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**Susitna-Watana Hydroelectric Project
(FERC No. 14241)**

**Caribou Distribution, Abundance, Movements,
Productivity, and Survival Study
Study Plan Section 10.6**

Final Study Plan

Alaska Energy Authority



July 2013

10.6. Caribou Distribution, Abundance, Movements, Productivity, and Survival

On December 14, 2012, Alaska Energy Authority (AEA) filed with the Federal Energy Regulatory Commission (FERC or Commission) its Revised Study Plan (RSP), which included 58 individual study plans (AEA 2012). Section 10.6 of the RSP described the Caribou Distribution, Abundance, Movement, Productivity, and Survival Study. This study focuses on characterizing caribou distribution, movements, population size, productivity, group size, and density in the Project area through radio telemetry and geospatial analyses. RSP 10.6 provided goals, objectives, and proposed methods for data collection regarding caribou.

On February 1, 2013, FERC staff issued its study plan determination (February 1 SPD) for 44 of the 58 studies, approving 31 studies as filed and 13 with modifications. RSP Section 10.6 was one of the 31 studies approved with no modifications. As such, in finalizing and issuing Final Study Plan Section 10.6, AEA has made no modifications to this study from its Revised Study Plan.

10.6.1. General Description of the Proposed Study

This study plan outlines the objectives and methods for characterizing caribou distribution, movements, population size, productivity, group size, and density in the Project area through radio telemetry and geospatial analyses. Aerial radio-tracking surveys via fixed-wing aircraft will be used to monitor seasonal distribution and range use in the study area, including characterization of calving areas, rutting areas, wintering areas, and migration/movement corridors. In addition to standard VHF radio collars, satellite-linked GPS collars will be deployed to evaluate fine-scale spatial distribution and movements of cows and bulls.

This study is a multi-year effort that is being conducted by the Alaska Department of Fish and Game (ADF&G). ADF&G began the caribou movement study in 2012 by deploying radio collars. This study supplements ADF&G's ongoing caribou research in the region by increasing the sample size of radio-collared cows and by radio-collaring bulls in both the Nelchina and Delta herds to better delineate the seasonal movements and range use of each herd. Radio collars were deployed in October 2012 and will be monitored for the remainder of this study. GPS/satellite collars deployed in October 2012 will be removed in October 2014.

Study Goal and Objectives

The goal of this study is to obtain sufficient population information on caribou to evaluate Project-related effects on important seasonal ranges, such as calving areas, rutting areas, wintering areas, and migration/movement corridors.

The study has four specific objectives:

- Document seasonal use of and movement through the Project area by both females and males of the Nelchina caribou herd (NCH) and the Delta caribou herd (DCH).
- Assess the relative importance of the Project area to both the NCH and DCH.
- Document productivity and survival of caribou using the Project area.
- Analyze data from historical caribou studies and synthesize with recent data for the NCH and DCH, as a continuation of the caribou task of the 2012 study (AEA 2012).

10.6.2. Existing Information and Need for Additional Information

The current population objective for the NCH was established to ensure consistently high sustainable harvest levels for Alaskan hunters (Tobey and Schwanke 2009). ADF&G's management objectives for the NCH in Game Management Unit (GMU) 13 and GMU subunit 14B are to maintain a fall population of 35,000 to 40,000 caribou, with minimum ratios of 40 bulls to 100 cows and 40 calves to 100 cows; and to provide for an annual harvest of 3,000 to 6,000 caribou (Tobey and Schwanke 2009). ADF&G's management objectives for the DCH in GMU 20A are to maintain sex ratios of at least 30 bulls to 100 cows and at least 6 large bulls to 100 cows; reverse the decline of the herd and increase the midsummer population to 5,000–7,000 caribou; and sustain an annual harvest of 300 to 700 caribou (Seaton 2009).

The caribou study for the original Alaska Power Authority (APA) Susitna Hydroelectric Project began in 1980 and continued through 1985. The objectives of the study were to determine the population status of the NCH, delineate subherds, and identify range use, movement patterns, migration routes, and migration timing (ABR 2011). Three resident subherds were identified and the proposed reservoir was found to intersect migration routes used by pregnant cows moving to calving grounds during late April and May and cows and calves moving to summer range during late June and July (Pitcher 1982). Caribou use of the Project area currently is complicated by range expansion and mixing of DCH animals with those from the NCH (Seaton 2009).

Caribou range use and movement studies during the early 1980s for the APA Susitna Hydroelectric Project are insufficient to accurately characterize current caribou use of the Project area. Since 1985, the number of NCH caribou has increased significantly. The NCH is a moderately large herd, numbering 40,233 caribou in 2011 (ADF&G, unpublished data), whereas the DCH is much smaller, numbering 2,985 caribou in 2007 (Seaton 2009). Both the NCH and the DCH use portions of the Project area extensively. A related change has been increased use of summer and winter range in the northwestern portion of the NCH range in GMU subunit 13E, northwest of the Project location. Because the NCH continues to calve in the eastern Talkeetna Mountains in GMU subunit 13A, south of the Project location, changes in summer and winter range could mean more caribou will cross through the Project area during seasonal migrations to and from the calving grounds. Hence, although the existing information suggests that NCH animals are more likely to cross the inundation zone, it is possible that some DCH animals may do so as well. The proposed study will elucidate the current movement patterns of both herds.

Current annual monitoring efforts for the NCH and DCH by ADF&G identify general herd distribution, productivity, and annual survival for the purpose of assessing annual herd trends and related harvest strategies, but more data are needed to meet the needs of the Project. Therefore, this study has been designed to provide additional data, much of it at finer temporal and spatial scales than previously available, to assess potential Project-related impacts and to help identify potential mitigation measures for caribou in the Project area. Mixing of the two caribou herds since the mid-1990s in the northern portion of the Project area between the Susitna River and Butte Lake has been a more recent development that adds a level of complexity to range use and importance for the two herds (Seaton 2009). In addition, established vegetation exclosures in the NCH range can be used to monitor abundance of lichens in an ungrazed area for assessment of range conditions.

Documentation of currently used areas, along with information on the timing, duration, and proportion of the regional population that uses those areas, can be used to develop any necessary

protection, mitigation, and enhance measures, as appropriate. This information also will be useful for mitigating inadvertent disturbance from unrelated field studies for the Project.

10.6.3. Study Area

The caribou study area will reflect use of the Project area by the NCH and the DCH. The study area will include most of GMU 13E east of and including Broad Pass (Figure 10.6-1). The study area also will include drainages emptying into the Upper Susitna River in GMU 13B, as well as a small portion of northwestern GMU 13A from Kosina Creek east to the Oshetna River. The study area encompasses the reservoir inundation zone, associated infrastructure, and potential access and transmission line corridors from the west and the north. Downstream areas in the Middle Susitna River basin that could be affected by changes in stream flows, temperatures, and ice conditions that could alter conditions for river crossings traditionally used by caribou will be included as well. The study area must be somewhat larger than the areas of primary focus, because of the history of caribou movements in the area and the need to fully evaluate caribou migration routes and habitat preferences.

10.6.4. Study Methods

ADF&G began a caribou movement study in 2012 by deploying new VHF and satellite-linked GPS radio collars, with more collars scheduled for deployment in subsequent years of this study. This study supplements ADF&G's ongoing caribou research in the region by increasing the sample size of radio-collared cows and by radio-collaring bulls in both herds to better delineate the seasonal movements and range use of each herd. In addition, GPS collars will be deployed on bulls and cows to detect fine-scale movements for both herds. Some captures will occur in the month of April to target caribou overwintering in the Project area, with additional captures occurring in October to target migratory caribou.

To address fine-scale movements—both temporally and geographically—at least 60 GPS collars will be deployed (40–45 on NCH animals and 15–20 on DCH animals). Up to 70 percent of the GPS collars will be deployed on cows. Considering that the proposed reservoir inundation zone is primarily used during migration, gathering daily locations with the use of GPS collars is the only way to ensure that travel corridors and travel patterns are identified accurately. Small piston-powered (Robinson R-44) helicopters and chemical immobilization techniques will be used for caribou captures and small fixed-wing aircraft (Piper PA-18 or similar) will be used for radio-tracking flights.

Due to limited battery life, the GPS collars will need to be removed after two years for retrieval of all data stored on board; the collars then will be refurbished and redeployed to gather additional data to further describe movements and range utilization and incorporate annual differences. All GPS collars eventually will be removed to ensure that all data stored onboard the collars is retrieved. Standard VHF radio collars will be deployed with the expectation that they will remain on the animals.

The VHF collars deployed in April 2012 (8 on DCH bulls and 7 on NCH bulls) will be monitored for the remainder of this study, whereas the GPS collars deployed in May 2012 (4 each on NCH and DCH bulls) will be monitored until the collars are retrieved in April or May 2014 for data downloading and collar refurbishing. Radio collars deployed in October 2012 (55 GPS collars on females and 15 VHF collars on bulls) will be monitored for the remainder of this

study, and the GPS collars will be removed in October 2014. Collar failures are not anticipated, although a small percentage may malfunction, requiring capture and replacement outside of the schedule outlined.

All existing radio collars deployed on NCH and DCH caribou will be monitored monthly within the Project area via aerial radio-tracking. During spring and fall migration periods, as well as the calving season, additional flights will be conducted more frequently (every two weeks).

No net loss is expected to occur for existing herd monitoring programs. For those caribou currently radio-collared, if radio collars are replaced with GPS collars for this study, then new or refurbished radio collars will be redeployed on each of these animals at the end of the study.

To investigate seasonal movements and range use by bull caribou, 15 VHF collars and 8 GPS collars were deployed on bulls of both herds in April and May 2012, supplementing approximately 80 existing radio collars on NCH cows and 40 existing radio collars on DCH cows. The female segment represents the reproductive portion of the herd, as well as the leading edge of seasonal movements, supporting the higher number of collars for cows.

VHF-collared caribou must be located via fixed-wing aircraft. Monthly aerial radio-tracking flights will provide general documentation of herd distribution and the extent of herd mixing in the Project area. Additional flights (every two weeks) during spring and fall migrations will result in more precise documentation of use of the Project area by both herds. The large sample of radio-collared caribou is necessary to fully evaluate the relative importance of the Project area in terms of available herd ranges and potential movement corridors. The outlined sample sizes should be sufficient for an accurate representation of herd-wide movement patterns and range use.

Locations collected from satellite and GPS collars will be used to evaluate the spatial distribution and movements of cows and bulls from each herd. Additional locations, reproduction, survival status, and group size will be documented for each caribou located during scheduled radio-tracking flights.

Data analysis and visual representation of data will be accomplished using a Geographic Information System (GIS) running ArcGIS® software. Population estimates based on existing data will be calculated consistent with the method used to collect the data. Density estimates will be calculated at a spatial resolution suitable to evaluate potential habitat loss and alteration from the Project. Telemetry data will be used to delineate seasonal ranges and movement corridors using techniques such as kernel density estimates (Seaman and Powell 1996) and Brownian bridge (or similar) movement model techniques (Horne et al. 2007; Sawyer et al. 2009), depending on the volume and suitability of the data for use with these techniques.

10.6.5. Consistency with Generally Accepted Scientific Practices

ADF&G is the primary agency responsible for monitoring caribou populations in Alaska. The techniques used to capture, collar, and track caribou in this study have been developed by ADF&G through decades of experience working with big game species in Alaska. The methods employed in this study will consist of standard capture, handling, and monitoring techniques for cow caribou (Adams et al. 1987). In recent years, these techniques also have been used for bull caribou. All methods will be fully evaluated and compliant with Alaska Interagency Animal Care

and Use Committee certification. Standard permits required by the State of Alaska for animal capture and monitoring are in-hand.

Caribou data will be analyzed according to commonly accepted statistical techniques. Spatial analyses will employ commonly accepted techniques such as fixed-kernel density estimation with least-squares cross validation or plug-in bandwidth selection (Seaman and Powell 1996; Gitzen et al. 2006).

10.6.6. Schedule

This study is a multi-year effort that began with collar deployment and radio-tracking in 2012. The schedule for 2013–2014 activities is depicted in Table 10.6-1. GPS and VHF radio collars that were deployed in 2012 will be monitored at least monthly throughout the entire year in 2013 and 2014, except during migration periods in spring (May–June) and fall (August–September), when they will be tracked more often (every two weeks) to delineate migratory movements in relation to the Project area. The Initial Study Report will be completed by February 2014 and will include analyses of data obtained through fall migration 2013, at a minimum. In April 2014, the GPS/satellite collars deployed in April 2012 will be removed to retrieve the data stored in the collars for analysis (the collars must be retrieved to obtain all data). In October 2014, the GPS/satellite collars that were deployed in October 2012 will be removed and the collars removed in April 2014 will be redeployed (after having been refurbished). The Updated Study Report will be completed by February 2015 and will include analyses of data obtained through fall migration 2014, at minimum. Project updates will be provided at Technical Workgroup meetings, which will be held quarterly in 2013 and 2014.

10.6.7. Relationship with Other Studies

As is depicted below (Figure 10.6-2), the caribou study does not require information inputs from any other Project studies, although it will benefit from preliminary studies begun in 2012 (AEA 2012), which analyzed historical data from the original APA Susitna Hydroelectric Project studies in the 1980s. The GIS database of caribou locations from VHF and GPS radio collars will be used to assess seasonal patterns of habitat use. Output from the caribou study will be used to inform the Evaluation of Wildlife Habitat Use (Section 10.19) through geospatial analysis by overlaying location and movement data on the Project habitat map to identify important areas of seasonal ranges that receive repeated use, movement corridors in relation to the proposed reservoir and Project infrastructure, and important habitat types (e.g., for which use exceeds availability). These geospatial analyses, along with results from other studies (e.g., Ice Processes Study [Section 7.6], Subsistence Study [Section 14.5], Wildlife Harvest Analysis [Section 10.20], Large Carnivores Study [Section 10.8]) will be used in 2015 to assess potential impacts and to evaluate protection, mitigation, and enhancement measures, as appropriate, during development of the FERC License Application.

The potential impacts of the Project on caribou may include direct and indirect habitat loss and alteration or blockage of movement corridors in portions of the range of both the NCH and the DCH, because animals from either herd may encounter the reservoir inundation zone, access and transmission line corridors, and other Project facilities. Other potential impacts include changes in mortality rates that may result from increased subsistence or recreational harvest facilitated by improved access or from changes in predator populations, and mortality from collisions with

vehicles or unstable ice conditions in the impoundment. During the impact assessment that will be conducted in 2015 for the FERC License Application, data on the distribution, abundance, productivity, and habitat use of caribou in the study area will be used to assess Project impacts. Location data will be used to identify movement corridors. Location and abundance data can be plotted on the wildlife habitat map that will be developed by the Vegetation and Wildlife Habitat Mapping Study (Section 11.5) to identify important caribou habitats. Direct habitat loss can be calculated through geospatial analysis by overlaying the impoundment, access and transmission facility “footprints”, and related proposed Project infrastructure onto the habitat map and evaluating the loss of important caribou habitats. Indirect habitat loss and avoidance impacts can be estimated by applying various buffer distances, as determined from available information on the anticipated effects of similar projects or activities on caribou. Similarly, movement corridors can be compared to Project features to assess the extent to which movements and distribution may be affected. ADF&G harvest data will be used to establish baseline harvest levels and to monitor changes in harvest that may result from improved access. In this way, the GIS analysis will be combined with information from the literature to estimate the geographic extent, frequency, duration, and magnitude of Project effects on caribou populations.

10.6.8. Level of Effort and Cost

This study is a multi-year effort that is being conducted by ADF&G. The estimated cost of the study through 2014 is approximately \$610,000.

10.6.9. Literature Cited

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10.6.10. Tables**Table 10.6-1. Schedule for implementation of the caribou study.**

Activity	2012	2013				2014				2015
	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q
Deployment of GPS/satellite and VHF collars in October 2012, with monitoring at least monthly	—								—	
Monitor radio collars every two weeks during migration periods			—	—			—	—		
Initial Study Report, including data obtained through fall migration in 2013					—△					
Remove GPS collars deployed in April 2012							—			
Remove satellite collars deployed in October 2012 and deploy refurbished GPS collars removed in April 2014									—	
Monitoring, at least monthly, of GPS collars deployed in October 2014									—	—
Updated Study Report, including telemetry data obtained during fall migration in 2014									—▲	

Legend:

- Planned Activity
△ Initial Study Report
▲ Updated Study Report

10.6.11. Figures

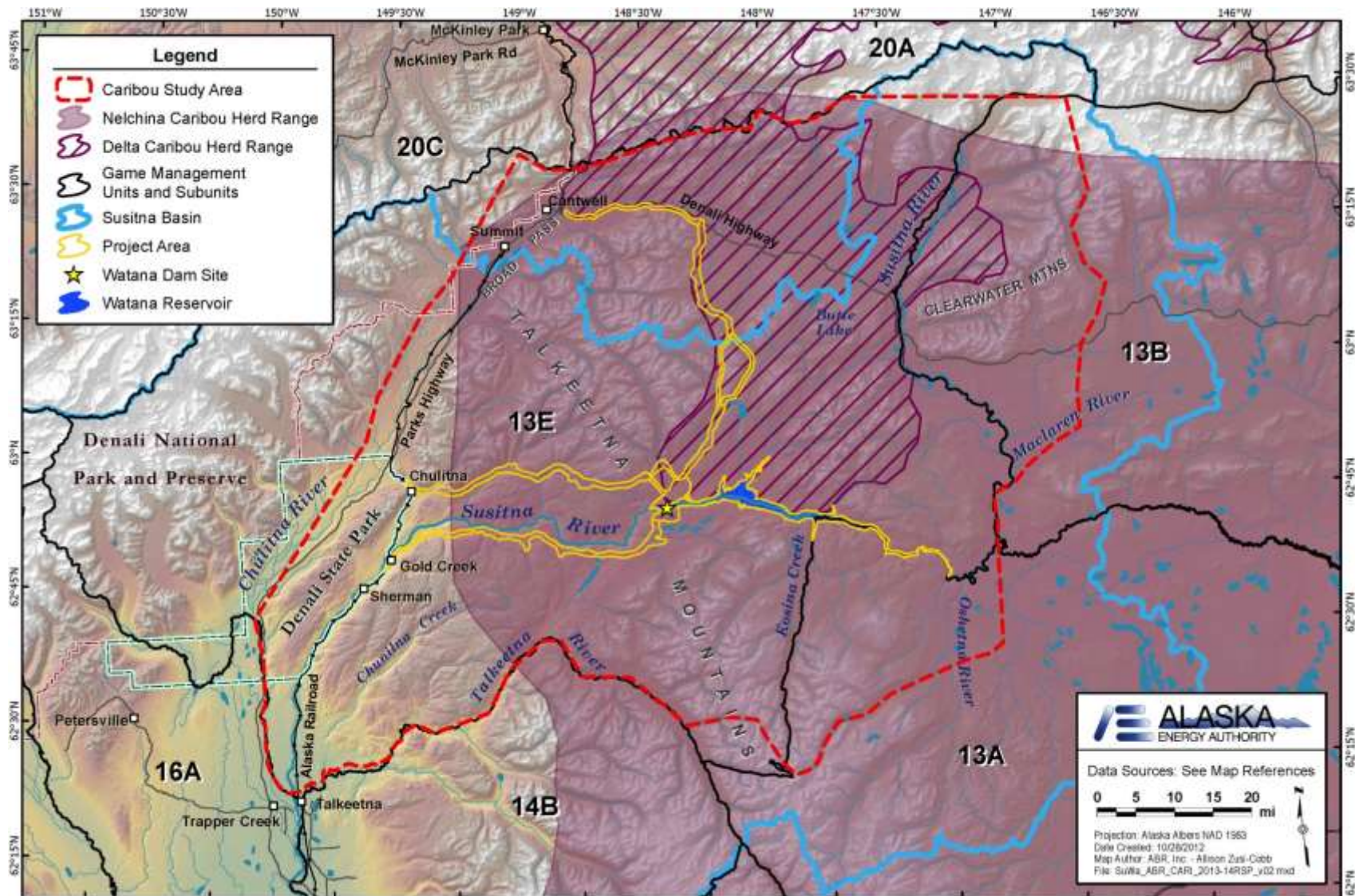
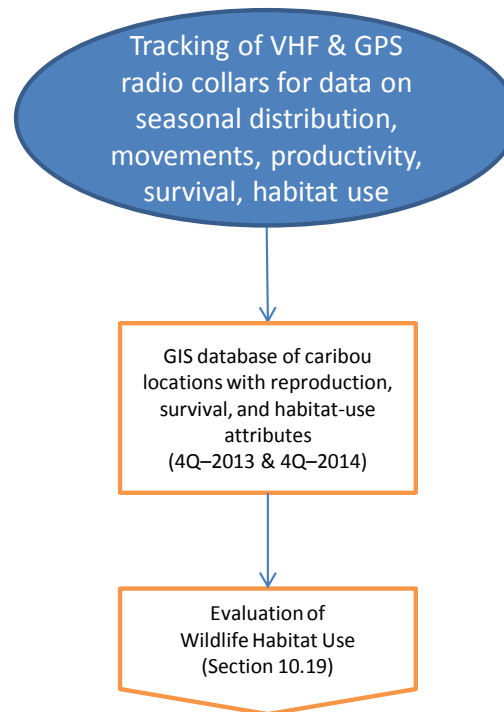


Figure 10.6-1. Caribou study area.

STUDY INTERDEPENDENCIES FOR CARIBOU STUDY**Figure 10.6-2. Interdependencies for caribou study.**