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Forest Service
Alaska Region

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# Environmental Assessment

## Daves Creek Stream Restoration Project

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

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# Summary

The Chugach National Forest is proposing to conduct a stream and riparian restoration project on Daves Creek, downstream of the Tern Lake outlet. The project area is located on the Kenai Peninsula approximately 11 miles east of Cooper Landing, Alaska on the Seward Ranger District. The proposed project would address the area around the Tern Lake outlet and the first ½-mile of Daves Creek downstream of the outlet. The Proposed Action includes the following:

- Replace the existing culvert with a bridge at the outlet of Tern Lake to improve fish passage.
- Restore the stream channel, floodplain, and streamside vegetation within a 2,000-foot long segment of Daves Creek downstream of the Tern Lake outlet to improve fish and wildlife habitat, stream channel condition, and water quality.
- Replace the existing fish-viewing platform at the Tern Lake outlet and enhance the existing trails in the immediate vicinity of the Tern Lake Day Use Area.

In addition to the Proposed Action, the Forest Service also evaluated two other alternatives:

- **Alternative A (No Action):** This alternative would not allow for any restoration of Daves Creek, replacement of the culvert, or recreational facility improvement.
- **Alternative C (Limited Restoration):** This alternative proposes the following:
  - Replace the existing culvert at the Tern Lake outlet with a bridge to improve fish passage.
  - Restore the stream channel of only the first 400 feet of Daves Creek downstream of the Tern Lake outlet by modifying the existing log weir structures and constructing pool-riffle sequences in order to improve fish migration, fish habitat, and stream channel condition. The remainder of the heavily impacted stream channel further downstream along the Sterling Highway would remain in its current condition.
  - Replace the existing fish-viewing platform at the Tern Lake outlet and enhance the existing trails in the immediate vicinity of the Tern Lake Day Use Area.

Environmental effects of the Proposed Action include a variety of short-term effects that would occur as a result of construction. These include the creation of several temporary turbidity pulses in Daves Creek, removal of existing riparian vegetation, mortality of aquatic species, loss of riparian trees and snags that provide wildlife habitat, disturbance of soils, and increases in the spread of invasive plants. These short term impacts would occur during the 2-year construction period.

Numerous benefits over existing conditions would be realized over time as a result of project implementation. The short-term benefits would include increased fish passage into Tern Lake, improved aquatic habitat, improved stream channel and floodplain function, and improved water quality. Associated longer term benefits would include improved quality of riparian vegetation, increased fish production, improved wildlife habitat, improved soil conditions and productivity, and increased plant species and community diversity within the riparian area.

Based upon the environmental consequences of the alternatives, the responsible official will decide whether or not to approve replacement of the existing culvert at the Tern Lake outlet, whether or not to approve the reconstruction of the Daves Creek stream channel, floodplain, and riparian area, and whether or not to approve the replacement of the existing fish viewing platform and enhancement of the existing trails in the immediate vicinity of the Tern Lake Day Use Area.

# Chapter 1 - Proposed Action and Purpose & Need

## Introduction

The Forest Service has prepared this Environmental Assessment in compliance with the National Environmental Policy Act (NEPA) and other relevant federal and state laws and regulations. This Environmental Assessment discloses the direct, indirect, and cumulative environmental impacts that would result from the Proposed Action and alternatives. Additional documentation, including more detailed analyses of project area resources, may be found in the project planning record located at the Seward Ranger District office in Seward, Alaska.

## Background

Daves Creek originates at the outlet of Tern Lake (figure 1). The Daves Creek watershed is a tributary of Quartz Creek and the Kenai River. The Tern Lake / Daves Creek system provides high-quality spawning and rearing habitat for Chinook, coho, and sockeye salmon, rainbow trout, Dolly Varden char, slimy sculpin, and round whitefish. Located near the junction of the Seward and Sterling Highways, the Tern Lake area is also a premier location for viewing fish and wildlife.

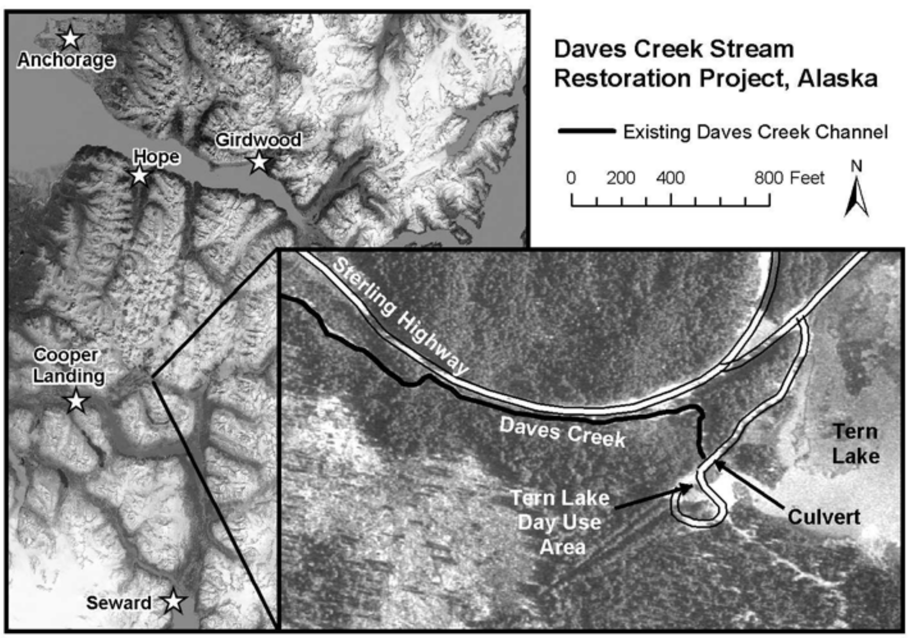


**Figure 1. Location of the proposed Daves Creek Stream Restoration Project**

The proposed project addresses the area around the Tern Lake outlet and the first ½-mile of Daves Creek downstream of the outlet. Much of the length of Daves Creek provides high quality fish habitat, but the first ½ mile downstream of the Tern Lake outlet has been adversely impacted by the following influences:

- Construction of the Sterling Highway in the 1940s cut off portions of Daves Creek and relocated the channel into a ditch along the south side of the highway. This straightened and simplified the stream channel, cutting off its floodplain and accelerating streamflow velocities along the highway embankment. This has resulted in increased stream gradient and erosion rates, which have subsequently degraded fish habitat.

- A culvert was placed at the Tern Lake outlet in the 1960s or 1970s on what is now the entrance road to the Tern Lake Day Use Area. This culvert is a seasonal migration barrier to juvenile salmon, trout, and char, and affects Daves Creek's capability to pass flood flows out of Tern Lake.
- Winter sanding gravel and trash from the Sterling Highway readily enter and accumulate in Daves Creek because of the lack of vegetative buffer between Daves Creek and the highway. This impacts salmon spawning conditions and salmon egg survival.

## Purpose & Need for Action

The purpose of the Daves Creek Stream Restoration Project includes the following:

- Restore fish passage into Tern Lake
- Restore fish habitat and improve water quality in disturbed segments of Daves Creek
- Restore natural function to the Daves Creek stream channel, floodplain, and riparian area
- Enhance or create spawning habitat
- Enhance off-channel salmon rearing habitat
- Enhance wildlife nesting and foraging habitat
- Upgrade the existing trails and replace the fish viewing platform at the Tern Lake outlet
- Provide interpretive displays related to fish, wildlife, hydrology, and restoration

These actions are needed because the Tern Lake outlet culvert impedes fish passage, and the Daves Creek channel downstream of the outlet is not functioning properly in regards to aquatic and terrestrial habitat. Further, the existing recreational facilities do not provide an opportunity for the public to observe fish and wildlife safely and without degradation to the stream banks. These actions respond to the goals and objectives outlined in the *Revised Chugach Land and Resource Management Plan*, May 2002 (Forest Plan) (USDA Forest Service 2002b) and the *Daves Creek Watershed Restoration Plan,* February 2008 (USDA Forest Service 2008), and help move the project area towards the desired conditions described in the Forest Plan (pg. 3-2 through 3-3 and pg. 3-13). Much of the background for this project, as well as additional resource information, is provided in the *Daves Creek Watershed Restoration Plan*.

## Proposed Action

This project proposes replacement of the Tern Lake outlet culvert with a bridge, restoration of the Daves Creek stream channel downstream of the Tern Lake outlet, and enhancement of the existing recreational facilities. The designs of these components would be coordinated to optimize aquatic organism passage and habitat conditions, while enhancing access and viewing of fish and wildlife for a variety of users.

Elements of the Proposed Action include the following:

- Replacement of the existing Tern Lake outlet culvert with a suitable structure such as a bridge, in order to improve fish migration and improve conveyance of flood flows. The Tern Lake outlet would be constructed to maintain the low-water lake level.
- Restoration of up to 2,000 feet of the Daves Creek stream channel, creating a new meandering stream channel that mimics natural conditions, with pool-riffle sequences, floodplains, woody debris, rearing habitat, and spawning areas. Stream banks and floodplains would be re-vegetated with native plant species.
- Replacement of the existing fish-viewing platform at the Tern Lake outlet, and accessible improvements to existing trails in the immediate vicinity of the Tern Lake outlet.

Under the Proposed Action, restoration would occur over a 2-year period, with restoration activities occurring for up to approximately 3 months per year. In-stream restoration activities would be limited to the 2-month period between May 15 and July 15, as required by the Alaska Department of Fish and Game to minimize impacts to spawning or rearing salmon.

The Proposed Action would require the construction of approximately 0.4 miles of temporary access roads for equipment to accomplish the stream channel restoration. Equipment would likely include excavators, D-5 to D-8 bulldozers, rock trucks, and a tree skidder. The temporary access roads would be reclaimed upon completion of the project.

## Decision Framework

The Seward District Ranger is the authorized officer for this decision. This decision will determine whether to replace the culvert at the Tern Lake outlet, reconstruct the stream channel in Daves Creek downstream of the Tern Lake outlet, and upgrade the existing recreational facilities in the project area. In addition, the authorized officer will decide whether any monitoring or mitigation is required.

## Public Involvement

The proposal was listed in the Schedule of Proposed Actions (SOPA) on January 1, 2008. The proposal was provided to the public and other agencies for comment during scoping from February 27, 2008 through April 2, 2008. In addition, as part of the public involvement process, the agency held a public meeting on March 8, 2008 at the Kenai Lake Work Center. Using the comments from the public, other agencies, and fishing, historical, and local conservation groups, the interdisciplinary team developed a list of issues to address. Project comments are located in the Daves Creek Stream Restoration Project planning record.

## Issues

The following five primary issues were identified for the Daves Creek Stream Restoration Project as being relevant considerations in developing alternatives:

- Effects of culvert replacement and stream channel rehabilitation on water quality, hydrology, aquatic habitat and fisheries
- Effects of culvert replacement and stream channel rehabilitation on fish and aquatic organism migration
- Effects of rehabilitation on ecological resources
- Effects of rehabilitation activities on soil resources
- Effects of rehabilitation activities on wildlife resources

# Chapter 2 - Comparison of Alternatives

This chapter describes and compares the alternatives considered for the Daves Creek Stream Restoration Project. It includes a description of each alternative and a map of each action alternative considered. This section also presents the alternatives in comparative form, defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public. Some of the information used to compare the alternatives is based upon the design of the alternative, and some of the information is based upon the environmental, social and economic effects of implementing each alternative.

## Alternatives

### *Alternative A - No Action*

Under the no action alternative, stream channel restoration in Daves Creek and culvert replacement at the Tern Lake outlet would not occur. In addition, the fish-viewing platform at the Tern lake outlet would not be replaced, and the existing trails around that area would not be improved.

### *Alternative B - Proposed Action*

This alternative proposes the following (figure 2):

#### Culvert Replacement

The existing culvert at the Tern Lake outlet would be replaced with a bridge in order to restore fish passage into Tern Lake and provide greater flood flow capacity out of Tern Lake. Grade control constructed at the outlet would maintain the present low water lake elevation.

#### Stream Restoration

Up to 2,000 feet of the Daves Creek stream channel immediately downstream of the Tern Lake outlet would be rehabilitated. The restored stream, floodplain, and riparian area would cover up to 9 acres. The channel would mimic natural conditions and include pool-riffle sequences, floodplains, and fish habitat features such as woody debris, rearing pools, and spawning gravel. The new stream channel dimensions would be modeled from hydraulic analysis and channel feature dimensions of reference reaches. The following stream channel restoration objectives would be achieved under Alternative B:

- Construct floodplains that are 2 to 5 times wider than the channel width
- Reduce the average stream gradient of the restored reach from 0.9 to about 0.7 percent
- Reduce or eliminate road gravel and trash entering the stream banks and channel
- Increase large in-stream woody material to about 340 pieces/river mile
- Increase spawning habitat by 840 $yd^2$
- Increase off channel rearing habitat by 72 $yd^2$

The first 400-foot reach immediately downstream of the Tern Lake outlet would be rehabilitated by leaving the existing channel in place, but modifying the three existing log weir structures, reducing the stream channel slope, and constructing pool-riffle sequences to emulate a natural channel. The existing log weirs would be removed, slightly modified, or left in place and incorporated into the design in order to increase channel stability, reduce the falls/plunge height to no more than 8 inches, and improve fish passage into Tern Lake. The slope downstream of the lake outlet would be reduced through this reach to reduce the risk of “head-cutting” or undermining of the new bridge. Pools would be excavated at the terminus of each riffle.  Woody debris would be incorporated into the outside bendway of each pool to increase channel stability and increase hiding cover for fish.

The lower portion of the project reach, where the channel was artificially straightened alongside the Sterling Highway, would be reconstructed into a meandering stream channel further from the Sterling Highway.  Portions of the existing channel would be incorporated into the channel design as part of the main channel and/or off-channel habitat, and abandoned sections of the old channel would be filled in with the excavated material from the new channel to create floodplain.  The channel would include sequences of pools and riffles, and constructed logjams along the new channel would protect the stream banks and provide fish habitat.  Alcoves, rearing ponds, and sloughs would be constructed to enhance fish and wildlife habitat.

A 100 to 300-foot wide floodplain would be constructed for the new channel throughout the project reach in order to increase the flood capacity, enhance the riparian vegetation, and improve habitat.  The width of the floodplain would be 2 to 5 times the channel width.  Floodplains and streambanks would be revegetated with native plants, grasses, and trees.  A vegetative buffer zone would be developed between the highway and the stream channel to capture sediment and other pollutants from the highway.

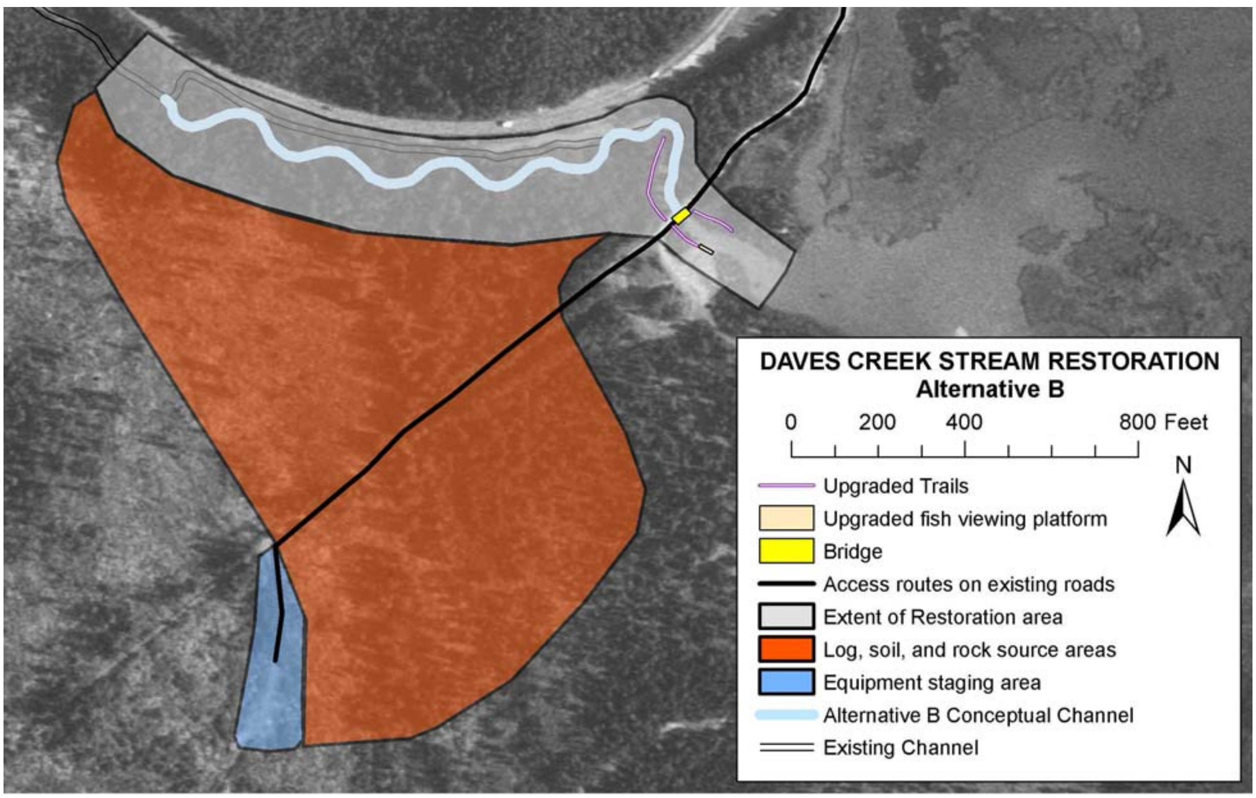

**Figure 2. Alternative B conceptual design for Daves Creek. Kenai Peninsula, AK**

Trees, rock, and soil needed for the stream channel restoration would be selectively taken from a 24-acre area to the south of Daves Creek, to be used for constructed logjams, channel material, and newly constructed floodplains.  If needed, additional material could be taken from the existing gravel pit at mile-35 of the Seward Highway, or the existing rock pit at mile-38 of the Sterling Highway.  A 1-acre equipment staging area would be located south of the existing Old Sterling Highway, and the Old Sterling Highway would be used to access portions of the project area.  Approximately 0.4 miles of temporary access trails for equipment would be constructed for the project and reclaimed upon project completion. Equipment would likely include excavators, bulldozers, rock trucks, and a tree skidder.

### Recreation Facility Improvements

A pedestrian walkway would be constructed on the new bridge for safety and to enhance fish-viewing opportunities. Up to 400 feet of existing user trails in the immediate vicinity of the Tern Lake outlet would be upgraded to accessible trail standards to enhance access to Tern Lake and Daves Creek and reduce impacts to the banks. The existing fish-viewing platform at the Tern Lake outlet would be replaced with an accessible platform to improve safety and reduce resource impacts around the lake outlet.

## *Alternative C - Limited Restoration*

Alternative C proposes the following (figure 3):

### Culvert Replacement

Same as Alternative B.

### Stream Restoration

Only the 400-foot reach of Daves Creek immediately downstream of the Tern Lake outlet would be rehabilitated. The restored area would cover up to 2.3 acres. The existing channel would be modified in place, and the impaired reach of Daves Creek along the Sterling Highway would not be restored. The following stream channel restoration objectives would be achieved under Alternative C, within only the 400-foot project reach:

- Reduce or eliminate jump height at log weirs from 2 feet to less than 8 inches
- Increase large in-stream woody material to about 340 pieces/river mile
- Increase spawning habitat by 120 $yd^2$
- Increase alcove and off-channel rearing habitat by 9 $yd^2$

Only the first 400-foot reach immediately downstream of the Tern Lake outlet would be rehabilitated by leaving the existing channel in place, but modifying the three existing log structures, reducing the stream channel slope, and constructing pool-riffle sequences to emulate a natural channel. The existing log weirs would be removed, slightly modified, or left in place and incorporated into the design in order to increase channel stability, reduce the falls/plunge height to no more than 8 inches, and improve fish passage into Tern Lake. The slope downstream of the lake outlet would be reduced through this reach to reduce the risk of “head-cutting” or undermining of the new bridge. Pools would be excavated at the terminus of each riffle. Woody debris would be incorporated into the outside bendway of each pool to increase channel stability and increase hiding cover for fish.

Trees, rock, and soil needed for the stream channel restoration would be selectively taken from a 12-acre area to the south of Daves Creek, to be used for constructed logjams, channel material, and soil for newly constructed floodplains. A 1-acre equipment staging area would be located south of the existing Old Sterling Highway, and the Old Sterling Highway would be used to access part of the project area. Approximately 0.3 miles of temporary access trails for equipment would be constructed for the project and reclaimed upon project completion. Equipment would likely include an excavator.

### Recreation Facility Improvements

Same as Alternative B.

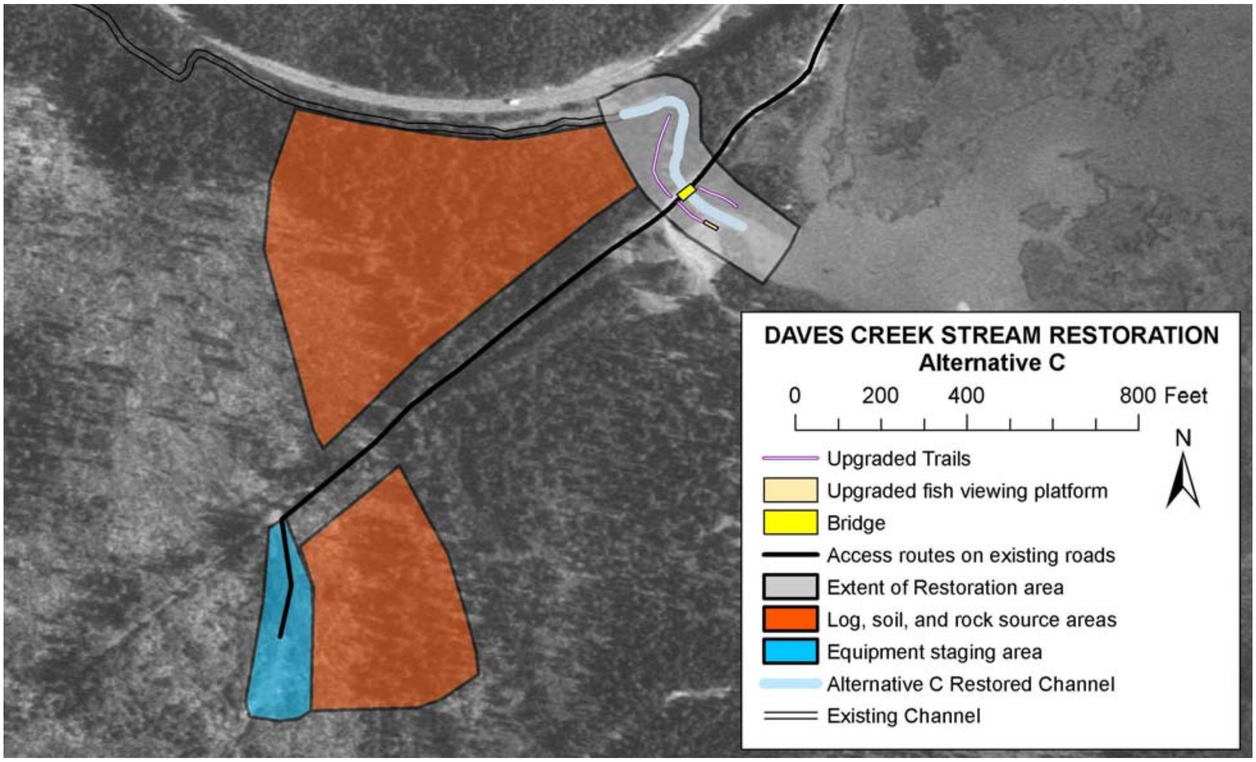


**Figure 3. Alternative C conceptual design for Daves Creek. Kenai Peninsula, AK**

## *Mitigation Measures Common to All Alternatives*

In response to public comments and through interdisciplinary team analysis, mitigation measures were developed to reduce potential resource impacts the various alternatives may cause. The mitigation measures may be applied to either of the action alternatives.

### Mitigation Measures for Watershed, Hydrology, and Fisheries

1. Best management practices (BMPs) in Forest Service Handbook 2509.22, *Region 10 Soil and Water Conservation Handbook* (USDA Forest Service 2006a), would be used to minimize sediment input into the creek during construction of bridge abutments, bridge piers, and bridge decking. BMPs would also be used to avoid stream sedimentation during construction of temporary access routes and skid trials. Of primary importance would be limiting the concentration of runoff waters on the road and trail surfaces.

2. New stream channel segments would be constructed “in the dry.” Where excavation and grading work would take place immediately adjacent to Daves Creek and Tern Lake, a construction berm or silt fence would be used to contain construction-related sediment runoff. Stream diversions would be kept to a minimum to limit turbidity plumes. All in-channel stream work would occur during the Alaska Department of Fish and Game May 15 to July 15, instream construction timing window to minimize impacts to spawning or rearing salmon.

3. In compliance with the Clean Water Act and the US Forest Service Pacific Northwest Region guidelines, the General Water Quality Best Management Practices (USDA Forest Service 1988) would be followed. These BMPs are rated by their effectiveness, as either *high* (documented 90% effectiveness), *moderate* (documented 75-90% effectiveness), or *low* (unknown or unverified effectiveness), providing a qualitative assessment for the expected effectiveness that the applied measure will have on preventing or reducing impacts on water quality and beneficial uses. Unless

otherwise noted, the contract administrator is responsible for seeing that the prescribed mitigation is accomplished.

- BMP VM-2 (High effectiveness): The use of mechanized equipment within the ordinary high-water mark would be held to a minimum. Approved equipment would be limited to loaders, dump truck, tracked excavators and dozers with GVW no greater than 120,000 lbs., portable winch, power saws and hand tools. Heavy equipment will be cleaned and free of leaks before use in the stream channel.
- BMP W-4 (High effectiveness): A spill containment plan would be prepared and approved before operations would start. The plan would require absorbent booms and diapers to be available on-site in case of petroleum leaks or spills. Refuel equipment will be stored at a site at least 100 feet from water bodies.
- BMP R-13 (Moderate effectiveness): Control methods such as diversion of water away from excavation sites, use of filter fences, temporary settling ponds, and check dams would be required in order to minimize downstream sedimentation and turbidity.
- BMP VM-3 (High effectiveness): Erosion control methods such as coarse mulch, willow cuttings and native grass would be applied to areas of exposed or disturbed ground in order to reduce surface soil erosion and sedimentation.
- BMP R-7, R-23 (Moderate effectiveness): Access roads would be rehabilitated upon completion of the project. These roads would be water-barred and seeded with native grasses in order to prevent noxious weed infestation. The dispersed sites along these access roads would be rehabilitated to block vehicular access to the river's channel.
- (High effectiveness): Access points used to allow heavy machinery to enter streams will be rehabilitated and protected following use. This will include shaping the disturbed area to a stable configuration, revegetation, and applying rock or woody debris where necessary to further protect the site from subsequent erosion, and to block vehicular access to the stream. The objective of this is to limit erosion and sediment delivery from disturbed areas immediately adjacent to the stream.
- (Moderate effectiveness): Fish stranded in dewatered sections will be rescued and transported above the project area.
- (High effectiveness): Site-specific areas such as islands above the 50-year floodplain would be mulched or have bluejoint sod mats applied. Overstocked sapling stands of spruce and cottonwood growing in areas of adequate soils would be thinned. Thinned material would be used as coarse mulch throughout the new floodplain. Natural vegetation of mechanically disturbed areas will be promoted where seed source and site conditions are favorable. Native plant species originating from local genetic stocks would be planted in areas where natural re-vegetation conditions are not favorable.

## Mitigation Measures for Soils

1. Source materials such as topsoil, soil backfill material, and soil organics should be selected and/or approved for broad use by the Forest soil scientist.

2. Any source material, including those in number 1, plus any material that is brought to the site (e.g., seedling plugs from a greenhouse), should be weed seed and propagule free.

3. All material brought to the site, including soil, soil organics, and mulch will be from sites that included only native plant communities.

4. If soil crusting, hardening, or cementing becomes an operational issue, areas to be replanted and/or revegetated will be suitably cultivated first.

## Mitigation Measures for Wildlife

1. Retain as much as possible of the current largest spruce, cottonwood, and birch trees.
2. Maintain at least 4 snags and 4 logs per acre as described in the Forest Plan (pg 3-25, Table 3-2), preferably the largest that occur.
3. Retain at least 120 pieces of downed wood per acre (largest available) if possible.
4. Following channel restoration, plant or regenerate naturally spruce, black cottonwood, willow, and alder.
5. Unavoidable natural regeneration of preferred forage species (willow, birch, and aspen) will occur near the highway. Thin spruce and retain larger spruce and cottonwood trees to encourage a more mature forest near the highway. Wildlife biologists, ecologists, and/or vegetation specialist will mark leave trees in restoration and log extraction areas.
6. Follow Forest Plan guidelines for goshawk, bald eagle, Trumpeter Swans and other species if nests are found.
7. Develop screened foraging habitat where possible for bears along the creek from the Sterling Highway.

## Mitigation Measures for Plant Ecology and Botany

1. Introduction of non-native plant species to this project area or spread of existing populations is not desirable. The following non-native prevention actions are recommended (DeVelice et al. 2005; USDA Forest Service 2001):
   - All materials used for mulching, erosion control, rehabilitation, or other uses, should be free of invasive plant species.
   - Any fill material that is brought to the site should be known to be free of non-native plant species seeds or parts[1].
   - Clean vehicles and equipment before being brought to the site including wheel wells, undercarriages, tires, and tools.
2. Use only native species in revegetation and include non-native plant prevention and control in the project design (Forest Plan pg. 3-25).
3. If sensitive plant species are found during the implementation of this project, appropriate avoidance or mitigation measures should be developed.

## Mitigation Measures for Cultural Resources

1. Known cultural resources will be avoided. Should unknown cultural resources be encountered, all operations will be shut down until inventory has been completed by the Forest Archeologist.

[1] See the non-native plant discussion in regard to the off site gravel, cobble, and boulder areas under "Existing Condition".

## Comparison of Alternatives

Table 1 shows the comparison of implementing the no action alternative as well as the two action alternatives for the Daves Creek Stream Restoration Project.

**Table 1. Comparison of alternatives for the Daves Creek Project**

| | Alternative A | Alternative B | Alternative C |
|---|---|---|---|
| Fish Passage Restored into Tern Lake | No | Yes | Yes |
| Length of Stream Restored | 0 miles | 0.4 miles | 0.1 miles |
| Recreation Upgrades | No | Yes | Yes |
| Increased off channel rearing habitat | 0 $yd^2$ | 72 $yd^2$ | 9 $yd^2$ |
| Number of Turbidity pulses exceeding 5 Nephelometric Turbidity Units (NTU) | 0 events | 4 to 6 events (over a 2 year period) | 2 to 4 events (over a 2 year period) |
| Spawning gravel area created | 0 $yd^2$ | 840 $yd^2$ | 120 $yd^2$ |
| Amount of in-channel Large Woody Debris (LWD) placed | 0 pieces | 140 pieces | 35 pieces |
| Number of key pools created or enhanced within the project area | 0 pools | 10 to 12 pools | 4 pools |

# Chapter 3 - Affected Environment

## Watershed, Hydrology, and Fisheries

### Watershed Overview

Tern Lake and Daves Creek are located on the Kenai Peninsula, about 30 miles north of Seward, Alaska (figure 4). The Daves Creek watershed is part of the upper Kenai River watershed. The Daves Creek watershed at the Tern Lake outlet covers 9.5 square miles, with elevations ranging from approximately 600 to 5,000 feet. Daves Creek originates at the outlet of the 55-acre Tern Lake and flows approximately 7 miles southwesterly to its confluence with Quartz Creek. Quartz Creek drains into the northern end of Kenai Lake. The Daves Creek and Quartz Creek watersheds are described in detail in the *Quartz Creek Hydrologic Condition Assessment* (MacFarlane 2007).

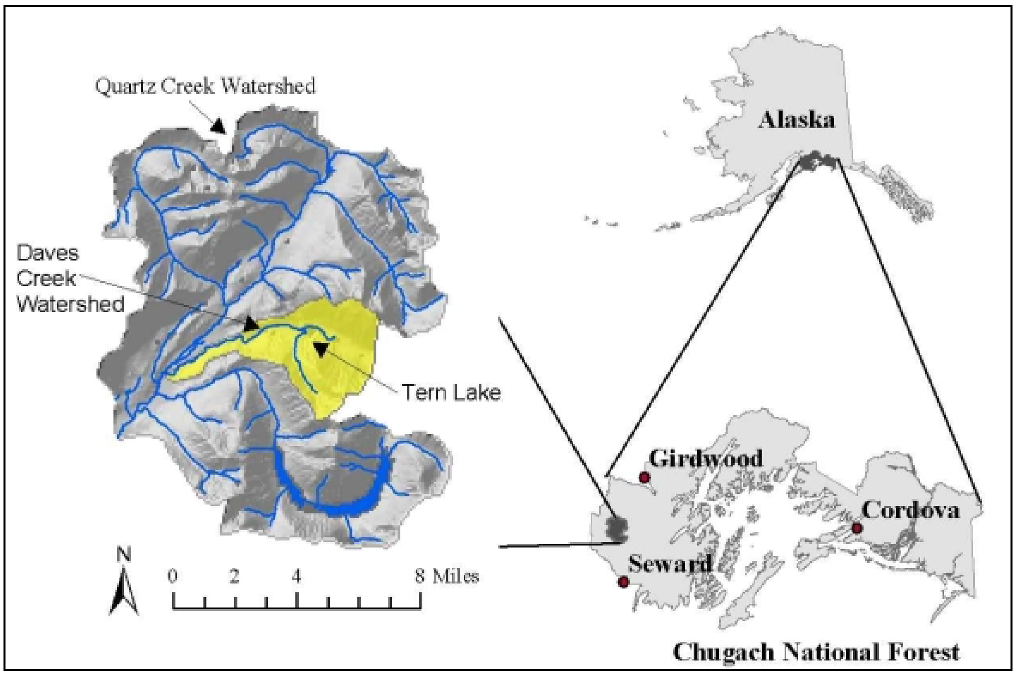


**Figure 4. Location of Tern Lake within the Quartz Creek basin, Kenai Peninsula, AK**

The Tern Lake/Daves Creek system provides high-quality spawning and rearing habitat for a variety of salmon and other fish species. However, various human impacts have affected the Daves Creek channel, its hydrologic function, its aquatic habitat, and its riparian ecosystem. The construction of the culvert at the Tern Lake outlet and the relocation of Daves Creek to the south side of the Sterling Highway during construction of the highway in the 1940s are the largest impacts. Stream channel characteristics, biological characteristics, and impacts to the watershed are described in detail in the *Daves Creek Watershed Restoration Plan* (USDA Forest Service 2008).

### Valley Morphology

The Daves Creek watershed drains steep mountain slopes and consists of two sub-drainages, the 2.1-square-mile “Upper Daves Creek” and the 7.4-square-mile “Tern Lake Creek.” Upper Daves Creek flows north into Tern Lake. This small drainage contains a small remnant glacier that produces abundant sediment and has developed an alluvial fan over the past 14,000 years. The Upper Daves Creek alluvial fan has effectively dammed the valley floor and created the shallow Tern Lake (figure

5). Upper Daves Creek has historically migrated across this alluvial fan as additional sediment has been deposited on the fan. It is possible that at some point in the future Upper Daves Creek will migrate to the west side of the fan and completely bypass Tern Lake, reducing the inflow and outflow of the lake. Just downstream of the lake, the Upper Daves Creek alluvial fan has pushed Daves Creek toward the north side of the Daves Creek valley.

Daves Creek begins at the outlet of Tern Lake. The majority of Daves Creek downstream of Tern Lake is a sinuous C4 or E4 channel, based on the Rosgen channel type classification (Rosgen 1996), flowing through a wide, low gradient valley. Two miles downstream of Tern Lake, Daves Creek cuts through a shallow canyon as it drops down to the lower Quartz Creek valley.

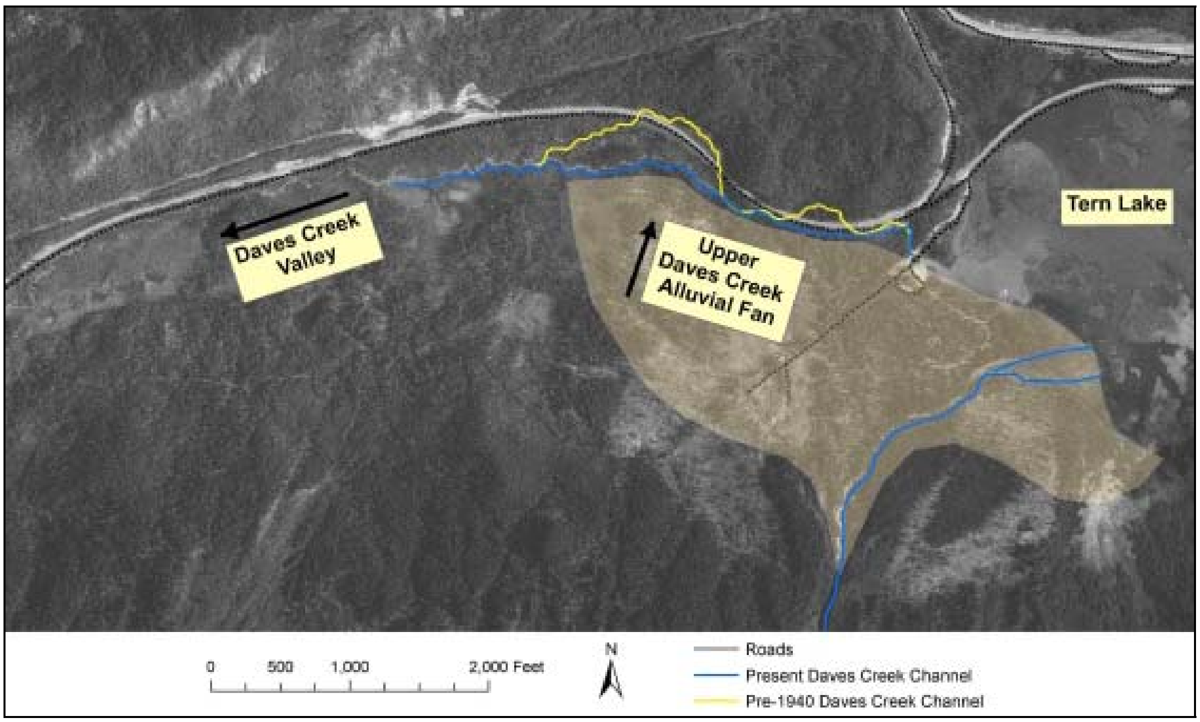


**Figure 5. The Upper Daves Creek alluvial fan that forms (dams) Tern Lake, and the location of the historic Daves Creek channel**

The first ½-mile of Daves Creek immediately downstream of the Tern Lake outlet has been impacted by the culvert at the Tern Lake outlet, the three log weirs placed across the channel in the reach just downstream of the culvert, the relocation of the channel during construction of the Sterling Highway, and the close proximity of the channel to the highway. Changes as a result of these stressors have resulted in a 1500-foot artificial channel downstream of the Tern Lake outlet, where hydrologic function is impeded and natural fish habitat features are limited.

The Tern Lake outlet culvert was constructed in the 1960s or 1970s to replace a previously existing bridge of the Old Sterling Highway. Rip-rap was installed downstream of the culvert, and no downcutting of the stream channel has occurred. The culvert at the outlet of Tern Lake is 42 feet in length, 8 feet wide and 6 feet high. The culvert has a gradient of 1.9 percent, and typical low water flow velocities are about 7 ft/sec with a flow width of about 5 feet. The Daves Creek channel downstream of the culvert widens considerably, to an average width of about 31 feet. The culvert outlet is not perched.

The installation of the culvert likely reduced Daves Creek's capacity to pass flood flows out of Tern Lake as compared to the formerly bridged outlet because of a reduction in cross sectional area. The likely result of replacing the bridge with a culvert was that flood flows caused greater increases in the lake level of Tern Lake, and flood flows in Daves Creek were smaller, but of longer duration.

Simulated flows of 10 cfs to 100 cfs using the *Fish Xing version 2.2* modeling software suggested that the culvert is a velocity barrier to juvenile salmon, trout, and char 80mm and less in length. The culvert in its existing condition likely blocks or impedes migration into Tern Lake for these fish.

The three log weirs in the first 400 feet of Daves Creek downstream of the culvert were placed in the 1980s in order to provide grade control and spawning habitat. Negative impacts to the channel as well as the fish populations have occurred as a result these structures. Because these weirs were constructed flat across the channel, the current is not deflected away from the banks, and high flows have caused bank erosion around the ends of the logs. Also, two of the logs have jump heights and water velocities that create barriers to juvenile fish migration.

Perhaps the most drastic change to the Daves Creek channel is the relocation of the channel as a result of the construction of the Sterling Highway in the 1940s, and further encroachments on the channel during highway widening projects. The Sterling Highway cut off a considerable portion of the historic Daves Creek channel, leaving a straightened, steepened, and incised channel in the ditch along the highway (figure 5). The altered channel contains few pools, high velocity flows, and limited spawning habitat. Abandoned sections of Daves Creek remain on the north side of the highway.

Because little or no buffer currently exists along portions of Daves Creek where it flows adjacent to the Sterling Highway, winter sanding gravel from the highway is readily supplied to the channel, and trash frequently ends up in the channel. The steep, eroding embankment of the Sterling Highway also contributes abundant sediment to the Daves Creek channel. The material entering the channel decreases gravel permeability and can damage spawning habitat and increase egg mortality.

### Flow Regime

Spring runoff in Daves Creek generally begins in early May. High stream flows are controlled primarily by snowmelt runoff and rainfall runoff, with a snowmelt peak occurring in June and peak flows from rainfall events occurring generally in September and October. Low winter flows generally occur from December through April, with the lowest flows occurring in mid-March. The small glacial remnant in the Upper Daves Creek basin does not provide a lot of additional runoff, but does produce some degree of turbidity during the summer from glacial melt. The 55-acre Tern Lake provides some flow attenuation from floods, but this is limited because of its shallow depths.

No stream gauge data exist for Daves Creek, but 10 years of historic peak flow data and flood recurrence data are available for a nearby gauge on Quartz Creek at Gilpatricks, Alaska, at Mile-42 of the Seward Highway (Curran et al. 2003; US Geological Survey 2007). Snowmelt peak flows on Daves Creek at the Tern Lake outlet likely average about 80 to 140 cfs, with peak snowmelt runoff during extreme snowpack years reaching as high as 300 to 400 cfs (Blanchet 2003). Average annual low flows on Daves Creek at the Tern Lake outlet range from about 2 to 6 cfs. Extreme low flow conditions can reduce egg-to-fry survival for salmon in Daves Creek.

### Stream Channel Characteristics

The project area consists of 3 distinct reaches, based on channel characteristics, geomorphic controls, and levels of impairment (figure 6). The *Structure Reach* is the 400-foot reach immediately downstream of the Tern Lake outlet. The *Upper Highway Reach* is a 300-foot reach where the Daves

Creek channel begins to flow adjacent to the Sterling Highway. The *Lower Highway Reach* is a 700-foot reach adjacent to the highway. The following is a description of the stream channel characteristics for each of these reaches, based on surveys conducted for the *Daves Creek Watershed Restoration Plan* (USDA Forest Service, 2008).

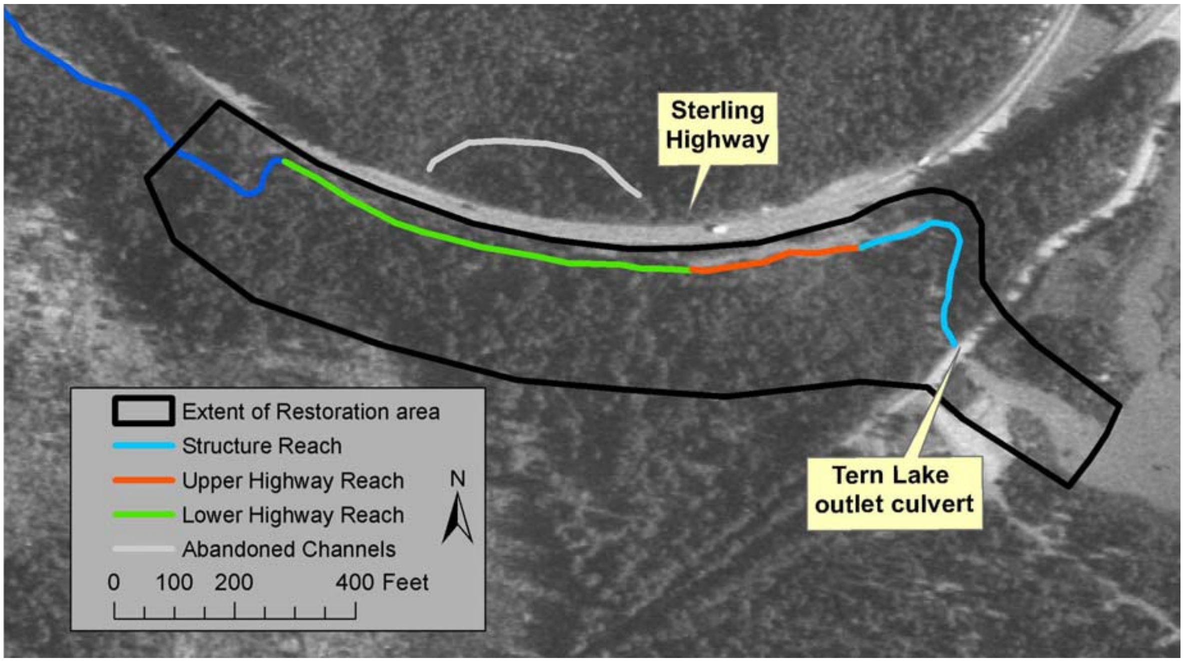


**Figure 6. Daves Creek stream reaches downstream of Tern Lake**

The *Structure Reach* includes 3 log weir structures constructed in the 1980s. Two of these log weirs have resulted in fish migration barriers and bank erosion. The user trail along the left bank has impaired riparian vegetation and caused localized areas of bank erosion (figure 7).

**Figure 7. The *Structure Reach* of Daves Creek, showing the second log weir and the user trail. The culvert is just upstream of the photograph**

The bankfull channel width in the *Structure Reach* ranges from 32 to 39 feet, with depths of 1.0 to 1.2 feet and relatively high width-to-depth ratios. The channel is over-widened because of the scouring effect of the culvert outlet as well as the design and function of the log weirs. The floodplain in this reach is wide. The average stream channel gradient is 1.0%, but the 3 log structures create steps from 0.3 to 1.4 feet high. Pools exist in this reach, but the substrate is relatively coarse. Spawning habitat is limited by the coarse substrate, and rearing habitat is limited by the lack of off-channel habitat. About 14 pieces of large woody debris were counted within this 400-foot long reach.

The *Upper Highway Reach* is an artificially straightened channel characterized by low sinuosity, limited floodplains, and low stream channel gradient (figure 8). The steep embankment of the Sterling Highway is adjacent to the right bank, and road sanding gravel and trash are very abundant in the channel and on the banks. The road sanding gravel, averaging about 4mm in diameter, is visible in the substrate. The channel is confined by the road embankment on the north side and a low terrace on the south side, and functional floodplain area is limited. Pools exist in this reach, but large woody debris is nearly absent, and the low channel complexity results in limited spawning and rearing habitat for fish.

**Figure 8. The *Upper Highway Reach* of Daves Creek, showing the lack of habitat features, and the proximity of the Sterling Highway**

The *Lower Highway Reach* is an artificially straightened channel characterized by low sinuosity, complete lack of floodplain, steep gradient, and a narrow, constricted stream channel with no pools and poor fish rearing habitat (figure 9). The channel is confined by the steep, eroding, 10-foot high embankment of the Sterling Highway on the north and a 3 to 5-foot high terrace on the south. Road sanding gravel, averaging about 4 mm in diameter, is visible in the substrate. Bankfull channel widths range from 14 to 23 feet, which is considerably less than the 32 to 34-foot widths that would be expected based on surveys of a reference reach. The channel gradient averages 1.1%, with a maximum riffle gradient of 2.1%. The constriction and high gradient result in high shear stresses, capable of moving larger particles, and the large channel substrate limits spawning habitat. The lack of floodplains limits the amount of off-channel rearing habitat. Only about 15 pieces of large woody debris were counted within this 700-foot long reach. Habitat quality and productivity for fish are limited in this reach by the lack of pools or other slow water habitat, the lack of channel complexity, the limited woody debris, and poor riparian health.

**Figure 9. The *Lower Highway Reach* of Daves Creek. Note the erosion along the highway embankment and the lack of floodplain.**

The three impaired reaches within the project area were compared to a relatively undisturbed reference reach further downstream, as described in the *Daves Creek Watershed Restoration Plan* (USDA Forest Service 2008). Compared to reference conditions, or the conditions that would be expected without the impacts from the various stressors, the impaired reaches have lower sinuosity, higher gradient, larger substrate, substantially fewer pools, narrower or non-existent floodplains, and fewer habitat features such as large woody debris, spawning areas, and off-channel rearing areas. These limitations of the impaired reaches impede hydrologic function, causing further downcutting and erosion along the highway embankment and creating limiting factors for aquatic habitat.

## *Fish Populations*

The fish species found in Daves Creek include pink (*Oncorhynchus gorbuscha*), Chinook (*O. tshawytscha*), sockeye (*O. nerka*), and coho salmon (*O. kisutch*), rainbow trout (*O. mykiss*), Dolly Varden char (*Salvelinus malma*), round whitefish (*Prosopium cylindraceum*), and slimy sculpin (*Cottus cognatus*). Salmonid rearing and spawning occur within Tern Lake and downstream of the lake in Daves Creek (figure 10). The lake and surrounding tributaries were identified by the Alaska Department of Fish and Game as important spawning, rearing, and over-wintering habitat for coho, Chinook, sockeye, and whitefish. Sport fishing in Daves Creek is only allowed for rainbow trout and Dolly Varden. Daves Creek and Tern Lake are closed to salmon fishing.

The results of two years of adult fish population surveys (2004 and 2007) indicate that the reaches within the project area are important spawning areas for pink, sockeye, and coho salmon (USDA Forest Service 2008). Spawning fish were observed in all reaches within the project area, with sockeye being the most abundant. Schools of Dolly Varden and rainbow trout were observed feeding behind spawning sockeye salmon. Adult fish also stage in Daves Creek on their way to spawn in Tern Lake.

Outlets of lakes are typically hot spots for spawning and rearing fish. The alluvial fan that created Tern Lake is porous, and the water from Upper Daves Creek and Tern Lake charge the groundwater that percolates up just downstream of the lake outlet, keeping it free of ice in the winter in this key spawning area.

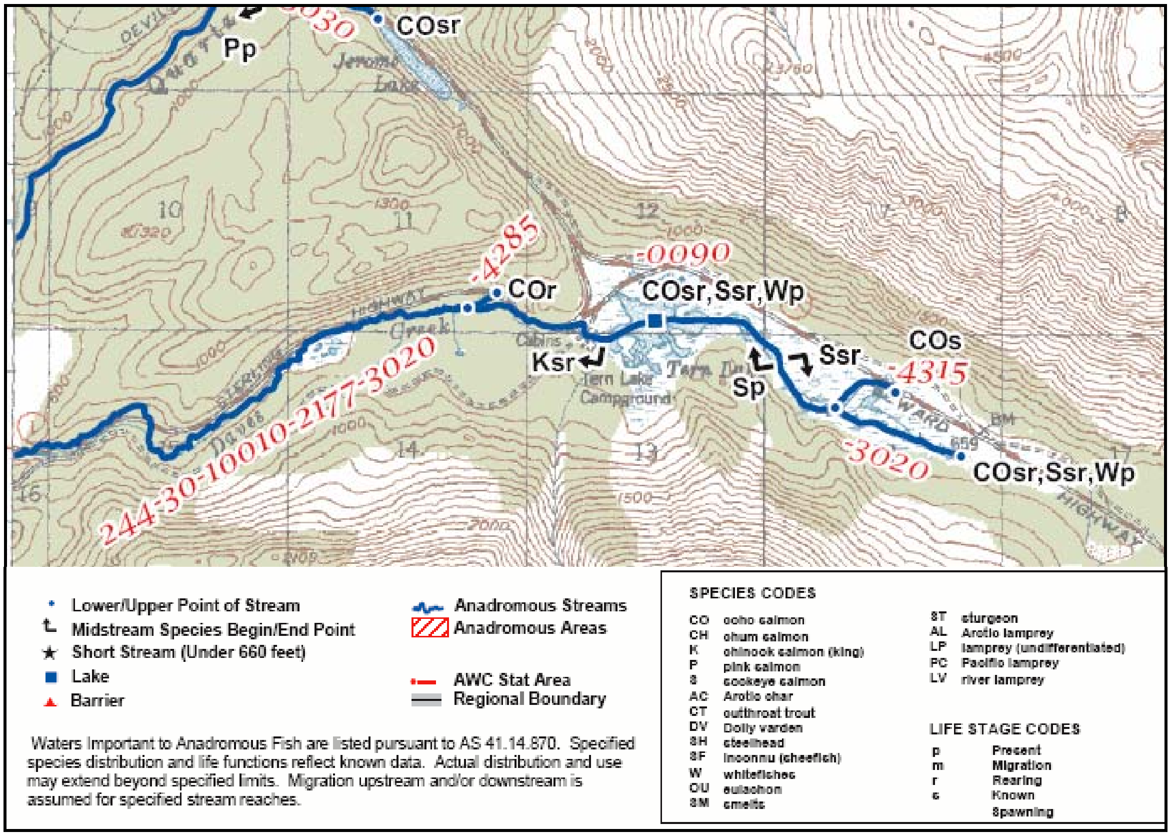


**Figure 10. Fish distribution in Tern Lake and Daves Creek. Modified from the Alaska Department of Fish and Game fish distribution map.**

## Soils

The soils in the project area are the result of numerous erosional events during the last 10,000 years. These events include glacial scouring and deposition of moraines by alpine glaciers during the late Pleistocene; deposition from rill and sheet erosion of soils up-slope of Tern Lake; deposition of debris from avalanches; and deposition of alluvium from streams that flow directly into the lake. Tern Lake owes its presence to an alluvial fan located in the proximity of the Tern Lake Day Use Area. The alluvial fan created a partial dam to retain water in the lake before it continued on down Daves Creek to Kenai Lake. Sedimentation into the lake probably started during the time of glacial recession, sometime before 9,800 years ago. Pollen analyses from core samples in the lake sediments indicate the presence of pollen as old as 9,800 years (Ager 2001).

The soils found in the landscapes surrounding Tern Lake are described in soil map units (SMUs) as described in the Kenai Road Corridor Soil Survey (Davidson 1989). More detailed information, interpretations and maps can be found in that survey. Figure 11 shows the relative location of these soils.

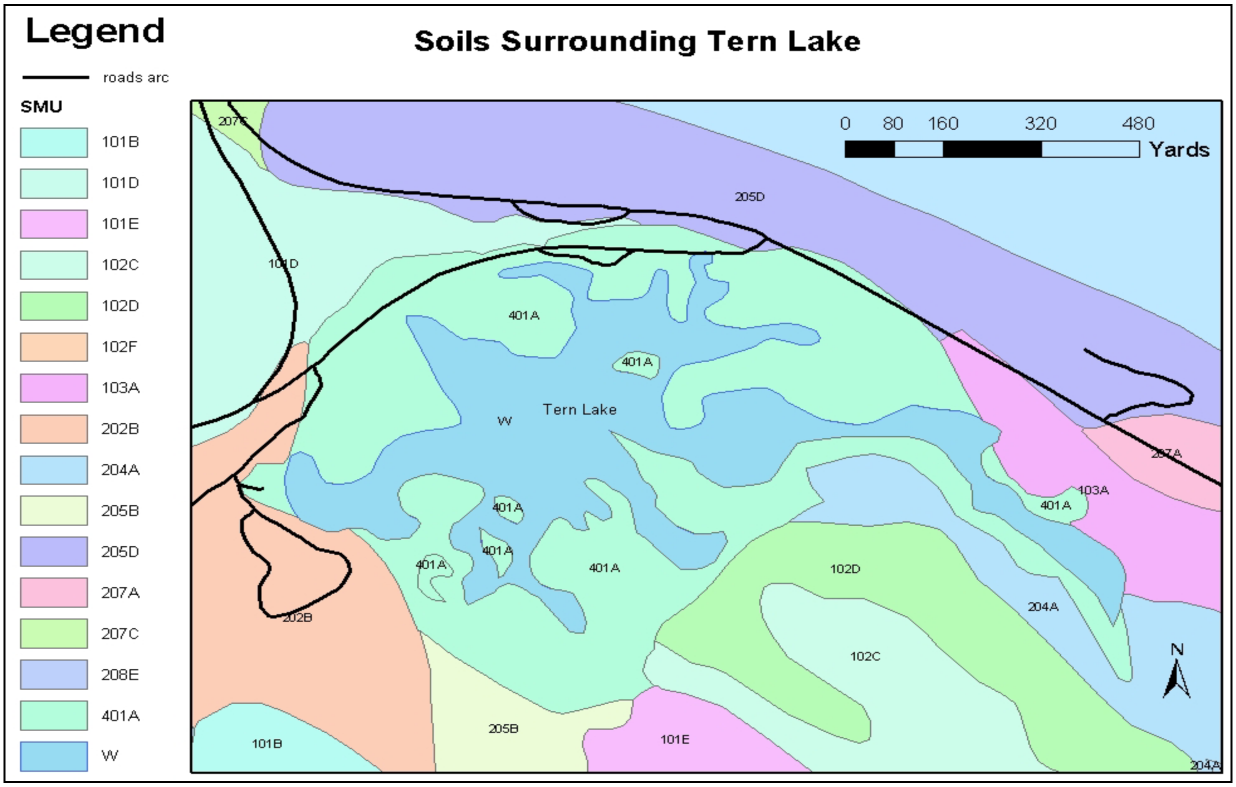


**Figure 11. Soils surrounding the Tern Lake and Daves Creek area**

## *Existing Condition*

The Daves Creek project area has been affected by other past projects. These include a recreational development at Tern Lake consisting of a parking and picnic area, a small viewing stand, and trail. There are also permanent roads associated with the recreation development and abandoned section of the Old Sterling Highway. An old log landing is also present off the Old Sterling Highway. Outside of the project area, but within the watershed, is an old timber harvest area, the new Sterling Highway, and the original Seward Highway.

Within the project area, soil quality ranges from minimally disturbed to undisturbed. Current soil physical and biological components and soil chemistry are judged to be similar to undisturbed reference sites. The only area that is an exception is the parking/picnic area, trail and part of the original Sterling Highway, which is approximately 3.7 acres.

## *Desired Condition*

The *Region 10 Soil Management Manual* (FSM 2554) (USDA Forest Service, 2006b) and *Region 10 Soil Management Handbook* (FSH 2509.18) (USDA Forest Service 1991), recommend at least 85% non-detrimental disturbance following project implementation. This is the measure used to determine effects.

In addition, the Forest Plan (pg. 3-22) directs certain conditions and standards for development or ground disturbing activity on mass wasting prone land types. The Tern Lake - Daves Creek project area does not contain any mass-wasting prone land types. There are mass-wasting/mass-wasting potential land types elsewhere in the Quartz Creek watershed; however, no ground disturbing activities would occur there.

Soils in the project area would eventually be restored to their correct classification based on a suitable reference. These soils would have particle size control sections and moisture control sections within their classification's range of normal variation. Physical, biological and chemical characteristics would have high similarity to the classification reference. In the reconstructed portion of the valley bottom, it would require several years to several decades to attain these conditions.

# Wildlife

## *Habitat*

The primary vegetation cover of the Daves Creek project area is black cottonwood (*Populus balsamifera* spp. *trichocarpa*) and Lutz spruce (*Picea* x *lutzii*) with some paper birch (*Betula papyrifera*) and aspen. The vegetative structure is approximately 60-70 years old with an understory of smaller suppressed spruce. A variety of willow species, alder, cottonwood, spruce, and scattered willow occur near the stream bank. The area provides habitat for a variety of wildlife species that use mid-aged to mature mixed forest.

## *Wildlife Species*

A variety of wildlife species that use forested habitat use the project area. Black bear are frequently seen feeding in the avalanche chutes and willow thicket along the east shore of Tern Lake, river otters have been seen feeding in Tern Lake and Daves Creek, and brown bears are known to travel through and forage on fish. Beavers have made attempts to inhabit Tern Lake, but have failed either as a result of poor habitat or trapping pressure. Coyote and ermine are also noted in the area and the tracks of wolf and lynx are seen in and around Tern Lake in the winter.

The Forest Plan identifies threatened and endangered species (TES), management indicator species (MIS), and species of special interest (SSI) on the Chugach National Forest. Table 2 lists MIS and SSI that have existing habitat in the project area. There are no TES in the project area; therefore, TES will not be discussed further in this document (see Forest Plan EIS pg. 3-225 for a list of TES).

**Table 2. MIS and SSI with existing habitat within the project area**

| Species | MIS | SSI |
|---|---|---|
| Brown Bear | X | |
| Moose | X | |
| Gray Wolf | | X |
| Lynx | | X |
| River Otter | | X |
| Townsend's Warbler | | X |
| Wolverine | | X |
| Bald Eagle | | X |
| Northern Goshawk | | X |

## Management Indicator Species

### *Moose*

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, with the main mortality factors being predation, hunting, and collisions with vehicles along the highway and railroad (Forest Plan EIS pg. 3-216). The combination of feeding and old growth hiding/thermal cover is also important, especially in areas of large-scale disturbance (Renecker and Schwartz 1998).

During fall and winter, moose consume large quantities of willow, birch, and aspen twigs. Moose eat a variety of foods, particularly sedges, equisetum (horsetail), pondweeds, and grasses. During summer, moose feed on vegetation in shallow ponds, forbs, and the leaves of birch, willow, and aspen. Most moose make seasonal movements for calving, rutting, and wintering areas.

Although the majority of the project area does not contain early-mid successional habitat, moose do use the project area as both summer and winter range (Alaska Department of Fish and Game 1985). A composition survey in combination with harvest reports suggests that the moose population has been relatively stable over the last decade within game management unit (GMU) 7 (see ADF&G Moose Management Report 2001-2003 pg. 107).

### *Brown Bear*

Brown bears have large home range requirements. South-facing hillsides and avalanche chutes, big game winter ranges, and salmon streams provide the high quality forage habitat needed by bears. Brown bears are opportunistic wide-ranging foragers, so brown bear habitat can be anywhere a bear wants to be and brown bears have not been identified as a species that requires a minimum patch size of a particular habitat type (Forest Plan EIS pg. 3-214). Brown bears are known to frequent Daves Creek, Tern Lake and the Old Sterling Highway. The project area provides foraging habitat for salmon from July to December, and brown bears may also use this area as a travel corridor.

## Species of Special Interest

### *Gray wolf*

Wolves are carnivores, and depend heavily on ungulates, such as moose (see Forest Plan EIS pg. 3-218). Wolf surveys for GMUs 7 and 15 have not been completed since the 1990s; however, harvest data, observations by ADF&G staff, and reports from trappers indicate that wolves may have increased in recent years. Despite a lack of recent survey information, ADF&G estimated wolf populations in GMUs 7 and 15 at 200 wolves in 20 packs (see ADF&G Wolf Management Report 2002-2005).

There are several packs on the Seward Ranger District. One pack is reported by ADF&G to exist in the Tern Lake area (personal communication with Ted Spraker, ADF&G, 2001). Nearby residents report seeing wolves or their tracks on occasion in the winter and it is thought that they may use the project area during the summer as well.

### *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 successional 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 (see Forest Plan EIS pg. 3-218). The birch stands in the project area contain an understory of denser conifer thickets that may provide hare habitat.  Lynx may forage in the project area due to the diverse mix of spruce and hardwood forest in and adjacent to the project area.

### *River Otter*

River otters are associated with coastal and fresh water environments and the immediately adjacent (within 100-500 feet) upland habitats.  Beach characteristics affect the availability of food and cover, and adjacent upland vegetation provides cover (see Forest Plan EIS pg. 3-220).  River otters hunt on land and in fresh water and are know to feed on a variety of fish (including salmon) and occasionally birds, mammals, and vegetable matter.  Otters are known to occur at times in Tern Lake and may use Daves Creek or the adjacent areas for traveling, foraging or denning.

### *Townsend's Warbler*

Townsend's warblers are fairly common breeding birds on the Chugach National Forest with the highest densities occurring on the Eastern Kenai Peninsula (see Forest Plan EIS pg. 3-222).  Studies in South-Central Alaska suggest a preference for breeding in areas with high density of large white spruce and steeper slopes (Matsuoka et al. 1997).   This type of habitat does not occur in the project area.  During bird surveys conducted in the Tern Lake area between June 18 and June 24, 2002, Townsend's warblers were not detected; however, it is possible that Townsend warblers forage in the area.

### *Wolverine*

Wolverines are thought to occur in low densities on the Kenai Peninsula, an estimated 3 per 386 $mi^2$ in 2004 (Golden 2004).  Wolverine surveys were conducted in February 1992 as part of a cooperative project with ADF&G (Golden et al. 1993).  Wolverine surveys were also conducted beginning the winter of 2004 by ADF&G using the sample unit probability estimator technique (Golden 2004).  The survey was conducted in the Carter-Crescent area south of the Daves Creek Project area.  Wolverine tracks were not noted during surveys, although subsequent trapping efforts in 2008 have shown wolverines do use the area.

Wolverines have large foraging areas and appear dependent on carrion.  It is likely they forage in winter ranges of sheep, goat, caribou, and moose throughout the Seward Ranger District.  Wolverine in Idaho showed a significant preference for high elevation, rocky habitats in summer and montane conifer communities in winter.  Females showed a specific preference for den sites and talus slopes, which were neither widely available nor evenly distributed across the landscape (Copeland 1996).

The project area does not likely provide suitable denning habitat; however, wolverines may travel through the project area while foraging, as the surrounding area contains moose, mountain goat and Dall sheep.

### *Bald Eagle*

Bald Eagles are often found along Alaska's coast, offshore islands, and interior lakes and rivers and winter in southern Alaska.  Bald Eagles often use and rebuild the same nest each year.  Nest trees are usually close to water, afford a clear view of the surrounding area, and often provide sparse cover above the nest. Eagles in South-central Alaska nest in old cottonwood trees near water. Bald Eagles congregate where food is plentiful, and they may continue to roost near the nest tree.

Suitable nesting habitat does not occur within the project area, due to lack of large cottonwoods, and there are no known bald eagle nests within 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). 13 of 17 known goshawk nests on the SRD are in old growth hemlock-spruce stands characterized by a closed canopy, large average diameter, gap regeneration and an open under story. There are no known nests in the project area and the majority of birch and spruce in the project area do not appear large enough to provide optimal goshawk nesting habitat. Goshawks may use the area for foraging, but potential nesting habitat does not currently occur.

### *Desired Condition*

The Forest Plan (pg. 3-13) describes the desired condition for fish and wildlife as follows:

> "[n]atural processes with active management in selected locations will sustain fish and wildlife habitat. Fish and wildlife will continue to flourish in their current abundance with stable populations and abundant habitat. Threatened and endangered species will have populations moving toward recovery. Sensitive species will have appropriate habitat conditions with stable or improving population trends. Management indicator species and species of concern will have stable population trends, providing a continuing subsistence resource. Brown bear human confrontation will be minimal in important seasonal feeding areas and travel corridors, resulting in limited risks to brown bears through "defense of life and property" mortality. Species used for subsistence will continue to be available for subsistence uses."

## Plant Ecology and Botany

### *Existing Condition*

Most of the Daves Creek project area is forested with various mixtures of black cottonwood (*Populus balsamifera* spp. *trichocarpa*), Lutz spruce (*Picea* x *lutzii*), and paper birch (*Betula papyrifera*). These forests are of the "Birch – Large" and "Birch – Pole" cover types (figure 12), as mapped by Rude (2008)[2] and fall within bioenvironmental class "613" as described in USDA Forest Service (2002a, pages 3-60 through 3-63). Predominant vegetation communities and plant species (DeVelice et al. 1999) within this combination of cover type and bioenvironment and supplemented by June 2, 2008 field survey information (DeVelice 2008) are as listed in tables 1 (vegetation communities) and 2 (plant species) within the Plant Ecology and Botany Report located in the planning record.

Nineteen non-native plant species have been documented within a one mile radius of the center of the Daves Creek project area and are listed in table 3 (AKEPIC 2007; Duffy 2003). Of these, only smooth brome (*Bromus inermis*) and common dandelion (*Taraxacum officinale*) have invasiveness ranks exceeding 60 percent (0 to 100 basis with 100 being most invasive; AKEPIC 2007).

Quick reconnaissance surveys for non-native plants were made at the two off site areas proposed for gravel, cobble, and boulders acquisition: 1) Sterling Highway Mile 38 Rock Pit - the greatest concentration of non-native plants was observed on the road edge along the bottom of the rock slope. Potentially these plants could be scrapped to the side before rock material was gathered to minimize the presence of non-native plant propagules. 2) Seward Highway Mile 35 Gravel Pit – non-native plants are present in mostly small, dispersed populations. It would be desirable to collect gravel only at locations in the pit where no plants are present.

[2] Based on June 2, 2008 surveys (DeVelice 2008), the forest labeled as "Birch – Large" in the project area is in reality mostly mixed forest of black cottonwood and Lutz spruce.

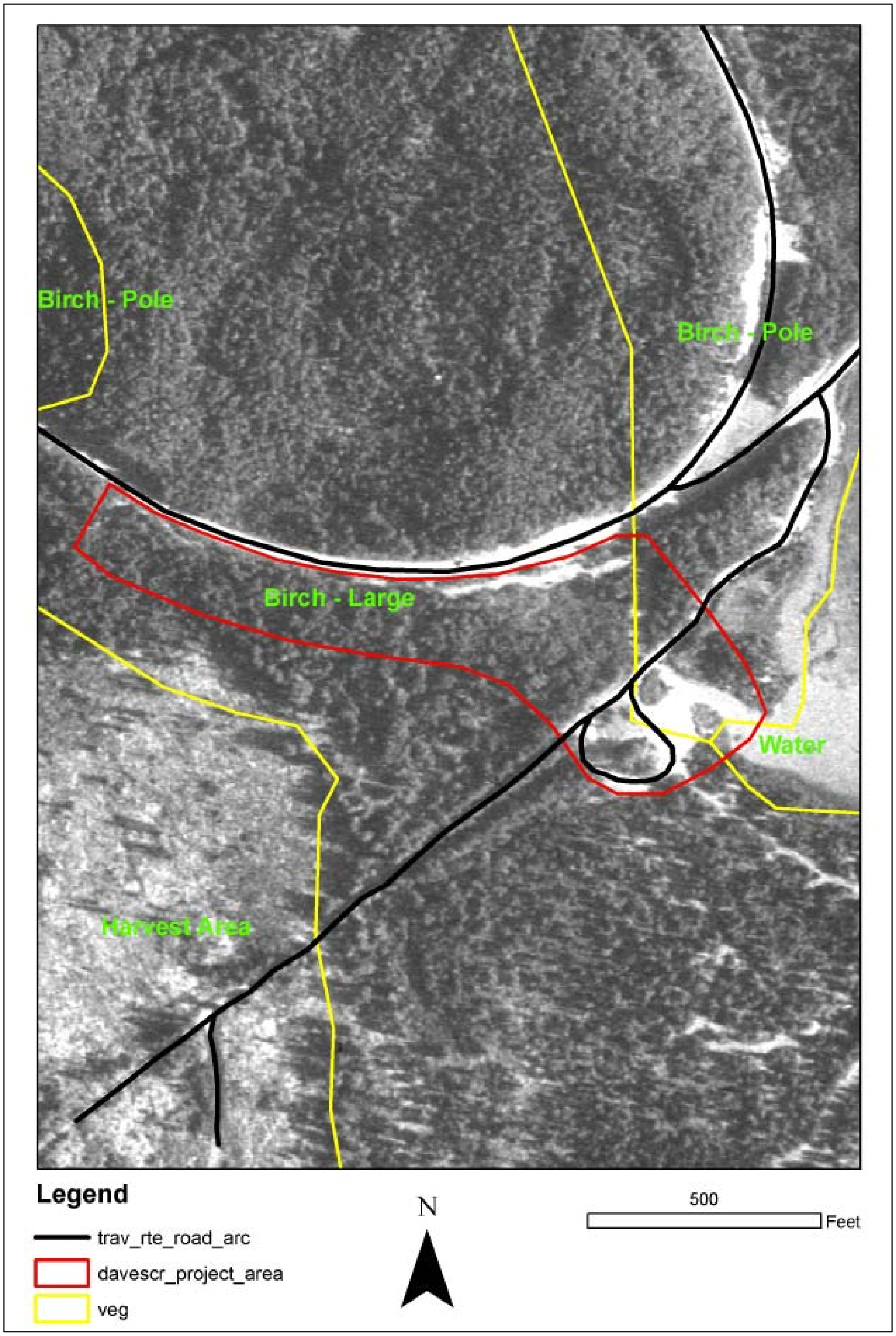


**Figure 12. Vegetation cover types (Rude 2008) of the Daves Creek project area. Based on June 2, 2008 surveys (DeVelice 2008), the forest labeled as "Birch – Large" in the project area is in reality mostly mixed forest of black cottonwood and Lutz spruce.**

Based on the bioenvironmental database used in the Forest Plan Revision (Forest Plan EIS pp. 3-169 through 3-176), the only Alaska Region sensitive plant species potentially occurring in the Daves Creek project area is pale poppy (*Papaver alboroseum*).

**Table 3. Non-native plant species documented within a one-mile radius of the center of the Daves Creek project area as documented in the AKEPIC (2007) database and Duffy (2003)**

| Scientific Name | Common Name | Invasiveness Rank |
|---|---|---|
| *Achillea millefolium* | common yarrow | 48 |
| *Bromus inermis* | smooth brome | 62 |
| *Cerastium fontanum* | larger mouse-eared chickweed | 36 |
| *Cerastium glomeratum* | mouse-eared chickweed | 36 |
| *Chenopodium album* | lamb's quarters | 35 |
| *Crepis tectorum* | annual hawksbeard | 43 |
| *Dactylis glomerata* | orchard grass | 54 |
| *Galeopsis bifida* | hempnettle | 43 |
| *Matricaria discoidea* | pineappleweed | 34 |
| *Phleum pratense* | Timothy | 56 |
| *Plantago major* | common plantain | 44 |
| *Poa annua* | annual bluegrass | 51 |
| *Poa pratensis* | Kentucky bluegrass | 57 |
| *Polygonum aviculare* | knotweed | 48 |
| *Rumex crispus* | curled dock | 48 |
| *Taraxacum officinale* | common dandelion | 62 |
| *Trifolium hybridum* | alsike clover | 57 |
| *Trifolium pratense* | red clover | 53 |
| *Trifolium repens* | white clover | 59 |

### *Desired Condition*

Desired conditions relating to vegetation, non-native ("exotic") plant species, and sensitive plant species as specified in the Forest Plan (pg. 3-13) are, respectively:

- Vegetation will be that resulting from natural processes. Selected locations will be altered by management activities either to restore degraded conditions or to provide benefits to wildlife.
- Exotic plant infestations will be decreasing in size.
- The abundance and distribution of sensitive plants will be stable.

Vegetation desired conditions for the two management area prescriptions under which the Daves Creek area occurs (outside and inside the Sterling Highway corridor, respectively) are:

- Fish, Wildlife, and Recreation Management Area (Forest Plan pg. 4-63) - The area will contain a mix of vegetation mosaics of various types, age classes and structural stages.
- Major Transportation/Utility Systems Management Area (Forest Plan pg. 4-88) - Vegetative composition and structure will be altered to meet the needs of the site. Trees will be removed to allow for a safety area located below and to the side of powerlines. Other areas, such as pipelines and electronic sites, will be cleared of all vegetation. The boundaries of cut areas bordering utility corridors should blend in with the surrounding vegetation.

## Recreation

Recreation is one of the major activities that occur in the Daves Creek watershed, with excellent opportunities for wildlife viewing at Tern Lake and salmon viewing at the Tern Lake outlet. Other recreational activities in the watershed include fishing, hiking, biking, skiing, and snowmobiling. Daves Creek is closed to salmon fishing, but provides fishing opportunities for other species. The Old Sterling Highway provides opportunities for hiking and biking. The current recreational infrastructure that exists within the Daves Creek project area includes a fish-viewing platform at the

Tern Lake outlet. In addition, there are numerous miles of system trail and a picnic and parking area with restroom facilities on the west side of Daves Creek. Most of the recreational infrastructure in the project area was constructed between 1960 and 1995. The current fish-viewing platform does not meet current accessible standards and is in need of maintenance. In addition, approximately 220 feet of trail is currently impacting riparian vegetation along the west side of Daves Creek.

## Scenic Byways

The Seward Highway is designated as a USDA Forest Service Scenic Byway, Alaska Scenic Byway and All-American Road. The Sterling Highway has been designated as an Alaska Scenic Byway. Both were constructed in the 1940s. The Seward Highway is approximately 127 miles long and is located between Anchorage and Seward, Alaska. The Sterling Highway contains two designated Alaska Scenic Byway segments; a northern segment from Wye to Skilak Lake (Milepost 37 to milepost 75) and a southern segment from Anchor Point to Homer Spit (Milepost 157 to Milepost 180). Both the Seward and Sterling Highways pass through the Daves Creek watershed, and the junction of these two highways is at Tern Lake, near the Daves Creek project area. These highways provide access to much of the watershed for recreational uses, including fishing, hiking, biking, and skiing. Tern Lake is a premier area for wildlife viewing, and salmon viewing is popular at the outlet of the lake.

# Chapter 4 - Environmental Consequences

## Introduction

This chapter provides a summary of the environmental impacts under each alternative. It discusses the effects relative to applicable physical, biological, and social environments within the project area. To address cumulative effects, the Forest Service examined the environmental impacts of each alternative in conjunction with past, present, and reasonably foreseeable future actions. The discussions of resources and potential effects incorporate existing information included in the Revised Forest Plan Final Environmental Impact Statement (Forest Plan EIS), project specific resource reports and related information, and other sources as indicated.

## Watershed, Hydrology, and Fisheries

### *Alternative A – No Action*

#### Direct and Indirect Effects

##### *Fish Passage*

Under the no action alternative, fish passage would continue to be directly and indirectly impeded and blocked by the Tern Lake outlet culvert. The blockage prevents juvenile sockeye, coho and Chinook salmon, and resident rainbow, Dolly Varden, whitefish and sculpin from accessing the highly productive shallow lake habitat upstream of the culvert. This blockage will continue to limit the production of the system for the long term.

##### *Channel Processes*

Under the no action alternative, no modifications would be made to the culvert, stream channel, riparian area, floodplains, trails, or fish viewing platform. Aquatic habitat within Daves Creek would continue to be negatively impacted by the confinement of the stream channel along the highway. Road sand, gravel, and fill from the Sterling Highway would continue to enter the stream, as well as trash and potential pollutants. The increased fine sediment load generated from the highway would likely reduce the survival of salmon, trout and char eggs for the long term. No short-term turbidity pulses as a result of restoration would be caused in Daves Creek.

##### *Riparian Forest Recovery*

The indirect negative effects stemming from poor riparian conditions caused by the proximity of the highway would indirectly limit productivity within the project reach for the foreseeable future by reducing the amount of large woody debris and organic material available to the stream.

##### *Large Woody Debris*

The lack of large woody debris (LWD) within the project reach would continue to inhibit juvenile salmonid rearing habitat, suitable spawning sites, and habitat diversity. Under this alternative, LWD would potentially decrease because contributions of LWD from both the planning area and upstream are minor. The culvert would continue to block natural wood routing and downstream transport. Therefore, LWD accumulations would not likely reach historic levels (more than 300 pieces per river mile). The highway limits riparian vegetation to the left bank of the stream. The highway would continue to directly negatively affect riparian vegetation, LWD, the stream channel and fish habitat conditions for the foreseeable future. This would impede the recovery of suitable sockeye, Chinook, coho, pink, chum and Dolly Varden habitat and continue to limit their production within the project area for the long term.

#### *Off-channel Fish Habitat*

Under the no action alternative, the stream channel would continue to be confined and cut-off from the historic off-channel habitat indefinitely. No new off-channel habitat would be created under this alternative. Rearing habitat for salmon and char would continue to be directly limited within the project area for the long term.

#### *Pool Frequency and Quality*

The lack of pools within the project area limits resting and rearing habitat for juvenile and adult salmonids. Under this alternative, no improvement to pool quantity or quality would occur. The poor pool quality of the project reach would continue to have direct and indirect negative effects on the production of adult and juvenile salmon, trout, char, whitefish and sculpin.

### Cumulative Effects

Cumulative effects are described as the impacts on the environment that result from the incremental impact of the action added to other past, present, and reasonably foreseeable actions, regardless of the agency or person undertaking the action. The detrimental effects from no action would be more correctly termed as indirect effects of the lack of recovery from past degrading actions rather than cumulative effects from no action.

The proposed project area is a portion of approximately ½ mile of Daves Creek's channel that has been highly disturbed by road construction. By not improving channel conditions in this alternative, the project area continues to act cumulatively with other disturbed channel reaches in maintaining degraded channel conditions and degraded stream and riparian habitat for fish and wildlife. This reach is particularly important because of its orientation to the outlet of Tern Lake.

### Summary of Effects of Alternative A

Under this alternative, no restoration of Daves Creek would occur. This alternative is not consistent with the Forest Service's goal to maintain or restore water quality to provide for stable and productive riparian and aquatic ecosystems, stream channel integrity, or to promote the recovery of aquatic vegetation. This alternative would not address the project goals and objectives in the short or long term. Fish passage would continue to be impeded and/or blocked by the Tern Lake outlet culvert. Daves Creek would remain confined to the road ditch of the Sterling Highway for about 1,500 feet. Fish production would continue to be substantially limited.

## *Alternative B—Proposed Action*

### Direct and Indirect Effects

#### *Fish Passage*

The culvert would be replaced with a bridge to provide unimpeded fish passage and reduce the risk of flooding during peak flow events. The estimated design bankfill width of the new structure is 23 feet, which is three times the existing culvert width. The design channel slope under the new structure is 0.4 percent, four times less than the existing culvert slope. The reduction in slope and increase in width at the lake outlet would directly promote unimpeded fish passage. Modification of the weirs and construction of pool-riffle sequences in the first 400 feet of Daves Creek downstream of the culvert would also help restore fish passage in this reach for juvenile fish.

### *Water Quality / Sediment / Turbidity*

Project construction under this alternative would generate short-term increases in sediment loads and turbidity in Daves Creek. Short-term plumes of fine-grained sediment would be released into Daves Creek when the culvert is replaced and when water is diverted into the newly constructed segments of channel. Between 4 and 6 individual diversions would be required over the course of the project, generating 4 to 6 high turbidity events over a two-year period.

When water is diverted around the culvert during bridge construction, and as newly constructed channel segments are first connected to the flows of Daves Creek, suspended sediment and turbidity would increase considerably within the channel. Fine silt and clay could remain in suspension for approximately one mile downstream for a limited time period, dissipating with time and distance. Short-term turbidity pulses exceeding the State water quality standard of 5 NTUs above natural conditions (Alaska Department of Environmental Conservation 2008) are expected for up to one hour after cessation of stream channel disturbance. All diversions would take place during the Alaska Department of Fish and Game instream construction window from May 15 to July 15, and would partially coincide with times of naturally higher turbidities resulting from higher flows and glacial runoff.

Additional incidental but very minor increases in turbidity could be generated from other construction activities, including bridge construction, road and trail construction, timber harvesting and skidding, new channel development, habitat development, soil removal and placement, and fish viewing area development.

### *Aquatic Species*

Adverse effects to fish would be short-term and would occur during construction. Direct mortality of fishes could occur during the implementation of either action alternative, as a result of heavy equipment crossing the stream, excavation of the streambed, and channel diversions. The impact to the overall populations is expected to be very small and limited to resident fish and two cohorts of anadromous fish within the immediate project reach. The instream implementation phases of this project would occur after the fry and smolt have emigrated. Adult pink, Chinook, and coho salmon would be able to immigrate through the project area unimpeded and spawn upstream. During implementation, direct impacts within the project reach are expected to be limited to age 0 and 1+ Chinook salmon and coho salmon, resident Dolly Varden and sculpin. Direct and indirect mortality of fish are not expected to occur as a result of culvert decommissioning, bridge construction, or trail or road construction.

Direct mortality of aquatic macroinvertebrates within the project area would be expected. This impact would be brief (up to 12 hours) after disturbance and would be limited to the restored reach and up to 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 could take 47 days.

Indirect fish mortality could also occur as a result of increased turbidity. High turbidities have been shown to cause gill abrasion and reduce the feeding ability of salmonids. Such turbidities could indirectly kill juvenile coho and chinook salmon, resident Dolly Varden char and sculpin within and downstream of the project area (Lloyd 1987; Sigler et al. 1984). However, many studies have shown that fish can tolerate sediment exposure for short periods (McLeay et al. 1983), but when duration is considered as well as concentration, a duration time exposure limit appears to apply to most fish (Newcombe and MacDonald 1991).

The turbidity generating phases of the project would be implemented during mid-May through mid-July to minimize the impacts to fish populations. Pink, chum, coho, sockeye, and Chinook salmon, resident Dolly Varden char, mountain whitefish and sculpin are all outside of their susceptible early life stages (egg to fry) during this period. Using the Alaska Department of Fish and Game timing window means that Daves Creek salmon fry will have emerged from stream gravels before any stream diversions are initiated. Accordingly, the previous winter's eggs would not be threatened by losses resulting from sedimentation of the spawning gravels. Also during the construction window, stream flows typically reach their peak snowmelt generated flows. During this time, natural turbidities are elevated, stream velocities are high, and fine-grained sediments that can deposit in salmon redds (nests) are much more likely to stay in suspension.

### *Flooding*

Replacement of the culvert with a new bridge would widen the existing lake outlet by about three times at the flood prone elevation. The normal and low flow channels would be constructed to maintain the existing lake elevations; however, the velocities below the structure would be reduced by channel reconstruction, which will allow unimpeded passage of fish. The widened flood-prone width under the new bridge would reduce the high water level of Tern Lake for any given flood event, reducing flood risk to private land holders and the Sterling Highway by allowing peak flow discharges to exit the lake at a more natural rate. The lake fluctuation would not be as high, which would promote riparian recovery of vegetation around the lake, indirectly increasing both fish and wildlife habitat. The project would also result in small decreases in downstream flood levels and flood-related sediment loads as an indirect result of increased floodplain area created by the new bridge and restored channel.

### *Spawning Habitat*

Appropriately-sized gravel would be placed in the newly constructed channel sections to create, "jump start," or augment existing spawning gravel patches. Under alternative B, the extent of spawning area would increase substantially to approximately $840yd^2$. It is estimated that <5% of all spawning within Daves Creek currently occurs within the project reach. The increase in available spawning gravel would dramatically increase sockeye, Chinook, coho and pink salmon utilization and production within the project reach.

### *Large Woody Debris (LWD)*

During channel construction, approximately 100 to 200 trees would be incorporated into the newly created stream channel as in-stream structures, and additional trees would be distributed throughout the reclaimed floodplain. The abundance of LWD would be increased from about 100 pieces/river mile to over 300 pieces/river mile.

The addition of LWD would dramatically increase channel complexity, protect stream banks, increase pool quality and retain nutrients. Benefits to adult and juvenile salmonids from the addition of LWD include the addition of cover, increased pool depths and retention of carcasses and other organics. Salmon carcasses can contribute anywhere between 20 and 30% of the available nitrogen and phosphorus in a particular stream system (Bilby 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 associated with anadromous watersheds in Alaska and the Pacific Northwest (Cedarholm et al. 2000). The addition of LWD and the increased retention of these nutrients would indirectly benefit all ecosystem aspects, ranging from stream microorganisms and benthic macroinvertebrates, to top-level predators such as eagles and bear.

Implementation of this alternative 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, as riparian areas mature, salmonids would also benefit from restored and self-maintained levels of channel complexity. LWD would also provide roughness elements that would help regulate bed load 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. Replacing the culvert with a bridge would also allow more natural routing of LWD and organic material through the reach, which would directly and indirectly benefit aquatic organisms.

### *Watershed Morphology*

Alternative B would increase the flood-prone width to stream channel width ratio both at the outlet where the culvert now exists, and within the newly constructed channel segments downstream of the outlet. The stream gradient would also be reduced by increasing the length and sinuosity of the channel. The new channel and floodplain complex would be designed to allow streamflows to overflow the main channel onto the floodplain during typical 1 to 2-year flood events, providing low velocity flow refugia for fish during high flows, and depositing nutrients within the riparian area.

Creation of floodplain would help to incrementally reduce the size of flood peaks by temporarily storing water on the floodplain. Increasing channel sinuosity and reducing the flow volume in the main channel during flooding would result in slower stream velocities and lower shear on the bed and banks of the stream. This would allow for greatly improved retention of spawning gravels and woody debris within in the main channel. Increasing the channel length would allow spawning gravel to be retained, which would directly benefit all fish within the project reach. Reduced flow velocities and channel shear would reduce erosion of sediments from the bed and banks of the stream for the long term.

Connnecting alcoves, side sloughs, ponds, and side channels into the main channel would create high flow refugia and increase off channel habitat by approximately 72 $yd^2$. The increase in off channel rearing habitat would primarily benefit Chinook and coho salmon. Other species such as Dolly Varden, rainbow trout, whitefish, and sockeye would also benefit directly and indirectly from increased off-channel habitat.

The number of key residual pools would increase from 4 pools to between 10 and 12 pools within the project reach. The increase in pool frequency would directly and indirectly benefit all species and life stages of fish by providing low velocity resting habitat, and bubble curtains and depths that provide hiding cover from predators. In addition, the increase in pool habitat would indirectly increase foraging efficiency for juvenile and resident life stages of fish.

### *Recreational angling*

Project related habitat improvements are most likely to benefit sockeye, Chinook and coho salmon and resident rainbow, Dolly Varden and whitefish populations, with some probable increases in pink salmon spawning as well. Increased spawning habitat on Daves Creek would result in a small total increase in the salmon runs on Daves Creek. The increase in pools and the fish congregating within the project area could potentially indirectly increase angling pressure from both humans and bears. Alternative B could result in small increases in bank fishing on Daves Creek. Such increases could possibly result in localized increases in trampling of streambank vegetation, and possible increases in degradation of spawning and rearing habitat.

## Cumulative Effects

Alternative B would have a long-term benefit to fish passage and channel function, aquatic and riparian habitat, and increased fish production. Adverse effects to water quality would be primarily short-term and would occur during construction. Some future development around the "Avalanche Acres" area is possible and there will be standard road maintenance of the Seward Highway. Neither future development nor road maintenance is likely to cumulatively impact water quality or aquatic resources. Currently there are few projects or activities occurring within the Daves Creek Watershed that would combine with current impacts, this project and foreseen activities within the watershed to cumulatively impact the aquatic or fisheries resources.

### Summary of Effects of Alternative B

The long-term indirect and cumulative effects of implementing this project would be the restoration of fish passage, floodplains, riparian vegetation, spawning substrate, pools, and perennial side channel flows and associated over-wintering habitat. This restoration would improve aquatic habitat quantity and quality, fish populations and aquatic invertebrates. In addition, traction sand and gravel from the highway would no longer directly enter the stream. Aquatic vertebrate and invertebrate populations are expected to respond positively to the stream channel and riparian rehabilitation. Increased spawning and rearing habitat created by this alternative is expected to provide a long-term, net positive benefit to the project reach, the aquatic ecosystem, and fisheries resources for the foreseeable future.

## *Alternative C*

### Direct and Indirect Effects

#### *Fish Passage*

Same as Alternative B.

#### *Water Quality / Sediment / Turbidity*

Alternative C would produce between 2 and 4 turbidity pulses over a 2-year period. The magnitude and duration of these turbidity pulses would be less than those that would occur under Alternative B. The impacts of turbidity and sedimentation on Daves Creek would be similar in nature, although substantially less severe than the impacts described under Alternative B. A turbidity plume would be created during the channel diversion associated with the culvert removal, but the existing channel would remain in place and water would not be diverted into any new channel segments as part of the stream restoration.

#### *Aquatic Species*

Alternative C would create substantially less aquatic habitat than Alternative B. Fish passage would be restored, and fishery production would be expected to be increased. However, by not restoring the entire length of the impaired stream channel downstream of the culvert, there would be approximately 700$yd^2$ less spawning gravel area created by Alternative C. Therefore, fish production would be expected to be substantially less than under Alternative B.

#### *Flooding*

The culvert would be replaced by a bridge as described in Alternative B, therefore there would be an identical reduction in flooding risk to private land owners and the Sterling Highway at Tern Lake.

##### *Watershed Morphology*

Alternative C would restore only about 400 feet of stream channel. The substantially lower length of restored channel would result in decreased short term impacts to water quality and aquatic resources as compared to Alternative B. However, long-term benefits to channel function, floodplain integrity, and bank stability are considerably higher in Alternative B.

##### *Recreational angling*

Restoring fish passage would incrementally increase the fisheries production within Tern Lake and Daves Creek. However, the limited amount of stream channel restoration and habitat creation would not result in a substantial increase in fishable pools or salmon and trout populations. Increased numbers of anglers using this section of Daves Creek would not likely increase under Alternative C.

#### Cumulative Effects

This alternative combined with past, present and future activities within the watershed are not expected to cause long-term detrimental impacts to water/aquatic resources or existing fisheries.

#### Summary of Effects of Alternative C

Fish passage would be restored in Alternative C in the same manner as in Alternative B. However, Alternative C would restore only 400 feet of stream channel within the project area, therefore creating fewer up-front water quality disturbances than Alternative B. The cumulative long-term benefits of aquatic habitat rehabilitation and fish production would be substantially less than those under Alternative B.

#### Effects Determination for Essential Fish Habitat

The Daves Creek basin is considered part of the Essential Fish Habitat (EFH) for sockeye, Chinook, coho, and pink salmon. Because Daves/Quartz Creek/Kenai River drains into the Cook Inlet, and salmon are part of the commercial catch along the Kenai Peninsula, EFH for these species extends up Daves Creek basin above the project area. EFH is not likely to be adversely affected (NLAA), as discussed in the fisheries assessment (table 4, next page).

## Soils

### *Alternative A – No Action*

#### Direct and Indirect Effects

The existing condition as described in Chapter 3 would remain.

#### Cumulative Effects

As described in Chapter 3, approximately 0.1% of the watershed is detrimentally affected and this would remain.

#### Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Due to the fact that no additional disturbance would occur, the project area and watershed would remain well within the 15% detrimental disturbance recommendation for soil quality and productivity.

**Table 4. Aquatic species risk assessment**

| 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. Will likely contribute to increased production & 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. Will likely contribute to increased production & 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 will 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 will 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 will likely contribute to increased production and viability for the species in the long term. |
| Sculpin *Cottidae* | Moderate | Moderate – Mortality of adult & juvenile sculpin within project reach expected | Low | May impact individuals or habitat in the short term but will 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 will 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 will likely contribute to increased production and viability for the species in the long term. |

## *Alternative B—Proposed Action*

### Direct and Indirect Effects

This alternative necessitates sourcing suitable material (gravel, rock, soil, planting stock, and LWD) adjacent to the stream in the valley bottom and on the Upper Daves Creek alluvial fan. Including these areas, about 11.8 acres would be disturbed temporarily. The alternative would reconstruct and restore about 6.7 acres of this area to a condition that would allow the eventual full restoration of functioning valley bottom soils for biomass production, biological diversity, storage of water and interaction between valley bottom water table and the channel. Based on restoration efforts elsewhere (e.g., Resurrection Cr.) and recovery from natural disturbance events (e.g., erosion and sediment from landslides), this condition would be partly functional upon completion of the reconstructed floodplain, and would be fully functional within a couple decades. The sourcing areas would be backfilled with available suitable soil, but would not return to the way it was for several years to a couple decades (e.g., sod stripping vs. tree pulling vs. gravel extraction). These soils are considered detrimentally disturbed. The aerial extent of this long-term disturbance is estimated at about 1.0 acres or 8.4% of the project area.

### Cumulative Effects

Researchers suggest that when detrimental soil disturbance surpasses about fifteen percent it becomes difficult to mitigate or restore soil function and quality, ecosystem productivity, and off-site effects (Daddow and Warington 1983; Maser 1997; Harvey et al. 1994; Everett 1994). This project's soil effects are added and compared with effects of other nearby developments that are in the Quartz Creek watershed. The cumulative amount of detrimental soil disturbance in the watershed after this project is implemented is estimated to be 26.5 acres or 0.1% of the Quartz Creek Watershed, essentially the same as the current condition (Alternative A).

### Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

The project complies with the Forest Plan Standards and Forest Service Directives as described under Direct/Indirect and Cumulative Effects.

## *Alternative C*

### Direct and Indirect Effects

Similar to Alternative B, for the same reasons, except that the detrimental acres are estimated to be 2.0 acres or 13.2% of the expected activity area.

### Cumulative Effects

Similar to Alternative B, for the same reasons, except that the detrimental acres are estimated to be 26.9; this is still 0.1% of the Quartz Creek watershed.

### Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

The project complies with the Forest Plan Standards and Forest Service Directives as described under Direct/Indirect and Cumulative Effects.

# Wildlife

There are two kinds of environmental consequences to wildlife under any action alternative: short term (those occurring during project implementation) and long term (those occurring outside of project implementation). In the short term, wildlife species that inhabit the project area would likely avoid the area during this time. That is, when equipment and streambank restoration activities are actually occurring, wildlife would avoid the project area. Essentially, this would result in an avoidance of the area for approximately 3 to 6 months under Alternative B and 2 to 4 months under Alternative C. Although short term avoidance would occur, mitigation measures for wildlife were developed to minimize the extent of these short term effects (see Mitigation Measures for Wildlife in Chapter 2).

In the long term, most wildlife species would be unaffected or would benefit under either action alternative because the project is expected to restore Daves Creek to more natural conditions and improve salmon habitat upon which many wildlife species depend (table 5). In addition, either action alternative would only result in avoidance of the project area for a short time, and neither of the action alternatives is expected to result in permanent displacement of any wildlife species that currently use the project area as habitat. Furthermore, vegetation that is removed in order to implement any of the action alternatives would be re-planted.

**Table 5. Relationship of wildlife in the project area to the salmon life cycle**

| Relationship to Salmon Life Cycle | Incu-bation | Fresh-water Rearing | Spawn-ing | Carcass | Comments |
|---|---|---|---|---|---|
| ***Strong Consistent Relationship*** | | | | | |
| Common Merganser | x | x | | | |
| Bald Eagle | | | x | x | Strong relationship w/ salmon; also indirect relationship |
| Osprey | | x | x | | feeds on gulls, terns, and waterfowl that eat salmon |
| Black Bear | | | x | x | occasionally catch & consume smolts |
| Grizzly Bear | | | x | x | |
| River Otter | | x | x | x | |
| ***Recurrent Relationship*** | | | | | |
| Common Loon | | x | | | Also potential relationship with spawning salmon |
| Common Merganser | | | | x | carcasses |
| Barrow's Goldeneye | | x | | x | |
| Arctic Tern | | x | | | |
| Gulls | | | | x | |
| Stellar's Jay | | | | x | |
| Black-billed Magpie | | x | | x | |
| Common Raven | | x | x | x | |
| Coyote | | | | x | |
| Gray Wolf | | | x | x | |
| Mink | | x | x | x | |
| ***Indirect Relationship*** | | | | | |
| Bald Eagle | x | x | | x | feeds on gulls, terns, and waterfowl that eat salmon |
| ***Rare Relationship*** | | | | | |
| Red-Necked Grebe | | | | x | |
| Trumpeter Swan | x | x | | | |
| Mallard | x | | | x | |
| Green-winged Teal | x | | | | |
| Mew Gull | x | | | | |
| Greater Yellowlegs | | | | x | |
| Red Fox | | | | x | |
| Wolverine | | | | x | |
| Black-Tailed deer | | | | x | |

## *Effects Specific to Alternatives*

The following factors or analysis indicators are relevant for distinguishing between the alternatives:

- Disturbance time
- Acres of habitat affected.
- Square yards of salmon spawning/incubation and rearing habitat created

These indicators and their variations across alternatives are displayed in table 6.

**Table 6. Indicators of effects on wildlife and habitat**

| Habitat Acres Affected | No Action | Alternative B | Alternative C |
|---|---|---|---|
| Stream restoration area | 0 | 9.0 acres | 2.3 acres |
| Log, soil, and rock source areas | 0 | 23.6 acres | 12.4 acres |
| Total area affected | 0 | 32.6 acres | 14.7 acres |
| Proposed Trails | 0 | 380 ft | 380 ft |
| Length of stream habitat created/restored | 0 | 2000 ft | 400 ft |
| Spawning/Incubation area created | 0 | 840 $yd^2$ | 120 $yd^2$ |
| Rearing area created | 0 | 72 $yd^2$ | 9 $yd^2$ |
| Disturbance Time during May 15 to July 15 | 0 | 3 - 4 months | 2 months |
| Disturbance Time during Fall | 0 | 0 - 2 months | 0 - 2 months |

### Alternative A – No Action

Taking no action whatsoever will result in a continuation of the existing condition in the project area. There would also be no short-term avoidance of any wildlife species. In addition, the project area would continue to serve as marginal habitat for species that depend on salmon due to poor conditions on this section of Daves Creek.

### Alternative B – Proposed Action

Alterative B would cause short-term disturbance to a variety of wildlife in the project area for approximately 3 to 6 months on approximately 32.6 acres (table 6). Alternative B would cause some immediate habitat loss to the riparian vegetation primarily in the restoration area (9 acres). In addition, thinning of the adjacent forest to provide logs for restoration would allow the remaining trees to grow larger and faster, which would enhance the potential for larger trees to grow. The result would be a diversity and potential nesting habitat for raptors in the future and improved cover for moose and other species in the southern portion of the project area. This alternative would be the most beneficial of any alternative considered to a wide variety of wildlife that depend on salmon because it would result in the greatest improvement to salmon habitat of any of the alternatives considered (see Watershed, Hydrology, and Fisheries Environmental Consequences above).

### Alternative C

Alternative C would result in short term disturbance to wildlife similar to that of Alternative B; however, this disturbance would only be for a period of 2 to 4 months as opposed to 3 to 6 months. This alternative would result in a minor reduction in short term effects to wildlife as wildlife would avoid the project area for a shorter period of time than under Alternative C. Although Alternative B would result in a shorter period of avoidance of the project area, this difference is not expected to be meaningful because temporary avoidance does not result in any permanent displacement of any species. In addition, Alternative C would also result in fewer acres affected because restoration activities are more limited; however, this distinction is not meaningful as these areas would be re-planted.

## Plant Ecology and Botany

### *Methodology*

Non-native plant interpretations follow the *Chugach National Forest Invasive Plant Management Plan* (DeVelice et al. 2005) and the *Guide to Noxious Weed Prevention Practices* (USDA Forest

Service 2001). Biological evaluation for sensitive plants follows Stensvold (2002) including prefield review, field survey, and preparation of the biological evaluation report (Bella 2003; DeVelice 2008).

### *Alternative A – No Action*

Channel incision, potential headcutting, and bank erosion along the highway would potentially increase the occurrence of bare soil conditions favorable to non-native plant infestation. Because sensitive plants have not been found within the area (DeVelice 2008), the no action alternative is not expected to have effects on sensitive plants.

### *Alternatives B and C – Action Alternatives*

Environmental consequences include a decrease in vegetation cover initially. As vegetation succession proceeds following project completion, there may ultimately be an increase in plant species and plant community diversity as a result of increased habitat diversity created with the construction of new stream meanders, alcoves, rearing ponds, and sloughs. There is a likelihood of non-native species being introduced and existing populations being spread by equipment, vehicles, and foot traffic, or with materials used for revegetation. The potential for non-native plant increases would be particularly high in areas of exposed soil. The project is not expected to adversely affect sensitive plants since none have been found within areas likely to be affected by project activities (DeVelice 2008).

## Recreation

### *Alternative A – No Action*

Visitors to the Daves Creek Stream Restoration project area would continue to use the fish-viewing platform and existing trails to view fish and wildlife. The restroom, picnic and parking areas would be left as is. Over time, the fish-viewing platform would be deemed unsafe and removal or decommissioning would be necessary. Eventually, the existing culvert would need to be replaced, which would block access to the restroom and picnic facilitates.

### *Alternatives B and C – Action Alternatives*

Both action alternatives would cause short-term disruptions in recreational use of the area. Replacement of the culvert would block access to the picnic area, fish-viewing platform, and restroom for up to about a month in Alternatives B and C. Stream restoration would generate noise and disrupt the recreation experience for about 3 to 6 months over a two-year period for Alternative B and 2 to 4 months for Alternative C. After project completion, recreationists would have a new bridge and fish/wildlife viewing platform to access the facilities and improved trail access that would improve riparian resources over the existing condition. In addition, the improved fish and wildlife habitat created by either action alternative should increase fish and wildlife viewing in the project area. From an indirect effects standpoint, there may be higher use in other areas of the Daves Creek watershed or surrounding areas; but not to the level that would cause concern.

## Scenic Byways

### *Alternative A – No Action*

There would be no impact on scenic byway resources with the implementation of the no action alternative. At some point in the future, the culvert would need to be replaced, and the construction activities associated with its replacement would impact the scenic quality as described for Alternatives B and C.

### *Alternatives B and C – Action Alternatives*

In the short term, construction activities for the Daves Creek Restoration Project would impact scenic byway quality through the project area over a two-year period.  Over the long term, the stream and riparian areas would return to a more natural state, which would improve the scenic byway qualities of the area.

# Consultation and Coordination

The Forest Service consulted the following individuals, Federal, state and local agencies, tribes and non-Forest Service persons during the development of this environmental assessment:

### Interdisciplinary Team Members:

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### Federal, State, and Local Agencies:

Alaska Department of Fish and Game
Alaska Department of Natural Resources
Alaska Department of Transportation
National Marine Fisheries Services
NOAA Restoration Center
U.S. Army Corp of Engineers
U.S. Fish and Wildlife Service

### Tribes:

Kenaitze Tribe

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