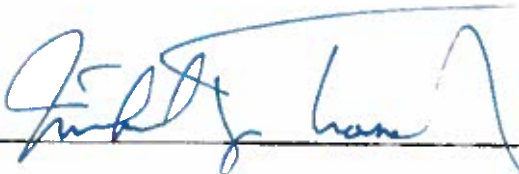


ATTACHMENT D

Floodplain Statement of Findings  
Canyon City Loop Trail  
Klondike Gold Rush National Historical Park

Recommended

 8/31/15

Michael J. Tranel, Superintendent, Klondike Gold Rush National Historical Park

Date

Certified for Technical Accuracy and Servicewide Consistency

 9/2/15

for Chief, National Park Service Water Resources Division

Date

Approved

 9/29/2015

Alaska Regional Director

Date

## **Introduction**

### **Proposed Action**

A 3937 ft. trail extension would be constructed to create a loop trail to enhance the cultural and natural interpretation of the Historic Canyon City Townsite area of the Chilkoot Trail, Klondike National Historical Park, Alaska. The proposed route is located entirely within the floodplain of the Taiya River. Currently, the trail to the historic townsite is an out-and-back spur trail off of the Chilkoot Trail with several social trails branching off of the spur trail. Some of the social trails are damaging archeological features at the site. The trail construction would help to direct traffic away from these sensitive features.

The loop trail would start at the terminus of the existing Canyon City spur trail and continue to the southwest to the bank of the Nourse River, then progress back to the east where it would connect with the historic wagon road from Dyea and turn north to merge with the existing Canyon City spur trail and the bridge across the Taiya to the Chilkoot Trail.

### **Site Description**

Canyon City is located eight miles north of the head of the Chilkoot Trail in Klondike Gold Rush National Historical Park. The town site is located on the west bank of the Taiya River and just north and upstream of its confluence with the Nourse River. Historically, Canyon City was a settlement during the Klondike Gold Rush (1897 through 1899). It was a day's travel from the head of the Chilkoot Trail and a natural stopping gateway to the upper Taiya River valley. Consequently it became the first major stop for prospectors traversing the trail. The area is currently a popular camping area for people hiking the Chilkoot Trail.

The proposed route is located entirely on a gravel flood plain within a mixed forest of open cottonwood, pockets of spruce and dense alder in the low lying areas. The vegetation of the lower valley has been scoured by two major flood events (see below) leaving relatively sparse vegetation and a thin organic layer. These flood events also deposited large amounts of glacial debris from the site of Canyon City southward. Due to this thin organic layer there would be very minimal ground disturbance along the length of the trail. The majority of the proposed construction area of the loop trail is 6-10 feet above the Mean Water Level. The Canyon City Loop Trail is on a peninsula of land between the Nourse and Taiya Rivers. On site investigations have displayed no signs of flooding in the area of the proposed trail despite having the 3rd highest recorded water level in the lower Taiya in 2014.

The proposed trail along with a majority of the Chilkoot Trail south of Canyon City would be subject to the effects of a glacial outburst in the Nourse watershed. The distance to higher ground is similar to other locations along the Chilkoot Trail south of Canyon City at about a quarter mile. The under-story between the proposed trail and higher ground is thinner in many places than on the Chilkoot Trail. Visitation to KLGO averages nearly a million people annually of who approximately 3,000 hike the 33-mile Chilkoot Trail. Canyon City is the preferred camp for families and visitors who do not want to undertake the entire Chilkoot Trail and providing additional recreational opportunities in this area would greatly increase the visitor experience.

Canyon City has been a popular camping ground since the trail's inception. It was the site of an organized settlement during the Klondike Gold Rush of 1897-99. The site's prominence stems from its open and flat location at the south end of the Taiya River Canyon (Dyea Canyon) (Norris 1986:1). A day's travel from Dyea, Canyon City evolved as the first major stop on the Chilkoot Trail route to the Klondike gold fields. It became a natural resting place for packers and prospectors before negotiating the difficult canyon and gateway to the upper Taiya Valley (Ferriera 2010:42).

### **General characterization of floodplain values and of the nature of flooding and associated floodplain processes in the area**

The Taiya River watershed is a coastal river system that includes glacially-fed streams and dramatically changing river channels. The Taiya River receives its primary runoff from annual snowpack and glaciers and carries a heavy sediment load. The dynamic channel migration has already caused the loss of over 30% of the townsite of Dyea, part of the National Historic Landmark, located 7 miles downstream from the project site. Retreating glaciers, the development of proglacial lakes, and periodic glacial lake outburst floods have strongly influenced patterns of erosion and deposition during seasonal flood events and periodic glacial lake outbursts. The topography of the region was mainly formed by glaciation which ended approximately 13,000 years ago. Alpine glaciers still exist at higher elevations. Soils in the Taiya River valley are composed of alluvial deposits (ERTEC, 1983).

The level of the Taiya River changes frequently on a seasonal and often daily basis. The Taiya and its tributaries are fed by glacial runoff so generally the highest levels are seen in the springtime during the seasonal thaw. River flow is typically high during spring and early summer, although not usually high enough to cause flooding unless there has been a heavy snowfall or the area receives an abnormal amount of precipitation. Summer is usually the driest time of the year and the river levels are maintained by snowmelt. Late summer and fall is the wettest season for the area and consequently carries the highest seasonal flood risk for the Taiya River. Warm temperatures causing increased snowmelt compounded with increased precipitation can cause seasonal floods that constantly rework the physical landscape.

Catastrophic glacial lake dam outburst floods wash glacial ice, boulders, soil and vegetation down the river. The most recent outburst flood occurred in 2002 and past events have been documented since the 1800's. Most historic accounts cite telltale signs of flood events such as widening of the river, areas of bare gravel, and sparse vegetation. The largest of these events most likely occurred at the head of the Nourse River sometime between 1883 and 1887 and moved boulders up to 8 feet in diameter, stripping the landscape of vegetation 20 feet above the riverbanks (Ferreira, 2004; Hood, 2006)

### **Justification for Use of the Floodplain**

#### **Description of why the proposed action must be located in the Floodplain**

The purpose of Klondike Gold Rush National Historical Park (KLGO) is to preserve in public ownership, for the benefit and inspiration of the people of the United States, the historic structures, trails, artifacts, landscapes, and stories associated with the Klondike Gold Rush of 1898 (Public Law 94-323). The National Park Service (NPS) proposes to enhance the visitor experience at Canyon City through the creation of a ¾ mile loop trail that expands on the existing trail in the Historic Canyon City town site located 8 miles up the Chilkoot Trail in KLGO.

The goal of the project is to protect, interpret, and connect visitors with both the natural and cultural resources of the Historic Canyon City town site. This would be accomplished by the creation of an

interpretive loop trail with interpretive signs about the boom and bust settlement of Canyon City. This project would formalize a social trail route that already exists in the area. This project has to take place in the floodplain as that is where Canyon City is located. Historically, travel routes took advantage of the floodplain in this area where the relatively flat, open area provided space to stop and rest. Because the areas of interest (the historic townsite and natural riverine environments) occur on the floodplain, the proposed project by nature would take place in that area.

### **Investigation of alternative sites**

Due to the restrictions of topography and the location of Canyon City, no other alternative sites were investigated. Traveling along the floodplain is safer than traveling along the steep valley walls. The alternative to constructing the trail would be to take no action.

### **Description of Site-Specific Flood Risk**

The Taiya River covers a drainage area of 179 square miles, with a channel slope of 210 feet per mile, an average basin elevation of 3,400 feet, 20 percent forest cover, 33 percent glacial cover, and average annual precipitation of 90 inches. The predicted maximum glacial outburst flood discharge is 25,000 cubic feet per second compared to an average discharge of 1,130 cubic feet per second (Jones and Fahl, 1994).

The project location is located upstream of the confluence of the Taiya and Nourse Rivers. The trail location is 100ft higher in elevation than the river level and would only flood in an extreme flood event.

In 2002 an event comparable to an extreme flood for the project area took place 7 miles downstream when 10 million cubic yards of the moraine of West Creek Glacier collapsed into the proglacial lake causing the lake level to rise and spill into West Creek flooding Klondike Gold Rush National Historical Park and the small community of Dyea. This flood event produced a peak discharge of 16,209 cubic feet per second and forced the residents and recreational campers at Dyea to evacuate immediately. The flood caused significant damage to the community's infrastructure. This event instigated an investigation of geologic hazards in the area, that concluded that West Creek was unlikely to cause another flood event, but that the Nourse Glacier moraine and other unnamed glacial features in the Nourse Valley may cause outburst flood events in the future, although no glacial features currently show signs of instability (Denton, et al., 2005). Due to the project location being upstream of the confluence of the Nourse and Taiya River this location would flood only in an extreme event similar to the 2002 glacial outburst flood.

### **Recurrence interval of flooding at the site**

The USGS operates a stream gage site on the Taiya River near Dyea, 7 miles downstream of the project area. While not completely representative of the conditions upstream at the Canyon City site, flood recurrence intervals at the gage site may be used as a predictor for conditions in the basin. The analysis only accounts for "normal" flow and not the irregular outburst flooding events. Trail flooding resulting in periodic trail closures on the lower Chilkoot Trail occur at a stage height of 17 feet with a recurrence interval of 2 years. Dyea campground flooding and some road inundation occur at a stage height of 19 feet with a recurrence interval of 5 years. Based on the site geomorphology, vegetation, and historical records, sections of the proposed project area proximal to the Nourse and Taiya Rivers would likely flood at a recurrence interval of 10 years.

Changes in glacial geomorphology and hydrology have caused at least three catastrophic flood events in the past 150 years. One in 1897 caused the deaths of three prospectors at Sheep Camp (Schirokauer,

2007). The most recent event was in 2002 when heavily saturated soils caused a moraine failure on West Creek, a tributary of the Taiya River. Sometime between 1875 and 1880 a catastrophic glacial lake outburst flood scrubbed the nearly one-mile wide valley floor clean of vegetation.

#### **Hydraulics of flooding at the site (depths, velocities)**

Similar to the predictions of flood intervals for the project area, data from the USGD Dyea stream gage site is assumed to be representative of the flood hydraulics for the project location. During the 2002 outburst flood of West Creek the Dyea gage measured a discharged peak volume of 16,209 cubic feet per second (Denton, et al., 2005). A discharge of 25,000 cubic feet per second has been estimated for the Taiya River for a 1967 glacial outburst (Jones and Fahl, 1994).

#### **Time required for flooding to occur (amount of warning time possible)**

The time required for a glacial lake outburst can vary from a few hours to a few days, but usually drain quickly enough to create flood hazards downstream with little to no warning (Post and Mayo, 1971). In the September 18, 1897 glacial outburst flood, a tower of water from between 5 to 40 feet high, depending on the source, had traveled 2 miles in 10 minutes, from Stone House Camp to Sheep Camp and struck with such force that the eponymous boulder of Stone House was moved a quarter mile downstream (Gurcke, 2011). In the 2002 West Creek glacial outburst flood the day before the flood occurred, glacier guides noticed water pouring over the top of the glacial moraine. They assumed only that the creek was changing course and removed all their equipment from the area. It was the sound of rushing water that alerted residents to the flood (Capps, 2004).

#### **Opportunity for site evacuation in the event of flooding**

During the Sheep Camp glacial outburst flood of 1897, the sound of rushing water warned people a flood was coming. All but one person survived by running to higher ground. During the West Creek glacial outburst flood of 2002, warning signs were present, such as a well-developed slump scarp and a horizon of groundwater seepage in the face of the moraine, but not clearly recognized.

The majority of the proposed construction area of the loop trail is 100 feet above the current riverbanks. Only one section of trail approaches within 300-500 feet of the rivers is located on or near the active floodplain and the area likely to be affected by outburst flooding and by normal floods with longer recurrence intervals. It is approximately one quarter mile to higher ground from the confluence. It is assumed that if visitors are in the active floodplain area they would be able to hike to higher ground in the event to a flood.

Canyon City is located 4.8 miles south of Sheep Camp where Rangers are stationed. Response time to travel the 4.8 miles from Sheep Camp to Canyon City is estimated at 3 hours. In the event of a flood visitors could walk north to Sheep Camp and on to Bennett in Canada via the Chilkoot Trail where they would be transported to Skagway via train. If hiking out is not an option due to either the physical limitations of the visitors or environmental factors it is also possible they could be flown out by helicopter.

#### **Geomorphic considerations (erosion, sediment deposition, channel adjustments)**

The development of the loop trail would not have a substantive effect on erosion, sediment deposition, and channel adjustment. There would be some soil compaction and some opportunity for water to occupy the unvegetated trail surface, but the effects would be negligible. The elimination and revegetation of the social trail network in the area would result in a net decrease of these effects. Large

natural flooding events and resulting geomorphic changes would be of such a scale that they are not likely to be affected by the project.

In 1894, J.J. McArthur took a photograph that encompasses the project area while standing on the side of Mount Hoffman looking south down the Taiya River valley where it joins the Nourse River. The photo shows clear effects of a dramatic flood event. Vegetation had been stripped away in a v-shape culminating at the mouth of the Nourse River Canyon.

Channel migration is frequent on glacially fed rivers due to the heavy sediment load and flooding is often a catalyst for these channel changes however at the project location the potential for channel migration is low. Unlike further downstream near Dyea there is little evidence of channel migration as there are few old channels found at the project area.

#### **Description and explanation of flood mitigation plans**

The Municipality of Skagway is developing plans to install an early flood warning system for the Nourse River. Risk to hikers of the trail can be mitigated by not allowing camping in the project area on the floodplain, which would encourage people to only pass through and camp in the designated campground on the east side of the Taiya River closer to higher ground.

#### **Measures to reduce hazards to human life and property to the regulatory floodplain level, while minimizing the impact to the natural resources of the floodplain, including the use of non-structural measures as much as practicable**

The Municipality of Skagway is developing plans to install an early flood warning system for the Nourse glacier. Educating hikers about the warning signs of a catastrophic flood and informing them of the need to get to higher ground as quickly as possible would also help mitigate the risk.

The development of a loop trail would not introduce any structural changes that would have an effect on the floodplain and natural resources associated with it. The elimination and natural revegetation of the social trail network would result in a net improvement of natural site conditions.

The trail crew would employ sustainable design and best building practices to the proposed loop trail in order to maintain the floodplain and associated natural resources. Design aspects include limited structure installation, alignment to maintain natural sheet flow and overflow patterns of the site, no hardened surfaces, and re-contouring and vegetation of impacted areas (social trails) to a more natural condition. The revegetation of the social trail network would result in a net improvement of the natural site conditions.

#### **Acknowledgement that structures and facilities are designed to be consistent with the intent of the standards and criteria of the National Flood Insurance Program (44 CFR Part 60).**

The proposed loop trail would be designed to be consistent with the intent of the standards and criteria of the National Flood Insurance Program.

#### **Summary**

Klondike Gold Rush National Historical Park has identified a proposed action for improving the Canyon City Trail. Constructing a loop trail on the floodplain between the Taiya and Nourse Rivers would help protect the cultural resources that are currently being degraded and also provide additional interpretation opportunities to increase visitor appreciation of both the natural and cultural resources of

this unique area. The risks of flooding can be mitigated by installing an early flood warning on the Nourse glacier and by educating hikers about warning signs of a flood and informing them what action to take should a flood occur.

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