Alaska District
U.S. Army Corps of Engineers

Civil Works Branch

Public Notice

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Please refer to the identification number when replying.

Environmental Assessment and
Finding of No Significant Impact
Interim Risk Reduction Measures
Chena River Lakes Project, Fairbanks, Alaska

The Alaska District, U.S Army Corps of Engineers proposes to revise operating procedures, clear vegetation, and modify project structures to reduce risks and consequences of dam failure at the Chena River Lakes Project near Fairbanks, Alaska. The Chena River Lakes Project Interim Risk Reduction Measures Environmental Assessment identifies proposed measures, issues and resources of concern, and environmental effects of the action. The enclosed environmental assessment and unsigned finding of no significant impact (FONSI) are provided for your review and comment. Public meetings were held in Fairbanks (January 27) and North Pole (January 28) to present information and answer questions about the action. No further meetings are planned before action is initiated. If you believe another meeting is needed, please notify us at the address below.

The comment period will close March 1, 2010. Comments received by this date will become part of the official record. The District Commander will sign the FONSI upon review of comments received and resolution of significant objections.

Please contact Guy McConnell if you have questions, need any further information, or wish to comment on the environmental assessment or the proposed action.

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US Army Corps of Engineers
Alaska District

Environmental Assessment and
Finding of No Significant Impact

Interim Risk Reduction Measures Chena River Lakes Project Fairbanks, Alaska

January 2010

Finding of No Significant Impact
Interim Risk Reduction Measures
Chena River Lakes Project
Fairbanks, Alaska

The Alaska District, U.S. Army Corps of Engineers will revise operating procedures, clear vegetation, and modify project structures to reduce risks and consequences of dam failure at the Chena River Lakes Project near Fairbanks, Alaska. These actions are immediate, interim measures in response to a recent nation-wide evaluation of dams and the risks and failure modes that were identified in that evaluation.

The Moose Creek Dam, part of the Chena River Lakes Project, reduces flooding risk to Fairbanks and surrounding areas by temporarily storing or diverting floodwaters of the Chena River. The dam impounds water temporarily during high water events. The Chena River runs free through the project during normal flows.

Operating procedures will be revised to minimize floodwater retention time and volume without exceeding authorized discharges in Fairbanks or causing undue flooding along the Chena River. The control sill across the project floodway will be lowered to release more impounded water to the Tanana River earlier during high water events. Accumulated silt will be removed from stilling basins at the Moose Creek Dam control works and at the floodway control sill so they function properly and to facilitate inspection. Vegetation, primarily trees and brush, will be cleared so it will not restrict floodwater discharge, so the dam can be inspected and mitigation actions can be taken during high water events, and so the vegetation does not contribute to dam failure risks. Additional interim and permanent measures may follow. The actions addressed in this Finding are necessary now and do not pre-decide additional measures that might be employed later.

These actions will commence in the late winter and early spring of 2010. They will not substantially impair air quality in the Fairbanks nonattainment area or water quality in the Chena River. Vegetation removal will not affect endangered plant species or plants that are locally uncommon or of particular value. Vegetation clearing would not discharge into waters of the United States, including wetlands. Changes in operation could, under specific and unusual circumstances, delay salmon returns to the upper Chena River. Lowering the sill could increase the occasional release of floodwaters and juvenile fish into the Tanana River. Vegetation clearing would be timed to avoid taking of nesting birds, their eggs, or young. Approximately 100 acres of locally common bird habitat would be substantially modified by the vegetation clearing.

The Alaska District, U.S. Army Corps of Engineers will work with resource agencies to monitor effects of lowering the control sill and modifying operations. Any impacts identified will be mitigated to the maximum extent practicable.

The actions addressed in this Finding are defined and discussed in the environmental assessment, *Interim Risk Reduction Measures, Chena River Lakes Project, Fairbanks, Alaska,* January 2010. I have determined that these actions will not significantly affect the human environment and therefore, an environmental impact statement will not be prepared.

Reinhard W. Koenig
Colonel, Corps of Engineers
District Engineer

Interim Risk Reduction Measures
Chena River Lakes Project
Fairbanks, Alaska

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1.0 PURPOSE AND NEED

1.1 Proposed Action

Chena River Lakes Project is in the Alaska District of the U.S. Army Corps of Engineers (USACE). It is approximately 17 miles east and 35 river miles up the Chena River from Fairbanks, Alaska. Figure 1 shows project vicinity and location.

The Alaska District proposes to modify structures and operation of project features at the Chena River Lakes Project to reduce floodwater retention time and flood pool elevations during Chena River flood events. The District also proposes to clear vegetation on and near project features to allow thorough inspection, to reduce risk of dam failure, and to remove obstructions that impede discharge of flood water. The District proposes to take these actions as interim measures to reduce the risk and consequences of dam failure. The District proposes to begin implementation of these measures before the next potential flood season. This environmental assessment focuses on those immediate measures. Further interim and long-term measures may be considered later in separate processes.

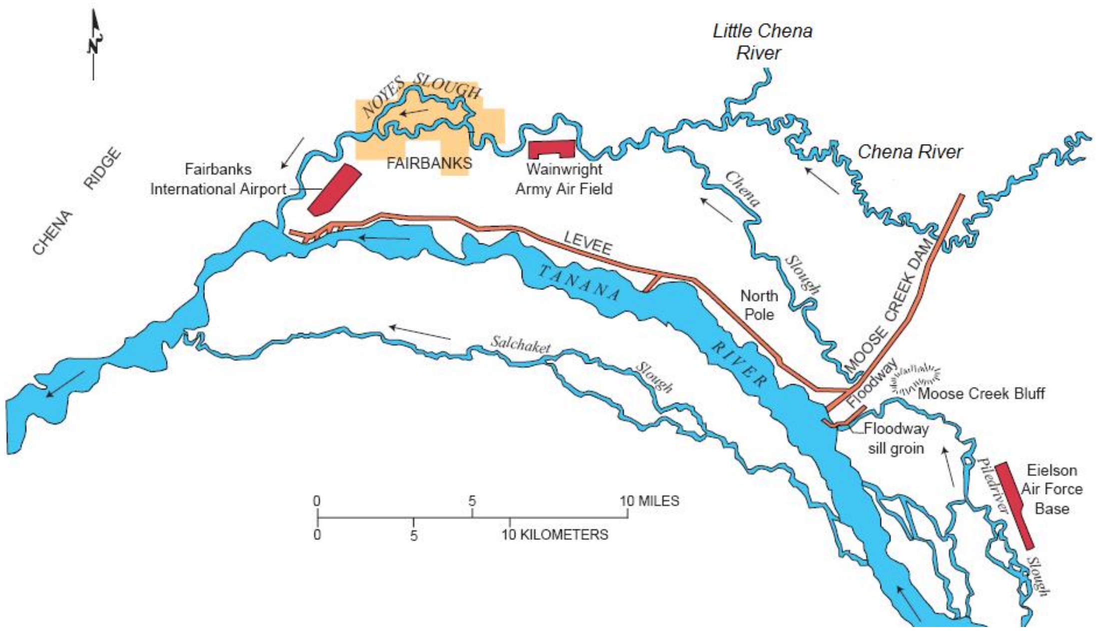


Figure 1. Overview of the Chena River Lakes Project (modified from USGS Report WRI 00-4227)

1.2 Project Features

The primary purpose of the project is to provide flood damage reduction for the city of Fairbanks. The project also reduces flood damage in North Pole, Fort Wainwright cantonment area, and unincorporated areas in the vicinity. Much of the greater Fairbanks area is in the floodplains of the Chena and Tanana rivers. The Chena River Lakes Project reduces flood damage from the Chena River by temporarily impounding floodwater behind the Moose Creek Dam and diverting it toward the Tanana River during flood events.

Tanana River flooding in the Fairbanks area also is reduced by the Tanana River Levee, another element of the Chena River Lakes Project. The Tanana River Levee is on the north bank of the Tanana River. It separates Tanana River flood waters from the south side of the Fairbanks area. It prevents floodwater from the Tanana River from flowing into part the river's natural floodplain around Fairbanks. It was constructed by the Corps of Engineers and is owned and maintained by the Fairbanks North Star Borough.

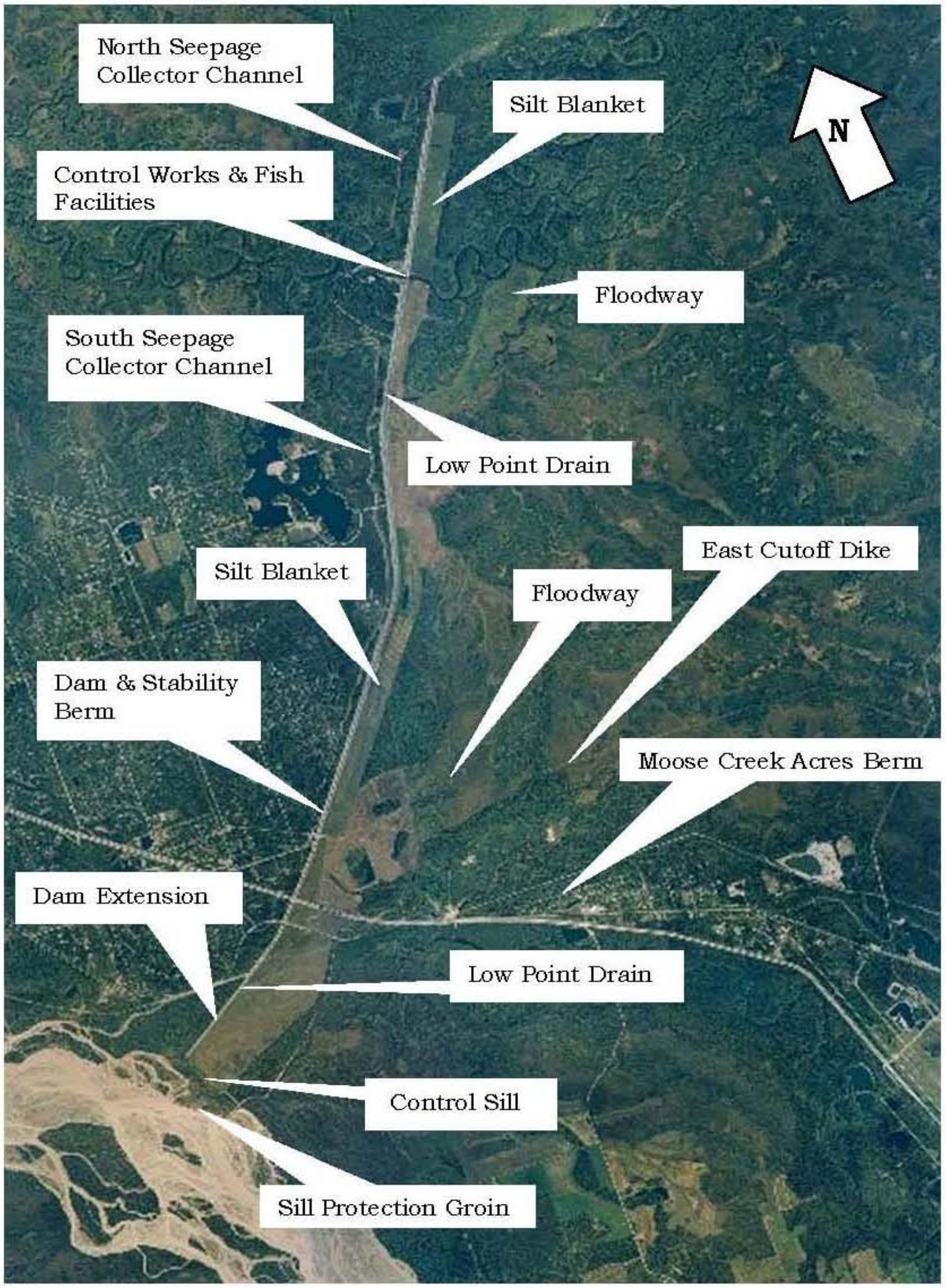
Chena River Lakes Project construction began after a 1967 flood that extensively damaged Fairbanks and surrounding communities. The project was completed in 1979 and was first operated for a test fill in 1981.

Figure 2 is a project features illustration sheet that shows an overhead view of the Chena River Lakes Project. Major features are labeled. Their roles in flood control are described as follows:

- Moose Creek Dam - Main Embankment is a 7.5-mile-long earthfill structure that, along with a 0.7-mile extension, extends from an unnamed ridge north of the Chena River southward to the Tanana River. It reaches a maximum height of 50 feet above the Chena River streambed. The upstream side of the embankment is constructed of semi-pervious silty gravel to inhibit seepage. An upstream silt seepage blanket 600 to 1,000 feet wide and constructed of silt and 149 relief wells near the downstream toes of the dam and the toe of the stability berm also control seepage.

- Moose Creek Dam - Outlet Control Structure, or control works, contains four 25-foot-wide concrete bays divided by piers. Each bay is fitted with a hydraulically operated control gate. Each bay is designed to pass Chena River flows at a maximum of 3,000 cubic feet per second (cfs). Additional water may flow through the fishways on both sides of the control structure. Each fishway is a narrow, artificially roughened channel that provides a low-velocity route for fish passage through the control works until flood control operations begin. A fish ladder is operated in the control structure during high water events above 500.5 feet mean sea level (MSL) when water velocity through the control gates and the fishways impedes upstream fish migration.

PROJECT FEATURES ILLUSTRATION SHEET



MOOSE CREEK DAM

Figure 2. Overhead view of Chena River Lakes Project

- Project Floodway is an excavated, cleared channel that is a maximum of 2,400 feet wide. It collects Chena River floodwaters for diversion to the Tanana River. The floodway is approximately 6.5 miles long. A 2,000-foot-long sheet pile sill between the floodway and the Tanana River keeps floodwater from the Tanana River from entering the floodway. Figure 3 shows the southern end of the floodway and its juncture with the Tanana River.

Figure 3. Southern end of the cleared floodway and Tanana River.

- East Cutoff Dike is a low embankment about 5,600 feet long that prevents water from the project from entering Moose Creek drainage at high pool elevations. This feature is referred to as the East Saddle Dam in some Chena River Lakes project literature.

- Low Point Drains are gated structures used to remove trapped water at low points in the floodway after floodwaters have receded. Two low point drains pass through the Moose Creek Dam. They are designated the north (or main) low point drain and the south low point drain.

- Seepage Collection Channels collect below-dam seepage and water from the north low point drain and relief wells and direct it back to the Chena River downstream of Moose Creek Dam. They are near the dam both north and south of the river.

- Moose Creek Acres Berm is a small levee that protects the community of Moose Creek Acres from water that backs up into Moose Creek during high flows on the Tanana River.

- Tanana River Levee extends 22 miles west from the south end of Moose Creek Dam and terminates at the confluence of the Tanana and Chena rivers. It protects the greater Fairbanks area from flooding during high water events on the Tanana River. Tanana River Levee has 11 groins and 3 seepage collector channels.

Remote meteorological and gaging stations arrayed across the 2,115-square-mile Chena River drainage provide information about rainfall, temperature, snow depth, and stream flows in tributaries to help project operators predict severity and duration of floods.

1.3 Current Operations

Chena River Lakes Project structures along the Tanana River are passive; they are periodically repaired and maintained but do not require operation during flood events. Some of the project structures controlling the Chena River are actively operated during flood events. Normal Chena River flows are less than 2,000 cfs, and the project typically is not operated for flood control until necessary to keep discharge in Fairbanks to less than 12,000 cfs. Chena River water is not retained by the project during normal flows; the dam control gates are open and the river flows downstream unimpeded.

During flood events, when river discharge in Fairbanks exceeds or is expected to exceed about 12,000 cfs, dam control gates are partially closed to control discharge of floodwaters. Gates may be closed further as the Chena River rises or when other sources of inflow below the dam increase river discharge so that at Fairbanks it approaches 12,000 cfs. Gates also may be lowered when adult salmon are returning to spawn so that the pool fills behind the dam and a fish ladder can be used to let the salmon escape upstream past the dam. Minimum discharge of 1,000 cfs is maintained whenever control gates are lowered to ensure that fish and their habitat downstream from the dam have sufficient water.

The project can regulate Chena River floodwater and/or divert it to the Tanana River. This protects low-lying lands in the floodplain downstream of the project. Those lands include most of Fairbanks, the cantonment area of Fort Wainwright, and some unincorporated areas in the vicinity. The maximum recorded flood at Fairbanks was 74,000 cfs in 1967. It inundated most of Fairbanks. The second highest recorded Fairbanks flood was 24,000 cfs in 1948, when a 16-year flood event inundated about 30 percent of the city.

Operation of the project has avoided an estimated $250 to $275 million in flood-related damages since the project became fully functional after the test fill in 1981. This averages $8.9 million per year. During fiscal year 2008, the Chena River Lakes Project received 156,739 visits at the recreation areas near the Moose Creek Dam. At a conservative benefit estimate of $7 per visit, this equates to recreation benefits of about $1.1 million per year.

All elevations stated in this document are referenced to the North America Vertical Datum of 1929, NAVD29. The Chena River channel bottom at Moose Creek Dam is about 480 feet above mean sea level (MSL). At average summer flows the water surface elevation of the river at the dam is 485 to 490 feet MSL. At elevations of 495 to 496 feet MSL, the Chena River begins to overflow its banks and into the floodway. Floodwaters pool in the eastern part of the floodway until they rise above 502 feet MSL and can flow westward to the floodway control sill at the Tanana River. If floodwaters continue to rise in the floodway to reach 506.7 feet MSL at the floodway sill, then they begin to flow over the sill into the Tanana River. The highest pool recorded in 30 years of Chena River Lakes Project operation was in May and June 1992, when Chena River water surface elevations rose to 507.6 feet MSL. This has been only event high enough to overflow the floodway sill.

1.4 Issues and Resources of Concern

Principal issues associated with floodwater retention and operation of the Moose Creek Dam control structure are public safety in the inundation area downstream of the dam, potential for flooding downstream property structures, and effects on migratory fish passage. The safety of people who are protected by the Chena River Lakes Project and who could be at risk by failure of any project component are the greatest concern. Their safety is the principal driving force leading to this action and to the decisions that will be made. Issues and concerns can be defined and categorized as follows:

Dam Safety. Moose Creek Dam and the smaller and lower East Cutoff Dike were constructed primarily of silty gravel and gravel. The Moose Creek Dam was constructed on soils that are primarily sands and gravels. The East Cutoff Dike was constructed on frozen silts and organic silts that are likely underlain with sands and gravels.

Water can migrate beneath both the dam and the East Cutoff Dike when floodwater is retained in the floodway. Water moving beneath both structures can weaken them and can lead to failure. Water beneath the dam or dike also raises groundwater down-gradient from them and may cause flooding in those down-gradient areas.

Current risk reduction considerations call for retained floodwaters to be discharged as soon as possible and to be kept at minimum pool elevations behind dams of this type. Other measures are employed in construction and operation to minimize water movement through dams. Upstream silt blankets and relief wells have been installed at the Chena River Lakes Project to prevent water movement from causing damage to the structures and their foundations.

Vegetation control may be important to prevent water from piping beneath dams, to ensure unimpeded discharge of flood waters into drainage channels, and to assist in performing effective inspection during flood events.

Flooding and Loss of Property. The Chena River Lakes Project has mitigated floodwaters of the Chena River in the greater Fairbanks area for 3 decades and also has reduced flood damage from the Tanana River. The project has been a major factor allowing Fairbanks to grow into the city it is now and in the expansion of facilities at Fort Wainwright and the role of Fort Wainwright meeting national military objectives. The project also has made it possible for housing to be constructed near the river in areas so low-lying that they could never have been developed without it. Structures in those low-lying areas could be affected by changes in project structures or operations. Changes in operation also could increase potential for flood damage and affect economic value of real property in the area. Community planning and tax values could be affected.

Cultural Resources. Historic structures in Fairbanks and on Fort Wainwright could be affected by flooding or construction resulting from changes in project structures or operation. Traditional and customary uses also could be affected.

Fish and Wildlife. The Chena and Tanana rivers are migratory corridors for chum and Chinook Pacific salmon. Both species spawn in the Chena River, primarily upstream of the Chena River Lakes Project. The Chena River is rearing habitat for both species and is one of the best-known grayling sport fishing streams in Alaska.

Salmon juveniles and other fish are affected by Chena River flooding. Any event, natural or man-made, that causes the Chena River to overflow its banks may strand juvenile salmon, juvenile grayling, and other fish. Adult salmon pass through the control structure as they return to upstream spawning habitat. As water backs up behind the dam during flood events, water velocity through the gates becomes too great for salmon and other fish to overcome. Returning salmon adults, grayling, and other fish that might be waiting to migrate to the upper Chena River must hold downstream from the control structure until the pool behind the dam is lowered enough so that water velocity is reduced and they can pass upstream through the control structure.

Salmon delayed too long during their return migration could be less able to reach spawning habitat and their reproduction could be less successful. A fish ladder can be used to allow upstream migration, but only after a flood pool is formed behind the Moose Creek Dam. Changes in project features or operation that might impede salmon returns or impede critical seasonal upstream migration by other fish would raise concern among resource agencies and others interested in the Chena River salmon fishery.

Most birds and mammals that inhabit central interior Alaska are represented at the Chena project. Most are adapted, at least at the population level, to extreme subarctic climatic and floodplain conditions. Construction and operation of the Chena River Lakes Project may have affected wildlife, but effects are not readily apparent. Changes in structures, operation, or maintenance that could affect birds and mammals would be of concern to resource agencies and other interested users.

2.0 ALTERNATIVES

2.1 Range of Alternatives

Four specific, immediate objectives based on the needs identified in Section 1 are as follows:

- Reduce retention time for floodwaters behind Moose Creek Dam
- Minimize flood pool elevations behind Moose Creek Dam
- Minimize water movement through and beneath Moose Creek Dam and the East Cutoff Dike
- Facilitate inspection during flood events

The scope of alternatives considered in detail encompasses measures that can be employed in the near term with reasonably available resources and authorities. National Environmental Policy Act guidelines require that a full range of alternatives be considered for major Federal actions, but they allow the process to be tiered in a series of sequential actions. This environmental assessment addresses interim risk reduction measures to meet immediate needs. It also could become the first tier of a process leading to more extensive changes to facilities and operations at the Chena River Lakes Project.

Section 1 also identified issues and concerns related to resources in the project area. Potential for impacts to those resources, and measures to mitigate those impacts, are evaluated for each alternative considered in detail. The single most important objective is to protect the safety of people in the area influenced by the Chena River Lakes Project. The following objectives and constraints for protection of resources were identified in addition to that central objective:

- Minimize impacts to salmon migrating up the Chena River
- Minimize stranding of fish during flood events
- Protect habitat identified as important to fish and wildlife
- Protect cultural resources
- Minimize damage to property and economic activities
- Minimize effects to water quality

There also are resource protection laws and regulations that must be considered in planning. They include the Clean Water Act, the Migratory Bird Act, and many others. Any action taken would be implemented to ensure compliance with those statutes.

Alternatives in the following discussion are roughly grouped in the following objectives to help comparison, but some actions would meet more than one objective:

1. No action
2. Reduce the volume of water entering the Chena River Lakes Project
3. Modify operations to impound less water
4. Modify project features to impound less water
5. Remove vegetation to stop damage and improve inspection and operation

2.2 No Action

The no action alternative must be considered in environmental assessments. The no action alternative is to continue operation of the Chena River Lakes Project as it is operated now. Project features would not be altered to lessen risk, vegetation control would not be increased, and operating instructions for the control structure would be unchanged.

2.3 Reduce the Volume of Water Entering Chena River Lakes Project

Chena River floodwater could be diverted into another drainage or stored in a new reservoir upstream from the Chena Project. No measures could be implemented under existing legislative authorities to support this alternative. This alternative was studied in the 1970's during feasibility studies for the current Chena River Lakes Project. This alternative would require re-initiation of lengthy feasibility studies. Outcome would be uncertain, and no immediate action could be taken. This alternative is eliminated from detailed consideration in this environmental assessment. Earlier studies also considered diverting or impounding the Little Chena River, which empties into the Chena downstream of Moose Creek Dam. Discharge from the Little Chena adds to the total Chena River water discharge at Fairbanks. The Little Chena alone could discharge more than 12,000 cfs. Controlling discharge from the Little Chena would allow more discharge from Moose Creek Dam during high water events. Re-initiating consideration of that alternative is outside the scope of this environmental assessment but could be reconsidered in evaluations of long-term solutions to flooding in Fairbanks.

2.4 Modify Project Operations to Store Less Water

Current operations release all Chena River water through the Moose Creek Dam control structure unless water must be retained or diverted to protect downstream lands from flooding. There is no reason to alter this part of project operation. When the intake structure is operated to retain Chena River water, the Alaska District coordinates with the Alaska Department of Fish and Game (ADF&G) to determine whether returning adult salmon may be in the lower Chena River. Under present operating procedures, floodwaters may be retained so water levels behind the dam are raised and the fish ladder can be used to pass returning salmon upstream. Any time the Moose Creel Dam floodgates are lowered, they are operated to release a minimum flow of 1,000 cfs to preserve downstream aquatic habitat.

2.4.1 Operations for Fish Passage

The project is operated to store only as much water as required to avoid downstream flooding if a high water event is predicted to be of short duration or limited volume. Salmon are assumed to be blocked from migrating upstream at discharges of 8,000 cfs or a pool elevation of approximately 495 feet MSL. Upstream migration of salmon is halted until enough water is discharged to lower the river elevation to less than approximately 495 feet MSL or until the pool behind the dam is raised to at least 500.5 feet MSL (optimally to 502 feet MSL) so that the project fish ladder can be operated. Raising the pool from 495 feet MSL to 502 feet MSL impounds approximately 14,000 acre-feet of water.

The decision of whether to discharge water rapidly as possible or to retain it to allow the fish ladder to pass salmon is made collaboratively by the Corps and ADF&G biologists and hydrologists and is based on observed and predicted runoff in the Chena River drainage, weather forecasts, stage of salmon migration, and other factors. The fish ladder has been operated twice: once during the test fill in June and July 1981 when peak pool elevation reached 501.4 feet MSL and again in late May and June 1985 when the flood pool reached 505.3 feet MSL. The fish ladder worked well on both occasions. Fisheries resource managers who were contacted during more recent high water events have agreed that rather than operating the fish ladder, as much water as possible should be released to shorten high water events and to minimize the size and duration of the flood pool behind Moose Creek Dam.

The Corps proposes to alter operations so that water would not be impounded behind Moose Creek Dam specifically to enable operation of the fish ladder for upstream fish passage. The fish ladder would be available when the pool reached enough elevation for it to function, but flood water would not be stored solely for the purpose of bringing the fish ladder into operation sooner. Eliminating this intentional impoundment could reduce stored volume by as much as 14,000 acre-feet during flood events. This action would reduce the potential for dam failure and for seepage into ground water beneath the dam.

Had this measure been implemented at the beginning of project operations, it would have affected operation of the fish ladder on only two occasions for a total of 20 days. Omitting the test fill, which was not needed to protect Fairbanks, only 6 days of fish ladder operation would have been affected.

Larger flood events can be expected to raise pool elevations behind the Moose Creek Dam to 502 feet MSL even if water is discharged as rapidly as possible without exceeding discharge objectives in Fairbanks. The fish ladder would be deployed and operated during any event when the pool elevation was expected to exceed 500.5 feet MSL and consultation with ADF&G determined that the fish ladder was needed for salmon passage. The fish ladder would be ineffective if pool elevations exceeded 510 feet MSL. The Corps would not attempt to operate it if the flood pool was above that elevation.

This proposed action would have little effect on the time required to bring the fish ladder into operation during larger high water events. Building the flood pool to 502 feet MSL while water was released at 8,500 cfs during a 10-year flood event would take 23 hours longer and only 5 hours longer during a 100-year event.

2.4.2 Adjust Operations to Optimize Discharge Rates

Water released from Moose Creek Dam downstream into the Chena River channel is restricted to approximately 8,500 cfs. This minimizes flooding in low-lying areas along the river. When the Little Chena River and other tributaries downstream were contributing relatively little water, discharge from Moose Creek Dam could be increased without exceeding the 12,000 cfs discharge objective in Fairbanks. Increasing that discharge rate through the control structure would increase potential for flooding along the river downstream from the dam, but could be implemented if better on-site monitoring at critical locations could prevent flooding in the reach between the dam and Fairbanks. The Corps proposes to modify operating procedures by stationing hydrologists or other qualified observers on the ground at critical locations during flood events when operations need to safely discharge as much water as possible without undue flooding.

2.5 Modify Project Features to Impound Less Water

Two alternatives could be implemented so that Moose Creek Dam impounded less water: They are as follows:

- Modify the control structure so it can release more water. This would flood downstream floodplain lands unless the Chena River channel was extensively modified to contain the additional water. This cannot be implemented as an interim measure and is not considered further in this assessment.

- Modify the control sill at the junction of the project floodway and the Tanana River. Figure 4 shows the control sill during the highest Tanana River elevation since the sill was constructed. The sill could be lowered or gated to release Chena River floodwater into the Tanana River. Gating would require a series of long, low flood gates that could not be constructed as an interim measure. Lowering the control sill and providing for an alternative measure that could replace the sill's function is considered in detail.

Figure 4. Floodway control sill structure; Tanana River elevation 500.9, July 30, 2009

The control sill keeps Tanana River floodwater from entering the Chena River Lakes Project and the Chena River. Without the control sill, Tanana River flood waters above approximately 501 feet MSL would enter the lower section of the floodway. At approximately 502 feet MSL, floodwater would flow over the high point in the floodway and into the Chena River, adding suspended sediment to the river, increasing the volume of stored water, and impacting fish habitat. The control sill has not yet been needed. In almost 30 years of project operation, the highest Tanana River water level at the control sill was 501 feet MSL, but the sill could be important during more severe Tanana River flood events.

The control sill also retains Chena River floodwater and during many high water events, and in some conditions it substantially affects maximum pool elevation in the Chena River Lakes Project. Lowering the sill from its present crest of 506.7 feet MSL would lower pool elevation. The largest water volume ever stored by the project was during the 1992 flood event when the pool crested at 507.6 feet MSL. The maximum pool elevation during that event would have been substantially lower if the control sill had been at 502 feet MSL. Lowering the sill would be a cost effective action to reduce both volume and duration of floodwater retention by the project. It could be implemented as an immediate interim measure.

Lowering the sill would divert water into the Tanana River earlier in flood events and would reduce the maximum pool elevation during floods. This action also would reduce the probability that the flood pool would reach the East Cutoff Dike. Reducing pool elevation would reduce the potential for dam failure and lower the probability of an uncontrolled release of pool. The smaller volume of water impounded behind the Moose Creek Dam also would reduce consequences of an uncontrolled release. A significantly larger flood would be required to reach the 507.6-foot MSL pool elevation recorded during the 1992 event.

Lowering the control sill would increase the probability that water from the Tanana River could enter the floodway and affect fish and aquatic habitat of the Chena River. Tanana River water in the floodway could affect groundwater in the Lyle/Nelson Road area, although it would take a major Tanana River flood event to produce a substantial pool in the floodway.

The Corps would provide alternate measures to keep Tanana River flood water from reaching the Chena River. Low-permeability gravel, blocks, sandbags, and sand or other material would be stockpiled near the floodway and would be placed during floods to create a water barrier at the Richardson Highway crossing to stop Tanana River inflow. The temporary barrier would be removed after each Tanana River flood event.

2.6 Remove Sediment and Control Vegetation

The Corps proposes to remove silt and accumulated organic material from stilling basins at the control works and the floodway control sill. The Corps also proposes to remove vegetation that obstructs inspection of Moose Creek Dam and vegetation that impedes water flow out of the project floodway. Those actions would help operators and inspectors identify and mitigate potential problems, reduce potential for dam failure, and expedite floodwater discharge into the Tanana River from the floodway. Removing vegetation also would reduce potential for water to seep along roots and pipe through the voids roots may leave in earthfill structures. Seepage and piping can weaken dams and increase the risk of failure.

Approximately 1,500 cubic yards of silt from the Tanana River have accumulated in the stilling basin at the base of the 2,000-foot-long floodway control sill. The stilling basin keeps water flowing over the sill from eroding around and under the base. The accumulated silt and vegetation prevents inspection of the structure and impedes its function. The Corps proposes to remove accumulated material and vegetation with appropriate heavy equipment. All work would be conducted when the Tanana River is low enough so that work can be performed in the dry. Material removed during this action would be placed on upland project lands as topsoil or landscaping fill to meet project objectives. Work would be timed or limited in area to avoid effects to migratory birds. A storm water pollution prevention plan would be prepared if the total area filled with the silty material exceeded 1 acre.

Less than 50 cubic yards of silty material would be removed from the control works stilling basins. Removal methods have not been determined. Small amounts of sediment adhered to the outlet structure and basin may be scrubbed off mechanically and allowed to settle to the bottom. Larger amounts would, if necessary, be removed mechanically and used for landscape fill. Dewatering a small area of the Chena River at the control works may be required. Specific plans for in-water work would be coordinated with the

Alaska Department of Fish and Game. Any timing or operational measures required to protect fish or their habitat would be incorporated into the action.

The Corps proposes to clear vegetation along the toe of Moose Creek Dam and the dam extension, in the floodway upstream from the dam, and at the end of the floodway beyond the control sill. Figures 5 and 6 show the areas that would be cleared at the toe of the dam, the toe of the dam extension, and beyond the control sill. Vegetation clearing in the floodway would be at various locations where existing clearing does not extend a full 50 feet upstream from the upstream margin of the silt blanket. Areas to be cleared in the floodway are discontinuous and vary in dimension. Those areas are not shown in figures 5 and 6. Vegetation control is required by dam safety regulations and would substantially improve the Corps' ability to identify and react to events that could lead to dam failure. It also would improve water flow for project operation.

Vegetation can be controlled by fire, herbicide, or mechanical methods. The Corps proposes to use only mechanical vegetation removal for interim measures. Trees valuable for firewood would, where feasible, be felled by chainsaw, roughly limbed, and made available to the public.

Trees and brush at the end of the floodway past the control sill are all less than 6 inches in diameter and are not salvageable for firewood. Mechanical flails or cutters would be used to clear and chop all woody vegetation in that 31-acre area. The chopped woody vegetation would be left in place. The vegetation clearing would not excavate or grub into the earth during this action.

A 50-foot-wide swath along the downstream toe of Moose Creek Dam, including the dam extension at the southern end of the dam, would be cleared for the full 7.5-mile length of the dam and the 0.7-mile length of the extension (figures 5 and 6). This area totals approximately 45 acres. An additional area of about 25 acres would be cleared in the floodway. Trees salvageable for firewood would be felled, limbed, and stacked for public use. Smaller trees and brush would be mechanically chopped or flailed. This work would be accomplished in the winter or early spring while the ground was frozen. Vegetation clearing would not excavate or grub into the earth during this action. Woody debris and felled timber could be stacked, piled, or otherwise collected only into locations that had been inspected and determined not to be waters of the United States including wetlands.

Timing and clearing methods would be constrained to avoid the taking of migratory birds. Particular care would be taken near the Chena River and other water bodies to avoid introduction of sediment or woody debris and to ensure compliance with State water quality standards.

The Corps will consider a separate, later action to grub or excavate roots in the cleared areas. Jurisdictional wetlands will be identified and their functions and values will be considered in additional documentation before that action is implemented. Appropriate documentation will be prepared to meet requirements of the National Environmental Policy Act and other regulations.

Figure 5. Northern segment of proposed vegetation clearing at Moose Creek Dam.

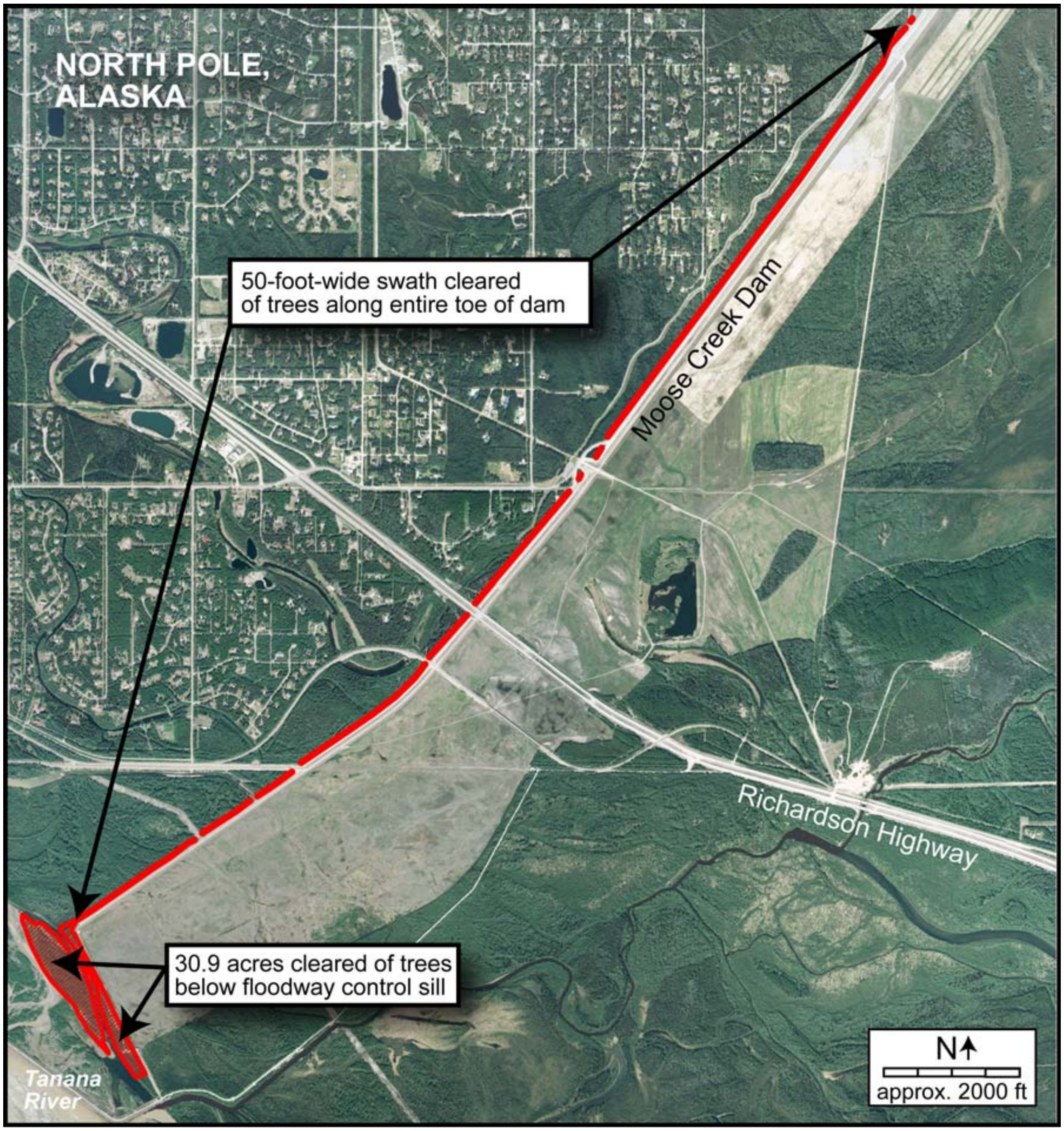


Figure 6. Southern segment of vegetation clearing at Moose Creek Dam and at the control sill.

3.0 AFFECTED ENVIRONMENT

3.1 The Project Area

The Chena River Lakes Project is in central interior Alaska at approximately 64.7°N, 147.3°W near the community of North Pole (population 2,099), and a short distance from Fairbanks (the second largest city in Alaska, population 30,367). The project also is near Eielson Air Force Base (population 2,858) and Fort Wainwright (population 10,906). Figure 1 shows the location of the Chena River Lake Project and those communities.

The project is less than 150 miles south of the Arctic Circle. Climate is typical of interior locations in the far north. Average January temperatures range from -19 to -2 °F; average July temperatures range from 49 to 71 °F. Extreme temperatures range from more than -60 °F to almost 100 °F. The area is in discontinuous permafrost with much of the area underlain with perennially frozen ground. Annual precipitation is 11.5 inches, with 67.8 inches of snowfall. Heaviest precipitation generally is in August and September.

The Chena River Lakes Project and the surrounding communities are at the border of the broad Tanana Valley. Bedrock is estimated to be about 600 feet beneath Moose Creek Dam. Continuous permafrost often forms hydrologically impermeable barriers in the far north, but groundwater moves readily through thawed gravelly strata that dominates the conditions found beneath Moose Creek Dam.

The Chena River drains a total of 2,115 square miles, of which 1,496 are upstream of the Moose Creek Dam. Most of the rest of the drainage flows into the Little Chena River, which joins the Chena River downstream from Moose Creek Dam. Chena River does not receive glacier melt water or water from any other major source of suspended sediment, so water is relatively clear and the stream bottom is gravel or rocky through most of its length. Flows typically are between 1,000 and 2,000 cfs in the summer and less than 100 cfs in the winter. Peak flows generally are in two periods: in the spring when the warming sun and rain melt snow in the highlands that make up much of the Chena River drainage and in late summer, which often is rainy in Alaska. Unusually deep snow in the upper drainage may contribute to larger spring flood events, and heavy rains may exacerbate flooding from the snowmelt. Table 1, based on hydrological modeling, provides information about high water events since the project began operation.

Table 1. Modeled Chena River flows

	Peak Inflow (cfs)
10-year flood	**16,268**
100-year flood	**33,635**
300-year flood	**42,000**
1948 flood	**19,065**
1967 flood	**57,400**
1992 flood	**16,600**
Standard project flood	**74,000**
Project maximum flood	**186,000**

3.2 Resources of Concern

Section 3 provides information about the Chena and Tanana rivers, their floodplains, and their biological and cultural resources that might be affected by alternatives identified in Section 2. It also provides information to illustrate the need for action.

Principal identified resources of concern are as follows:

- Air Quality
- Water quality and river elevations
- Vegetation and wildlife habitat
- Fish, particularly salmon and grayling
- Mammals and their important habitat
- Birds and their important habitat
- Historic and other cultural resources

Air Quality. Fairbanks is particularly susceptible to air quality problems during the winter due to increased heating requirements combined with temperature inversions during cold weather. Surrounded by hills on three sides, temperature inversions can trap a layer of cold air close to the ground. Even relatively small amounts of pollution can accumulate to unacceptable levels over periods of days or even weeks at a time.

The USEPA designated the urban part of Fairbanks North Star Borough (FNSB) a non-attainment area for carbon monoxide in 1991. However, FNSB has not violated the National Ambient Air Quality Standard (NAAQS) for carbon monoxide since 1999. Since that time, EPA approved the FNSB's carbon monoxide attainment plan and the area designated in 1999 became a Carbon Monoxide Maintenance Area on September 27, 2004. All of the activities proposed in the assessment are well outside the boundaries of the carbon monoxide maintenance area.

In December 2009, an expanded segment of the Fairbanks North Star Borough was designated as a nonattainment area due to due to violations of recently promulgated national ambient air quality standards (NAAQS) for particulate matter smaller than 2.5 micrometers in diameter (PM2.5) in the city of Fairbanks. The PM2.5 nonattainment area boundaries extend outside the city and are illustrated in figure 7.

The nonattainment area encompasses part of the 8.2-mile-long Moose Creek Dam and extension, but does not extend to the control sill at the Tanana River. Much of the vegetation clearing would take place within the nonattainment area, but the work to lower the control sill and clear vegetation at the Tanana River would take place outside it.

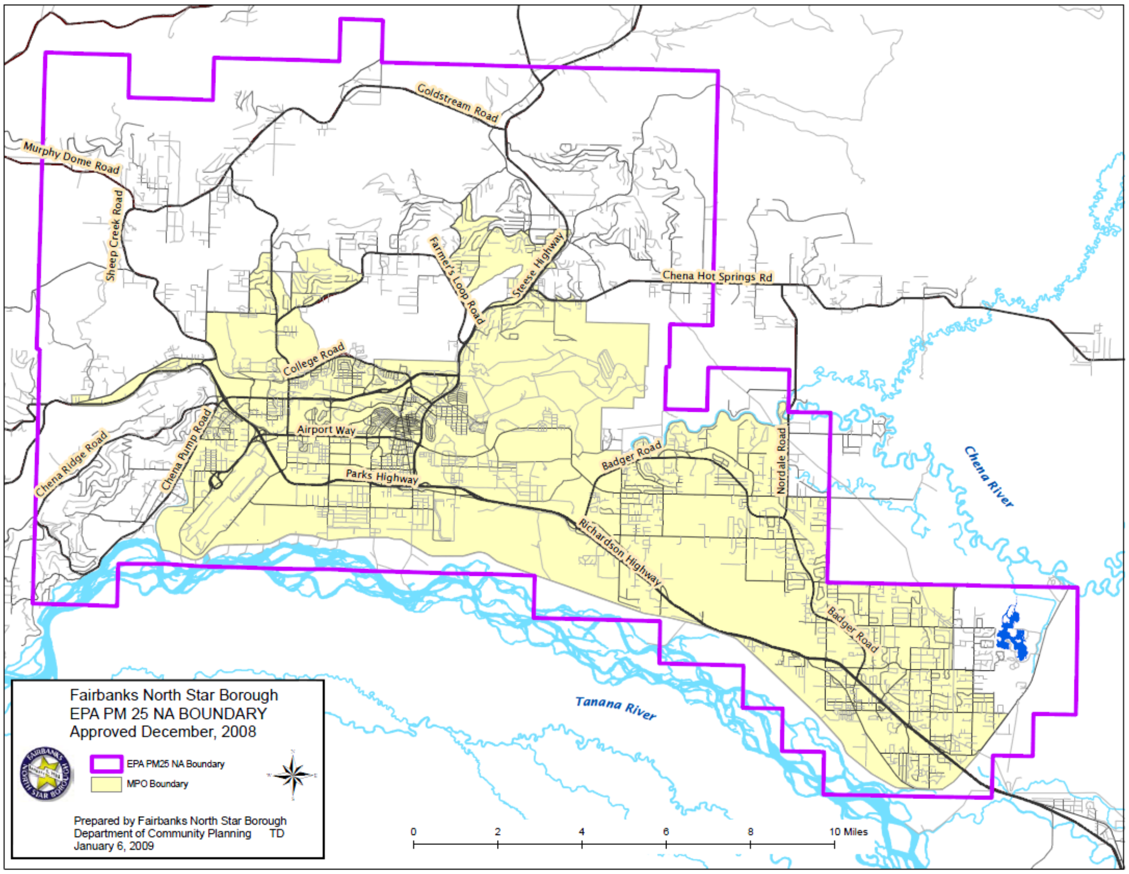


Figure 7. PM2.5 Non-attainment area, Fairbanks North Star Borough.

Most of the PM2.5 in Fairbanks is thought to be generated by combustion of fuel and wood for heat, electricity, and transportation. Typical PM2.5 sources include power plants, vehicles, wood burning stoves, and wildland fires. In Fairbanks, air quality problems are most prevalent during cold weather temperature inversions. Figure 8 illustrates the number of days that PM2.5 concentrations exceeded standards in downtown Fairbanks during recent winters.

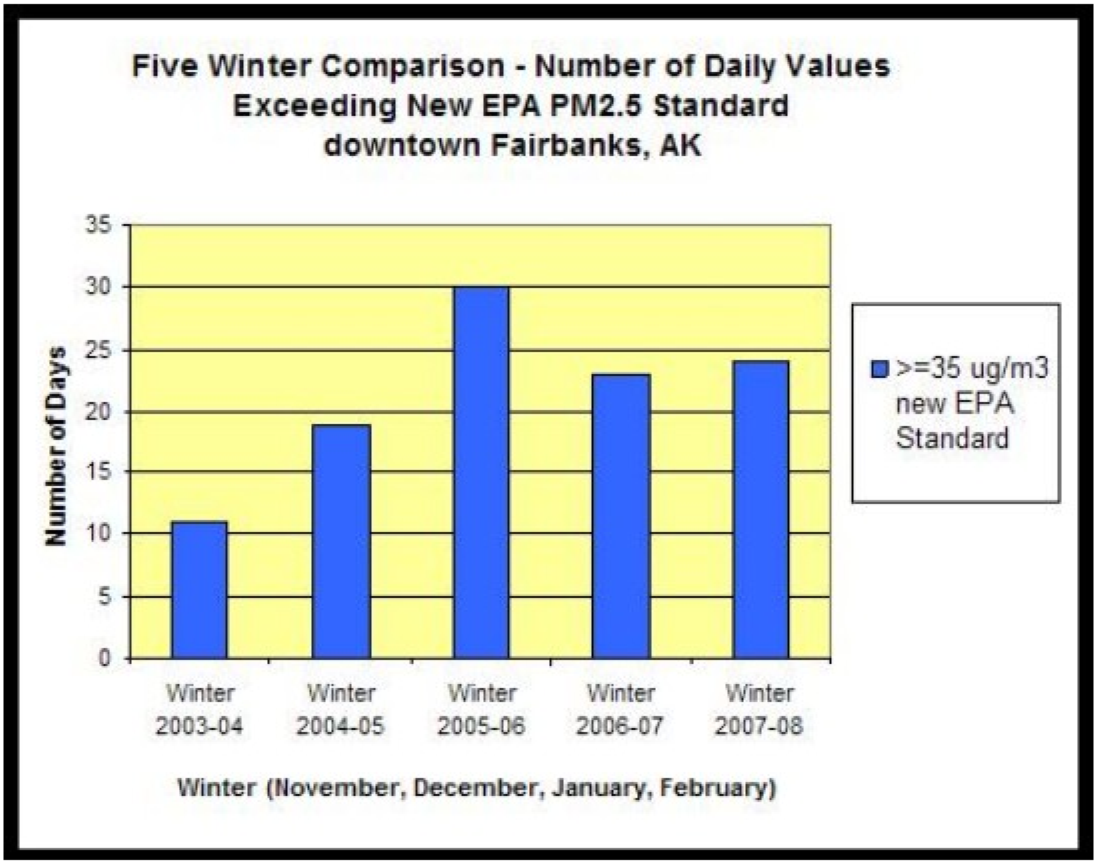


Figure 8. PM2.5 exceeding standards in Fairbanks 2003-2008.

Water Quality and River Flood Elevation. Chena River is not fed by glacial runoff, and turbidity is relatively low. Principal water quality issues are associated with natural presence of elements from mineralization. Past mining probably has made metals more available to the system. Arsenic, barium, chromium, and zinc concentrations were relatively high in sediments sampled in the lower Chena River (USACE 1998).

The Chena River Lakes Project and operation of the project do not appreciably affect Chena River water quality, although sediments may settle out of water impounded during flood events. Before human development in the Fairbanks area, floodwaters of the Tanana and Chena rivers comingled in their shared floodplains and periodically filled remnant channels left by meandering rivers. Silt and bedload material would have been introduced into the lower Chena River during those events. Levees, slough blocks, and drainage modifications now limit Tanana River incursions into the lower Chena River. The Chena River in the project area does not receive water from the Tanana River. Any nutrient benefit it may have gained from Tanana River sediment is lost, but light penetration for photosynthesis and sight feeding by fish and invertebrates is unimpeded by Tanana River suspended solids, and aquatic bottom habitat is not clogged with silt. Exclusion of Tanana River water may have benefited both salmon and grayling.

The floodway high point is 502 feet MSL, high enough to prevent all but the highest observed Tanana River floods from reaching the Chena River. The 2,000-foot-long control sill was placed at the floodway outlet to create an even higher Tanana River block at elevation 506.7 feet. The Tanana River has not comingled with the Chena River in the project area since the project was constructed.

The Chena River Lakes Project is operated to keep river discharge in Fairbanks to less than 12,000 cfs. It also is operated to minimize flooding in the 35-mile river reach between Moose Creek Dam and Fairbanks.

Vegetation. Clearing vegetation would remove diverse woody vegetation from about 100 acres. Grass and herbaceous vegetation might be cut, but would soon return. Approximately 30 acres of the vegetation to be removed would be second-growth alder and poplar in the Tanana River floodplain adjacent to the control sill at the end of the floodway (figure 6). All that vegetation is less than 6 inches in diameter.

The remainder, approximately 70 acres, is mixed and diverse woody vegetation along the toe of Moose Creek Dam. The area planned for clearing at the toe of the dam is a narrow strip 50 feet wide and 8.2 miles long, so vegetation varies considerably from one end to the other. The northern 3 miles is approximately 80 percent birch with occasional, scattered large white spruce nearer the Chena River. The area closer to Lake Park and the project office compound is small diameter (2 to 4 inches) black spruce-tamarack with intermittent patches of willow. From the fee booth to the Alyeska oil pipeline, vegetation is mostly dense stands of young spruce, balsam poplar, and aspen, with large spruce around the bridges. The southern 2 miles nearer the Tanana is a young stand of balsam poplar and aspen. Vegetation to be cleared in the floodway is strongly influenced by soil patterns remaining from river channels, permafrost, and other factors. Vegetation types and diversity in the floodway are similar to those along the dam toe.

Wetlands are intermittent along the dam toe south of the Chena River, generally where ground water is shallow or in permafrost. There also are scattered areas of potential wetlands in the areas proposed for clearing in the floodway.

Fish. Intensive fish collections from above and below the Chena River Lakes Project (USACE 1999) and earlier collections (Van Hulle; 1968, Walker 1983, and USFWS, 1984) identified the following species:

- Chinook salmon
- Chum salmon
- Arctic lamprey
- Lake chub
- Arctic grayling
- Longnose sucker
- Round whitefish
- Humpback whitefish
- Broad whitefish
- Least cisco

Sheefish
Northern pike
Burbot
Slimy sculpin
Nine spine stickleback

Three of those species, Chinook salmon, chum salmon, and arctic grayling are of particular importance in the biology of the Chena River and are highly important in the Tanana River system fishery. Arctic grayling are comparatively large, are abundant in the river, are important predators, and are highly prized in the recreational fishery. Both salmon species transport important nutrient sources into the system.

Grayling. Grayling overwinter in deeper water of home rivers or in glacially fed rivers. They are observed during the winter in the lower Chena. They disperse into spawning and feeding habitat as the ice begins to go out in the spring, typically in May. They have been reported to spawn over riffles with relatively small gravel, but are known to spawn on a variety of habitats and have been observed spawning in muddy sloughs of the Chena River. They typically spawn soon after ice-out as water temperatures begin to rise and stream discharges increase.

Embryos hatch in about 3 weeks and emerge as fry a few days later. Fry have very little mobility in their first two weeks and flooding may cause high mortality (USACE 1999). Young of year (YoY) are more mobile, but smaller YoY still prefer quieter water where they often form dense schools. Falling water levels may strand fry and in isolated pools (Armstrong 1986). The Chena River Lakes Project floodway emulates a natural pool during flood events when the control structure gates are closed. YoY were observed in impounded water at the Chena River Lakes Project, but limited observations did not find substantial numbers of dead YoY after drawdown. Although specific data are sparse, impounding Chena River floodwater is generally understood to increase potential for mortality to grayling fry and YoY during flood events in late spring and summer. Larger sub-adult and adult grayling may move into the floodway during flood events, but little evidence of post-flood mortality has been reported.

Substantially smaller Chena River grayling year classes were noted after the 1967 and 1981 Chena floods, indicating that both natural flooding before the project and flooding into the constructed floodway could have caused substantial mortality. There is no way to determine whether mortality from natural flooding before project construction was comparable with mortality from flooding into the constructed floodway during post-construction events.

Chinook Salmon. Chinook salmon spawning in interior Alaska is limited to relatively few streams. The Chena River is one of the more important spawning rivers in the middle reaches of the Yukon River drainage. Biologists (USACE 1999) estimated that approximately 6 percent of the total Yukon River Chinook harvest between 1987 and 1996 (10,800 average per year) were Chinooks contributed by the Chena River. Estimated escapement to the Chena River from 1986 to 2008 is shown in figure 9.

Chinook typically first return to the Chena River to spawn in mid to late June. A few may spawn below Moose Creek Dam, but almost the entire spawning effort is upstream from the dam. High water events that discharge more than 8,000 cfs or impound water behind Moose Creek Dam produce enough water velocity through the control structure to halt upstream migration. Delays could reduce reproductive success and recruitment. Flood events coinciding with Chinook return migrations have been uncommon, and quantitative data to evaluate potential effects are sparse.

Chinook spawn in the deepest, swiftest river waters used by Pacific salmon and in the coarsest substrate. Some spawning redds may be in areas of the river that are inundated when the control gates are closed. This can flood the redds and may reduce reproductive success.

Eggs hatch in early spring and fry emerge during or just after ice-out on the river. Most of the juveniles collected were taken within 3 weeks after ice-out. Juvenile salmon remain in the Chena River for more than a year, until the following spring or summer, and then migrate into the Yukon drainage and then into the Bering Sea.

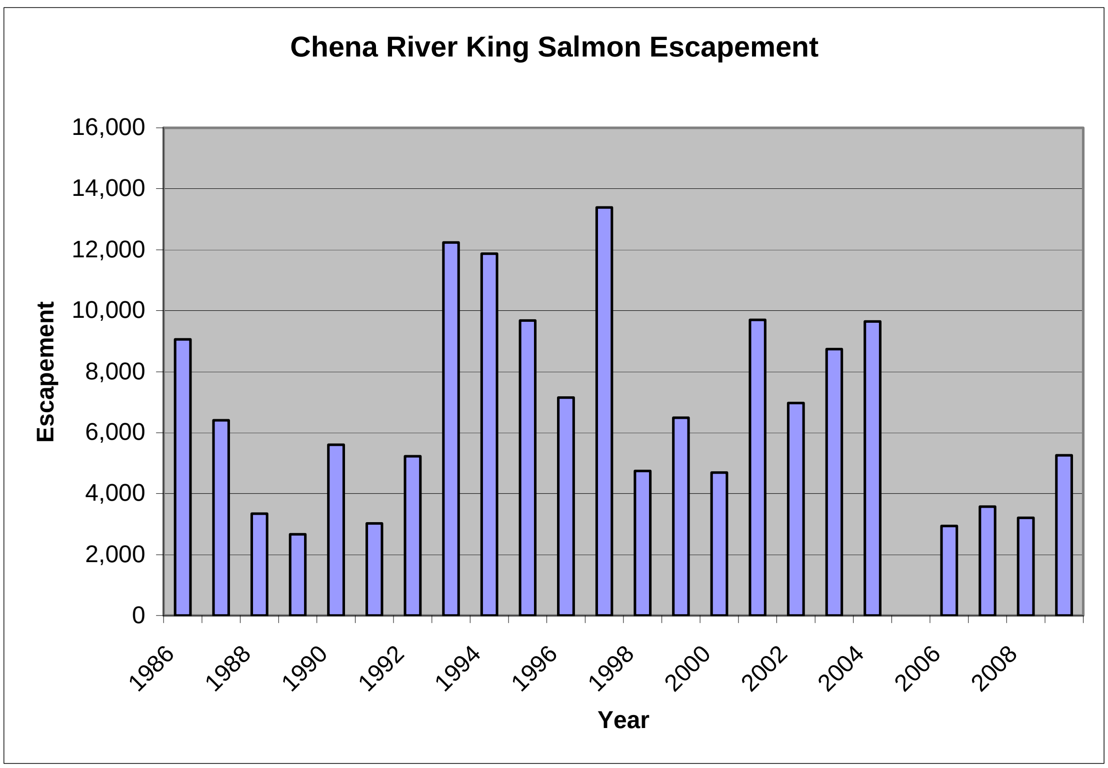


Figure 9. Chinook (king) salmon escapement to the Chena River 1986-2008 (ADF&G 2010).

The newly emerged fry feed on insects and plankton, grow, and gradually become more mobile. Chinook juveniles readily enter flood pools formed behind the Moose Creek Dam during flood events and were reported to be most abundant close to the dam, often in schools of 20 to 40, and may be attracted by the "astonishing" abundance of floating insects and spiders in the flood pool (USACE 1988). Second-year Chinooks are predatory. Along with insects and other invertebrates, they eat other fish. They have been observed feeding on chum salmon juveniles in the Chena River (USACE 1999), and they certainly feed on other juvenile fish.

Salmon juveniles may be better attuned to water flow and changes in flow than some non-migratory species. Salmon juveniles, both Chinook and chum, are commonly observed in Moose Creek Dam flood pools when the control gates were closed, but seem to retreat back to the river as water drops, either directly or through the two low-point drains (USACE 1988; 1999). They may be more likely to remain behind as a pool is isolated where water is relatively deep, and there is concern that they may be trapped in the armor rock of the dam (USFWS 1984).

Grayling, whitefish, and other fish prey on juvenile salmon of both species. Biologists examining grayling stomach contents in the Chena River during a 3-year study estimated grayling predation at 0.03 juveniles taken per fish per day (USACE 1999). Individual fish, particularly when juveniles are concentrated, may take many more. During a flood event as juveniles were returning to the main river channel, biologists reported stomach contents of 28 juvenile salmon in one 14-inch grayling and 31 in the stomach of a 16-inch whitefish (USFWS 1984).

The Chena River Lakes Project probably has little effect on juvenile salmon when the control gates are not being operated and water is not impounded. There may be less shoreline vegetation and other cover upstream of the dam, but the riverine habitat is largely unaffected. As floodwaters build up behind the dam control gates in the first weeks after ice-out, water velocity through the control structure increases and the young, less mobile juveniles may be injured as they are swept through. Studies of juvenile Chinook salmon in 1996 (USACE 1999) did not report substantial differences in scale loss between those collected above and below the control structure or correlation with increased water velocity, but did find that larger juveniles more frequently lost scales at both locations.

When the control gates are closed, impounded water flows out of the river banks and into the floodway where it creates a temporary lake. The impounded water may be warmer and prey organisms are more abundant. This may be an exceptional opportunity for juvenile salmon to feed and grow, which improves their mobility and potential to survive outmigration to the Bering Sea. This advantage is offset by predation and by the potential for juveniles to be stranded. There are insufficient data to evaluate losses when the Chena River is of out its banks, but there appears to be general consensus among experienced professional biologists that Chena River flood events are detrimental and that salmon year classes benefit when both natural and human-caused floodplain inundation is infrequent and limited in duration and extent. This is particularly important in the first few weeks after ice-out when young of year fish are less mobile. Salmon juveniles in the Chena probably benefit when flood events at the Chena River Lakes Project are managed to be short in duration and volume of water impounded.

Chum Salmon. Unlike Chinook salmon, chums outmigrate to the ocean the same summer they emerge from spawning redds. Their early life history is similar to Chinook salmon; they begin to emerge as the ice goes out and reach peak abundance within about 3 weeks, are very poor swimmers for the first 2 or 3 weeks, and feed on plankton and small insects. Unlike Chinook, however, most chum juveniles outmigrate to the Tanana River within a few weeks after they emerge. Some chum juveniles are still in the river into early summer, and they were reported in pools in the floodway during a June flood.

Adult chum salmon typically begin returning to Chena River in July and may continue into late August. Estimated escapement to the Chena River from 1986 to 2008 is shown in figure 10. Chum salmon escapement is underestimated in some years because census was halted while chums were still returning. They generally spawn in water that is shallower and bottom material that is smaller in grain size than the spawning habitat used by Chinook salmon.

Effects of operations are about like those associated with Chinook salmon, except that all the juveniles in the Chena are fry or young of year that have little mobility and are relatively unable to avoid predation or other hazards. They also are largely gone from the Chena by mid June, so the juvenile chums are not affected much by events later in the summer.

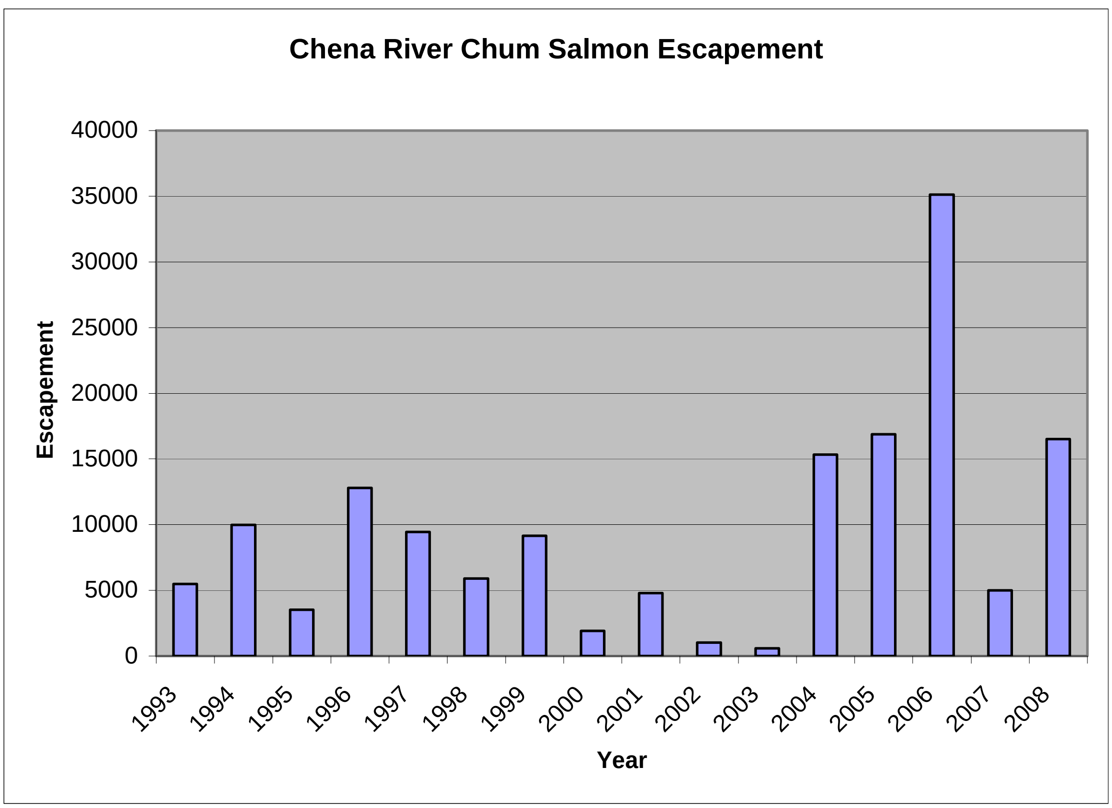


Figure 10. Chum salmon escapement to the Chena River 1993-2008 (ADF&G 2010).

Other Fish Species. Less is known about other fish species in the Chena River. Arctic lamprey, lake chubs, longnose suckers, and whitefish are probably the most abundant of fish species other than salmon and grayling in the Chena. They are widely distributed in interior Alaska. Project effects on those species are likely to be similar to effects on salmon and grayling. Longnose suckers may be more likely to be stranded after flood events.

Mammals. Habitat along the dam toe is segmented and disturbed by project features, roads, bike paths, and other structures and facilities. This is likely to diminish substantially its value as habitat for larger mammals. Moose, wolf, bear, fox, lynx, and coyote move through this habitat regularly, but its use does not appear to be of great importance or of more than moderate intensity for those species.

Birds. At least 70 different species of songbirds, possibly 19 species of raptors, 5 species of grouse, more than a dozen species of waterfowl, and many species of marsh and shorebirds are present at least seasonally in the Chena River Watershed (USACE 1997). Most of those species are present at least occasionally in the Chena River Lakes Project area. A bird survey in 2005 by the Alaska Bird Observatory identified three species that were of particular interest: Townsend's warbler, rusty blackbird, and Hammond's flycatcher. Those three were identified in brushy habitat near ponds/sloughs on the floodway closer to Moose Creek Bluff, well outside the area proposed for clearing.

The proposed action would affect birds associated with the floodway and other areas that might be inundated by a flood event. Birds using habitat that would be cleared for vegetation control also would be affected. Bird populations have not been surveyed in those areas, but experienced biologists and natural resource managers are familiar with the area. No habitats of particular national, regional, or local importance have been identified.

Historic and Other Cultural Resources. The Chena River Lakes Project contains sites that are listed in the Federal register of historic places. None of those listed sites are in areas that would be cleared of vegetation or at the control sill that would be lowered.

The Chena River Lakes Project is an important recreational site for residents of and visitors to interior Alaska. Its grounds also are used for personal use hunting and fishing, and for training and education functions.

4.0 ENVIRONMENTAL CONSEQUENCES

This section addresses the environmental consequences of the proposed actions and viable alternatives on the important resources of the action area. Effects on each of the resources addressed in Section 3 are considered in this section.

4.1 Air Quality

A conformity analysis is required for Federal projects in nonattainment areas unless they are exempted. USACE guidance requires clearing of vegetation within 50 feet of the Moose Creek Dam toes and along the upstream seepage blanket. The proposed action would mechanically clear vegetation at the dam toes and at the control sill over a period of approximately 40 days in the late winter and early spring. Cleared vegetation would not be burned for this action. Larger trees would be made available to the public. These associated maintenance activities are specifically exempted from conformity analysis requirements. The actions related to the lowering of the sill are not exempted but are outside the non-attainment area.

Although the Corps is not prescribing specific methods and equipment to be used, the entire project to clear the vegetation and lower the sill is expected to require the consumption of less than 1,000 gallons of fuel. Most fuel consumption would be associated with the vegetation clearing activities. The contractor will be required to use low-sulfur fuel in all diesel-powered equipment. The activities would be performed outside the time periods when air quality standards are typically exceeded. Impacts to air quality would be minor.

4.2 Water Quality and River Elevations

Vegetation Removal. Proposed changes in operation and actions to remove vegetation would not increase or otherwise change the presence of or concentrations of any heavy metal or other material that would adversely affect water quality. The action would not increase turbidity in the Chena River. Material would not be discharged into waters of the United States.

Lowering the Control Sill. Lowering the control sill at the floodway terminus would increase the chance that water from the Tanana River could enter the flood way unless other measures were provided. The highest recorded water level since the control sill was installed was 501 feet MSL during a 111,000 cfs Tanana River discharge. The sill would be lowered to no less than 502 feet MSL. Record flooding in 1967 reached a recorded level of 502.5 feet at the location of the control sill, so another flood of the same magnitude (125,000 cfs) would be about 6 inches over the control sill if it is lowered as proposed. The predicted 100-year (1.0 percent chance of exceedence) flood is slightly lower than the flood elevation recorded in 1967 (table 2)

Table 2. Tanana River percent chance exceedence at the floodway sill.

Percent Chance Exceedence	Water Level at the Floodway Sill Structure (ft msl)
SPF[1]	505.2
0.2	502.6
0.5	502.3
1.0	502.0
2.0	501.7
5.0	501.3
10.0	501.1
20.0	500.7
50.0	500.3

[1] Tanana River Standard Project Flood is 265,000 cfs and approximately double the magnitude of the 100 year flood event.

If the control sill was lowered to 502 feet MSL as proposed, a Tanana River flood event equivalent to the 1967 flood would overtop the control sill by about 0.5 foot and the muddy Tanana River water would enter the floodway. If the flood was larger and lasted long enough, water could build up and eventually overtop the floodway highpoint (502 feet MSL) and flow toward the Chena River. The Corps would pre-position low-permeability gravel, sand bags, construction blocks, or other material near the Richardson Highway bridge as a contingency plan and would place that material to block advancing floodwaters that might mix with the Chena River. The temporary block would be removed after Tanana River water receded. The proposed action would not allow Tanana River flood water to enter the Chena River.

Lowering the control sill would reduce pool elevations and duration of impoundment events for all high water events that raised the Moose Creek Dam flood pool to more than 502 feet MSL. Table 3 records 21 high water events in the 29 years since (and including) the 1981 test fill. Three of those events, in 1985, 1992, and 1993, produced pools of more than 502 feet MSL. Those three events would have been affected by a lower sill.

Changes in Operating Procedures. Proposed changes in project operation would reduce the water retention in some circumstances. Continuing to release water instead of storing it to raise the pool for fish ladder operation would reduce the amount of water retained by approximately 1,500 acre feet per day. Water has not been impounded to operate the fish ladder for most high water events in the past because it was not needed to protect salmon return migration. The proposed change would prevent this practice of intentionally raising the of flood pool during future high-water events and would reduce volume and duration of impounded water. Effects on fish are discussed in section 4.3.

Optimizing release volume by using trained monitors downstream from Moose Creek dam would further reduce flood pool elevation and retention time without increasing downstream risks. Specific effects on pool elevation and retention time have not been predicted, but this action would have positive effects.

Table 3. Chena River Lakes Project High Water Events

EVENT	PEAK FLOW THROUGH DAM BEFORE GATE CLOSURE/DATE (CFS)	PEAK FLOW AT FAIRBANKS BEFORE GATE CLOSURE/DATE (CFS)	DATE OF GATE CLOSURE	PEAK FLOW REGULATED THROUGH DAM DATE (CFS)	PEAK FLOW @ FAIRBANKS DURING REGULATION DATE (CFS)	PEAK RESERVOIR STAGE/DATE (FT MSL)	DATE GATES COMPLETELY OPEN
1981 (1) TEST FILL	4500 6/30/81	5490 6/30/81	7/9/1981	5930 7/15/81	6160 7/15/81	501.4 7/13/81	7/16/1981
1984 (1) 13-23 JUN	3000 6/16/84		6/16/1984	7100 6/22/84	6500 6/23/84	501.9 6/20/84	6/22/1984
1984 (1) 20-25 JUL	8260 7/23/84	8000 7/26/84	7/23/1984	8170 7/24/84	8350 7/24/84	496.6 7/24/84	7/25/1984
1984 (1) 26-29 JUL	6350 7/27/84	6400 7/27/84	7/27/1984	6850 7/28/84	7700 7/28/84	496.0 7/28/84	7/28/1984
1985 (2) 23MAY-3JUN	7150 5/29/85	8150 5/29/85	5/24/1985	8250 5/27/85	8950 5/28/85	505.3 5/25/85	6/3/1985
1986 (1) 24-27 JUN	5500 6/25/86		6/24/1986	4750 6/26/86		497.5 6/26/86	6/27/1986
1986 (1) 21-24 JUL			7/21/1986	5900 7/23/86		498.5 7/22/86	7/23/1986
1986 (1) 23-28 AUG	5100 8/22/86		8/22/1986	8300 8/24/86		501.9 8/24/86	8/28/1986
1989 (1) 27-29 JUN	8350 6/27/89	.+- 8300	6/27/1989	8600 6/27/89		497.5 6/27/89	6/29/1989
1991 (1) 5-15 MAY	7855 5/5/91	.+- 8000 5/8/91	5/5/1991	8300 5/5/91	11350 5/8/91	503.0 5/11/91	5/15/1991
1991 (1) 10-21 AUG	7700 8/20/91	3706 8/20/91	8/20/1991	7800 8/20/91	7698 8/22/91	496.2 8/22/91	8/21/1991
1992(1&2) 24MAY-11JUN	7800 5/26/92	.+- 7110	5/26/1992	8700 5/26/92-5/28/92	10500 6/30/92	507.6 6/5/92	6/11/1992
1994 (1) 21-30 JUN	8055 6/28/94	9340 6/24/94	6/28/1994	8175	9570 6/25/94	501.0 6/28/94	6/29/1994
1995 (1) 27-29 JUN	8420 6/25/95	6430 AVDAY 6/27/95	6/28/1995	8360 6/28/95	8640 AVDAY 6/25/95	498.0 6/28/95	6/29/1995
2000 (1) 15-17 AUG	8200 8/15/2000	3470 AVDAY 8/14/2000	8/15/2000	8300 8/15/2000	8620 AVDAY 8/16/20	496.9 8/1/2000	8/17/2000
2002 2-3 MAY			5/2/2002		4000	496.4 5/2/2002	5/2/2002
2002 (1) 19-21 AUG	8300 8/29/2002	8450 8/19/2002	8/19/2002	8400 8/20/2002	8940 8/21/2004	497.2 8/20/2002	8/21/2002
2003 (1) 29-31 JUL	8000 7/29/2003	8230 7/29/2003	7/29/2003	8700 7/29/2003	10400 7/30/2003	498.0 7/30/2003	7/31/2003
2003 (1) 4 SEP	8650 9/4/2003	8140 9/3/2004	9/4/2003	8700 9/4/2003	9300 9/5/2004	496.5 9/4/2003	9/6/2003
2008 (1) 29 JUL-2 AUG	8010 8/1/2008	8690 8/1/2008	8/1/2008	8050 8/1/2008	9160 8/2/2008	495.5 8/1/2008	8/2/2008
2009 (2&3) 2-5 MAY	8130 5/4/2009	NA	NA	NA	NA	496.7 5/4/2009	NA

NOTE 1: RAINFALL EVENT

NOTE 2: SNOW MELT EVENT

NOTE 3: FLOOD CONTROL GATES WERE NOT OPERATED DURING THIS EVENT. TRASH RACKS AND IMPOUNDED DEBRIS REDUCED PEAK FLOWS BELOW THE PROJECT OPERATING THRESHOLD.

4.3 Vegetation

The proposed action would remove 31 acres of second growth alders and balsam poplar in the Tanana River bottom and approximately 70 acres of vegetation of various species along 8.2 miles of the Moose Creek Dam and extension toe and along the cleared area of the floodway. No endangered species or any species or assemblage of special concern would be impacted. The species represented in this area are locally and regionally abundant. Impacts would be minor and local.

4.4 Fish

Effects of Operation Changes

Optimizing Releases. Placing monitors downstream from Moose Creek Dam and increasing releases during flood events would not affect Chena River fish unless river surface elevations were raised high enough to allow the river to flow into the adjacent floodplain, which could strand fish as flood waters receded. Monitors would prevent substantial flooding, and after action surveys would be conducted if needed.

Not Building Pool for Fish Ladder Operation. The Chena fish ladder has been successfully operated twice. Once during the 1981 project test fill, when it worked successfully even though the flood pool elevation never quite reached the 502-foot MSL elevation intended for its operation (table 3). The second deployment was in 1985 when the flood pool elevation reached 505.3 feet MSL and the fish ladder again operated as expected, although probably too early in the Chinook migration to have been very important to the fishery. Since then, it has not been operated. It has been deployed since 1985, but the flood pool did not build to enough elevation for it to pass fish.

Chena project managers, working together with State and Federal agency biologists, have altered their shared view about when and how the fish ladder should be deployed and when the flood pool should be intentionally raised for fish ladder deployment and salmon passage. Agency biologists recognize trade-offs between building a flood pool to avoid delaying salmon movement to spawning locations versus the need to minimize flood pool area so that juvenile salmon, grayling, and other fish do not disperse into the floodplain where they are more likely to be stranded or eaten. Primary factors in the decision to hold water to operate the fish ladder or release it to minimize flood pool size and duration include the following:

Migration stage–Adult salmon that have recently returned to the Chena and are still in relatively good condition may be held without great loss for longer than the same species later in the spawning period.

Developmental stage of juveniles–Newly emerged fry are almost helpless in any stream current. Mobility of juvenile salmon increases rapidly after emergence so that they are much more able to occupy habitat they prefer, avoid predation, and presumably to make their way back into the river as flood pools recede. Chum salmon juveniles outmigrate in late spring or early summer, so they are outside the influence of flooding before the end of July. Building a flood pool for the fish ladder in late July would have less adverse effect on juvenile salmon (and probably on most other Chena River fish) than a flood pool in May.

Predicted magnitude of high water events–There is little need to keep control gates closed to build a flood pool in larger flood events. A 10-year flood (16,000 cfs, about like the 1992 event) will, even while the 8,500 cfs is being released from the dam, build a flood pool to 502 feet MSL in approximately 1 day. A 100-year event will build a flood pool to 502 feet MSL in less than 5 hours. Smaller events may take days to impound enough water to operate the fish ladder if water is being released, while salmon wait to move to spawning habitat. At times, even with the control gates releasing only the 1,000 cfs minimum flows, water may not reach enough elevation for the fish ladder to work even after days of minimum project discharges. In general, there is less inclination to impound water for fish ladder operation in May or June, and a better risk-reward balance to favor fish ladder operation later in the summer. Even the late-spawning chum salmon are on their spawning habitat before the end of August, so there is little reason to impound water for fish ladder operation by late August.

Since 1995, the control gates have been operated for flood control eight times (table 3). None of those events produced a flood pool that even approached enough elevation for the fish ladder to work, and all high water events lasted only a few days. The proposed operational changes would not have affected salmon during that 14-year period. This also is true of six other high water events since the 1981 test fill that never raised the flood pool to 500 feet MSL and that each lasted only a few days (table 3).

Six high water events after the 1981 test fill produced enough water for a long enough period to build a flood pool for fish ladder operation. Those events began in the following periods:

June 1984
May 1985
August 1986
May 1991
May 1992
June 1994

The control gates were lowered to build a flood pool for fish ladder operation in the 1985 event, but that proved unnecessary; the event would have soon reached sufficient elevation even if the project had continued to release maximum allowable discharge volume. The 1992 event flood pool quickly built to enough elevation for the fish ladder without lowering the gates, but the fish ladder was not deployed. Biologists elected to not raise the pool for fish ladder operation during the remaining events because disadvantages out weighed the advantages.

Providing for control gate closures so the fish ladder could be deployed seemed to be an important mitigation provision early in project development. Experience in the ensuing 30 years indicates it is seldom needed and that it could be removed as an interim measure to better ensure dam safety without undue risk to migrating fish. This proposed action would not affect fish ladder operation when the flood pool elevation reaches 502 feet MSL without lowering the control gates. Lowering the gates to build a flood pool could be reinstated, if needed, later when permanent measures are in place to acceptably lessen risks of dam failure.

Implementation of this change could delay salmon returning to spawn and could lead to less reproductive success by salmon when specific high water events with specific characteristics coincided with specific timing related to salmon spawning. It also could temporarily restrict seasonal movement of other fish in the Chena River. The Alaska District would work with State and Federal fisheries to avoid, minimize, or compensate for any loss of reproductive success resulting from this action.

Effects of Lowering the Control Sill. Lowering the Chena River project floodway control sill could alter the frequency that Chena River water is emptied from the floodway into the Tanana River. The action would have little effect on the Tanana River and would not expose the Chena River to inflow from Tanana River water. Should a Tanana River event reach enough elevation to enter the floodway, it would be blocked with a temporary sill across the floodway at the Richardson Highway crossing.

Lowering the control sill would have no effect on the Chena River or the Chena River Project until flood pool elevations reached at least 502 feet MSL at the control sill. At that elevation, Chena River water in the floodway would begin to flow into the Tanana River. This could have several effects on Chena River fish, which are discussed as follows:

Attraction of Spawning Salmon. Adult salmon returning to spawn in the Chena River could be attracted by the presence of Chena River water in the Tanana, which could lead them to swim past the mouth of the Chena and upstream to the control sill where they would be unable to enter the Chena River drainage. This is possible, but seems unlikely. Salmon attracted to the outlet sill would have to swim upstream past the Chena River, which would be discharging 10,000 or more cfs of water that the salmon are specifically imprinted to find. Discharges of Chena project floodway into the Tanana River would be well mixed long before they traveled almost 20 miles to the mouth of the Chena, especially since the Tanana River typically is high when the Chena River is flooding.

Loss of Fish in the Flood Pool. Juvenile salmon, grayling, and other fish move into the floodway with floodwaters when the Chena River rises above its banks at 495 to 496 feet MSL. Those fish may occupy the floodway for part or all of the high water event. As waters recede, they move back into the river. Some may be stranded in the floodway. Stranded juvenile salmon have not been reported in large numbers in the floodway, but those small fish may be difficult to see, and after-action fish surveys have been limited. Changes to the control sill would not increase the frequency that the floodway was inundated, but lowering the sill could affect fish that enter the floodway during high water events over 502 feet MSL. Fish in the floodway could return to the

Chena River or could be discharged into the Tanana River. There have been three high water events of that magnitude since 1981.

Numbers of fish that might be discharged into the Tanana River over the control sill would depend upon the season, rate of discharge, length of the high water event, and possibly other factors that may not be readily apparent. Effects probably would be greatest during an early season event, in May and early June, when juveniles of most species are least mobile and most abundant in the Chena River. Chum young of year and second year Chinook juveniles might be less affected if a flood event discharged them into the Tanana River because they would soon be out migrating to the Tanana anyway, but any forced early outmigration should be regarded as a potentially adverse effect.

Smaller Flood Pools and Shorter Retention. Lowering the control sill would reduce the flood pool elevation, the area flooded, and the duration of floodway inundation during larger high water events (USACE 2010). The three high water events that exceeded 502 feet MSL since 1981 would have been substantially less severe and shorter in duration. Fish would have had less time to disperse into the floodway, less water would have flowed into woodlands and other areas where fish would be more likely to be stranded, and potential for predation would have been reduced.

Returning adult salmon would have benefited. A lower sill would not have prevented fish ladder use because the fish ladder is fully effective by the time water levels reach the proposed lower sill elevation at 502 feet MSL. With the lower sill, the high water events would have ended sooner and fish migration through the control works would have been restored sooner. Spawning redds in the project area would have been flooded for less time, which might have helped survival of embryos.

4.5 Mammals

Proposed vegetation removal would result in the loss of approximately 100 acres of feeding and other general use habitat. The affected habitat is not identified as particularly valuable and is similar to other habitat abundant in the area. Loss of this habitat would be of no more than minor importance to local and regional populations of any affected species. Proposed changes in operation would be of minor importance to large mammals. Small ground-dwelling mammals might benefit to a minor degree from less inundation area and duration.

4.6 Birds

Clearing vegetation would remove passerine nesting and general feeding habitat from about 100 acres. Approximately 31 acres of that would be second-growth alder and poplar at the end of the floodway. The remainder would be mixed and diverse woody vegetation along the toe of Moose Creek Dam. Both areas could be expected to serve as nesting habitat for passerines, raptors, grouse, and others. They also could be used as feeding, resting, and breeding habitat. There is abundant similar habitat in the vicinity. The principal concern is that reproductive effort could be lost if nests, eggs, or fledglings are destroyed by vegetation clearing or by water control revisions that would change the areas or timing of inundation.

Vegetation clearing would be limited to periods when birds are not nesting in the action area (1 May -15 July by USFWS guidance) so there would be no taking of migratory or other birds. Proposed actions to reduce pool elevations and retention time could benefit birds nesting on the ground or in low vegetation.

4.7 Historic and Other Cultural Resources.

None of the proposed actions would adversely affect historic, cultural, or recreational resources. Failure to implement those measures, the No Action Alternative, would endanger cultural resources outside the immediate action area by failing to reduce potential for dam failure and flooding.

5.0 PREPARERS AND ACKNOWLEDGEMENTS

Guy McConnell, biologist, Alaska District Corps of Engineers was the principal preparer for this document and is solely responsible for conclusions and any errors in this document.

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