Susitna-Watana Hydroelectric Project
(FERC No. 14241)

Moose Distribution, Abundance, Movements, Productivity, and Survival Study
Study Plan Section 10.5

Final Study Plan

Alaska Energy Authority

SUSITNA-WATANA HYDRO

Clean, reliable energy for the next 100 years.

July 2013

10. WILDLIFE RESOURCES

10.5. Moose 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). Included within the RSP was the Moose Distribution, Abundance, Movements, Productivity, and Survival Study, Section 10.5. RSP Section 10.5 focuses on characterizing moose distribution, movements, population size, productivity, and habitat use in the study area through geospatial analysis. RSP 10.5 provided goals, objectives, and proposed methods for moose data collection and analysis.

On February 1, 2013, FERC staff issued its study determination (February 1 SPD) for 44 of the 58 studies, approving 31 studies as filed and 13 with modifications. RSP Section 10.5 was one of the 13 approved with modifications. In its February 1 SPD, FERC recommended the following:

While Alaska DFG recommends daily radiotracking during peak moose calving as AEA proposes, Alaska DFG recommends that the reference to peak calving as May 15-31 be removed because the precise dates for moose calving may vary between populations and years.

Alaska DFG's recommended study modification would provide greater flexibility in the event that the calving dates vary from the May 15-31 timeframe, would not increase cost or effort, and would ensure efficient use of resources. Alaska DFG's recommended methods are consistent with generally accepted practices in the scientific community (section 5.9(b)(6)) and should be adequate to collect the information necessary to address project effects (section 5.9(b)(5)). Therefore, we recommend that AEA modify the study as recommended by Alaska DFG.

In accordance with the February 1 SPD, AEA addressed the recommended modifications in the Final Study Plan for Section 10.5.

10.5.1. General Description of the Proposed Study

The moose study is being conducted by the Alaska Department of Fish and Game (ADF&G). The moose study began with a late-winter population survey in March 2012 and deployment of radio collars in October 2012 and will continue through 2013 and 2014. Although beyond the scope of the FERC licensing study process, ADF&G will continue to survey and monitor radio-collared moose throughout the lifespan of the radio collars deployed for the study (approximately 2016).

This study plan outlines the objectives and methods for characterizing moose distribution, movements, population size, productivity, and habitat use in the study area through geospatial analysis. Radio telemetry surveys via fixed-wing aircraft will be used to monitor distribution, productivity, harvest potential, and habitat use of moose in the study area. In addition to standard Very High Frequency (VHF) radio collars, satellite-linked Global Positioning System (GPS) collars will be deployed to evaluate fine-scale spatial distribution and movements of cows and bulls. Winter surveys will be flown to enumerate moose in and near the reservoir inundation zone. GeoSpatial Population Estimation (GSPE) techniques (Ver Hoef 2002; Kellie and DeLong 2006) and traditional count methods in portions of the study area will be used to generate

population estimates. Browse surveys will be used to monitor habitat utilization of the inundation zone, access and transmission corridors, and area downstream from the Project area.

Study Goal and Objectives

The goal of the study is to obtain sufficient population information and use of the study area to evaluate the potential effects of the Project on moose.

Specific study objectives include the following:

- Document the moose population and composition in the study area.
- Assess the relative importance of the habitat in the inundation zone, proposed access/transmission corridors, and the riparian area below the Project.
- Document the productivity and calf survival of moose using the study area.
- Document the level of late winter use of adults and calves in the proposed inundation area.
- Document moose browse utilization in and adjacent to the inundation zone and the riparian area below the Project.
- Document the amount of potentially available habitat for improvement through crushing, prescribed burning, or other habitat enhancement.
- Analyze and synthesize data from historical and current studies of moose as a continuation of the 2012 big-game distribution and movements study (AEA 2012).

10.5.2. Existing Information and Need for Additional Information

Moose studies during the early 1980s for the original Alaska Power Authority (APA) Susitna Hydroelectric Project were comprehensive, and annual monitoring of moose populations in the general area has been conducted by ADF&G; however, more recent data specific to this Project are needed to accurately characterize the current moose population size, distribution, and habitat use. New information is also needed to assess current issues pertaining to human use of the moose population in the Project region.

For management purposes, moose in Game Management Unit (GMU) 13 are monitored annually using aerial trend-count surveys. Within GMU subunits 13A, 13B, and 13E, a group of continuous count areas (CAs) are surveyed annually (including CA 14; Figure 10.5-1); additional trend-count areas are surveyed periodically. These surveys, which provide managers with population composition and general trend data, have been conducted in this area since the 1950s.

Additional areas such as CA 7, which includes Watana Creek in GMU 13E (Figure 10.5-1), are not surveyed regularly. CA 7 was surveyed annually between 1980 and 1986 (776–1,284 moose observed; 0.9–1.5 moose per square mile). The most recent aerial trend-count survey in that area was conducted in 2001 (776 moose observed; 0.9 moose per square mile). In addition, an intensive population survey was conducted in spring 2012, a year of heavy snowfall. A total of 441 moose (381 adults and 60 calves) were observed in an area of 277.7 square miles, for a density estimate of 1.6 moose per square mile. The density estimate is likely to increase after the estimate is adjusted for sightability (R. Schwanke, ADF&G, 2012, pers. comm.). An additional

intensive population survey will be conducted for the area downstream from the proposed dam location.

Changes in hunter access due to the proposed Project will be evaluated. Hunter demand for moose in GMU 13 is very strong and continues to grow. Due to this trend and with implementation of moose population composition objectives in the early 1990s, the GMU 13 moose population composition has been monitored closely to maintain a sustainable harvest and high hunter satisfaction rates. Existing annual monitoring efforts for moose in GMU 13A and 13E address abundance, distribution, and recruitment for the purposes of assessing annual moose population trends and related harvest regulatory strategies. These data, however, are insufficient to address potential Project-related impacts or to identify potential mitigation for moose. Data collected through standard VHF radio telemetry, satellite-linked GPS telemetry, and aerial surveys of population composition, density, and calf production will document currently used areas, as well as provide data on the timing and duration of seasonal range use and the proportion of the regional moose population that uses the Project area. Previous habitat evaluations were based on vegetation cover types that were mapped within 16 kilometers (10 miles) on each side of the Susitna River between Gold Creek and the Maclaren River (TES 1982). However, that vegetation mapping was conducted over 30 years ago.

Both the vegetation and wildlife habitat mapping and the wildlife habitat evaluation will be updated during Project studies (see Sections 11.5 and 10.19, respectively). The wildlife habitat evaluation completed in the early 1980s was based largely on vegetation types. The current study will go beyond vegetation mapping to document both habitat use by moose and the actual biomass removed by browsing. Moose locations derived from this study will be used to develop a stratified sampling design (Paragi et al. 2008) and to identify habitats that may be suitable for treatment to enhance habitat for moose and other wildlife species using early successional stages of vegetative communities.

The information developed will be used to inform development of appropriate protection, mitigation, and enhancement measures for the Project in support of ADF&G management objectives for moose in GMU 13.

10.5.3. Study Area

The moose study area will include the majority of GMU 13E east of the Parks Highway and the Alaska Railroad and from the Denali Highway south to upper Chunilna Creek (Figure 10.5-1). The study area will also include a small portion of northwestern GMU 13A, from Kosina Creek east to the Oshetna River drainage. The study area encompasses the reservoir inundation zone, access and transmission corridors, and associated Project infrastructure. The study area is somewhat larger than the Project area to fully evaluate the seasonal movements and habitat preferences of moose likely to use the Project area.

10.5.4. Study Methods

10.5.4.1. Moose Distribution, Movements, Productivity, and Survival

To delineate moose movements in the Project area, as well as to evaluate productivity and survival, a sample of cow and bull moose will be equipped with VHF collars. Additionally, GPS collars will be deployed on bulls and cows to detect fine-scale movements by both sexes.

Moose will be captured and collared in late March and October–December, depending on various factors including the physical condition of the moose and the timing of hunting seasons. VHF collars are expected to function for 5 to 7 years, whereas GPS collars have a 2-year life span. If unexpected collar malfunctions or hunting losses occur, additional captures and collar replacement outside of the outlined schedule may be required to maintain a sufficiently large sample size.

In October 2012, 40 GPS collars were deployed on 26 cows and 14 bulls. At the same time, 10 VHF collars were deployed on 7 cows and 3 bulls. The GPS collars are scheduled to drop off on November 1, 2014, for retrieval and downloading of all data stored in the collars. Another 50 VHF radio collars will be deployed in March 2013 on 33 cows and 17 bulls. The two separate capture periods will help to address the spatial variability of a migratory moose population, as well as potential loss of collared animals during the hunting season. The large sample size of radio-collared moose, with a 2:1 ratio of cows to bulls, is expected to adequately record movements and productivity of moose in the study area and to provide context on the relative importance of the Project area in terms of available habitat throughout the year.

Monthly aerial radio-tracking surveys in fixed-wing aircraft will be conducted to document the distribution of radio-collared moose in the study area. During the spring calving (May 10–June 15) and fall hunting seasons (September 1–20), aerial surveys will be conducted weekly to document more frequently the distribution of moose in the study area. Additionally, to accurately document productivity and associated calf loss, surveys will be conducted daily during calving. Small fixed-wing airplanes (Piper PA-18 or similar) will be used for these radio-tracking flights.

Fine-scale movements will be monitored with the 40 GPS collars deployed in October 2012. Due to the relatively consistent annual moose habitat use and movement patterns, the relatively short 2-year life span of GPS collars should be sufficient for documenting fine-scale movements of moose in the study area. Considering that the Project area is used year-round by moose, gathering daily locations with the use of GPS collars is the only way to ensure that habitat use and travel patterns, particularly during calving, hunting season, and the rut for both sexes are accurately identified.

GPS locations of collared moose will be used to evaluate spatial distribution and movements of cows and bulls. Location, date, reproduction, and survival status will be documented for each moose located during scheduled radio-tracking flights. Data mapping and spatial analyses will be accomplished using ArcGIS software.

10.5.4.2. Population Monitoring

Moose populations will be evaluated using three survey techniques. Conventional survey methods pertaining to optimal snow conditions, daylight, flight patterns, and other factors (Ballard and Whitman 1988) will be used for all surveys to maximize survey precision, maintain consistency among surveys, and facilitate comparisons with existing datasets. To assess winter use of the reservoir inundation zone, ADF&G surveyed the area in late winter (March 20–22) 2012 and will do so again in 2013. Due to the seasonal absence of antlers, it will not be possible to distinguish bulls from cows during late-winter surveys, but numbers of calves and adults will be reported.

Intensive population estimates use GSPE techniques (Ver Hoef 2002; Kellie and DeLong 2006) or the Gasaway method (Gasaway et al. 1986). The timing of population estimates will depend

on weather conditions and snow cover, logistical considerations, and potential scheduling conflicts with other concurrent moose surveys. The preferred approach is to estimate moose populations above and below the proposed dam within the study area during one GSPE sampling event, currently planned for November 2013. A total of at least 200 randomly selected 6-square-mile sample units will be surveyed. If suitable survey conditions do not occur in November 2013, then the GSPE survey will be rescheduled for March 2014. Sample units will be flown at a high search intensity (>6.5 minutes per square mile). Counts will be corrected for sightability using established methods (Gasaway et al. 1986; Kellie and DeLong 2006).

Previously established trend count areas CA 7 and CA 14 (Figure 10.5-1) were surveyed in November 2012 and will be surveyed again in November of 2013 and 2014 to obtain current data for comparison with data from previous years.

10.5.4.3. Moose Browse Survey and Habitat Assessment

Techniques developed by Seaton (2002) and used subsequently by Paragi et al. (2008) and Seaton et al. (2011) will be used to estimate the proportion of browse biomass removed by moose. Current annual growth (CAG) of important browse species such as willow (*Salix* spp.), aspen and balsam poplar (*Populus* spp.), and Alaska birch (*Betula neoalaskana*) will be estimated. Only plants with CAG between 0.5 meters (1.6 feet) and 3 meters (9.8 feet) in height will be sampled. Three plants per species at each sample plot will be selected and 10 twigs on each plant will be measured. The diameter at the base of CAG (or the point where twig is browsed, if older than last annulus) and the diameter at the point of browsing will be noted. The duration of sampling will be 8 to 10 days each year in March 2013 and 2014. Sampling must occur after most of the winter browse activity has occurred but before spring green-up. Small helicopters will be used to access study plots. The browse study will be conducted for two years to account for annual variability in snow depth and other conditions.

The seasonal use and importance of the inundation zone and access/transmission corridors will be quantified primarily by analysis of GPS and VHF telemetry data to determine moose movements and habitat preferences. Browse utilization surveys will further refine the relative importance of habitat within the study area by documenting the impact of moose on vegetation. Browse utilization surveys will cover available habitat above and below the dam within the extent of the GSPE survey grid. Studies conducted for the Botanical Resources Program in preparation for the Project licensing process—Vegetation and Wildlife Habitat Mapping in the Upper and Middle Susitna Basin (Section 11.5), Riparian Vegetation Study Downstream of the Proposed Susitna–Watana Dam (Section 11.6), and Wetland Mapping Study in the Upper and Middle Susitna basin (Section 11.7)—will help to identify areas where potential habitat improvement may be considered to mitigate for the loss of habitat in the Project area.

10.5.5. Consistency with Generally Accepted Scientific Practice

Moose movement patterns and productivity and survival in the Project area will be studied by marking animals with radio and GPS satellite collars. The combination of these two collar types will provide both broad-scale and local-scale information on movement patterns in the Project area. These data will be necessary to evaluate broad (seasonal) movements and more local-scale movements within those areas expected to be affected by Project development. The use of these two collar types represents a robust approach to collecting data on moose movement patterns,

productivity, and survival that are widespread in Alaska and elsewhere. The outlined sample sizes should be more than sufficient for an accurate and precise representation of moose distribution, movements, and productivity within the study area.

The capture methods employed in this study will be standard capture, handling, and monitoring techniques for moose (Schmitt and Dalton 1987). Helicopters and chemical immobilization techniques will be utilized for moose captures. 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.

Moose population monitoring will be conducted by intensively surveying randomly located plots and extrapolating those data to the study area, a technique that is widely used in Alaska and is the appropriate sampling design for determining population levels of ungulates that are widely dispersed across the landscape (Gasaway et al. 1986; Ver Hoef 2002; Kellie and DeLong 2006).

Moose browse will be studied using methods developed by ADF&G for studies in Interior Alaska to estimate the proportion of browse biomass removed (Paragi et al. 2008; Seaton et al. 2011). These currently are considered to be the most appropriate methods for quantifying moose browse in Alaska.

10.5.6. Schedule

This study is a multi-year effort that began in 2012 with a late-winter population survey in the reservoir inundation zone and initial collar deployment and radio-tracking in the fall and early winter. To meet the needs of the FERC study process, the Initial Study Report (ISR) will be completed by February 2014 and the Updated Study Report (USR) will be completed by February 2015 (Table 10.5-1), and will include the results of the browse surveys and habitat assessment. Because the battery life of some of the radio collars will extend beyond December 2014, however, ADF&G will continue to survey and monitor those collared moose throughout the collar life span (approximately 2016) and will produce a final technical summary report at that time. However, the 2.5 years of study information that will be summarized in the Updated Study Report is expected to provide sufficient information to assess the potential impacts of the Project on moose.

VHF collars and GPS collars were deployed in October 2012 and will be monitored at least monthly for the life of the study. In March 2013, more VHF collars will be deployed for monitoring at least monthly. Another population survey of adults and calves in the reservoir inundation zone and adjacent habitats will be conducted in March 2013, and winter browse surveys will be conducted in March 2013 and 2014. Radio collars will be tracked every two weeks during May 10–June 15 in 2013 and 2014, including daily monitoring during calving each year. Radio collars also will be tracked weekly during September 1–20 in 2013 and 2014. Post-rut aggregation composition surveys will be conducted in CA 7 and CA 14 in November 2013 and 2014 and the GSPE survey of the areas above and below the proposed dam will be conducted in November 2013 (or March 2014). Any remaining GPS collars will be retrieved in March 2015.

In 2014 and 2015, licensing participants will have opportunities to review and comment on the study reports (ISR in early 2014 and USR in early 2015). Updates on the study progress will be provided during Technical Workgroup meetings which will be held quarterly in 2013 and 2014.

10.5.7. Relationship with Other Studies

As is depicted below (Figure 10.5-2), the moose study will rely on the Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin (Section 11.5) to identify habitats that are likely to receive higher levels of use by moose, which will then be used to stratify and allocate sampling effort for GSPE surveys and browse surveys. If the GSPE effort is accomplished in 2012 (before preliminary mapping is available from the 2013–2014 study), then the best available vegetation mapping information will be used, including historical mapping from the original APA Susitna Hydroelectric Project. Data from tracking radio collars, from winter population surveys, and from the browse surveys will be used for habitat ranking in the Evaluation of Wildlife Habitat Use (Section 10.19). Geospatial analysis of habitat and their values will be used to quantify potential effects and to evaluate potential PM&E measures, as appropriate, in the impact assessment that will be conducted in 2015 for the FERC License Applications.

The primary potential impacts of Project construction and operation, as described in the Pre-application Document (AEA 2011), are moose habitat loss and alteration, blockage of movements, and increased mortality due to subsistence and recreational harvest facilitated by improved hunter access along transmission and access corridors. Data on the population, distribution, productivity, and habitat use of moose in the study area will be used to assess Project impacts in the impact assessment that will be conducted in 2015 for the FERC License Application. Location data, population data, and browse intensity data can be plotted on the wildlife habitat map that will be developed for the Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin (Section 11.5) to identify important moose habitats or to provide quantitative or semi-quantitative estimates of habitat value. Direct habitat loss can be calculated through geospatial analysis by overlaying the impoundment, access and transmission corridors, and related Project infrastructure onto the habitat map and evaluating the loss of important moose habitats. Indirect habitat loss and alteration 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 moose. By incorporating population data from the various surveys into the analysis, the number of animals affected can be estimated. In this way, the Geographic Information System (GIS) analysis will be combined with information from the literature to estimate the geographic extent, frequency, duration, and magnitude of Project effects on moose populations. The concurrent investigation of riparian habitats downstream of the dam site (Floodplain and Riparian Instream Flow Study [Section 8.6] and Riparian Vegetation Study Downstream of the Proposed Susitna–Watana Dam (Section 11.6) will provide additional data with which to assess impacts on moose, establishing baseline conditions and modeling riparian succession in areas in which habitat or browse availability may be affected by altered flow regimes. Harvest data collected by ADF&G and USFWS for the Wildlife Harvest Analysis (Section 10.20) will be used to establish baseline harvest levels and to monitor increased harvest that may result from improved access. Data on the movements of radio-collared moose can be used to assess potential blockage of movements in the inundation area. Any necessary protection, mitigation, and enhancement (PM&E) measures will be developed by examining the seasonal distribution and abundance of moose among habitats in relation to the geographic extent and seasonal timing of various Project activities.

10.5.8. Level of Effort and Cost

The cost of this multi-year study is estimated to total approximately $750,000.

10.5.9. Literature Cited

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10.5.10. Tables

Table 10.5-1. Schedule for implementation of the Moose Distribution, Abundance, Movements, Productivity, and Survival 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
Initial deployment of VHF and GPS collars, with monitoring at least monthly	——	——	——	——	——	——	——	——	——	——
Deployment of remaining VHF collars, with monitoring at least monthly		——	——	——	——	——	——	——	——	——
Monitor radio collars every two weeks and daily during calving			—	—			—	—		
Conduct adult/calf population survey of inundation zone and adjacent habitat		—								
Conduct winter browse survey		—				—				
Conduct GSPE survey for areas above and below proposed dam					—	.....				
Conduct post-rut aggregation composition surveys in CA7 and CA14	—				—				—	
Initial Study Report						—Δ				
Updated Study Report										—▲
Remove GPS collars									—	—

Legend:

—— Planned Activity
..... Follow-up activity (as needed)
Δ Initial Study Report
▲ Updated Study Report

10.5.11. Figures

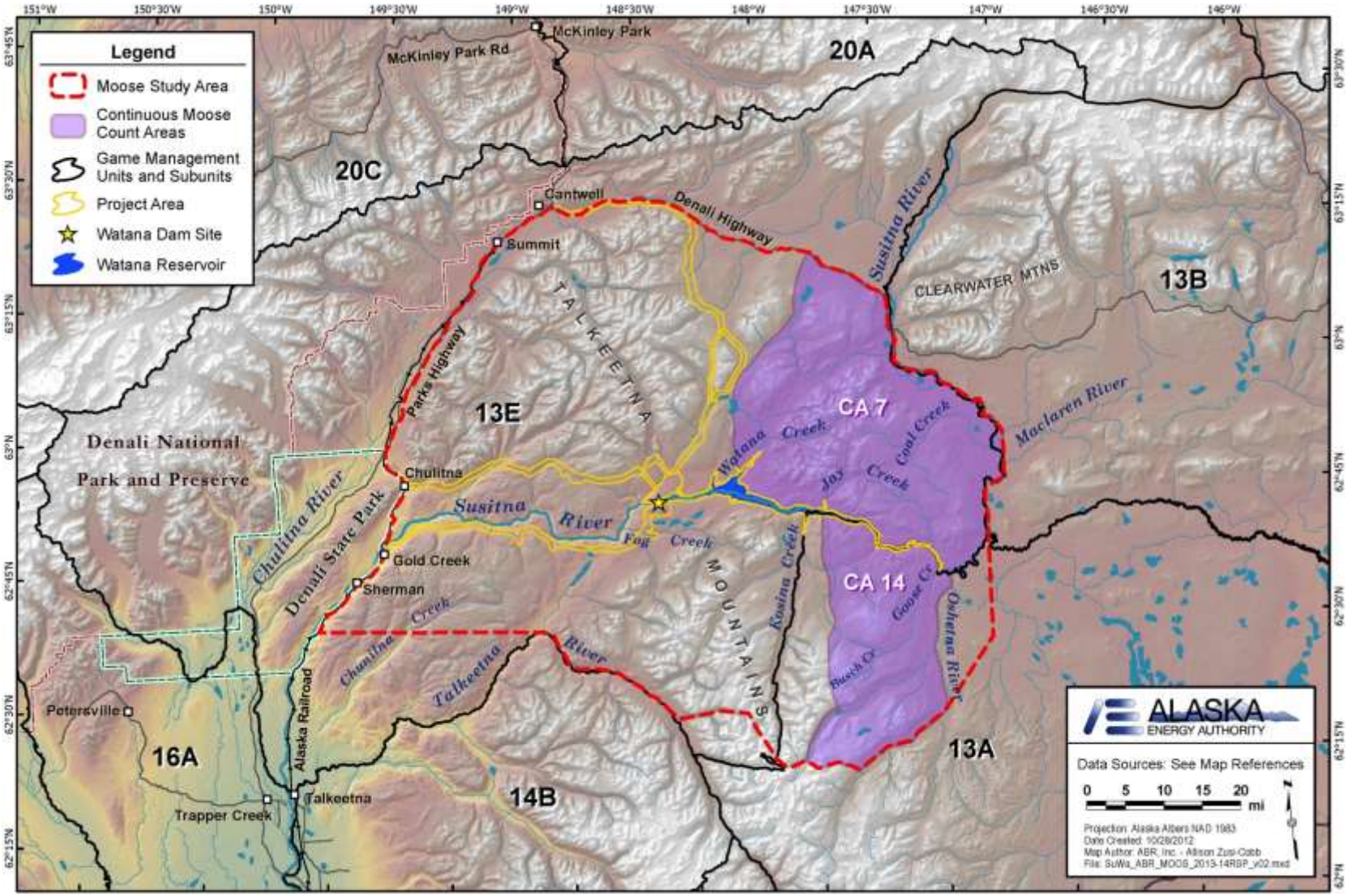

Figure 10.5-1. Moose study area.

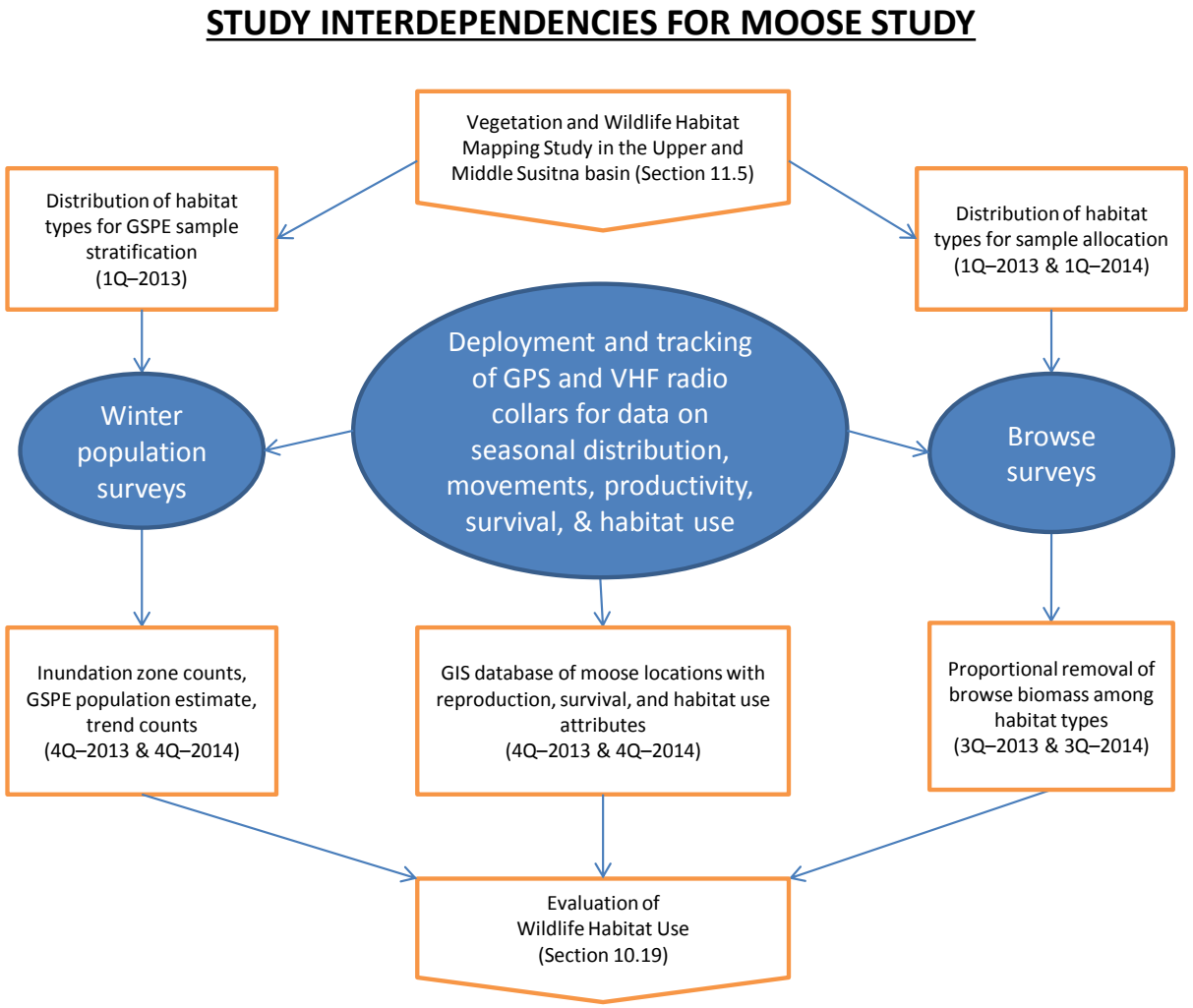

Figure 10.5-2. Interdependencies for moose study.