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SUSITNA-WATANA HYDRO

Susitna-Watana Hydroelectric Project
(FERC No. 14241)

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

Initial Study Report
Part A: Sections 1-6, 8-10

Prepared for

Alaska Energy Authority

SUSITNA-WATANA HYDRO

Clean, reliable energy for the next 100 years.

Prepared by

Alaska Department of Fish and Game

Palmer, Alaska

June 2014

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LIST OF ACRONYMS, ABBREVIATIONS, AND DEFINITIONS

Abbreviation	Definition
AEA	Alaska Energy Authority
CA	count area
CAG	current annual growth
CIRWG	Cook Inlet Region Working Group
DFG	Department of Fish and Game
FERC	Federal Energy Regulatory Commission
GMU	Game Management Unit
GPS	global positioning system
GSPE	GeoSpatial Population Estimator
ILP	Integrated Licensing Process
ISR	Initial Study Report
LZ	landing zone
Project	Susitna-Watana Hydroelectric Project
RSP	Revised Study Plan
SCF	Sightability Correction Factor
SPD	study plan determination
USR	Updated Study Report
VHF	Very High Frequency

1. INTRODUCTION

On December 14, 2012, Alaska Energy Authority (AEA) filed with the Federal Energy Regulatory Commission (FERC or Commission) its Revised Study Plan (RSP) for the Susitna-Watana Hydroelectric Project No. 14241 (Project), 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 Section 10.5 described the goal, 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 radio-tracking 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 has adopted the FERC requested modifications.

Following the first study season, FERC's regulations for the Integrated Licensing Process (ILP) require AEA to "prepare and file with the Commission an initial study report describing its overall progress in implementing the study plan and schedule and the data collected, including an explanation of any variance from the study plan and schedule" (18 CFR 5.15(c)(1)). This Initial Study Report (ISR) on the Moose Distribution, Abundance, Movements, Productivity, and Survival Study has been prepared in accordance with FERC's ILP regulations and details AEA's status in implementing the study, as set forth in the FERC-approved RSP and as modified by FERC's February 1 SPD (collectively referred to herein as the "Study Plan").

2. STUDY 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.

The study objectives are established in RSP Section 10.5.1:

- 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).

3. STUDY AREA

As established by RSP Section 10.5.3, the study area includes the majority of Game Management Unit (GMU) 13E east of the Parks Highway and the Alaska Railroad and from the Denali Highway south to upper Chunilna Creek (Figure 3-1). The study area also includes a small portion of northwestern GMU 13A, from Kosina Creek east to the Oshetna River drainage. The study area encompasses the proposed reservoir inundation zone, access and transmission corridors, and associated Project infrastructure.

4. METHODS AND VARIANCES IN 2013

The study team implemented the methods described in the Study Plan with one variance in the browse survey methods (RSP Section 10.5.4.3), as described in Section 4.3.1 below.

4.1. Moose Distribution, Movements, Productivity, and Survival

To delineate moose movements in the Project area and to evaluate productivity and survival, the study team equipped cow and bull moose with Very High Frequency (VHF) and Argos-linked satellite (global positioning system [GPS]) collars in October 2012 and March 2013. The study team deployed 60 percent of collars on cows because they represent the reproductive portion of the herd.

The study team conducted aerial radio-tracking (telemetry) surveys in fixed-wing aircraft monthly to document the distribution of radio-collared moose in the study area. During the spring calving and the fall season, the study team conducted aerial surveys weekly to document more frequently the distribution of moose in the study area. Additionally, to accurately document productivity and associated calf loss, the study team conducted twinning surveys daily during calving. The study team used small fixed-wing airplanes (Piper PA-18 “Super Cub”) for these radio-tracking flights. The study team documented location, date, reproduction, and survival status for moose located during each flight.

Moose locations are regularly obtained from deployed GPS collars via a satellite data link using the Argos Data Collection System and locations are provided to the study team on a monthly compact disc from Telonics. The study team accomplished data mapping and spatial analyses using *ArcGIS*® software.

Data collection and analysis will be in progress during the next study season. The study team used kernel density analysis (Seaman and Powell 1996) in *ArcGIS* software to visually represent telemetry locations of radio-collared moose and satellite locations of GPS-collared moose from October 2012 to September 2013.

4.1.1. Variances

No variances from the methods described in the Study Plan for delineating moose movements in the Project area and evaluating productivity and survival (RSP Section 10.5.4.1) were necessary in 2013.

4.2. Population Monitoring

The study team evaluated moose populations using three survey techniques. The study team used conventional survey methods pertaining to optimal snow conditions, daylight, flight patterns, and other factors (Ballard and Whitman 1988) for all surveys to maximize survey precision, maintain consistency among surveys, and facilitate comparisons with existing datasets.

To assess winter use of the proposed reservoir inundation zone, the study team surveyed the area in March 2012 and 2013 (Figure 3-1). Due to the seasonal absence of antlers, it was not possible to distinguish bulls from cows during late-winter surveys, but the study team recorded numbers of calves and adults. Population estimates will be corrected for sightability using data from intensive surveys (Gasaway et al. 1986).

The study team conducted a GeoSpatial Population Estimator survey (GSPE; Ver Hoef 2002, Kellie and DeLong 2006) in November 2013 to estimate moose populations above and below the proposed dam site within the study area. The study team divided the survey area into 633 sample units using the standard sample unit grid (Kellie and DeLong 2006) and stratified based on high and low moose density. The low-stratum consisted of sample units expected to have few or no moose. The study team accomplished a desktop stratification (Kellie and DeLong 2006) of the area using land cover classifications by Ducks Unlimited (2000), locations from radio-collared moose, and historic aerial trend-count survey data. One hundred sample units (60 high density and 40 low density) were randomly chosen upstream and downstream of the proposed Watana dam site for a total of 200 sample units. Pilot/observer teams in Piper PA-18 fixed-wing airplanes flew selected sample units at a high search intensity (> 6.5 minutes per square mile) and documented observed moose, based on sex and age class. An additional team of two observers and a pilot in a Cessna 185 was responsible for coordinating the survey teams and monitoring detection of radio-collared moose by each team. Immediately after a unit or group of units was completed, the pilot/observer team or the coordination team radio-tracked collared moose in the vicinity to determine if any collared moose were missed during the survey. Pilots recorded a waypoint of all circled moose and GPS flight tracks were downloaded each night. The study team used this information to rectify discrepancies in whether teams observed collared moose (i.e., circling in GPS flight path could be matched against locations of collared moose).

The study team conducted aerial trend-count surveys in previously established count areas (CAs), including CA 7 and CA 14 (Figure 3-1) in November 2012 and November 2013, to obtain current data for comparison with data from previous years.

4.2.1. Variances

No variances from the methods described in the Study Plan for population monitoring (RSP Section 10.5.4.2) were necessary in 2013.

4.3. Moose Browse Survey and Habitat Assessment

The study team used techniques developed by Seaton (2002) and used subsequently by Paragi et al. (2008) and Seaton et al. (2011) to estimate the proportion of browse biomass removed by moose. The study team divided the study area into 640 sample units using the standard GSPE sampling grid (Kellie and DeLong 2006). The study team stratified the sample units into either the high-stratum (high moose density) or the low-stratum (low moose density). One hundred sixty-seven high-stratum and 156 low-stratum cells were identified upstream of the proposed Watana dam site; 168 high-stratum and 149 low-stratum cells were identified downstream of the proposed Watana dam site. Of these, 48 high-stratum and 32 low-stratum cells both upstream and downstream of the proposed Watana dam site were randomly chosen for potential sampling (Table 4.3-1). The study team over-selected the number of potential cells to be sampled to accommodate omission of attempted cells that did not meet the sampling criteria. Sampling was conducted during March 28–April 5, 2013, after most of the winter browse activity had occurred but before spring green-up. The study team conducted surveys using an R-44 helicopter and two teams of biologists. The study team selected survey plots by beginning at the southeast corner of a randomly chosen cell and flying a northwest trajectory until a safe landing zone (LZ) was located. The study team then flew a random distance (30–100 meters) and bearing (0–359 degrees) from that LZ until a vegetative community with browse species was located. If the study team observed browse species, the plot was marked and visited on foot. If no browse species protruded from the snow within 100 meters of the first LZ, the vegetative community was noted and another randomly selected cell was chosen. Likewise, if an LZ could not be located (because of solid forest cover) or no vegetation was observed protruding from the snow while flying the northwest trajectory (such as in high alpine habitats), the cell was not sampled and another randomly selected cell was chosen. At each plot visited on foot, the study team measured current annual growth (CAG) of important browse species such as willow (*Salix* spp.), aspen and balsam poplar (*Populus* spp.), and Alaska birch (*Betula neoalaskana*) at each plot. The study team only sampled browse species between 0.5 meters (1.6 feet) and 3 meters (9.8 feet) in height. The study team randomly selected three plants per species in each 30-meter diameter plot and measured 10 twigs on each plant. The study team recorded twig diameter at the base of the CAG (or the point where twig was browsed, if older than last annulus) and the diameter at the point of browsing for each twig (Paragi et al. 2008).

4.3.1. Variances

The Study Plan (RSP Section 10.5.4.3) assumed that all portions of the study area would be equally available for sample allocation, but Cook Inlet Regional Working Group (CIRWG) lands were not available for sampling in 2013 due to the lack of a land-access agreement. Of the 96 randomly chosen high-stratum cells in the browse survey area, nine (9.4%) were located predominantly on CIRWG lands and were unavailable for sampling in 2013 (Table 4.3-1). Fourteen randomly chosen high-stratum cells were located partially on CIRWG lands, but had LZs on accessible lands that were potentially available for sampling. Ultimately, the sampling plan described above was flexible enough to accommodate the need to work around randomly chosen cells dominated by CIRWG lands (see Figure 5.1-4), just as randomly chosen cells that did not meet the sampling criteria (no LZ, no vegetation, or no browse species) were not sampled. Thus, the study team was still able to accomplish the browse survey objective in 2013.

5. RESULTS

5.1. Moose Distribution, Movements, Productivity, and Survival

In October 2012, the study team deployed 40 GPS collars on 26 cows and 14 bulls in the study area and deployed 10 VHF collars on seven cows and three bulls. The study team deployed another 50 VHF radio-collars in March 2013 on 33 cows and 17 bulls. In addition, the study team re-deployed five GPS and two VHF collars from mortality collar pickups on November 8–9, 2013 (Table 5.1-1).

The study team obtained a total of 2,010 locations of 100 collared moose from October 2012 through September 2013. The study team located all VHF-collared moose regularly during monthly telemetry flights. The study team conducted aerial surveys weekly during calving (May 10–June 21, 2013) and fall (August 15–September 30, 2013).

The study team conducted twinning surveys daily during May 15–June 4, 2013, to document productivity and calf survival. Of the 60 radio-collared cows located, 31 had a single calf and 13 (30%) had twins. Of the 57 calves observed, 30 (53%) survived to July 1, 2013; 74 percent of the calf losses observed occurred in the first week of life.

The study team divided telemetry locations from radio-collared moose and satellite locations from GPS-collared moose from May 2012 through September 2013 into six seasons: spring (April 1–May 9), calving (May 10–June 15), summer (June 16–August 31), fall (September 1–October 31), post-rut aggregation (November 1–30), and winter (December 1–March 31). The study team used kernel-density analysis (Seaman and Powell 1996) and *ArcGIS* software to create 50 percent, 75 percent, and 95 percent utilization distribution contours for each season from the combined telemetry and satellite data (Figure 5.1-1).

5.2. Population Monitoring

The study team conducted all moose surveys under suitable conditions, considering snow cover, wind, daylight, and precipitation.

The study team counted 427 moose during late-winter inundation surveys in both March 2012 and March 2013 (Figure 5.1-2). Of the 40 sample units surveyed, the study team randomly selected 10 each year for intensive surveys (Gasaway et al. 1986). These randomly selected units will be used to develop a sightability correction factor (SCF).

The study team sampled 205 sample units and counted 1,283 moose in over 100 survey hours during the GSPE survey in November 2013. The study team conducted the survey using seven pilot/observer teams. Of the 633 sample units in the study area, the study team assigned 319 to the high-density stratum and 314 to the low-density stratum (Figure 5.1-3). The study team will calculate an SCF for the population estimate using the proportion of collared moose seen by pilot/observer teams.

The study team conducted traditional aerial trend-count surveys in CA 7 and CA 14 (Figure 3-1) in November 2012 and November 2013. Results from those surveys will be compared with results from previous years in the Updated Study Report (USR).

5.3. Moose Browse Survey and Habitat Assessment

Two field crews of two biologists sampled 21 high-stratum and 14 low-stratum randomly selected cells both above and below the proposed Watana dam site, for a total of 70 cells sampled in the study area. Thirty-one additional cells were evaluated for sampling but were not sampled because they did not meet the sampling criteria. Two of these cells were not sampled because safe LZs were not found, four had no vegetation, and 25 had no browse species. Nine randomly selected cells were not attempted because they were located predominantly on CIRWG lands that were not available because of the lack of a land-access agreement. Because the study team had already met sampling objectives, 50 other randomly selected cells were not attempted (Table 4.3-1, Figure 5.1-4). The study team currently is using data from these surveys to calculate the proportional removal of biomass by moose in the study area.

6. DISCUSSION

Monitoring of the distribution, productivity and survival of moose in the study area is ongoing via the 55 VHF-collared moose (36 cows, 19 bulls) and 37 GPS-collared moose (24 cows, 13 bulls) currently alive in the study area. Evaluation of the moose population and composition in the study area is also ongoing; the surveys completed thus far include late-winter inundation surveys in March 2012 and March 2013, a GSPE in November 2013, and aerial trend-count surveys in November 2012 and November 2013. Estimation of moose browse utilization in the study area is in progress via browse surveys in the study area, the first of which was conducted March-April 2013.

The Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin study team (Study 11.5) will produce a fine-scale habitat map within a two mile buffer surrounding the Project area and is approaching 25% completion. This map was not available for use in the stratification of the survey areas for the 2013 browse survey and GSPE surveys as intended. However, these study areas are much larger than the Study 11.5 study area, and the stratification completed using Ducks Unlimited (2000) land cover classifications, locations from radio-collared moose, and historic aerial trend-count survey data was sufficient to meet study objectives. Data from this study will be provided to the study team for the Evaluation of Wildlife Habitat Use Study (Study 10.19) to use in their mapping of vegetation and wildlife habitats in the Project area.

From October 1976 to January 1986, 115 adult moose and 61 five- to ten-month old calves were collared upstream of the Devils Canyon dam site proposed for the prior Alaska Power Authority Susitna project. Those collared animals were relocated 5,421 times over the course of the study, for an average of 30 relocations per animal (Ballard and Whitman 1988). In addition, 39 moose were collared in 1980 and 1981 downstream of the Devils Canyon dam site proposed for the APA project and were relocated 1,072 times, for an average of 28 relocations per animal (Modafferi 1987). From October 2012 to September 2013, the study team for the current Project obtained 2,010 telemetry relocations from 100 collared adult moose, for an average of 20 relocations per animal. The study team will continue to collect locations of VHF-collared moose through the duration of the study. In addition, the study team has collected 47,176 GPS relocations from 40 GPS-collared moose via the Argos Data Collection System from October 2012 to October 2013 and will continue to collect regular relocations from these individuals until the GPS collars drop off in November 2014. Results from these surveys will be compared with results from previous years in the USR.

The study team implemented the methods outlined in RSP Section 10.5.4 with only one variance in the browse survey methods. Nine of the randomly selected high-stratum browse survey cells were predominately located on CIRWG lands and were therefore unavailable for sampling in 2013 due to the lack of a land-access agreement (Table 5.1-1). However, the initial over-selection of potential survey cells and the flexibility of the established study method allowed the study team to move to alternative cells when CIRWG lands were encountered, without compromising the browse study objective. Additionally, nine of the 14 randomly chosen high-stratum cells that were partially on CIRWG lands but had potential LZs on adjacent accessible land were attempted during the survey. Four of these cells were successfully sampled, including one plot that had an LZ below the ordinary high-water mark on the Susitna River (i.e., on state land). Five of the 14 selected cells were attempted but were not sampled because no browse species were available for measuring, so they did not meet the sampling criteria. Twelve other high-stratum cells in the study with no CIRWG land were also attempted but were not sampled due to a lack of browse species (Table 5.1-1). Therefore, the lack of access to CIRWG lands in 2013 did not interfere with the sampling of any of the 14 cells that were only partially covered by CIRWG lands and the study team was able to meet the browse study objectives using established methods.

The study team anticipates that the data collected in 2012 and 2013, combined with the data to be collected in the next study season, will be adequate to meet the study objectives outlined in RSP Section 10.5.1.

7. COMPLETING THE STUDY

[Section 7 appears in the Part C section of this ISR.]

8. LITERATURE CITED

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9. TABLES

Table 4.3-1. Sample Cell Allocation for the Moose Browse Survey in 2013.

Study Area	Stratum	Total Cells in Study Area	Cells Randomly Selected	Selected Cells Sampled	Selected Cells Attempted that Did Not Meet the Sampling Criteria:			Selected Cells Not Attempted	
					No LZ[1]	No Veg[2]	No Browse Sp.	Primarily on CIRWG Lands[4]	Total Not Attempted
Upstream	High	167	48	21	0	0	9	4	18
	Low	156	32	14	0	2	8	0	8
Downstream	High	168	48	21	1	2	3	5	21
	Low	149	32	14	1	0	5	0	12
Total		**640**	**160**	**70**	**2**	**4**	**25**	**9**	**59**

Notes:

1 No safe helicopter landing zone (LZ) was seen while flying the trajectory from the southeast corner to the northwest corner.

2 No vegetation was seen while flying the trajectory from the southeast corner to the northwest corner.

3 No browse species were seen within 100 meters of the first LZ.

4 Randomly selected cells located primarily on CIRWG lands were not attempted due to the lack of a land-access agreement in 2013.

Table 5.1-1. Moose Captures and Radio-collar Deployment, 2012–2013.

Collar Type	Sex	Initial Captures			November 2013	TOTAL
		October 2012	March 2013	Total		
VHF	Bulls	3	17	20	1	**21**
	Cows	7	33	40	1	**41**
GPS	Bulls	14	0	14	3	**17**
	Cows	26	0	26	2	**28**
TOTAL		**50**	**50**	**100**	**7**	**107**

10. FIGURES

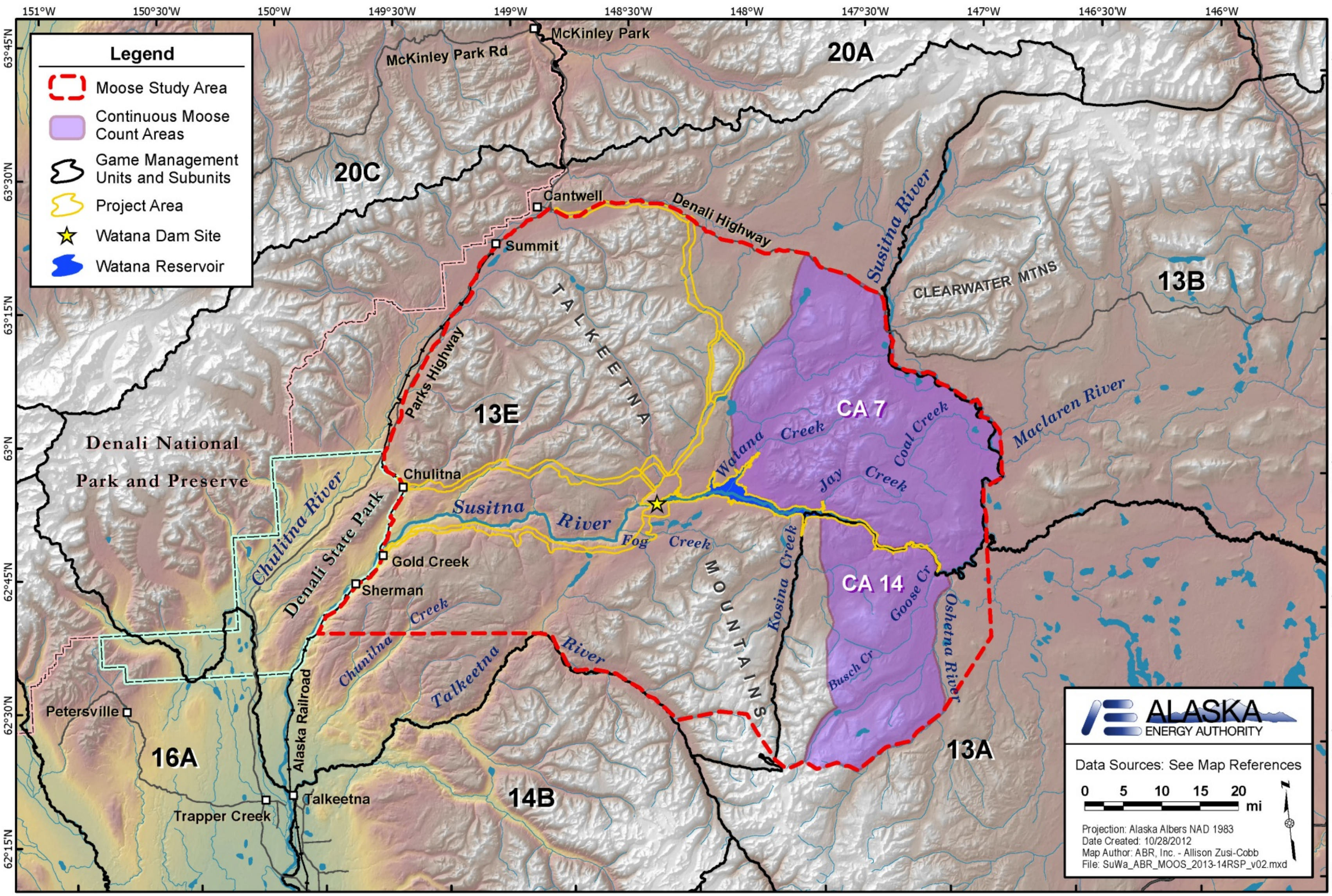

Figure 3-1. Moose Study Area.

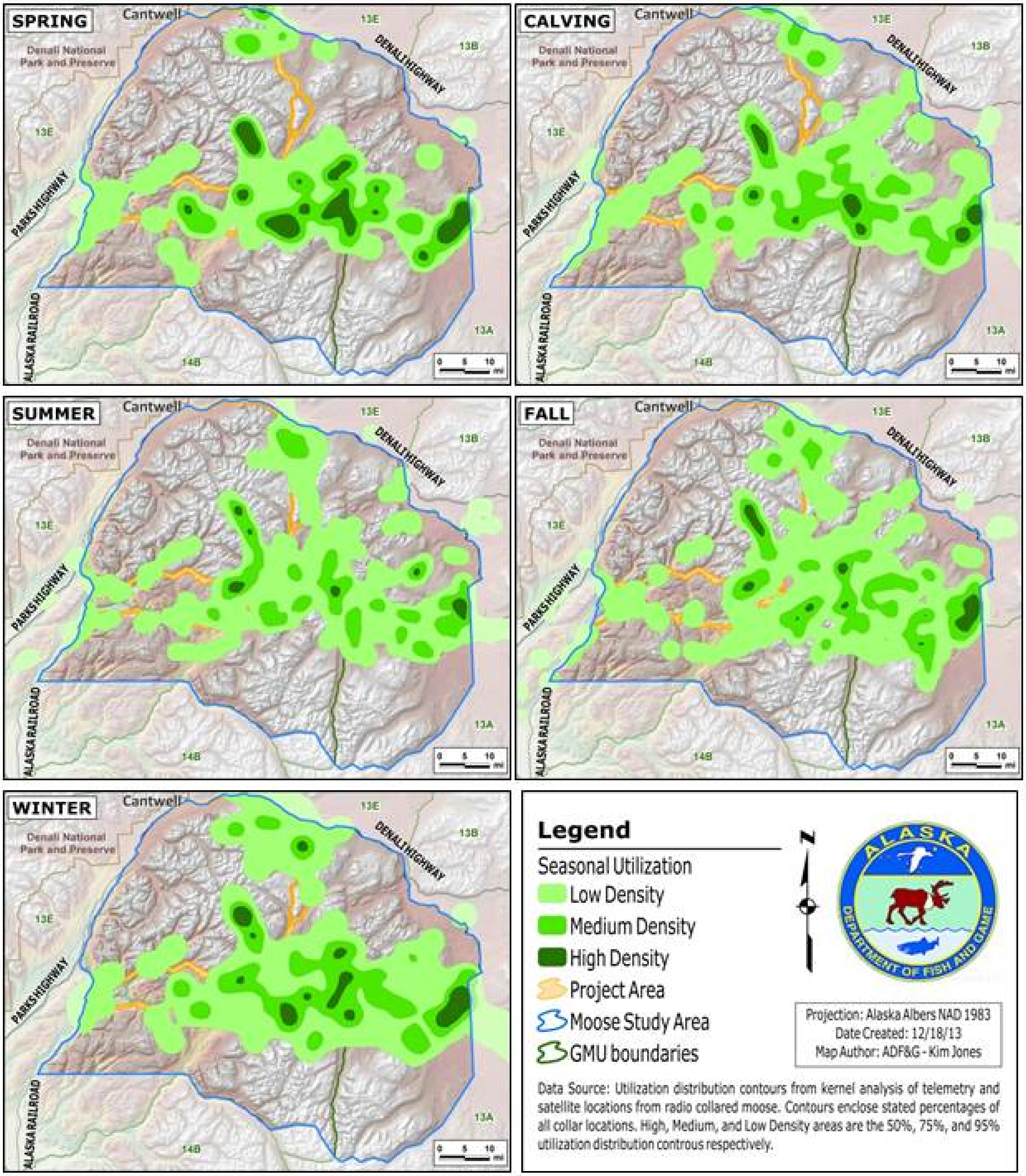

Figure 5.1-1. Seasonal Summaries of Radio-collared Moose Locations, 2012–2013.

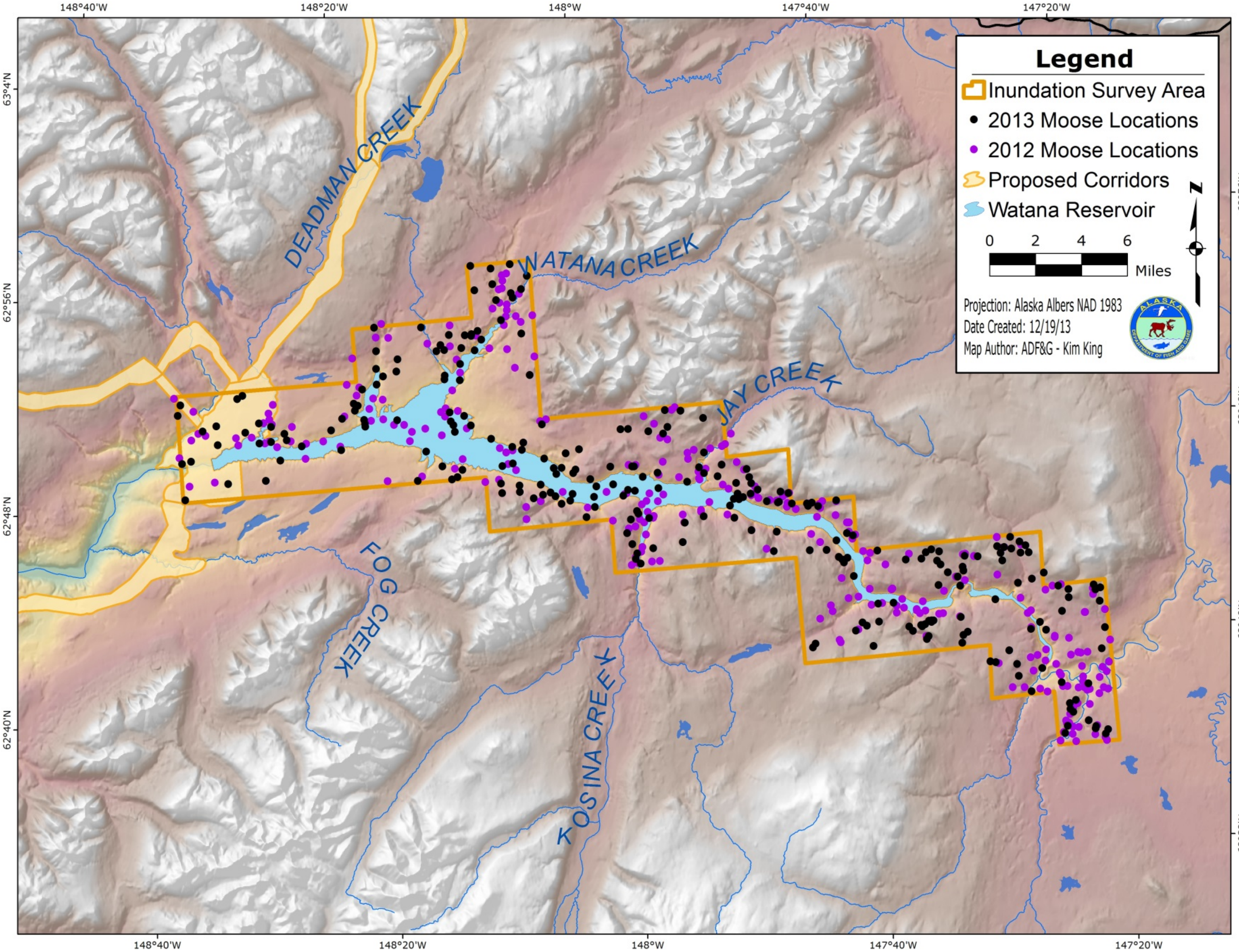

Figure 5.1-2. Locations of Moose Observed in the Reservoir Inundation Zone Survey Area, March 2012 and 2013.

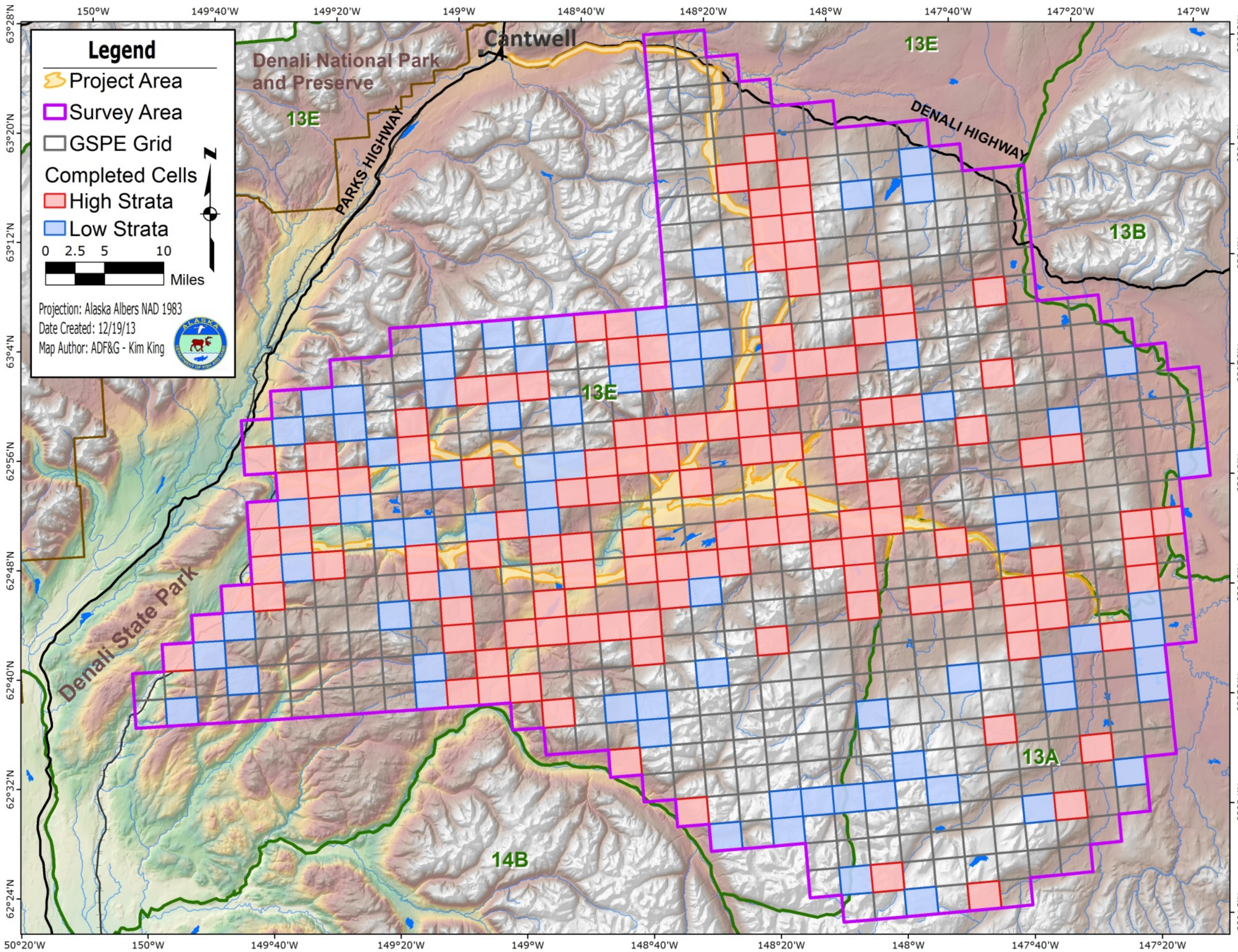

Figure 5.1-3. GSPE Aerial Survey Area, November 2013.

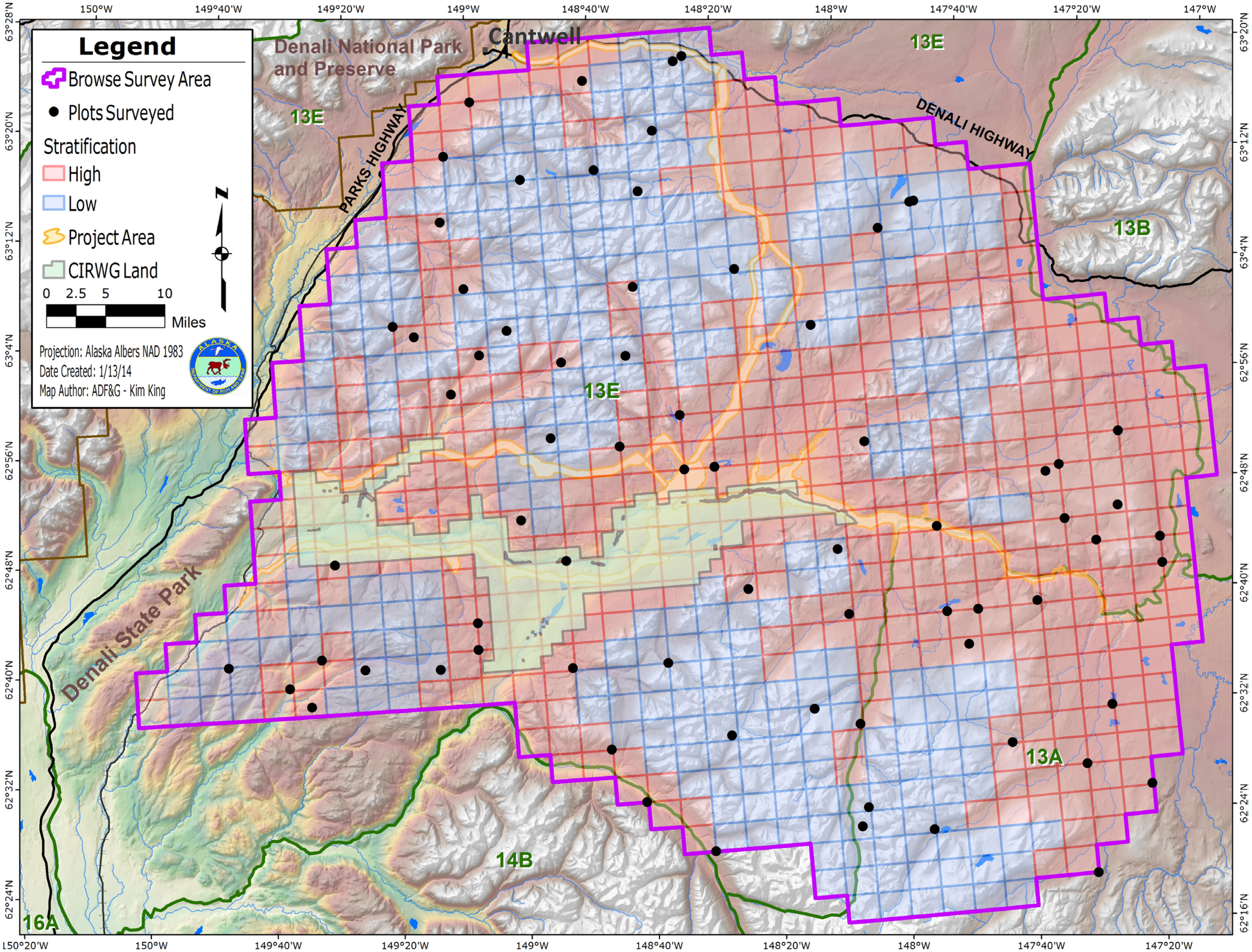

Figure 5.1-4. Browse-Survey Sample Plots, March–April 2013.