

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

**Wood Frog Occupancy and Habitat Use Study  
Study Plan Section 10.18**

**Final Study Plan**

Alaska Energy Authority



July 2013

## 10.18. Wood Frog Occupancy and Habitat Use

On December 14, 2012, Alaska Energy Authority (AEA) filed with the Federal Energy Regulatory Commission (FERC or Commission) its Revised Study Plan (RSP), which included 58 individual study plans (AEA 2012). Section 10.18 of the RSP described the Wood Frog Occupancy and Habitat Use Study. This study focuses on evaluating the distribution of breeding wood frogs in those portions of the Project area in the upper and middle Susitna basin where breeding frogs could be directly or indirectly affected by Project development activities. The study will involve both field surveys and habitat occupancy modeling. RSP 10.18 provided goals, objectives, and proposed methods for data collection regarding wood frogs.

On February 1, 2013, FERC staff issued its study plan determination (February 1 SPD) for 44 of the 58 studies, approving 31 studies as filed and 13 with modifications. RSP Section 10.18 was one of the 31 studies approved with no modifications. As such, in finalizing and issuing Final Study Plan Section 10.18, AEA has made no modifications to this study from its Revised Study Plan.

### 10.18.1. General Description of the Proposed Study

The Wood Frog Occupancy and Habitat Use study (Wood Frog Study) will be conducted over two years (2013 and 2014), with fieldwork scheduled in May each year. The study will focus on evaluating the distribution of breeding wood frogs in those portions of the Project area in the upper and middle Susitna basin where breeding frogs could be directly or indirectly affected by Project development activities. The study will involve both field surveys and habitat occupancy modeling. In addition, AEA is proposing to opportunistically capture and sample frogs (non-lethally) to assay for the presence of the chytrid fungus that has been linked to amphibian declines worldwide (see Section 10.18.2 below).

#### Study Goal and Objectives

The goal of the Wood Frog Study is to characterize the use of the Project area by breeding wood frogs to facilitate an assessment of potential impacts on wood frogs from development of the proposed Project.

The study has four objectives:

- Review existing data on habitat use and distribution of breeding wood frogs in a broad region surrounding the Project area.
- Estimate the current occupancy rate for breeding wood frogs in suitable habitats in the study area through a combination of field surveys and habitat-occupancy modeling.
- Use information on current habitat occupancy and habitat use to estimate the habitat loss and alteration expected to occur from development of the Project.
- Sample frogs opportunistically for the presence of the chytrid fungus that has been linked to amphibian population declines. (At the request of state and federal management agencies, EA has agreed to sample for the chytrid fungus, to opportunistically take advantage of planned fieldwork by providing some baseline information on the occurrence of the fungus in the Project area pre-development.)

The Wood Frog Study is planned as a two-year study. Results from the first year of work in 2013 will be presented in the Initial Study Report and will be used to update the study plan for 2014, as needed, and to adjust the field survey methods and survey areas, if necessary, based on comments on the Initial Study Report by FERC, resource agencies, and other licensing participants.

### 10.18.2. Existing Information and Need for Additional Information

Because amphibians were not included in the original Alaska Power Authority (APA) Susitna Hydroelectric Project environmental program studies in the 1980s, data on the occurrence of wood frogs in the upper Susitna drainage is lacking. It is likely that wood frogs occur in the Project area because they occur in suitable habitats throughout southern Alaska and in the interior north to the southern slopes of the Brooks Range; they have also been documented in Denali National Park and Preserve, near Healy, and in the lower Susitna drainage (Cook and MacDonald 2003; Anderson 2004; Gotthardt 2004, 2005; Hokit and Brown 2006; MacDonald 2010). Amphibian populations appear to have been declining worldwide for several decades (Blaustein and Wake 1990; McCallum 2007) and, although populations may be healthy in Alaska (Gotthardt 2004, 2005), concern has been expressed about the conservation status of wood frogs in Alaska (ADF&G 2006). Because of this and because their status in the Project area is unknown, field surveys for wood frogs will be conducted in areas likely to be affected by Project facilities and activities.

*Batrachochytrium dendrobatidis* (Bd) is a chytrid fungus that causes the disease chytridiomycosis in amphibians. Since it was first discovered in amphibians in 1998, it has devastated amphibian populations around the world, including in North America. Bd is sometimes a non-lethal parasite and some amphibian species and some populations of susceptible species are known to survive infection. The fungus is widespread and ranges from lowland forests to cold mountain tops, and is typically associated with host mortality in high altitude environments and during winter, with greater pathogenicity at lower temperatures. Wood frogs have been identified as a frog species susceptible to infection by Bd, and Bd was first detected in a dead wood frog in Kenai National Wildlife Refuge in 2002 (Reeves 2008). The only other positive detection of Bd was near Dyea in Southeast Alaska in 2006 and was associated with the apparent die-off of western toads in Southeast Alaska (Sunday, May 21, 2006, *Juneau Empire*). No sampling for Bd has occurred in the Project area. Bd is believed to spread mainly through contact between infected frogs or with infected water. In its comments on study requests for the Project, the Alaska Department of Fish and Game (ADF&G) requested that water or frogs at survey locations be tested for the presence of Bd (see Section 8.4 in AEA 2012).

### 10.18.3. Study Area

The study area includes those water bodies and suitable wetland habitats in the proposed Project area in which habitat loss, habitat alteration, and disturbance are expected to occur. The proposed study area encompasses the reservoir impoundment zone, areas for infrastructure of the dam and powerhouse and supporting facilities, the proposed access roads, and material sites (Figure 10.18-1).

#### 10.18.4. Study Methods

##### 10.18.4.1. Field Surveys and Occupancy Modeling

Because the study area is large and the calling period of breeding male frogs is short, this study will not involve a comprehensive survey of all potential frog breeding habitat present in the study area. Instead, observers will survey for frogs in smaller sampling regions containing suitable habitats. Up to 10 sampling regions will be selected to survey for wood frogs in the study area (two in each of the three access road corridors and four in the reservoir zone and dam and camp facilities area of the proposed reservoir). Using a Geographic Information System (GIS), the sampling regions will be selected randomly from available areas of suitable water body and wetland habitats for frogs by overlaying a grid onto the full study area (Figure 10.18-1), removing all grid cells that contain no suitable habitat (or very little habitat), and then randomly selecting from the remaining cells for sampling. The random cell-selection process will be stratified so that sampling regions are selected in each of the transmission line/access road corridors and in the inundation/dam infrastructure zone, as noted above. One exception to this random cell-selection process will be made to ensure that the water bodies and wetlands in the dam and camp facilities area near the proposed dam are included as one of the sampling regions.

Within the study area boundary, potential water bodies and wetland habitats (with permanent standing water) to be surveyed will be identified from interpretation of aerial photos or remote-sensed imagery and from the preliminary mapping of vegetation, wildlife habitats, and wetlands (see Sections 11.5 and 11.7). From this set of water bodies and wetlands, habitats will be categorized as having a higher or lower probability of supporting breeding frogs. The random sampling of water bodies and wetlands in each sampling region then will be stratified so that a greater effort is made to survey habitats that have a higher probability of being used by frogs. Habitats more likely to be used by breeding frogs will be identified using GIS as those that (1) are not known to support fish (if available, data from the fish distribution and abundance studies [see Section 9] will be used to document fish occurrence, recognizing that those data may not be complete in 2013); (2) are not connected to stream systems supporting fish; and (3) have at least some emergent vegetation. Fish are efficient predators of frogs, and in studies in south-central Alaska, including portions of the lower Susitna basin (Gotthardt 2004), frogs have been recorded in lower numbers in water bodies that support fish. Emergent and aquatic vegetation in water bodies provides a substrate for frog egg-masses and escape cover from aquatic predators, as well as helping to increase dissolved oxygen in the water (France 1997; Babbitt and Tanner 1998).

With a set of water bodies and wetlands identified throughout the study area that have the potential to support breeding frogs, a subset of those sites in each of the 10 sampling regions in the study area will be selected to survey for breeding frogs. Within each sampling region, a minimum of 12 potential water body and/or wetland sites will be selected for sampling using a stratified random selection process in GIS, as noted above, so that more effort is expended on sampling sites likely to be of higher value to breeding frogs. With 12 sites sampled in each of 10 sampling regions, at least 120 sites are expected to be surveyed across the full study area in each year. In practice, more than 120 sites may be surveyed because some sites will not need to be visited twice (i.e., when frogs are detected on the first visit, see below). A minimum distance of 250 meters (820 feet) between sample sites will be maintained to avoid duplicate detections of frogs.

Ground-based auditory surveys of the randomly selected water bodies and wetlands in the study area will be conducted during the breeding season for frogs (mid- to late May). (In addition to these surveys, it is expected that incidental detections of wood frogs will also be documented during data collection efforts for other resources [e.g., fisheries, vegetation and wetlands, and ground-based bird surveys], and this information may provide additional information on the occurrence of frogs in the study area.) Survey sites will be accessed by helicopter and on foot by navigating to predetermined sample sites using hand-held global positioning system (GPS) receivers. The field surveys will involve auditory detections of calling frogs to ascertain the presence or absence of wood frogs at each sampling site. Observations along the margins of each water body or wetland will be made at locations where observers can readily hear calling frogs. For small water bodies and wetlands, a single observation point will suffice to detect the presence of frogs, but for large water bodies and wetlands, multiple observation points may be needed to determine the presence of frogs. For large water bodies and wetlands, up to four observation points will be located and sampled, with distances of up to 500 meters between each point to achieve adequate survey coverage. Up to two independent, replicate surveys will be made by trained observers to each water body during the peak calling period (approximately 1200 to 2200 hours) of male wood frogs in southern Alaska (Gotthardt 2004; PLP 2011). Due to variability in the calling frequency of male wood frogs even during the peak of the breeding season (see PLP 2011), two visits may be needed to detect frogs at some water bodies; these replicate survey data will also be used to calculate the detectability of calling frogs, which is a critical component of this study. The second survey at each site will be conducted by a different observer with no knowledge of the survey results from the first survey. However, because this study involves the use of a “removal design” to estimate occupancy, if detected on the first survey, a second survey will not be needed (i.e., that site will be “removed” from further sampling; see Mackenzie and Royle [2005] for more information). Surveys will be conducted only under favorable weather conditions (e.g., light rain or no rain, air temperature higher than 4° C [39° F], and wind speeds less than or equal to 25 kilometers per hour [15 miles per hour]). Observers will spend a minimum of 5 minutes at each survey location listening for calling frogs, but will terminate the survey early if frogs are detected.

To increase accuracy in the calculation of detectability of calling frogs, a small number of acoustic monitoring devices will be deployed at a subset of water bodies known to be occupied by frogs. Data from automated acoustic monitoring devices, which record calls throughout the day, will allow calculations of the probability of frogs calling on a given date, or at a specific time period and/or temperature range during the day, and will provide a direct estimate of the detectability of calling frogs.

Habitat and environmental characteristics (e.g., size and depth of water body, substrate, presence and type of emergent aquatic vegetation, distance to human disturbance, water quality [pH level, dissolved oxygen], ice cover, elevation, aspect, surrounding terrestrial vegetation, water and air temperature, precipitation, cloud cover, wind speed, time of day, beaver activity) will be recorded during the field surveys to facilitate the development of a Project-specific occupancy estimation model based on the habitat characteristics of the occupied water bodies. In addition, data from the vegetation and habitat mapping, wetland mapping, and wetland functional assessment studies (see Sections 11.5 and 11.7), and the literature (e.g., Stevens et al. 2006; AKNHP 2008) will be evaluated as potential model variables to characterize wood frog habitat.

With estimates of the detectability of wood frogs calculated from the field data collected for this study, the observed ("naïve") occupancy rate of frogs in water bodies and wetlands will be corrected (to account for those frogs present but not detected) to produce a corrected occupancy rate for the water bodies and wetlands in each of the sampling regions.

#### *10.18.4.2. Bioassays for *Batrachochytrium dendrobatidis* (Bd)*

The specific assay and sampling methods for Bd will be determined through consultation with commercial or research laboratories. Currently available information indicates that no standard methods for bioassay of Bd have been proffered or certified by the U.S. Environmental Protection Agency (EPA) or other regulatory or standards agencies. The currently proposed strategy is to assess the presence/absence of Bd from swabs of frog skin, which would then be analyzed using a Polymerase Chain Reaction (PCR) technique to test for chytrid fungus.

Further consultation with the ADF&G and the U.S. Fish and Wildlife Service (USFWS) in early 2013 will be conducted to finalize the sampling protocol described here, but provisionally, frogs will be collected opportunistically during the field surveys with long-handled nets. The skin of the abdomen and/or foot webbing of each captured frog will be swabbed 25 times with a sterile cotton swab, after which the frog will be released unharmed. The samples will then be sealed and refrigerated and analyzed later in the laboratory for the presence of chytrid DNA.

#### *10.18.4.3. Reporting and Data Deliverables*

The reports and data deliverables for this study include the following:

- **Electronic copies of field data.** A geospatially-referenced relational database of field data collected during the 2013 and 2014 field seasons, including representative photographs of water body habitats occupied by wood frogs, will be prepared. Naming conventions of files and data fields, spatial resolution, map projections, and metadata descriptions will meet the data standards to be established for the Project.
- **Initial Study Report and Updated Study Report.** The Wood Frog Study results will be presented in the Initial and Updated Study reports, according to the schedule indicated in Table 10.18-1. The reports will include descriptions of the field methods, a map of the water bodies and wetlands surveyed, results of the occupancy surveys, and descriptions of the potential impacts to wood frogs from development of the Project.

#### **10.18.5. Consistency with Generally Accepted Scientific Practice**

The Wood Frog Study will involve occupancy surveys of randomly selected water bodies and suitable wetland habitats, and will be conducted following currently accepted practices for the monitoring of amphibians, with field surveys designed to estimate detectability (USGS 2012). A similar occupancy survey of wood frogs in randomly selected water bodies was successfully conducted by ABR in 2007 on another large-scale project in southwest Alaska (see PLP 2011).

#### **10.18.6. Schedule**

The Wood Frog Study is planned to be conducted over two years. The activities for each year are described in Table 10.18-1. Finalization of the sampling protocol for Bd will occur in February and March of 2013. Review of aerial imagery and selection of sampling regions and habitat areas

to be surveyed will be conducted in March and April each year. Field surveys by a crew of two biologists will be conducted during the second and third weeks of May each year, with specific survey timing and duration to be determined annually, depending on snowmelt and lake-thaw information obtained from personnel working on other studies in the Project area each spring. Data analyses will be conducted during September–December each year. The Initial Study Report will be completed by February 2014 and the Updated Study Report will be completed by February 2015.

Technical Workgroup meetings will be planned on a quarterly basis in 2013 and 2014 to review study progress. Licensing participants will have the opportunity to review and comment on the Initial Study Report and Updated Study Report when they are completed.

#### **10.18.7. Relationship with Other Studies**

As depicted in Figure 10.18-2, the Wood Frog Study will use information from the Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin (Section 11.5), the Wetland Mapping Study in the Upper and Middle Susitna Basin (Section 11.7), and the fish distribution and abundance studies in the Upper, Middle, and Lower Susitna River (Sections 9.5 and 9.6) to identify habitats potentially occupied by wood frogs. Potential habitats will be identified from air-photo interpretation during the mapping studies and, where available, from fish presence data in individual water bodies (those without fish being of higher value for frogs). Random sampling will be used to first select sampling regions for acoustic surveys of frogs from among all areas of suitable habitat in the study area, and then to select specific areas of habitat to be surveyed. Acoustical survey data from multiple visits will be used to estimate detectability of calling male frogs and to develop occupancy estimates for the areas of habitat surveyed. When completed, data from this study will be used in the Evaluation of Wildlife Habitat Use study (Section 10.19) to determine habitat values for wood frogs for each of the wildlife habitat types mapped for the Project.

The distribution information and habitat occupancy estimates for wood frogs determined in this study will be used to assess the potential impacts of the Project and to develop PM&E measures, as appropriate, during preparation of the FERC License Application in 2015.

Wood frogs potentially could be affected primarily by direct mortality during construction and by the loss of water bodies and wetlands suitable for breeding from the placement of fill and from inundation in the reservoir impoundment zone. Additional impacts could occur from the alteration of habitats due to erosion, fugitive dust accumulation, permafrost degradation, landslides, and off-road vehicle use. Aquatic habitats created by the impoundment may not be suitable for wood frogs due to their preference for smaller water bodies.

The impact assessment for wood frogs will be conducted by ascertaining which water bodies and wetland types are suitable for breeding using habitat characteristics that can be identified from aerial imagery interpretation, wildlife habitat and wetlands mapping, and fish survey data, as described above in Section 10.18.4.1. This information will allow the calculation of the amount of suitable habitat available before development. Using the corrected occupancy estimates from this study, the amount of the available habitat will be reduced to that amount most likely to be actually occupied (e.g., if the occupancy rate is estimated at 50 percent, then, on average, only 50 percent of the available habitat will be occupied). However, because all suitable habitat in the study area cannot be sampled, there will not be spatially explicit information for all sites to

indicate which sites are actually occupied and which are not. With this available habitat and occupancy information, the Project footprint will be overlain, in GIS, on the map polygons representing suitable water body and wetland types to estimate the acreages of water bodies and wetlands that would be lost directly to fill or inundation. This acreage figure will then be reduced to account for the calculated occupancy rate, as noted above. The estimation of acreages of frog breeding habitats that could be affected by habitat alteration will be conducted similarly by overlaying habitat alteration buffers (surrounding the proposed Project infrastructure) to identify which habitats are likely to be affected by ancillary impacts associated with Project construction and operations. The size and number of habitat alteration buffer(s) to be used will be determined based upon the final specifications for Project construction and operations activities, which will be provided in the Project description.

Sampling for Bd in frogs in 2013 and 2014 will establish a baseline for comparison of the occurrence of Bd in frogs in the Project area after construction of the proposed Project.

Cumulative effects on wood frogs in the region of the proposed Project will be assessed in the FERC License Application document (to be prepared in 2015) and the details of that analysis (e.g., the spatial scale and temporal extent for cumulative effects) will be defined at that time.

#### **10.18.8. Level of Effort and Cost**

The Wood Frog Study is planned to be conducted over two years (2013–2014). A single field survey effort will be conducted each year in late spring (May) by a crew of two biologists. Based on previous occupancy surveys (PLP 2011), it is estimated that roughly 25 sites can be surveyed in a day. Occupancy surveys will be conducted for approximately 10 days each year. Helicopter support will be required for this study with multiple drop-offs and pick-ups in the afternoon and evening hours each day in the field (i.e., a dedicated helicopter may be required). The bulk of the costs associated with this study are for the field sampling, data analysis, and reporting. The projected cost for this study in each year is on the order of \$80,000, for an approximate estimated total of \$160,000 for both years.

#### **10.18.9. Literature Cited**

- ADF&G (Alaska Department of Fish and Game). 2006. *Our wealth maintained: A strategy for conserving Alaska's diverse wildlife and fish resources*. Alaska Department of Fish and Game Juneau. 824 pp.
- AEA (Alaska Energy Authority). 2012. Proposed Study Plan: Susitna-Watana Hydroelectric Project FERC Project No. 14241. July 2012. Prepared for the Federal Energy Regulatory Commission by the Alaska Energy Authority, Anchorage, Alaska.
- AKNHP (Alaska Natural Heritage Program). 2008. Alaska Wood Frog Monitoring Project results, 2002–2008. Available online: <http://aknhp.uaa.alaska.edu/zoology/citizen-science/alaska-wood-frog-monitoring/results-2002-2008/> (accessed October 2012).
- Anderson, B. C. 2004. An opportunistic amphibian inventory in Alaska's national parks, 2001–2003. Final report, National Park Service, Alaska Region Survey and Inventory Program, Anchorage. 44 pp.
- Babbitt, K. J., and G. W. Tanner. 1998. Effects of cover and predator size on survival and development of *Rana utricularia* tadpoles. *Oecologia* 114: 258–262.



- Blaustein, A. R., and D. B. Wake. 1990. Declining amphibian populations: a global phenomenon? *Trends in Ecology and Evolution* 5: 203–204.
- Cook, J. A., and S. O. MacDonald. 2003. Mammal inventory of Alaska's national parks and preserves: Denali National Park and Preserve. 2002 annual report for National Park Service, Alaska Region Survey and Inventory Program, Anchorage, by Idaho State University, Pocatello. 24 pp.
- France, R. L. 1997. The importance of beaver lodges in structuring littoral communities in boreal headwater lakes. *Canadian Journal of Zoology* 75: 1009–1013.
- Gotthardt, T. 2004. Monitoring the distribution of amphibians in the Cook Inlet watershed: 2003 final report. Alaska Natural Heritage Program, University of Alaska, Anchorage.
- Gotthardt, T. 2005. Wood frog conservation status report. Alaska Natural Heritage Program, University of Alaska, Anchorage.
- Hokit, D. G., and A. Brown. 2006. Distribution patterns of wood frogs (*Rana sylvatica*) in Denali National Park. *Northwestern Naturalist* 87: 128–137.
- MacDonald, S. O. 2010. *The amphibians and reptiles of Alaska: a field handbook*. Version 2.0. University of Alaska Museum, Fairbanks, and Museum of Southwestern Biology, Albuquerque, NM. Available online: <http://aknhp.uaa.alaska.edu/wp-content/uploads/2011/02/Herps-of-Alaska-Handbook-Final-Version-2-reduced.pdf> (accessed March 2012).
- MacKenzie, D. I., and J. A. Royle. 2005. Designing occupancy studies: general advice and allocating survey effort. *Journal of Applied Ecology* 42:1105–1114.
- McCallum, M. L. 2007. Amphibian decline or extinction? Current declines dwarf background extinction rate. *Journal of Herpetology* 41: 483–491.
- PLP (Pebble Limited Partnership). 2011. Pebble Project Environmental Baseline Document, 2004 through 2008. Chapter 16.12: Wood frogs—Mine Study Area. Pebble Limited Partnership, Anchorage. Available online: <http://www.pebbleresearch.com/> (accessed June 2012).
- Reeves, M. K. 2008. *Batrachochytrium dendrobatidis* in wood frogs (*Rana sylvatica*) from three national wildlife refuges in Alaska, USA. *Herpetological Review* 39: 68–70.
- Stevens, C. E., C. A. Paszkowski, and G. J. Scrimgeour. 2006. Older is better: Beaver ponds on boreal streams as breeding habitat for the wood frog. *Journal of Wildlife Management* 70: 1360–1371.
- USGS (U.S. Geological Survey). 2012. Amphibian Research and Monitoring Initiative. Available online: [http://armi.usgs.gov/amphibian\\_monitoring.php](http://armi.usgs.gov/amphibian_monitoring.php) (accessed October 2012).

**10.18.10.Tables**

**Table 10.18-1. Schedule for implementation of the Wood Frog Study.**

Activity	2013				2014				2015
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1Q
Finalize sampling protocol for Bd	—								
Review aerial imagery to select aquatic habitats to survey	—				—				
Field survey; survey timing and duration may be modified, depending on snowmelt and lake-thaw information obtained from other Project studies		—				—			
Data analysis			—	—			—	—	
Initial Study Report					△				
Updated Study Report									▲

Legend:

- Planned Activity
- △ Initial Study Report
- ▲ Updated Study Report

10.18.11.Figures

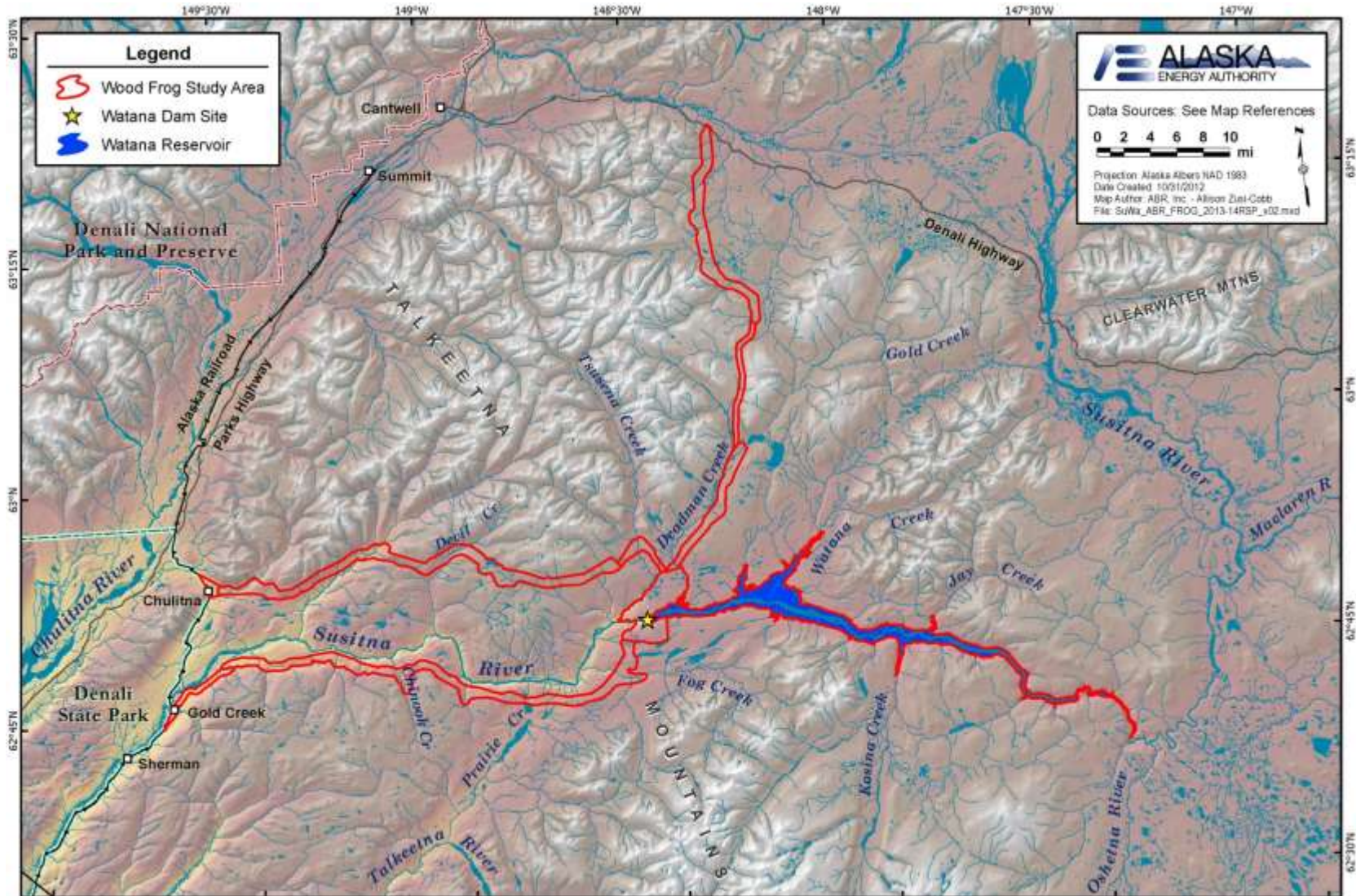


Figure 10.18-1. Wood frog study area.

**STUDY INTERDEPENDENCIES FOR WOOD FROG STUDY**

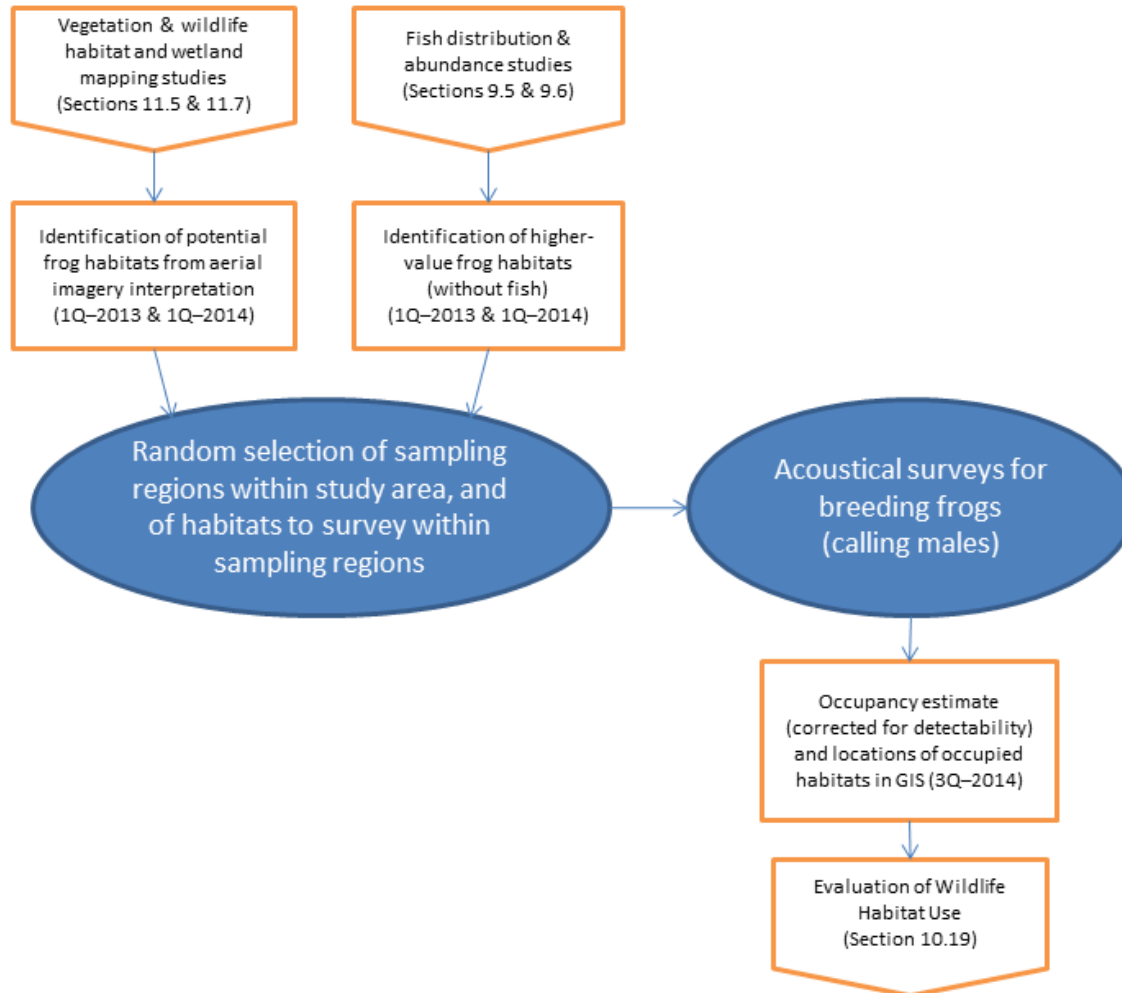


Figure 10.18-2. Interdependencies for Wood Frog Study.