Susitna-Watana Hydroelectric Project
(FERC No. 14241)

Terrestrial Furbearer Abundance and Habitat Use
Study Plan Section 10.10

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.

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LIST OF ACRONYMS, ABBREVIATIONS, AND DEFINITIONS

Abbreviation	Definition
AEA	Alaska Energy Authority
CIRWG	Cook Inlet Regional Working Group
DNA	Deoxyribonucleic acid
DNPP	Denali National Park and Preserve
FERC	Federal Energy Regulatory Commission
GIS	Geographic Information System.
GPS	global positioning system
ILP	Integrated Licensing Process
ISR	Initial Study Report
Project	Susitna-Watana Hydroelectric Project
RSP	Revised Study Plan
SPD	Study Plan Determination
UAF	University of Alaska in Fairbanks

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). RSP Section 10.10 described the study of Terrestrial Furbearer Abundance and Habitat Use. This study focuses on providing current information on the abundance and habitat use of four terrestrial furbearers: coyote (*Canis latrans*), red fox (*Vulpes vulpes*), lynx (*Lynx canadensis*), and marten (*Martes americana*). RSP Section 10.10 describes the goal, objectives, and proposed methods for data collection regarding terrestrial furbearers.

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. Study 10.10 was one of the 31 studies approved with no modifications.

Following the first study season, FERC's regulations for the Integrated Licensing Process (ILP) require AEA to "prepare and file with the Commission and initial study report describing its overall progress in implementing the study plan and schedule and 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 Terrestrial Furbearer Abundance and Habitat Use 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 RSP as approved in FERC's February 1 SPD (referred to herein as the "Study Plan").

2. STUDY OBJECTIVES

The five objectives of this study are established in RSP Section 10.10.1:

1) Develop population estimates of coyotes and red foxes through fecal genotyping and genetic capture–recapture analyses, using scats collected along trails and rivers throughout the study area during winter months (January–March) in 2013 and 2014;
2) Develop a population estimate of marten through DNA-based capture–recapture analysis, using hair samples collected in the reservoir inundation zone with hair-snag tubes;
3) Develop a population estimate of lynx through DNA-based capture–recapture analysis, using hair samples collected throughout the study area with hair-snag plates;
4) Assess prey abundance in the study area by conducting snowshoe hare pellet counts and estimating vole density using a mark–recapture framework from live-trapping sessions;
5) Compile habitat-use data for the furbearer species being studied, using aerial track surveys.

3. STUDY AREA

As established by RSP Section 10.10.3, the terrestrial furbearer study area (Figure 3-1) includes all terrestrial areas that are safely accessible by snowmachine within a 10-kilometer (6.2-mile) buffer zone surrounding the areas that may be directly altered or disturbed by Project construction and operations, including facility sites, laydown/storage areas, the reservoir inundation zone, and access road and transmission-line corridors.

4. METHODS AND VARIANCES IN 2013

The methods implemented for each of the four major study components and variances are described below.

4.1. Sample Collection

AEA implemented the methods as described in the Study Plan (RSP Section 10.10.4.1), with the exception of variances explained below (Section 4.1.1).

The study team established five survey transects, each ranging in length from approximately 25 to 50 km (15–30 mi), along natural corridors of animal movement in the study area, such as creeks, rivers, and the Denali Highway (Figure 4.1-1). Transects along the Susitna River and Denali access corridor were relatively long (40–50 km), with shorter transects extending up several tributary drainages (Watana, Tsusena, and Butte creeks). Transect placement ensured roughly equal coverage of the 2013 survey area and avoided gaps. The study team surveyed transects daily on a rotating basis, such that each transect was traveled every week between January 7 and April 15, 2013, collecting all canid (fox and coyote) and felid (lynx) scats along the transects.

The study team also deployed hair-snag plates every 5 km (3.1 mi) along the transects that were established for scat collection. Hair-snag stations were checked twice monthly during January 29–April 12, 2013. Five marten hair tubes (Williams et al. 2009) were deployed in forested locations considered likely to be used by marten to test the effectiveness of the sampling method.

The study team estimated snowshoe hare abundance from counts of fecal pellets in 15 survey grids in the 2013 survey area (Figure 4.1-2). Pellet grids were placed in contiguous areas of hare habitat (spruce forest and riparian shrub) located throughout the 2013 survey area in major. Creek drainages and portions of the Project area, including the Denali corridor and reservoir inundation zone were specific areas of interest. Four grids established in August 2012 were resurveyed and 11 new grids were established in 2013.

The study team estimated abundance of voles by using live-trapping in 15 grids (Figure 4.1-2). One grid established in August 2012 was resurveyed and 14 new grids were established in 2013. Each grid comprised 100 live-trap sites, spaced at 10-m (32.8 ft) intervals. The study team deployed traps for one night at each grid. Data from 1-night trapping sessions were compared with results from 5-night trapping sessions of a similar study in the Denali National Park and Preserve (DNPP) in which the ratio of recaptured tagged individuals to unmarked individuals was used to calculate an estimate of population abundance. This comparison allowed abundance estimates to be generated while expanding the sampling coverage area 5-fold.

4.1.1. Variances

The 2013 survey area was modified for the following reasons: (1) the long distance to much of the study area from the winter base of operations at Alpine Creek Lodge on the Denali Highway; (2) physical barriers that prevented travel by snow machine along the lower sections of the Susitna River; and (3) the lack of access to Cook Inlet Regional Working Group (CIRWG) lands. The lack of a suitable base of operations centrally located within the study area made it impossible to achieve full access to the entire study area. Because Alpine Creek Lodge was the only feasible option for a base of winter operations, access to sampling sites along the Denali Highway was convenient, but access to areas closer to the dam site and west of Tsusena Creek was extremely challenging. The lack of access to CIRWG lands prevented the field crew from sampling in the western portion of the inundation zone and adjacent area. The combination of those access restrictions with physical barriers along the Susitna River (cliffs, steep slopes, and unstable ice conditions) made it impossible or unsafe to cross from the north side of the Susitna River to the south side in the reservoir inundation zone. Sampling was conducted in as much of the study area described in the Study Plan as much as possible, but no surveys were conducted in the Chulitna and Gold Creek corridors in 2013. To maximize sampling effort in areas accessible by snowmachine from the winter base of operations, the 2013 survey area was expanded to include areas northeast of the study area (Figure 3-1). These variances allowed sampling to be conducted in a large enough area that findings can be extrapolated across the entire survey area. In this way, the study team will still be able to meet the study objectives.

The study team modified the deployment and use of the lynx hair snags to increase sampling efficiency in the field and to create a survey layout that allowed better comparison of the lynx survey data with those from the canid scat collection effort. Rather than subdividing the entire study area into 50 blocks as proposed in the Study Plan, lynx stations were deployed along the major sampling transect routes that were established for scat collections. Stations were systematically deployed every 5 km (3.1 mi) along those routes to maintain a similar sampling density to that described in the Study Plan. This method of station layout and deployment allowed the field crew to check the hair stations while simultaneously looking for scats, thereby increasing the efficiency of data collection. Creating spatial overlap of the sample collection locations provided more descriptive data concerning abundance of canids and lynx as well as potential interspecific interactions in the shared sampling area. These variances will have no impact of the study team's ability to meet study objectives because sampling routes tended to be located along drainages and therefore encompassed most of the available lynx habitat in the study area. Areas between sampling routes were generally alpine habitats at higher elevations, which are considered unsuitable for lynx.

Collection of marten hair samples was not accomplished in 2013 as proposed in the Study Plan because of the lack of access to CIRWG lands and the difficulty of snowmachine access in the reservoir inundation zone, which included a large proportion of suitable marten habitat (spruce forest). That area was outlined in the Study Plan as the primary area to be surveyed for martens in both years of study. Access to these areas in the next study season will allow the study objective to be achieved.

Snowshoe hare surveys were conducted primarily as described in the Study Plan, although the study team changed the way that the sample grid locations were allocated to better account for variability of habitats throughout the 2013 survey area. Instead of dividing the study area into equal-sized blocks as described in the Study Plan, grids were established in parts of the study area where the desired habitat elements (spruce forest and riparian shrubs) occurred in contiguous patches. Habitat maps and aerial scouting were used to pinpoint the specific locations that fit these habitat requirements. The study team chose locations that were evenly spread out and were close to creek or river drainages, which tended to have the most suitable habitat. The study team also attempted to establish grids in portions of the proposed Project area, such as the Denali access corridor. Some sampling bias may have been introduced by the nonrandom selection of survey locations, but the study team concluded that the revised sampling design provided a more robust method of estimating snowshoe hare abundance. The study team increased the number of sample grids from the 8–10 grids proposed in the Study Plan to a total of 15 grids, an increase in sampling effort that was considered necessary because of the high level of habitat heterogeneity in the study area.

The vole live-trapping survey also involved variances from the Study Plan. As proposed, trapping grids were established in spruce and meadow habitats. These grids were set up in pairs (one grid in spruce and one in meadow) throughout several major drainages and the Denali access corridor (see Section 5.1 below). One grid was set up in a meadow without a paired forest grid because of the lack of suitable spruce habitat in that location. Trapping nights were reduced from the one to five nights proposed to a single night per grid. Accordingly, the captured voles were not marked. This reduction in effort was justified by the strong correlation (r = 0.85; L. Prugh, unpublished data) between the number of voles caught on the first night of trapping and the vole density estimated from 5-night mark–recapture trapping sessions in a similar study in DNPP. Trapping for a single night per grid in this study provided adequate information for use in estimating vole abundance while allowing sampling coverage to be increased five-fold in the 2013 survey area. By reducing effort at each site to one night of trapping, each grid size could be increased from the proposed 50 traps per grid to 100 traps per grid and the total number of grids was increased from 8–10 to a total of 15. Both of these changes increased sample sizes and provided better coverage of the survey area.

4.2. Genetic Analyses

AEA implemented the methods as described in the Study Plan (RSP Section 10.10.4.2) with no variances. Samples currently are being processed in the Prugh laboratory at the University of Alaska (UAF) for completion of analyses during winter 2014, so no results were available for inclusion in the ISR.

4.2.1. Variances

No variances from the study plan methods for genetic analyses occurred during 2013. However, analyses were delayed substantially for two reasons: (1) the study team was not able to initiate laboratory analyses until July 2013, because the study team had to set up a new laboratory in a new building, and was not able to move into the building until late June 2013; (2) the development of a new species identification protocol was more difficult and time-consuming than originally anticipated. However, the study team does not expect delays in completing and reporting final genetic analyses in 2014 and thus will be able to meet the study objective.

4.3. Habitat Use

AEA implemented the methods as described in the Study Plan (RSP Section 10.10.4.3), with the exception of variances explained below (Section 4.3.1).

Habitat use was evaluated by using a combination of data from aerial surveys and ground-based surveys. Helicopter surveys of wildlife tracks in the snow were conducted on February 26, March 27, and April 19, 2013. The survey design was based on the helicopter-based track surveys that were conducted in the Project area in the 1980s (Gipson et al. 1984), using the same 14 transect lines (Figure 4.3-1) to facilitate comparison of current and historical data. An experienced observer (Dr. Laura Prugh) flew along the transect lines at low altitude (100–200 ft) and slow speed (20–40 mph) in a Robinson R44 helicopter. The two helicopter pilots used on different surveys (Troy Cambier and Rick Swisher) were experienced at furbearer track identification and served as observers during the surveys. A global positioning system (GPS) receiver was used to record the locations of all furbearer tracks encountered. Associated data included the species that made the tracks and field descriptions of the habitat in which the tracks were found, following the same scheme as in the ground-based track surveys. The GPS locations were overlaid on a wildlife habitat map using a geographical information system (GIS) and *ArcGIS*® software (ESRI, Redlands, California) to examine patterns of habitat use in the survey area for each furbearer species.

4.3.1. Variances

Additional data on habitat use and species occupancy (beyond those described in the Study Plan) were collected during the ground-based track surveys in winter 2013.

Ground-based track surveys were used to examine habitat associations. Using a GIS, a grid of $2 \times 2\text{-km}^2$ cells was overlain on the study area. Cells were classified as being primarily comprised of low shrub, tall shrub, forest, or alpine habitat, based on existing vegetation mapping, and proportional sampling was used to select cells randomly within each habitat stratum. Selected cells were sampled either by conducting track transects or by placing a motion-triggered camera (Reconyx® PC800 HyperFire Professional) in a likely travel route within the cell. Camera stations were deployed for periods of 2–3 weeks, baited with a scent (commercially available skunk lure) and a bird (grouse or ptarmigan) wing as attractants. All furbearer tracks encountered along transects were recorded, along with species identity, GPS waypoint, vegetation, and snow characteristics (depth and compaction). Tracks of hares and voles were also counted. The percentage of vegetative cover was classified on a scale from 0–4 for the major tree species in the canopy, understory shrub species, and grass species. When it becomes available, the vegetation and habitat map that will be produced by the Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin (Study 11.5) will be used to evaluate habitat use by the target species of furbearers.

These additions to the study design will not affect the ability of the study team to meet the study objectives. Ground-based track surveys will continue to be carried out in the next study season, but the use of motion-triggered cameras will be discontinued because the addition of cameras to the study design in 2013 did not provide useful results.

4.4. Statistical Analyses and Data Interpretation

AEA implemented the methods as described in the Study Plan (RSP Section 10.10.4.4), with the exception of variances explained below (Section 4.4.1).

4.4.1. Variances

The Study Plan did not propose to include occupancy modeling in the study design; rather, the study team included this additional analytical element during final project planning. Detections from photographs were used along with track data to assess furbearer habitat associations using occupancy models in software programs *MARK* and *RMARK*. These computer programs allow estimation of the proportion of survey cells occupied by each furbearer species, probability of detections for each species and for each survey method, and occupancy as a function of prey availability and habitat type.

These additions will benefit the study by increasing the amount of data available to help describe current furbearer populations. These additions, which will help to achieve the study objective by providing additional data, will be carried out in the next study season.

5. RESULTS

Data developed in support of this study are available for download at http://gis.suhydro.org/reports/isr.

5.1. Sample Collection

The study team collected 111 fox and coyote scats in 2013. Samples were collected from all of the targeted furbearer species (Table 5.1-1). Fewer hair samples were collected from the lynx hair snags than expected (Table 5.1-2). As discussed above, only a small number of marten hair tubes were deployed in the 2013 field season. However, trial runs of these hair tubes successfully showed the effectiveness of the traps.

Prey surveys during the 2013 summer field season produced highly variable results. Snowshoe hare surveys were conducted in the Jay, Watana, Butte, Deadman, Tsusena, Seattle, and Brushkana creek drainages. Although data analysis is still in process at this writing, the raw data suggested that hare density was extremely variable throughout the study area (Table 5.1-3). Several areas of high use were located, as well as areas with little to no hare sign. Overall vole density in the study area appeared to be extremely low in 2013 (Table 5.1-4). Survey areas included the Jay, Watana, Butte, Deadman, Tsusena, and Seattle creek drainages and Deadman Mountain. Capture success was low, with no indication of differences between habitat types. The range of total captures per survey grid was 0–2 voles. The vole species captured included red-backed vole (*Myodes rutilus*), meadow vole (*Microtus pennsylvanicus*), and singing vole (*Microtus miurus*). Although trap mortality can be a common occurrence during small mammal surveys, precautions were taken to minimize this during the Susitna trapping sessions. No mortalities of captured voles occurred during the 2013 sampling.

5.2. Habitat Use and Furbearer Occupancy

A total of 899 sets of tracks were recorded during the three helicopter surveys, 557 of which were of the four target furbearer species (Table 5.2-1). No coyote tracks were seen on the aerial survey transects. Furbearer track density increased markedly from west to east, peaking at Watana Creek (Figure 5.2-1).

Collection of habitat data during aerial and ground-based surveys in the 2013 winter field season resulted in an extensive database of microhabitat information. Detection of furbearers at remote camera stations and detection of furbearer tracks along survey transects have been modeled as a function of survey method (Table 5.2-2) and are currently being modeled as a function of habitat classification and prey abundance using program *MARK*.

5.3. Genetic and Statistical Analyses

Genetic analysis of scat and hair samples is ongoing in the UAF lab. The study team obtained reference tissue samples from museum specimens of known species identity to screen a set of microsatellite markers. The study team then optimized those DNA markers and began DNA fingerprinting of scats. Additionally, the study team used the reference tissues and scats to develop a species identification protocol, which was more difficult to develop than expected due to the large suite of carnivore species present in the area. This difficulty delayed large-scale processing of scats because it is generally preferable to verify species identity before determining individual ID. DNA from approximately 40 percent of the scats have been extracted at this writing and, of those, 35 percent have been genotyped (DNA fingerprinted) at least once.

6. DISCUSSION

Overall, the study effort has proceeded largely as planned, although progress was hampered by the lack of access to CIRWG lands, the lack of a centrally located base camp for winter operations, and delays in getting the genetic signatures for some target species. Implementation of data collection techniques during the winter and summer field seasons was productive and closely followed the Study Plan. Aside from the limitations with the marten surveys, the only variances with data collection methods were small changes in survey design to increase efficiency in the field. Although the majority of data collection methods were implemented successfully, the surveys produced mixed results.

One concern from the 2013 season was the low capture success of voles. Upon initial review, these results may seem to be related to the short, one-night trapping sessions. The study team considered transitioning to a longer trapping session at each survey grid and reducing the overall number of survey grids sampled. However, this study followed the exact procedures implemented in the DNPP study, during the same time frame, and results from the DNPP study showed much higher vole densities, suggesting that the low capture rates in Susitna may not have been a function of the survey technique, but simply a representation of low vole density in the study area.

Initial results from occupancy analyses indicated that the probability of detection varies according to species. When modeled as a function of survey method, the study team observed a wide range of detection probabilities from 0 (coyotes) to 0.45 (red fox). These values indicate that the survey methods are more suitable for some species than for others. Occupancy estimates for each species indicate that red fox and coyotes have the highest occupancy probability throughout the study area. However, it is likely that marten and lynx occupancy is more closely tied to habitat type because of their narrower habitat preferences. For some of the more elusive furbearer species in the study area (coyote and lynx), low sample size may also need to be considered as a confounding effect on both detection probability and occupancy rate. These results are useful and will help to adjust the survey effort during the next year of study to increase sample size. Incorporating modified track survey techniques, including two seasons worth of data, and include habitat and prey abundance covariates, will lead to even more detailed occupancy models after the next year of study.

Overall, collection of genetic samples in 2013 was a success. Although analyses of population size, population growth rates, survival, and recruitment of our target species have not yet been completed, the study team does not expect any changes in the final data products. The delays in genetic analysis have caused a slight setback, but are not expected to alter the ability of the study team to achieve the study objective.

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 5.2-1. Track Counts from Aerial Furbearer Surveys, Winter 2013.

Species	February 26	March 27	April 19	Total
Marten	93	105	193	391
Weasel	68	43	91	202
Lynx	22	53	39	114
Wolverine	14	40	53	107
Fox	13	28	11	52
Wolf	9	0	11	20
Otter	2	6	4	12
Mink	0	1	0	1
Total	221	276	402	899
DSLS	2	4	9	--
Tracks per DSLS[1]	110.5	69	44.7	--

Notes:

1 DSLS = Days Since Last Snowfall

Table 5.2-2. Furbearer Occupancy (*PSI*) and Detection Probability (*P*) as a Function of Survey Method.

Species	PSI[1]	95% Interval	*P*[2]	95% Interval
Coyote	0.71	0.37–.091	0	0–1
Red Fox	0.49	0.34–0.64	0.45	0.34–0.57
Lynx	0.38	0.16–0.65	0.14	0.06–0.32
Marten	0.37	0.22–0.54	0.24	0.10–0.48

Notes:

1 Occupancy (PSI) describes the probability that the survey area is occupied by the target species, given that species are imperfectly detected.

2 Detection probability (P) describes the probability of detecting that species assuming it is present.

Table 7.3-1. Scat Samples Collected during Terrestrial Furbearer Study, Winter 2013.

Species[1]	Total Number of Scats Collected
Coyote	35
Red Fox	76
Lynx	2
Marten	6
Wolverine	12
Total	131

Notes:

1 Samples were identified in the field based on size and shape of scat, or presence of animal tracks nearby. Not all samples have been positively identified to species in the DNA lab.

Table 7.3-2. Hair Samples Collected during Terrestrial Furbearer Study, Winter 2013.

Species[1]	Total Number of Hairs Collected
Lynx	23
Wolverine	6
Total	29

Notes:

1 Samples were identified in the field based on hair coloration and size, and the presence of furbearer tracks near the hair snag station. Not all samples have been positively identified to species in the DNA lab.

Table 7.3-3. Average Number of Hare Pellets per Survey Plot at 15 Survey Locations, Summer 2013.

Survey Location	Average Number of Pellets/Plot
1) Watana Creek Shrub	2.04
2) Jay Creek Forest	2.24
3) Tsusena Creek Shrub	8.7
4) Deadman Creek Forest	25.84
5) Watana Creek Forest	3.34
6) Upper Butte Creek Forest	0.48
7) Upper Butte Creek Shrub	1.32
8) Seattle Creek Shrub	3.78
9) Seattle Creek Forest	0.33
10) Butte Lake Forest	0.62
11) Butte Lake Shrub	16.48
12) Southern Butte Creek Forest	6.16
13) Southern Butte Creek Shrub	3.28
14) Jay Creek Shrub	45.16
15) Oshetna Creek Forest	29.78
Range	0.33–45.16

Table 7.3-4. Number of Voles Captured at 15 Survey Locations, Summer 2013.

Survey Location	Number of Captured Voles (Species)
1) Watana Creek Forest	1 (Red-backed Vole)
2) Watana Creek Meadow	0
3) Jay Creek Forest	0
4) Jay Creek Meadow	2 (Meadow Vole, Singing Vole)
5) Tsusena Creek Forest	1 (Red-backed Vole)
6) Tsusena Creek Meadow	0
7) West Tsusena Creek Forest	2 (Red-backed Vole)
8) West Tsusena Creek Meadow	1(Red-backed Vole)
9) Upper Butte Creek Forest	1 (Red-backed Vole)
10) Upper Butte Creek Meadow	1 (Red-backed Vole)
11) Upper Watana Creek Forest	1 (Red-backed Vole)
12) Upper Watana Creek Meadow	0
13) Seattle Creek Forest	1 (Red-backed Vole)
14) Seattle Creek Meadow	2 (Red-backed Vole)
15) Deadman Mountain Meadow	0
Total	13

10. FIGURES

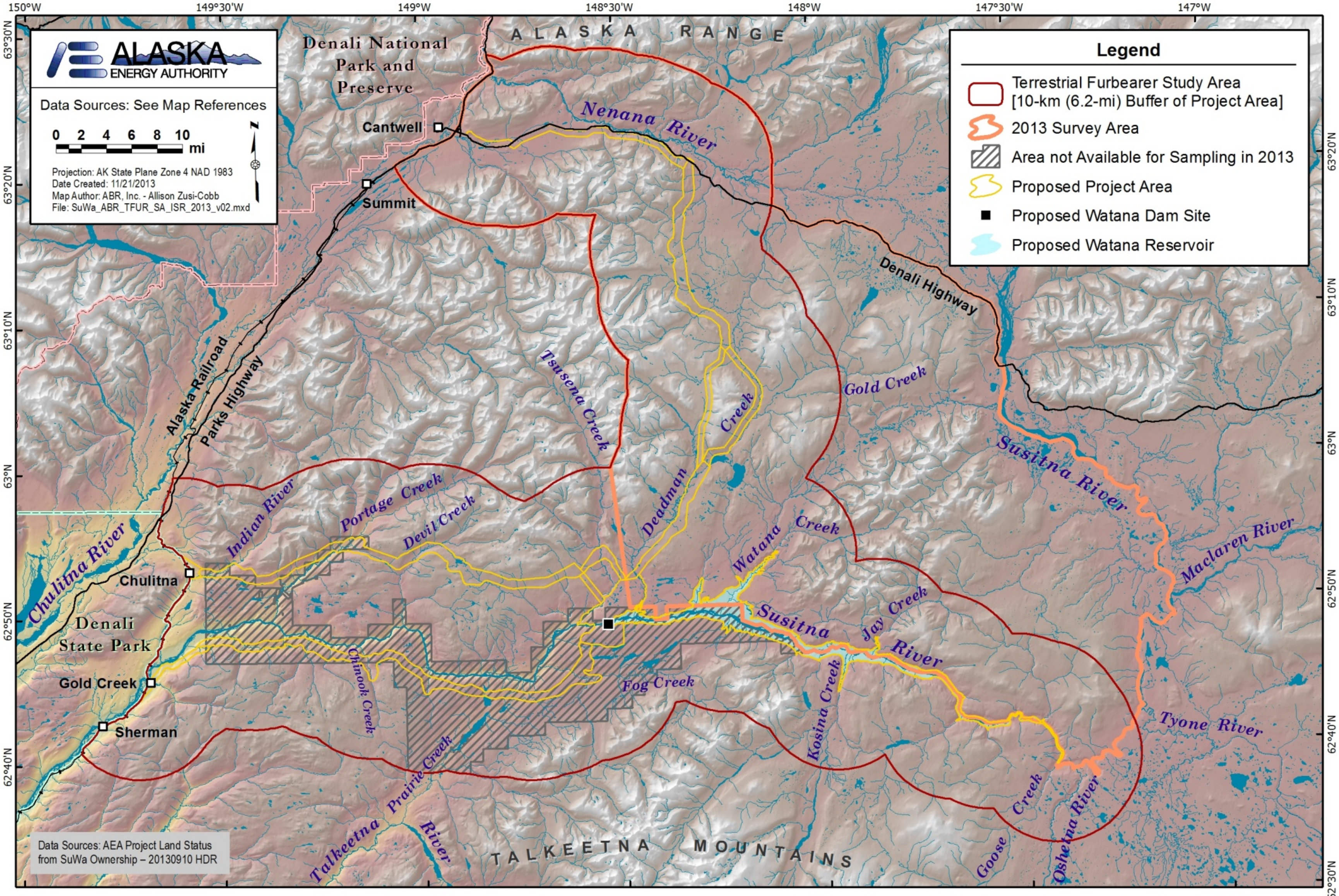

Figure 3-1. Terrestrial Furbearer Study Area and 2013 Survey Area for the Susitna-Watana Hydroelectric Project.

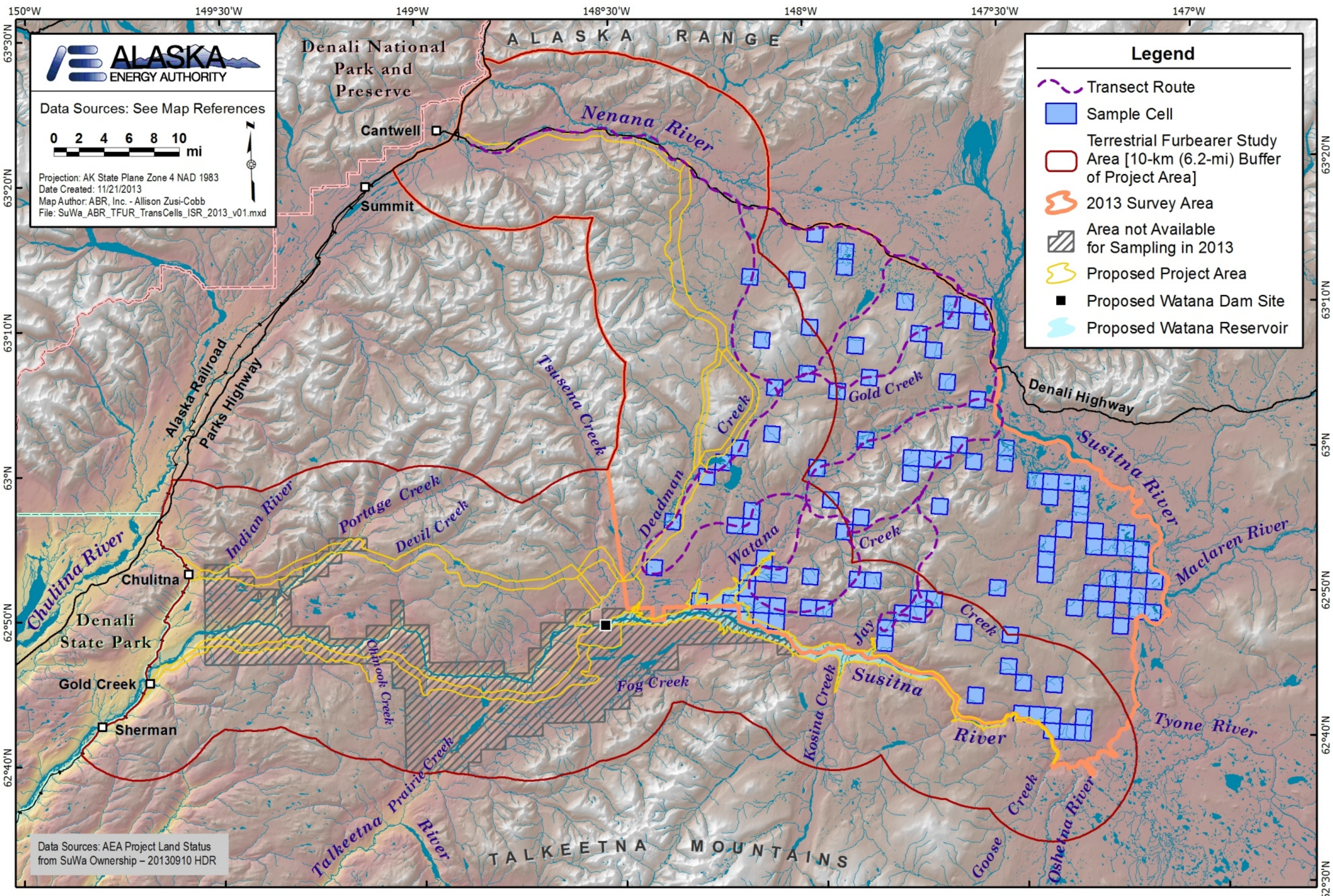

Figure 4.1-1. Location of Ground-based Transect and Occupancy Survey Cells Sampled in Winter 2013.

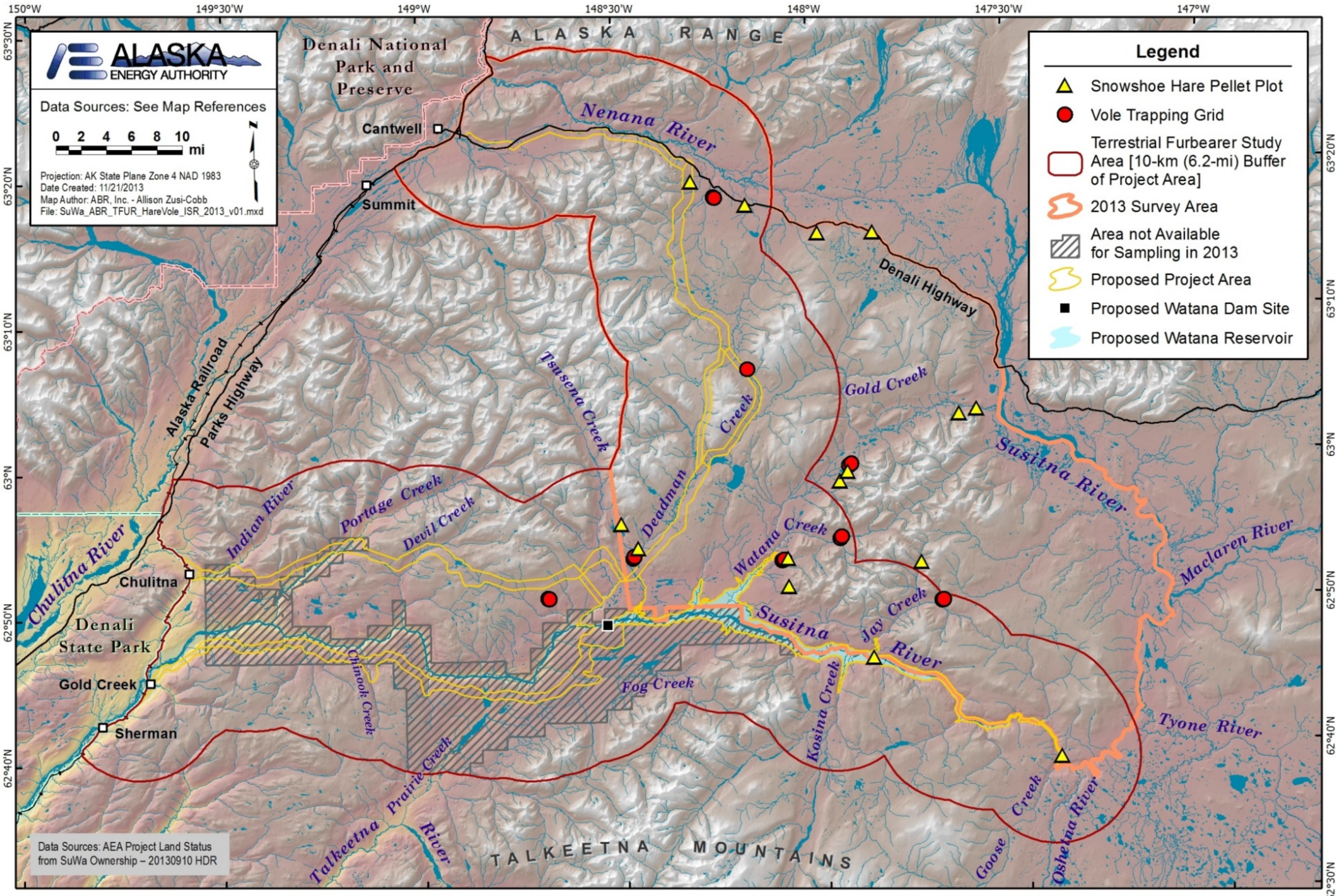

Figure 4.1-2. Grid Locations Sampled for Snowshoe Hare and Vole Abundance in Summer 2013.

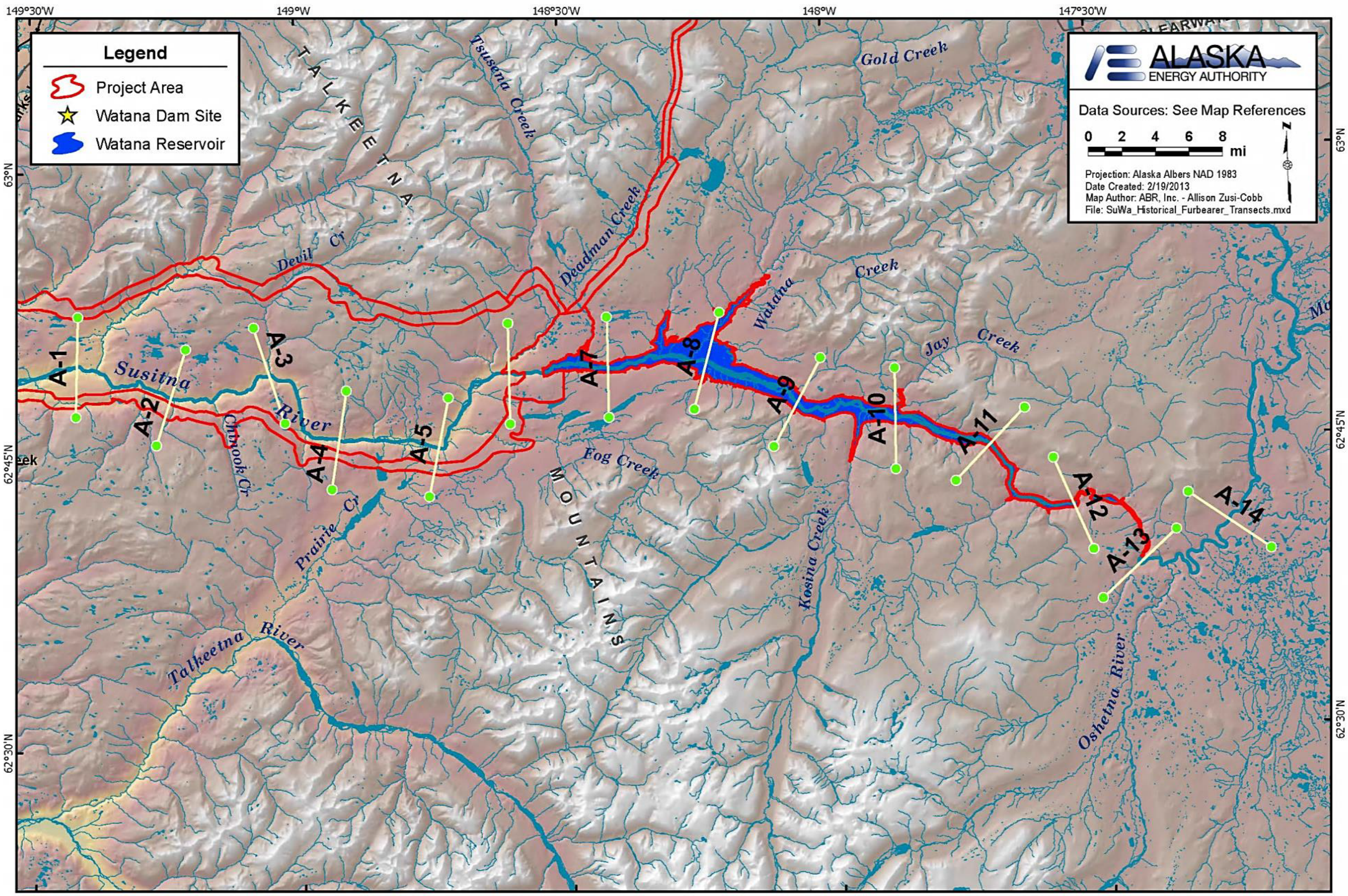

Figure 4.3-1. Aerial Transects for Track Surveys of Terrestrial Furbearers in Winter 2013.

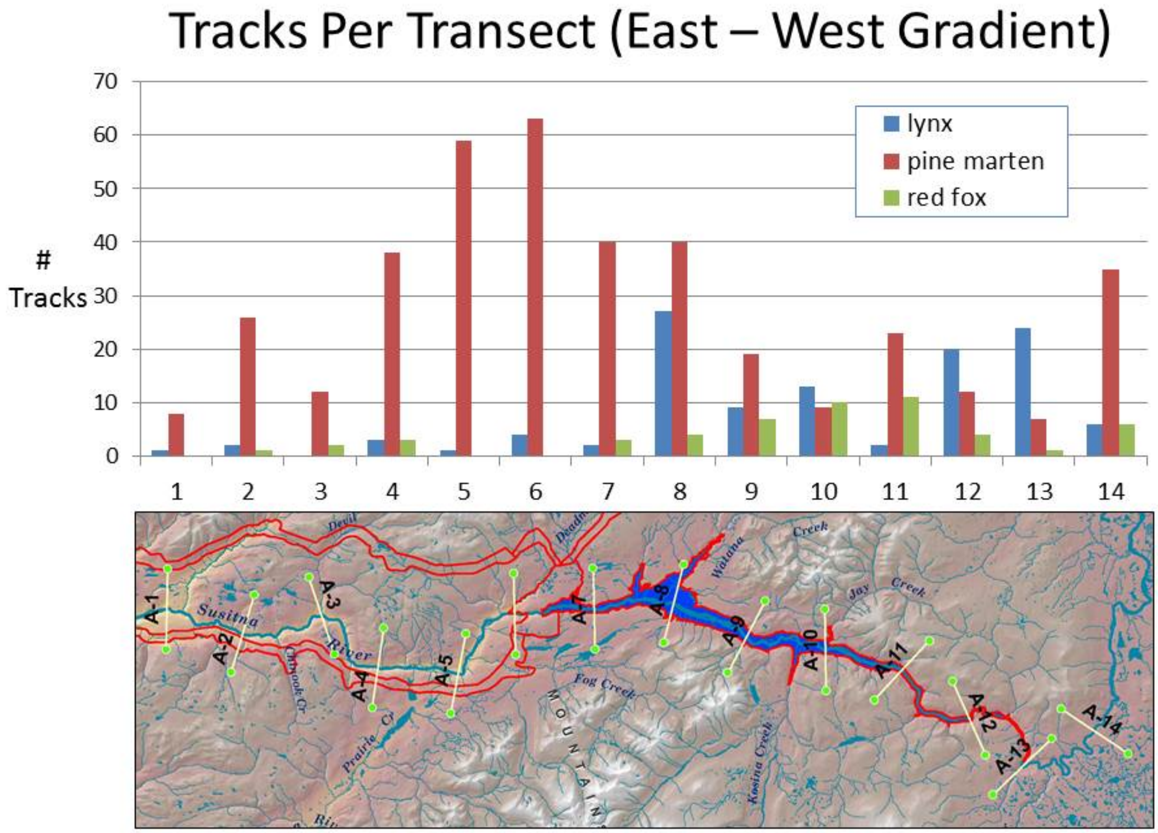

Figure 5.2-1. Track Counts of Terrestrial Furbearers along Each Aerial Survey Transect in Winter 2013. (Counts were summed across the three surveys.)