Susitna-Watana Hydroelectric Project
(FERC No. 14241)

Invasive Plant Study
Study Plan Section 11.9

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

ABR, Inc.—Environmental Research & Services

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LIST OF ACRONYMS, ABBREVIATIONS, AND DEFINITIONS

Abbreviation	Definition
AEA	Alaska Energy Authority
AKEPIC	Alaska Exotic Plants Information Clearinghouse
AKNHP	Alaska Natural Heritage Program
ATV	all-terrain vehicle
CIRWG	Cook Inlet Region Working Group
FERC	Federal Energy Regulatory Commission
GPS	Global positioning system. A system of radio-emitting and -receiving satellites used for determining positions on the earth.
ILP	Integrated Licensing Process
ISR	Initial Study Report
ORV	off-road vehicle
PM&E	protection, mitigation and enhancement
Project	Susitna-Watana Hydroelectric Project
RSP	Revised Study Plan
SPD	study plan determination
UAF	University of Alaska
USDA	United States Department of Agriculture

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). Section 11.9 of the RSP described the Invasive Plant Study. 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 11.9 was one of the 31 studies approved with no modifications.

In this study, disturbed habitats in and near the Project area that could serve as sources of invasive vascular plant species are being identified, and field surveys are being conducted in those disturbed areas to locate populations of invasive species that have some potential to spread into, or farther into, the Project area in association with development activities. An ecological risk assessment will be conducted for the invasive species identified during the field surveys to evaluate the risk of the continued spread of those species because of Project development activities. RSP Section 11.9 provided goals, objectives, and proposed methods for data collection regarding invasive plants.

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 Invasive Plant 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 (referred to herein as the "Study Plan").

2. STUDY OBJECTIVES

The study objectives are established in RSP Section 11.9.1. The overall goals of the Invasive Plant Study are to determine the current prevalence of invasive vascular plants in the Project area and nearby disturbed areas, and to assess the risk of the continued spread of invasive species as a result of Project development. Invasive plant species are defined as non-native species that pose a serious ecological threat to natural systems and whose populations are difficult to control (Carlson et al. 2008). Currently, 164 of the 284 non-native plant species that occur in Alaska are considered invasive (Nawrocki et al. 2011).

The specific objectives of the Invasive Plant Study are to:

- Identify the locations at which invasive plant species have already become established in the Project area and in nearby disturbed areas;
- Estimate population sizes for invasive species and map their current distributions; and
- Determine whether any of the species found could pose a substantial ecological threat if populations were to spread into the Project area.

3. STUDY AREA

The study area for the Invasive Plant Study is set forth in RSP Section 11.9.3. As discussed therein, since invasive vascular plant species are generally confined to disturbed areas and the Project area is primarily undeveloped, the 2013 field survey for this study was focused on disturbed areas near the Project area that could act as potential pathways for invasive species to enter and establish in the Project area. Sections of the George Parks (Parks) and Denali highways that are relatively close to the three possible alignments for the access road and transmission lines, primitive roads and off-road vehicle (ORV) trails emanating from the Denali Highway that currently provide access into the Project area, and other disturbed areas near the Parks and Denali highway corridors were surveyed (Figure 3-1).

Sites not within the Project area but that could serve as sources for invasives during construction (e.g., Stephan Lake Lodge, High Lake Lodge, Gold Creek Camp, and the Talkeetna airport) will be surveyed in the next year of study. Additionally, as engineering design for the Project proceeds, potential gravel material sources will be identified and any existing gravel mine sites being considered for support of Project construction and operations also will be surveyed for invasive plant species.

4. METHODS AND VARIANCES IN 2013

The invasive plant survey included a review of the Alaska Exotic Plants Information Clearinghouse (AKEPIC) database, maintained by the Alaska Natural Heritage Program (AKNHP), to identify invasive species previously documented in the study area; a field survey of previously surveyed sites and new areas identified as potentially harboring invasive species; and a preliminary assessment of the ecological risk of the invasive species found during the field survey. The field survey focused on roads and trails that could be used to access the Project area and that had site characteristics that would likely encourage the establishment of invasive plants. These include well-drained, typically gravelly soils that are frequently disturbed. The ecological risk assessment involves an examination of plant species life-history traits and a set of ecological and plant management/control factors that influence the degree to which an invasive species can establish and threaten native plant communities.

4.1. Field Surveys

The field surveys for this study were conducted as set forth in Section 11.9.4.1 of the RSP with no variances. Prior to the 2013 field survey, recent aerial imagery for portions of the Parks and Denali highway corridors near the Project area was reviewed to identify disturbed sites that could harbor invasive species or were at risk for colonization by invasive species. These included ORV trails, gravel roads, quarry sites, and other disturbed areas. The current records in the AKEPIC database also were reviewed to identify survey locations in the vicinity of the Project area that could be resurveyed to determine if invasive species are still present and whether the populations (in cases in which population estimates are available) are contracting, expanding, or are relatively unchanged since previous surveys. Based on a search of collection localities in the AKEPIC database, which included data from invasive plant surveys conducted along road systems near the Project area (Parks and Denali highways) and from other plant surveys in the

Susitna River Basin upstream of Gold Creek, 21 invasive plant species were found to occur in areas relatively near the Project area (Table 4.1-1).

The invasive plant field survey was conducted with a 2-person team from August 19–28, 2013 following guidelines in the AKEPIC User Manual (AKNHP 2012). For ORV trails, two observers walked up the trail for at least 200 m (656 ft), or 200 m (656 ft) beyond the last invasive plant sighting. If an established campsite or clearing was observed on aerial photos farther up the trail, the trail was surveyed up to that disturbance. The highway roadsides on either side of a trail junction and on both sides of the road for approximately 100 m (328 ft) in each direction (total of approximately 400 linear m [1,312 ft]) also were surveyed. The trail and adjacent roadside surveys were recorded as one sample location.

For paved and gravel pullouts/waysides, the entire graveled area and brushed (disturbed) perimeter was surveyed. Trails and campsites associated with pullouts were also surveyed. Adjoining roadsides were surveyed for approximately 50 m (164 ft) beyond pullouts if invasives were discovered at pullouts. Creek sides near pullouts also were surveyed, and natural (undisturbed) plant communities adjacent to pullouts were periodically checked for the presence of invasive species. If pre-selected sample points at pullouts were > 5 km (3.1 miles) apart, the intervening road segments were periodically surveyed for invasives.

Suspected invasive species were collected for identification and the locations of populations encountered were recorded with a hand-held global positioning system (GPS) receiver. Digital photographs of the sample site and invasive species present were taken at each sampled location. Non-native species that are not considered invasive also were noted when encountered. If possible, population estimates for invasive species were made by visually enumerating or estimating the number of plants in the area. If enumeration or estimation of the number of individual plants was not possible, the degree of infestation at each location was ranked qualitatively as low (1–10 percent cover of assessment area), medium (10–40 percent cover), or high (> 40 percent cover). Because the distribution and size of the areas where invasive species were present was highly variable, the use of a standard assessment-area size (e.g., a 10-m [33-ft] radius plot) was not appropriate for evaluating the degree of infestation. Instead, the geographic limits of an infested area were used to define the assessment-area boundaries (these areas may be as small as 0.01 acre or as large as 2 acres).

Invasive species were identified in the field using Hultén (1968), Cody (1996), Skinner et al. (2012), and (AKNHP 2013), but the final taxonomic nomenclature used in this report is based on the Natural Resources Conservation Service's PLANTS database (NRCS 2013). Voucher specimens of invasive species were collected and submitted to the University of Alaska in Fairbanks (UAF) Herbarium for final identification. All field data were entered into a Microsoft Access database and will be made available for entry into the AKEPIC database upon completion of the study.

4.1.1. Variances

In 2013, there were no variances from the methods for field data collection described in RSP Section 11.9.4.1. While field data collection did not occur on Cook Inlet Regional Working Group (CIRWG) lands because land-access permits were not available, this was not considered a

variance because this study was designed so that the disturbed areas comprising the study area would be surveyed over the two study years. A sufficient number of disturbed sites outside of CIRWG lands were accessible for assessment in 2013.

4.2. Ecological Risk Assessment

The methodologies for ecological risk assessment in this study were conducted as set forth in Section 11.9.4.2 of the RSP with no variances. To assess the ecological risk of invasive plant species found in and near the Project area, the invasiveness ranking system developed for non-native vascular plant species in Alaska by the AKNHP in association with the U.S. Forest Service, U.S. Department of Agriculture, U.S. Geological Survey, National Park Service, and the UAF Cooperative Extension Service (Carlson et al. 2008; Nawrocki et al. 2011) was used. In this ranking system, the overall invasiveness scores for each species are based on sub-scores for ecological impact, biological characteristics (e.g., life history, potential for spread, allelopathy), distribution, and feasibility of control. The higher the overall score (ranging from 1–100), the greater the risk that a species will have negative ecological effects and the lower the likelihood it can be controlled effectively. A preliminary assessment of the local ecological risk of invasive species being spread because of Project development activities was assessed by taking into account the invasiveness score for each species found; evaluating the number, size, and location of each population; and considering the species' possible mode(s) of dispersal into the Project area based on likely construction and operations scenarios. To the extent possible, the potential impact of invasive species on ecologically important native plant species in the Project area also was assessed.

4.2.1. Variances

In 2013, there were no variances from the methods for the ecological risk assessment described in RSP Section 11.9.4.2.

5. RESULTS

Data generated in support of this study are available for download at http://gis.suhydro.org/reports/isr. The data are in the file: ISR_11_9_INPL_FieldData.accdb.

5.1. Field Survey

In 2013, 107 field sites were surveyed, 23 of which had previously been surveyed in 2004, 2006, or 2012 (Figure 3-1). At those 23 locations, no invasive species were observed at two locations in previous surveys or by Project researchers. Additionally, no invasive species were found at 6 of the other sites surveyed in this study. A total of 28 invasive plant taxa were recorded on the remaining 99 sites (Table 5.1-1), including 10 additional species that were not found in previous surveys as recorded in the AKEPIC database. Four species that were previously recorded at the AKEPIC sites, however, were not found in 2013: *Bromus tectorum* (cheatgrass or downy brome), *Leontodon hirtus* (rough hawkbit), *Melilotus officinalis* (yellow sweetclover), and *Sonchus asper* (spiny sowthistle). Individual species were found at a variable number of survey sites, ranging from 1 to 76, with most (22) species occurring at 10 or fewer sites. In general, the

cover of invasive plants at the surveyed sites was modest, with 439 (95%) of the 463 cover-value observations across all 107 sites recorded as either trace (< 1%) or low (1–5%) cover (Table 5.1-2). Observations of moderate cover values (11–25% and 26–40%) for invasive species were recorded for only 13 (3%) of the cover-value observations. High cover (95%) was observed only for *Stellaria media* (common chickweed) at a single site; this species is considered weakly invasive, with an invasiveness rank of 42.

With few exceptions, populations of invasive species were confined to road rights-of-way and other sites with gravelly, well-drained substrates. Invasive plants were uncommon along undeveloped roads and trail networks, but were sometimes present at trailheads and adjacent roadsides. In a few cases, invasive species were found farther up trails at campsites or other disturbed locations, typically where the substrate was sandy or gravelly. An exception was at field plot suwa-inv-028 at a trailhead near the eastern end of the study area; at this site several individuals of *Taraxacum officinalis* (common dandelion) had established in undisturbed vegetation (Low Open Alder–Willow Scrub) adjacent to the trail.

No information is available on the survey boundaries for the infestation areas assessed during the previous AKEPIC field studies, so comparing differences in percent cover of invasive species between those surveys and this study was not possible. Nevertheless, the levels of infestation found in both the AKEPIC surveys and this study were generally categorized as low, based on the canopy-cover estimates for the four survey years (2004, 2006, 2012, and 2013). Perhaps most notable when comparing the previous surveys to the 2013 data was that, for many of the sites revisited, new invasive species were recorded in 2013; thus, the overall number of invasive species associated with at least the revisited survey sites has increased over the past 9 years. This is notwithstanding the fact that four species (see above), which were recorded in the earlier AKEPIC surveys, were not found in this study. Populations of invasive species still appear, however, to be confined primarily to heavily disturbed areas along the margins of main roadways and trail entrances. This may be due largely to soil substrates in undisturbed areas being unsuitable for promoting the expansion of populations of invasive species. At some locations, it was likely that invasive plant populations had been eliminated or reduced considerably by management practices (e.g., road-corridor maintenance and expanded paved areas, including parking lots).

5.2. Ecological Risk Assessment

Because the populations of most invasive species found during the 2013 survey were negligible to small in size, the current ecological risk of invasive plants in the vicinity of the Project area is relatively low. However, 7 of the 28 species (25 percent) have U.S. Department of Agriculture (USDA) rankings of moderately (60–69) to extremely (> 80) invasive (Table 5.1-1; Figures 5.2-1 through 5.2-4). The two species of greatest concern are probably *Hordeum jubatum* (foxtail barley) and *Melilotus alba* (white sweetclover). *H. jubatum* (invasiveness rank: 63) is able to colonize a wide range of disturbed habitats, from well drained, gravelly substrates to relatively wet, silty soils. This species is difficult to eradicate and is potentially harmful to wildlife, although it can be controlled with herbicides. Although *H. jubatum* is palatable to grazers early in the season, later in the summer the mature awns (bristles on flower heads) can be irritating to the eyes, mouths, and skin of grazing mammals. *H. jubatum* was present at 50 (47%) of the 107 sites surveyed in 2013, although cover levels were relatively low.

The AKEPIC research group has identified *M. alba* (invasiveness rank: 81) as one of Alaska's most problematic invasive species, due to its propensity to form dense stands on river bars. In addition, *M. alba* serves as a host for nitrogen-fixing bacteria, which means its establishment is likely to alter soil-nutrient composition and could help promote the establishment of other species, native or non-native. Recent studies of several Alaska rivers found that low to moderate densities of *M. alba* are associated with the establishment of other exotic species, while high densities can negatively affect the establishment of both native and non-native species (Conn et al. 2011; Spellman and Wurtz 2011). Native species that were shown to be negatively affected by the presence of *M. alba* included the often dominant riparian shrub, *Salix alaxensis* (feltleaf willow), and the forb, *Lathyrus japonicus* var. *maritimus* (beach pea). During the 2013 field study, *M. alba* was present at 7 (7%) of the 107 sites surveyed.

Both *H. jubatum* and *M. alba* were found mostly at trace (< 1%) and low (1–5%) cover values (48 and 5 locations, respectively) during the 2013 survey; *H. jubatum* was found at 6–10% cover at only 2 sites (Table 5.1-2). Nevertheless, they are aggressive colonizers and can pose ecological threats if larger populations establish.

6. DISCUSSION

The Invasive Plant Study is a 2-year study that was initiated in 2013. Results from the first year of study, along with observations of invasive plants made in the other botanical studies being conducted for the Project, especially the Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin (Study 11.5) and the Wetland Mapping Study in the Upper and Middle Susitna Basin (Study 11.7), will be used in planning for the next year of field surveys for invasive species.

Results from the 2013 field survey provided important baseline data on the extent to which invasive plants are currently associated with areas along the Parks and Denali highways where each of the three alternative road corridors for the Project are planned to originate. The data document the occurrence of invasive species along the margins of these highway corridors and along the initial sections of trails and unimproved roads that enter the Project area from those highways. Repeat visits to the AKEPIC survey sites in 2013 provided insight into changes in invasive species occurrence and their population sizes over time. The characterization of conditions at sites that support invasive species now will be useful in preparing appropriate protection, mitigation and enhancement measures, as those data will help in determining the appropriate risk-management protocols and identifying which Project activities are most likely to promote the establishment of invasive species. For example, based on a review of previous invasive plant surveys in Alaska, 70% of infestations of invasive plants were associated with fill importation (Nawrocki et al. 2011).

The invasive plant study team is working with the study teams for the Wetlands Mapping Study (Study 11.7), Vegetation and Wildlife Habitat Mapping Study (Study 11.5), and Riparian Vegetation Study (Study 11.6) to identify potential high-risk locations for invasive plants within the Project area. Casual observations in 2012 and 2013 by other botanical studies field crews indicated that invasive plants (primarily *Taraxacum officinalis*) were present at the Talkeetna Airport; in the Susitna River corridor between Willow and Talkeetna (near human disturbances)

along a section of the Upper River near Sherman; and in the vicinity of both Stephan Lake Lodge and Gold Creek Camp. The Upper River location near Sherman was in a relatively pristine area, although it was close (70–100 m [230–330 ft]) to the Alaska Railroad corridor. The other Upper River locations (near Gold Creek Camp) were associated with all-terrain vehicle trails or river gravel bars. This information will be used to help guide field survey efforts in the next year of study.

7. COMPLETING THE STUDY

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

8. LITERATURE CITED

AEA (Alaska Energy Authority). 2012. Revised Study Plan: Susitna-Watana Hydroelectric Project FERC Project No. 14241. December 2012. Prepared for the Federal Energy Regulatory Commission by the Alaska Energy Authority, Anchorage, Alaska. Available on-line at http://www.susitna-watanahydro.org/study-plan. Accessed September 2013.

AKNHP (Alaska Natural Heritage Program). 2012. Alaska Exotic Plants Information Clearinghouse (AKEPIC) User's Manual. Alaska Natural Heritage Program, University of Alaska, Anchorage, AK. 18 pp. Available on-line at http://aknhp.uaa.alaska.edu./botany/akepic. Accessed May 2013.

AKNHP (Alaska Natural Heritage Program). 2013. Identification of Non-native Plants in Alaska. Alaska Natural Heritage Program, University of Alaska, Anchorage, AK. 251 pp.

Carlson M.L., I.V. Lapina, M. Shephard, J. Conn, R. Densmore, P. Spencer, J. Heys, J. Riley, and J. Nielsen. 2008. *Invasiveness ranking system for non-native plants of Alaska*. Technical Report R10-TP-143. U.S. Dept. of Agriculture and U.S. Forest Service, Alaska Region, Anchorage, Alaska. 218 pp.

Cody, W. J. 1996. *Flora of the Yukon Territory.* Second Edition. NRC Research Press, National Research Council of Canada. Ottawa, Ontario, Canada. 669 pp.

Conn, J. S., N. R. Werdin-Pfisterer, K. L. Beattie, and R V. Densmore. 2011. Ecology of invasive *Melilotus albus* on Alaskan glacial river floodplains. *Arctic, Antarctic, and Alpine Research*, 43(3):343-354. 2011.

Hultén, E. 1968. *Flora of Alaska and neighboring territories*. Stanford University Press. Stanford, CA. 1008 pp.

Nawrocki, T. H. Klein, M. Carlson, L. Flagstad, J. Conn, R. DeVelice, A. Grant, G. Graziano, B. Million, and W. Rapp. 2011. Invasiveness Ranking of 50 Non-native Plant Species for Alaska. Prepared for the Alaska Association of Conservation Districts by the Alaska Natural Heritage Program, University of Alaska, Anchorage, AK. 28 pp.

NRCS (Natural Resources Conservation Service). 2013. PLANTS database. Available on-line at http://plants.usda.gov/java/. Accessed 09/26/2013. Accessed September 2013.

Skinner, Q. D., S.J. Wright, R.J. Henszey, J.L. Henszey, and S.K. Wyman. 2012. *Field Guide for Alaska grasses*. Education Resources Publishing, Cumming, GA. 384 pp.

Spellman, B. T. and T. L. Wurtz. 2011. Invasive sweetclover (*Melilotus alba*) impacts native seedling recruitment along floodplains of interior Alaska. *Biological Invasions*. doi:10.1007/s10530-010-9931-4: 12

9. TABLES

Table 4.1-1. Invasive Vascular Plant Species Previously Found in the Vicinity of the Susitna-Watana Hydroelectric Project Area.[1]

Scientific Name	Common Name	Invasiveness Rank[2]
Bromus inermis	smooth brome	62
Bromus tectorum	cheatgrass	78
Crepis tectorum	narrowleaf hawksbeard	56
Galeopsis tetrahit	brittlestem hempnettle	50
Hordeum jubatum	foxtail barley	63
Leontodon hirtus	rough hawkbit	NR
Matricaria discoidea	pineappleweed	32
Melilotus alba	white sweetclover	81
Melilotus officinalis	yellow sweetclover	69
Phleum pratense	timothy	54
Plantago major	common plantain	44
Poa annua	annual bluegrass	46
Poa pratensis	spreading bluegrass or Kentucky	52
Polygonum aviculare	prostrate knotweed	45
Sonchus asper	spiny sowthistle	46
Tanacetum vulgare	common tansy	60
Taraxacum officinale	common dandelion	58
Trifolium hybridum	alsike clover	57
Trifolium repens	white clover	59
Tripleurospermum inodorum	scentless false mayweed	48
Vicia cracca	bird vetch	73

1. Species records from the AKEPIC database of invasive species maintained by the AKNHP (see text).
2. Assigned according to the Invasiveness Ranking System for Non-native Plants of Alaska (Carlson et al. 2008) and the Invasiveness Ranking of 50 Non-native Plant Species for Alaska (Nawrocki et al. 2011). Species are ranked on a scale of 0 to 100, with 100 being an extremely invasive species; NR = not ranked.

Table 5.1-1. Invasive Species Found During the August 2013 Field Survey, Susitna-Watana Hydroelectric Project.

Scientific Name	Common Name	Invasiveness Rank[1]	Number of Sites[2]	Percent of Sites[2]
Bromus inermis	smooth brome	62	5	4.7
Capsella bursa-pastoris	shepherd's purse	40	2	1.9
Cerastium fontanum	big chickweed	36	2	1.9
Chenopodium album	lambsquarters	37	9	8.4
Crepis tectorum	narrowleaf hawksbeard	56	10	9.3
Galeopsis tetrahit	brittlestem hempnettle	50	2	1.9
Hordeum jubatum	foxtail barley	63	50	46.7
Leontodon autumnalis	fall dandelion	51	1	0.9
Lepidium densiflorum	common pepperweed	25	2	1.9
Leucanthemum vulgare	oxeye daisy	61	2	1.9
Linaria vulgaris	butter and eggs	69	2	1.9
Lolium multiflorum	Italian ryegrass	41	2	1.9
Matricaria discoidea	pineappleweed	32	75	70.1
Melilotus alba	white sweetclover	81	7	6.5
Phleum pratense	timothy	54	22	20.6
Plantago major	common plantain	44	76	71.0
Poa annua	annual bluegrass	46	38	35.5
Poa pratensis ssp. irrigata	spreading bluegrass	52	10	9.3
Poa pratensis ssp. pratensis	Kentucky bluegrass	52	10	9.3
Polygonum aviculare	knotweed	45	25	23.4
Rumex acetosella	sheep sorel	51	1	0.9
Stellaria media	common chickweed	42	9	8.4
Tanacetum vulgare	common tansy	60	1	0.9
Taraxacum officinale	common dandelion	58	71	66.4
Trifolium hybridum	alsike clover	57	20	18.7
Trifolium repens	white clover	59	7	6.5
Tripleurospermum inodorum	scentless false mayweed	48	3	2.8
Vicia cracca	bird vetch	73	4	3.7

1. Assigned according to the Invasiveness Ranking System for Non-native Plants of Alaska (Carlson et al. 2008) and the Invasiveness Ranking of 50 Non-native Plant Species for Alaska (Nawrocki et al. 2011). Species are ranked on a scale of 0 to 100, with 100 being an extremely invasive species; NR = not ranked.
2. Number and percent of field sites (out of 107 total surveyed) on which each species was found.

Table 5.1-2. Number of Observations (Survey Sites) of Invasive Plants in Six Cover-value Categories, Susitna-Watana Hydroelectric Project Area, 2013.

	Percent Cover Categories[1]							
Species	Trace (< 1 %)	1–5%	6–10%	11–25%	26–40%	95%		Total No. of Observations
Bromus inermis	1	2		1	1			5
Capsella bursa-pastoris	1	1						2
Cerastium fontanum	1	1						2
Chenopodium album	6	3						9
Crepis tectorum	5	5						10
Galeopsis tetrahit	1							1
Hordeum jubatum	30	18	2					50
Leontodon autumnalis		1						1
Lepidium densiflorum		2						2
Leucanthemum vulgare		1			1			2
Linaria vulgaris		2						2
Lolium multiflorum		2						2
Matricaria discoidea	32	40	3					75
Melilotus alba	4	1						5
Phleum pratense	11	10						21
Plantago major	38	37	1					76
Poa annua	9	25		3	1			38
Poa pratensis	6	4						10
Poa pratensis	6	4						10
Polygonum aviculare	13	7	2	3				25
Rumex acetosella		1						1
Stellaria media	2	4	1	1		1		9
Tanacetum vulgare		1						1
Trifolium hybridum	6	14						20
Taraxacum officinale	28	41	1	1				71
Trifolium repens	4	3						7
Tripleurospermum inodorum	3							3
Vicia cracca	1	1			1			3
Totals	208	231	10	9	4	1		463

1. Listed are the number of survey sites at which each species was recorded in each cover-value category.

10. FIGURES

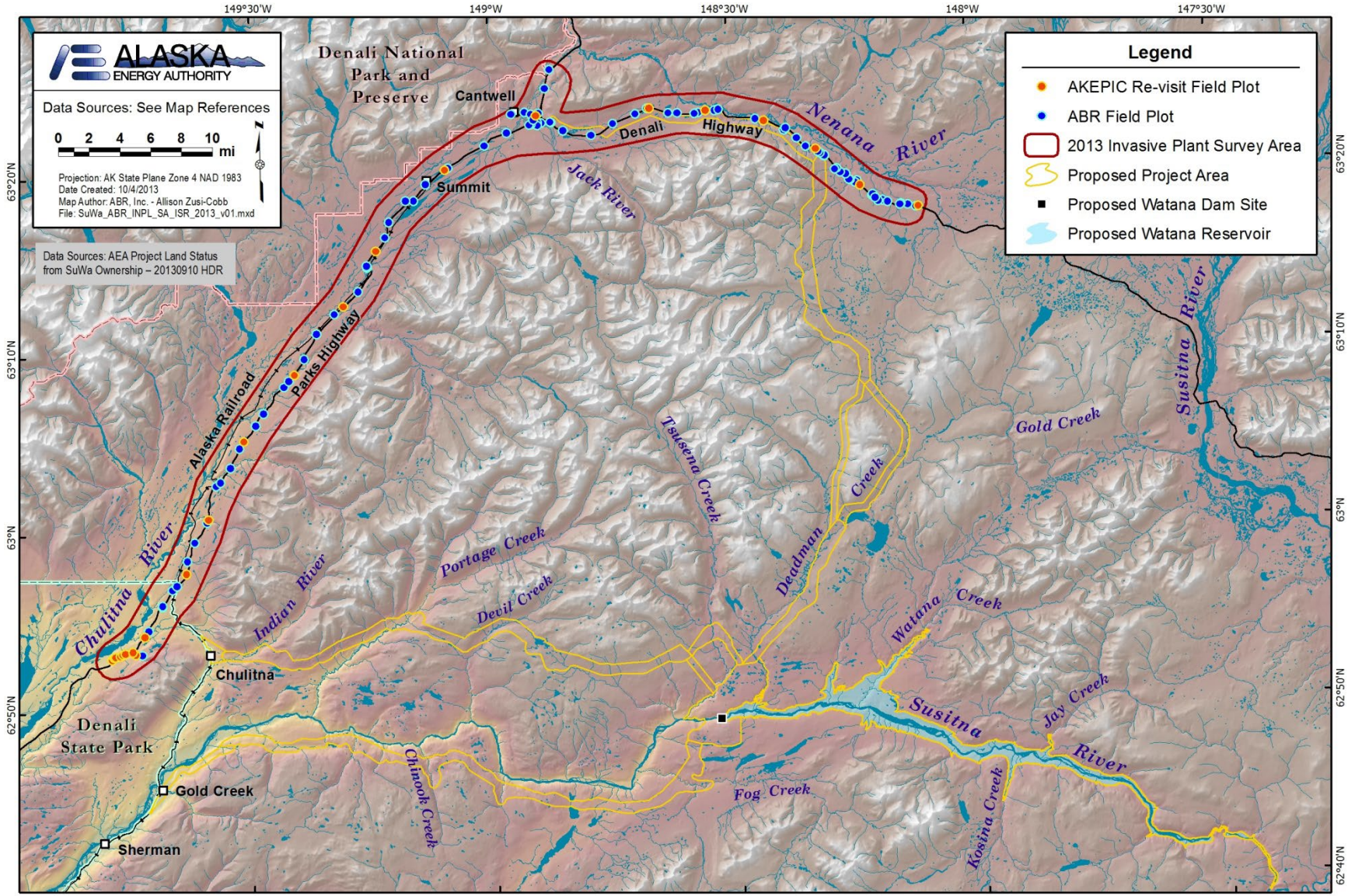

Figure 3-1. Invasive Plant Survey Plot Locations in the Vicinity of the Susitna-Watana Hydroelectic Project Area, 2013.

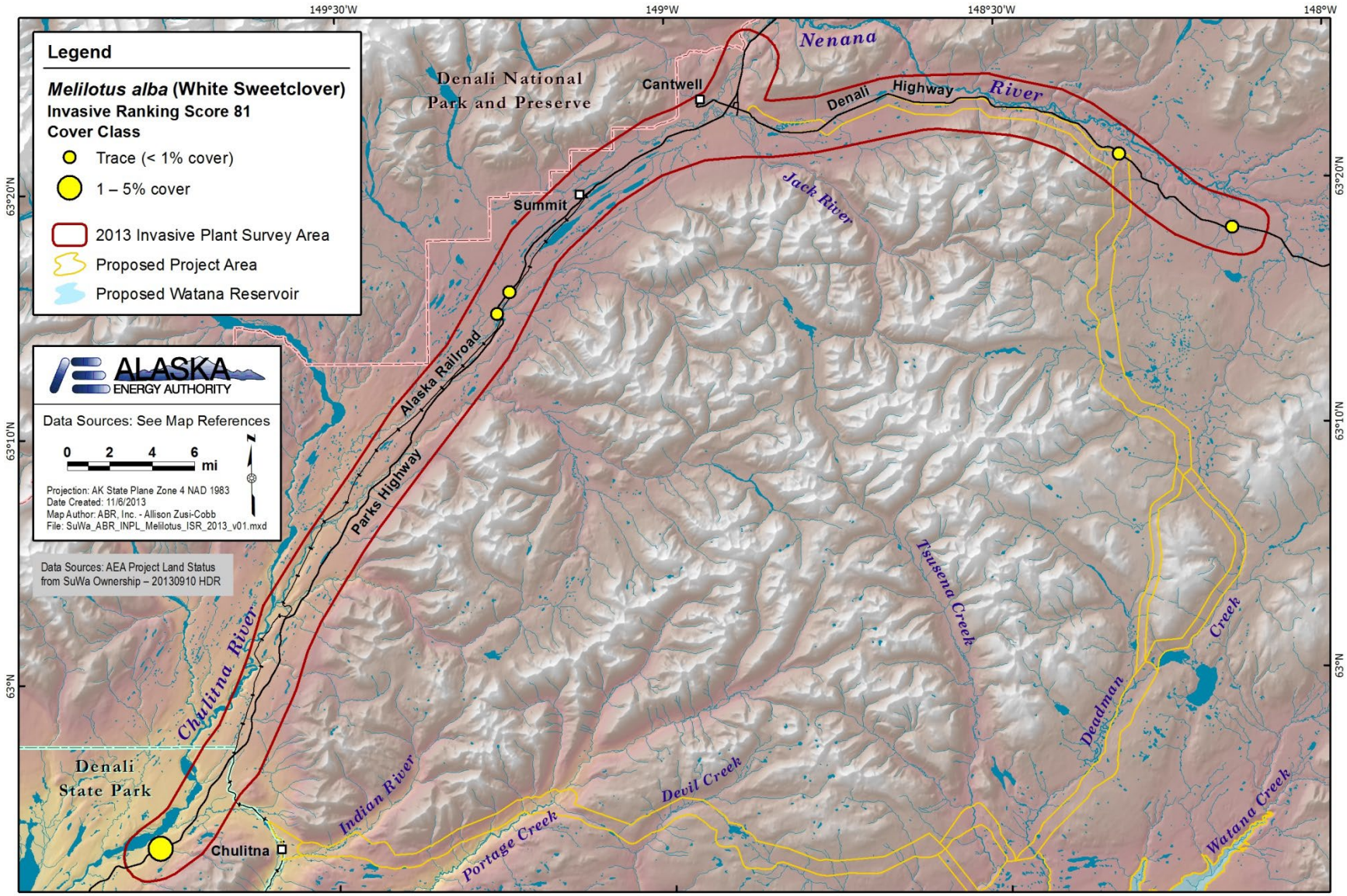

Figure 5.2-1. Locations and Degree of Infestation of *Melilotus alba* in the Invasive Plant Survey Area, Susitna-Watana Hydroelectric Project, 2013.

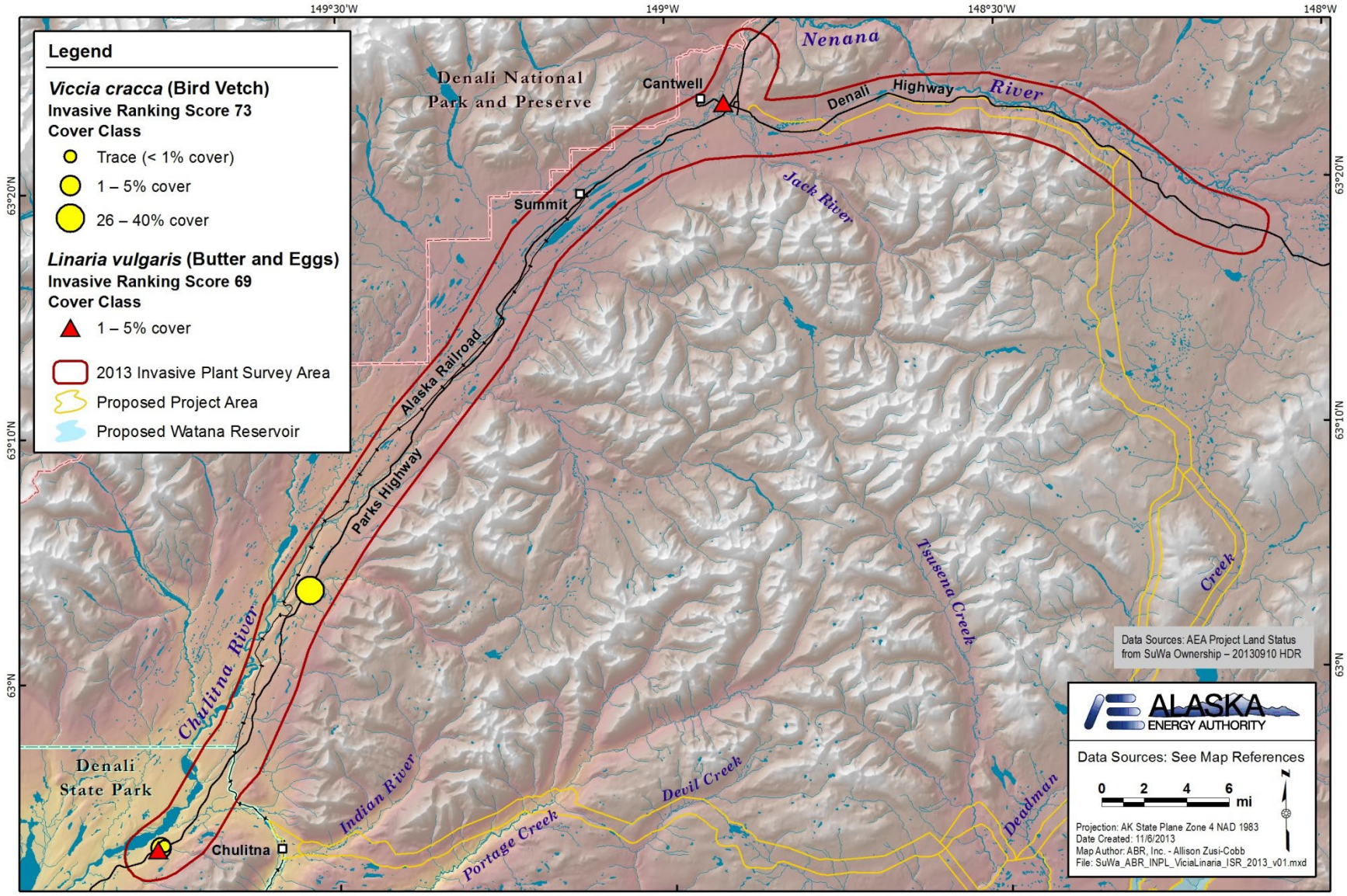

Figure 5.2-2. Locations and Degree of Infestation of *Viccia cracca* and *Linaria vulgaris* in the Invasive Plant Survey Area, Susitna-Watana Hydroelectric Project, 2013.

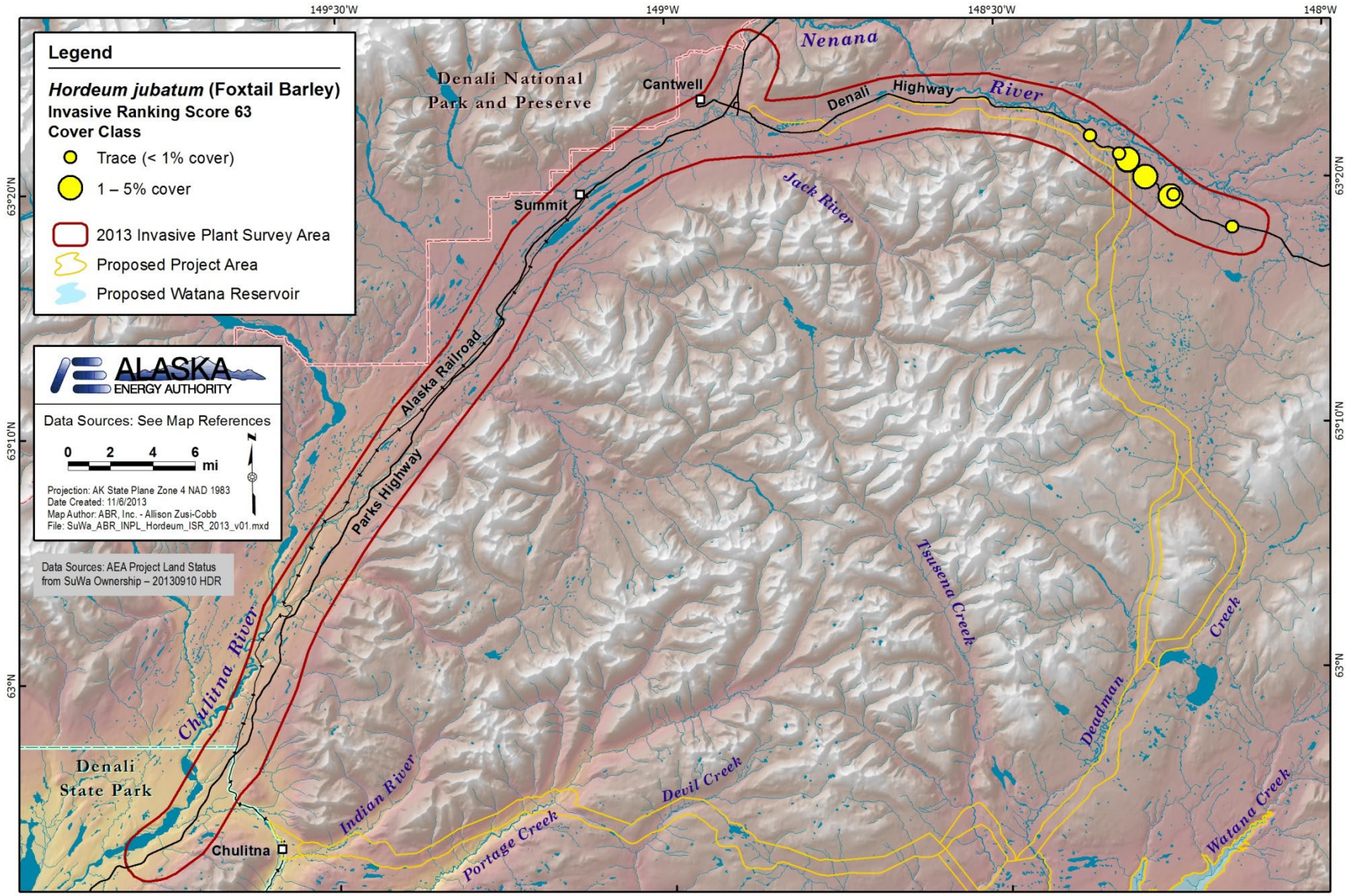

Figure 5.2-3. Locations and Degree of Infestation of *Hordeum jubatum* in the Invasive Plant Survey Area, Susitna-Watana Hydroelectric Project, 2013.

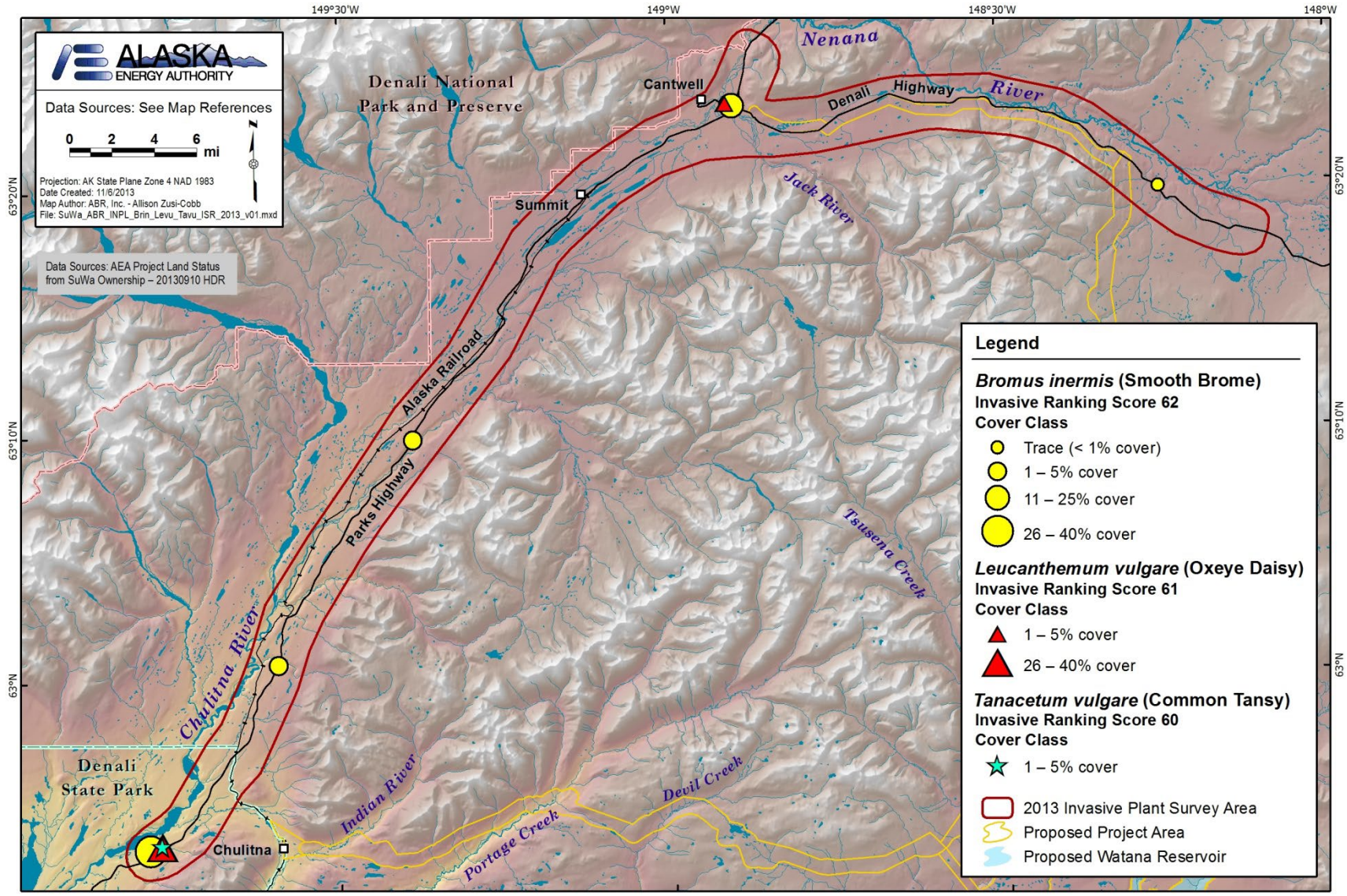

Figure 5.2-4. Locations and Degree of Infestation of *Bromus inermus, Leucanthemum vulgare,* and *Tanacetum vulgare* in the Invasive Plant Survey Area, Susitna-Watana Hydroelectric Project, 2013.

PART A - APPENDIX A: PHOTOS OF SELECTED INVASIVE SPECIES, 2013 FIELD SURVEY, SUSITNA-WATANA HYDROPOWER PROJECT.

Taraxacum officinale

Field plot: suwa-inv-004

Melilotus alba

Field plot: suwa-inv-005

Matricaria discoidea

Field plot: suwa-inv-023

Poa annua

Field plot: suwa-inv-089

Chenapodium alba

Field plot: suwa-inv-014

Hordeum jubatum

Field plot: suwa-inv-015

Bromus inermis
Field plot: suwa-inv-018

Trifolium repens
Field plot: suwa-inv-102

Poa pratensis ssp. pratensis
Field plot: suwa-inv-028

Trifolium hybridum
Field plot: suwa-inv-103

Crepis tectorum
Field plot: suwa-inv-067

Stellaria media
Field plot: suwa-inv-043

Tanacetum vulgare

Field plot: suwa-inv-068

Vicia cracca

Field plot: suwa-inv-068

Phleum pratense

Field plot: suwa-inv-005

Taraxacum officinale

Field plot: suwa-inv-089