

Reconstruction of this section of Resurrection Creek within the restoration corridor would restore the natural hydrologic function of the stream channel in the short term, with further improvement in the long term. Restoration would provide a stable, yet semi-dynamic channel system modeled after an undisturbed reference reach. Floodplains would allow flood flows to deliver nutrients to the riparian area, decrease peak flow magnitudes by temporarily storing water on the floodplain, and increase channel stability by reducing shear stresses on the channel bed and banks. This would allow for the growth of healthy riparian vegetation, which would further benefit ecologic and hydrologic function. Within the restoration corridor, a wide riparian buffer zone of generally at least one channel width on each side of Resurrection Creek would protect the stream channel from activities occurring outside of the restoration corridor. The increased sinuosity and decreased channel gradient would decrease flow velocities, reduce shear stresses, allow for stable pool-riffle morphology, and increase channel complexity. The pool-riffle sequences would allow for natural sorting of gravels and cobbles, improving channel function and habitat.

The proposed mining would have little effect on channel morphology, as most mining activities would occur outside of the restoration corridor. The three proposed equipment fords across Resurrection Creek and the associated roads through the restoration corridor would slightly impede the natural function of the channel and riparian area. Impeded riparian vegetation and bank erosion would be associated with these crossings, and the armored bed of the channel could impede natural sediment transport processes.

Aquatic Habitat

The proposed restoration would improve aquatic habitat in Resurrection Creek and within the restoration corridor. Approximately 3600 square yards of new spawning areas would be constructed in the lower gradient areas of the channel, and the designed channel morphology would allow for natural sorting and retention of spawning gravels in these areas. This large increase in available spawning gravel would dramatically increase Chinook, coho, pink, and potentially chum salmon utilization and production within the project reach. Also, Dolly Varden and sculpin would benefit from the increase in prey base.

The number of pools in Resurrection Creek would increase from less than 5 pools per mile to about 20 pools per mile. The increase in primary pools would directly and indirectly benefit all species and life stages of fish by providing low water velocity resting habitat, and bubble curtains and depths that provide hiding cover from predators. The increase in pool habitat would also indirectly increase foraging efficiency for juvenile and resident life stages of fish.

Hundreds of whole trees, including the root wads, would be incorporated into the restored channel as constructed logjams, instream structures, and floodplain roughness. Instream LWD would increase from about 12 pieces per mile to over 300 pieces per mile. Benefits to adult and juvenile salmonids from the addition of LWD include increased channel complexity, increased cover, increased pool depths, and retention of carcasses and other organics. Salmon carcasses can contribute 20 to 30% of the available nitrogen and phosphorus in a particular stream system (Bilby et al. 1993). The marine-derived nutrients associated with salmon carcass decomposition are known to play a major role in the productivity of aquatic and riparian systems in anadromous watersheds in the Pacific Northwest (Cedarholm et al. 2000). The addition of LWD and the increased retention of these nutrients would indirectly benefit all levels of the ecosystem, from stream microorganisms and benthic macroinvertebrates to top level predators.

The proposed stream restoration would in the short and long term indirectly benefit both juvenile and adult salmonids by creating large lateral pools for rearing and resting during migrations and over-wintering. In the long term, salmonids would also benefit from restored and self-maintained levels of channel complexity. LWD would provide roughness elements that would help regulate bedload movement of the stream channel and fine sediment deposition on the floodplain through time. Log complexes would also assist in the regulation of water velocity and volume within side channels.

Approximately 8,000 feet of side channels would be constructed and designed to carry 5 to 20% of the flow of Resurrection Creek. The creation of side channels, side channel pond complexes, and other off-channel habitat areas would increase the amount of high flow refugia for a variety of species. These areas would provide the greatest benefits to juvenile coho salmon, although other species such as Dolly Varden and Chinook salmon would also benefit directly and indirectly from the increase in off-channel habitat.

The proposed mining in the Proposed Action would have little effect on aquatic habitat, as most mining activities would occur outside of the restoration corridor. However, the three proposed equipment fords across Resurrection Creek would impede habitat along the banks at these sites by limiting vegetation growth and the development of vegetated overhanging banks that provide cover and habitat. The widened and armored bed of the channel at the equipment fords would also limit spawning habitat at these sites.

Essential Fish Habitat

The Resurrection Creek basin is considered to be part of the Essential Fish Habitat (EFH) for Chinook, coho, pink and chum salmon. Because Resurrection

Creek drains into the Turnagain Arm of Cook Inlet and salmon are part of the commercial catch along the Kenai Peninsula, EFH for these species extends up Resurrection Creek basin to long-standing natural barriers (river mile-31). In the short-term (1 to 2 years) EFH would likely be adversely affected (LAA), therefore consultation with NOAA Fisheries has been initiated. However, the long term indirect and cumulative effects of implementing this project would be the restoration of riparian vegetation, increased spawning substrate, increased pool habitat, and increased perennial side channel flows and associated over-wintering habitat, which would improve aquatic habitat quantity and quality, fish populations and aquatic invertebrates. Aquatic vertebrate and invertebrate populations are expected to respond positively to the stream channel and riparian rehabilitation. Increased spawning and rearing habitat created by the project are expected to provide a long-term, net positive benefit to the project reach, the aquatic ecosystem, and fisheries resources for the foreseeable future. Table 4 evaluates the effects of the Proposed Action on EFH by species.

Cumulative Effects

Impacts to water quality in terms of turbidity increases during stream restoration activities and the impacts of turbidity on aquatic species would be short term, occurring only during restoration activities. The impacts on water quality related to turbidity from the proposed mining activities would be minimal, as the state mining regulations limit the amount of mining related sediments that may enter Resurrection Creek. Other activities occurring in the Resurrection Creek watershed are concentrated primarily along the lower several miles of Resurrection Creek and adjacent to the town of Hope, and these activities cover less than 10% of the watershed. The cumulative impacts of these other activities on water quality are minimal. Currently, there are few projects or activities in the watershed that would cumulatively impact the water or aquatic resources.

Mining operations in the watershed other than those proposed by Hope Mining Company are small scale operations, and state mining regulations limit the amount of mining sediments that may enter Resurrection Creek. The combined effects of stream sedimentation produced from the proposed project and other mining activities in the area would only result in temporary exceedences of State water quality standards for turbidity during short-term stream restoration-related turbidity plumes, as approved under a Section 401 permit.

Fuel reduction projects in the area have shown to produce very limited surface disturbance or erosion, are not located adjacent to the riparian corridor, and would not be expected to create additional stream sedimentation into Resurrection Creek. The Resurrection Creek Road and the Resurrection Pass National Recreation Trail are known to produce very limited sedimentation or surface erosion. Proposed developments on private lands adjacent to and downstream of the project area are not expected to produce sedimentation into Resurrection Creek, as they are not located adjacent to the riparian corridor.

Table 4 Aquatic Species Risk Assessment for the Proposed Action

Species	Probability of Effect	Consequence of Effect	Cumulative Effect	Determination of Effect
Pink salmon *O. gorbuscha*	Low	Low	Low	Low risk of impacting individuals or habitat in the short-term and would likely contribute to increased production and viability for the species in the long-term.
Chum salmon *O. keta*	Low	Low	Low	Low risk of impacting individuals or habitat in the short-term and would likely contribute to increased production and viability for the species in the long- term.
Coho salmon *O. kisutch*	Moderate to Low	Low – Some mortality of 0 – 1+ parr	Low	May impact individuals or habitat in the short-term but would likely contribute to increased production and viability for the species in the long-term.
Chinook salmon *O. tshawytscha*	Moderate	Low – Some mortality of 0 – 2+ parr	Low	May impact individuals or habitat in the short-term but would likely contribute to increased production and viability for the species in the long-term.
Whitefish *Prosopium* sp.	Low	Low – Some mortality of juveniles	Low	May impact individuals or habitat in the short-term but would likely contribute to increased production and viability for the species in the long-term.
Sculpin *Cottidae*	Moderate	Moderate – Mortality of adult and juvenile sculpin within project reach expected	Low	May impact individuals or habitat in the short-term but would likely contribute to increased production and viability for the species in the long-term.
Stickleback *Gasterosteidae*	Moderate	Low	Low	May impact individuals or habitat in the short-term but would likely contribute to increased production and viability for the species in the long-term.
Dolly Varden *Salvelinus malma*	Moderate	Low – Some mortality of juveniles	Low	May impact individuals or habitat in the short-term but would likely contribute to increased production and viability for the species in the long-term.

The Proposed Action would have long term benefits to the health and function of the riparian corridor and the function of the watershed. With the 1 mile of restoration completed in the Phase I Resurrection Creek Restoration project in 2005 and 2006, and the 2 miles of restoration that would be completed in the Proposed Action, about 3 miles out of the 4.5 miles of stream channel impaired by historic mining would be restored to a naturally functioning condition. This would provide long term benefits to channel function, aquatic and riparian habitat, water quality, and aquatic species populations.

Irreversible and Irretrievable Commitments of Resources

Under the Proposed Action, direct mortality to aquatic populations, including macroinvertebrates, would likely occur during equipment crossings and channel construction.

Adverse Environmental Effects that cannot be avoided or mitigated

The Proposed Action would result in short term increases in turbidity during the course of the stream restoration work. These turbidity pulses could impact aquatic populations in the short term, but the impact of these turbidity pulses on the overall fish populations is expected to be small and limited to the project area and two miles downstream. Despite mitigation measures, direct mortality to aquatic populations including macroinvertebrates is possible during equipment crossings and channel construction.

Compliance or conflicts with the CNF LRMP

The Proposed Action is consistent with the goals and objectives as stated in the Forest Plan (USDA Forest Service, Chugach National Forest 2002a) for Fish and Wildlife Habitat and Water, Wetlands, and Riparian Areas. The proposed project would occur within lands in the *Minerals Management Area* (521) and *Forest Restoration Management Area* (314) prescriptions as defined in the Forest Plan, although all mining areas would be managed as *Minerals Management Areas* once mining plans become approved. The activities proposed in the Proposed Action are consistent with the management prescriptions in the project area.

Consistency with Regulatory Framework (i.e. Clean water Act, ESA, Clean Air Act, NFMA, NEPA, FS manual, State Laws, etc…)

No streams listed on the Clean Water Act Section 303(d) list of impaired water bodies are located within or downstream of the project area. The Proposed Action would comply with the state antidegradation policy (Alaska Department of Environmental Conservation 2006) to prevent deterioration of water bodies that currently meet state water quality standards. The Proposed Action would result in a number of short term exceedences of the State of Alaska water quality standards for turbidity (Alaska Department of Environmental Conservation 2006) during the course of the stream restoration work, but water quality conditions following restoration would be equal to or better than the existing conditions. All stream restoration work and mining operations would follow all applicable State and Federal permitting requirements, including the regulations under the Clean Water Act Section 404 for dredge and fill within wetlands and the Clean Water Act Section 401 for compliance with water quality standards.

Alternative 3- No Restoration

Short and Long-term Direct and Indirect Effects

Water Quality/ Sediment/ Turbidity

Under Alternative 3, no stream channel restoration would occur on Resurrection Creek. Although substantial ground disturbance would occur as a result of mining, turbidity levels in Resurrection Creek would not likely increase as a result of mining activities outside of the stream channel because settling pond systems would be used to capture all sediment created during the mining process. Any outflow from the settling pond systems would be required to meet State of Alaska water quality standards.

Equipment fords used during mining activities would have the potential to create small pulses of turbidity. These pulses would be very short in duration and would not likely cause turbidity to exceed the state water quality standards. The banks and channel at the equipment ford areas would be hardened using larger substrate in order to minimize any water quality impacts.

The potential would exist for water quality impacts to occur as a result of mining activities. With only a 20-foot wide mining buffer along Resurrection Creek, some of the existing settling ponds, ditches, and roads are located as close as 20 feet from the bank. Some of these features would have a moderate to high potential to fail as a result of natural channel changes or during high flow events because of inadequate riparian bank protection. Pond, road, or ditch failure could potentially send large amounts of sediment into Resurrection Creek. A present-day example of this is the migration of Resurrection Creek through the buffer zone and up against a mining road near the proposed Area 21. Because the road has no riparian stabilization, the road is quickly eroding into the channel. Some existing settling ponds are within 20 feet of the bank of Resurrection Creek. These settling ponds pose the largest risk to water quality impairment. Pond ‘O’ is an example of an old settling pond that was located adjacent to Resurrection Creek in the proposed Area 26a that was captured by Resurrection Creek, subsequently delivering its stored sediment to the channel. This area is now a side channel of Resurrection Creek.

The clearing of vegetation from any portion of the proposed 267 acres of mining area also increases the risk that a large scale precipitation event could cause large scale erosion of cleared mining areas. This risk is lowest in the previously mined flat valley floor where substrates are primarily gravel and cobble, and highest on the high terraces and hillslope areas where soils are undisturbed and substrates are finer. Runoff from a large precipitation event through a disturbed mining area could potentially deliver large amounts of sediment to the stream channel, and the proposed 20-foot buffer would do little to stop this sediment from reaching the Resurrection Creek channel. This buffer is not wide enough to protect and provide a functional riparian buffer for a 70-foot wide channel. Despite mitigation measures, fuel and oil spills from mining equipment operating adjacent to Resurrection Creek could also potentially impact water quality. The potential for such impacts would be higher than under the Proposed Action because of the limited riparian buffer width.

Channel relocation of 3,350 feet of Resurrection Creek would cause a number of large, short term increases in turbidity in Resurrection Creek. Between 2 and 4 turbidity pulses of greater than 300 NTU would likely occur during this activity. Because Resurrection Creek is not a source of drinking water for nearby residents, these impacts would not affect drinking water quality. Because the channel would not be "restored," but would just be relocated, channel restoration design features intended to maintain channel stability would not be implemented as they would be in the Proposed Action. It is likely that sediment sources from eroding banks, downcutting, and other channel adjustment would continue to cause moderate turbidities for hours or days after each segment of channel is relocated. Any additional adjustments to the relocated channel made by HMC would cause additional turbidity increases. Because measures to stabilize banks would not likely be made during the channel relocation, channel stability would improve slowly, and persistent eroding banks would likely cause long term effects on turbidity and water quality.

Aquatic Species

Under Alternative 3, direct mortality to aquatic species would occur as a result of equipment crossings and relocation of 3,350 feet of the Resurrection Creek channel. These impacts are similar to those described in the effects of the Proposed Action, but on a smaller scale because only about 30% of the reach would be affected by the channel relocation. Fish mortality would also occur as a result of fish that are stranded in the old stream channel segment after relocation of the channel.

Indirect mortality of aquatic species would occur as a result of increased turbidity levels in Resurrection Creek resulting from channel relocation, as described in the effects of the Proposed Action. Although fewer pulses of turbidity would be created than under the Proposed Action, it is likely that the magnitude and duration of the turbidity pulses would be greater under Alternative 3 because the new channel would not have natural design features for stability.

Alternative 3 would result in no benefit to aquatic species. The relocated segments of Resurrection Creek would not be restored, but just relocated. These reaches would be similar to the existing channel in character, with limited fish habitat. Fish production in this reach would not be expected to increase as a result of the channel relocation. Fish production may even decrease in this reach in the short term because the new channel would likely have little beneficial bank structure or riparian vegetation.

Stream Chanel Morphology

Under Alternative 3, no stream channel restoration would occur on Resurrection Creek. The Resurrection Creek channel would remain similar to its present impaired condition, with low sinuosity, high gradient, large substrate, few pools, low channel complexity, and few functional floodplain areas. The 20-foot wide vegetated buffer along Resurrection Creek would continue to be limited in its functionality as a riparian zone to protect the stream channel. Natural recovery of the channel to a more natural condition would not likely occur within the next

100 years. These channel morphology characteristics would continue to limit and negatively impact fish habitat and fish production.

The 3350 feet of relocated channel segments would likely be similar to the existing channel, with low sinuosity, high gradient, large substrate, few pools, low channel complexity, and few functional floodplain areas. This new channel segment would not be designed to emulate a natural pool-riffle channel, and it would not naturally recover to such a condition. Because the new channel would not be constructed using design features of a naturally stable channel, it is likely to be relatively unstable, particularly during the first few years while stabilizing bank vegetation may not be present. The potential for dynamic channel changes occurring in this channel segment during high flow events is high.

Some historic tailings piles may be selectively pulled back and mined from the banks within the 20-foot buffer along Resurrection Creek, as allowed by the Forest Service. This would incrementally help return some of the banks to a natural bank height and recover some of the floodplain that was impaired by these tailings piles, improving channel function.

A vegetated buffer zone of at least one channel width (approximately 70 feet) is needed to minimize impacts to the stream channel condition and function. Forest Service Region 10 BMPs for timber harvest (USDA Forest Service, Alaska Region 2006) require a 100-foot wide buffer zone on streams such as Resurrection Creek to protect the stream course. Floodplain and riparian condition along Resurrection Creek would be impaired under Alternative 3 because mining would be allowed on the floodplains to within 20 feet of the banks. Some of these floodplains function to attenuate flood flows, and removal of riparian vegetation in these floodplains could impact flood dynamics. Fine sediments would be removed from the floodplain substrate through the mining process, increasing the ground permeability. Riparian productivity would be greatly impaired in the short term. Implementation of a suitable reclamation plan would help to partially restore riparian function in the long term, but several decades would be required after mining to reestablish the riparian ecosystem.

Aquatic Habitat

No stream restoration would be implemented under Alternative 3, and in the long term, aquatic habitat conditions in Resurrection Creek would remain similar to existing conditions. The lack of LWD within the project area would continue to inhibit juvenile salmonid rearing habitat, suitable spawning sites, and habitat diversity. The quantity of LWD would potentially decrease because of limited recruitment of new trees, limited riparian areas, and the ability of the straight, simplified channel to flush existing LWD downstream. Off-channel habitat for salmonid rearing would continue to be very limited in this reach, with few side channels or backwater areas. Pool frequency and quality would also continue to be limited in the project reach and would continue to have direct and indirect negative effects on the production of adult and juvenile salmon and char.

Aquatic habitat conditions in the channel segments relocated by HMC would be worse than the existing conditions in the short term. Bank stability would be poor, and riparian vegetation would be limited. No beneficial habitat features

such as pools, logjams, undercut banks, side channels, or spawning areas would be incorporated into the new channel. Although bank stability and riparian vegetation would likely improve over the long term, the overall stability of the new channel segments would be low.

Essential Fish Habitat

In the short term, Essential Fish Habitat would likely be adversely affected as a result of the channel relocation proposed in Alternative 3. Because no stream restoration would occur, no long term improvements to EFH would occur as they would under the Proposed Action.

Cumulative Effects

Impacts to water quality in terms of turbidity increases during channel relocation activities and the impacts of turbidity on aquatic species would be primarily short term, with some long term impacts. The impacts on water quality from the proposed mining activities would be minimal, as the State mining regulations limit the amount of mining-related sediments that may enter Resurrection Creek. Other activities occurring in the Resurrection Creek watershed are concentrated primarily along the lower several miles of Resurrection Creek and adjacent to the town of Hope, and these activities cover less than 10% of the watershed. The cumulative impacts of these other activities on water quality are minimal. Currently, there are few projects or activities in the watershed that would cumulatively impact the water or aquatic resources.

Mining operations in the watershed other than those proposed by Hope Mining Company are small scale operations, and state mining regulations limit the amount of mining sediments that may enter Resurrection Creek. The combined effects of stream sedimentation from the proposed project and other mining activities in the area are unlikely to exceed state water quality standards, except during stream channel relocation.

Fuel reduction projects in the area have shown to produce very limited surface disturbance or erosion, are not located adjacent to the riparian corridor, and would not be expected to create additional stream sedimentation into Resurrection Creek. The Resurrection Creek Road and the Resurrection Pass National Recreation Trail are known to produce very limited sedimentation or surface erosion. Proposed developments on private lands adjacent to and downstream of the project area are not expected to produce sedimentation into Resurrection Creek, as they are not located adjacent to the riparian corridor.

Irreversible and Irretrievable Commitments of Resources

Under Alternative 3, direct mortality to aquatic species, including macroinvertebrates, would likely occur as a result of equipment crossings and relocation the Resurrection Creek channel.

Adverse Environmental Effects that cannot be avoided or mitigated

Alternative 3 would result in short term increases in turbidity during the course of the channel relocation work. These turbidity pulses could impact aquatic

populations in the short term, but the impact of these turbidity pulses on the overall fish populations is expected to be small and limited to the lower portion of the project area and two miles downstream. Despite mitigation measures, direct mortality to aquatic populations is possible during equipment crossings and channel relocation. Mining activities would create a moderate to high potential for failure of settling ponds, which could cause impairment of water quality in Resurrection Creek.

Compliance or conflicts with the CNF LRMP

The proposed mining under Alternative 3 would occur within lands in the Minerals Management Area (521) and Forest Restoration Management Area (314) prescriptions as defined in the Forest Plan, although all mining areas would be managed as Minerals Management Areas once mining plans become approved. The activities proposed in Alternative 3 are consistent with the management prescriptions in the project area.

Consistency with Regulatory Framework (i.e. Clean water Act, ESA, Clean Air Act, NFMA, NEPA, FS manual, State Laws, etc…)

No streams listed on the Clean Water Act Section 303(d) list of impaired water bodies are located within or downstream of the project area. Alternative 3 may comply with the state antidegradation policy (Alaska Department of Environmental Conservation 2006) to prevent deterioration of water bodies that currently meet state water quality standards. Alternative 3 would result in a number of short term exceedences of the State of Alaska water quality standards for turbidity (Alaska Department of Environmental Conservation 2006) during the course of the channel relocation work. All channel relocation work and mining operations would follow all applicable State and Federal permitting requirements, including the regulations under the Clean Water Act Section 404 for dredge and fill within wetlands and the Clean Water Act Section 401 for compliance with water quality standards.

Conclusion

The Proposed Action would result in a greater number of short term turbidity pulses than Alternative 3, potentially causing greater impacts to aquatic populations in the short term. However, the Proposed Action would also provide considerable benefits to aquatic populations, channel morphology, and aquatic habitat in the short term and long term, while Alternative 3 would provide no such benefits. The restoration corridor in the Proposed Action would provide greater protection for the channel in the long term from mining activities occurring in adjacent areas, allowing Resurrection Creek to function naturally, while the 20-foot wide buffers in Alternative 3 would not provide adequate stream channel corridor protection or allow for natural channel function.

Vegetation Ecology

Affected Environment

Mining has altered current vegetation within the project area, particularly in riparian areas directly adjacent to the stream channel where most mining is concentrated. Recreational and commercial placer operations have influenced riparian and floodplain vegetation plant communities including those dominated by willow (*Salix* spp.), black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), and Sitka alder (*Alnus crispa* ssp. *sinuata*). Mining activities tend to shift vegetation assemblages to earlier seral states like some of the tall scrub and broadleaf or mixed forest types described by DeVelice et al. (1999).

Hydraulic placer mining from the early 1900's generated numerous tailings piles within the project area. The piles are composed of large cobbles which are extremely well-drained, which for the most part prevents the growth of vascular plants, eliminating the development of a duff layer and soil formation, and leaving the piles barren of most vegetation growth other than crustose lichens and mosses. Some piles support individual scattered black cottonwood trees or shrubs.

Forested areas near and within the project area have been affected by the spruce bark beetle (*Dendroctonus rufipennis*) infestation over the past twenty years. Ten years following a spruce bark beetle outbreak in a site within the watershed large changes in the vegetation composition and structure have been documented (Holsten et al. 1995). Many of the dead spruce (*Picea glauca* and *P. x lutzii*) are now falling over, creating areas of coarse woody debris. Regeneration of both spruce and paper birch (*Betula papyrifera*) is slowed in these areas due to increased cover of dead woody material, dense growth of bluejoint reedgrass (*Calamagrostis canadensis*), and lack of scarified or open soil for seedling establishment. Refer to the vegetation composition and structure description in the Wildlife analysis in this chapter for additional detail of vegetation in the project area.

Disturbances within the project area created a high proportion of seedling/sapling stage trees, mostly black cottonwood. Approximately half of the forested sections are open or in a seedling/sapling stage, with a mix of pole, medium, and large size trees. Very large trees are rare, and are mainly black cottonwood with a few Lutz spruce. Stands of medium to large size mountain hemlock (*Tsuga mertensiana*) are found in the uplands. With succession, the black cottonwood component would eventually be replaced by Lutz spruce, although areas being actively mined will be in a constant state of early succession. Steep areas with bedrock are bordered by spruce (mostly dead) and mountain hemlock. Overall structure is erratic given the site history and current use, but patches of three structural stages (stand initiation, stem exclusion, overstory reinitiation are evident (Oliver and Larsen 1990)). Old growth is not present except in isolated pockets of very old black cottonwoods.

Development and other human caused disturbances have provided for the introduction of non-native species to the project area. Non-native species are most typically found immediately around developed and disturbed areas.

Generally, the known populations have not presented a threat to native vegetation, although populations can spread rapidly with increased activity (Myers and Bazely 2003). Known populations of non-native plant species include a fairly high concentration of common dandelion (*Taraxacum officinale*), as well as populations of narrowleaf hawksbeard (*Crepis tectorum*), and scentless false mayweed (*Triplospermum perforata*) along access roads on the east side of Resurrection Creek. Oxeye daisy (*Leucanthemum vulgare*) is found scattered on both sides of the creek. Other non-native species include *Linaria vulgaris* (butter and eggs), white and red clover (*Trifolium repens* and *T. pratense*, respectively), pineapple weed (*Matricaria matricarioides*), timothy (*Phleum pratense*), and common plantain (*Plantago major*).

Based on the bioenvironmental database used in the Chugach Forest Plan Revision (USDA Forest Service, Chugach National Forest 2002a, pages 3-169 through 3-176), the only Alaska Region sensitive plant species potentially occurring in the project area are Norberg arnica (*Arnica lessingii* ssp. *norbergii*), goose-grass sedge (*Carex lenticularis* var. *dolia*), and pale poppy (*Papaver alboroseum*). Of these, only pale poppy will remain on a revision of the Alaska Region sensitive species list since the other two are now included in more broadly distributed or abundant taxa (Mary Stensvold, *personal communication*). No sensitive plant species have been observed, so sensitive plant populations are not expected to be affected by project activities.

Environmental Consequences

Issues

No significant or important issues related to sensitive plants or vegetation resources were identified during public scoping or by the interdisciplinary team. Varying degrees of effect will still occur due to different design features of the alternatives to vegetation.

Measurement Indicators

Comparison of alternatives in terms of vegetation ecology will be based on the following parameters:

- Amount of re-vegetation area
- Area of potential sensitive plant habitat affected
- Area of potential non-native species introduction and spread

Methodology

The following data sources were used to analyze vegetation resources:

Landcover Classification GIS Raster Dataset (Markon and Williams 1996): A satellite image based classification that for the main trail corridor, was primarily derived from SPOT multispectral imagery from August 1990. Each 30-meter

pixel was assigned to one of 25 classes. The vegetation classes basically follow the first three levels of the five level hierarchy of Viereck et al. (1992).

Cover Type GIS Coverage (Forest Service 1997): An air photo based map developed from interpretation of aerial photography from the 1950's through 1970's. Minimum map unit size is 10 acres (about 4 hectares). Each polygon was assigned to one of 21 classes.

Non-Native Plants Report (Duffy 2003): The list of non-native plant species reported by Duffy (2003) from the Kenai Mountains is presented and the potential implications of the proposed project to non-native plant occurrences are summarized.

Non-Native Plant Inventory: Kenai Trails (DeVelice 2003): The list of non-native plant species reported by DeVelice (2003) from the Kenai Trails is presented and the potential implications of the proposed project to non-native plant occurrences are summarized.

Field Work: Sensitive and invasive plant surveys (Bella and McKee 2007; Mohatt and Charnon 2008).

Sensitive Plants GIS Coverage (Forest Service 1998): This coverage was created from data obtained from the Alaska Natural Heritage Program.

Scale of the Analysis

The geographic bound for direct and indirect effects is the project area boundary. Cumulative effects include the entire Kenai Mountains.

Short-term impacts are generally those that occur throughout the duration of the proposed activities. Long-term impacts can occur for decades after activities have ceased, particularly where vegetation composition has changed.

Alternative 2 - Proposed Action

Direct and Indirect Effects

This alternative includes full restoration of the channel, floodplain, and riparian areas within an approximately 76 acre corridor. It includes spreading soil on the restored floodplains to support native vegetation, and native vegetation establishment through planting and seeding on sites where conditions for natural regeneration are not favorable. The effort is maximized towards moving the area towards the desired future conditions specified by the Forest Plan (USDA Forest Service, Chugach National Forest 2002a). Initially there would be a loss of riparian vegetation during restoration activities. This alternative also includes 200 acres of mechanized mining and 41 acres of hand mining activities, as well as operational areas such as camps, settling ponds, ditches, and roads. Operational areas would generally occur on previously mined areas and on current mining sites.

Area of Re-vegetation

There is a high likelihood of non-native species being introduced and existing populations being spread by equipment, vehicles, and foot traffic, or with

materials used for re-vegetation. The potential for non-native plant increases would be particularly high in areas of exposed soil. Under this alternative, a maximum of 340 acres would be impacted by ground-disturbing activities with high potential for exposed soil. Of the 340 acres, 76 acres in the restoration area would ultimately increase in natural vegetation habitat as tailings piles are removed, soils are spread and the site re-vegetated with native species. Initially, many of the areas being restored would appear barren since the current conditions of these areas are highly disturbed. The Chugach Forest Plan (USDA Forest Service, Chugach National Forest 2002a, page 3-13) describes the desired future condition in terms of vegetation: "*Vegetation on the Chugach National Forest will be the vegetation that results from natural processes. Selected locations will be altered by management activities either to restore degraded conditions or to provide benefits to wildlife. The abundance and distribution of sensitive plants will be stable. Exotic plant infestations will be decreasing in size*." The increased diversity in vegetation composition and structure following restoration activities may improve potential habitat increase for several rare or sensitive plant species, particularly in the riparian zone.

Non-Native Species

The remaining 264 acres outside of the restoration corridor would have some level of reclamation. However, much of the reclamation would only involve re-contouring tailings and redistributing stockpiled soil and overburden. There is a reclamation plan that would include natural establishment of vegetation. It will take a while for some sites to establish vegetation, which is why the potential for invasive plants is high. Over time native species would likely move in but non-natives would continue to make up much of the species composition. Without a more aggressive weed management plan it would be difficult for native plant communities to become established.

Sensitive Plants

Potential habitat occurs for two Region 10 sensitive species: pale poppy and spotted lady's slipper. Habitats for the pale poppy include gravel bars, dry meadows, and rock outcrops. However, this species has not been found within areas likely to be affected by project activities (Bella 2007). Surveys for this project were conducted prior to the addition of the spotted lady's slipper. This is a showy plant that would most likely have been noted by botanists in past surveys. It has not been found on the Seward Ranger District, but there is a sighting on the adjacent Glacier Ranger District. Habitats for this species include moist to dry open deciduous and spruce forest, tundra, meadows, and scree. Since it is not known to occur on the Seward Ranger District and there are no comments regarding this species in past surveys, the likelihood that it actually occurs in the project is fairly low. Based on the above information, the implementation of this alternative is not expected to adversely affect sensitive plants.

Cumulative Effects

Other existing or reasonably foreseeable future projects in vicinity of the this project include ongoing fuel reduction projects along Hope Highway, ongoing fuel reduction projects along Palmer Creek Road, the Resurrection Creek Restoration Phase I restoration project, private land development, Porcupine Campground reconstruction, new trailhead developments, Hope Point Trail reconstruction, ongoing trail use of Resurrection Pass National Recreation Trail, existing approved mining operations of the Hope Mining Company, and small scale suction dredging mining operations on Palmer Creek. Alternative 2 would add up to approximately 340 acres of additional ground disturbance. Proposed activities may impact potential habitat, but are unlikely to impact actual sensitive plant populations since none were found during surveys. Under Alternative 2 approximately 76 acres would be restored and would eventually support native vegetation communities, which in turn could increase potential habitat for sensitive species. Across the Kenai Peninsula portion of the Chugach National Forest, there are vast areas of potential habitat (over one million acres). Cumulatively, the loss of another 264 acres would not make a measurable effect to sensitive plants when over one million acres of potential habitat still exist on the Kenai Peninsula.

Irreversible and Irretrievable Commitments of Resources

There would be a loss of the current unique “botanical desert” created by the tailings piles. There would be a change in the forested structure of the project area by the removal of trees. The successional pathway of the project area’s forested stands would be altered. There would be a change in the forested composition of the project area by the removal of different tree species than what would develop over time if no mining and subsequent tree removal took place. These changes may linger in the mining areas if species composition is mainly non-native species.

Alternative 3 – No Restoration

Direct and Indirect Effects

Area of Re-vegetation

Under Alternative 3, approximately 267 acres would be impacted by mining activities. Effects of this alternative would be similar to those described for the mining portion of Alternative 2 except there would be no opportunity for re-vegetation of the stream corridor with the lack of a restoration component. No restoration would occur on the 76 acre stream restoration area identified in Alternative 2. However, reclamation of mining activities up to 20 feet of the stream would be required. Vegetation condition would not be restored as described in the desired future condition for vegetation in the Chugach Forest Plan (USDA Forest Service, Chugach National Forest 2002a). Vegetation cover typical of South-central Alaskan stream systems would not return to the tailing pile areas. Further, the tailings would continue to prevent flood flows from delivering fine sediment to the floodplain areas, thereby limiting riparian vegetation growth.

Non-Native Species

Proposed activities, especially in the mining areas, are expected to increase non-native plant abundance and spread.

Sensitive Plants

Similar to Alternative 2, potential habitat for two sensitive species occurs in the project area (pale poppy and spotted lady's slipper). However, neither plant has been found or noted in past surveys. Based on the above information, the implementation of this alternative is not expected to adversely affect sensitive plants.

Cumulative Effects

Other existing or reasonably foreseeable future projects in vicinity of the project are the same as those described in Alternative 2. Alternative 3 proposes 267 acres of ground disturbance from mining activities. Proposed activities may impact potential habitat, but are unlikely to impact actual sensitive plant populations since none were found during surveys. There is no restoration proposed under Alternative 3 and the existing stream channel would remain in a degraded condition. Across the Kenai Peninsula portion of the Chugach National Forest, there are vast areas of potential habitat (over one million acres). Cumulatively, the loss of another 267 acres would not make a measurable effect to sensitive plants when over one million acres of potential habitat still exist on the Kenai Peninsula.

Irreversible and Irretrievable Commitments of Resources

These effects are the same as those described under Alternative 2.

Conclusion

In summary, implementation of either alternative is not expected to adversely affect sensitive plants. Proposed activities, especially in the mining areas, are expected to increase non-native plant abundance and spread.

Wildlife Habitat

Affected Environment

Placer mining nearly a century ago has greatly altered the fish and wildlife habitat in the project area through negative effects on the riparian and forest vegetation composition and structure, vegetation succession capability, and salmon spawning and rearing habitat.

The affected environment for wildlife is summarized here. The wildlife specialist report in the project record notes all species and habitats documented during wildlife surveys, as well as species considered but not analyzed further due to lack of existing or potential habitat.

Vegetation Composition and Structure

The Resurrection Creek project area is approximately 375 acres, containing a mixture of primarily pole size to large hardwoods (cottonwood, birch) and seedling/sapling to large conifers (white spruce and mountain hemlock). Details on the vegetation composition and structure are listed in the wildlife specialist report in the project record. Also refer to the Ecology section in this chapter.

Wildlife

Threatened, Endangered & Sensitive Species

There are no threatened, endangered, sensitive or proposed species that are likely to occur in the project area, or would be affected by this project.

MIS and SSI

The following Management Indicator species (MIS) and Species of Special Interest (SSI) may occur within the project area. Existing or potential habitat for these species in the project area are listed in Table 5.

Table 5 MIS and SSI in the project area

SPECIES	MIS	SSI	Existing Habitat	Potential Habitat
Brown Bear	X		Yes	Yes
Moose	X		Yes	Yes
Bald Eagle		X	Yes	Yes
Northern Goshawk		X	No	Yes (foraging)
Gray Wolf		X	Yes	Yes
Lynx		X	Unknown	Yes
River Otter		X	Unknown	Yes
Townsend's Warbler		X	Yes	Yes
Wolverine		X	Unknown	Yes

Management Indicator Species

Management indicator species are the moose and brown bear. The affected environment is summarized below.

Moose*:* Moose populations on the Chugach National Forest are stable but habitat is declining, which may cause a decline in the population over time. Moose are primarily associated with early-mid successional habitat and riparian areas. On the Kenai Peninsula the factor limiting the growth of moose populations is the availability of early- to mid-successional habitat, and the main mortality factors are predation, hunting, and mortality from collisions with vehicles along the highway and railroad (Lottsfeldt-Frost 2000). Moose use the project area during the rut as winter range (Alaska Department of Fish and Game 1985) and were noted during surveys in the summer. Moose sign is present throughout the project area.

Brown Bear: Brown bears have large home range requirements and an intolerance of human disruption and development. The primary limiting factor for brown bears on the Kenai Peninsula is spring and summer feeding habitat. South-facing hillsides and avalanche chutes, big game winter ranges, and salmon streams provide the high quality forage needed by bears before and after denning (Suring et al. 2005). The project area does not contain primary bear habitat (Graves et al. 2007), although bears are known to travel through and forage for salmon in Resurrection Creek.

Species of Special Interest

Gray wolf*:* Wolves are highly social animals and usually live in packs that include parents and pups of the year. Wolves are adaptable and exist in a wide variety of habitats (Alaska Department of Fish and Game 2007). One pack was reported by Alaska Department of Fish and Game to exist in Resurrection Creek (personal communication with Ted Spraker, ADF&G, 2001). Mining employees also report seeing wolves in the past ten years.

Lynx*:* Lynx inhabit much of Alaska's forested terrain and use a variety of habitats, including spruce and hardwood forests, and both sub alpine and early seral communities. The best habitat occurs where there is a diversity of vegetation types with an abundance of early successional growth, which provides habitat for snowshoe hare and other small prey species. Hares also like dense conifer thickets of seedlings and saplings for food and cover. Lynx sign was not evident during surveys, yet potential habitat exists because of the diverse mix of spruce and hardwood forest and patches of early seral growth. The project reach occurs close to the community of Hope. Local trapping efforts may influence lynx numbers or potential use of the project area.

River Otter*:* River otters are associated with coastal and fresh water environments and the immediately adjacent (within 100 to 500 feet) upland habitats. Beach characteristics affect the availability of food and cover, and adjacent upland vegetation provides cover. Old-growth forests have the highest habitat value, providing canopy cover, large-diameter trees and snags, and burrow and den sites. Younger successional stages provide lower quality habitat. River otters in Alaska hunt on land and in fresh and salt water. They eat snails, mussels, clams, sea urchins, insects, crabs, shrimp, octopi, frogs, a variety of fish, and occasionally birds, mammals, and vegetable matter. High quality habitat for otters does not occur in the project reach. Otters were not noted during wildlife surveys. Lower quality habitat exists, and otters may use the project reach for traveling, foraging or denning.

Townsend's warbler*:* Townsend's warblers are fairly common breeding birds on the Chugach National Forest and can be found primarily in coniferous forests or mixed forests where coniferous trees comprise a predominant feature of the habitats (Bent 1953; Erskine 1977). It was listed as a species of special concern by the Alaska Department of Fish and Game in 1998. Townsend's warblers were in the project reach during surveys but did not appear to be abundant.

Wolverine*:* The wolverine is an animal of montane forest, tundra, and taiga. Several factors appear to influence wolverine habitat selection at the landscape

and stand levels. The distribution and density of large mammal carrion is a primary factor along with the level of human disturbance. Other habitat parameters such as escape cover from predators, availability of den sites, prey concentrations, and cover can affect daily movement and habitat use patterns (Howell 1999). Wolverine tracks were located in Resurrection Creek and Palmer Creek during a 1992 interagency survey (Golden 1994). In 2004, another survey was conducted, and no tracks were noted in the area (Golden 2004). The project area probably does not provide suitable denning habitat. Wolverines may travel through the project reach while foraging.

Bald Eagle*:* Bald Eagles are often found along Alaska's coast, offshore islands, and Interior lakes and rivers. Bald Eagles often use and rebuild the same nest each year. Eagles in South-central Alaska nest in old cottonwood trees near water. The majority of bald eagle nests on the Seward Ranger District are in mature cottonwood trees with an average diameter of 31 inches and within one quarter mile of an anadromous fish bearing stream. There is a significant lack of such trees in the watershed, in part due to past mining activities. No nests are known to occur in the project area.

Northern Goshawk*:* The northern goshawk is a low density, forest raptor that feeds in the understory on squirrels, birds and snowshoe hares. The amount and combination of feeding and nesting habitat appears to be the primary limiting factors (Iverson et al. 1996). The majority of goshawk nests on the Seward Ranger District are in old growth hemlock-spruce stands characterized by a closed canopy, large average diameter, gap regeneration and an open under story. No nests have been located in the project area. Most of the large spruce has died due to attack by spruce bark beetles. The majority of birch and hemlock in the project area does not appear large enough to provide optimal goshawk nesting habitat. Goshawks may use the project area for foraging, however potential nesting habitat does not currently occur.

Migratory Birds

Priority species identified in the Boreal Partners in Flight "Land bird Conservation Plan for Alaska Bio-geographic Regions version 1.0, the US Fish and Wildlife Service's Alaska Region Birds of Conservation Concern in 2002, were reviewed. Refer to the project record for the species that could potentially occur in the project area. Eight priority species have potential habitat in the project area, but only one, the varied thrush was noted during wildlife surveys.

Environmental Consequences

Issues

No significant issues related to wildlife or habitats were identified during public scoping or by the interdisciplinary team. However varying degrees of effect will still occur under any of the alternatives. In general, alternatives may impact individual animals; however none of the alternatives are expected to affect populations or viability of any species.

Measurement Indicators

Units of measure to describe and compare relative effects on wildlife are:

- Acres of habitat disturbed by mining and/or restoration activities
- Acres of habitat restored

Factors Analyzed

- Habitat Affected
- Wildlife Affected
    - Wildlife Species of Concern

Methodology

1. Review Forest Plan direction regarding wildlife and habitat, and other legal direction for the project area.
2. Identify the species to be addressed and the potential for them to occur within the project area
3. Describe the habitats that are present within the project area
4. Describe the effects of the alternatives on the species and their habitats
5. Develop mitigation measures to minimize effects
6. A variety of bird and mammal species or their sign were observed during surveys of wildlife and habitat during the summers of 2008 and 2009. Mine employees were interviewed for species observed during the last 10 years. These species are noted in the wildlife specialist report located in the project record.

Assumptions

The assumptions for this analysis are that both mining and restoration can disturb wildlife species (individuals, but not populations) and their habitats.

1) Mining Effects to wildlife habitat are negative in the short and long-term. Habitat quality and quantity will decrease as vegetation is removed and vegetation composition and structural diversity decreases. Site quality will be lower after reclamation due to some inevitable loss of topsoil during the removal, stockpiling and reclamation process. Lower site quality impairs the site's ability to recover and produce mature forest structures and large trees over the long term, expanding the time it takes to recover by 40 or more years. Permanent vegetation loss from lost soil productivity will occur on up to 37.6 acres. The area may favor alder until nitrogen builds in the soil to allow recovery of other species. The more acres mined the more negative effects to wildlife habitats.

2) Mining Effects to wildlife species will be negative in the short and long term. Disturbance to wildlife from noise, people, machinery, and vehicles will occur throughout the 20 year mining operations period. Machinery may destroy nests, roosts, dens, and can kill individual animals. The more area mined, the greater the negative effects to wildlife species.

3) Restoration effects to wildlife habitat are negative in the short term but beneficial in the long-term. Short term destruction of a minimal amount of habitat in Area 16 habitat will be replaced with higher quality habitat throughout the restoration corridor as riparian vegetation composition and structural diversity increases. The rest of the restoration corridor will already be disturbed and vegetation removed during mining in Areas 5a and 19 (previous decision). Vegetation is not expected to return in areas where permanent soil productivity has been lost. Short and long term wildlife habitat improvement will occur as a result of improving salmon incubation, freshwater rearing, spawning habitat and potential increases in overall salmon production. This will benefit species that feed directly on salmon at different life stages or indirectly on species that feed on salmon.
4) Restoration effects to wildlife species will be negative in the short and beneficial in the long term. Short-term effects include disturbance to wildlife from noise, people, machinery, and vehicles and will occur throughout the up to 4-year implementation period. Short and long term wildlife habitat improvement will occur as a result of restoring riparian vegetation in the floodplain, restoring the stream channel, and creating new side channels. Over the short term, early seral hardwoods will benefit species such as moose, small mammals and birds. Over the long term, mature riparian forest will provide habitat for species lie bald eagles and Townsend's warblers. Side channels will provide foraging and nesting habitat for birds and mammals. The more area restored, the greater the benefit to wildlife.
5) The level of disturbance will be similar regardless of which activity is occurring, mining or restoration.

Scale of the Analysis

Geographic bounds for direct and indirect effects were considered to be the project area and an area that extends one mile from the project area. This boundary was selected because vegetation would be removed from the project area, and noise from mining or restoration operations could extend one mile beyond the project area boundary and has the potential to disturb wildlife.

The watershed was considered for cumulative effects because many wide ranging species such as wolverines, bears, moose, goshawks and others may move through or use habitat within the project area and throughout portions of the entire watershed.

Temporal bounds

Short term effects: 1 to 4 years

Long Term effects: 20 years (life of mining plan of operations), and 100 years (potential time frame for vegetation to be restored to mature structure and composition).

Effects to Wildlife Species

Effects to all wildlife species (including management indicator species, species of special interest, and migratory birds) are similar; therefore, these effects are discussed together.

Effects Common to All Alternatives

Mining and restoration can have effects on both individual wildlife and their habitats. Effects to wildlife are primarily related to the disturbance from active mining or restoration operations. In addition, effects to wildlife habitat are caused by vegetation removal for mining or restoration operations.

Effects from Habitat Manipulation

Vegetation Removal: Removal of vegetation during restoration work (limited to clumps in Area 16) and mining (throughout project area in both Alternatives, and previously in the restoration corridor in Areas 5a and 19) may have direct effects on wildlife by removing nesting and foraging habitat or cover (for resting, traveling, or foraging) for most species with potential and existing habitat in the project area. Nesting migratory birds and small mammals may have nests, young, or adults killed if vegetation is removed in these areas.

Removal of vegetation may cause long term indirect effects (30 to 100 years) because mining activities would likely reduce soil productivity when vegetation is removed. Reduced soil productivity can alter the manner and rate at which these areas become re-vegetated. This would ultimately influence the type of habitat these areas would provide. In addition, areas with lower soil productivity would take longer to become mature forests than under natural conditions.

Planting and natural re-vegetation is expected to re-establish habitat for early seral species within several years, but species that depend on mid-aged or mature forest would experience longer term habitat loss while the vegetation grows to more mature stages. The alternatives would promote (restoration area) or inhibit (mining areas) this growth, diversity of composition and structure, and time needed to reach mature stages.

Effects from Disturbance

Noise and physical disturbance from people, camps, vehicles, and machinery from both restoration and mining activities may cause direct effects such as habitat abandonment or avoidance to a wide variety of wildlife species. Noise may occur up to 1 mile out from the project area (see noise analysis in this chapter). The total area that could be disturbed by noise within and outside the project area totals 5,324 acres (acres contained within the project area and within 1 mile of the project boundary). Decibel levels generated by mining equipment are expected to produce noise levels in the range of 65 to 80 dB at active mining sites. Mining equipment noise may be detectable up to 1 mile from the active mining site with decibel levels ranging from those that are not audible to potentially reaching 50 to 55 dB. Noise levels would be variable as affected by topography and vegetation. Disturbance would vary by species and individual,

and may range from no effect to habitat avoidance or abandonment, effects on hearing or behavioral changes. Noise at these decibels would potentially be heard from April through October for approximately 20 years, or the length of the mining operations period. Restoration activities may cause additional concentrated disturbance during a period of up to 4 years within the corridor, in addition to ongoing mining outside the corridor.

Alternative 2- Proposed Action

Short and Long-term Direct and Indirect Effects

Acres of Habitat Affected

The proposed project area is approximately 375 acres, containing a mixture of primarily pole size to large hardwoods (cottonwood, birch) and seedling/sapling to large conifers (white spruce and mountain hemlock). Current vegetation composition is a result of past mining and current mining activity with small pockets of trees in areas that were not mined. Within the 375 acre project area, 264 acres would be disturbed by mining activities. Within the 76-acre restoration corridor, 54 acres of floodplain and riparian vegetation would be restored and 8,000 feet of side channels would be created.

Alternative 2 proposes mining operations on 264 acres outside the restoration corridor. Mining operations would generally have a negative effect on wildlife habitat for most species. Mining operations would cause short and long term habitat loss of conifer, hardwood and riparian forest types on up to 264 acres spread out over a 20-year time period. Some patches of trees would remain on steeper slopes that preclude mining, however these areas would provide low quality habitat due to adjacent vegetation removal and disturbance.

In the long term, areas that are mined would experience a loss of soil productivity (refer to soils analysis). For this reason, vegetation may not respond after mining with as much vigor or density as under natural conditions. This would result in a slower re-vegetation (40 years or more) for this area to reach a mature forest and develop larger trees. In addition, it is expected that species that are more tolerant of lower soil productivity, such as alder, would be the dominant species to establish. Alder is a less preferred browse species for moose. However, it is also expected that some limited early seral hardwood browse would also establish in the reclaimed areas.

Similar habitat loss and disturbance would occur within the 76 acre restoration corridor up to a 4 year period and during restoration operations. Most of the vegetation would already have been removed by mining operations previous to restoration, except in Area 16, where clumps of larger trees in the remaining intact floodplain would be left where possible.

Restoration of 54 acres of floodplain, riparian vegetation, and development of 8,000 feet of new side channels would create new habitat favoring species that feed on spawning or rearing salmon (brown bear, otters, eagles, and wolves), breed or forage in side channels (harlequin ducks and other birds), den or nest in riparian vegetation (river otters, bald eagles, and migratory birds), or forage for vegetation or for prey species in riparian areas (moose, lynx, wolverine, wolves,

bears, eagles, and goshawks). The riparian vegetation would have the potential to grow into mature forest over time benefiting bald eagles by providing nesting habitat. Riparian vegetation would offer 500 feet of screened foraging habitat for bears and cover for animals using the creek as a travel corridor (bears, wolves, otters, moose, and others).

Wildlife Species

Wildlife species may be disturbed from machinery, vehicles and people causing them to avoid or abandon habitat during mining operations on 264 acres over the 20 year operating period, and during restoration activities on 76 acres over up to a 4 year operations period. Noise has the potential to disturb wildlife in the project area at decibel levels from 65 to 80 dB at active mining sites, and adjacent to the project area up to 1 mile out at decibel levels up to 55 dB (see noise analysis in this chapter). The 5,324-acre area within and adjacent to the project area that may be affected by noise is based on a 1 mile distance from the project boundary. Noise levels would be variable based on topography and vegetation. Persistent equipment noise may disturb and displace wildlife during the months of April through October over the 20 years of operation. The potential effect of mining or restoration noise to different species or individuals at various distances and decibel levels is difficult to quantify.

Animals rely on meaningful sounds for communication, navigation, avoiding danger and finding food against a background of noise (Kaseloo and Tyson 2004). The effect of noise on wildlife has only recently been considered a potential threat to animal health and long-term survival. Little research has been done on the effects of mining noise on animals; most has focused on vehicles, roads and aircraft. Research into the effects of noise on wildlife often presents conflicting results because of the variety of factors and variables that can affect and/or interfere with the determination of the actual effects that human-produced noise is having on any given creature. Most researchers agree that noise can affect an animal's physiology and behavior, and if it becomes a chronic stress, noise can be injurious to an animal's energy budget, reproductive success and long-term survival. The diversity of effects that noise can have among and between species makes it difficult for the scientific community to present definitive evidence for wildlife as a whole. Management or protection through mitigation is difficult because each species could potentially have different thresholds of disturbance (Radle 2007).

The noise disturbance area covers the majority of all identified moose winter range in the Resurrection Creek watershed (Alaska Department of Fish and Game 1985). It is unknown how moose would respond to noise within the project area or within 1 mile. Wildlife species would have a beneficial effect from improved foraging, nesting habitat, or prey habitat, and cover on 76 acres after restoration.

Some individual animals such as nestling birds or small mammals may be killed during operations. More detail on effects on specific Management Indicator Species and Species of Special Interest can be found in the wildlife specialist report in the project record.

Cumulative Effects

The following projects were considered for cumulative effects. For more detail on effects by project, see the wildlife specialist report in the project record.

- Ongoing fuel reduction projects/harvesting/pile burning along Hope Highway: about 800 acres.
- Ongoing fuel reduction projects along Palmer Creek Road (new units to be implemented in 2010, included in acres above)
- Resurrection Creek Restoration Project Phase I
- Development on private land at mile 14 of Hope Highway and along Resurrection Creek Road
- Porcupine Campground Reconstruction
- New trailhead development for Gull Rock and Hope Point Trail along Cripple Creek Road
- Hope Point Trail reconstruction
- Ongoing trail use of Resurrection Pass National Recreation Trail
- Existing approved mining operations within Hope Mining Company Claims north of Resurrection Pass Trail Bridge on both sides of Resurrection Creek.
- Small scale suction dredging mining operations on Palmer Creek (HHH claims, Hope 11).

Overall, these projects all modify wildlife habitat by affecting vegetation through removal or modification of forest structure and composition. Mining alone is affecting 3% of the watershed, and fuel reduction is affecting about 1%. The Forest Service owns 97.6% of the watershed. The other 2.4% is private, state, or other land owners, and these areas have potential for development. While these numbers seem low, most is occurring in forested areas which only make up 25% of the watershed. Human use in the watershed may increase through development on private lands and recreation. Effects from all these projects or development can affect individuals of wider ranging species such as bears, moose, wolverines, wolves, and lynx that use forested areas. Mature forested habitats would continue to decline with spruce bark beetle impacts, development, mining and some recreation, affecting species such as northern goshawks, Townsend's warblers, as well as bald eagles in riparian zones. Estimating that 5% or more of the watershed is affected by mining, fuel reduction, recreation and development, therefore approximately 20% of the forested habitat used all or in part by the species listed above would be affected in the foreseeable future and may have effects on individuals. While cumulative effects cause degraded habitat and disturbance to individuals of a variety of species, it is unknown if it would affect populations in the watershed of any species due to lack of population information.

Irreversible and Irretrievable Commitments of Resources

Under Alternative 2, actions would cause varying degrees of soil productivity loss up to 264 acres, with 24.3 acres of permanent loss. On 24.3 acres, this would permanently inhibit growth of vegetation and associated wildlife habitat. Mature forest composition and structure containing large trees, which is important wildlife

habitat for a variety of species may be delayed by 40 or more years in developing due to loss of site productivity on the 264 acres. Despite mitigation measures, direct mortality to individuals of a variety of birds and small mammals is possible in areas of mining and restoration activities.

Adverse Environmental Effects that cannot be avoided or mitigated

The mining claim holder has a right to the mineral estate; therefore short and long term adverse effects to wildlife habitat up to 264 acres due to removal of the majority of vegetation during mining operations cannot be avoided or mitigated. Despite mitigation measures, direct mortality to individuals of a variety of birds and small mammals is possible in areas of mining and restoration activities.

Compliance or conflicts with the CNF LRMP

This Alternative is in compliance with CNF LRMP.

Consistency with Regulatory Framework (i.e. Clean water Act, ESA, Clean Air Act, NFMA, NEPA, FS manual, State Laws, etc…).

This Alternative is in compliance with the Endangered Species Act (ESA).

Alternative 3- No Restoration

Short and Long-term Direct and Indirect Effects

Acres of Habitat Affected

Alternative 3 permits mining operations on 267 acres, 3 more acres than Alternative 2. Mining activities would occur without a defined restoration corridor and restoration of Resurrection Creek would not take place. Many of the mining activities would be similar in quantity and area to those described in the Proposed Action, except some areas are expanded and mining would occur within the restoration corridor area described in Alternative 2. Alternative 3 mining operations would cause short and long term habitat loss, reduction of soil productivity, disturbance, and associated effects to wildlife as in Alternative 2.

Alternative 3 would not offer the benefits to enhancing wildlife habitat (food, cover, foraging areas) on the 76 acres through restoration. In this alternative, most of the corridor can be mined, with the same effects as in other mining operations areas. Because the corridor was previously mined using hydraulic mining methods, the corridor has very limited topsoil. Riparian vegetation would remain sparse indefinitely, retaining poor habitat conditions for riparian species and salmon.

Wildlife Species

As in Alternative 2, wildlife species may be disturbed and avoid or abandon habitat during mining operations on 267 acres over the 20 year operating period. Noise disturbance within 1 mile of the project area may cause habitat avoidance, abandonment, or behavioral changes by some species or individuals. Foraging, nesting habitat, prey habitat, and cover conditions would remain poor. More detail on effects on individual management indicator species and species of special interest can be found in the wildlife specialist report in the project record.

Cumulative Effects

Cumulative effects for Alternative 3 are the same as listed for Alternative 2.

Irreversible and Irretrievable Commitments of Resources

Under Alternative 3, actions would cause varying degrees of soil productivity loss up to 267 acres, with 37.6 acres of permanent loss (see soils analysis in this chapter). Mature forest composition and structure containing large trees, which is important wildlife habitat for a variety of species may take an additional 40 or more years to develop due to loss of site productivity. Despite mitigation measures, direct mortality to individuals of a variety of birds and small mammals is possible in areas of mining and restoration activities.

Adverse Environmental Effects that cannot be avoided or mitigated

The mining claim holder has a right to the mineral estate; therefore short and long term adverse effects to wildlife habitat on 267 acres due to removal of the majority of vegetation during mining operations cannot be avoided or mitigated. Despite mitigation measures, direct mortality to individuals of a variety of birds and small mammals is possible in areas of mining and restoration activities.

Compliance or conflicts with the CNF LRMP

With mitigation measures listed, this alternative is in compliance with CNF LRMP.

Consistency with Regulatory Framework (i.e. Clean water Act, ESA, Clean Air Act, NFMA, NEPA, FS manual, State Laws, etc…).

With mitigation measures listed in Chapter 2, this alternative is in compliance with the ESA.

Conclusion

Alternative 2

TES Species: There is no existing or potential habitat for, and thus no effect on threatened, endangered, sensitive or proposed species in the project area.

Management Indicator Species***:*** Short term decrease in habitat quality and quantity due to vegetation removal would occur in the restoration corridor. Short and long term decrease of habitat quality and quantity due to vegetation removal and lowered site quality in mining areas would occur. Disturbance to wildlife from noise, people, and machinery may cause habitat abandonment or avoidance in restoration area (short term) and mining areas (long term), or within 1 mile of the project area due to noise disturbance. Long term improvement of foraging habitat quality and quantity would occur in the restoration corridor for brown bears as restoration improves spawning and rearing habitat and develops screened foraging areas for bears. Restoration and mining may provide some early seral hardwood browse for moose, and lower soil productivity after mining may favor non preferred species such as alder.

Species of Special Interest and Migratory Birds***:*** Same effects as listed for MIS. Migratory bird nests and young may be destroyed during restoration or mining during the breeding season. Long term improvement of foraging habitat quality

and quantity would occur in restoration corridor for SSI that forage on salmon (bald eagles, river otters, wolves). Restored riparian vegetation improves foraging, nesting habitat, and cover for migratory birds and small mammals, and improves prey habitat for lynx, goshawks, wolves, wolverines. The potential for development of mature cottonwood nesting habitat for bald eagles and migratory birds would occur over the long term. This alternative would develop vegetation cover for burrowing and den sites for river otters. Declining site quality from mining would delay development of mature forest for nest or roost habitat for eagles, goshawks, and migratory birds by 40 or more years.

Alternative 3- No Restoration

TES Species: There is no existing or potential habitat for, and thus no effect on threatened, endangered, sensitive or proposed species in the project area.

Management Indicator Species***:*** Mining effects would be the same as Alternative 2 except effects would occur on an additional 3 acres. Sub-optimal foraging habitat for bears near the creek would be retained due to poor quality salmon spawning and rearing habitat and minimal cover.

Species of Special Interest and Migratory Birds**:** Mining effects would be the same as Alternative 2 except on 3 more acres. Sub-optimal foraging habitat for bald eagles and river otters would be retained due to poor quality salmon spawning and rearing habitat. Minimal cover would remain adjacent to Resurrection Creek. This alternative retains poor riparian vegetation conditions. Lowered soil productivity would delay long term potential for mature trees and nest habitat development for goshawks, and Townsend's warblers, by 40 or more years. Upland habitat quality for otters would be poor.

Social Environment

Heritage Resources

Affected Environment

Current Conditions

Forest Service management of cultural resources is legislated by Acts of Congress and Executive Orders. These Acts and Orders require inventories of cultural resources, and preservation and interpretation of all types of cultural resources for the benefit of the public. The requirements of these, plus a Programmatic Agreement between Region 10 of the Forest Service, the State Historic Preservation Officer and the Advisory Council on Historic Preservation, ensures that the Forest Service administers all activities subject to Section 106 and 110 of the National Historic Preservation Act (NHPA), in accordance with defined stipulations.

Knowledge of the current range, distribution and condition of cultural resources is dependent on the research of historic records, reports, archives and field investigations. The information available for the known cultural resources comes primarily from research and field investigations conducted by the Chugach National Forest Heritage Department and the private sector archaeological contracts for various Chugach National Forest projects. Investigations follow current research methodologies and techniques, and are reviewed by the State Historic Preservation Office to ensure the latest acceptable scientific methods and protocols are followed.

Historic mining resources constitute the greatest part of the known cultural resources in and near the project area. The NHPA and Executive Order 11593 require archaeological inventory to be completed prior to implementation of any undertaking. Of the area directly impacted by this phase of stream restoration, a majority of acreage has been surveyed. Numerous Euro-American historic properties are currently documented within the Resurrection Creek watershed. Of these sites, one lies within this current proposed project area, the Hope Historic Mining District. This site has been properly documented and is eligible for inclusion on the National Register of Historic Places.

Another type of heritage site that needs to be addressed within the drainage is the cultural landscape. Cultural Landscapes are a type of historic property addressed in the Secretary of the Interior's Standards and Guidelines, as revised in 1992. A cultural landscape is defined as "a geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values: (Birnhaum 1994:1). Cultural landscapes generally fall into one of four categories: historic designed landscapes, historic vernacular landscapes, historic site landscapes, or ethnographic landscapes. The associated mining landscapes fall under the category of historic vernacular landscape, "a landscape that evolved through uses by the people whose activities or occupancy shaped the landscape" (Birnhaum 1994:2). A portion of the archaeological features in

the project area can be classified as a vernacular landscape. The historic period with which most of the cultural landscapes in the area are associated is the early 20th century. Specifically, the features that contribute to the historic character of the cultural landscape include the mining areas, living areas, tailing piles, ponds and ditches, the historic cabins and outbuildings, and trails and roads.

On March 30, 2009, the Omnibus Public Lands Management Act of 2009 was signed, designating Alaska's first national heritage area, known as the Kenai Mountains-Turnagain Arm National Heritage Area, which focuses on the theme of transportation for mining and settlement. The Resurrection Creek Stream and Riparian Restoration Project falls within the boundaries of this NHA and the Forest Service anticipates working closely with the Kenai Mountains-Turnagain Arm Heritage Corridor Communities Association (KTCA) and National Park Service to interpret the historic resources in the area.

Figure 9 View of interpretive area in mining Area 19

Environmental Consequences

The Proposed Action would result in the redistribution of the historic mine tailings piles. The tailings are contributing features for the Hope Mining Company Historic Mining District, and redistribution would constitute an adverse effect. In order to mitigate these effects, the Forest Service has consulted with the State Historic Preservation Officer (SHPO) in drafting a Memorandum of Agreement (MOA). The MOA will address the development of an interpretive area which will be located on the south end of the project, affording public access near Resurrection

Creek Road, in which a representative section of intact historic mine tailings will be interpreted. The Forest Service will be working with Hope Mining Company and other potential entities in developing the interpretive area.

Issues

No significant issues regarding heritage resources were identified. All alternatives could affect contributing elements of the historic district.

Measurement Indicators

Effects to historic properties primarily relate to changes in the characteristics of a property that make it eligible to the National Register of Historic Places.

Methodology

Determinations of effects are reached in consultation with the State Historic Preservation Officer and/or the Advisory Council on Historic Preservation, as defined in 36 CFR part 800.

Alternative 2- Proposed Action

Short and Long-Term Direct and Indirect Effects

Approximately 7.2 acres of historic mine tailings would be redistributed, causing adverse effects to historic property and the historic district. Additionally, mining may uncover previously undocumented mining artifacts. The adverse effects would be mitigated through the use of interpretive panels, and approximately 1/4 acre of intact historic mine tailings would be preserved and interpreted for the public. Long term direct effects would include permanent alteration of the landscape (tailings) through natural stream action.

Cumulative Effects

There would ultimately be increased public awareness about historic mining and especially the tailing piles, which would not have occurred had the current mining operation and the consequent interpretive area not been developed.

Irreversible and Irretrievable Commitments of Resources

Loss of portions of the historic landscape would occur. However, not all portions of the contributing elements (tailings) would be lost, and portions that are removed would be captured by data recording and mitigated by interpretive displays.

Adverse Environmental Effects that cannot be avoided or mitigated

There are no adverse environmental effects that cannot be avoided or mitigated.

Compliance or conflicts with the CNF LRMP

The mitigation measures were crafted in consultation with the Forest, interested publics and the State Historic Preservation Office, and are in full compliance with the Forest Plan, all legal mandates and Programmatic Agreements.

Alternative 3 – No Restoration

Continued mining operations have the same potential to affect the historic district contributing elements as Alternative 2. All mitigation measures, effects, and compliance measures for Alternative 2 apply to Alternative 3.

Conclusion

If the recommended interpretive displays are constructed, the project would be in compliance with Section 106 and 110 of the National Historic Preservation Act, as amended, and with consultation measures reached in agreement with the State Historic Preservation Office of Alaska.

Recreation

Affected Environment

The project is located approximately two to four miles south of Hope on Resurrection Creek. The project area is downstream of the Resurrection Pass North Trailhead. The Resurrection Pass National Recreation Trail is located just outside of the southern boundary of the project area. The recreation use in the project area was generally described in the Resurrection Creek Restoration Project Recreation Resource Report and this document is incorporated by reference in accordance with 40 CFR 1502.21. This report discusses general levels of use for the north end of Resurrection Pass National Recreation Trail, public use cabins and dispersed camping, recreational mining, scenic resources, and sport fishing which would potentially be affected by this project.

Recreation Use Within or Immediately Adjacent to the Project Area

Currently, there is little to no recreation use that occurs within the project area. The majority of the recreation use that occurs in the area is generally concentrated within Porcupine Campground and the Resurrection Pass National Recreation Trail. In addition, this section of Resurrection Creek does not provide fishing opportunities that are desired by a majority of sport anglers.

Resurrection Pass National Recreation Trail

The primary recreation activity immediately adjacent to the project area is use of the Resurrection Pass National Recreation Trail. By definition, national recreation trails represent the more outstanding trail opportunities of the Forest developed trail system, offer extended trail experiences reasonably close to population centers, and possess significant natural and cultural features. The scenic features along the Resurrection Pass National Recreation Trail include alpine meadows, mountain lakes, and Juneau Falls. Cultural features include remnants of the mining and trapping era. The Resurrection Pass National Recreation Trail is nationally recognized for mountain biking opportunities as well as hiking. The 38.8 mile long trail is used year round for non-motorized activities including hiking, biking, cross-country skiing, and horseback riding. The north trailhead is

located at the southern boundary of the project area. Every other year from December 1 to April 30, the trail is open to snow-machine use. It is open to horse and bicycle use from July 1 to March 31.

Recreational Gold Panning and Dispersed Camping

The Chugach National Forest has a long history of placer gold mining on the Kenai Peninsula. Currently gold panning, sluicing, and dredging for non-commercial purposes are important outdoor activities on the Forest as indicated by the number of participants, investment in equipment and supplies, impact on local economies, and the frequency of this type of activity. Within the project area, there is a sustained use by recreational miners. Dispersed camping in the project area is usually associated with the recreational gold panning activities. Specific use figures have not been collected on dispersed use. The designated recreation gold panning area between the private property and the Resurrection Pass North Trailhead offers road accessible dispersed camping. The only site amenity is a vault toilet.

Scenic Resources

The lands within the project area have been subject to manipulation for the last century. In most of the project area, the existing landscape character meets the Forest Plan Standard of a low scenic integrity level. These landscapes appear moderately altered to Forest visitors. There are places along the stream bank within the project area that appear heavily altered from the past mining activities. This includes the presence of large mining tailings devoid of vegetation, and the unnatural floodplain of the creek. These areas have a very low scenic integrity, since they strongly dominate the landscape character. However, at the same time the dominant mining tailings paint a picture of the mining culture that provides a sense of place to the community of Hope. Scenic integrity is the state of naturalness or, conversely, the state of disturbance created by human activities or alteration. Scenic Integrity Objective (SIO) is the final Land Resource Management Plan (LRMP) management allocation of scenic integrity levels.

Sport Fishing

The Alaska Department of Fish and Game (ADF&G) is responsible for regulating fishing on National Forest lands. According to ADF&G regulations, Resurrection Creek is closed year-round to sport fishing for all king (Chinook) Salmon, and open to sport fishing for other salmon of all sizes, rainbow/steelhead trout, arctic char/Dolly Varden, grayling, lake trout and other finfish (Alaska Department of Fish and Game 2009). Fishing for king salmon is closed because at this time there is a lack of information on the Resurrection Creek king salmon stock. Several small populations of king salmon are present in Cook Inlet, and low abundance combined with limited information on population status preclude establishment of a viable harvest oriented king salmon sport fishery. The Resurrection Creek falls into this category (Begich 2009). If the sport fishing regulations for Resurrection Creek were to change for any species they would need to be made through the Alaska Board of Fisheries regulatory process.

Currently sport fishing for pink salmon mainly occurs at the mouth of Resurrection Creek. An increasing number of anglers are discovering the pink salmon fishing between the mouth and the Hope Highway bridge. Approximately 20 anglers can be seen fishing within ½ mile of the highway bridge on any given day during the season. A handful of locals have been known to fish the section between the highway bridge and the foot bridge on Resurrection Pass National Recreation Trail (Johansen 2004).

Environmental Consequences

Recreation resources have been analyzed for the Forest lands within the project area. No significant issues were identified related to recreation resources in the project area. Impacts to recreation resources that are addressed in this analysis include a qualitative assessment of impacts from implementation of restoration activities on Scenic resources, Sport fishing, and Recreational experience. Refer to the Noise analysis in this chapter for noise impacts to recreationists.

The scale of the recreational analysis includes the project area and the larger lower Resurrection Creek valley and drainage while the indirect and cumulative effects analysis includes the community of Hope and activities on Palmer Creek and Resurrection Creek Roads.

Alternative 2 – Proposed Action

Short and Long-term Direct and Indirect Effects

Scenic Resources

The mining activities in this alternative would have direct effects on scenic resources that would last beyond 20 years (the expected duration of mining activities). Scenic resources and landscape characteristics including form, line, color, and texture would be adversely impacted by active mining operations, most noticeably in mining Areas 14 and 21, which are located adjacent to the Resurrection Creek Road. This may affect visitor satisfaction as the landscape would appear less natural. A 20-foot vegetative screening along Resurrection Creek Road in mining Areas 14 and 21 is required in order to retain some scenic values for visitors and residents driving Resurrection Creek Road. This buffer is not expected to completely screen mining activities from the road, especially within the first five years due to sparse vegetation. However, over time, as vegetation continues to grow within the buffer, mining activities would be less observable from Resurrection Creek Road.

Alternative 2 would restore a portion of Resurrection Creek to its natural landscape characteristics. In order to accomplish this, the existing vegetation would be cut and used to construct the new floodplain and associated features and would result in a direct effect on form, line, color, and texture of the scenic resources. The existing vegetation is a positive element of the landscape. Removal of much of the vegetation is a long-term direct effect on scenic resources. Once the desired condition has been met for restoration, the new vegetation and establishment of a natural appearing floodplain would meet the

LRMP direction for scenic resources. This would create a short-term deviation from the LRMP direction in order to accomplish the long-term desired conditions.

The SIO for the project area is classified as “low” and would decrease to “very low” for up to 20 years or longer based on the success of reclamation from mining activities under the Proposed Action. Restoration activities over time, however, are expected to bring the SIO up to at least “moderate” in the restoration corridor.

Sport Fishing

The effects of this alternative on sport fishing cannot be accurately predicted with the information currently available. There is no evidence that an increase in fish populations resulting from restoration activities would cause an increase in sport fishing.

Recreational Experience

Potential continued use of ATV’s crossing Resurrection Pass Trail bridge to access mining operations on the west side of Resurrection Creek may cause safety concerns with recreation users.

Cumulative Effects Common to both Action Alternatives

Recreational Experience

1. Visitor expectations may be different than the actual experiences of driving to and accessing the Resurrection Pass National Recreational Trail due to the following:

- Sights and sounds created by the use of heavy equipment in various projects along Hope Highway and along Resurrection Creek and Palmer Creek Roads.
- Smoke from pile burning lingering in the area.
- Development on private land at mile 14 of Hope Highway and along Resurrection Creek Road.
- Sights and sounds from small scale suction dredging mining operations within the recreational mining area on Resurrection Creek.
- Increased highway traffic from the various projects.

2. The Porcupine Campground is slated for reconstruction in 2010 and would affect recreation users due to the lack of camping facilities in the vicinity during the time of construction. This may cause additional dispersed camping due to displacement of the recreation users.

Upon completion of all these projects, the cumulative effects would subside.

Irreversible and Irretrievable Commitments of Resources

The topography would be heavily modified, and the majority of vegetation would be removed in the mining areas affecting several characteristics of the landscape resulting in a decrease in scenic quality over 20 years or more.

Adverse Environmental Effects that cannot be avoided or mitigated

Adverse environmental effects would be the same as stated for irreversible and irretrievable commitments of resources.

Compliance or conflicts with the CNF LRMP

The project is in compliance with all direction set forth in the CNF LRMP as it relates to managing recreational resources in the project area.

Consistency with Regulatory Framework (i.e. Clean water Act, ESA, Clean Air Act, NFMA, NEPA, FS manual, State Laws, etc…)

The project is consistent with the policies and laws that relate to recreation resources.

Alternative 3- No Restoration

Short and Long-term Direct and Indirect Effects

Scenic Resources

The effects of Alternative 3 on scenic resources would be the same as Alternative 2 regarding mining activities that would take place. The long-term beneficial effects of restoration would not occur.

Sport Fishing

The effects of Alternative 3 on sport fishing cannot be accurately predicted with the information currently available. An increase in fish populations is not expected to occur from implementation of mining activities.

Recreational Experience

Potential continued use of ATV's crossing Resurrection Pass Trail bridge to access mining operations on the west side of Resurrection Creek may cause safety concerns with recreation users.

Irreversible and Irretrievable Commitments of Resources

The topography would be heavily modified, and the majority of vegetation would be removed in the mining areas affecting several characteristics of the landscape resulting in a decrease in scenic quality over 20 years or more.

Adverse Environmental Effects that cannot be avoided or mitigated

Adverse environmental effects would be the same as stated for irreversible and irretrievable commitments of resources.

Compliance or conflicts with the CNF LRMP

The project is in compliance with all direction set forth in the CNF LRMP as it relates to managing recreational resources in the project area.

Consistency with Regulatory Framework (i.e. Clean water Act, ESA, Clean Air Act, NFMA, NEPA, FS manual, State Laws, etc…)

The project is consistent with the policies and laws that relate to recreation resources.

Conclusion

The impacts to recreation use from any of the action alternatives would be minimal. In addition, mining activities would be easily observable from Resurrection Creek Road until the buffer becomes more vegetated, which is estimated to be about five years. It is not expected that these sights and sounds would be so disruptive as to cause recreation users to choose other places to recreate or be displaced. In addition, the cumulative effects described above are not expected to meaningfully contribute to the effects to recreation from any of the action alternatives.

Inventoried Roadless Area

Affected Environment

Inventoried Roadless Areas

In January 2001, the Forest Service established inventoried roadless areas (IRA) on National Forest System lands (see 36 CFR 294.10 through 36 CFR 294.14 (2001). In general, IRAs are large relatively undisturbed landscapes. The following features generally characterize IRAs:

1. High quality or undisturbed soil, water, and air;
2. Sources of public drinking water;
3. Diversity of plant and animal communities;
4. Habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent on large, undisturbed areas of land;
5. Primitive, semi-primitive non-motorized and semi-primitive motorized classes of dispersed recreation;
6. Reference landscapes;
7. Natural appearing landscapes with high scenic quality;
8. Traditional cultural properties and sacred sites; and
9. Other locally identified unique characteristics

Location and Background

The Resurrection IRA is located on the Kenai Peninsula. It is 224,460 acres in size and is one of sixteen IRAs on the Chugach National Forest. The Resurrection IRA lies south of the community of Hope and north of the community of Cooper Landing. It is bounded on the east by the Seward Highway; on the south by the Sterling Highway; and the west by the Kenai Wilderness Area and proposed Wilderness within the Kenai National Wildlife Refuge (see Figure 10). The Resurrection IRA has numerous access points along the Seward and Sterling Highway. Additional access to the Resurrection IRA is provided by floatplane.

The boundary of the Resurrection IRA begins approximately 1/4 mile from the Seward Highway, Sterling Highway, Palmer Creek Road, and Resurrection Creek Road. There are also non-National Forest Lands adjacent to the Resurrection IRA near the communities of Hope, Sunrise, and Cooper Landing

and near the junction of the Seward and Hope Highways, and the Summit Lakes area. The above highways and non-National Forest System lands have been subject to human influences and development.

As evidence of human influence and development are more apparent in some areas adjacent to the Resurrection IRA, the presence of roadless area characteristics within these adjacent portions of the Resurrection IRA are somewhat diminished. Human influences that are noticeable from the portion of the project area within the Resurrection IRA include ongoing placer mining and traffic along Resurrection Creek Road.

Roadless Area Characteristics

Below is a description of the general roadless area characteristics and a discussion on whether these characteristics are present in the Resurrection IRA. The description also includes a discussion, where appropriate, on the extent to which these characteristics are present within the project area portion of the Resurrection IRA (see Figure 11).

Topography: The topography of the Resurrection IRA consists of rounded, frost-churned mountaintops separated by valleys shaped by alpine glaciers. Elevations range from 100 to 5,000 feet.

Soil, Water, and Air: The soils within the Resurrection IRA are in good condition and are well or moderately well drained, and moderately deep to deep. Most soils within the Resurrection IRA have a surface organic layer, which is thickest under a forest canopy or in wetter areas. Soils in the valley bottoms are usually formed in alluvial deposits and are well to poorly drained, depending on the depth of the water table, and slightly acid (USDA Forest Service, Chugach National Forest 2002b, Appendix C, pg. C-7).

The majority of homes in Hope use wells for their water source. Approximately 100 wells exist in the area. Numerous springs are found throughout the watershed, most commonly along lower portions of the valley side slope, below long slopes. Groundwater on the side-slopes trickles through the soil layers and the fractured bedrock below, and emerges lower on the slopes. The greywacke and shale bedrock geology of this area is not porous enough to create significant aquifers. Alluvial gravels within the Resurrection Creek valley floor are porous and can contain a sizeable aquifer. Most wells in Hope tap into this aquifer. In the project area, the depth of the alluvial gravels is limited in some places by clay layers and bedrock near the surface (USDA Forest Service, Chugach National Forest 2002b) (see the Aquatic Resources analysis in this chapter).

Air quality in south-central Alaska is relatively undisturbed from human sources as a result of sparse populations, large distances from major pollution sources, and climate (see Air Quality analysis in this chapter).

Diversity of plant and animal communities: Within the Resurrection IRA, characteristic needleleaf forest trees include white spruce, Lutz spruce, mountain hemlock, and occasional black spruce. Mountain hemlock occurs primarily on sideslopes at low to mid elevations while the spruces may dominate on both

valley bottoms and sideslopes. Paper birch is a dominant broadleaf forest species and a major component of the mixed forests. Sitka alder characterizes the tall scrubland. Natural and human caused fires are common and significantly affect forest vegetation succession in this area. The spruce bark beetle is currently causing extensive mortality within the spruce forests of this area. Undergrowth species common within the forest zone include bluejoint reedgrass, rusty menziesia, early blueberry, devil's club, wood fern, lowbush cranberry, crowberry, splendid feathermoss, and Schreber feathermoss.

Broadleaf forests of black cottonwood and willow (especially Barclay and feltleaf) scrublands are normally found in the valley bottoms. Alpine vegetation consists of dwarf scrublands and herbaceous vegetation types often dominated by such species as crowberry, starry cassiope, bog blueberry, luetkea, white mountain-avens, bluejoint reedgrass, and rough fescue.

Moose, black and brown bears, some sheep, wolves, and coyotes are the dominant large wildlife in the unit. A small herd of caribou inhabits the northern half of the unit. Wolverine, fox, lynx, marten, mink, otter, red squirrel, grouse, ptarmigan, hare, bald eagle, owls, hawks and a variety of passerine birds contribute to the variety of wildlife resource. No federally listed threatened or endangered species occur within the area. There are no Alaska Region sensitive wildlife species within the Resurrection IRA (see wildlife analysis).

The following Alaska Region sensitive plant species are known or suspected to occur within the area: Norberg arnica, goose-grass sedge, and pale poppy.

Reference landscapes: The majority of the Resurrection IRA appears unmodified and in a predominately natural condition; however, there are minor modifications, such as the Resurrection Pass National Recreation Trail and public use cabins that are evident when one is close to them (USDA Forest Service, Chugach National Forest 2002b, Appendix C, pp C-10 through C-11).

The project area portion of the Resurrection IRA is not a good example of a reference landscape due to the presence of past mining within the IRA and because of human influences on the lands adjacent to the IRA.

Landscape Character and Recreation Settings: The Resurrection IRA provides primarily primitive, semi-primitive non-motorized, and semi-primitive motorized recreation settings and opportunities. The majority of the Resurrection IRA appears unmodified and in a predominately natural condition. Overall, the Resurrection IRA provides spectacular scenery (USDA Forest Service, Chugach National Forest 2002b, Appendix C, pg. C-11). Although the majority of the Resurrection IRA represents natural conditions, the project area portion of the Resurrection IRA is not a naturally appearing landscape. The primary reason that this portion of the Resurrection IRA does not have a naturally appearing landscape is due to the historic and present day mining activities and the proximity to Resurrection Creek Road.

Traditional cultural properties and sacred sites: There are no known traditional cultural properties or sacred sites within the Resurrection IRA.

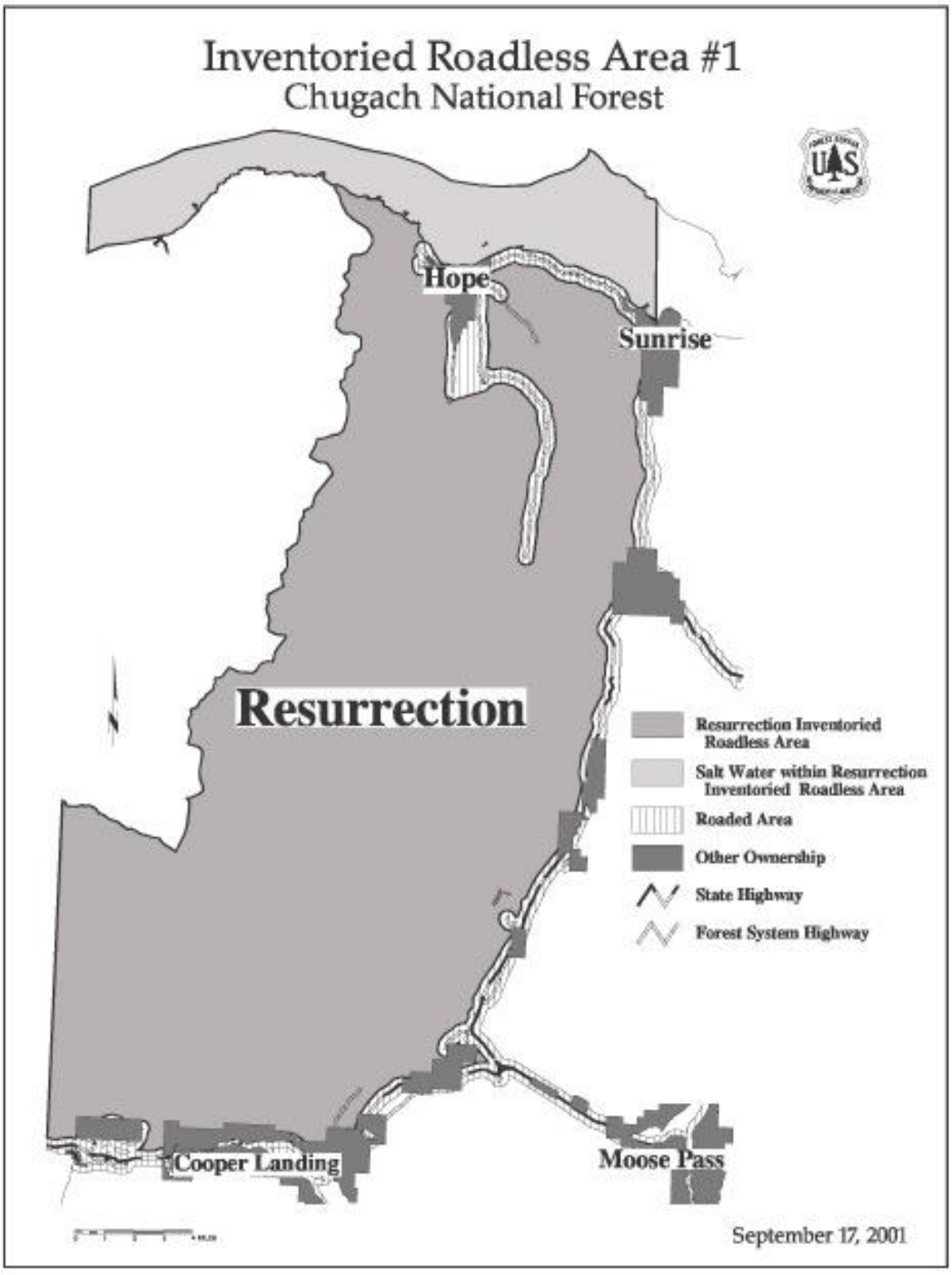

Figure 10 Resurrection Inventoried Roadless Area

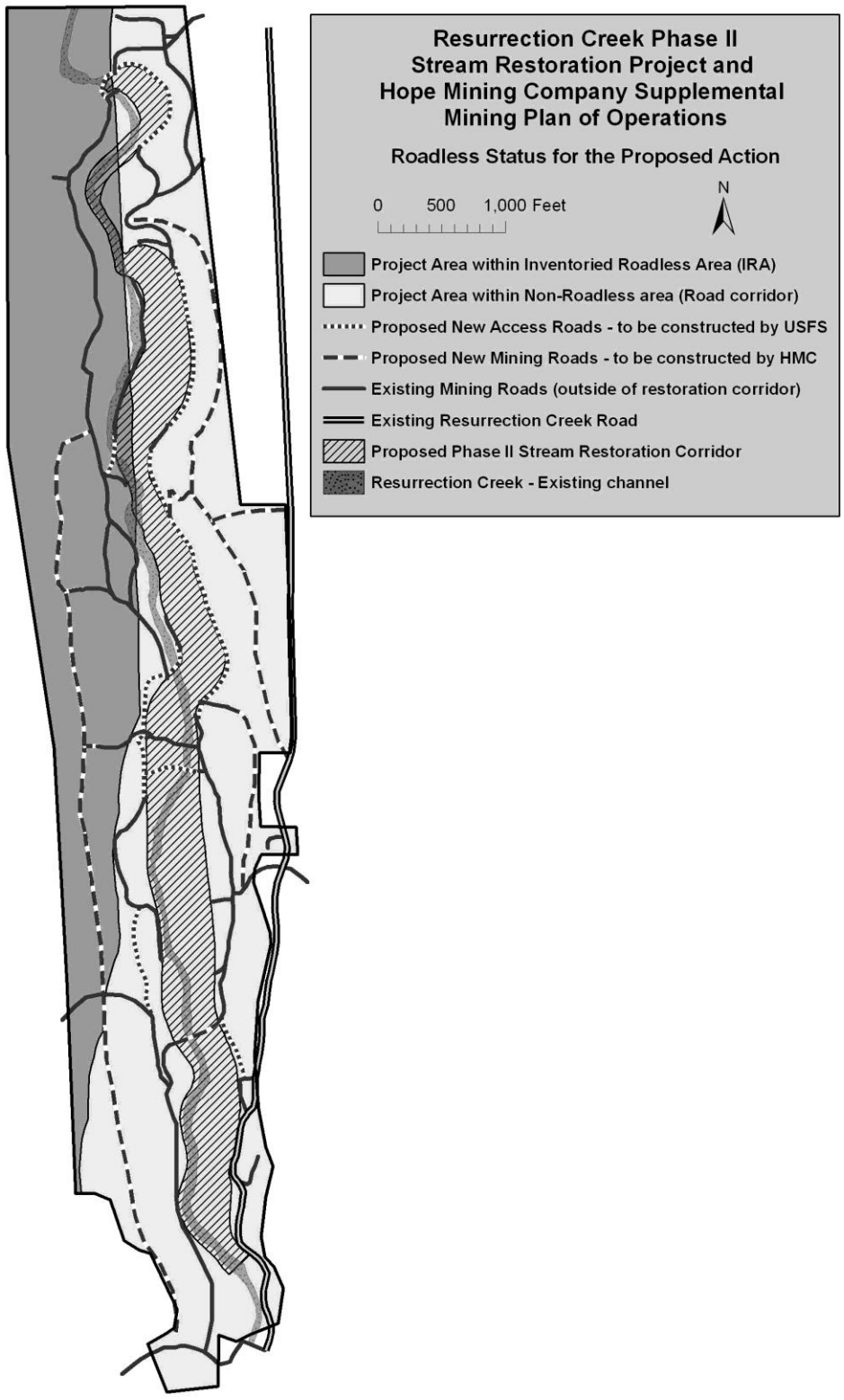

Figure 11 Resurrection Inventoried Roadless Area within the project area

Environmental Consequences

The temporal scope for the short term is 4 to 5 years, and long-term is 20 years. The geographic bounds of the analysis for direct and indirect effects are the project boundary, and for cumulative effects it is the entire Resurrection IRA.

Indicators

- Natural Appearing Landscape
- Wilderness Suitability

Alternative 2 - Proposed Action

Direct and Indirect Effects

Natural Appearing Landscape and Wilderness Suitability

The mining plan of operations is expected to take place over 20 years. During this time, timber would be removed from as much as 134 acres of the Resurrection IRA, and 1.06 miles of road would be constructed. Timber cutting and road building have the potential to adversely affect roadless area characteristics. It is expected that approximately 134 acres, or less than one percent of the total acres of Resurrection IRA, would appear more unnatural and would be less capable of being suitable for Wilderness designation because evidence of mining would be apparent. After 20 years or at the completion of mining activities, the area would be reclaimed. It is expected that after reclamation, the affected portion of the Resurrection IRA would appear more natural over time and once again become suitable for Wilderness designation.

Approximately 5 acres of the proposed restoration corridor lie within the IRA. The restoration effort is expected to take place each summer for up to four years. After completion, Resurrection Creek would more closely represent natural conditions because it would appear and function as it did before mining channelized Resurrection Creek early in the 20th century. It is also expected that the 5-acre portion of the restoration corridor within the Resurrection IRA would become more suitable for Wilderness designation for this reason. In sum, it is expected that the portion of the restoration corridor within the Resurrection IRA would appear more unnatural during and shortly after implementation; approximately 4 or 5 years. After five years, it is expected that this area would gradually appear more natural as re-vegetation and proper functioning of the floodplain returns and the evidence of human disturbance from restoration becomes less noticeable.

Cumulative Effects

As discussed above, roadless area characteristics within the Resurrection IRA are somewhat diminished where the boundary is adjacent to highways, non-National Forest lands or other development. The project area portion of the Resurrection IRA is specifically affected by Resurrection Creek Road and present mining activities. However, the Resurrection IRA is still predominately an undisturbed landscape. It is not expected that any of the alternatives would meaningfully affect the wilderness suitability for the Resurrection IRA because

only a very small portion of the IRA is expected to be affected and these effects would not be permanent.

Irreversible and Irretrievable Commitments of Resources

None.

Adverse Environmental Effects that cannot be avoided or mitigated

None.

Compliance or conflicts with the CNF LRMP

The Proposed Action would not conflict with the CNF LRMP.

Consistency with Regulatory Framework (i.e. Clean water Act, ESA, Clean Air Act, NFMA, NEPA, FS manual, State Laws, etc…)

Alternatives 2 is consistent with the 2001 Roadless Rule for the following reasons:

1) The restoration of Resurrection Creek would require timber cutting on five acres. The timber in this area is generally small diameter hemlock (less than 24 inch DBH). Once removed, this timber would primarily be used to accomplish restoration; however, a small portion may be made available for personal use firewood. Timber cutting for the restoration is exempted under the 2001 roadless rule at 36 CFR 294.13(b)(1)(ii) because the restoration project restores ecosystem characteristics that were adversely affected by historic mining.
2) The mining plan of operations would require both timber cutting and road building. The mining plan of operations proposes timber cutting of small diameter (less than 24 inch DBH) birch, hemlock, and spruce trees on 134 acres and 1.06 miles of temporary road construction within the inventoried roadless area. Timber cutting and road construction for mining activities is exempted under the 2001 Roadless Rule at 36 CFR 294.12(b)(3) because of a prior existing mineral right. This right was established in 1974.

Alternative 3 - No Restoration

Direct and Indirect Effects

Natural Appearing Landscape and Wilderness Suitability

If no restoration of Resurrection Creek occurs, Resurrection Creek would remain channelized, fish habitat would continue to be poor, and evidence of human disturbance would be apparent. Resurrection Creek would continue to be less capable of being suitable for Wilderness designation. In addition, timber would be removed from approximately 134 acres of the Resurrection IRA and 1.06 miles of road would be constructed. It is expected that this portion of the Resurrection IRA (less than 1%) would appear more unnatural and would be less capable of being suitable for Wilderness designation because evidence of mining would be apparent. After 20 years or at the completion of mining activities, the area would be reclaimed. It is expected that after reclamation, the affected

portion of the Resurrection IRA would appear more natural over time and once again become suitable for Wilderness designation.

Cumulative Effects

Cumulative effects under Alternative 3 would be the same as under the Proposed Action.

Irreversible and Irretrievable Commitments of Resources

None.

Adverse Environmental Effects that cannot be avoided or mitigated

None.

Compliance or conflicts with the CNF LRMP

Alternative 3 would not conflict with the CNF LRMP.

Consistency with Regulatory Framework (i.e. Clean water Act, ESA, Clean Air Act, NFMA, NEPA, FS manual, State Laws, etc…)

Alternatives 3 is consistent with the 2001 Roadless Rule because the mining plan of operations would require both timber cutting and road building. The mining plan of operations proposes timber cutting of small diameter (less than 24 inch DBH) birch, hemlock, and spruce trees on 134 acres and 1.06 miles of temporary road construction within the inventoried roadless area. Timber cutting and road construction for mining activities is exempted under the 2001 Roadless Rule at 36 CFR 294.12(b)(3) because of a prior existing mineral right. This right was established in 1974.

Social and Economic Resources

Affected Environment

Existing Condition

Commercial mining occurs on federal mining claims along Resurrection Creek. Recreational mining activities are also popular on Resurrection Creek south of Resurrection Pass North Trailhead. The Resurrection Creek recreational gold panning area is one of only three public panning areas in the Seward Ranger District. Other forms of recreation, such as camping, hiking, mountain biking, backpacking, sightseeing, skiing, and motorized sports occur in the Hope area. In the vicinity are trails such as Resurrection Pass National Recreation Trail, Gull Rock Trail, and Hope Point Trail, and road corridors. These recreation activities draw visitors and economic activity to Hope. Additionally, many residents rely to some extent on subsistence uses tied to Resurrection Creek. Subsistence uses include hunting, fishing, gathering wood products for building materials and firewood, and the harvest of special forest products such as mushrooms, berries, and moss (Hart Crowser, Inc. 2002).

Community History

Hope and Sunrise were Alaska's first gold rush towns. Gold was discovered in Resurrection Creek in 1889, about eight years before the larger Klondike gold rush in Dawson and Nome. Prospectors rushed to stake claims after the discovery. Residents of the community living in tents and cabins at the mouth of the creek decided to name themselves after the youngest rusher to step off the next boat. His name was Percy Hope. Sunrise City, on Sixmile Creek, was named after the way the morning sun disappeared behind the mountains and made a second and third "sunrise." Both towns grew to include stores, hotels, social halls, community councils, post offices, and saloons. With the start of the Klondike Gold Rush in 1897, the population in both communities dwindled as miners left for the richer strike to the north (Hope Chamber of Commerce 2008).

Hope is located approximately 88 miles by road from Anchorage on the south shore of the Turnagain Arm of Cook Inlet. Several historic buildings are still present and continue to serve Hope residents (Hope Chamber of Commerce 2008).

Demographics

Much demographic data for Hope and Sunrise is derived from a sampling of households. Due to the small size of these communities, samples sizes are very small; therefore the potential for sampling error is relatively high. Findings should therefore be considered with caution.

The Alaska Department of Labor and Workforce Development, Research and Analysis Section reports that the estimated 2007 population was 143 in Hope and 22 in Sunrise (2008). According to the 2000 Census, 92 and 89 percent of the sampled populations in Hope and Sunrise respectively reported their race as white. Two percent of Hope residents and 11 percent of Sunrise residents reported that they were American Indian or Alaska Native. The median age was reported as 46.9 in Hope and 44.5 in Sunrise (Alaska Department of Commerce 2008). Table 6 displays the findings reported in the 2000 census about housing in Hope and Sunrise.

Table 6 Housing characteristics (2000 Census).

Characteristic	Hope, AK	Sunrise, AK
Total Housing Units	175	25
Occupied Housing Units	77	9
Housing for seasonal, recreational, or occasional use	84	16

Source: 2000 Census, Table DP-1. Profile of General Demographic Characteristics: 2000.

Approximately one-fourth of the homes in Hope use individual water wells, septic tank systems, and are fully plumbed. The school operates its own well water system. Many homes are only used seasonally. Housing in Sunrise lacks

complete plumbing (Alaska Department of Labor, Workforce Development, Research and Analysis Section 2008).

Employment and Income

Current employment and income data at the community level was not available. The information in Table 7 is drawn from the 1990 and 2000 Census. Industrial classifications changed between the 1990 and 2000 Census. In order to track changes in employment, it was necessary to combine the data into fewer groupings to allow a comparison. This results in a loss of some detail, but is necessary in order to obtain an accurate comparison and identify changes.

From 1990 to 2000, employment in Hope declined in all sectors except for transportation, information, warehousing, utilities and public administration. The greatest losses occurred in the construction, wholesale trade and education, health, social services sectors.

The estimates of income and poverty levels in Hope are based on a sampling of 15.4 percent and are subject to sampling variability. Additionally, the following estimates are based on the 2000 Census and could differ significantly today (Alaska Department of Commerce 2008).

Table 7 Employment statistics by industry, Hope, Alaska

Industry	Percent Total Employment	Total Employment 1990	Net Change Employment 1990-2000	1990-2000 Rate of Growth
Agriculture, forestry, fishing, mining, manufacturing	15	9	-3	-33
Construction	0	7	-7	-100
Wholesale trade	0	7	-7	-100
Retail trade, arts, entertainment, recreation, accommodations, food services	15	21	-15	-71
Transportation, information, warehousing, utilities	38	0	15	1500
Finance, insurance, real estate, rental, leasing	0	0	0	0
Professional, scientific, management, administrative, other professional services.	0	0	0	0
Educational, health, social services	0	17	-17	-100
Public administration	31	0	12	1200
Total	100	61	-22	-36

Source: DEMOsthenes2002, Version 2.3, June 2003. Note: the data on which DEMOsthenes is built was restructured between 1990 and 2000, and so changes in employment in the indicated sectors may only represent reclassification of jobs.

The 1999 per capita income was $9,079, which would be $10,678 in 2008 dollars. The median family income was $24,432 in 1999, which is $28,735 in 2008 dollars. An estimated 11.7 percent of the population was below poverty level (Alaska Department of Commerce 2008).

The school and local retail businesses provide the only employment in Hope. Some mining activity continues to occur. There is also a small sawmill used by the community. Two residents hold a commercial fishing permit. Total employment was 39, with a majority of those (20) employed in government. The unemployment rate was 13.3 percent. Those who were 16 and older and not working (unemployed and not seeking work) was almost 60 percent. (Alaska Department of Commerce 2008). Many Hope community members appear to rely on subsistence uses which lowers the level of labor force participation and median incomes (USDA Forest Service, Chugach National Forest 2004).

Desired Condition

The 2002 Chugach Forest Plan does not contain social or economic goals or objectives, however the following is found in Appendix A (USDA Forest Service, Chugach National Forest 2002b):

"Ecosystem management will involve consideration of not only goods and services but also the viability of ecological, social, and economic systems now and in the future. Achieving this goal requires that ecosystem conditions, natural processes, natural disturbance patterns, and productive capabilities be incorporated into decision making processes so that human needs are considered in relation to the sustainable capability of the system."

Environmental Consequences

A variety of concerns have emerged regarding the social and economic effects of the Resurrection Creek Phase II Stream and Riparian Restoration Project. The majority of concerns include changes in the social environment that are currently unquantifiable with the methods and techniques available. These concerns include impacts to the scenic and recreational quality of the watershed, visitor traffic, noise (refer to the recreation analysis in this chapter), and impacts to local businesses. Social effects lacking quantifiable indicators are addressed through a qualitative assessment of foreseeable impacts on the social environment.

The only quantifiable economic factor is the cost of restoration activities. Activities defined under the action alternatives would result in financial costs incurred by the Forest Service. Public concern has been raised about the Forest Service's use of tax payer dollars for restoration activities, and whether or not future mining activities could disrupt the benefits of restoration. A financial efficiency analysis estimates the net present value (NPV) of all costs that can be converted into dollar figures and benefits associated with the action alternatives There remains a subset of costs and benefits associated with restoration that are

not quantifiable in monetary terms. The financial efficiency analysis is supplemented with a qualitative analysis of social impacts.

The remaining factors involve the effects from the mining operation itself. The remaining factors involve the effects from the mining operation itself. This analysis does not address mining activities because they are protected under the statutes of the 1872 Mining Law. The effects analysis is limited to restoration activities defined in the action alternatives. Mining activities would occur under each alternative, and the associated impacts on the social and economic environment would occur regardless of this decision.

Methodology and Assumptions

The decision to be made does not affect HMC's legal right to mine, thus it is assumed that mining would occur under both action alternatives. Social and economic impacts from mining are not considered as part of this analysis.

The Final Environmental Impact Statement for the Chugach Land and Resource Management Plan describes the social and economic environment for the Forest (USDA Forest Service, Chugach National Forest 2002a). This analysis describes the social and economic conditions and effects associated with the Resurrection Creek Stream and Riparian Restoration Phase II project Proposed Action and alternatives. The sections that follow address estimated effects expected in the local vicinity of the project area.

A detailed cost analysis allows for the comparison of costs across alternatives at a common scale. All costs are discounted back to present value so that they may be compared across action alternatives. NPV is the indicator used to make the comparison. The data used for this analysis consists of a detailed estimate of costs and year of occurrence of restoration and mining permit administrative activities. This data is supplied by the Forest. It is assumed that the cost and timeline estimates are the best available given the current management scenario. The cost analysis is based specifically on these estimates, and any deviation would result in the actual NPVs differing from those estimated in this report.

In addition to the cost analysis, a qualitative approach is taken to report non-benefits and costs that cannot be converted into dollars. These benefits and cost are not directly accounted for in the market place and are not reported as a dollar value. Information used to conduct this analysis consists of comments received during public scoping periods and meetings, as well as information gained from other projects similar in nature, including Phase I of Resurrection Creek restoration.

Methodology for assessing direct and indirect effects is twofold. First, cost of implementation is addressed through the cost analysis. The second step in addressing effects is a qualitative analysis of the remaining social and economic implications. Because values are not quantifiable does not imply that they do not exist. There are a variety of effects on the socioeconomic environment that could result from implementation of these alternatives. Thus, it is important to rely on qualitative measures to appropriately describe their presence within the study area.

The cost of restoration is a direct cost to the Forest Service. In addition to these costs, a variety of socioeconomic concerns have emerged which are likely to affect local conditions. Since the Forest Service is legally obligated to process the proposed mining plan of operations and provide reasonable access to the mineral estate, many comments regarding not approving the mining or calling for reductions in area and operations are considered outside the scope of the analysis. There were however, social concerns regarding the restoration itself. Those concerns pertaining to the social and economic environments fell into two categories. The first revolved around the cost to the government and potential for benefits to last well into the future. And the second area of concern consisted of the recreational benefits of restoration and the indirect effects resulting from possible changes in tourism pressure.

Cost analysis was conducted using Quicksilver, a financial analysis tool developed by the Forest Service to generate measures of financial efficiency. In this case, only the costs of implementation are quantifiable; therefore net present value is simply the discounted sum of costs incurred over the 20 year planning horizon. According to OMB Circular A-94, NPV is the standard criterion for deciding whether a project is economically justifiable (Office of Management and Budget 1992). Economic principles associated with the time value of money suggest that money now is worth more than money in the future. Thus, benefits and costs occurring in the future must be discounted back to represent their current value. A Federally prescribed discount rate of 4% is used in this analysis (FSM 1971.21). Inflation is also a variable that can affect the NPV's associated with each alternative. However, due to the uncertainty of future inflation, OMB Circular A-94 recommends the avoidance of making assumptions about the inflation rate whenever possible. Thus, for the purposes of this project, inflation will be left at zero.

IMPLAN

Effects from changes in recreation were modeled using IMPLAN 2.0 and TMECA (Minnesota IMPLAN Group 2006). Economic activity generated from recreational visits cycles through the economy and ultimately effects jobs and income. There are many interdependencies between businesses, consumers and natural resources. As visitor days increase, so does the economic activity associated with them. Businesses must hire more labor to accommodate the increase in demand for goods and services; this in-turn increases total income. For example, 1,000 overnight fishing trips by non-local parties are estimated to generate 3 jobs and $71,335 in labor income on the Kenai Peninsula Borough. Non-locals have a greater impact to the economy because their expenditures are considered new money, i.e. money that didn't exist locally prior to their trip. In the case of Hope and Sunrise, most of the activity would occur outside of the communities because they do not have the economic base to support a dramatic increase in expenditures. If infrastructure and retail markets were to expand, a greater proportion of jobs and income would be generated locally as a result of increased tourism.

Financial Efficiency

Financial efficiency is a comparison of costs and benefits that can be quantified in terms of funds spent or received within the project area. When considering quantitative issues, financial efficiency analysis offers a consistent measure for comparison of alternatives. This type of analysis does not account for non-market benefits, opportunity costs, individual values, or other values, benefits, and costs that are not easily quantifiable. This is not to imply that such values are not significant or important, but to recognize that non-market values are difficult to represent with appropriate dollar figures. The values not included in this part of the analysis are often at the center of disagreements in forest resource projects. Therefore, financial efficiency should not be viewed as a complete answer but as one tool decision makers use to gain information about resources, alternatives, and trade-offs between costs and benefits.

Because mining activities are not accounted for in this analysis, the market value of gold removed is not measured as a benefit in the financial efficiency analysis. Therefore, there are no benefits associated with this project; NPV is the discounted sum of costs associated with the restoration activities. Since there are no benefits accounted for in the quantitative analysis, the method applied is better referred to as a cost analysis rather than financial efficiency.

Scope of Analysis

The study area for the analysis of direct, indirect, and cumulative social and economic effects for the proposed Resurrection Creek Phase II Stream and Riparian Restoration project is the Resurrection Creek drainage, including the communities of Hope and Sunrise, Alaska. Hope, an unincorporated community located near the mouth of Resurrection Creek, is the population center closest to the project area. Sunrise is located seven miles east of Hope along the Hope Road. Social and economic impacts beyond these communities are expected to be too small to be measurable.

Activities for this project are estimated to occur over a twenty-year time horizon with the main restoration activities occurring in the first 3 to 4 years of implementation followed by monitoring of project effectiveness and administration of minerals resources. The direct, indirect and cumulative impacts are assumed to occur during this time period.

Issues

No significant social or economic issues were identified internally or through public scoping. Commenters expressed a desire to see employment opportunities provided in Hope in association with the restoration activities proposed. Efforts would be made to utilized local labor resources to accomplish restoration activities to the extent possible under all action alternatives.

Measurement Indicators

The primary measurement indicator for the quantitative analysis is NPV. Costs and benefits that cannot be displayed as a dollar value are accounted for in a qualitative analysis of impacts to the social and economic environments. Qualitative indicators discussed include ecological health, recreational capacity, visitor days, employment and community isolation.

Alternative 2 – Proposed Action

Ecological Health

Restoration activities would occur along a two mile stretch of Resurrection Creek within a 200 to 500 foot corridor as specified in the December 3, 2007 conceptual agreement between the Forest Service and Hope Mining Company (HMC). Restoration would be made in an attempt to bring the watershed back to pre-mining conditions, improving ecosystems and benefiting wildlife and aquatic species. The activities associated with this alternative would present a cost to the Forest Service and result in changed ecological conditions in the watershed. Restoration costs and improved ecological conditions could affect the social and economic environments in many ways. The purpose of this section is to estimate the direct, indirect and cumulative effects that would result under implementation of this alternative.

Direct and Indirect Effects

NPV

The effects analyzed for this alternative would occur as a result of implementation of full restoration and the continuation of mining operations. The NPV for all activities under this alternative is negative $2,694,761. This includes the cost of restoration as well as administration and monitoring costs. The discounted cost of restoration activities themselves would be negative $1,479,497; and the discounted cost of administration and monitoring would be $1,215,264. The sum of these costs is the total NPV of this alternative. Specific welfare criteria beyond the total cost of the project may affect the determination of the preferred alternative. The decision maker should assess the results of the cost analysis along with the non-monetized economic and social impacts associated with the alternatives. The NPV reported above is based solely on the financial information provided by local sources. The data provided does not allow for the quantitative valuing of secondary impacts. Thus, the financial measures provided here should be balanced with the qualitative assessment of additional socioeconomic impacts.

The Resurrection Creek Phase II Stream and Riparian Restoration Project would be funded primarily by the Forest Service, resulting in the expenditure of funds supplied by US tax payers. As reported above, the NPV for this alternative is a negative $2,694,761. A variety of ecological benefits are anticipated to occur as a result of this project. For the project to be considered economically efficient, benefits from the project must outweigh the total costs. Since the majority of benefits are unquantifiable, and must be measured in qualitative terms there is no distinct decision criteria representing economic efficiency, and much is left to

the discretion of the decision maker. Although restoration of the creek would result in improved ecological conditions, mining activities are protected under the 1872 Mining Law. There exists a potential for mining activities to occur post restoration. It is assumed that the probability of future mining is low because the improved technology used now for mining should allow for the majority of gold to be extracted, greatly reducing the potential benefit of future mining. However, if future mining were to occur in the restoration corridor, the claimant would be required to reclaim the landscape to post restoration conditions. Therefore, it is assumed that benefits from restoration would last well into the future.

Employment

The exact level of jobs and income that would be generated under this alternative is unknown. It is assumed that restoration activities would have employment and income impacts similar to those that occurred under Phase I restoration. Working with local stakeholders and interest groups to perform restoration activities could allow for some jobs to be performed by local residents. This is typically viewed as a benefit to economies by reducing unemployment and increasing labor income.

Recreation Capacity & Visitor Days

Another possible indirect effect from restoration is changed recreation patterns due to improved ecosystems and watershed health. Crone et al. (2002) report that Forest management activities affect freshwater salmon habitat, and that the industries most impacted by this are recreation and tourism. This alternative should bring the Resurrection Creek watershed closer to its natural state, improving scenery, water quality, wildlife and aquatic habitats. However, it is not anticipated that that this alternative would impact recreation more so than the natural migration of tourism patterns. Effects to visitor use are reported in the recreation section of this chapter.

There is no evidence that recreation visits to the study area would increase as a result of this alternative. However, fishing is a popular outdoor activity in the area. The nearby Russian and Kenai Rivers are well known for their fishing and become overcrowded with fisherman during salmon runs. A primary concern among local residents is that the restoration could improve salmon populations and indirectly cause a dramatic increase in visitors. The basis for this concern is the town of Hope lacks the infrastructure to support sport-fishing related tourism similar to that of the Russian River. A lack of parking lots, restrooms, fish cleaning stations, informational services and retail markets would greatly stress community resources, and could ultimately degrade the standard of living for local residents. Many people choose to live in Hope because of its isolation and high amenity values. Even though restoration along Resurrection Creek would improve natural amenities, the concern is that an increase in tourism could result in decreased quality of life for many residents. Conversely, some local residents may view improving ecosystems health as an opportunity to expand economic wellbeing by marketing goods and services to visitors. Hope is likely to experience greater proportional social and economic consequences from forest management due to low economic diversity scores, low median incomes and subsistence preference (Crone et al. 2002). Recreation related expenditures

have a positive economic impact on many isolated communities. Expenditures to non-locals are considered exports and represent new money to the area. If Hope were to experience an increase in recreational visits, current businesses would likely experience an increase in the demand for their goods and services. Likewise, entrepreneurs may see an opportunity to build additional infrastructure to meet that demand. Since there are no estimates of change in recreational visits that would occur under this alternative; it is not possible to predict the associated economic impacts.

Cumulative Effects

Cumulative effects include the total change in social and economic conditions that would result from the specifications under this alternative in conjunction with the direct and indirect effects of other present and reasonably foreseeable activities being conducted in the study area. For example, any environmental change as a result of the Proposed Action would be in addition to other restoration activities occurring simultaneously near Hope and Sunrise on both public and private lands. On the margin, other restoration projects are likely to have similar effects on the social and economic environment. Individually, such projects may not have much bearing on local communities; however, cumulatively, they may substantially impact the socioeconomic environment.

There are numerous present and reasonably foreseeable projects occurring in the study area that could yield additional consequences for social and economic conditions. Those projects are:

- Ongoing fuel reduction projects/harvesting/pile burning along Hope Highway
- Ongoing fuel reduction projects along Palmer Creek Road (new units to be implemented in 2010)
- Resurrection Creek Restoration Project Phase I
- Development on private land at mile 14 of Hope Highway and along Resurrection Creek Road.
- Porcupine Campground Reconstruction (slated for 2010)
- New trailhead development for Gull Rock and Hope Point Trail along Cripple Creek Road (also referred as Robinette Road).
- Hope Point Trail reconstruction
- Ongoing trail use of Resurrection Pass National Recreation Trail
- Existing approved mining operations within Hope Mining Company Claims north of Resurrection Pass National Recreation Trail bridge on both sides of Resurrection Creek. 95 acres
- Small scale suction dredging mining operations on Palmer Creek (HHH claims, Hope 11)

The actual direct and indirect effects of these projects are unknown. The degree to which the socioeconomic environment would be impacted, as well as the distribution of effects, cannot be determined from the information available. Individually, each project would likely have a minimal impact on social and economic conditions; however, cumulatively they could have a noticeable effect

on employment and income, as well as influence social well being for local residents.

Alternative 3: No Restoration

Ecological Health

Under this alternative there would be no restoration conducted by the Forest Service. Mining operations would continue as currently approved along with the proposed mining operations. HMC would be responsible to reclaim the watershed to its current state, but would receive no assistance from the Forest Service to improve watershed health and ecosystems diversity. The Forest Service would increase administrative oversight of mining operations and reclamation activities. This would allow for more oversight of mining activities, and more assurance that HMC would comply with the standards set forth in the Settlement Agreement.

Direct and Indirect Effects

NPV

Since restoration would not occur under this alternative, the only direct costs assumed by the Forest Service would be those associated with minerals administration. The NPV of this project would be negative $689,736, which is simply the discounted sum of total costs because there are no benefits that can be displayed in dollar values. The Forest Service would invoke more stringent administration over mining and reclamation activities. There would be no impacts to local employment and income resulting from restoration.

Recreation Capacity & Visitor Days

There would be no ecological benefits and thus no impacts on recreational visits. Refer to the Recreation Analysis in this chapter for additional information on effects to recreation. There are no anticipated benefits for aquatic life, therefore no expected increase in fishing pressure as a direct result of this alternative.

Employment

Overall, it is expected that social and economic conditions would remain similar to those under the No Action. Employment and income levels would not be substantially affected, and there would not be a significant increase in the demand for goods and services stimulating growth in infrastructure. Cost to tax payers would be much less than under the Proposed Action, but no restoration activities would take place.

Cumulative Effects

Cumulative effects would include the total change in social and economic conditions that would result from the specifications under this alternative in conjunction with the direct and indirect effects of other present and reasonably foreseeable activities being conducted in the study area. The list of projects in the cumulative effects of the Proposed Action would still impact the socioeconomic environments, but the effects contributed under this alternative would be less since no restoration activities would occur. There would be no

impact to employment and income as a result of restoration activities or changes in recreation patterns. There are no tools readily available to estimate the actual cumulative effects from the projects listed above and Alternative 3.

Irreversible and Irretrievable Commitments of Resources

The alternatives would not result in social or economic irreversible and irretrievable commitments of forest resources.

Compliance or conflicts with the CNF LRMP

There is no specific social or economic CNF LRMP direction. However, this project should meet the LRMP direction to:

- Work with local communities and interest groups to identify, record, restore, or preserve heritage resources on National Forest System lands (p III-12).
- Support heritage-based tourism activities (p III-12).
- Cooperate and support local communities and interest groups to further their interests in interpreting, identifying, recording, restoring, or preserving heritage resources on non-National Forest System lands (p III-12).

Conclusion

Mining activities by HMC are protected under the 1872 Mining Law, and are assumed to occur under all alternatives. Full restoration would only occur under Alternative 2. This would yield the greatest improvement in ecological conditions, but also impose the greatest cost to the Forest Service. A concern expressed by local stakeholders is that improved ecological capacity could increase opportunities for outdoor recreation. Increases in recreational visits could place added stress on existing infrastructure and public services, and would take away from the isolation that many residents enjoy. On the other hand, increased tourism could result in economic development opportunities. However, there is no evidence that Alternative 2 would impact recreational patterns. There would be no restoration under Alternative 3, but the Forest Service would have greater administration over HMC's mining and reclamation activities. There would be no ecological benefits and no change in recreational traffic. Therefore use of existing infrastructure would remain low, and the communities of Hope and Sunrise would remain isolated. The only cost to the Forest Service would be minerals administration.

Short-term Uses and Long-term Productivity

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by the Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

Short-term uses are those expected to occur on the Forest over the next ten years. These uses include recreation opportunities including outfitter guides, timber salvage, and potential mining activities. Long-term productivity refers to the capability of the land to provide resource outputs for a period of time beyond the next ten years.

The minimum management requirement established by regulation (36 CFR 219.27) provides for the maintenance of long-term productivity of the land. Minimum management requirements prescribed by the forest-wide standards and guidelines assure that long-term productivity of the land will not be impaired by short-term uses.

As provided for by the Forest Plan, minimum management requirements guide implementation of the action alternatives. Adherence to these requirements ensures that long-term productivity of the land is not impaired by short-term uses.

Monitoring specified in this EIS and the Forest Plan validates that the management requirements and mitigation are effective in protecting long-term productivity.

Unavoidable Adverse Effects

The following information is a summary of the unavoidable adverse effects analyses in this chapter.

Unavoidable Adverse Effects from implementation of Alternative 2:

Soils: If the mitigation measures are applied, adverse effects to soil resources that cannot be avoided are expected to be permanent for 24.3 acres. The estimated disturbance would likely be permanent due to flooding, compaction, and the placement of coarse substrate which cannot be avoided and mitigated.

Noise: Noise from mining activities or restoration activities may be a nuisance for some area residences within one mile of the project area.

Hydrology/Aquatic Resources: Short term increases in turbidity would occur during the course of the stream restoration work. These turbidity pulses could impact aquatic populations in the short term, but the impact of these turbidity pulses on the overall fish populations is expected to be small and limited to the project area and two miles downstream. Despite mitigation measures, direct mortality to aquatic populations including macroinvertebrates is possible during equipment crossings and channel construction.

Wildlife: The mining claim holder has a right to the mineral estate; therefore short and long term adverse effects to wildlife habitat up to 264 acres due to removal of the majority of vegetation during mining operations cannot be avoided or mitigated. Despite mitigation measures, direct mortality to individuals of a variety of birds and small mammals is possible in areas of mining and restoration activities.

Scenic Resources: The topography would be heavily modified, and the majority of vegetation would be removed in the mining areas affecting several characteristics of the landscape resulting in a decrease in scenic quality over 20 years or more.

Unavoidable Adverse Effects from implementation of Alternative 3:

Soils: Adverse effects to 37.6 acres of soil cannot be avoided are expected to be permanent because natural processes would not be able to counter or restore them within human timeframes.

Noise: Noise from mining activities or restoration activities may be a nuisance for some area residences within one mile of the project area.

Hydrology/Aquatic Resources: Short term increases in turbidity would occur during the course of the channel relocation work. These turbidity pulses could impact aquatic populations in the short term, but the impact of these turbidity pulses on the overall fish populations is expected to be small and limited to the lower portion of the project area and two miles downstream. Despite mitigation measures, direct mortality to aquatic populations is possible during equipment crossings and channel relocation. Mining activities would create a moderate to high potential for failure of settling ponds, which could cause impairment of water quality in Resurrection Creek.

Wildlife: The mining claim holder has a right to the mineral estate; therefore short and long term adverse effects to wildlife habitat on 267 acres due to removal of the majority of vegetation during mining operations can't be avoided or mitigated. Despite mitigation measures, direct mortality to individuals of a variety of birds and small mammals is possible in areas of mining and restoration activities.

Scenic Resources: The topography would be heavily modified, and the majority of vegetation would be removed in the mining areas affecting several characteristics of the landscape resulting in a decrease in scenic quality over 20 years or more.

Irreversible and Irretrievable Commitments of Resources

Irreversible is a term that describes the loss of future actions. The term applies primarily to the effects of use of nonrenewable resources, such as minerals or cultural resources, or to those factors, such as soil productivity that are renewable only over long periods of time.

Irretrievable is a term that applies to the loss of production, harvest, or use of natural resources. For example, some or all of the timber production from an area is lost irretrievably while an area is serving as a winter sports site. The production lost is irretrievable, but the action is not irreversible. If the use changes, it is possible to resume timber production.

Irreversible and Irretrievable Commitments of Resources for Alternative 2:

Minerals: The extraction of gold is an irreversible commitment of resources. Approximately 200 acres (3,226,700 cubic yards) would be mined.

Soils: About 24.3 acres of the estimated disturbance of soils would likely be permanent due to flooding and compaction, and the placement of coarse substrate which cannot be avoided and mitigated.

Hydrology/Aquatic Resources: Direct mortality to aquatic populations, including macroinvertebrates, would likely occur during equipment crossings and channel construction.

Ecology: There would be a loss of the current unique "botanical desert" created by the tailings piles. There would be a change in the forested structure of the project area by the removal of trees. The successional pathway of the project area's forested stands would be altered. There would be a change in the forested composition of the project area by the removal of different tree species than what would develop over time if no harvest took place. These changes may linger in the mining areas if species composition is mainly non-native species.

Wildlife: Actions would cause varying degrees of soil productivity loss up to 264 acres, with 24.3 acres of permanent loss. On 24.3 acres, this would permanently inhibit growth of vegetation and associated wildlife habitat. Mature forest composition and structure containing large trees, which is important wildlife

habitat for a variety of species may be delayed by 40 or more years in developing due to loss of site productivity on the 264 acres. Despite mitigation measures, direct mortality to individuals of a variety of birds and small mammals is possible in areas of mining and restoration activities.

Heritage Resources: Loss of portions of the historic landscape would occur. However, not all portions of the contributing elements (tailings) would be lost, and portions that are removed would be captured by data recording and mitigated by interpretive displays.

Scenic Resources: The topography would be heavily modified, and the majority of vegetation would be removed in the mining areas affecting several characteristics of the landscape resulting in a decrease in scenic quality over 20 years or more.

Irreversible and Irretrievable Commitments of Resources for Alternative 3:

Minerals: The extraction of gold is an irreversible commitment of resources. Approximately 193 acres (3,114,000 cubic yards) would be mined.

Soils: About 37.6 acres of disturbance, including roads, is estimated to be an irreversible or irretrievable commitment of soil resources.

Hydrology/Aquatic Resources: Direct mortality to aquatic species, including macroinvertebrates, would likely occur as a result of equipment crossings and relocation the Resurrection Creek channel.

Ecology: There would be a loss of the current unique “botanical desert” created by the tailings piles. There would be a change in the forested structure of the project area by the removal of trees. The successional pathway of the project area’s forested stands would be altered. There would be a change in the forested composition of the project area by the removal of different tree species than what would develop over time if no harvest took place. These changes may linger in the mining areas if species composition is mainly non-native species.

Wildlife: Actions would cause varying degrees of soil productivity loss up to 267 acres, with 37.6 acres of permanent loss (see soils analysis). Mature forest composition and structure containing large trees, which is important wildlife habitat for a variety of species may take an additional 40 or more years to develop due to loss of site productivity. Despite mitigation measures, direct mortality to individuals of a variety of birds and small mammals is possible in areas of mining and restoration activities.

Heritage Resources: Loss of portions of the historic landscape would occur. However, not all portions of the contributing elements (tailings) would be lost, and portions that are removed would be captured by data recording and mitigated by displays.

Scenic Resources: The topography would be heavily modified, and the majority of vegetation would be removed in the mining areas affecting several characteristics of the landscape resulting in a decrease in scenic quality over 20 years or more.

Cumulative Effects

Cumulative effects are addressed in the environmental consequences sections under each resource in this chapter.

Other Required Disclosures

NEPA at 40 CFR 1502.25(a) directs "to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with …other environmental review laws and executive orders."

The Biological Evaluation for wildlife (see Appendix A) indicates that no formal or informal consultation with Fish and Wildlife is necessary for wildlife species because there are no federally listed or proposed wildlife species or designated or proposed critical habitats in the action area. However, consultation with Fish and Wildlife Service will continue for fisheries.

Consultation with Alaska State Historic Preservation Office is ongoing for heritage resources.

CHAPTER 4. CONSULTATION AND COORDINATION

Preparers and Contributors

The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons during the development of this Environmental Impact Statement:

Interdisciplinary Team Members

Brian Bair	**TEAMS Fisheries Biologist**
Project Role & Responsibility	Interdisciplinary Core Team Member: Fisheries, Noise; Lead Project Designer
Degree	Bachelor of Science in Biology, Montana State University 1990
Experience	16 years of experience in watershed and aquatic habitat condition assessment, water quality and habitat restoration / rehabilitation project planning, design and implementation.
Mary Ann Benoit	**Seward Ranger District Wildlife Biologist**
Project Role & Responsibility	Wildlife Biologist
Degree	Bachelor of Science in Biology, Northern Arizona University, 1994. Bachelor of Arts in Interior Design, Mount Vernon College, 1980
Experience	24 years of experience in wildlife biology, natural resource management, and environmental analysis, 4 national forests in Regions 3 and 10.
Betty Charnon	**Chugach National Forest Ecologist**
Project Role & Responsibility	Ecologist
Degree	Bachelor of Arts in Human Ecology, Connecticut College 1988 Master of Forestry, Yale School of Forestry and Environmental Studies 1991
Experience	18 years experience as ecologist/botanist for the Forest Service.
Steve Hohensee	**Chugach National Forest Geologist**
Project Role & Responsibility	Forest Geologist, Mineral Examiner, and Certified Minerals Administrator. Advisory role on mining law, mineral management regulations, financial assurance and bonding, mining methodology, etc.
Degree	MS in Geology, University of Missouri-Columbia, 1989
Experience	8 years managing large mining projects from environmental analysis to construction/implementation, administration during operations, maintaining adequate financial assurance for reclamation.

Karen Kromrey	**CNF Public Services Staff Officer – Planning**
Project Role & Responsibility	Interdisciplinary Core Team Member, Mining Administration
Degree	Bachelor of Science in Forestry, Colorado State University, 1987
Experience	24 years of experience in Forest Management, recreation Management, with the past five years focus on Minerals Management (Regions 2 and 10).
Bill MacFarlane	**Chugach National Forest Hydrologist**
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Josh Milligan	**Seward Ranger District NEPA Coordinator**
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Experience	8 years with the Forest Service in natural resource management.
Sherry Nelson	**Seward Ranger District Heritage Program Manager**
Project Role & Responsibility	SHPO Consultation
Degree	MA Anthropology, History and Historic Preservation, University of Oregon 2002; BA Anthropology, Minor Geological Sciences, University of Oregon, 2000
Experience	7 years with the Forest Service
Robert Nykamp	**TEAMS Archaeologist**
Project Role & Responsibility	Archaeologist; assist in the preparation of cultural resource mitigation factors and contribution to NEPA document
Degree	BA, Anthropology, University of Colorado, Boulder (1978); Graduate Studies program, University of Colorado, Boulder, 1982-1985
Experience	Professional archaeologist since 1977; Forest Archaeologist for 10 years, 3 years Wild and Scenic River planner; NEPA IDT member and project leader; TEAMS Heritage Resources Program Lead (manager) since 2001
Barbara Ott	**TEAMS Economist**
Project Role & Responsibility	Social and Economic Analyst responsible for the Social and Economic Affected Environment analysis.
Degree	M.S. in Management from Colorado State University. B.A. in Business Administration, Chadron State College.
Experience	30 years of experience in social and economic analyses for NFMA and NEPA compliance, forest plan revisions, resource management plans, and projects, with experience in all 9 regions of the Forest Service.

Bobbie Jo Skibo	**Seward Ranger District Recreation Specialist**
Project Role & Responsibility	Recreation Environmental Analysis
Degree	Master of Applied Science- Environmental Management and Policy, University of Denver, 2009; Bachelor of Arts-Ecopsychology, Prescott College, 2002.
Experience	7 years of experience working on broad-based interagency and interdisciplinary natural resource issues on the Chugach National Forest.
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Degree	Bachelor of Landscape Architecture, Utah State University, 1988 (*Sigma Alpha Zeta*); Associate of Science, Northwest Community College, 1985
Experience	20 years of experience regarding environmental analysis, with an emphasis on scenery management in Forest Service Regions 2, 3, 4, 5, 6, 8 and 10.
Dan Svoboda	**Chugach National Forest Soil Scientist**
Project Role & Responsibility	Soils investigation, analysis, and interpretation.
Degree	B.S.; M.S. Forestry; Plant & Soil Science 1975; 1981 Southern Illinois Univ., Carbondale
Experience	32 years in assessment, inventory, use, ecology, management, and restoration of forest, range, agricultural, and mined lands soil resources.
Joshua Wilson	**TEAMS Economist**
Project Role & Responsibility	Social and Economic Analyst Environmental Consequences
Degree	BS Managerial Economics, UC Davis 2003; MS Ag and Resource Economics, Colorado State University 2005
Experience	1.5 Years as a STEP Economist for the Forest Service Ecosystems Management Coordination, 1.5 Years as a contractor Economist for TEAMS, and permanent TEAMS employee since April 2009.

Distribution of the Environmental Impact Statement

This Draft Environmental Impact Statement has been distributed to individuals who specifically requested a copy of the document. In addition, copies of the Draft Environmental Impact Statement and/or a website link were made available to the following Federal agencies, federally recognized tribes, State and local governments, organizations, and individuals:

FEDERAL AGENCIES

Congress
Honorable Don Young, U.S. House of Representatives
Honorable Lisa Murkowski, U.S. Senate
Honorable Mark Begich, U.S. Senate

Advisory Council on Historic Preservation
Advisory Council on Historic Preservation, Director of Planning and Review

Department of Agriculture
USDA APHIS PPD/EAD
Natural Resources Conservation Service
National Agricultural Library

Department of Interior
Bureau of Land Management, Alaska Office
Office of Environmental Policy and Compliance

Department of Commerce
NOAA Office of Policy and Strategic Planning
NOAA Restoration Center
National Marine Fisheries Service

Department of Defense
Army Corp of Engineers, Pacific Ocean Division

Department of Energy
Director, Office of NEPA Policy and Compliance

Environmental Protection Agency
Environmental Protection Agency, Region 10

Department of Transportation
U.S. Coast Guard, Environmental Impact Branch

Federal Aviation Administration
Federal Aviation Administration, Alaska Region Headquarters

US Fish and Wildlife Service
Ecological Services
Office of Subsistence Management

STATE AGENCIES

Alaska Coastal Management Program
Alaska Department of Fish and Game
Alaska Department of Natural Resources
Office of Habitat Management and Permitting
Division of Mining, Lands & Water
Alaska Department of Environment Conservation
Division of Water
Kenai Peninsula Borough

LOCAL/REGIONAL GROUPS

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Alaska Miners Association, Inc.
Chugach Outdoor Center / Jay Doyle
Hope Mining Company / Al Johnson
Hope Sunrise Historical Society / Diane Olthius
Hope/Sunrise Neighborhood Development Association / Jeanne Berger

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GLOSSARY

Anoxic — The condition of oxygen deficiency or absence of oxygen. Soils that have undergone a long period of oxygen deficiency lack biological attributes important for plant growth and have an altered chemistry that is not conducive to near surface soil processes.

Bankfull Channel — The stream channel that is formed by the dominant discharge, also referred to as the active channel, which meanders across the floodplain as it forms pools, riffles, and point bars.

Bar or Gravel Bar — (1) A sand or gravel deposit found on the bed of a stream that is often exposed during low-water periods. (2) An elongated landform generated by waves and currents, usually running parallel to the shore, composed predominantly of unconsolidated sand, gravel, stones, cobbles, or rubble and with water on two sides.

Bed Load — (1) Sediment particles up to rock, which slide and roll along the bottom of the streambed. (2) Material in movement along a stream bottom, or, if wind is the moving agent, along the surface. (3) The sediment that is transported in a stream by rolling, sliding, or skipping along or very close to the bed. Contrast with material carried in Suspension or Solution.

Bed Shear Stress — The force per unit area exerted by water as it shears over a surface.

Entrenchment Ratio — Flood-prone width divided by bankfull width; a measure of floodplain accessibility and inundation.

Floodplain — (1) (FEMA) Any normally dry land area that is susceptible to being inundated by water from any natural source. This area is usually low land adjacent to a river, stream, watercourse, ocean or lake. (2) A strip of relatively smooth land bordering a stream, built of sediment carried by the stream and dropped in the slack water beyond the influence of the swiftest current. It is called a Living Flood Plain if it is overflowed in times of high water but a Fossil Flood Plain if it is beyond the reach of the highest flood. (3) The lowland that borders a stream or river, usually dry but subject to flooding. (4) The transversely level floor of the axial-stream drainage way of a semi-bolson or of a major desert stream valley that is occasionally or regularly alluviated by the stream overflowing its channel during flood. (5) The land adjacent to a channel at the elevation of the bankfull discharge, which is inundated on the average of about 2 out of 3 years. The floor of stream valleys, which can be inundated by small to very large floods. The one-in-100-year floodplain has a 0.01 chance per year of being covered with water. (6) That land outside of a stream channel described by the perimeter of the Maximum Probable Flood. Also referred to as a Flood-Prone Area.

Flood-prone Width — Width or extent of floodwaters within a valley.

Graminoid — A grass or grass-like plant.

Hyporheic — The hyporheic zone is a region beneath and lateral to a stream bed where there is mixing of shallow groundwater and surface water.

In-stream Large Woody Material — Coarse wood material such as twigs, branches, logs, trees, and roots that fall into streams.

Length of Meander — One full sine wave of a stream meander.

Meander — (1) The turn of a stream, either live or cut off. The winding of a stream channel in the shape of a series of loop-like bends. (2) A sinuous channel form in flatter river grades formed by the erosion on one side of the channel (pools) and deposition on the other side (point bars).

Meander Belt Width — Amplitude or width containing the meander.

Mine tailings — Rock spoils from mining activity.

Morphology — (1) The science of the structure of organisms. (2) The external structure form and arrangement of rocks in relation to the development of landforms. River morphology deals with the science of analyzing the structural make-up of rivers and streams. Geomorphology deals with the shape of the Earth's surface.

Net Present Value (NPV) — The discounted sum of monetizable costs and benefits.

Organic — Matter derived from living organisms.

Pool — (1) A location in an active stream channel, usually located on the outside bends of meanders, where the water is deepest and has reduced current velocities. (2) A deep reach of a stream; a part of the stream with depth greater than the surrounding areas frequented by fish. The reach of a stream between two riffles; a small and relatively deep body of quiet water in a stream or river. Natural streams often consist of a succession of pools and riffles.

Recreation Opportunity Spectrum (ROS) — A system developed by the Forest Service that classifies recreation settings on National Forest lands according to their physical, social, and managerial characteristics. These ROS settings are formally applied to National Forest lands and not adjacent private lands. However, the presence and condition of private lands influence the ROS settings assigned to National Forest lands (ROS Users Guide, 1982).

Reference Reach — Undisturbed reach of stream that possesses similar channel morphology, hydrology, sediment regime and biota relative to the disturbed site to be analyzed, rehabilitated or restored.

Recurrence Interval — In statistical analysis of hydrologic data, based on the assumption that observations are equally spaced in time with the interval between two successive observations as a unit of time, the return period is the reciprocal of 1 minus the probability of a value equal to or less than a certain value; it is the mean number of such time units necessary to obtain a value equal to or greater than a certain value one time. For example, with a one-year interval between observations, a return period of 100 years means that, on the average, an event of this magnitude, or greater, is not expected to occur more often than once in 100 years.

Redd — A depression in gravel created by salmon and trout to deposit and incubate their eggs.

Riffle — (1) A shallow rapids, usually located at the crossover in a meander of the active channel. (2) Shallow rapids in an open stream, where the water surface is broken into waves by obstructions such as shoals or sandbars wholly or partly submerged beneath the water surface. (3) Also, a stretch of choppy water caused by such a shoal or sandbar; a rapid; a shallow part of the stream.

Riparian Areas (Habitat) — (1) Land areas directly influenced by a body of water. Usually such areas have visible vegetation or physical characteristics showing this water influence. Streamsides, lake borders, and marshes are typical riparian areas. Generally refers to such areas along flowing bodies of water. The term "littoral" is generally used to denote such areas along non-flowing bodies of water. (2) (USFWS) Plant communities contiguous to and affected by surface and subsurface hydrologic features of perennial or intermittent Lotic and Lentic water bodies (rivers, streams, lakes, or drainage ways). Riparian areas have one or both of the following characteristics: (a) distinctively different vegetative species than adjacent areas, and (b) species similar to adjacent areas but exhibiting more vigorous or robust growth forms. Riparian areas are usually transitional between Wetlands and Uplands.

Sediment — (1) Soil particles that have been transported from their natural location by wind or water action; particles of sand, soil, and minerals that are washed from the land and settle on the bottoms of wetlands and other aquatic habitats. (2) The soil material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by erosion (by air, water, gravity, or ice) and has come to rest on the earth's surface. (3) Solid material that is transported by, suspended in, or deposited from water. It originates mostly from disintegrated rocks; it also includes chemical and biochemical precipitates and decomposed organic material, such as humus. The quantity, characteristics, and cause of the occurrence of sediment in streams are influenced by environmental factors. Some major factors are degree of slope, length of slope, soil characteristics, land usage, and quantity and intensity of precipitation. (4) In the singular, the word is usually applied to material in suspension in water or recently deposited from suspension. In the plural the word is applied to all kinds of deposits from the waters of streams, lakes, or seas, and in a more general sense to deposits of wind and ice. Such deposits that have been consolidated are generally called sedimentary rocks. (5) Fragmental or clastic mineral particles derived from soil, alluvial, and rock materials by processes of erosion, and transported by water, wind, ice, and gravity. A special kind of sediment is generated by precipitation of solids from solution (i.e., calcium carbonate, iron oxides).

Semi-Primitive Non-Motorized — An area characterized by a predominantly natural or natural-appearing environment. Interaction with between other users is low, but there is often evidence of users.

Side Channel — Typically small stream channel which branches off of the mainstream channel.

Snag — A tree or branch embedded in a lake or streambed. A stub or stump remaining after a branch has been lopped or torn off.

Smolt — A juvenile, silvery salmon up to 15 cm long, which has lost its parr marks and has attained the silvery coloration of the adult. This coloration signifies the readiness of the young fish to migrate to the seas and its ability to adapt to the water environment.

Spawning Gravel — Streambed substrate suitable for salmonid spawning.

Subsoiling — The breaking up of subsoils without inverting them.

Succession — (Biology) (1) The ecological process of sequential replacement by plant communities on a given site as a result of differential reproduction and competition. (2) Directional, orderly process of change in a living community in which the community modifies the physical environment to eventually establish an ecosystem which is as stable as possible at the site in question.

Thalweg — (1) The line connecting the deepest points along a stream. (2) The lowest thread along the axial part of a valley or stream channel. (3) A subsurface, ground-water stream percolating beneath and in the general direction of a surface stream course or valley. (4) The middle, chief, or deepest part of a navigable channel or waterway.

Turbidity — A measure of light obscuration by water. Turbidity increases as the amount of suspended sediments in the water column increase.

Woody Debris — Coarse wood material such as twigs, branches, logs, trees, and roots that fall into streams.

LIST OF ACRONYMS AND ABBREVIATIONS

ACMP	Alaska Coastal Zone Management Program
ACOE	Army Corps of Engineers
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ATV	All Terrain Vehicle
BLM	Bureau of Land Management
BMP	Best Management Practice
cfs	Cubic feet per second
CFR	Code of Federal Regulations
CNF	Chugach National Forest
dB	Decibel
dbh	Diameter at breast height (Forestry)
DEIS	Draft Environmental Impact Statement
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FSH	Forest Service Handbook
FSM	Forest Service Manual
GIS	Geographic Information Systems
HMC	Hope Mining Company
IRA	Inventoried Roadless Area
LAA	Likely Adversely Affected
LRMP	Land and Resource Management Plan
LWD	Large Woody Debris
MIS	Management Indicator Species
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NHA	National Heritage Area
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPV	Net Present Value
NTU	Nephelometric Turbidity Unit
OHV	Off-Highway Vehicle
OMB	Office of Management and Budget
SHPO	State Historic Preservation Office
SIO	Scenic Integrity Objective
SSI	Species of Special Interest
TES	Threatened and Endangered Species
USC	United States Code
USDA	United States Department of Agriculture
USF&WS	United States Fish and Wildlife Service
USFS	United States Forest Service

APPENDIX A. BIOLOGICAL EVALUATION

CHUGACH NATIONAL FOREST - Biological Evaluation for Threatened, Endangered, or Sensitive Species

Date: 8-12-09

Project Name: Resurrection Creek Restoration II

District: Seward Ranger District
Project Type: Riparian Area Restoration and Mining operations
Location: Seward District – Resurrection Creek, Hope Mining Company claims near Hope Alaska.
Project Actions: Restoration of 75 acres of floodplain, and mining on 299 acres.
Vegetation/Habitat Type: Pole size to large hardwoods (cottonwood, birch) and seedling/sapling to large conifers (white spruce and mountain hemlock).

I. Prior Biological Evaluation				**No**	**Yes**
Prior Project BE: Wildlife	Date:			X	
II. Species and/or Habitat				**No**	**Yes**
2. Previous Species Observation				X	
3. Federally Listed Species Present				X	
4. Habitat For Federally Listed Species Present				X	
5. Sensitive Species Present				X	
6. Habitat For Sensitive Species Present				X	
III. Analysis of Effects				**No**	**Yes**
1. Significant Habitat Alteration					X
2. Effects Outside Project Area					X
3. Cumulative Effects on Listed Species or Habitat				X	
4. Cumulative Effects on Sensitive Species or Habitat				X	
IV. Determination of Effects				**No**	**Yes**
1. No Affect Threatened, Endangered, or Proposed Species					X
2 May Affect Threatened, Endangered, or Proposed Species				X	
3. May Affect Individual Sensitive Species				X	
4. May Affect Sensitive Species' Population Viability				X	
V. Consultation Requirements				**No**	**Yes**
1. Formal Consultation Required				X	
2. Additional Informal Consultation Required				X	
Prepared and Approved By	Mary Ann Benoit		Date: 8-11-09		

AFFECTED ENVIRONMENT

HABITAT

The Resurrection Creek project area is approximately 375 acres, containing a mixture of primarily pole size to large hardwoods (cottonwood, birch) and seedling/sapling to large conifers (white spruce and mountain hemlock). Details are listed in the affected environment section of the wildlife specialist report.

WILDLIFE

Effects on Federally Threatened and Endangered Species or Critical Habitat

The humpback whale (Megaptera novaeangliae) is an endangered species that occurs in all oceans of the world. Humpback whales do not occur in the project area. *Determination of Effect: No effect to humpback whales or their habitat.*

The Steller sea lion (Eumetopias jubatus) is an endangered species with centers of abundance and distribution in the Gulf of Alaska and Aleutian Islands. The Steller's sea lion does not occur in the project area. *Determination of Effect: No effect to Steller's sea lions or their habitat.*

Steller's eiders (Polysticta stelleri) are a threatened species that do not breed on the Chugach National Forest. They may winter on the south end of the Kenai Peninsula, but not on the Seward Ranger District (personal communication with Bill Shuster, Seward Ranger District Resource Staff Officer). *Determination of Effect: No effect to Steller's eiders or their habitat.*

The Cook Inlet beluga whale (Delphinapterus leucas) is an endangered marine mammal that occurs in Cook Inlet, including Turnagain Arm near the mouth of Resurrection Creek. Beluga whale movements follow their prey, coinciding with anadromous fish migrations. They often aggregate near the mouths of rivers and streams where salmon runs occur. Known and possible natural factors influencing the Cook Inlet beluga whales include stranding events, predation, parasitism and disease, and environmental change. Human-induced factors may include subsistence harvest, poaching, fishing, pollution, vessel traffic, tourism and whale watching, coastal development, noise, oil and gas activities, and scientific research. Beluga whales do not occur in the project area. Indirectly, foraging habitat could be affected if the mining operations were to affect salmon reproduction and survival in resurrection Creek. The fisheries biologist determined that there would be no effect on salmon or other fish, so this is unlikely. Restoration work should improve salmon spawning and rearing habitat. The scope of the restoration work is probably not large enough to have a substantial effect on the Beluga whale population, although it may have a minor beneficial effect to individuals. *Determination of Effect: No effect to beluga whales or their habitat.*

Effects on Proposed or Candidate T&E Species/Critical Habitat

The Kittlitz's Murrelet (Brachyramphus brevirostris), is a candidate species for listing as endangered or threatened. This small diving seabird inhabits Alaskan coastal waters. During the breeding season, this species prefers habitat near tidewater glaciers, and to a lesser extent, offshore of remnant high-elevation glaciers and de-glaciated coastal mountains. Breeding habitat requirements are less well known. Available information indicates this species nests in unvegetated scree fields, coastal cliffs, barren ground, rock ledges, and talus above timberline in coastal mountains, generally in the vicinity of glaciers, cirques near glaciers, or recently glaciated areas. During the breeding season they are often found in mid-bay waters and within

200 m of shore. During the non-breeding season they often occur farther offshore. Breeding and non-breeding habitat does not likely exist in the project areas. *Determination of Effect: No effect to Kittlitz's murrelets or their habitat.*

Effects on Sensitive Species

The Dusky Canada Goose (Branta canadensis occidentalis) is a Region 10 sensitive species. The breeding distribution is restricted primarily to the Copper River Delta (Campbell et al. 1990). It winters primarily in the Willamette Valley in Oregon, and along the Columbia River in Washington (Cornely et al. 1988). The Dusky Canada goose does not occur in the project area. *Determination of Effect: No effect to Dusky Canada geese or their habitat.*

The Aleutian Tern (Sterna aleutica) is a Region 10 sensitive species that generally arrives at the Kenai Peninsula between 4–16 May. Fall migration begins shortly after individuals abandon colonies, typically in August. Staging sometimes occurs in coastal areas, but birds usually depart directly for the sea. Breeding colonies are restricted to coastal sites, typically located at heads of bays, reefs, permanent and ephemeral islands, estuaries in lagoons and at river mouths (Haney et al. 1991, North 1997). They often nest with Arctic Terns. Nests are a depression in vegetation, usually on grassy or mossy flats, sand spits, sandbars, sand dunes, pebbly seacoasts, vegetated summits of flat-topped islands, reticulate and string bogs, wet coastal marshes, or tundra (Haney et al. 1991, North 1997). Colony locations frequently shift from year to year among traditionally used sites; as a result, local populations may fluctuate greatly (Haney et al. 1991). They usually forage in shallow water, including tidal rips, along rivers, and over inshore marine waters, and freshwater ponds and marshes, bays or fjord habitats. Summer diet primarily small fishes; capelin and sand lance are favored. They may also consume marine invertebrates and some insects. In summer, they forage mostly in shallow water, near colonies and within 1–10 km of land, but also well out to sea.

Individuals lay clutches of 1-3 eggs in mid-May to late June. Hatching occurs mid-June to late July. Young fledge in 4 weeks, mid-July to late August; may remain at nest for 1–2 weeks after they are able to fly. Forages alone, in monospecific flocks, or in mixed-species flocks. Frequently associated with Arctic tern in North America. Due to the species tendency to concentrate in a few areas, contamination as a result of oil spills is a potential threat. Heavy predation by birds and mammals and mortality associated with exposure to inclement weather may contribute to low reproductive success. Species is sensitive to disturbance at nesting colonies; complete colony abandonment has been observed following a single visit by humans (Haney et al. 1991). On non-breeding range, threatened by over fishing of prey species, uncontrolled waste disposal, and land-based pollution (Haney et al. 1991).

The project area does not contain suitable nesting habitat, but potential habitat may exist near the mouth of Resurrection River. The project area is within 10 km of this site and the coast so the project area may contain potential foraging habitat. This species has not been documented to occur in the area. Surveys have not been done in the area as it was just added to the sensitive species list. Mining operations are not expected to affect fish habitat or induce contaminants into the river due to mitigation measures, state regulations, and best management practices required during this operation. Mining activities are unlikely to affect tern populations. Restoration activities will benefit fish habitat, but the project is limited in scale so may only have minor beneficial effects to individuals. *Determination of Effect: No effect to Aleutian Tern's or their habitat.*

The black oystercatcher (Haematopus bachmani) is a Region 10 sensitive species. Completely dependent on marine shorelines for its food and nesting, this is a monogamous, long-lived bird. Breeding pairs establish well-defined, composite feeding and nesting territories and generally occupy the same territory year after year, often along low-sloping gravel or rocky shorelines where intertidal prey are abundant. Pairs nest just above the high-tide line and use the intertidal zone to feed themselves and provision their chicks. Diets of adults and chicks consist mainly of mollusks; principally mussels and limpets. No existing or potential nesting or foraging habitat exists in the project area. *Determination of Effect: No effect to black oystercatchers or their habitat.*

DISCUSSION OF CUMULATIVE EFFECTS

This project will not cause short or long-term changes to sensitive wildlife habitat as a direct result of mining activities. There should be no adverse cumulative effects on endangered, threatened, or sensitive species due to mitigation measures and best management practices followed to reduce any impacts to fish populations or potential contamination of the creek.

MITIGATING MEASURES REQUIRED FOR ALL ALTERNATIVES

Mitigation measures are listed in detail in the Environmental Assessment for this project

CONCLUSION

The Resurrection Creek II Restoration Project is not likely to have an adverse effect on vertebrate endangered, threatened or endangered species or their habitats, nor should it impact sensitive species or their habitats.

LITERATURE CITED IN BIOLOGICAL EVALUATION

Campbell, B. H. 1990. Factors affecting the nesting success of Dusky Canada Geese, *Branta canadensis occidenta*l*is* , on the Copper River delta, Alaska. Can. Field-Nat. 104: 567–574.

Cornely, J. E., B. H. Campbell and R. L. Jarvis. 1985. Productivity, mortality, and population status of dusky Canada Geese. Trans. N. Am. Wildl. Nat. Resour. Conf. 50: 540–548.

Haney, J. C., J. M. Andrew, and D. S. Lee. 1991. A closer look: Aleutian Tern. Birding, December 1991: 347-351.

North, M. R. 1997. Aleutian Tern (Sterna aleutica). In: The Birds of North America, No. 291 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and the American Ornithologists' Union, Washington, D.C.

APPENDIX B. MAPS

The following maps are provided in this section:

- Aerial photo map of the project area
- Alternative 2 Map (The Proposed Action)
- Alternative 3 Map (No Restoration)