10.18. Wood Frog Occupancy and Habitat Use

10.18.1. General Description of the Proposed Study

The wood frog study will be conducted over two years (2013 and 2014), with field work scheduled for 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 (nonlethally) to assay for the presence of the chytrid fungus that has been linked to amphibian declines worldwide (see Section 10.18.2 below).

10.18.1.1. Study Goals 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 (see Section 10.18.3 below) 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 habitat alteration expected to occur from development of the Project; and
- Sample frogs opportunistically for the presence of the chytrid fungus that has been linked to amphibian population declines.

The wood frog study is planned as a two-year study (2013–2014). Results from the first year of work in 2013 will be presented in the Initial Study Report and will be used to update this 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 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 21 May 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, 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 proposed study area includes those waterbodies and suitable wetland habitats in and adjacent to the proposed Project footprint 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 route and transmission-line corridors, and materials sites (Figure 10.18-1 – To Be Added in RSP).

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 frogs is short, this study will not involve a comprehensive survey of all potential wood 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 transmission line/access road corridors and four in the inundation/dam infrastructure zone of the proposed reservoir). Using a GIS, the sampling regions will be selected randomly from available areas of suitable waterbody 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 infrastrucure zone, as noted above. One exception to this random cell-selection process will be made to ensure that the waterbodies and wetlands in the infrastructure and camp area near the proposed dam are included as one of the sampling regions.

Within the study area boundary, potential waterbodies 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 waterbodies and wetlands, habitats will be categorized as having a higher or lower probability of supporting breeding frogs. The random sampling of waterbodies 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, although those data are not likely to 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 waterbodies that support fish. Emergent and aquatic vegetation in waterbodies 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 waterbodies 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 waterbody 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, however. 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 between each sample site will be maintained to avoid duplicate detections of frogs.

Ground-based auditory surveys of the randomly selected waterbodies and wetlands in the study area will be conducted during the breeding season for frogs (mid- to late May) in 2013 and 2014. (In addition to these surveys, it is expected that incidental detections of wood frogs also will 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 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 waterbody or wetland will be made at locations where observers can readily hear calling frogs. For small waterbodies and wetlands, a single observation point will suffice to detect the presence of frogs, but for large waterbodies and wetlands, multiple observation points may be needed to determine the presence of frogs. For large waterbodies 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 waterbody 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 waterbodies; these replicate survey data also will 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, if detected on the first survey, a second survey will not be needed. 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 km/hour [15 mph]). 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 waterbodies 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 waterbody, substrate, presence and type of emergent aquatic vegetation, distance to human disturbance, water quality [pH level, dissolved O_2], 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 waterbodies. 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 waterbodies and wetlands will be corrected (to account for those frogs present but not detected) to produce a corrected occupancy rate for the waterbodies 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 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 USFWS 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. Impact Assessment

Wood frogs potentially could be affected primarily by direct mortality during construction and by the loss of waterbodies 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 waterbodies.

The impact assessment for wood frogs will be conducted by ascertaining which waterbodies and wetland types are suitable for breeding wood frogs 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%, then, on average, only 50% 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 waterbody and wetland types to estimate the acreages of waterbodies and wetlands that would be lost directly to fill or inundation. This acreage figure then will 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 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. Any necessary PM&E measures also will be developed in the license application document.

10.18.4.4. Reporting and Data Deliverables

The reports and data deliverables for this study include:

- **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 waterbody 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 the schedule indicated below. The reports will include descriptions of the field methods, a map of the waterbodies 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 waterbodies 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 waterbodies 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 below.

2013

- Review of aerial imagery and Alaska GAP data, and selection of waterbodies to survey: March–April.
- Field survey: May 10–19 (one crew of two biologists); survey timing and duration may be modified, depending on snow-melt and lake-thaw information obtained from other Project personnel working in the Project area in spring 2013.
- Data analysis: September–October.
- Delivery of electronic copies of field data: November.

2014

- Initial Study Report: February.
- Selection of waterbodies to survey: March–April.
- Field survey: May 10–19 (one crew of two biologists); survey timing and duration may be modified, depending on snow-melt and lake-thaw information obtained from other Project personnel working in the Project area in spring 2014.
- Data analysis: September–October.
- Delivery of electronic copies of field data: November.

2015

- Updated Study Report: February.

10.18.7. 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.

10.18.8. Literature Cited

ADF&G. 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. 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).

AKNHP (Alaska Natural Heritage Program). 2012. The Alaska Gap Analysis Project. Alaska Natural Heritage Program, University of Alaska, Anchorage. Available online: http://aknhp.uaa.alaska.edu/zoology/akgap/ (accessed June 2011).

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).

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 (accessed October 2012).