11. BOTANICAL

11.1. Introduction

The botanical resources section describes the studies proposed to collect necessary baseline data to evaluate the potential impacts to vegetation, wildlife habitat, wetland, and vascular-plant resources in the Project area. Five proposed study plans are presented in this section. Two of these studies will involve the mapping of vegetation, wildlife habitats, and wetlands in the upper and middle Susitna basin where the Project dam, reservoir, supporting infrastructure, transmission lines, and access road are proposed to be built. A third study involves the mapping of successional vegetation, wildlife habitats, and wetlands in riparian areas along the Susitna River downstream of the proposed dam site, and also will involve modeling efforts to predict the potential changes in downstream riparian areas from Project development. A fourth study will involve surveys for rare vascular plant populations in those portions of the Project area where fill, inundation of the reservoir, or disturbance to plant populations would occur, and a fifth study will involve surveys for invasive vascular plants in currently disturbed areas that could serve as source areas for the spread of invasive plants in the Project area.

11.2. Nexus Between Project Construction / Existence / Operations and Effects on Resources to be Studied

Project construction and operations activities would directly and indirectly affect vegetation, wildlife habitats, and wetlands in and adjacent to those areas where physical alteration of the landscape would occur (the site of the proposed dam, the reservoir, and in those areas where supporting infrastructure, the access road, and transmission-lines are proposed). Project development also could indirectly affect vegetation, wildlife habitats, and wetlands in riparian areas downstream of the proposed dam because of alterations in patterns of river flow, sediment transport, ice scour, and subsequent changes in riverine geomorphology. Three of the botanical resources studies (the vegetation and wildlife habitat mapping study, wetland mapping study, and riparian study) will provide the information necessary to:

- Quantify the potential direct loss and alteration of vegetation types, wildlife habitats, and wetlands (including alterations in wetland functions) from development of the proposed Project;
- Evaluate the potential indirect and cumulative effects of Project development on vegetation, wildlife habitats, wetlands, and wetland functions; and
- Prepare a Clean Water Act Section 404 wetlands permit application for the Project, which will include proposed measures to address impacts to wetlands as much as practicable.

Project development could directly or indirectly result in the loss or degradation of habitats that support rare vascular plant species through the clearing of areas for fill and through disturbance to habitats adjacent to areas within the Project footprint. Similarly, disturbance to habitats from Project construction and operations activities could create opportunities for invasive vascular plant species to become established in the Project area. Project construction and operations activities also could provide vectors for the movement of invasive plant propagules into the Project area (e.g., construction equipment, vehicles, workers' boots, plant seed mixes). Two of

the botanical resources studies (the rare plant study and invasive plant study) will provide the information necessary to:

- Quantify the potential direct loss or disturbance to habitats supporting individuals or populations of rare plants from development of the proposed Project;
- Evaluate the potential indirect and cumulative effects of Project development on individuals or populations of rare plants; and
- Evaluate the potential for invasive plant species to become established in the Project area and the level of ecological threat from establishment.

11.3. Resource Management Goals and Objectives

There are no specific management goals for vegetation and wildlife habitats in Alaska. Federal and state management goals for bird and mammal species in Alaska are described in Section 10.3 of this RSP, and most of those management goals have a habitat component, in which the maintenance of habitats for the species or species group in question is part of the overall management goal(s).

Wetlands in Alaska are regulated under jurisdiction of the Environmental Protection Agency (EPA) 40 CFR Part 230 Section 404(b)(1) and Section 10 of the Rivers and Harbors Act of 1899 33 USC 403 regulations under the Clean Water Act. These regulations were developed "…to restore and maintain the chemical, physical, and biological integrity of waters of the United States through the control of discharges of dredged or fill material." The Section 404 program is designed to minimize the loss or negative impact to the nation's waters and wetlands. Mitigation for the loss of wetlands in Alaska must be done in compliance with the compensatory mitigation regulations of the U.S. Army Corps of Engineers (USACE) 33 CFR Parts 325 and 332 and EPA 40 CFR Part 230 ruling, Compensatory Mitigation for Losses of Aquatic Resources. The compensatory mitigation rule was enacted to improve the planning, implementation, and management of compensatory mitigation projects by requiring measurable, ecosystem-based performance standards and effective monitoring for all types of compensation.

The Aleutian shield fern (*Polystichum aleuticum*) is the only plant species listed as endangered under the federal Endangered Species Act (ESA) (USFWS 2010), and it is restricted to two islands (Adak and Atka) in the central Aleutian Island chain. The State of Alaska does not list any plant species as threatened or endangered (ADF&G 2010). Portions of the Project area, however, are managed by the Bureau of Land Management (BLM), and the BLM maintains a Special Status Species list, which was created from the Alaska Natural Heritage Program's Rare Vascular Plant List (AKNHP 2012). The BLM list is designed to identify species requiring special management consideration to promote their conservation and reduce the likelihood and need for future listing under the ESA.

Resource agencies have become increasingly concerned about invasive plants in Alaska because of their potential to negatively impact wildlife habitat, recreational values, rare plant populations, and native plant species diversity. In addition, they can greatly increase land management costs as financial resources are diverted from other resource management needs to control the spread of invasive species. As a result, the Alaska Department of Natural Resources, in cooperation with the Division of Agriculture, has been developing plans to help with the prevention, regulation, and enforcement of policies for the prevention and control of the spread of invasive

species (Herbert 2001, Graziano 2011). Planning tools already in place include the authority to declare pests, conduct inspections, quarantine and treat infested areas.

11.4. Summary of Consultation with Agencies, Alaska Native Entities and Other Licensing Participants

Summary tables of comments and responses from formal comment letters filed with FERC from November 1 through November 14, 2012, are provided in Appendix 1. Copies of the formal FERC-filed comment letters referenced in Appendix 1 are included in Appendix 2. In addition, a single comprehensive summary table of comments and responses from consultation, dated from Proposed Study Plan (PSP) filing (July 16, 2012) through release of Interim Draft RSPs (October 31, 2012), is provided in Appendix 3. Copies of meeting summaries from release of the PSP through the interim draft RSP are included in Appendix 4, organized chronologically.

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11.5. Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin

11.5.1. General Description of the Proposed Study

In the Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin, AEA will identify and map vegetation and wildlife habitats in the upper and middle Susitna basin where the reservoir and Project infrastructure is proposed. The mapping will encompass the inundation zone of the proposed reservoir, the dam site and associated infrastructure, and the three possible access route and transmission-line corridors. Vegetation and wildlife habitats in riparian areas along the Susitna River below the proposed dam will be mapped in a separate study, the Riparian Vegetation Study Downstream of the Proposed Susitna-Watana Dam (see Section 11.6). Mapping methods in the Vegetation and Wildlife Habitat Mapping Study and Riparian Vegetation Study are compatible, and the final map products will result in vegetation and wildlife habitats being mapped consistently in the Project area above the proposed dam and in riparian areas downstream of the dam site. The mapping of vegetation and wildlife habitats in the upper and middle Susitna basin will be conducted using current, high-resolution aerial photography and satellite imagery. The study will involve field surveys to collect ground-reference data to link the photosignatures in the study area (see Section 11.5.3 below) to known vegetation and wildlife habitat types; in the office, the boundaries for the identified vegetation and wildlife habitat types will be delineated by on-screen digitizing in a Geographic Information System (GIS) using the aerial photography and satellite imagery for the study area as the base data layers. The specific products of the Vegetation and Wildlife Habitat Mapping Study will be digital maps representing baseline conditions for vegetation and wildlife habitats in the Project area.

Study Goals and Objectives

The overall goals of the Vegetation and Wildlife Habitat Mapping Study are to prepare baseline maps of the existing vegetation and wildlife habitats in the upper and middle Susitna basin (upstream of Gold Creek). This mapping information will be used in AEA's License Application in 2015 (see Section 11.5.7 below), to assess impacts to both vegetation and wildlife resources from the proposed Project, and to develop any necessary protection, mitigation, and enhancement (PM&E) measures. When completed, the wildlife habitat maps will be used to estimate quantitatively the impacts of habitat loss and alteration for a selected set of bird, mammal, and amphibian species evaluated during the FERC licensing process. The wildlife habitat mapping prepared in this study will be one of the primary pieces of information used to evaluate impacts to wildlife species.

The specific objective of the Vegetation and Wildlife Habitat Mapping Study is to identify, delineate, and map vegetation and wildlife habitat types in the upper and middle Susitna basin using the vegetation map prepared in the 1980s for the Alaska Power Authority's Susitna Hydroelectric Project (APA Project) as a starting point, and updating that mapping to reflect current conditions as indicated on recent aerial imagery for the study area.

This multi-year study is being initiated in 2012 and will be continued in 2013 and 2014. Results from the 2012 work will be used to: (1) fine-tune the field investigations and mapping efforts for

the existing conditions found in the study area, and (2) customize the mapping work (e.g., study area) to reflect further refinements in the design of the Project.

11.5.2. Existing Information and Need for Additional Information

Wildlife habitats were not specifically mapped in the 1980s for the APA Project, although information on vegetation types important for moose browse was incorporated in the vegetation mapping data prepared by Kreig and Associates (1987; see below). All vegetation mapping for the APA Project was based on ground-reference data, with map polygons hand-drawn on mylar or acetate over topographic maps or aerial photos acquired in the early 1980s.

University of Alaska Agriculture Experiment Station (UAAES) used ground-reference data collected in 1980 (McKendrick et al. 1982) to map vegetation communities to Level III of the first version of the Alaska Vegetation Classification (AVC; Viereck and Dyrness 1980). UAAES mapped the Susitna River floodplain from Talkeetna to Devils Canyon, and mapped the river basin upstream from Devils Canyon (AEA 2011). Directly affected areas were mapped at a scale of 1:24,000, the remainder of the Susitna basin was mapped at a scale of 1:250,000. An additional area was mapped at a scale of 1:63,360, extending 10 miles in all directions from the Susitna River between Gold Creek and the mouth of the Maclaren River and encompassing the central transmission-line corridor along both sides of the Susitna River between the originally proposed dam site to Gold Creek.

Additional vegetation mapping covered parts of the upper and middle Susitna basin, from near the mouth of the Oshetna River (upstream of the Watana Dam site) to just downstream of the Devils Canyon Dam site (Kreig and Associates 1987). Vegetation types important for moose browse were a focus of this mapping effort. Vegetation types with high forage values for moose (mainly shrub and forest types) were mapped to the AVC Level IV (vegetation structure combined with dominant plants). In addition, each map polygon was assigned values for understory cover of willows, shrub birch, and alder; a limited ground-truth survey was conducted to verify understory shrub cover values. Mapping was performed at the 1:63,360 scale and incorporated the previous vegetation mapping (McKendrick et al. 1982); ground data and photography provided by the Alaska Department of Fish & Game (ADF&G), BLM, and U.S. Forest Service (USFS); and newly obtained ground and aerial data. A relational database of attributes for each polygon was developed and provided to ADF&G. The mapping data of Kreig and Associates (1987), in ArcGIS format, will be updated to reflect current conditions in the study area (see Section 11.5.4).

Although Kreig and Associates (1987) provides an overview of vegetation types within the study area, the map polygons delineated in the 1980s are likely to be outdated because of changes in landscape characteristics over the intervening 25-plus years. In particular, reductions in forest cover from fires (Kasischke and Turetsky 2006, Kasischke et al. 2010) and insect outbreaks (Werner et al. 2006), and permafrost degradation (Jorgensen et al. 2001) have been documented in recent decades in Interior Alaska. These recent landscape changes will not be represented in mapping data from the 1980s, and thus recent aerial imagery will be used to update Kreig and Associates (1987).

In addition, previous vegetation maps do not include the landscape context and physical habitat information necessary to adequately describe wildlife habitats. The Vegetation and Wildlife

Habitat Mapping Study will involve an integrated approach, mapping terrain units in addition to vegetation (see Section 11.5.4).

As described below in Study Methods (Section 11.5.4), the vegetation mapping of Kreig and Associates (1987) will be overlain on recent aerial imagery and the vegetation polygon boundaries will be updated to reflect the current extent of each vegetation type in the study area, mapped to Level IV of the AVC (Viereck et al. 1992). The 1980s vegetation mapping will be used as a planning tool to develop a list of vegetation types to survey in the field.

There are two existing high-resolution (0.3-m to 1.0-m pixel resolution) image data products available covering portions of the 4-mile buffer study area that are suitable for the mapping procedures described below. The Matanuska-Susitna Borough LIDAR (hereafter referred to as Mat-Su LIDAR) project imagery is a near-infrared, color ortho-mosaic at 0.3-meter (m) pixel resolution based on aerial photography obtained between July and October 2010; it covers portions of the study area from Gold Creek through the inundation area. The Denali Census (hereafter referred to as Denali) orthorectified aerial imagery acquired in May through September 2006 at a 1-m pixel resolution is a true color image product publicly available, and is suitable for mapping in those portions of the study area near Cantwell in the north. Moderate-resolution satellite imagery was obtained for the entire study area, constructed from RapidEye satellite images (hereafter referred to as RapidEye) dating from 2009 through 2011. The 5-band RapidEye imagery was resampled to a 4-m pixel resolution in a false natural color format. The moderate-resolution RapidEye imagery will be used for field-plot selection and general project planning for both botanical and wildlife studies, but is not suitable for boundary delineation of vegetation types and other terrain units (see Section 11.5.4 below).

11.5.3. Study Area

The study area for the mapping of vegetation and wildlife habitats consists of a 4-mile buffer zone surrounding those areas that would be directly altered or disturbed by Project construction and operations (Figure 11.5-1). The 4-mile buffer in Figure 11.5-1 was drawn from the road/transmission centerlines, from the polygon surrounding the proposed construction/dam/infrastructure area, and from the 2,050-ft level in the proposed reservoir. The affected areas include the proposed 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.

The alteration of successional vegetation and wildlife habitats downstream of the dam due to changes in instream flow, groundwater/surface water interactions, ice processes, and fluvial geomorphic features in the Susitna River will be specifically addressed in the Riparian Vegetation Study (Section 11.6). The Riparian Vegetation Study will be developed in coordination with the studies of riverine physical processes, most notably instream flow, groundwater, ice processes, and fluvial geomorphology (see Section 11.6).

11.5.4. Study Methods

AEA proposes an integrated approach to mapping vegetation and wildlife habitats based on Integrated Terrain Unit (ITU) mapping methods developed for Ecological Land Surveys (ELS) studies conducted in tundra, boreal forest, and coastal regions in Alaska (see Jorgenson et al. 2002 for an example study in Southcentral Alaska). The ITU mapping approach involves

mapping individual terrain units such as vegetation type, physiography, surface form, and disturbance type, and then combining them into composite units, which represent the range of landcover variation in the study area. When deriving wildlife habitats, ITUs are combined into broader, ecologically important categories that represent the habitats used by wildlife in the study area (see Section 11.5.4.2 below).

The method of combining various ITUs allows for the preparation of a number of thematic maps depending on the specific study needs. For the Project, a vegetation map at Level IV of the AVC (Viereck et al. 1992) and a wildlife habitat map based on the best combination of ITUs will be produced to yield a habitat map that accurately reflects use by wildlife. A concerted effort will be made to use data from existing vegetation maps prepared for the APA Project (McKendrick et al. 1982, Kreig and Associates 1987). As Kreig and Associates (1987) incorporates McKendrick et al. (1982) and is available in digital form, it will serve as the de facto existing vegetation map developed for the APA Project.

11.5.4.1. Develop Mapping Materials from Historical and Current Data

All available historical and current data layers that can be used to facilitate the mapping of vegetation and wildlife habitats have been compiled and are being managed in an ArcGIS geodatabase. These data include existing high-resolution aerial photography (for part of the study area), National Wetland Inventory (NWI) mapping, and existing digital vegetation mapping for the study area (Kreig and Associates 1987). The existing vegetation map layer (Kreig and Associates 1987) has been updated to ArcGIS 10.0 format for review and updating (see below). Additional high-resolution, recent imagery will be needed to complete the mapping of vegetation and wildlife habitats in this multi-year study, and it is expected that imagery will be available in late 2013.

11.5.4.2. ITU Mapping and Derivation of Wildlife Habitats

The existing vegetation map data (Kreig and Associates 1987) will be assessed for accuracy within the portions of the study area for which there is recent, high-resolution digital imagery, and map polygons will be updated to reflect Level III or IV vegetation types as defined by Viereck et al. (1992). The assignment of Level III (largely reflecting vegetation structure) or Level IV (vegetation structure plus dominant species) vegetation types will depend on how accurate the 1987 mapping is when compared to recent imagery. The accuracy assessment will focus on the extent of registration errors, match-line errors between adjoining mapping blocks, and on accuracy of map polygon vegetation codes in comparison to recent imagery. As much as possible, the 1987 vegetation mapping will be used as a planning tool to develop a list of target vegetation types to document during the fieldwork. The 1987 mapping, if not highly accurate at the Level IV of Viereck et al. (1992), may be modified (aggregated) into broader-scale vegetation types (Level III). These broad-scale vegetation map polygons would then serve as the basis from which finer-scale map polygons would be developed. When modifying the 1987 vegetation map layer, a minimum mapping size of 1.0 acre for vegetated areas and 0.25 acres for water bodies will be used. Each vegetation map polygon will be updated and coded with preliminary Level III or IV vegetation types (Viereck et al. 1992), as well as preliminary physiography, surface form, and disturbance types.

After the field season in 2012, the preliminary mapping will be revised so that it accurately reflects the field-verified occurrences of Level IV vegetation types, physiography, surface form, and disturbance types. Preliminary map polygons will be revised after the 2013 and 2014 field seasons. Once substantial progress has been made on the ITU mapping, a preliminary set of vegetation and wildlife habitat types will be prepared and presented in the Initial Study Report and Updated Study Report.

To derive wildlife habitat types, the ITU attributes assigned to each map polygon (vegetation, physiography, surface form, and disturbance type) will be combined to produce a large number of multivariate habitat types. These initial multivariate habitats then will be aggregated into a smaller set of derived habitat types that share similar characteristics considered important to the wildlife species that occur in the study area, such as the expected levels of available (plant) food sources and cover for escape and/or shelter. These factors can be directly related to the quantity and quality of vegetation, physiographic position, surface form, microtopography, soils, hydrology, and/or microclimates present. In the derivation of wildlife habitats, vegetation, physiography, surface form, and disturbance types will be used as the primary factors representing wildlife habitat quality, but information on soil drainage will be added as needed. The development of wildlife habitats is an iterative process tailored to the specific set of wildlife species to be evaluated for impacts from the proposed Project (see the Evaluation of Wildlife Habitat Use; Section 10.19). The final set of habitats to be mapped will be representative of those known to be used by birds, mammals, and amphibians in the Project area. In this process, AEA will rely on the Project-specific observations of wildlife habitat use and, as needed, the literature describing wildlife-habitat associations in Alaska.

11.5.4.3. Field Surveys

Ground-reference plots to be surveyed during summers of 2013–2014 will be selected to cover the range of mapped types identified during the preliminary mapping (above). When possible, ground-reference plots will be allocated directly to map polygons on the preliminary mapping representing Level IV vegetation types and the aggregated set of preliminary wildlife habitat types. For areas that have not been mapped yet, ground-reference plots will be selected using photosignatures from both moderate- and high-resolution imagery, as needed, to acquire the field data necessary to map vegetation to the Level IV of Viereck et al. (1992).

High-resolution imagery for the entire mapping study area will not be available in 2013 for either the preliminary mapping phase or the field season. Field sampling will be expanded beyond the Project footprint areas that are currently covered by high-resolution imagery (Mat-Su LIDAR and Denali). Areas not covered by preliminary mapping or high-resolution digital imagery will be sampled during summer 2013 using the recent 4-m pixel resolution satellite imagery (RapidEye).

Ground-reference plots will be sampled along transects located within major physiographic types, including riverine, lacustrine, lowland, and upland areas. To maximize efficiency in data collection, at each ground-reference plot data will be collected as necessary for vegetation and wildlife habitat mapping as well as wetlands mapping. At each plot, a standard U.S. Army Corps of Engineers (USACE) wetland determination and dataform will be completed (Environmental Laboratory 1987, USACE 2007; see the Wetland Mapping Study in the Upper and Middle Susitna Basin [Section 11.7]). Data elements to be recorded, including visual cover estimates of all vascular species present (within a 10-m [33-ft] radius; see below), soil pedon descriptions,

and hydrologic observations, are sufficient to satisfy data requirements for Viereck IV vegetation classification. Additional vegetation and wildlife habitat data elements will be recorded digitally in the field on an Android tablet computer using a customized data entry form designed to link directly to a relational database (Microsoft Access). Additional site characteristics to be recorded will include: physiography, surface form, microtopography, site disturbances, and plant phenological observations as described by Jorgenson et al. (2002) and Schick and Davis (2008). Observations will typically be recorded within a 10-m (33-ft) radius of relatively homogeneous vegetation as specified in Environmental Laboratory (1987). The size and dimensions of the plots may be modified, however, depending on the characteristics of the plant community at the site (e.g., narrower plots in riparian fringe habitats). The locations of all incidental observations of rare plants, invasive plants, wildlife species, or significant wildlife habitat features (e.g., raptor nests) will be documented.

11.5.4.4. Reporting and Data Deliverables

The reports and data deliverables for this study include:

- **Electronic copies of field data.** A geospatially-referenced relational database of historic (APA Project) data and data collected during the 2012–2014 field seasons, including representative photographs of vegetation and wildlife habitat types, 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.
- **Vegetation and wildlife habitat maps in ArcGIS and PDF formats.** The preliminary and final maps of vegetation and wildlife habitats will be delivered according to the schedule indicated below. 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. Final data presented in the formats described above will also be available online through an interactive web-based data-sharing program provided by ADNR.
- **Initial Study Report and Updated Study Report.** The Vegetation and Wildlife Habitat Mapping Study results will be presented to licensing participants in the Initial and Updated study reports, according the schedule indicated below. The reports will include descriptions of the vegetation and wildlife habitats identified, a summary table (acreages) of the vegetation and wildlife habitats represented in the mapping effort, and descriptions of the potential impacts to vegetation and wildlife habitats from development of the Project. In the Initial Study Report, AEA will include recommendations for the 2014 field survey effort. Both reports also will include field plot photographs including site, ground, and soil photographs for each plot surveyed.

11.5.5. Consistency with Generally Accepted Scientific Practice

The Vegetation and Wildlife Habitat Mapping Study will be conducted using standard methods for vegetation and terrain feature mapping through onscreen digitizing in GIS over digital aerial imagery. The mapping will be based on intensive ground-reference data, focused especially in the Project footprint areas. A multivariate, ITU mapping approach (following Jorgenson et al. 2002) will be used to derive and map wildlife habitats, following the methods successfully used to map wildlife habitats for other recent projects in Alaska (e.g., ABR 2008, Schick and Davis 2008, PLP 2011).

11.5.6. Schedule

Table 11.5-1 contains schedule information for the Vegetation and Wildlife Habitat Mapping Study. In 2014 and 2015, licensing participants will have opportunities to review and comment on the study reports (Initial Study Report in early 2014 and Updated Study Report in early 2015). Updates on the study progress will be provided during Technical Workgroup meetings, which will be held quarterly in 2013 and 2014.

11.5.7. Relationship with Other Studies

The relationships between the Vegetation and Wildlife Habitat Mapping Study and other Project studies are illustrated in Figure 11.5-2. The classification and mapping of vegetation and wildlife habitats in riparian areas along the Susitna River downstream of the proposed dam will be conducted in the Riparian Vegetation Study (Section 11.6), and will be coordinated with the classification and mapping of vegetation and wildlife habitats in this study to yield a single set of vegetation and wildlife habitat types to be mapped for the Project, both above and below the proposed dam. The set of wildlife habitats to be mapped will also be developed in coordination with the wildlife biologists conducting the bird, mammal, and amphibian studies for the Project. Specifically, habitat-use information for birds, mammals, and amphibians will be sought from the wildlife study teams so that the wildlife habitat types mapped will be representative of the habitats known to be used by wildlife in the Project area. When completed, the final wildlife habitat map polygons prepared in this study will be used in the evaluation of wildlife habitat use study (along with occurrence data for birds, mammals, and amphibians from each of the wildlife studies; see Section 10.19) to categorically rank habitat values for each of the mapped wildlife habitats by a selected set of bird and mammal species of concern.

This information from this study will be used in AEA's License Application, to assess the expected impacts of the proposed Project and to develop any appropriate measures for the PM&E of vegetation and wildlife habitats. Direct impacts to vegetation and wildlife habitats are expected to occur in the form of habitat loss from the placement of fill and the conversion of vegetation and terrestrial wildlife habitats to lacustrine habitats in the proposed reservoir. Direct habitat alteration in areas adjacent to gravel fill would occur from construction activities (e.g., storage and laydown yards, vehicular traffic). Indirect habitat alteration in areas adjacent to gravel fill could occur due to erosion, fugitive dust accumulation, permafrost degradation, landslides, and off-road vehicle use. Additional indirect habitat alteration could occur in areas adjacent to the proposed reservoir from changes in local climatic conditions. Indirect impacts could occur to riparian vegetation and wildlife habitats downstream of the proposed dam, due to changes in instream flow, groundwater/surface water interactions, ice processes, and fluvial geomorphic features in the Susitna River. These downstream effects will be addressed in the Riparian Vegetation Study (see Section 11.6).

The impact assessment for vegetation and wildlife habitats will be conducted in GIS. Direct effects to vegetation and wildlife habitats will be determined by overlaying the Project footprint on the final map polygons. Indirect effects to vegetation and wildlife habitats will be similarly determined by overlaying disturbance buffers (surrounding the proposed Project infrastructure) to identify areas likely to be affected by ancillary impacts associated with Project construction, operations, and maintenance. The size and number of disturbance buffer(s) will be based upon

the updated specifications for Project construction, operations, and maintenance activities, which will be updated throughout 2013-14.

In the vegetation and wildlife habitat impact assessment, the direct and indirect effects to vegetation and wildlife habitats will be quantitatively estimated (acreages of vegetation and wildlife habitat types affected) for each development alternative. The mapped wildlife habitat types also will be used to quantitatively assess the impacts of habitat loss and habitat alteration for each bird, mammal, and amphibian species of concern evaluated for impacts during the FERC licensing process (see Section 10.19). The first step in assessing impacts of habitat loss and alteration for wildlife species will be to conduct wildlife habitat-use evaluations for the bird, mammal, and amphibian species of concern. In that effort, each wildlife habitat type mapped in the study area will be categorically ranked for habitat value for each of the wildlife species of concern (see Section 10.19). Cumulative effects on vegetation and wildlife habitats 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.

11.5.8. Level of Effort and Cost

The Vegetation and Wildlife Habitat Mapping Study is planned as a three-year effort; work began in 2012 and will continue in 2013 and 2014. Field sampling will be conducted each year during the growing season by four to eight observers (working in crews of two). Surveys will be conducted for approximately 20 days in each year. The level of effort for 2013 is expected to be considerably greater than in 2012, because the 2012 effort was focused only on those portions of the study area that had aerial photography coverage of sufficient resolution for preliminary mapping and field sampling. High-resolution imagery should be available for the entire study area by fall 2013, so the number of person-days dedicated to the field effort will be increased to provide sufficient data for mapping the newly acquired high-resolution imagery. A less intensive field survey and mapping effort is anticipated in 2014. Field surveys will be conducted in conjunction with the Wetland Mapping Study to maximize efficiency and reduce costs. The study will involve extensive office-based activities to delineate the boundaries of various ITUs (vegetation, physiography, surface form, disturbance type) in a GIS and to prepare study reports.

Total costs in 2013 are estimated to be on the order of $500,000. The more limited 2014 field survey, which will be focused on problem areas or areas where the field survey coverage is insufficient, is estimated to cost approximately $300,000.

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11.5.10. Tables

Table 11.5-1. Schedule for implementation of the Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin.

Activity	2013				2014				2015
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q
Vegetation/habitat mapping and field plot selection	——	——							
Field surveys		——	——						
Incorporate project-specific habitat-use information from wildlife study teams into habitat type designations			——	——					
Vegetation/habitat map revisions and coordination of riparian areas mapping with riparian vegetation study team			——	——					
Initial Study Report				——	Δ				
Delivery of field data and preliminary vegetation and habitat maps				——					
Vegetation/habitat mapping and field plot selection for remaining unmapped areas					——	——			
Field surveys						——	——		
Incorporate project-specific habitat-use information from wildlife study teams into habitat type designations							——	——	
Final vegetation/habitat map revisions and coordination of riparian areas mapping with riparian vegetation study team							——	——	
Updated Study Report								——	▲
Delivery of final field data and final vegetation and habitat maps								——	

Legend:

—— Planned Activity
Δ Initial Study Report
▲ Updated Study Report

11.5.11. Figures

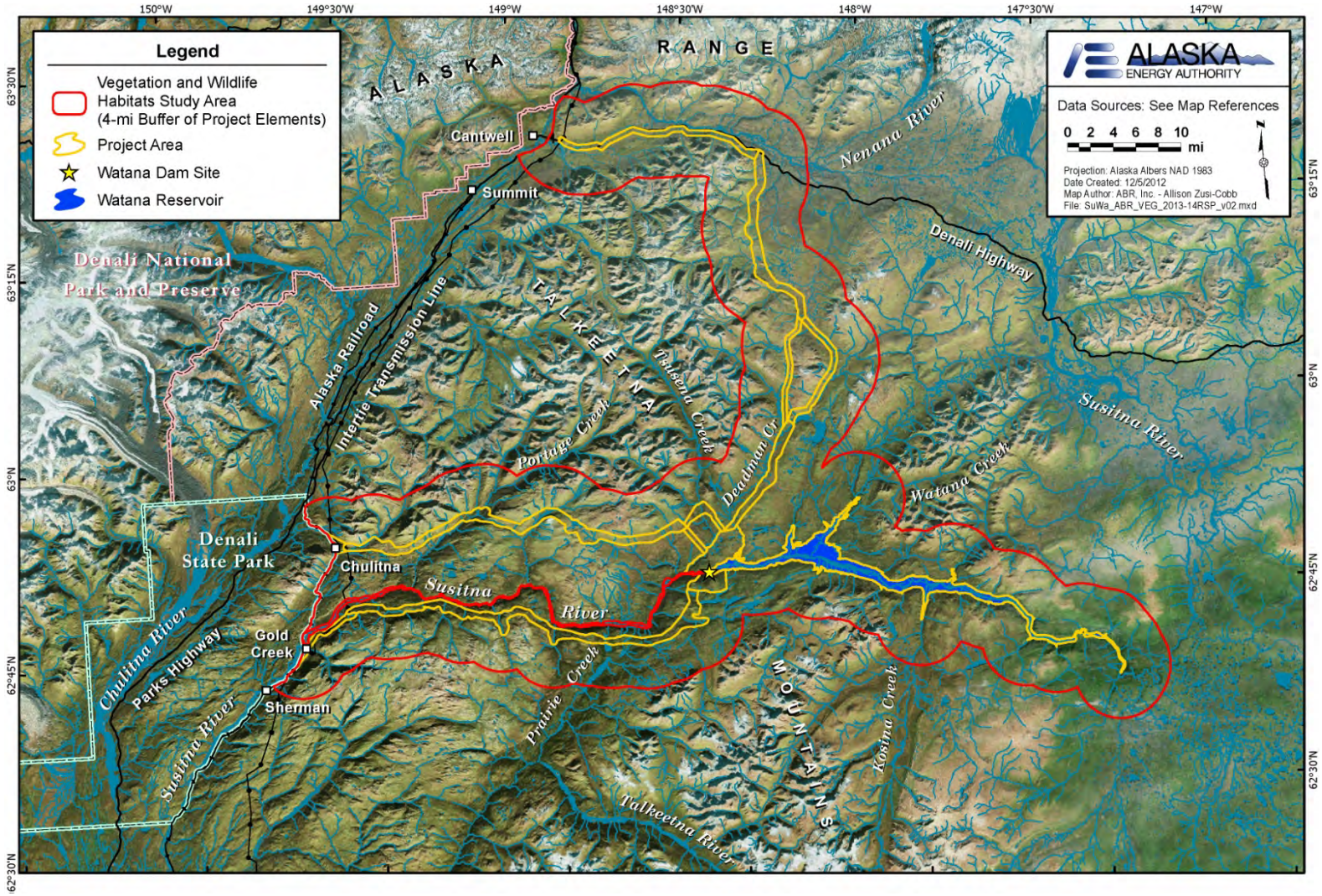

Figure 11.5-1. Study area for vegetation and wildlife habitat mapping for 2013 and 2014 in the Susitna-Watana Hydroelectric Project area.

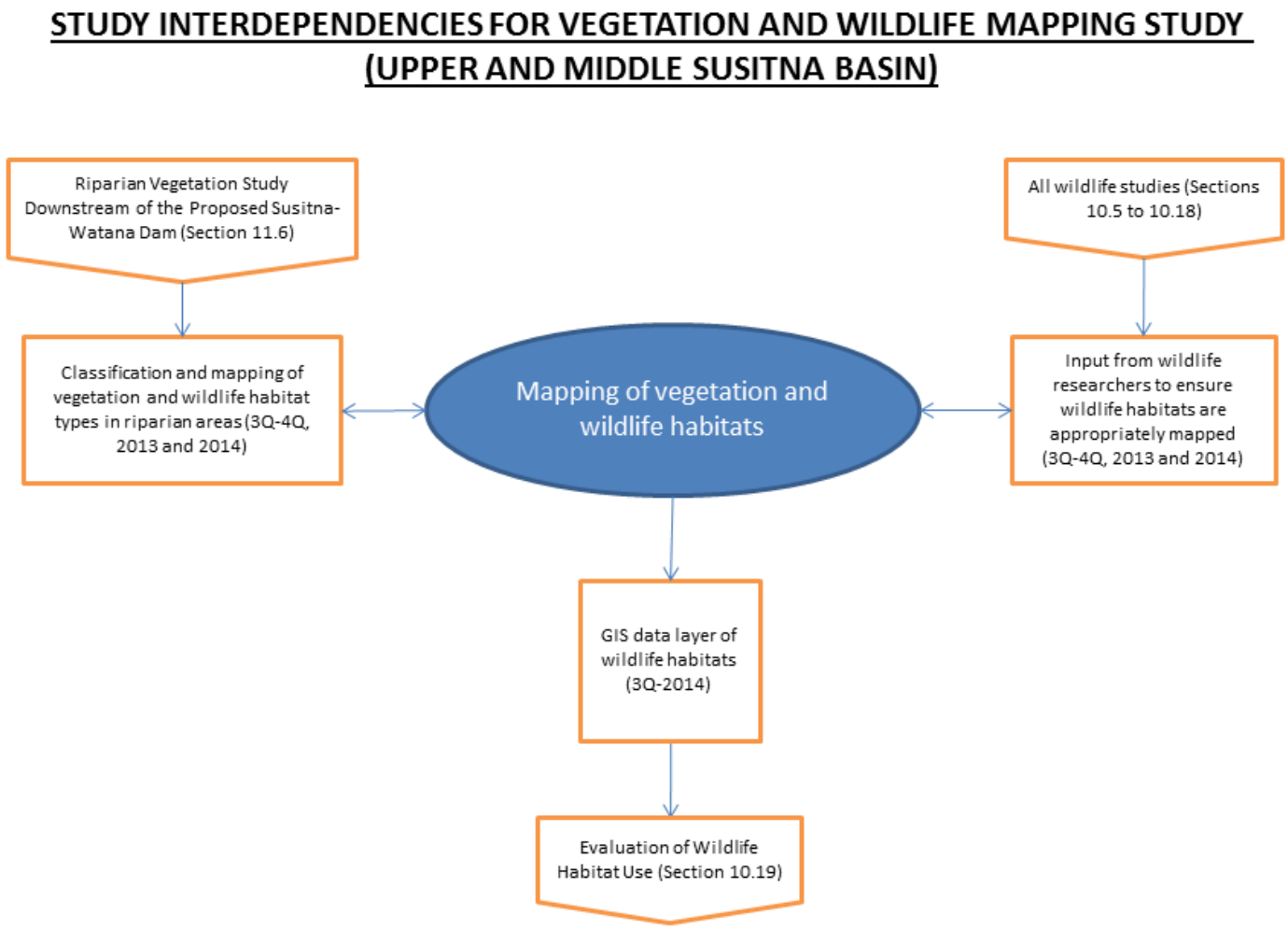

Figure 11.5-2. Study interdependencies for the Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin.

11.6. Riparian Vegetation Study Downstream of the Proposed Susitna-Watana Dam

11.6.1. General Description of the Proposed Study

The Riparian Vegetation Study Downstream of the Proposed Susitna-Watana Dam includes three primary components. First, AEA will identify, characterize, and map existing riparian (successional) vegetation, wetlands, and wildlife habitat types in riparian areas along the Susitna River downstream from the proposed Project dam site. Existing vegetation mapping will involve both a field effort (to ground-truth the photosignatures on the aerial photography and remote-sensed imagery to be used in the mapping), and an office-based effort to map riparian vegetation, wetlands, and wildlife habitats digitally in GIS. This component of the study will be coordinated with the Wetland Mapping Study in the Upper and Middle Susitna Basin (Section 11.7) so as to apply the same classification scheme for wetlands mapped in the riparian vegetation study, and allow for cross-referencing with the Cook Inlet basin wetland classification system and Viereck et al. (1992) Level IV vegetation classes, which will be used in the mapping of wetlands in the upper and middle Susitna basin. Note that no functional assessment for wetlands will be prepared for the wetlands mapped in the riparian vegetation study. This is because extensive information on physical processes will be collected in the other riparian-focused Project studies (see below), to enable predictions of how wetlands may change because of the Project's alteration of existing conditions downstream of the proposed dam.

Second, AEA will collect and analyze field data in support of one of the primary shared goals of the five riparian-focused Project studies (see below), which is to characterize landscape development and change on the Susitna River floodplain below the proposed dam. AEA will collect data on sedimentation and erosion, develop vegetation succession models, and describe vegetation-soil-landform relationships. To this end, AEA will resurvey, if possible, sites that were studied for successional vegetation along the Susitna River in the 1980s and 1990s, and collect current information on successional dynamics and sedimentation processes at sites that also will be studied for physical processes (see Section 11.6.4.2 below). Lastly, the riparian vegetation study will be closely coordinated with the Riparian Instream Flow Study (riparian IFS; Section 8.6) and three associated physical processes studies: Groundwater-related Aquatic Habitat Study (Section 7.5), Ice Processes in the Susitna River Study (Section 7.6), and Fluvial Geomorphology Modeling below Watana Dam Study (Section 6.6). The purpose of this close coordination is so that each study can provide necessary and complementary field data, without duplication of efforts. AEA will provide information on sedimentation and erosion, vegetation successional pathways, and mapping in support of the riparian IFS goal of developing a spatially-explicit model to predict potential changes to downstream riparian floodplain vegetation due to Project modifications of natural Susitna River flow, sedimentation, groundwater, and ice processes.

Study Goal and Objectives

The overall goals of the riparian vegetation study are to prepare baseline maps of local-scale riparian ecosystems (riparian ecotypes), wetlands, and wildlife habitat types in areas downstream from the proposed Project dam site; characterize sedimentation, vegetation succession, and vegetation-soil-landscape relationships; and coordinate with the development of the riparian IFS and other closely related studies to provide complimentary data products to support the

development of a spatially-explicit model to predict potential changes to downstream riparian floodplain vegetation due to Project modifications of flow, sedimentation, groundwater, and ice processes (to be developed in the riparian IFS; see Section 8.6.3.7). The mapping prepared in this study will be used, in the FERC License Application in 2015 (see Section 11.6.7 below), to assess the impacts to riparian ecotypes, wetlands, and wildlife habitats (see Section 10.19) in areas downstream from the proposed dam, and to develop possible protection, mitigation, and enhancement (PM&E) measures to address any identified effects.

The specific objectives of the riparian vegetation study are to:

- Identify, delineate, classify, and map riparian ecotypes, wetlands, and wildlife habitats downstream from the Watana Dam site;
- Characterize the role of erosion and sediment deposition in the formation of floodplain surfaces, soils and vegetation using a combination of stratigraphic descriptions, sieve analysis, and several complimentary sediment dating techniques;.
- Quantify and describe Susitna riparian vegetation communities using a combination of basic statistical summaries (e.g., basal area, density, stand age) and multivariate statistical techniques (e.g., cluster analysis, ordination, sorted tables), which will be used to develop of a series of conceptual models of floodplain vegetation succession building from those developed by Helm and Collins (1997);
- Coordinate closely in the implementation of the riparian IFS, groundwater, ice processes, and fluvial geomorphology studies to provide necessary and complimentary data, including vegetation successional models and mapping in support of a spatially-explicit model (to be developed in the riparian IFS; see Section 8.6.3.7) to predict potential impacts to downstream riparian floodplain vegetation due to Project alterations of existing conditions downstream of the proposed dam. Because of this close coordination, there will be no duplication of effort among the five studies.

This multi-year study is being initiated in 2012 and will continue in 2013 and 2014. Results from the 2012 work will be used to: (1) delineate the lateral study area boundary for use in 2013 field studies, (2) prepare a preliminary map of riparian ecotypes in a portion of the study area covered by adequate high-resolution aerial imagery, (3) conduct data analysis to support the development of preliminary floristic and ecotype classifications, and (4) support the development of the sampling scheme for the 2013 field season.

11.6.2. Existing Information and Need for Additional Information

Several riparian and vegetation mapping resources for the Project area were identified in the Pre-Application Document (PAD) (AEA 2011). Of primary importance to the riparian vegetation study are the previous vegetation mapping and vegetation successional dynamics studies by McKendrick et al. (1982), UAFAFES (1985), Collins and Helm (1997), and Helm and Collins (1997), which provide information on vegetation successional processes in areas downstream of the two dams proposed in the APA Project in the 1980s. Summary information on riparian processes in those downstream areas, derived from McKendrick et al. (1982) and UAFAFES (1985), is found in APA (1985). These previous studies will serve as a baseline for developing a sampling scheme for the riparian vegetation study proposed here (study plots from the 1980s and 1990s will be resampled if possible; see Section 11.6.4), and will provide a conceptual

framework upon which to build a vegetation succession classification and develop predictive models for assessing the downstream effects of the proposed Project on riparian habitats.

Wetlands were mapped for the APA Project in the 1980s through a cooperative agreement between U.S. Fish and Wildlife Service (USFWS) and the APA to produce a preliminary wetlands map for the APA Project area. Those wetlands map data were based on the vegetation mapping completed by McKendrick et al. (1982), with some additional modification using stereoscopic photo-interpretation, and are now a part of the National Wetlands Inventory (NWI; USFWS 1984). The Alaska Vegetation Classification (AVC; Viereck and Dyrness 1980) vegetation classes that were mapped in the early 1980s were cross-referenced and converted into wetlands classes using the classification scheme of Cowardin et al. (1979). The NWI data from the 1980s cover the current Project area and are expected to be available in digital format sometime in 2012. Those NWI data will help in understanding the types of wetlands that occur in the riparian vegetation study area, but the mapping is coarse-scale (1:63,360 scale) and will not be sufficient for determining effects on wetland resources (e.g., when mapping at the 1:63,360 scale, small drainages and other small wetland habitats are often overlooked). Because those NWI data are nearly 30 years old, and because riparian conditions have almost certainly changed in specific areas over that period, an updated map of riparian wetlands will be needed for the current Project.

Current, high-resolution (≤ 1 m) orthophoto imagery in true color and color infrared (CIR) formats, which will be used for the on-screen mapping work, is available for most of the riparian vegetation study area. Moderate-resolution (4–5 m pixel RapidEye imagery in a false natural color format), which was used to support the allocation of transects and study plots during the 2012 field studies, fills the remaining gaps in the study area. Additional high-resolution aerial imagery, in true color and CIR formats, for the Project area will be needed for the mapping of riparian ecotypes, wetlands, and wildlife habitats, and is expected to be acquired in summer 2013. That additional imagery likely will be available in late 2013 and can be used for mapping at that time (i.e., before the 2014 field season).

11.6.3. Study Area

The riparian vegetation study will be focused on riparian areas along the Susitna River and its tributaries below the proposed dam site. Riparian areas include all vegetation and soils that are directly (via flooding and overland flow) or indirectly (via ground water) influenced by river waters under current climate conditions. As such, these areas are expected to be altered by changes in instream flow, groundwater/surface water interactions, ice processes, and fluvial geomorphic surfaces from construction and operation of the proposed dam.

A preliminary study area for the riparian vegetation study is presented in Figure 11.6-1. The final study area will be defined in consultation with licensing participants in Q1 and Q2 2013 as described below. The study area will include those riparian areas downstream of the proposed dam site to a point at which the effects of altered stage and flow effects expected in the Susitna River would not be ecologically significant (i.e., the expected hydraulic alterations would be overridden by the input from other rivers and/or the effects of tidal fluctuations from Cook Inlet). The longitudinal extent of the riparian vegetation study area currently extends to river mile (RM) 75 because existing information indicates that the hydraulic effects of the Project below the Three Rivers Confluence at the Sunshine Gage (RM 84) show substantial attenuation, although small hydraulic effects appear to be detectable as far downstream as the Susitna Station Gage

(RM 26) (see the Preliminary Susitna River Pre-Project and Post-Project Flow Stages presentation from the October 23–25, 2012 Technical Workgroup [TWG] meetings; Appendix 4). The final determination of how far downstream Project operational effects will extend will depend largely on the results of the Open-water Flow Routing Model (see Section 8.5.4.3), which is scheduled to be completed in Q1 2013. Thus, an initial assessment of the downstream extent of Project effects will be developed in Q2 2013 (before the 2013 field season) with review and input from licensing participants during the Technical Workgroup meetings scheduled for 2013 (see Section 11.6.6 below). The assessment of the downstream extent of Project effects will include a review of information developed during the 1980s studies and study efforts initiated in 2012, such as sediment transport (see Section 6.5), habitat mapping (see Sections 6.5 and 9.9), operations modeling (see Section 8.5.4.2.2), and the Mainstem Open-water Flow Routing Model (see Section 8.5.4.3). The assessment will guide the need to extend studies farther downstream and, if needed, will identify which geomorphic reaches will be subject to detailed investigations in 2013 by the riparian vegetation, riparian IFS, groundwater, and fluvial geomorphology studies. Results of the 2013 riparian IFS studies would then be used to determine the extent to which additional geomorphic reaches should be studied in 2014.

As a starting point for delineating the lateral extent of the riparian vegetation study area, the extent of riverine physiography along the Susitna River has been mapped from the site of the proposed dam to Willow at RM 46. Riverine physiography includes those areas of the valley bottom directly influenced by regular (0–25 year) to irregular (25–100 year) overbank flooding, and includes off-channel water bodies. Riverine physiography was mapped by the riparian vegetation study team by photointerpretation of high-resolution aerial photography and satellite imagery for the Susitna River and currently (late November 2012) is undergoing review by the principal investigators leading the riparian IFS and associated physical processes studies (i.e., groundwater, ice processes, and fluvial geomorphology). Based on these reviews, AEA will prepare a revised riverine physiography map during Q1 2013, which will serve to define the lateral boundaries of the study area for both the riparian vegetation study and riparian IFS in 2013 and 2014. The lateral boundaries of the study area for the riparian vegetation study and riparian IFS will be finalized before the start of the field season in June of 2013.

11.6.4. Study Methods

Integrated Terrain Unit (ITU) mapping is an integrated approach to mapping landscape elements. It is a mulitvariate mapping process in which terrain unit map boundaries are adjusted so that there is increased coincidence between the boundaries and occurrences of interdependent ITU variables, such as hydrography, geology, physiography, soils and vegetation units (Jorgenson et al. 2003; 2009). The method of combining various ITUs allows for the preparation of a number of thematic maps that can be customized for specific study needs. An ITU approach to mapping riparian ecotypes, wetlands, and wildlife habitats (see Section 11.6.4.2.3 below) will be used based on methods and concepts developed for Ecological Land Survey (ELS) studies conducted in tundra, boreal forest, and coastal regions in Alaska over the past 15 years (see Jorgenson et. al. 2003 for an example study in Southcentral Alaska). The ITU mapping approach to be used in the riparian vegetation study will involve mapping terrain units such as vegetation type, poplar size class (e.g., pole, timber, large timber), fluvial geomorphology, and surface-form types (macrotopography and microtopography), and then combining them into units with ecological importance (in this case riparian ecotypes, wetlands, and wildlife habitats, see below). Also

based on previous ELS studies in Alaska, ELS plots (see Section 11.6.4.2.4 below) will be used in the field to collect detailed data on site characteristics, environmental variables, successional vegetation, and soils.

For the riparian vegetation study, a series of maps will be produced, including maps of the individual terrain units (i.e., geomorphology, surface-form, vegetation type, poplar size class), and maps of the aggregated terrain units (i.e., riparian ecotype , wetlands , and wildlife habitat). The mapping of wildlife habitats in the riparian vegetation study will be conducted in coordination with the vegetation and wildlife habitat mapping study (see Section 11.5) to derive a seamless map of wildlife habitats that apply Project-wide. Similarly, the mapping of wetlands will be conducted in coordination with the wetland mapping study (see Section 11.7) so that wetlands in the riparian vegetation study area can be similarly classified and compatible with the wetland types mapped in the Cook Inlet basin wetlands classification system (see Section 11.7); this will result in a single Project-wide wetland map. In the mapping of riparian ecotypes and in the study of riparian vegetation succession, the vegetation succession study plots studied in the 1980s and 1990s by McKendrick et al. (1982), UAFAFES (1985), Collins and Helm (1997), and Helm and Collins (1997) will be relocated where possible and re-sampled. The sampling of previously studied sites will help inform our interpretation of successional dynamics in the Susitna River floodplain.

11.6.4.1. Develop Mapping Materials from Historical and Current Data

Data sources that may be used for the mapping of riparian ecotypes and wildlife habitats include vegetation mapping and vegetation succession studies conducted in the Susitna River drainage by McKendrick et al. (1982), UAFAFES (1985), Collins and Helm (1997), Helm and Collins (1997). For wetlands, NWI data for the Project area, which was developed in the 1980s, should be available sometime in 2012. Additional data include soil surveys, digital elevation data, the National Hydrography Dataset (USGS 1999), and other map products that may have been produced for the area as part of other studies. These data will be compiled and reviewed and, if possible, included as a map layer in ArcGIS to assist the mapping efforts.

The available, high- and moderate-resolution aerial imagery for the project area will be acquired for use in the mapping effort. Additional, fine-scale, recent imagery will be needed to complete the mapping in this multi-year study, and it is expected that imagery will be available in late 2013.

11.6.4.2. Field Surveys

In 2012, the field ground-reference work was completed in two phases. In Phase 1, a helicopter-assisted reconnaissance of the Susitna River from Talkeetna to Willow took place in mid-June. The primary objective of the reconnaissance survey was to determine the feasibility of relocating the vegetation succession study plots originally established by McKendrick et al. (1982) and Collins and Helm (1997) for potential resampling, and to identify potential Focus Areas for the 2013–2014 studies. In previous versions of this study plan, Focus Areas were termed Intensive Stream Reaches; it is in these areas that field plots will be sampled in coordination with researchers from the riparian IFS and at which riparian vegetation field plots will co-located with those used for the groundwater studies.

Phase 2 of the 2012 field sampling occurred in late June–early July and included sampling of preselected study plots in conjunction with the data collection efforts for the Riparian IFS. Riparian habitats were sampled using ITU mapping transects (see below), along which ecosystem characterization and mapping verification data were collected.

In 2013–2014, field sampling will be coordinated with the riparian IFS and will occur from mid-June to late September and will include four components: (1) ELS plots will be sampled along transects within the Focus Areas in coordination with the riparian IFS and groundwater studies, (2) ITU mapping plots will continue to be surveyed along transects in the broader study area (i.e., outside Focus Areas) to rapidly collect field-verification data to further refine the riparian ecotype classes and mapping, (3) ELS plots will be sampled along transects in the broader study area in order to supplement the data from Focus Areas and facilitate the scaling-up of the results from the Focus Areas, and (4) rates of sedimentation across the Susitna River floodplain will be quantified using field stratigraphic descriptions and standard laboratory sediment dating methods. The methods for each of the above components of the riparian vegetation surveys are provided below.

11.6.4.2.1. Sampling Scheme

The preliminary mapping of riparian ecotypes, wetlands, and wildlife habitats (which is being prepared in 2012; see Section 11.6.4.3) will be used to design a stratified random sampling scheme to preselect potential study plots within riparian habitats. For those Focus Areas not covered by the 2012 preliminary mapping (see Section 11.6.4.3 below), ITU mapping will be completed for the Focus Areas in Q1 and Q2 2013 using the best available aerial imagery, and that mapping will serve as the base for the stratified random sampling. The number of plots within each Focus Area will be determined by the total area of each Focus Area following the general rule of 1 plot for every 10 acres for Focus Areas up to 200 acres, and a maximum of 20 plots for Focus Areas >200 acres. In addition to the stratified random sample, ELS plots sampled in Focus Areas will be co-located with ground water installations (see Section 11.6.4.2.4, ELS Plots, below).

Ground-reference plots to be surveyed along ITU and ELS transects sampled in the broader study area (study components 2 and 3, noted above) will be selected to cover the range of riparian habitats identified by photointerpretation of aerial imagery signatures on the high- and moderate-resolution imagery noted above. The preliminary mapping of riparian ecotypes, wetlands, and wildlife habitats (which is being prepared in 2012; see Section 11.6.4.3) and riparian process domains developed for the Riparian IFS will be used to design a stratified random sampling scheme to preselect potential study plots within riparian habitats. The objective will be to sample multiple map polygons for each riparian, wetland, and wildlife habitat type, incorporating as much replication as possible within the time and funding constraints for this work. For areas not covered by the 2012 preliminary mapping, a stratified random sampling scheme will be developed based on the riparian process domains, LiDAR elevation data, and photo-interpretation of aerial imagery.

11.6.4.2.2. Surface Elevation

Ground surface elevation will be recorded at all ELS plot centers, including those in Focus Areas and those in the broader study area in coordination with the Flow Routing and Riparian IFS field teams. Riparian vegetation elevation surveying will be conducted in the following manner. Plot

centers will be surveyed in by Riparian IFS field teams using a transit (elevation) and GPS unit (latitude/longitude). Transit surveys will be tied into an intermediate benchmark established at each Focus Area and ELS transect (e.g., nail in tree near riverbank). The flow routing field teams will then survey in the intermediate benchmark using an RTK instrument, thus tying the riparian survey plot elevations into project wide elevation datum.

11.6.4.2.3. ITU Mapping Plots

The purpose of the ITU mapping plots is the rapid collection of the basic variables used in the ecotype classification and ITU mapping process. Hence, the methods are designed to allow for efficiency in the field in order to cover a large area in a relatively short amount of time. Transects for the ITU plots will be oriented perpendicular to the Susitna River channel so as to cross various floodplain surfaces and patches of riparian vegetation in different successional stages. Five to ten circular plots of 10-meter (33-foot) radii will be sampled along each transect, each on a distinct floodplain surface and in a distinct vegetation type. The following variables will be recorded at each ITU mapping plot:

- Geo-referenced plot location (< 3-m accuracy);
- Site variables, including physiography, geomorphic unit, surface form, elevation, aspect, and slope.
- Vegetation structure and plant community composition to classify vegetation types to Level IV of the AVC (Viereck et al. 1992).
- Shallow soil pits will be dug to categorize drainage and soil moisture; soil hydrologic variables, including depth of water above or below ground surface, depth to saturated soil, pH, and electrical conductivity (EC); and soil depositional profiles.
- Wildlife sign such as winter or summer browse marks, nests, dens, droppings, singing birds, carcasses, tracks, and burrows.
- Locations of tree ice-scars, ice bull-dozing, or other evidence of disturbance by ice (i.e., ice rafted boulders, etc.) will be recorded at each plot and along each transect for use in the ice processes and riparian IFS.

11.6.4.2.4. ELS Plots

In early 2012, the adequacy of the methods of McKendrick et al. (1982), Collins and Helm (1997), and Helm and Collins (1997) for collecting the data necessary to describe vegetation successional stages were reviewed by the riparian vegetation and riparian IFS leads. In late 2012, in coordination with the riparian IFS, fluvial geomorphology, and groundwater study leads, the field methods for the intensive sampling of riparian vegetation and soils were revised to use modified ELS plots, following the ELS methods of Jorgenson et al. (2009). The ELS plots will be used to collect data on site and environmental variables; vegetation composition (abundance and richness) and structure (size class, density, age); as well as detailed soil characteristics (see Section 11.6.4.2.5, Soil Sampling and Sediment Aging, below). The purpose of the ELS plots is two-fold. First, the ELS plots are designed to facilitate the collection of detailed data on existing conditions (site characteristics, environmental variables, vegetation, and soils) for use in floristic, ecotype, and habitat analyses; sediment stratigraphy, aging, and sieve analyses; and the development of vegetation successional models. Two, the ELS plots and methods are designed to provide baseline data for a possible long-term monitoring study, with emphasis on repeatability

of methods and relocation of plots, for use in potential future studies of changes in riparian vegetation because of Project operations.

ELS plots will follow a variable-sized plot design as illustrated in Figure 11.6-2. The plot center (3-m radius) will be reserved as a trample zone in which no vegetation sampling will occur. In addition, at groundwater installations, the plot center will be co-located with the groundwater instrumentation. A 6.5-m radius plot (minus the plot center) will be used to (1) record species and DBH of all trees with a Diameter at Breast Height (DBH, ~1.5 meters) of < 5 cm; and (2) record stem counts of all tall (>1.5 m) shrubs. Protocols will be developed for handling multi-stem clusters from a single individual. Two representative trees of this size class and two representative shrubs within this zone will (1) be aged using increment cores (2 per tree, trees 2-5 cm DBH) or cookies (shrubs and trees < 2 cm DBH) extracted at the root collar; and (2) have approximate heights measured using a laser range finder designed to calculate height automatically. An 11.5-m radius plot (minus the plot center) will be used to record species of all trees with a DBH of ≥ 5 cm. Two trees of this size class within this zone will (1) be aged using increment cores (2 per tree) extracted at the root collar, and (2) have approximate heights measured using a laser range finder as described above. A 16.25-m radius plot (minus plot center) will be used to record DBH and species (if recognizable) of dead standing snags. Height of one representative snag within this area will be measured using a laser range finder.

The 16.25 meter radius plot will be divided into 4 quadrants using 100 meter measuring tapes that will serve as vegetation sampling lines for point-intercept measurements of all herbaceous and shrub species. The orientation of the lines will be determined from a random start bearing to orient the first line. The remaining lines will be oriented at 90 degree intervals to each other. Along each line, point-intercept measurements will be collected every 0.5-m using a laser mounted on a frost probe (Figure 11.6-3) for all herbaceous and shrub species beginning at 3.5 meters (just outside the plot center) and ending at 15.5 meters for a total 25 points per line and a 100 points per plot. All hits of a species by the laser will be tallied by three height classes for shrubs (< 0.20, 0.20–1.5, and 1.5–3 meters) and two height classes for herbaceous species (< 1.5 and 1.5–3.0 meters). For those hits ≥ 1.5 meters the laser will be oriented upwards and binoculars will be used if necessary to detect hits by the laser. Forest canopy cover of trees and tall shrubs > 3-m tall will be measured every 0.5-m using a densiometer. In addition to vascular species, hits of several categories of mosses (feather moss, *Sphagnum* spp., other mosses), lichens (foliose, fruticose, crustose), and bare ground (bare soil, litter, water) will also be recorded.

Once transect sampling is complete a random wander through the plot area will be conducted to record presence of species not previously recorded on the point-intercept transects. The random wander will continue until 10 minutes has passed since a new species has been recorded. Soil pits will be located in one randomly selected quadrant at approximately 9 meters from the plot center point and half way between the two adjacent vegetation sampling lines.

Landscape photographs will be taken from the plot center looking out along each vegetation sampling line, and from the end of each sampling line looking back towards plot center. Ground cover photographs will be taken at meter 13 along each vegetation sampling line.

Additional sampling details include:

- Plot locations (latitude/longitude) will be recorded using Trimble GeoXT GPS units (≤ 1-m accuracy).

- Permanent magnetic survey markers (SurvKap®) will be buried at approximately 20 cm depth at the plot center point to aid in relocating these plots into the future. At sites with ground water installations, magnetic survey marker will not initially be used. Rather the ground water installation will serve as the plot center marker. In the event that ground water installations are removed in the future, a magnetic survey marker will be placed at plot center at that time.
- Site variables, including physiography, geomorphic unit, surface form, elevation, aspect, and slope.
- Vegetation types will be classified in the field to Level IV of the AVC (Viereck et al. 1992).
- Wildlife sign such as winter or summer browse marks, nests, dens, droppings, singing birds, carcasses, tracks, and burrows will be recorded at each plot.
- Locations of tree ice-scars, ice bull-dozing, or other evidence of disturbance by ice (i.e., ice rafted boulders, etc.) will be recorded at each plot and while traversing to the next plot for use in the ice processes and riparian IFS.

The shape of the study plots on both the ITU mapping and ELS plots may vary depending on the shape of the vegetation stand being sampled. However, the same absolute area (tree and shrub plots) and the same total number of points (vegetation sampling lines) will be sampled in all cases. All field data will be recorded digitally in the field using a standardized data entry form on an Android tablet computer designed to link directly to a relational database (Microsoft Access).

11.6.4.2.5. Soil Sampling and Sediment Aging

- Soil pits will be dug down to basal gravel/cobbles (historic channel bed) or a depth of 2 meters, (whichever is shallower) for soil stratigraphy and sampling. Cut-banks will be used in place of soil pits whenever available and practical.
- The original gravel/cobble surface (historic channel bed) will be identified as a continuous layer of gravelly/cobbly sands (for practical purposes, this layer will be considered continuous when $\geq$ 40 cm thick).
- For those soils with depth to basal gravels > 2 meters a frost probe (0.25-inch diameter steel rod) will be used to determine the total depth to basal gravels.
- Tarps will be used to place soil materials extracted from the soil pits in order to protect the soil surface and increase efficiency in replacing the fill material when sampling is complete.
- Field stratigraphic descriptions will be prepared and soil samples collected for use in quantifying rates of sedimentation on the Susitna River floodplain. General methods are as follows. Floodplain soil pits will be excavated and soil stratigraphy will be described and measured using standard NRCS field techniques (Schoeneberger et al. 2002). Standard sediment grain-size sieve analysis will be conducted on the entire sediment profile. Depth and thicknesses of buried organic horizons will be recorded.
- Direct dating of fluvial sediments will be conducted using isotopic techniques, including, but not limited to, 137Cs and 210Pb measurements as described in Stokes and Walling (2003).
- Dendrochronologic techniques described above for the ELS plots will be used to age trees and current floodplain surfaces at each soil pit as described by Fritts (1976). The

results of the dendrochronology analyses will be used to corroborate the results obtained from sediment aging.

- Soil hydrology indicators will be recorded, including current depth to water table, presence of redoximorphic features (e.g., oxidation/reduction mottles, gley), and presence of hydrogen sulfide (as evidenced by a very pronounced "rotten egg" odor) to be used with the data from the ground water study as complimentary data on sub-surface hydrology.
- Additional soil variables will be collected within the upper 40 cm of the soil profile for use in the ecotype analysis including, drainage class, soil moisture, depth to saturated soil, pH, and electrical conductivity, dominant soil texture, thickness of surface organics, cumulative thickness of organic material, and thaw depth.

11.6.4.3. ITU Mapping of Downstream Riparian Areas

Preliminary mapping of local-scale riparian ecosystems (riparian ecotypes) by photointerpretation of the current aerial imagery available for the study area is currently (as of late November 2012) in progress. Ground-reference data collected in summer 2012 is being used to verify the mapping. For this preliminary mapping effort, the mapping is limited to those areas delineated as riverine physiography (see Study Area, above) and covered by the Matanuska-Susitna Borough (Mat-Su) aerial imagery collected in mid- to late summer 2011, which provides the best color signatures for mapping since the imagery in these areas was collected at full vegetation green-up. Color signatures in areas of the Mat-Su aerial imagery collected in late spring/early summer are not consistent with the mid- to late summer imagery as these areas were collected prior to full vegetation green-up making consistent and accurate interpretation of photo signatures across the entire study area difficult.

As noted above, riparian ecotypes are proposed to be mapped using an ITU approach. A minimum mapping size of 1 acre for terrestrial polygons and 0.25 acres for water bodies is proposed. ITU map polygons will be attributed with geomorphology (e.g., Braided Active Overbank Deposit); surface form (e.g., Mid-channel Bar); vegetation class (e.g., Open Balsam Poplar Forest), and poplar size class (e.g., pole, timber, large timber). Riparian vegetation in this study will be mapped to the Level IV of the AVC (Viereck, et al. 1992) with adjustments, as needed, for early successional riparian stages following Helm and Collins (1997). Following the mapping, the ITU codes will be aggregated into a set of preliminary riparian ecotypes based on the combination of ITUs that best represents the local-scale riparian habitats in the areas mapped.

Preliminary mapping of local-scale wetland ecosystems (wetland ecotypes) also will be mapped using the ITU approach in late 2012, but wetland ecotypes will be delineated separately, if needed, by photointerpretation so as to fit the wetland classification that will be used for the rest of the Project area (see Section 11.7). In particular, if there are wetlands in the floodplain of the Susitna River downstream of the proposed dam that are not represented in the wetlands mapping conducted in the upper Susitna basin, the existing wetlands mapping for lower elevations in the Matanuska-Susitna Borough (see http://cookinletwetlands.info/) will be consulted so as to map similar wetland types.

The objective of the wetlands mapping in the riparian vegetation study is to prepare a map of wetlands for downstream riparian areas following the same classification system used in the upper Susitna basin, and which can be cross-walked to the existing wetlands mapping for other

areas in the Matanuska-Susitna Borough (see Section 11.7 for more information). During consultation with resource management agencies, it was agreed that AEA will map wetlands as part of the riparian vegetation study, but will not conduct formal field wetland determinations in areas downstream of the proposed dam, (see Section 9.6 in AEA 2012). The U.S. Army Corps of Engineers has determined that no wetlands will be filled in the riparian areas downstream of the dam; therefore, wetlands mapping will not be needed for the Clean Water Act Section 404 dredge and fill permit. The wetlands mapping in the riparian vegetation study will be prepared to help in understanding how the downstream effects of alterations in instream flow, groundwater/surface water interactions, ice processes, and fluvial geomorphic features may affect wetlands in the floodplain of the Susitna River.

In December 2012, preliminary wildlife habitat types in downstream riparian areas will be mapped based on the ITU mapping described above, but will be derived using a separate aggregation of ITU parameters that specifically addresses the important elements of wildlife habitat use (see Section 11.5 for more information).

All the mapping of riparian areas will be conducted on-screen in GIS and will make extensive use of the field ground-reference data so that photosignatures are accurately interpreted. This mapping will be an on-going process and is expected to occur in 2012, 2013, and 2014. It is possible that the mapping of the full study area may not be completed until 2014. Once substantial progress has been made on the ITU mapping, however, a preliminary set of riparian ecotypes, wetland ecotypes, and wildlife habitat types will be prepared for review. This review will occur in both 2013 and 2014, and the preliminary set of riparian ecotypes, wetland ecotypes, wildlife habitat types will be presented in the Initial Study Report and Updated Study Report for review before being finalized.

11.6.4.4. Predicting Changes in Riparian Areas

In the riparian vegetation study, AEA proposes to intensively sample successional vegetation in the same stream reaches (Focus Areas) in which intensive sampling will occur in the riparian IFS and groundwater studies. Additionally, data from the fluvial geomorphology and ice processes studies will be integrated with those from the riparian vegetation, riparian IFS, and groundwater studies to develop comprehensive information on the existing conditions in riparian areas downstream of the proposed dam. This information will be used in the riparian IFS to correlate the range of existing conditions in instream flow, groundwater/surface water interactions, and geomorphic features with existing riparian habitats. These data will provide the baseline from which changes in instream flow, groundwater/surface water interactions, fluvial geomorphic features, and riparian vegetation will be modeled (in the riparian IFS) to predict how riparian habitats will change because of Project development (see the riparian IFS study plan, Section 8.6.3.7). In the modeling of changes in riparian vegetation in the Susitna River floodplain, researchers in the riparian IFS will use the field data noted above plus the results of the vegetation succession model (developed in the riparian vegetation study) in a spatially explicit model in a GIS to map the expected changes in riparian vegetation throughout the floodplain study area (see Section 8.6.3.7).

11.6.4.5. Reporting and Data Deliverables

The reports and data deliverables for this study include:

- **Electronic copies of field data.** A geospatially-referenced relational database of historic data and data collected during the 2012–2014 field seasons, including representative photographs of riparian ecotypes, wetland ecotypes, and wildlife habitat types 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.
- **Vegetation and wildlife habitat maps in ArcGIS and PDF formats.** The preliminary and final maps of riparian ecotypes, wetland ecotypes, and wildlife habitat types will be developed and delivered according to the schedule indicated below. 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. AEA will use ADNR's webmap application to develop interactive digital maps of riparian vegetation, wetlands, and wildlife habitats from the riparian vegetation study, so that licensing participants can access specific data layers, polygon attributes, and other map features.
- **Initial Study Report and Updated Study Report.** The riparian vegetation study results in the Initial and Updated study reports will be presented according the schedule indicated below. The reports will include descriptions of the riparian ecotypes, wetland ecotypes, and wildlife habitat types identified; a summary table (acreages) of the riparian ecotypes, wetland ecotypes, and wildlife habitat types represented in the mapping effort; and predictions of the expected changes in riparian areas due to Project development. The Initial Study Report will include recommendations for the 2014 field survey effort. Both reports also will include field plot photos including site, ground, and soil photographs for each plot surveyed.

11.6.5. Consistency with Generally Accepted Scientific Practice

The riparian vegetation study will be conducted using standard methods for the mapping of vegetation, wetlands, and terrain features (onscreen digitizing in GIS over digital aerial imagery). The mapping will be based on intensive ground-reference information, and the field data will be collected using the same methods used in the 1980s and 1990s so that the current data are comparable. These field methods are still appropriate for classifying successional vegetation types. A multivariate, ITU mapping approach (following Jorgenson et al. 2003) will be used for the mapping of wildlife habitats, and the derivation of wildlife habitats will be conducted following methods successfully used for the mapping of wildlife habitats for other recent projects in Alaska (e.g., ABR 2008, Schick and Davis 2008, PLP 2011). The prediction of change in riparian areas will be done in coordination with other studies of physical processes in riverine areas to help determine accurate relationships between physical changes and alterations in riparian habitats.

11.6.6. Schedule

See Table 11.6-1 for schedule information for the riparian vegetation study. In 2014 and 2015, licensing participants will have opportunities to review and comment on the study reports (Initial Study Report in early 2014 and Updated Study Report in early 2015). Updates on the study progress will be provided during Technical Workgroup meetings, which will be held quarterly in 2013 and 2014.

11.6.7. Relationship with Other Studies

The relationships between the riparian vegetation study and other Project studies are illustrated in Figure 11.6-4. The classification and mapping of vegetation, wetlands, and wildlife habitats in this study will be coordinated with the classification and mapping of vegetation, wetlands, and wildlife habitats in areas upstream of the proposed dam—in the vegetation and wildlife habitat mapping study (Section 11.5) and wetland mapping study (Section 11.7). This classification and mapping coordination will be done to yield comprehensive maps of vegetation, wetlands, and wildlife habitats for the Project area, both above and below the proposed dam.

There are four other Project studies related to the riparian vegetation study that are being conducted in riparian areas along the Susitna River downstream of the proposed dam. Data from each of those five riparian-focused studies will be needed to facilitate the predictions of change in riparian vegetation in the Susitna River floodplain (to be conducted in the riparian IFS; Figure 11.6-4). From the riparian IFS (see Section 8.6), information on the range of existing conditions for instream flow and recruitment of poplar (*Populus* spp.), spruce (*Picea glauca*), and willows (*Salix* spp.) will be needed to correlate with data on the existing vegetation in riparian areas. This information, along with the modeling of successional riparian vegetation in the Susitna River floodplain (to be conducted in the riparian vegetation study), will serve as the baseline from which changes in riparian vegetation can be predicted given the predicted changes in instream flow (as one of several factors that can influence plant communities following construction of the proposed dam; see below). In a similar study relationship, data from the groundwater study (see Section 7.5), which will be used to describe the range of existing conditions for groundwater/surface water interactions, will be needed to correlate with data on existing riparian vegetation. From this baseline, data on the predicted changes in groundwater/surface water interactions as a result of construction of the proposed dam will be needed to help further refine the predictions of changes in riparian vegetation. Two other riparian studies are related to the riparian vegetation study in the same ways. The range of existing conditions for ice effects (from the ice processes study; see Section 7.6) and fluvial geomorphic features (from the fluvial geomorphology study; see Section 6.6) in the Susitna River will be used to determine the baseline conditions that plant communities in riparian areas are responding to now. Then the predictions of changes in ice effects and fluvial geomorphic features as a result of construction of the proposed dam will be used to further refine the predictions of changes in riparian vegetation (to be conducted in the riparian IFS; Figure 11.6-4). As indicated in Figure 11.6-4, data from the riparian vegetation study and each of the other four interdependent, riparian-focused studies will be synthesized in the riparian IFS study to develop a spatially explicit model to predict potential changes in downstream riparian floodplain vegetation due to Project modifications of natural Susitna River flow, sedimentation, groundwater, and ice processes.

Data collected as part of the riparian vegetation study will be used by the other four interdependent, riparian-focused studies. Observations of ice-scars and other evidence of ice disturbance recorded at riparian vegetation plots and transects will be used by researchers conducting the ice processes study to aid in the identification of ice process domains. Soil stratigraphy and sediment aging data will be used by researchers conducting the fluvial geomorphology study, while elevation surveys of the intermediate benchmarks at Focus Areas and ELS transects (conducted by the fluvial geomorphology study team) will tie the vegetation study plots into the study-area-wide elevation datum. The vegetation study plots sampled in the riparian vegetation study will be co-located with groundwater installations and the data from the

groundwater study will inform the development of vegetation succession models (to be prepared in the riparian vegetation study). At the same time, the soil hydrology indicators recorded at the vegetation plots sampled in the riparian vegetation study will complement the groundwater data. Riparian ISF field crews will be collecting the dendrology and elevation data at the vegetation study plots in the Focus Areas, and will be performing the seedling recruitment study, all of which will feed into the riparian vegetation study, and specifically into the modeling of riparian vegetation succession. At the same time, the vegetation structure and composition data, and soil stratigraphy and sediment aging data (collected in the riparian vegetation study) will feed into the riparian IFS objectives of describing floodplain vegetation/groundwater/surface water functional groups and developing a predictive model of Project operations changes to erosion and sediment deposition patterns and associated floodplain vegetation. As noted above in Section 11.6.4.4, data from the riparian vegetation study and each of the four interdependent, riparian-focused studies will result in an interdisciplinary dataset for use in predicting potential impacts to downstream riparian floodplain vegetation due to the Project modifications of natural Susitna River flow, sedimentation, groundwater, and ice processes, which is to be conducted in the riparian IFS.

Lastly, the wildlife habitat types mapped in the riparian vegetation study will be used in the Evaluation of Wildlife Habitat Use Study (see Section 10.19) to categorically rank habitat values for each of the mapped riparian wildlife habitats by a selected set of wildlife species of concern. This information will be used in the impact assessments for wildlife habitats and wildlife species (see below) to be conducted for the FERC License Application.

When the predictions of changes in riparian vegetation described above are completed (in the Updated Study Report for the riparian IFS), the mapping of existing riparian vegetation, wetlands, and wildlife habitats prepared in the riparian vegetation study can be used to assess how those features of riparian areas along the Susitna River could be affected by construction of the proposed dam. These impact assessments will be conducted during the preparation of the FERC License Application in 2015.

Using the predictions of changes in riparian vegetation along with predictions of changes in fluvial geomorphic features (as a result of flow alterations and ice processes) and predicted changes in groundwater/surface water interactions (as described above), the predictions of how wildlife habitats could be affected in floodplain areas downstream of the proposed dam will follow relatively easily. This is because wildlife use of riparian areas depends largely on the presence or absence of vegetation, vegetation type, fluvial geomorphic features, and, to a lesser extent, soil properties, and data on the expected changes in all these landscape elements will be available from the five riparian-focused studies described above. With data indicating how wildlife habitats will be affected downstream of the proposed dam, the information from the Evaluation of Wildlife Habitat Use Study (see Section 10.19), will be used to assess what those changes in the availability of habitats important for a selected set of wildlife species of concern are likely to mean for the distribution and abundance of those species in the Susitna River floodplain.

Similarly, for wetlands in the Susitna River floodplain, the same information noted above on the predictions of changes in riparian vegetation, fluvial geomorphic features, and, importantly for wetlands, groundwater/surface water interactions, will be used to predict how riparian wetlands could be affected in areas downstream of the proposed dam.

In addition to the impact assessments for riparian vegetation, wildlife habitats, and wetlands, the development of any PM&E measures needed for those riparian resources will occur during the preparation of the FERC License Application in 2015.

11.6.8. Level of Effort and Cost

The riparian vegetation study is planned as a three-year effort, with field sampling conducted each year by four observers (two crews of two each) during the summers of 2012, 2013, and 2014. Surveys would be conducted for 14 to 18 days in each year, depending on the needs for additional ground-verification data (less extensive field surveys may be needed in 2014 as the mapping of the study area progresses). The riparian vegetation study will involve extensive, office-based activities to delineate the boundaries of various ITUs (e.g., vegetation, geomorphic type, surface form, disturbance type) in a GIS and to prepare study reports.

Total costs in 2013 are estimated to be on the order of $600,000. In 2014, a more limited field survey is expected, to focus on complex areas or areas where the field survey coverage is insufficient. Total costs in 2014 are estimated to be roughly $400,000.

11.6.9. Literature Cited

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11.6.10. Tables

Table 11.6-1. Schedule for implementation of the riparian vegetation study.

Activity	2013				2014				2015
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q
Develop mapping materials from historical and current data	—								
ITU mapping of riparian, wetland, and wildlife habitat types									
Field plot selection and field surveys		—	—						
ITU map revisions for riparian, wetland, and wildlife habitat types; coordination with other botanical resources mapping study teams			—	—					
Initial Study Report				—	Δ				
Delivery of field data and preliminary riparian, wetland, and widlife habitat maps				—					
ITU mapping of riparian, wetland, and wildlife habitat types					—	—			
Field plot selection (for remaining unmapped areas) and field surveys						—	—		
Final ITU map revisions for riparian, wetland, and wildlife habitat types; coordination with other botanical resources mapping study teams							—	—	
Modeling of riparian vegetation succession in Susitna River floodplain							—	—	
Updated Study Report								—	▲
Delivery of final field data and final riparian/wetland/habitat maps								—	

Legend:

— Planned Activity
Δ Initial Study Report
▲ Updated Study Report

11.6.11. Figures

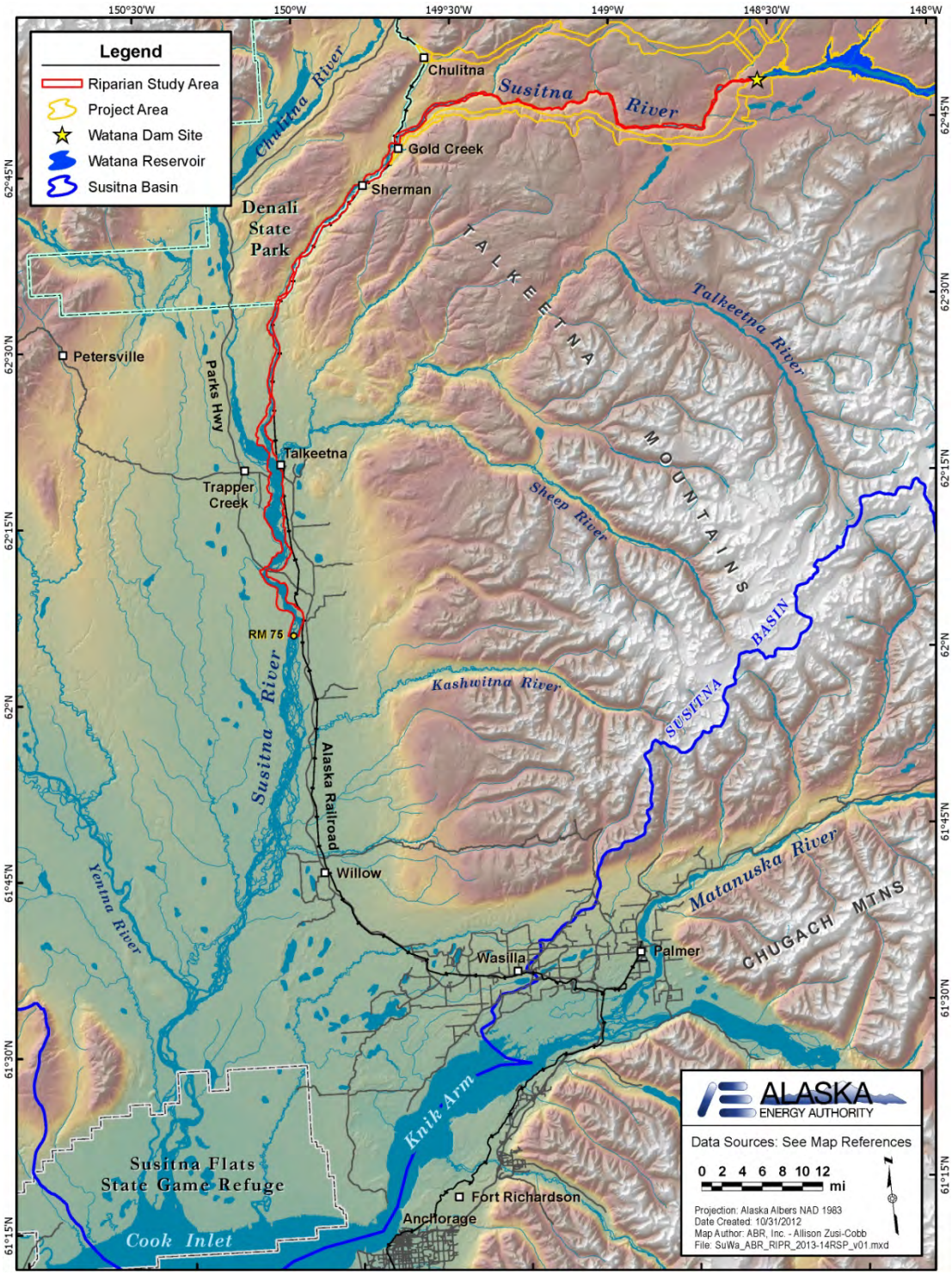

Figure 11.6-1. Preliminary riparian vegetation study area for 2013 and 2014 in the Susitna basin.

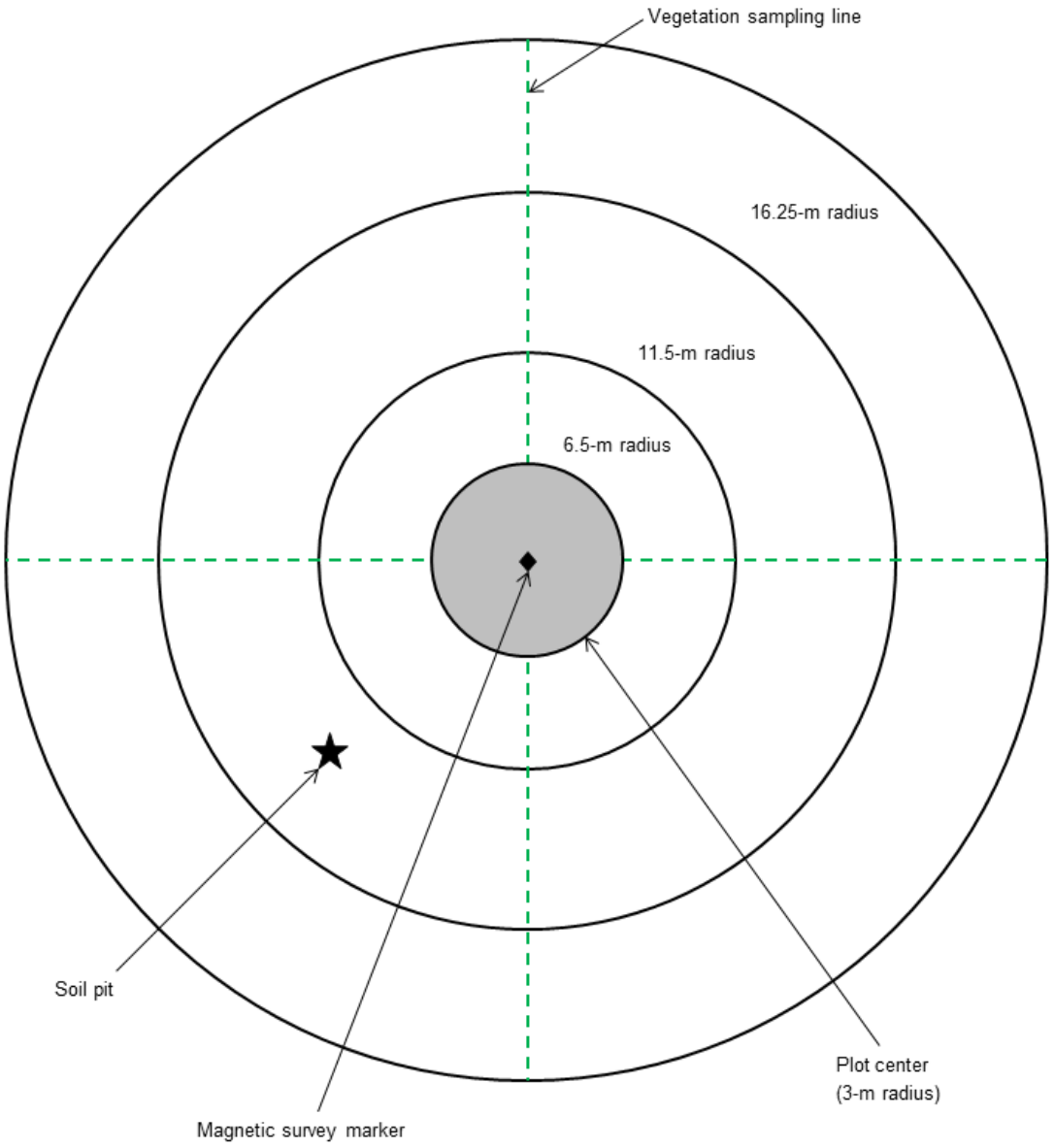

Figure 11.6-2. Diagram of Ecological Land Survey (ELS) plot for use in the riparian vegetation study showing plot center (3-m radius), 6.5-m radius plot (trees < 5 cm DBH and tall shrubs), 11.5 m-radius plot (trees ≥ 5 cm), 16.25-m

radius plot (snags), vegetation sampling lines, and soil pit location. Susitna-Watana Hydroelectric Project, Alaska, 2013-2014.

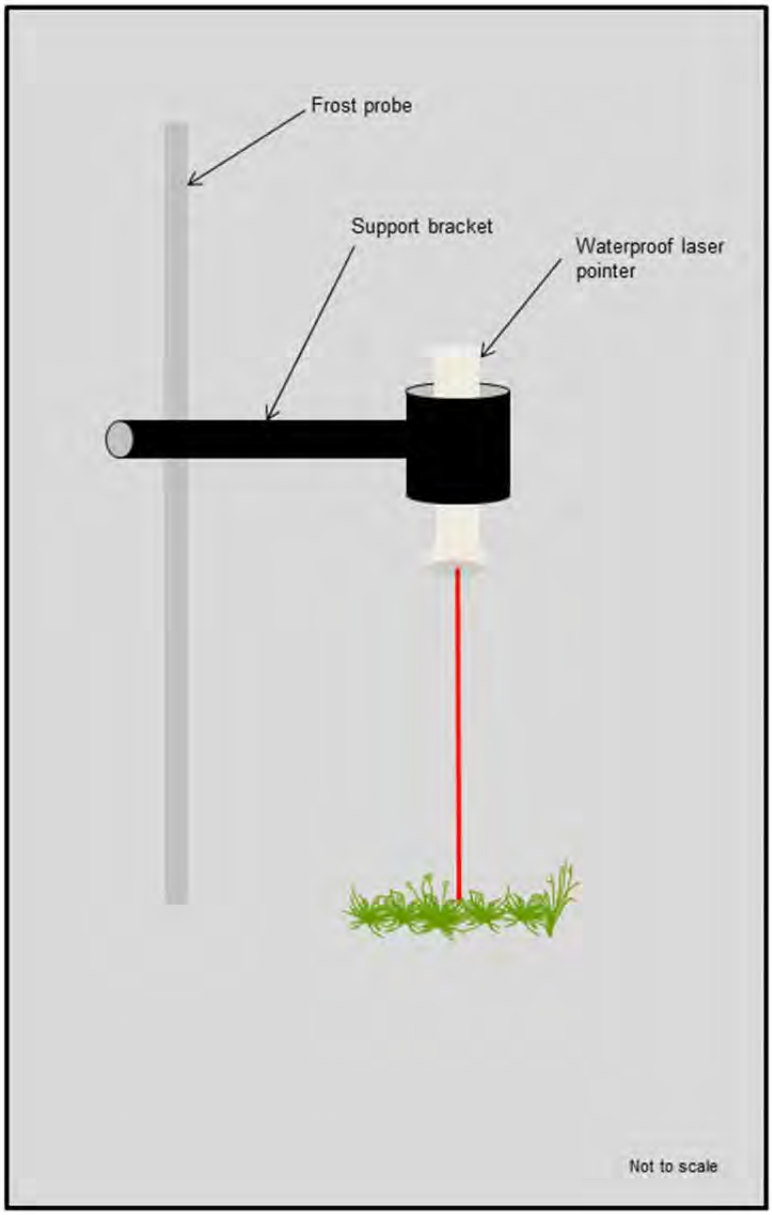

Figure 11.6-3. Diagram of laser point sampler mounted on frost probe for use in the riparian vegetation study, Susitna-Watana Hydroelectric Project, Alaska, 2013-2014.

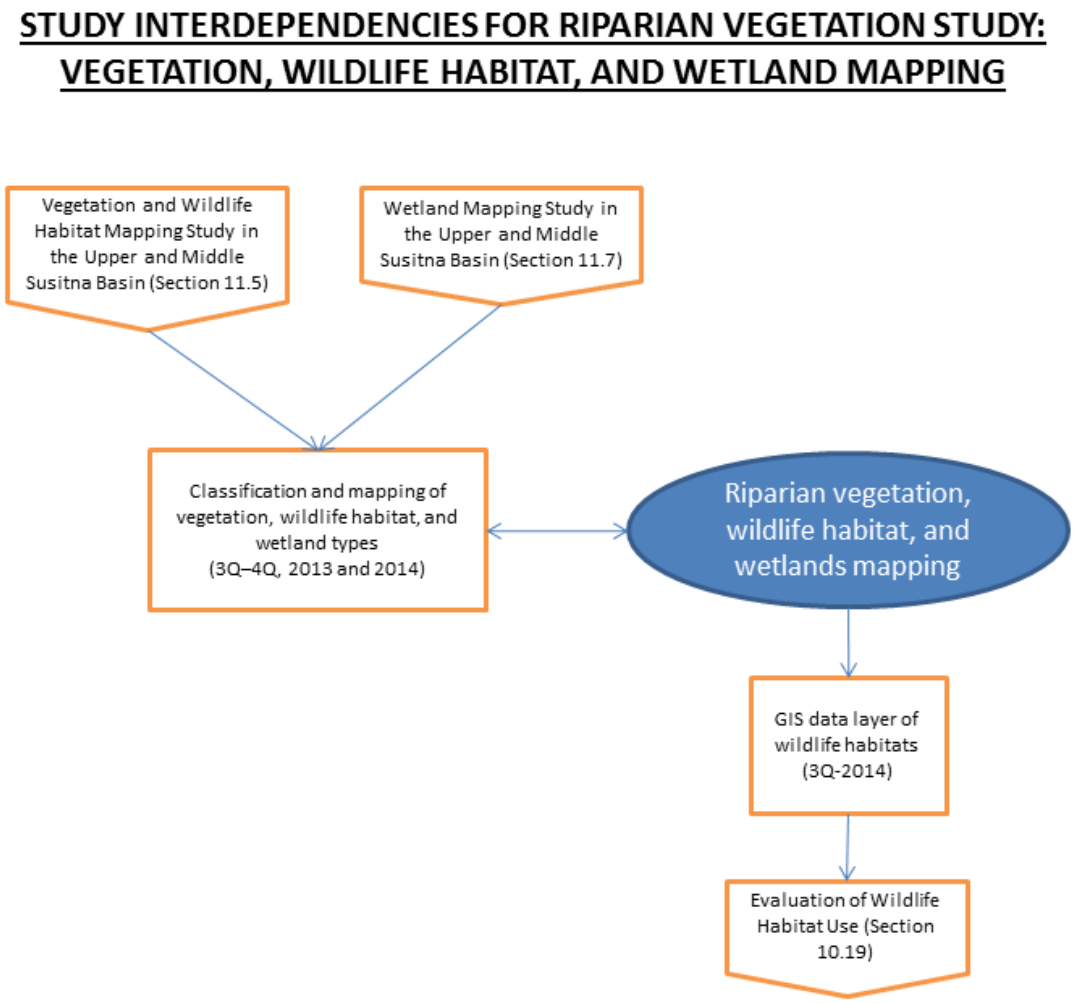

Figure 11.6-4a. Study interdependencies for the riparian vegetation study.

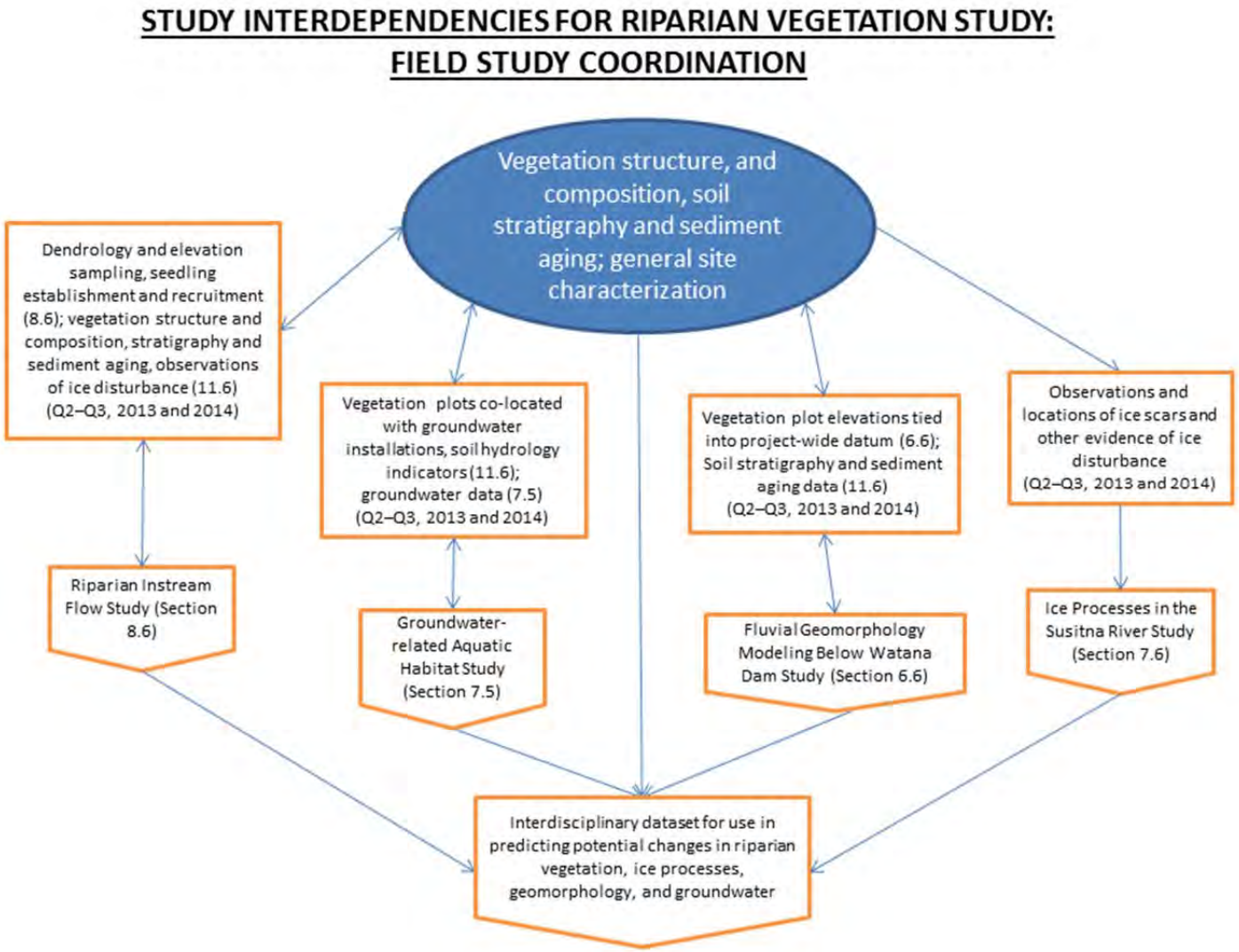

Figure 11.6-4b. Study interdependencies for the riparian vegetation study (continued).

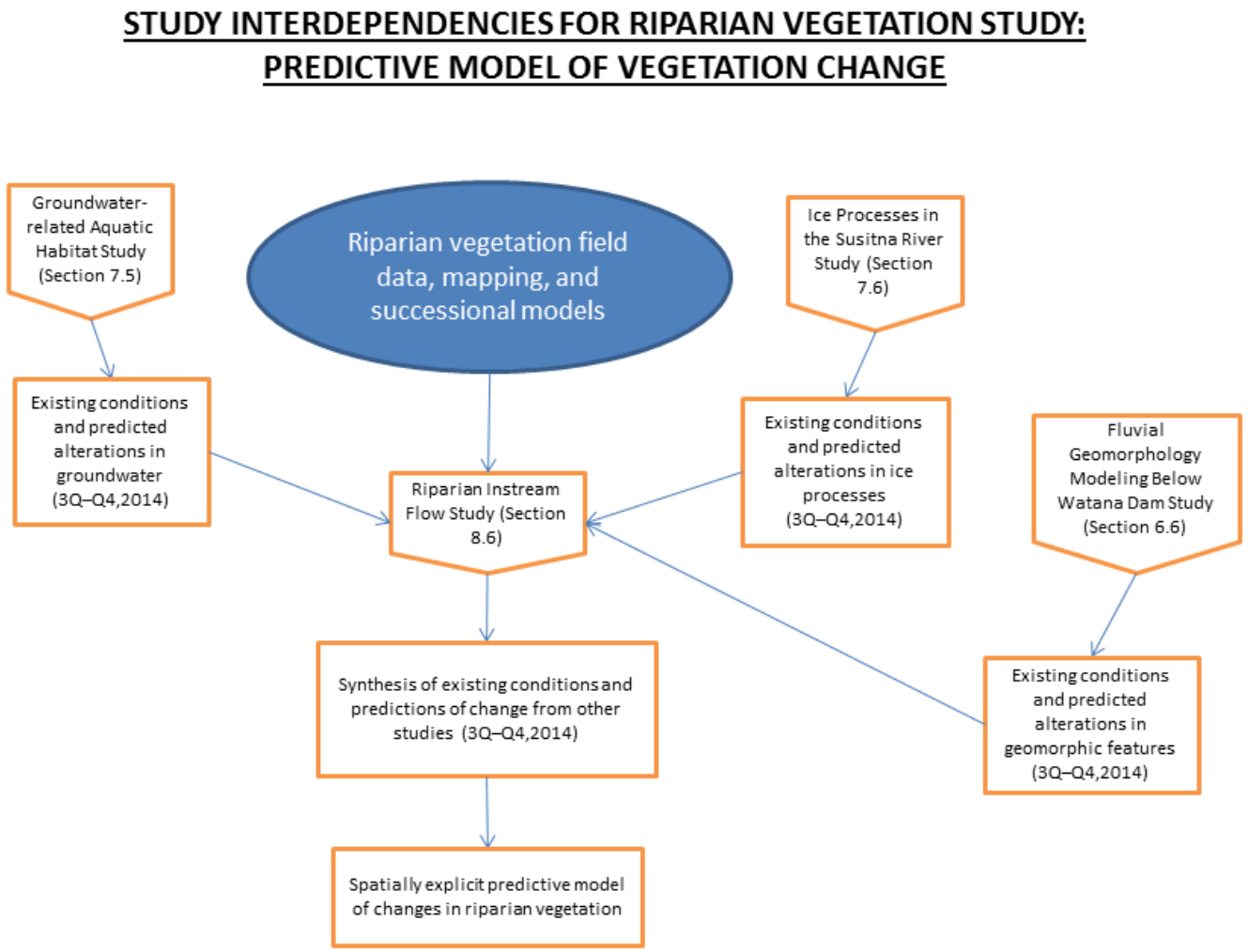

Figure 11.6-4c. Study interdependencies for the riparian vegetation study (continued).

11.7. Wetland Mapping Study in the Upper and Middle Susitna Basin

11.7.1. General Description of the Proposed Study

In the Wetland Mapping Study in the Upper and Middle Susitna Basin, AEA will identify and map the extent of wetlands in the in the upper and middle Susitna basin where the reservoir and Project infrastructure is proposed. The mapping will encompass the inundation zone of the proposed reservoir, the dam site and associated infrastructure, and the three possible access route and transmission-line corridors. The wetlands occurring downstream of the dam site in riparian areas will be mapped in a separate study, the Riparian Vegetation Study Downstream of the Proposed Susitna-Watana Dam (see Section 11.6). Mapping methods in the wetland mapping study and riparian vegetation study are compatible, and the final map products will result in wetlands being mapped consistently in the Project area above the proposed dam and in riparian areas downstream of the dam site. The mapping of wetlands in the upper and middle Susitna basin will be conducted using current, high-resolution aerial photography and satellite imagery. The study will involve field surveys to collect ground-reference data to link the photosignatures in the study area (see Section 11.7.3 below) to known wetland types, and in the office, the boundaries for the identified wetland types will delineated by on-screen digitizing in GIS using the aerial photography and satellite imagery for the study area as the base data layers. The wetland classification to be used in the study will be a hybrid classification specific to the wetlands in the study area, but it will be compatible with existing wetland classification systems used elsewhere in Alaska, especially the system used by the Matanuska-Susitna Borough. A wetland functional assessment also will be conducted in the study to determine the specific functions that the wetlands in the study area provide.

Study Goals and Objectives

The overall goal of the wetland mapping study is to prepare a baseline map of the existing wetland habitats in the upper and middle Susitna basin (upstream of dam site). This mapping information eventually will be used in 2015 (see Section 11.7.7 below) to assess impacts to wetland resources from the proposed Project, and to develop protection, mitigation, and enhancement (PM&E) measures, as appropriate.

The specific objectives of the wetland mapping study are to:

- Identify, delineate, and map wetlands in the upper and middle Susitna basin in GIS; and
- Determine functional values for the mapped wetland types.

This multi-year study is being initiated in 2012 and will be continued in 2013 and 2014. Results from the first year of work in 2012 will be used to update future versions of this study plan, as needed, to (1) fine-tune the field investigations and mapping efforts for the existing conditions found in the study area, and (2) customize the mapping work (e.g., study area) to reflect further refinements in the design of the Project.

11.7.2. Existing Information and Need for Additional Information

Wetlands were mapped for the Alaska Power Authority's Susitna Hydroelectric Project (APA Project) in the 1980s through a cooperative agreement between U.S. Fish and Wildlife Service (USFWS) and the APA to produce a preliminary wetlands map for the APA Project area at a

scale of 1:63,360. Those wetlands map data were based on the vegetation mapping completed by McKendrick et al. (1982), with some additional modification using stereoscopic photo-interpretation, and are now a part of the National Wetlands Inventory (NWI; USFWS 1984). The Alaska Vegetation Classification (AVC; Viereck and Dyrness 1980) vegetation classes that were mapped in the early 1980s were cross-referenced and converted into wetlands classes using the classification scheme of Cowardin et al. (1979).

The NWI mapping data will help in understanding the types of wetlands that occur in the study area, but the mapping was not conducted at a scale sufficient for determining Project impacts on wetland resources. When mapping at the 1:63,360 scale, small drainages and other small wetland habitats are often overlooked. Additionally, ground verification of NWI wetlands maps typically is fairly limited. Because those NWI data are nearly 30 years old, and because vegetation, hydrology, and soil conditions likely have changed over that period (see below), an updated map of wetlands will be needed for the proposed Project. NWI maps from the 1980s will not reflect recent landscape changes due to fire, insect outbreaks, development, and climate change. In particular, reductions in forest cover from fires (Kasischke and Turetsky 2006, Kasischke et al. 2010), insect outbreaks (Werner et al. 2006), and permafrost degradation (Jorgensen et al. 2001) have been documented in recent decades in Interior Alaska. These recent landscape changes will not be represented in wetlands mapping data from the 1980s.

11.7.3. Study Area

The proposed study area for wetlands mapping consists of a 2-mile buffer surrounding those areas that would be directly altered or disturbed by development of the Project (Figure 11.7-1). All direct and indirect effects of the proposed Project on wetlands are expected to be encompassed in a 2-mile buffer surrounding the Project infrastructure. (The 2-mile buffer in Figure 11.7-1 was drawn from the road/transmission centerlines, from the polygon surrounding the proposed construction/dam/infrastructure area, and from the 2,050-ft level in the proposed reservoir.) The study area includes three possible alternatives for road and transmission lines, the proposed reservoir inundation area, and supporting facilities. The Chulitna Corridor includes east-west running transmission lines and a road north of the Susitna River connecting to the Alaska Intertie and the Alaska Railroad near the Chulitna station. Another east-west configuration would follow a corridor south of the Susitna River running to Gold Creek station. A third corridor, the Denali Corridor, runs north, and would connect the dam site to the Denali Highway by road over a distance of about 44 miles. If transmission lines are run north up the Denali corridor, they would need to also run west along the existing Denali Highway to connect to the Alaska Intertie near Cantwell.

In areas paralleling the Susitna River between the dam site and Gold Creek, wetlands within the 2-mile study-area buffer (Figure 11.7-1) will be mapped up to the boundary of the riparian vegetation study area (see Section 11.6). The alteration of wetland habitats downstream of the dam (due to changes in instream flow, groundwater/surface water interactions, ice processes, and fluvial geomorphic features in the Susitna River) will be addressed in the riparian vegetation study. No placement of fill in wetlands is expected to occur downstream from the proposed dam; thus, a wetlands map will not be needed for the Clean Water Act Section 404 wetlands permit application for the Project (this has been confirmed by the U.S. Army Corps of Engineers [USACE]; see Section 9.7 in AEA 2011). In the riparian study, successional vegetation, wetlands, and wildlife habitats will be mapped. Mapping and prediction of changes in riparian

habitats from construction of the Project will be developed in collaboration with the AEA study teams for riverine physical processes, most notably instream flow, ice processes, and riverine geomorphology (see Section 11.6).

11.7.4. Study Methods

In general, the wetlands mapping for the study area will follow the protocols for preparing wetland maps that have been developed by the U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) program (National Wetlands Inventory Center 1995, Dahl et al. 2009), but wetlands will be classified using the elements of three different wetland classification systems: Cowardin et al. (1979), hydrogeomorphic (HGM) (Brinson 1993), and Viereck et al. (1992) Level IV vegetation types. Wetland types will be defined based on a number of landscape, geomorphic, hydrological, and biological variables, including the wetland classification systems above. This integrated classification approach is similar to a regional classification system developed for lowlands in the Cook Inlet basin (Gracz 2011), and thus will allow cross-referencing between the two classifications where they identify similar wetlands. This approach was agreed to during meetings with resource management agencies regarding the wetland mapping study in spring 2012 (see Section 9.7 in AEA 2011).

In addition to the wetlands mapping needed for supporting a Clean Water Act Section 404 dredge and fill permit application, a wetland functional assessment for the mapped wetland types will be prepared for a wetland impact assessment and mitigation plan to be completed at a later date. As agreed to with resource management agencies (see Section 9.7 in AEA 2011), the set of wetland functions to be assessed will be tailored to those expected to be of most importance in remote regions of Alaska in which landscape disturbances are few. The wetland functional assessment will be based on HGM principles. Although draft HGM guidebooks have been prepared for the Cook Inlet basin (Hall et al. 2003) and Interior Alaska (Alaska Department of Environmental Conservation and USACE 1999), the models are confined to a small set of HGM classes and are regionally specific; thus, they are not applicable to the Susitna basin, which lies in the transition zone between Interior Alaska and Cook Inlet and includes montane and riverine environments. As a result, the rapid assessment procedure developed by Magee (1998) is proposed to be used as the basis for assessing wetland functions, but the procedure (and parameters measured) will be modified as needed to evaluate wetland functions unique to the study area.

At a minimum, the wetland mapping study will include the following components:

- Initiate wetlands mapping using data collected during field surveys in summer 2012
- Preselect 2013 and 2014 field sampling locations and conduct field wetland determination and functional assessment surveys
- Revise preliminary wetlands map using field data collected in 2013 and 2014
- Incorporate data from the vegetation and wildlife habitat mapping study and available data on natural fire patterns along the reservoir reach of the Susitna River into the mapping of wetland types
- Report on the 2013 study results (Initial Study Report) and 2014 study results (Updated Study Report)

11.7.4.1. Wetlands Classification and Mapping

Prior to the 2013 field season, a preliminary map of wetland and upland boundaries will be created in areas where high-resolution imagery (0.3- to 1-ft pixels) is available. The map will be produced by digitizing polygons on-screen in ArcGIS 10.0, using ground-reference survey data collected in 2012. The goal of the preliminary mapping is to establish a reasonable set of characteristic wetland types that occur in the mapping study area, which will be used to guide field survey efforts in 2013 and 2014.

Classification and mapping of the study area will follow the protocols for preparing wetland maps that have been developed by the USFWS NWI program (National Wetlands Inventory Center 1995, Dahl et al. 2009). These protocols describe requirements for boundary delineation, polygon size, classification, and NWI annotation. The minimum mapping polygon size for most upland and wetland habitats will be 0.5 acres, with smaller polygons (0.1 acre) delineated for water bodies and other wetlands of ecological importance. Wetland and upland boundaries will be delineated based on color signature, plant canopy, and surface relief, along with hydrological indicators such as drainage patterns and surface water connections. As noted above, the classification of wetlands will incorporate elements of three different wetland classification systems: Cowardin et al. (1979), HGM (Brinson 1993), and Viereck et al. (1992) Level IV vegetation types. Wetland types will be defined based on a number of landscape, geomorphic, hydrological, and biological variables, including the wetland classification systems above, and the presence or absence of permafrost. This integrated approach is similar to a regional classification system developed for lowlands in the Cook Inlet basin (Gracz 2011), which improves upon Cowardin et al. (1979) by incorporating region-specific landscape, geomorphic, and wetland function features into the classification. The Cook Inlet system is specific to Cook Inlet lowlands, however, and many wetland types in the study area (which largely occurs at higher elevations) are unlikely to be represented in the Cook Inlet classification. Developing Project-specific wetland types will allow cross-referencing between the two classification systems and the identification of appropriate Cook Inlet classes for applicable lowland wetlands. Field parameters assessed that will be used to assist in developing Viereck Level IV and Cook Inlet basin vegetation and wetland classes include shrub and tree species canopy height, soil organic matter content, hydrologic regime, electrical conductivity, pH, presence of a restrictive layer, and geomorphic observations such as macro- and microtopography, slope, aspect, and surface form (e.g., eolian, fluvial, lacustrine, till).

The wetlands map will be revised in 2013 and 2014 following completion of the field surveys and the acquisition of additional imagery. The mapping will undergo a rigorous QA/QC review using tools developed by ABR and the Wetlands Data Verification Toolset developed by the NWI program to identify incorrect codes, digital anomalies, unattributed (null) polygons, adjacent polygons with the same coding, and digital slivers (< 0.01 acre). The NWI toolset was created using Environmental Systems Research, Incorporated's (ESRI) ModelBuilder (http://www.fws.gov/wetlands/Data/Tools-Forms.html).

Suitable high-resolution imagery (0.3- to 1-ft pixels) is not yet available for the entire study area; additional imagery acquisition is anticipated during the 2013 field season (the imagery will include both natural color and infrared formats). Thus, the detailed mapping of wetland types in 2013 will be limited to those areas with high-resolution imagery: a corridor around the Upper Susitna River, which covers the southern part of the reservoir inundation zone and in the vicinity

of Cantwell along the Denali corridor. Moderate-resolution RapidEye imagery (> 4-ft pixels), in a false natural color format, may be used for creating preliminary NWI and HGM classes and selecting field sample plots for the 2013 field season, but fine-scale mapping is only possible through the use of high-resolution imagery.

11.7.4.2. Field Surveys

The wetland field surveys will be organized to collect data from as many wetland types as possible in a way that maximizes safety and efficiency. The preliminary mapping effort described above will be used to preselect sampling transects and wetland-determination plots, although additional plots may be established in the field to describe transitional habitats or areas not discernible using photosignature features alone. Field plots will be sampled along transects located within major physiographic types, including riverine, lacustrine, lowland, and upland areas.

Wetland determinations will be made using the standard three-parameter approach described in the 1987 Corps of Engineers Wetlands Delineation Manual (Environment Laboratory 1987) and Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Alaska Region (Version 2.0) (USACE 2007). Field surveys will be conducted between June 15 and September 15, which is well within the median dates of the onset of vegetation green-up in spring and vegetation senescence in fall for south-central Alaska, as specified in the 2007 Regional Supplement. To be classified as a wetland, a site must be dominated by hydrophytic plants, have hydric soils, and show evidence of a wetland hydrologic regime. At each wetland determination plot, percent areal cover of plant species within each stratum (herb, shrub, and tree) will be visually estimated, generally within a 10-m (33-ft) radius of relatively homogeneous vegetation as specified in Environmental Laboratory (1987). The size and dimensions of the plots may be modified, however, depending on the site characteristics of the plant community (e.g., narrower plots in riparian fringe habitats). Additional documentation at each plot will include observations of wildlife use (e.g., stick nests, dens) and other site characteristics that reflect habitat quality and wetland function. Additional vegetation structure information for both vascular and nonvascular plants will be recorded to assist in evaluating use of the wetland types by birds and mammals.

In addition to wetland determination plots, ground-verification plots will be established for improving the accuracy of the overall mapping effort. At these plots, the dominant vascular plant species, Cowardin et al. (1979) wetland class, and Viereck Level IV vegetation class (Viereck et al. 1992) will be assigned. These verification assessments will be performed in areas where the wetland or upland status has been well documented in determination plots elsewhere, and will be used to improve map accuracy by increasing the number of documented wetland types tagged to particular aerial photosignatures.

A mobile Trimble® Nomad™ series GIS unit will be used to record the field wetlands data (using the WetForm database), record GPS location, and provide field access to aerial imagery and the preliminary mapping performed prior to the field survey. WetForm is a proprietary relational database used to enter wetlands site data in the field, and it facilitates the preparation of electronic copies of the USACE 2007 Regional Supplement dataform for each wetland determination plot. Additional data to support the wetland classification and functional assessment efforts will be collected electronically at each plot using an Android tablet computer.

11.7.4.3. Wetland Functional Assessment

Based on discussions with resource management agencies while planning the 2012 wetland mapping study (see Section 9.7 in AEA 2011), wetland functions in the study area will be assessed using HGM principles (Smith et al. 1995). Similar to formal HGM methodologies, HGM classes as defined by Brinson (1993) (e.g., depressional, slope, lacustrine fringe) will be used. The functional capacity of each wetland type will be assessed following Magee's (1998) rapid-assessment procedure, which involves incorporating field data into HGM-specific models. The Magee (1998) rapid-assessment procedure provides a means for collecting field data relevant to HGM assessments within a time frame compatible with the schedule for the Project. The procedure also has several key elements that make it suitable for use in this Project:

- It provides the flexibility needed for developing HGM models that are relevant to the Susitna basin.
- The rule-based, qualitative approach to assessing wetland function is important because its remoteness, and because virtually no multi-year, quantitative data on wetland ecosystem parameters are available for the Susitna basin.
- It incorporates lLandscape, hydrologic, soil, and vegetation variables into the model.
- The method has a high degree of repeatability, which helps ensure consistency in recording field observations by multiple observers.
- New functional assessment parameters can be added as needed.

In addition to the rapid-assessment procedure, for some wetland functions (described below), Project-specific data will be incorporated into the functional assessment and wetland function will be assigned to specific wetlands in the study area depending on their geographic location.

As agreed to with resource management agencies (see Appendices 3 and 4), the following set of 10 wetland functions will be evaluated using a combination of field data from this and other Project studies (see Figure 11.7-2), and will include GIS analyses of the spatial occurrence of the wetland types identified in the study area:

- Modification of groundwater discharge
- Modification of groundwater recharge
- Storm and flood-water storage
- Modification of stream flow
- Modification of water quality, including sediment retention and nutrient and toxicant removal
- Export of detritus
- Contribution to abundance and diversity of wetland vegetation
- Fish and wildlife habitat
- Consumptive uses
- Uniqueness

In the field, at each wetland determination plot, data reflecting wetland functional capacity will be collected for hydrologic variables (e.g., surface water pH, wetland water regime, presence of seeps or springs), soil (e.g., organic or mineral soils), and vegetation variables (e.g., dominant wetland type, vegetation interspersion) following Magee (1998). These data will be run through HGM-class-specific models (Magee 1998) to determine a base level of functional capacity for

each mapped wetland type for 7 of the 10 functions (all except fish and wildlife habitat, consumptive uses, and uniqueness).

The modification of groundwater discharge and modification of groundwater recharge functions will be determined with field data collected in this study. The presence of seeps or springs is a direct indicator of groundwater discharge, and is incompatible with groundwater recharge (Magee 1998). In locations with documented seeps and springs, individual polygons will be given the highest possible score for groundwater discharge and the lowest possible score for groundwater recharge. In wetlands without seeps and springs, groundwater recharge is assumed to occur.

The fish and wildlife and habitat functions will be assessed by incorporating Project-specific fish and wildlife occurrence data to derive spatially explicit functional capacity indices indicating which specific wetlands in the study area provide those habitat functions and to what degree. Fish-occurrence data for the study area from the fish distribution and abundance studies (see Section 9) will be used to attribute individual wetland (water body) polygons known to support fish, which will then be given higher rankings for the fish habitat function; rankings will be determined based on the number of fish species present so that water bodies supporting more species and a greater number of life-history stages will be ranked higher. Data from the wildlife studies (Section 10) will be used to identify habitat features important for particular species of birds and mammals and specific regions in the study area that are heavily used by wildlife. This information then will be used to evaluate the use of the mapped wetland types by a set of wildlife species of concern; essentially this will entail conducting habitat-use evaluations for wetland types instead of habitat-use evaluations for wildlife habitat types (as will be done in the evaluation of Evaluation of Wildlife Habitat Use; see Section 10.19). Wetlands known or expected to support wildlife will then be given a higher functional capacity index for wildlife habitat. As with the fish habitat function, those wetlands that support a greater number of wildlife species and more life-history stages will be ranked higher.

Magee (1998) does not include models for consumptive uses or uniqueness. If possible, the evaluation of the consumptive uses function will be spatially explicit, using Project-specific recreational- and subsistence-use data (see Sections 12.5 and 14, respectively) to indicate which general regions in the study area are used currently (actual use for recreation and subsistence activities such as hunting, trapping, fishing, berry picking). The coarse spatial resolution of the recreational- and subsistence-use data, however, likely will preclude a determination of which specific wetland types are being used, so a likelihood of actual use will be assigned based on the vegetation structure and plant species composition in each wetland type and proximity to access points. The potential for additional consumptive use in other parts of the study area after Project construction will be assessed in GIS by identifying those wetland types that are likely to be used now, as described above, and then determining the locations of those types where they occur adjacent to the proposed access road. Those wetland areas that could be more easily accessed via the new road will be categorized with a potential consumptive use value specific to the possible future use(s).

The specific definition of wetland uniqueness will be determined after the mapping of wetland types in the study area is complete. The uniqueness function will be used to identify those wetland types and their specific occurrences in the study area that are regionally scarce relative to other more common wetland types.

The study area lies within zones of discontinuous and sporadic permafrost (Brown et al. 2001), and permafrost is known to affect the functional capacity of wetlands (e.g., by slowing biogeochemical reaction rates due to low temperatures and reducing groundwater recharge). The presence or absence of permafrost will be included in the classification of wetland types (see Section 11.7.4.1 above), thus allowing distinctions between the functional capacities of permafrost and non-permafrost wetland types.

11.7.4.4. Reporting and Data Deliverables

The reports and data deliverables for this study include:

- **Electronic copies of field data.** A geospatially-referenced relational database of historic (APA Project) data and data collected during the 2012–2014 field seasons, including representative photographs of wetland types 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.
- **Wetland map in ArcGIS and PDF formats.** The preliminary and final wetland maps will be developed and delivered according to the schedule indicated below. 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. AEA will use ADNR's webmap application to develop interactive digital wetland maps, which will provide access to information on specific map polygons and other map features.
- **Initial Study Report and Updated Study Report.** The wetland mapping study results will be presented in the Initial and Updated study reports, according the schedule indicated below. The reports will include descriptions of the wetland types identified; a summary table (acreages) of the wetland types and upland areas represented in the wetlands mapping effort; a description of the vegetation, hydrology, and soils of the wetland types identified; the models used for the functional assessment; and descriptions of the potential impacts to wetland types from development of the Project. The Initial Study Report will include recommendations for the 2014 field survey effort. Both reports also will include field wetland dataforms for each plot surveyed, and field plot photos including site, ground, and soil photographs.

11.7.5. Consistency with Generally Accepted Scientific Practice

Wetlands in the study area will be identified using standard and accepted methods for the determination of wetlands in Alaska (Environment Laboratory 1987, USACE 2007). Similarly, wetland mapping will follow standard procedures for mapping wetlands across broad areas through onscreen digitizing in GIS over digital aerial imagery (National Wetlands Inventory Center 1995, Dahl et al. 2009). The mapping will be based on intensive ground-reference data, which is being collected in the vicinity of the proposed Project footprint, where most impacts will occur. The classification of wetlands in the study area will be done using a customized procedure based on several different wetland classification systems. The procedure to be used has been agreed to by licensing participants interested in wetlands mapping for the Project, and will provide data compatible with the mapping of wetlands in other areas surrounding the Project area.

11.7.6. Schedule

See Table 11.7-1 for schedule information for the wetlands mapping study. In 2014 and 2015, licensing participants will have opportunities to review and comment on the study reports (Initial Study Report in early 2014 and Updated Study Report in early 2015). Updates on the study progress will be provided during Technical Workgroup meetings, which will be held quarterly in 2013 and 2014.

11.7.7. Relationship with Other Studies

The relationships between the wetland mapping study and other Project studies are illustrated in Figure 11.7-2. The classification and mapping of wetlands in riparian areas along the Susitna River downstream of the proposed dam will be conducted in the riparian vegetation study (Section 11.6), and will be coordinated with the classification and mapping of wetlands in this study to yield a comprehensive map of wetlands for the Project area, both above and below the proposed dam.

There are a large number of other Project studies from which data inputs will be needed to support the wetlands functional assessment to be prepared as part of the wetland mapping study (Figure 11.7-2). Those relationships are described above in Section 11.7.4.3 in more detail, but briefly, data on the presence or absence of fish in specific water bodies in the study area (from the fish distribution and abundance studies; Section 9) will be used to prepare spatially explicit indices for the fish habitat function for the sampled water bodies. Similarly, data on the occurrence and habitat use of birds and mammals in the study area (from the wildlife studies; Section 10) will be used to prepare spatially explicit indices for the wildlife habitat function for those wetland types in specific portions of the study area that are known to be used by particular species of birds and mammals. From the Subsistence Baseline Documentation Study (Section 14) and the Recreation Resources Study (Section 12.5), data on the current consumptive uses in the study area will be used, if possible, to provide spatially explicit information on the current consumptive uses in the wetland types mapped in this study, and to provide the basis for determining the potential consumptive uses in other wetlands in the future with increased access along the Project road corridor.

Field wetland determination data (locations and standard USACE wetland determination forms), wetland map polygons, and functional assessment indices for the wetland types mapped in this study will be used in the Clean Water Act Section 404 wetlands permit application for the Project (Figure 11.7-2).

The wetland map polygons and functional assessment indices for the mapped wetland types will be used to assess impacts to wetlands from the proposed Project and to develop a set of PM&E measures to address wetlands, as appropriate. The wetland impact assessment will be performed in 2015, as part of the FERC License Application process and will be included in the Section 404 wetlands permit application. Direct impacts to wetlands and water bodies could occur in the form of habitat loss from the placement of fill and the conversion of palustrine wetlands to lacustrine habitats in the proposed reservoir. Direct habitat alteration could occur in those wetlands adjacent to areas of fill through construction activities (e.g., storage and laydown yards, vehicular traffic). Indirect habitat alteration could occur in wetlands adjacent to areas of fill due to erosion, fugitive dust accumulation, permafrost degradation, landslides, and off-road vehicle use. Additional indirect impacts in wetlands adjacent to the proposed reservoir could occur

through changes in local climatic conditions. Indirect impacts to riparian habitats (including wetlands) also could occur downstream of the proposed dam due to changes in instream flow, ice processes, and fluvial geomorphology in the Susitna River (hydrology, plant species diversity, and vegetation composition have the potential to be altered). These downstream effects will be addressed in the riparian vegetation study (see Section 11.6).

When analyzing effects to wetlands, researchers will quantify direct and indirect effects to wetlands (acreage per wetland type), and direct and indirect effects to wetland functions (acreage per wetland function) per development alternative. In the impact assessment, researchers also will identify which wetland types are particularly sensitive to disturbance, with assistance from Project study teams for permafrost and hydrology. Direct effects to wetlands will be determined in GIS by overlaying the Project footprint on the final wetland map polygons. Indirect effects to wetlands will be similarly determined by overlaying disturbance buffers (surrounding the proposed Project infrastructure) to identify areas likely to be affected by ancillary impacts associated with Project construction, operations, and maintenance. The size and number of disturbance buffer(s) will be based upon the final specifications for Project construction, operations, and maintenance activities, which will be provided in the Project description. Cumulative effects on wetlands in the region of the proposed Project will be assessed in the License Application document and the details of that analysis (e.g., the spatial scale and temporal extent for cumulative effects) will be defined at that time.

11.7.8. Level of Effort and Cost

The wetland mapping study is planned as a three-year effort; work began in 2012 and will continue in 2013 and 2014. Field sampling will be conducted each year during the growing season by four to eight observers (working in crews of two). Surveys will be conducted for approximately 20 days in each year. The level of effort for 2013 is expected to be considerably greater than in 2012, because the 2012 effort is focused only on those portions of the study area that have aerial photography coverage of sufficient resolution for preliminary mapping and field sampling. In 2013, high-resolution imagery should be available for the entire study area by early fall 2013, so the number of person-days dedicated to the field effort will be increased to support the expected increase in mapping effort when the high resolution imagery becomes available. Field surveys will be conducted in conjunction with the vegetation and wildlife habitat mapping study to maximize efficiency and reduce costs. A less extensive field survey and mapping effort is anticipated in 2014, as the study will be more focused on the final QA/QC of maps, wetlands map production, preparation of wetlands summary data tables, and the wetland functional assessment.

Total costs in 2013 are estimated at $500,000. A more limited field survey will be conducted in 2014 focusing on problem areas or areas where the field survey coverage to date is insufficient. Additional field data needed to support the wetland functional analysis will also be collected in 2014. Total costs in 2014 are estimated at $300,000.

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11.7.10. Tables

Table 11.7-1. Schedule for implementation of the Wetland Mapping Study in the Upper and Middle Susitna Basin.

Activity	2013				2014				2015
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q
Wetland mapping and field plot selection									
Field surveys		——	——						
Wetland map revisions and coordination of riparian areas mapping with riparian vegetation study team			——	——					
Initial Study Report				——	Δ				
Delivery of field data and preliminary wetland map				——					
Wetland mapping and field plot selection for remaining unmapped areas					——	——			
Field surveys						——	——		
Final wetland map revisions and coordination of riparian areas mapping with riparian vegetation study team							——	——	
Wetland functional analysis							——	——	
Updated Study Report								——	▲
Delivery of final field data and final wetland map								——	

Legend:

—— Planned Activity
Δ Initial Study Report
▲ Updated Study Report

11.7.11. Figures

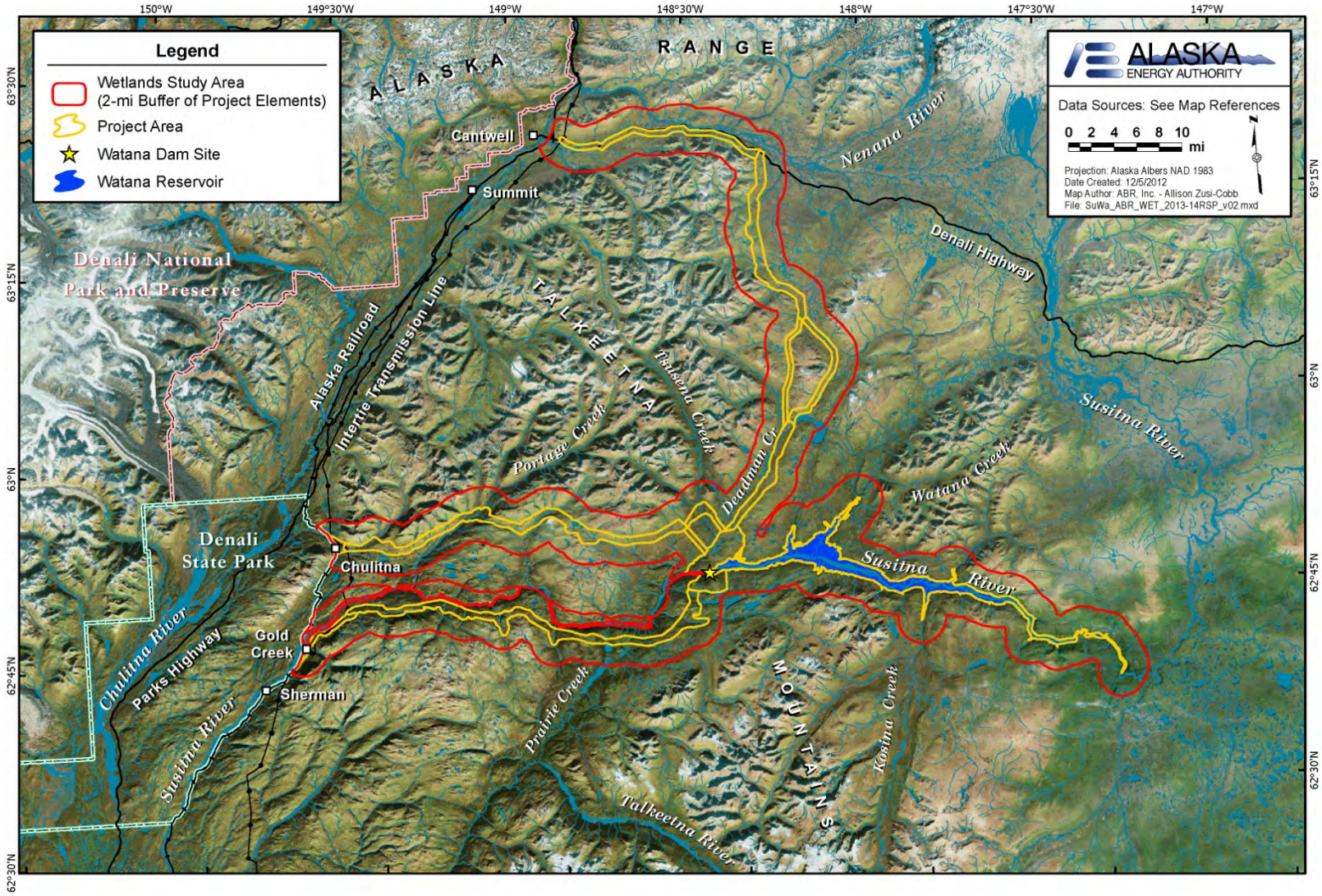

Figure 11.7-1. Study area for wetlands mapping in 2013 and 2014 in the Susitna-Watana Hydroelectric Project area.

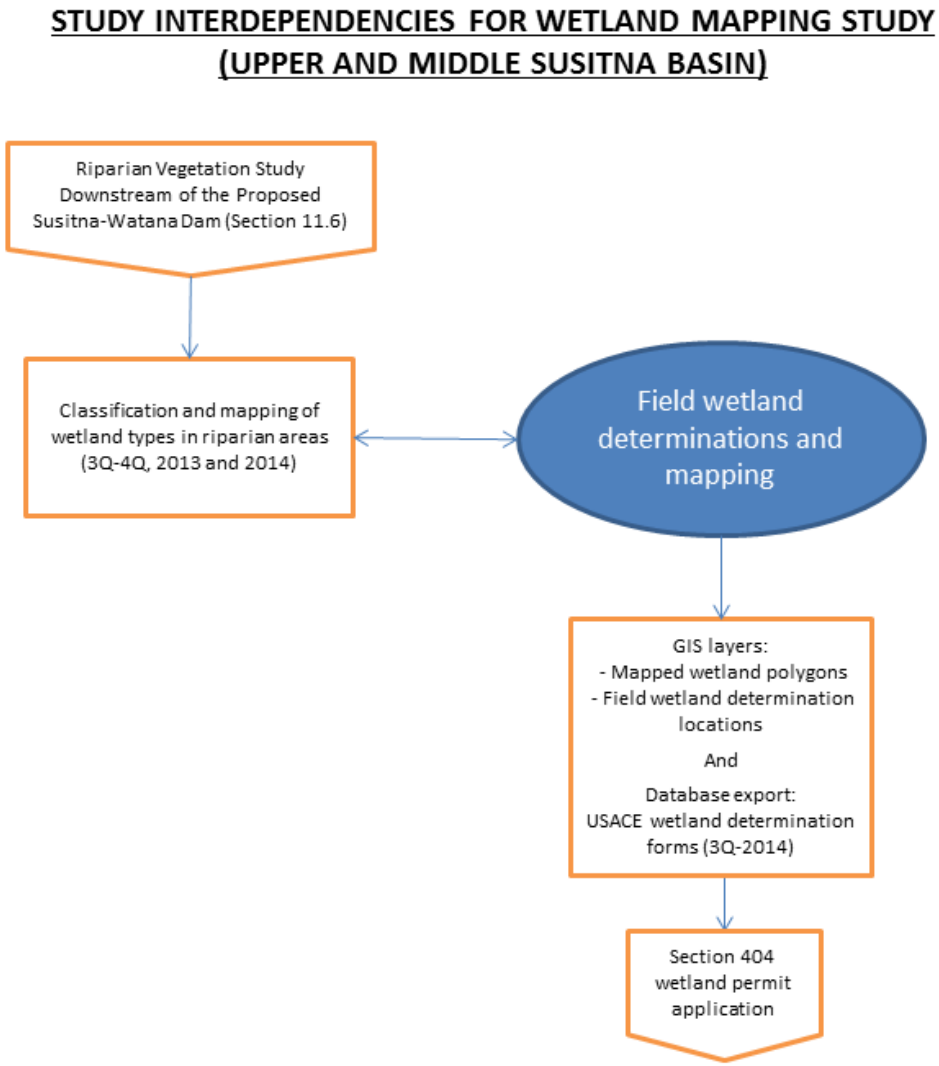

Figure 11.7-2a. Study interdependencies for the Wetland Mapping Study in the Upper and Middle Susitna Basin.

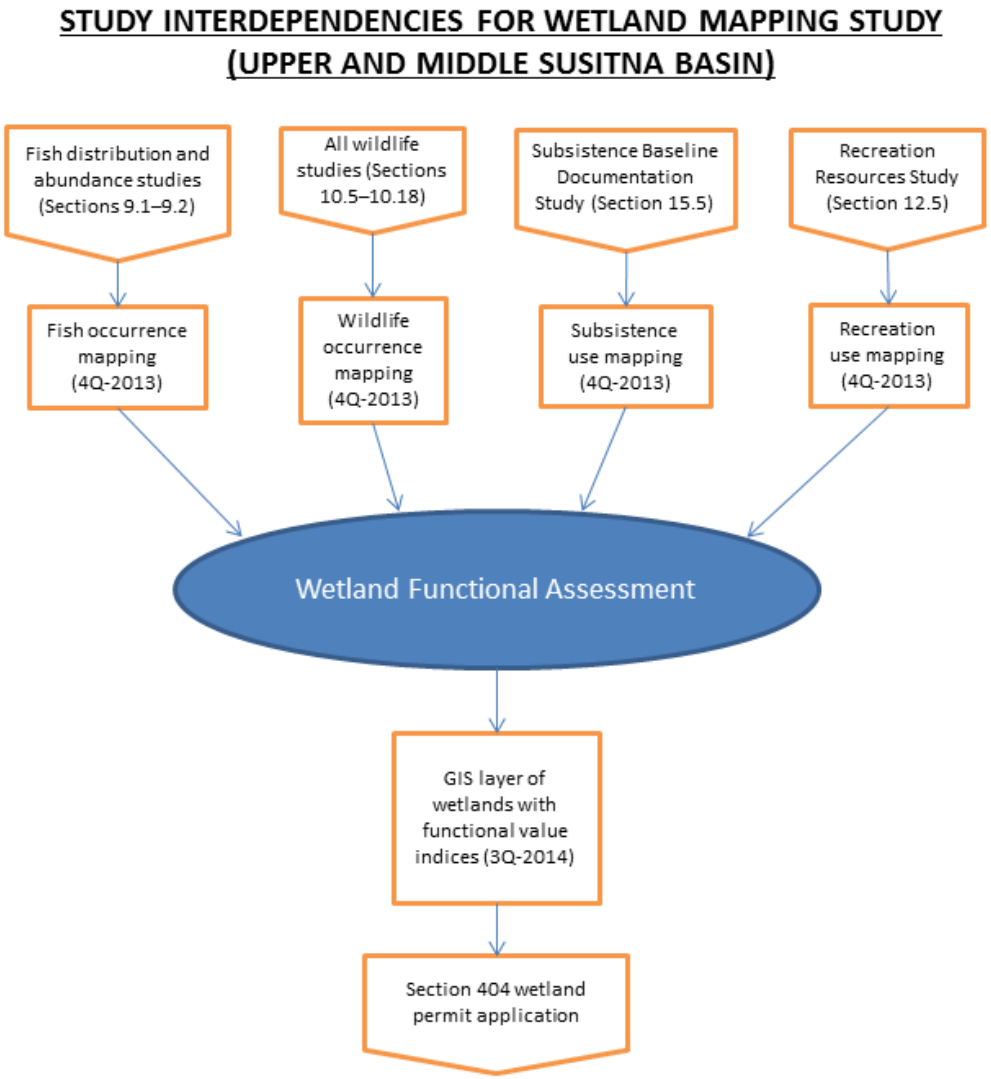

Figure 11.7-2b. Study interdependencies for the Wetland Mapping Study in the Upper and Middle Susitna Basin (continued).

11.8. Rare Plant Study

11.8.1. General Description of the Proposed Study

The Rare Plant Study is a field-based investigation in which AEA will identify appropriate habitats for a set of rare vascular species likely to occur in the Project area, and will conduct field surveys to search for any populations of rare plants that may occur. The focus of the surveys will be limited to those areas in which rare plant populations could be directly or indirectly affected by Project development activities in the upper and middle Susitna basin.

Study Goals and Objectives

The primary goal of the Rare Plant Study is to locate populations of rare vascular plant species that may occur in the upper and middle Susitna basin (upstream of Gold Creek) and may be affected by the Project. Rare vascular plant species in Alaska currently are being tracked in a database maintained by the Alaska Natural Heritage Program (AKNHP 2012a); this database will be used as the source list for possible rare species in the Project area. The Rare Plant Study is designed so that habitats where rare plants may occur are identified and then surveyed to locate any rare plant populations present. These data then will be used in AEA's License Application (see Section 11.8.7 below) to assist with Project design, construction, and operations planning to help develop protection, mitigation, and enhancement (PM&E) measures, as appropriate.

The specific objectives of the Rare Plant Study are to:

- Locate populations of rare vascular plant species that may occur in those portions of the Project area that would be disturbed by Project construction and operations activities; and
- Estimate population sizes for rare species and map their current distributions.

The data on any rare plant populations found in this study will be used, in the FERC License Application (to be prepared in 2015), to estimate quantitatively the potential direct, indirect, and cumulative impacts to rare plants from Project construction and operations activities. The Rare Plant Study is planned as a two-year study (2013–2014) and will be formally initiated in 2013. Any rare species found (with identifications confirmed by the herbarium at the University of Alaska, Fairbanks) during the field surveys in 2012 for the Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin (Section 11.5), the Riparian Vegetation Study Downstream of the Proposed Susitna-Watana Dam (Section 11.6), and the Wetland Mapping Study in the Upper and Middle Susitna Basin (see Section 11.7) will also be documented and used to assist in the planning of the rare species field surveys in 2013 and 2014. This study plan will be updated if necessary, which could include fine-tuning the field survey methods and survey areas, based on the results from the first year of work in 2013 and on AEA's recommendations for the Initial Study Report (ISR), as well as ISR comments received by FERC staff, resource agencies, and other interested licensing participants.

11.8.2. Existing Information and Need for Additional Information

The AKNHP maintains a geospatial database, called BIOTICS, with collection locality and habitat information for rare and/or endemic vascular plants in Alaska (AKNHP 2012a). The species list from that database, known as the Rare Vascular Plant List, currently includes 306 taxa (AKNHP 2012b). In a review of rare plant collection locations from the BIOTICS

database—selected from within a broad region surrounding the Project area (AEA 2011)—19 species with state rankings of S1 (critically imperiled) and S2 (imperiled) were identified (Table 11.8-1). These species were selected from the previous Rare Vascular Plant Tracking List (AKNHP 2008), which was the most up to date list available in 2011. Species that are very rare in the state (5 or fewer occurrences or very few individuals) or that are especially vulnerable to extirpation from the state are given a S1 ranking, whereas species with 6 to 20 collections in the state and with a somewhat lower vulnerability to extirpation are given a S2 ranking (Lipkin and Murray 1997). A higher number of species in the search area were ranked as S3 (rare or uncommon; 21 to 100 collections in the state), but in this study, the focus will be on those species with the rarer state rankings (S1, S2, S1S2, and S2S3).

An aquatic species known as flatleaf pondweed or Robbins pondweed (*Potamogeton robbinsii*) was recorded in the APA Project area in the 1980s, in Watana Lake (McKendrick et al. 1982). That collection represents a second recorded observation for the species in the search area (the only other record was near the Summit airstrip in 1953). *P. robbinsii* is listed as S1S2 (critically imperiled or imperiled in Alaska) and as G5 (demonstrably secure globally), indicating that populations are more numerous outside Alaska. Characteristic of most rare species, many of the 19 listed rare plant taxa identified in the data review in the PAD (AEA 2011) often occur in a narrow range of habitats (e.g., *Artemisia dracunculus* on exposed bluffs). Given the wide array of habitats present in the Project area (e.g., alpine, subalpine, forest, meadows, bogs, fens), it is possible that other rare plant taxa besides *P. robbinsii* may occur in the Project area.

Field surveys for rare plants will be needed for the proposed Project to document any populations of rare species occurring in areas that would be disturbed by Project construction and operations activities. This information will be used to develop PM&E measures to address rare plant species, as appropriate.

11.8.3. Study Area

Because rare plant species typically occur in specific habitats, the study area for the survey of rare plants will be defined primarily by the locations of suitable habitats that could support rare plant species (and that could be affected by development activities) within the Project area. This study area is depicted in Figure 11.8-1. Field surveys will be conducted only in areas in and adjacent to those portions of the Project area in which habitat loss, alteration, and/or disturbance will occur (the reservoir impoundment zone, areas for infrastructure of the dam and powerhouse and supporting facilities, the proposed access route and transmission-line corridors, material sites, and temporary camps and staging areas). Habitats for rare species will be identified from the preliminary mapping of vegetation, wildlife habitats, and wetlands (see Sections 11.5 and 11.7), and from photointerpretation of plant habitats on aerial photos or remote-sensed imagery. To prioritize the field survey efforts, areas to be searched will be categorized as having low, moderate, or high potential for supporting rare plants (see Section 11.8.4). Surveys for rare plants downstream of the proposed dam currently are not planned because complete habitat loss (which could affect rare plant populations) through placement of fill and other construction activities will not occur in downstream riparian areas. This approach may be altered, however, if one or more rare species are suspected to occur in riparian habitats and are sensitive to habitat alterations that may result from Project development activities.

11.8.4. Study Methods

11.8.4.1. Field Surveys

The list of 19 rare species identified in AEA (2011), which have the rarer state rankings (S1, S2, S1S2, and S2S3; Table 11.8-1), will serve as the initial list of rare species to survey. Species that are less rare in the state (S3 and S3S4 rankings) will be recorded if encountered in the field, but the focus of the survey work will be on the rarer species. The broad, regional search area used for rare plants in the PAD (AEA 2011) was a large rectangular area encompassing the entire drainage of the Susitna River from the headwaters in the Alaska Range to the mouth at Cook Inlet. In early 2013, AEA, with the help of resource management agencies and the AKNHP, will refine this regional search area so that it encompasses, as much as possible, areas with landscape features and habitats similar to those occurring in the local study area of the Project. Then, in early 2013, a formal request will be made to the AKNHP for a listing of rare vascular plant species from the BIOTICS database that have been recorded in the updated search area. These species will be selected from the recently updated Rare Vascular Plant List (AKNHP 2012b). Using the collection-area information for the list of rare species from the BIOTICS database, the suitable habitats for each rare species will be identified. For cases in which the habitat information from the collected specimen(s) is sparse, additional information on the habitats for rare species will be obtained from the scientific literature. These habitat types will serve as the primary focus for the field survey efforts.

Prior to the field surveys in 2013 and 2014, the preliminary mapping of vegetation, wildlife habitats, and wetlands, which is to be conducted in 2012 and 2013 (see Sections 11.5 and 11.7), as well as current, high-resolution aerial photography and remote-sensed imagery will be reviewed to identify suitable habitats for the rare plant species within the study area.

No standardized protocols have been developed for conducting rare plant surveys in Alaska, but the reconnaissance sampling methodology used by the AKNHP (Carlson et al. 2006; modified from Catling and Reznicek 2003) provides a template for use in this study. Using this methodology, researchers identify survey areas based on site-specific criteria, including regional or locally unique geological features, suitable habitats for the species of concern, logistical feasibility, and areas with high environmental gradients to maximize the potential of encountering rare species. For this study, emphasis will be placed on identifying and surveying suitable habitats for each species that has some potential to occur in the study area (see above). By combining these landscape elements, regions within the study area will be categorized as having low, moderate, or high potential for supporting rare plants, and survey efforts will be prioritized in those areas with high and moderate potential.

Field surveys will be conducted by botanists skilled in the identification of vascular plants, who have extensive field experience in Alaska (including previous experience surveying for rare plants), and who are competent using local, statewide, and national-level taxonomic keys. Most identifications of rare plants will be made initially using the Flora of Alaska (Hultén 1968) and the Alaska Rare Plant Field Guide (Lipkin and Murray 1997). In some cases, the Flora of North America North of Mexico (FNAEC, 1993–2012) will be used, for those plant families that have been revised by the FNAEC. Final nomenclature for rare plant taxa will follow that used in AKNHP (2012). In cases where the field crew determines that the collection of several plants will not significantly impact the population, voucher specimens will be collected for verification

of identifications. The confirmation of plant identifications will be made by the University of Alaska Herbarium. Otherwise, photographs will be taken and detailed plant descriptions compiled to confirm identifications.

The habitat-specific surveys for rare plants will be conducted multiple times during the summers of 2013 and 2014, as needed, to coincide with the flowering times of the particular species being sought. The timing of these surveys will depend on which plant taxa are determined to have the potential of occurring in the study area. When encountered, rare plant observations also will be recorded during the field surveys for vegetation and wildlife habitat mapping and wetland mapping studies in 2012, 2013, and 2014.

11.8.4.2. Reporting and Data Deliverables

The reports and data deliverables for this study include:

- **Electronic copies of field data.** A geospatially-referenced relational database of the rare plant locations found during the 2013 and 2014 field seasons, including representative photographs of the rare plant populations, will be prepared. If permission is granted from the AKNHP, the records of rare plants from the BIOTICS database, which occur near the Project area, will also be included in the database. Naming conventions of files and data fields, spatial resolution, map projections, and metadata descriptions will meet the data standards established for the Project.
- **Rare plant maps in ArcGIS and PDF formats.** The preliminary and final maps of the locations of rare plant populations will be developed and delivered according to the schedule indicated below. Naming conventions of files and data fields, spatial resolution, map projections, and metadata descriptions will meet the data standards established for the Project.
- **Initial Study Report and Updated Study Report.** The Rare Plant Study results will be presented in the Initial and Updated study reports, according to the schedule indicated below. The reports will include descriptions of the rare plant populations found as well as detailed site characteristics, survey methodology, and the names and experience of the surveyors. The Initial Study Report will include recommendations for the 2014 field survey effort. Both reports also will include copies of site photographs.

11.8.5. Consistency with Generally Accepted Scientific Practice

The Rare Plant Study will be conducted using the most up to date information on the previous locations of rare plants near the Project area, from the BIOTICS database maintained by the AKNHP (2012a, b). The field protocols for the rare plant surveys will follow those outlined in the reconnaissance sampling methodology used by the AKNHP (Carlson et al. 2006; modified from Catling and Reznicek 2003) for rare plant surveys in Alaska. These methods are the current standards for field surveys of rare plants in Alaska and were developed by the AKNHP, which is the state authority on rare plants and field surveys for rare plants.

11.8.6. Schedule

See Table 11.8.2 for schedule information for the Rare Plant Study. In 2014 and 2015, licensing participants will have opportunities to review and comment on the study reports (Initial Study

Report in early 2014 and Updated Study Report in early 2015). Updates on the study progress will be provided during Technical Workgroup meetings, which will be held quarterly in 2013 and 2014.

11.8.7. Relationship with Other Studies

The Rare Plant Study will be completed with data inputs (see Figure 11.8-2) from three other Project studies: the vegetation and wildlife habitat mapping, riparian vegetation, and wetland mapping studies (Sections 11.5, 11.6, and 11.7). Suitable habitats for rare plant species to be surveyed in the field will be identified from aerial imagery and from the mapping of vegetation, wildlife habitats, and wetlands. In addition, any observations or collections of rare plants recorded during the vegetation and wildlife habitat mapping, riparian vegetation, and wetland mapping field surveys will be used to help streamline the rare plant field surveys.

The data collected during the Rare Plant Study (locations and estimated population sizes) will be used directly in AEA's License Application in 2015 to assess the impacts the proposed Project could have on populations of rare plant species in the Project area. The rare plant data also will be used, in the License Application, to develop a set PM&E measures to address any potential impacts to rare plant species, as appropriate. Direct impacts to rare plant species from development of the Project could occur in the form of habitat loss from the placement of fill and from the conversion of terrestrial vegetation to lacustrine habitats in the proposed reservoir. Indirect impacts could occur from erosion, fugitive dust accumulation, permafrost degradation, landslides, infestations of invasive species, and off-road vehicle use.

The impact assessment for rare plant species will be conducted in GIS by overlaying the Project footprint on the locations of rare plant populations to determine which populations would be affected directly by fill. Determining which populations could be indirectly affected will be conducted similarly by overlaying disturbance buffers (surrounding the proposed Project infrastructure) to identify which areas are likely to be affected by ancillary impacts associated with Project construction, operations, and maintenance. The size and number of disturbance buffer(s) to be used will be determined based upon the final specifications for Project construction, operations, and maintenance activities.

In the impact assessment, the potential impacts to rare plant species will be evaluated by quantifying the reductions in populations (0 to 100 percent) that could occur directly from fill associated with the development of each Project alternative. Potential for indirect impacts (percentage reductions in populations in the disturbance buffers noted above) will also be assessed. Cumulative effects on rare plant species 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.

11.8.8. Level of Effort and Cost

The Rare Plant Study is planned to be conducted over two years (2013–2014). Field sampling will be conducted each year during the growing season by a crew of two observers. It is anticipated that the level of effort in 2013 and 2014 will be roughly the same (14 days each year). The Rare Plant Study will be coordinated with the other botanical studies being performed for the Project to help facilitate the field surveys for rare plants and minimize costs. The field

crews for the vegetation and wildlife habitat mapping, riparian, and wetland mapping studies will document the locations of any rare plant species encountered during their field surveys in 2012 and 2013, and this information will be used to help prioritize the field surveys for the Rare Plant Study. The total projected cost for this study for 2013 and 2014 combined is estimated at approximately $220,000.

11.8.9. Literature Cited

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11.8.10. Tables

Table 11.8-1. Rare vascular plant taxa that have been collected in a broad region surrounding the Susitna River drainage (see AEA 2011).1

Scientific Name	Common Name	No. of Collections	State Rank[2]	Global Rank[3]
Arnica diversifolia	Sticky arnica	1	S1	G5
Arnica lessingii ssp. *norbergii*	Norberg arnica	1	S2	G5T2Q
Arnica mollis	Hairy arnica	1	S1	G5
Artemisia dracunculus	Dragon wormwood	2	S1S2	G5
Blysmopsis rufa	Red clubrush	1	S1	unranked
Botrychium ascendens	Upward-lobed moonwort	1	S2	G2G3
Carex athrostachya	Slender beak sedge	1	S1S2	G5
Carex parryana	Parry sedge	2	S1	G4
Ceratophyllum demersum	Common hornwort	1	S1	G5
Chamaerhodos erecta ssp. *nuttallii*	Nuttall's ground-rose	1	S1S2	G5T4T5
Cicuta bulbifera	Bulb-bearing water-hemlock	1	S2	G5
Eleocharis kamtschatica	Kamchatka spike-rush	1	S2S3	G4
Eriophorum viridicarinatum	Green-keeled cottongrass	1	S2	G5
Erysimum asperum var. *angustatum*	Wallflower	1	S1S2	unranked
Glyceria striata var. *stricta*	Fowl mannagrass	3	S2	G5T5
Maianthemum stellatum	Starry solomon-plume	4	S2	G5
Potamogeton obtusifolius	Blunt-leaf pondweed	2	S2S3	G5
Potamogeton robbinsii [4]	Flatleaf pondweed	1	S1S2	G5
Potentilla drummondii	Drummond cinquefoil	1	S2	G5

Notes:

1 Data from the Rare Vascular Plant Tracking List (AKNHP 2008), as represented in 2011 in the BIOTICS database of rare species (AKNHP 2012a).
2 State rarity rankings: S1 = critically imperiled, S2 = imperiled, and S3 = rare or uncommon.
3 Global rarity rankings: G2 = imperiled, G3 = rare or uncommon, G4 = apparently secure, G5 = demonstrably secure, T = rank of subspecies or variety, Q = indicates uncertainty about taxonomic status which may affect global rank.
4 A second record of this species was made by McKendrick et al. (1982) in the upper Susitna River basin (Watana Lake) (see AEA 2011).

Table 11.8-2. Schedule for implementation of the Rare Plant Study.

Activity	2013				2014				2015
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1Q
Refine regional search area for rare plant occurrences	—								
Review of BIOTICS data and field survey site selection		—							
Field survey		—	—						
Data analysis			—	—					
Initial Study Report				—	Δ				
Delivery of preliminary field data and rare plant population maps				—					
Review of 2013 data and field survey site selection						—			
Field survey						—	—		
Data analysis							—	—	
Updated Study Report								—	▲
Delivery of final field data and rare plant population maps								—	

Legend:

— Planned Activity
Δ Initial Study Report
▲ Updated Study Report

11.8.11. Figures

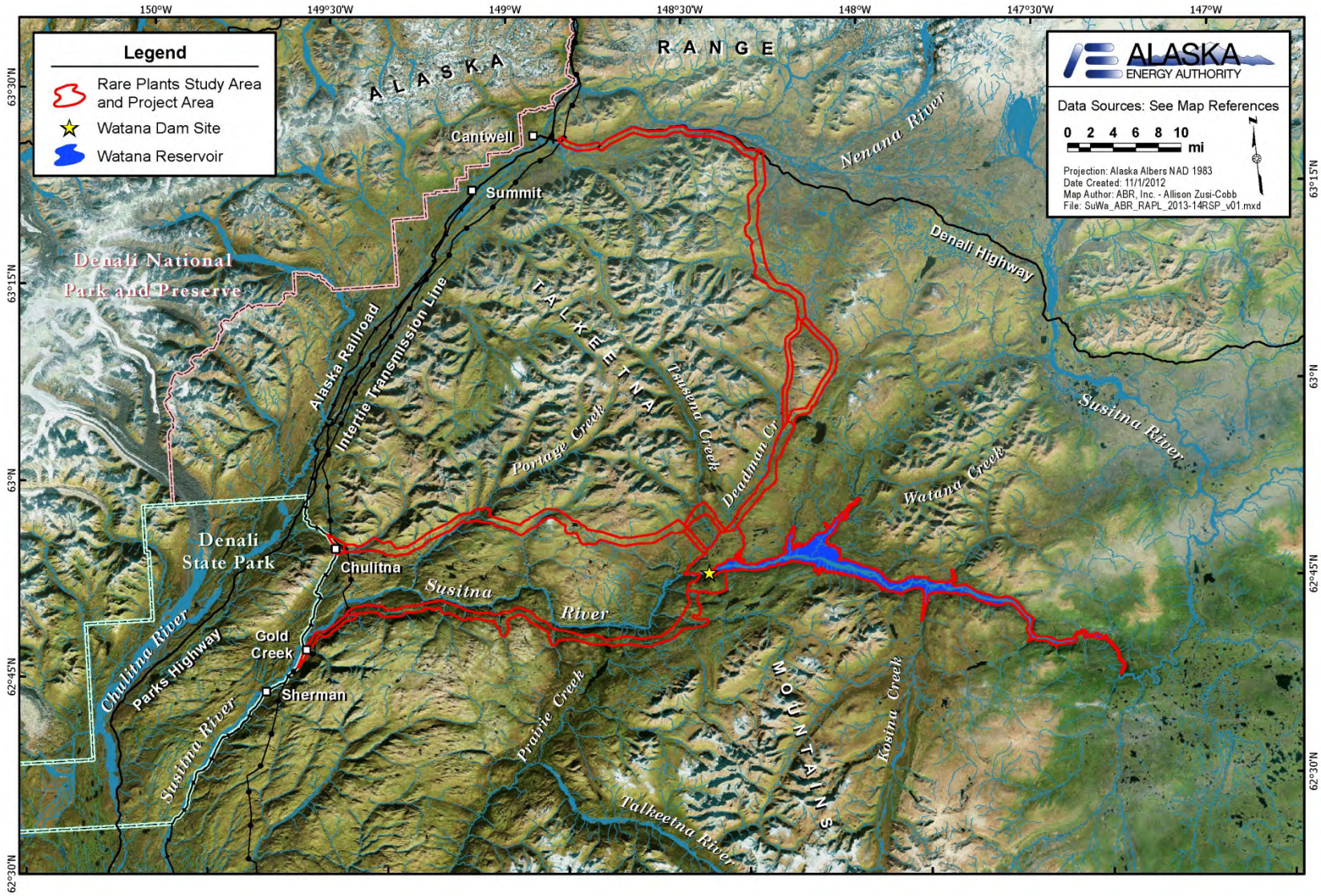

Figure 11.8-1. Study area for rare plant surveys in 2013 and 2014 in the Susitna-Watana Hydroelectric Project area.

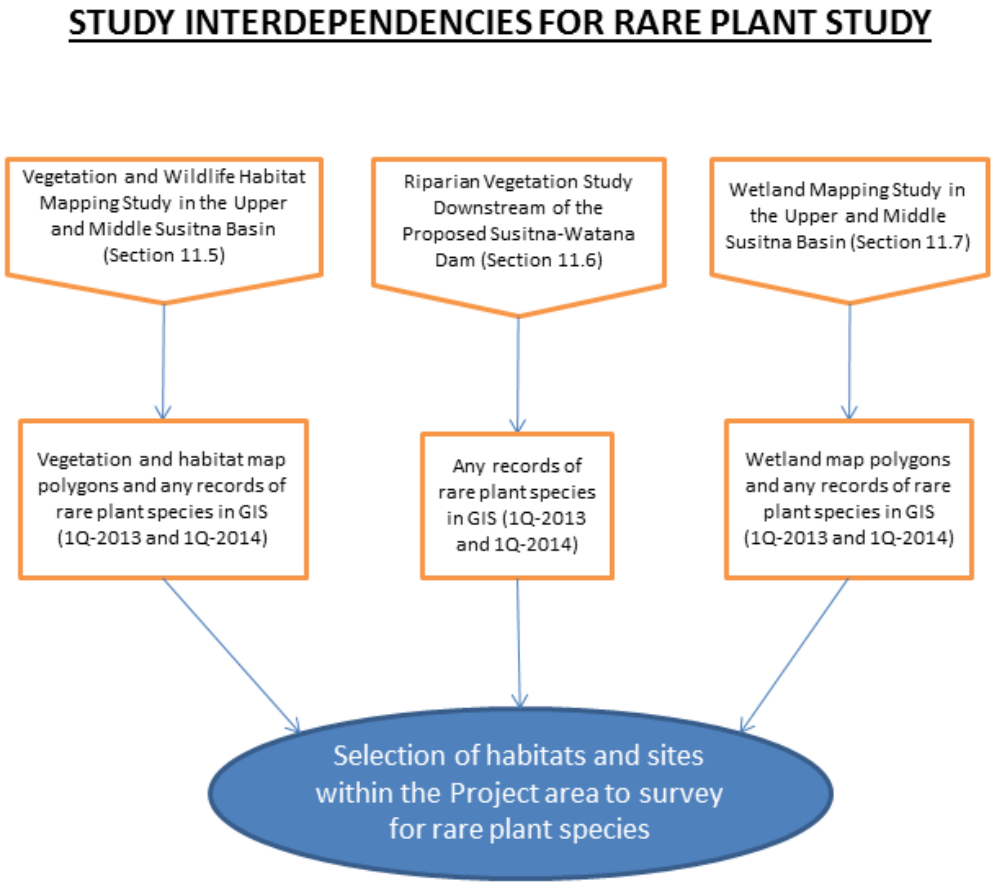

Figure 11.8-2. Study interdependencies for the Rare Plant Study.

11.9. Invasive Plant Study

11.9.1. General Description of the Proposed Study

The Invasive Plant Study is a field-based investigation in which AEA will identify disturbed habitats in and near the Project area that could serve as sources of invasive vascular plant species. Field surveys will then be conducted in those disturbed areas to locate populations of invasive species that have some potential to spread into, or farther into, the Project area associated with development activities. An ecological risk assessment will be conducted for the invasive species identified to evaluate the risk of the continued spread of those species because of Project development activities.

Study Goals and Objectives

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.

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 present could pose a substantial ecological threat.

The Invasive Plant Study is planned as a two-year study (2013–2014) that will be formally initiated in 2013. However, invasive species found during the field surveys in 2012 for the Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin (Section 11.5), the Riparian Vegetation Study Downstream of the Proposed Susitna-Watana Dam (Section 11.6), and the Wetland Mapping Study in the Upper and Middle Susitna Basin (see Section 11.7) were documented, and those records of invasive species will be used in planning the field surveys for invasive species in 2013 and 2014. Results from the first year of work in 2013 will be used to update this study plan, if needed, which could include fine-tuning the field survey methods and survey areas for invasive species, based on the results from the first year of work in 2013 and on AEA's recommendations for the Initial Study Report (ISR), as well as ISR comments received by FERC staff, resource agencies, and other interested licensing participants.

11.9.2. Existing Information and Need for Additional Information

No surveys of invasive vascular plants were conducted as part of the APA Project in the 1980s, primarily because the risk of invasive species was not considered a major concern at the time (AEA 2011). Resource management agencies have since become increasingly concerned, however, about the potential for invasive plant species to become established in Alaska as a result of construction activities associated with new development projects. As a result, the U.S. Forest Service, National Park Service, Bureau of Land Management, U.S. Fish and Wildlife Service, Department of Natural Resources Plant Material Center, and Alaska Natural Heritage Program (AKNHP) work in cooperation to support the Alaska Committee for Noxious and Invasive Plants Management (CNIPM) and the Strategic Plan for Noxious and Invasive Plants Management in Alaska (Hebert 2001). An outcome of the strategic plan was the development of the Alaska Exotic Plant Information Clearinghouse (AKEPIC) database. This geospatial database

is used to store invasive species occurrence and location information recorded in field surveys conducted throughout Alaska. The CNIPM provides updates regularly to the AKEPIC database as new surveys are conducted; the database is maintained by the AKNHP and can be accessed online (http://aknhp.uaa.alaska.edu/maps/akepic/).

Based on a search of collection localities in the AKEPIC database (AEA 2011), which included data from invasive plant surveys conducted along road systems in and near the Susitna basin and other regional plant surveys, 22 invasive plant species were found to occur in areas relatively near the proposed Project (Table 11.9-1). These 22 species have some potential to establish in the Project area (e.g., if seeds or reproductive shoots were brought in on construction equipment). Areas particularly vulnerable to the establishment of invasive plants include quarry sites, road edges, work pads, and gravel river bars (which are naturally disturbed by flooding and ice scouring). A species of particular concern is *Melilotus alba* (white sweetclover), which establishes readily and often forms monotypic stands along roadsides, trails, and river bars. The ability of this species to colonize linear features on the landscape is especially problematic because such features can act as corridors for dispersal and speed its establishment in new areas. *M. alba* already has been documented colonizing riparian areas along several of Alaska's glacially fed rivers, and low to moderate densities may promote 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).

Field surveys for invasive vascular plants will be needed to document the specific locations of invasive species in and near the Project area in order to assess the likelihood that Project development will further aid the spread of invasive species.

11.9.3. Study Area

Since invasive vascular plant species are generally confined to disturbed areas and the Project area is mostly undeveloped, the field surveys for this study will be focused initially on those areas that can act as potential pathways for invasive species to enter and establish in the Project area. Sections of the Parks and Denali highways that are relatively close to the alternative alignments for the access road and transmission lines, primitive roads or trails that currently provide access into the Project area, and other disturbed areas (see Section 11.9.4) will be surveyed. The specific locations and lengths of the highway segments to be surveyed will be defined during preparation for the field survey work in 2013, and will be based on the locations of the three possible alternative access corridors and their proximity to existing roadways. The primitive roads and trails and other disturbed areas to be surveyed will be identified from high-resolution aerial photography and remote-sensed imagery for the Project area. Some of this imagery exists now and additional imagery for those areas that are currently not covered will be acquired during summer 2013. Primitive roads and trails and other disturbed areas that occur within a 4-mile buffer surrounding the proposed Project infrastructure areas and that could be directly altered or disturbed by construction and operations activities (see Section 11.5, Figure 11.5-1) will be identified. As engineering design for the Project proceeds and final alternatives are developed, 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 to assess the extent to which invasive plant species are present. Surveys for invasive plants downstream of the proposed dam in riparian habitats currently are not being planned. Disturbance from construction and operations activities associated with the Project will not occur

in downstream areas; hence development of the Project will not result in an increase in potential disturbance vectors for the spread of invasives in downstream riparian areas.

11.9.4. Study Methods

11.9.4.1. Field Surveys

Prior to the field surveys in and near the Project area in 2013, recent aerial photography and remote-sensed imagery will be reviewed (see Section 11.9.3) to identify potential "hot spots" for invasive species. These include off-road vehicle trails, gravel roads, quarry sites, and other disturbances that may harbor invasives or are at risk for invasive plant colonization in association with the construction and operation of the proposed Project. The current records in the AKEPIC database will also be reviewed to determine what species have been recorded in the vicinity of the Project area. The areas where invasives have been recorded will be surveyed again to determine if the invasive species are still present and to assess whether the populations (in cases in which population estimates area available) are contracting, expanding, or are relatively unchanged since previous surveys.

Surveys for invasive vascular plants will be conducted in 2013 and 2014 following guidelines in the AKEPIC User Manual (AKNHP 2008). Suspected invasive species will be collected and the locations of populations recorded with a hand-held GPS receiver. Non-native species that are not considered invasive also will be noted. If possible, population estimates will be made by visually enumerating or estimating the number of plants in the area. If population estimates are not possible, the degree of infestation at each location will be ranked qualitatively as low (1–10 percent cover of assessment area), medium (10–40 percent cover), or high (>40 percent cover). The distribution and size of areas where invasive species are present are likely be highly variable, therefore use of a standard assessment area size (e.g., a 10-meter [33-foot] radius plot) will not be appropriate for evaluating the degree of infestation. Thus, the geographic limits of an infested area will be used to define the assessment area boundaries (these areas may be as small as 0.01 acre or as large as 2 acres). Species will be identified using Hultén (1968) and Identification of Non-native Plants in Alaska (AKNHP 2010). Collected specimens of selected species will be submitted to the University of Alaska Herbarium for confirmation of identifications. All field data will be made available for entry into the AKEPIC database. As engineering design and construction plans for the Project are further developed, the invasive plant work conducted in 2014 likely will be focused more on sources of invasive species closer to the Project area, such as gravel material sites, which could be used during construction activities and could result in the inadvertent transport of invasive species.

11.9.4.2. Ecological Risk Assessment

To assess the ecological risk of the invasive plant species found in and near the Project area to expand their distributions farther into the Project area, the U.S. Department of Agriculture (USDA) invasiveness rankings developed for selected species in Alaska (Carlson et al. 2008) will be used. 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. The invasiveness scores for each invasive species found during the

field surveys will be considered along with the number and size of the population(s) found, their proximity to proposed Project infrastructure and construction areas, and the species' dispersal mechanism(s) to rank the local ecological risk of spread and further infestation from development of the Project. In addition, to the extent possible, the potential impact of invasives on ecologically important native plant species will be identified. The data gathered in this study (i.e., local ecological risk rankings for each species) will be used to develop PM&E measures for inclusion in the License Application such as part of an invasive species management plan to address the risks of the introduction, spread, and establishment of invasive species in the Project area.

11.9.4.3. Reporting and Data Deliverables

The reports and data deliverables for this study include:

- **Electronic copies of field data.** A geospatially-referenced relational database of relevant records from the AKEPIC database and data collected during the 2013 and 2014 field seasons, including representative photographs of infested areas, 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.
- **Invasive species maps in ArcGIS and PDF formats.** The preliminary and final maps of the locations of invasive species populations will be developed and delivered according to the schedule indicated below. 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 Invasive Plant Study results will be presented in the Initial and Updated study reports according to the schedule indicated below. The reports will include descriptions of the invasive species populations found including estimated population sizes or degree of infestation, site characteristics, and the local ecological risk rankings for each species. The Initial Study Report will include any AEA recommendations for the 2014 field survey effort. Both reports also will include copies of field dataforms and field plot photographs.

11.9.5. Consistency with Generally Accepted Scientific Practice

The Invasive Plant Study will be conducted following the protocols described for invasive plant surveys in Alaska in the AKEPIC User Manual (AKNHP 2008). These methods are the current standards for field surveys of invasive plants in Alaska. The AKEPIC database of invasive plant records, which is maintained by the AKNHP, will be used as the primary source of current records of invasive species in and near the Project area. The AKEPIC database was developed by the CNIPM, which is a working group of six state and federal agencies organized specifically to address the ecological threat of invasive plant species in Alaska.

11.9.6. Schedule

See Table 11.9-2 for schedule information for the Invasive Plant Study. In 2014 and 2015, licensing participants will have opportunities to review and comment on the study reports (Initial Study Report in early 2014 and Updated Study Report in early 2015). Updates on the study

progress will be provided during Technical Workgroup meetings, which will be held quarterly in 2013 and 2014.

11.9.7. Relationship with Other Studies

The Invasive Plant Study will be completed with data inputs (see Figure 11.9-1) with data from three other Project studies: the vegetation and wildlife habitat mapping, riparian vegetation, and wetland mapping studies (Sections 11.5, 11.6, and 11.7). Disturbed sites within the Project area to be surveyed for invasive plant species will be identified from aerial imagery and from the mapping of vegetation, wildlife habitats, and wetlands. In addition, any observations or collections of invasive plants recorded during the vegetation and wildlife habitat mapping, riparian vegetation, and wetland mapping studies will be used to help locate populations of invasive plant species and streamline the field survey efforts.

The data collected during the Invasive Plant Study (locations, estimated population sizes, and ecological risk rankings for the invasive plant populations found) will be used directly in the FERC License Application in 2015 to assess the impacts the proposed Project could have on native plant species/communities through the spread of invasive species in the Project area. The invasive plant data also could be used to identify potential PM&E measures to address invasive species, as appropriate.

11.9.8. Level of Effort and Cost

The Invasive Plant Study is planned to be conducted over two years (2013–2014). Field sampling will be conducted each year during the growing season by a crew of two observers. The level of effort in 2013 is expected to be greater (10 days) than in 2014 (6 days). The goal in 2013 will be to survey the prominent disturbed habitats in and near the Project area, and work in 2014 likely will be focused on gravel material sites and other disturbed sites that may have been missed in the 2013 sampling. The Invasive Plant Study will be coordinated with the other botanical studies being performed for the Project to help facilitate the field surveys for invasive plants and minimize costs. The field crews for the vegetation and wildlife habitat mapping, riparian, and wetland mapping studies will document the locations of any invasive species encountered during their field surveys in 2012 and 2013, and this information will be used to help prioritize the field surveys for the Invasive Plant Study. The projected cost for this study in 2013 is on the order of $100,000. For 2014, the approximate cost is $50,000.

11.9.9. Literature Cited

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Hebert, M. 2001. Strategic plan for noxious and invasive plants management in Alaska. Cooperative Extension Service, University of Alaska Fairbanks. 20 pp.

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

11.9.10. Tables

Table 11.9-1. Invasive vascular plant species recorded on road-system surveys in and near the Susitna basin and in other plant surveys in the region of the proposed Project.

Scientific Name	Common Name	Invasiveness Rank[1]
Phalaris arundinacea	Reed canarygrass	83
Melilotus alba	White sweetclover	81
Cirsium arvense	Canada thistle	76
Prunus padus	European bird cherry	74
Sonchus arvensis	Perennial sowthistle	73
Vicia cracca	Bird vetch	73
Hordeum jubatum	Foxtail barley	63
Bromus inermis ssp. inermis	Smooth brome	62
Trifolium repens	White clover	59
Taraxacum officinale ssp. officinale	Common dandelion	58
Trifolium hybridum	Alsike clover	57
Crepis tectorum	Narrowleaf hawksbeard	54
Poa pratensis	Kentucky bluegrass	52
Poa annua	Annual bluegrass	46
Polygonum aviculare	Prostrate knotweed	45
Plantago major	Common plantain	44
Capsella bursa-pastoris	Shepherd's purse	40
Poa compressa	Flat-stem bluegrass	39
Chenopodium album	Lambsquarters	37
Cerastium glomeratum	Sticky chickweed	36
Matricaria discoidea	Pineapple weed	32
Brassica napus	Rapeseed mustard rutabaga	NR

Notes:

1 Assigned according to the Invasiveness Ranking System for Non-native Plants of Alaska (Carlson et al. 2008). Species are ranked on a scale of 0 to 100, with 100 being an extremely invasive species; NR = not ranked.

Table 11.9-2. Schedule for implementation of the Invasive Plant Study.

Activity	2013				2014				2015
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1Q
Review of AKEPIC data and field survey site selection		—							
Field survey		—	—						
Data analysis			—	—					
Initial Study Report				—	Δ				
Delivery of preliminary field data and invasive species maps				—					
Review of 2013 data and field survey site selection						—			
Field survey						—	—		
Data analysis							—	—	
Updated Study Report								—	▲
Delivery of final field data and invasive species maps								—	

Legend:

— Planned Activity
Δ Initial Study Report
▲ Updated Study Report

11.9.11. Figures

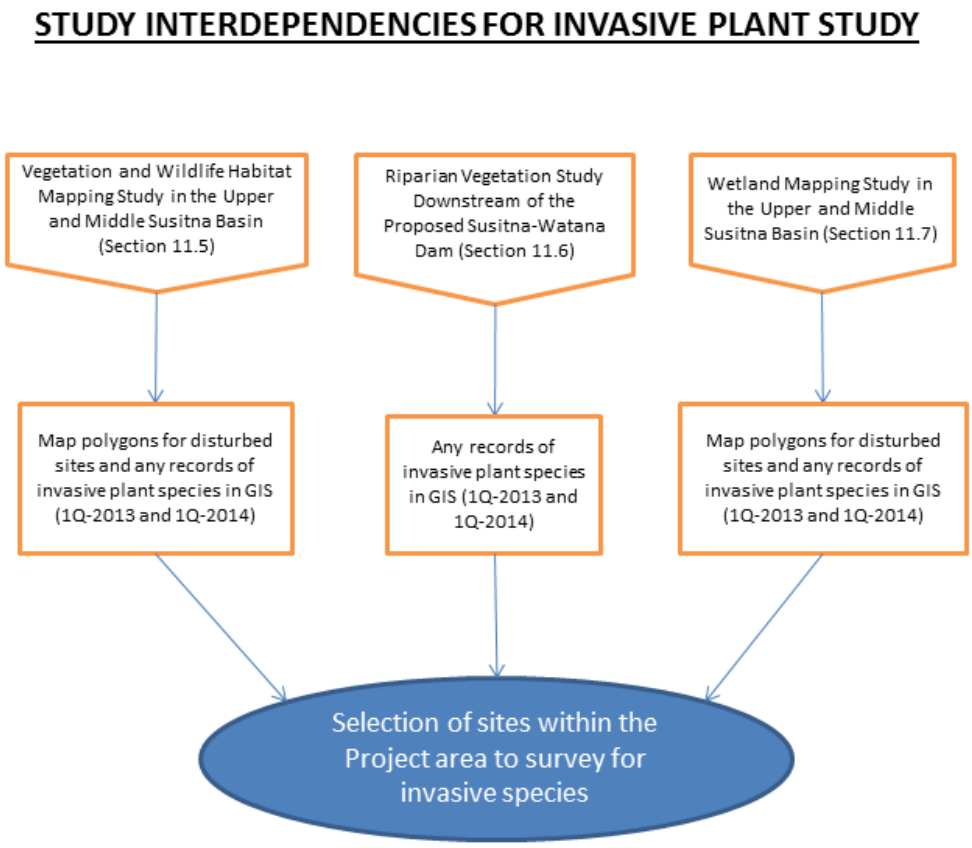

Figure 11.9-1. Study interdependencies for the Invasive Plant Study.

12. RECREATION AND AESTHETIC RESOURCES

12.1. Introduction

The Alaska Energy Authority (AEA) proposes a Recreation Resources Study, a Recreational River Flow Study, and an Aesthetic Resources Study in order to document baseline conditions and help assess potential impacts on recreation and aesthetic resources from construction and operation of the proposed Susitna-Watana Hydroelectric Project (Project).

The Recreation Resources Study (Section 12.5) will research, describe, and estimate recreation supply and demand (current and future projections), and assess reasonably foreseeable recreation needs associated with development of the Project. The Recreation Resources Study plan has been prepared in consultation with agencies and licensing participants.

The Aesthetic Resources Study (Section 12.6) will research, inventory, and describe visual and auditory resources in the Project area and identify potential impacts to these resources from construction and operation of the proposed Project.

River-based activities, including boating and fishing, are largely dependent on river flow levels, ice formation, river access points, and seasonal resource availability conditions. The River Recreation Flow and Access Study (Section 12.7) will identify and document flow-dependent recreational opportunities in the proposed Project area, identify flow preference curves, or ranges, for relevant river-related recreational activities, and help to identify relationships between river flow levels and river uses.

12.2. Nexus Between Project Construction / Existence / Operations and Effects on Resources to be Studied

The upper Susitna River valley is currently largely undeveloped. The Project, including a dam and associated facilities and access infrastructure, may affect recreational opportunities and uses, and the aesthetic character, of the Project area. For example, the proposed Project may affect a number of forms of ongoing recreation uses, such as fishing, boating, hiking, camping, birdwatching/wildlife viewing, hunting, all-terrain vehicle (ATV)/off-road vehicle (ORV) use, scenic touring, skiing, snowshoeing and other activities, by altering river flows and ice formation, altering wildlife habitat, and changing recreation access conditions. Construction and operation of the Project may alter visual and auditory conditions that recreationists and other users of the area now experience. More specifically, potential effects may include:

- Provision of new recreational facilities and opportunities
- Changes in public access with some new access opportunities
- Temporary and/or permanent changes levels of use
- Temporary and/or permanent disruption or displacement of current recreational activities
- Changes in visual or scenic quality
- Changes in visual or scenic attributes with some new viewpoint access opportunities

The Recreation Resources Study will identify existing and foreseeable future recreation opportunities (latent demand), levels of use, spatial use patterns, means of access, and existing

facilities capacities in the proposed Project area. The study will provide a basis for development of a Recreation Management Plan (RMP).

Operation and construction of the Project also may affect aesthetic resources, depending on the specific location of facilities, access roads and transmission routes, and the extent to which changes in river flows result in detectable changes to landscape character downriver of the proposed Project. The Aesthetic Resources Study will focus on these potential impacts, and help inform potential Project design and mitigation options.

The Recreation River Flow and Access Study analysis will describe the characteristics and attributes of river-based recreation, and inform the Recreation Resources and Aesthetic Resources Studies.

12.3. Resource Management Goals and Objectives

In addition to providing information needed to characterize the potential Project effects, the Recreation Resources and Aesthetic Resources studies will provide information to help AEA, resource agencies, Alaska Native entities, and others identify appropriate recreational measures for the Project License Application. Project studies are designed not only to meet Federal Energy Regulatory Commission (FERC) licensing requirements, but also to be relevant to recent, ongoing, and/or planned resource management activities by other agencies. Part of the Project Area includes federal lands managed by the Bureau of Land Management (BLM) in accordance with the Glennallen BLM Resource Area East Alaska Resource Management Plan (EARMP). Management policies in the EARMP include those related to recreation and aesthetic resources. The Alaska Statewide Outdoor Recreation Plan (SCORP) (2009-2014) also provides resource management considerations for recreation providers, advisory boards, user groups, and the public to use in making outdoor recreation supply and management decisions.

12.4. Summary of Consultation with Agencies, Alaska Native Entities and Other Licensing Participants

The Revised Study Plan (RSP) for recreation and aesthetic resources was developed using input from these Technical Workgroup meeting and informal consultations and comments received through November 14, 2012. AEA consulted with federal and state agencies, Alaska Native entities, and other licensing participants at Project Technical Workgroup meetings held on August 8, September 20, October 3, and October 17, 2012, and used input from these meetings to develop and revise the RSP. Between July and November 2012 several federal and state agencies, interested parties, and other licensing participants were contacted via telephone, e-mail, or through informal meetings. Agencies contacted include NPS, BLM, USFS, and ADFG as well as local business owners (Talkeetna Roadhouse, Mahay's River Boat Service, Maclaren River Lodge, Stephan Lake Lodge, Alpine Creek Lodge and Denali Highway Tours and Cabins). Topics included a variety of subjects concerning recreation and aesthetic resources, recreation survey development, available data resources, and information gathering for future field activities. Formal comment letters were also received from agencies and licensing participants on the PSP.

Summary tables of comments and responses from formal comment letters filed with FERC through November 14, 2012, are provided in Appendix 1. Copies of the formal FERC-filed

comment letters are included in Appendix 2. In addition, a single comprehensive summary table of comments and responses from consultation, dated from Proposed Study Plan (PSP) filing (July 16, 2012) through release of Interim Draft RSPs, is provided in Appendix 3. Copies of meeting summaries from release of the PSP through the interim draft RSP are included in Appendix 4, organized chronologically.

12.5. Recreation Resources Study

12.5.1. General Description of the Proposed Study

The Recreation Resources Study is designed to identify recreation resources and activities (by both visitors to Alaska and Alaska residents) that may be affected by the construction and operation of the proposed Susitna-Watana Hydroelectric Project (Project), and to help assess the potential impacts of Project construction and operation on those resources and activities. The specific goals of the study are to:

- Identify and document recreation resources and facilities that support commercial and non-commercial recreation in the Project area.
- Identify the types and levels of current recreational uses and future reasonably foreseeable future uses based on surveys and interviews, consultation with licensing participants, regional and statewide plans, and other data.
- Evaluate the potential impacts of Project construction and operation on recreation resources, needs, and uses in the Project area.
- Develop data to inform AEA's future development of a Recreation Management Plan for the Project.

12.5.2. Existing Information and Need for Additional Information

Existing information was compiled in the Recreation Data Gap Analysis (AEA 2011a) and recreation resource descriptions and inventory presented in AEA's Pre-application Document (PAD) (AEA 2011b). A study was conducted in 2012 to gather data to inform the 2013-2014 Recreation Resources Study plan, and included the following elements:

- Interviews and meetings, including Technical Workgroup (TWG) meetings, with key representatives of agencies and organizations knowledgeable about regional and state recreation management and issues.
- Preliminary compilation of existing recreation use data, inventory, and capacity information, including data for the Railbelt planning area as outlined in the SCORP 2009-2014. This Railbelt planning area includes those urban and rural communities accessible from Alaska's limited road and rail system, generally from the southern end of the Kenai Peninsula, north to Fairbanks, and east to the Canadian border (ADNR 2009).
- An inventory of Project area access.
- Incidental Observation Survey (IOS) data (completed by field crews).
- Coordination with other study disciplines and incorporation of data.
- Geo-referenced mapping.
- Field reconnaissance (July 2012), focusing on five general areas:
    - Reconnaissance and familiarization with the Susitna River corridor and trail network by boat and air

- Ground reconnaissance of recreation facilities, use areas, and trails along portions of the Parks and Denali Highways
- Identification of downstream recreation opportunities and access points
- Determination of viewsheds
- Identification of and possible intercept survey locales necessary for the recreation demand assessment

Available information from the 2012 data gathering efforts was presented and discussed at various TWG meetings, informing the Revised Study Plan's (RSP's) methodological approach.

12.5.3. Study Area

Three geographic areas are defined and used in this study plan:

First, the Recreation Effects Analysis Area is defined as the area proposed to be occupied by Project facilities as well as the Susitna River upstream to the Denali Highway Bridge and downstream to Sunshine, the proposed Project reservoir and some nearby shore lands and trails surrounding the reservoir location (see Figure 12.5-1). This area includes the proposed Watana Dam, located on the Susitna River at river mile 184 (measured from the mouth of the river), and the resulting Watana Reservoir. The dam would create an approximately 39-mile long lake which will be accessible to the general public. In addition, it is expected that the Susitna River corridor from the Denali Highway to the proposed reservoir would receive more recreation use than it currently receives and overland use via existing trails by hunters, anglers, trappers, and recreationists will likely increase as an indirect effect of the proposed Project. The study plan is designed to assess the potential impacts to recreational and aesthetic resources as a result of the Project, including potential conflict among recreational users and increased access and visual changes to the Denali State Park east of the Parks Highway. AEA plans to study the potential indirect effects of the proposed Project and thus lands and trails around the proposed Project facilities are included in the Recreation Effects Analysis Area as they would likely receive more use, or induced use as a result of Project development. The Recreation Effects Analysis Area also includes proposed access road and transmission line corridors, and other Project facility locations. The flow routing analysis and ice processes studies will be used to either confirm the 2013 Recreation Effects Analysis Area is appropriate or suggest that areas further downstream should be included in the 2014 Recreation Effects Analysis study area. The Recreation Effects Analysis Area will be adjusted, if appropriate, prior to the 2014 survey efforts. Any proposed adjustment will be recommended in AEA's Initial Study Report, which will be prepared and distributed in early February 2014.

Second, the Recreation Use Study Area, which includes, but is broader than, the Recreation Effects Analysis Area, is defined generally as the area encompassed by the following features (see Figure 12.5-1):

- The Parks Highway corridor and areas east, from the "Y" at the Talkeetna Spur Road intersection to Cantwell (including the Denali State Park)
- The Denali Highway corridor (including Brushkana and Tangle Lakes Campgrounds) and areas south, from Cantwell east to Paxson

- West from Paxson along a 2-mile buffer south of the Denali Highway to the Matanuska-Susitna Borough boundary
- Areas west of the Matanuska-Susitna Borough boundary between the Denali and Glenn Highways (including Lake Louise area)
- North from the Matanuska-Susitna Borough boundary (located south of Lake Louise), joining the Susitna River basin boundary, and then continuing from a line running north from Chickaloon, following the Chickaloon River to its headwaters at the Chickaloon Glacier, and, from there, turning west from the Chickaloon Glacier to connect at the Y Junction on the Parks Highway

The boundaries of the Recreation Use Study Area are the same as those used for the demand assessment, also referred to as the Recreation Supply and Demand Analysis Area.

If studies conducted in 2013 indicate that there may be Project-related changes to instream flow, sediment transport, and ice formation on the portion of the river from the Parks Highway Bridge downstream on the Susitna River that could affect recreation, an expansion of the Recreation Use Study Area/Recreation Supply and Demand Analysis Area and associated level of analysis of recreation resources uses to include the effected portion will be triggered in time for the 2014 study season. The 2014 study year also provides a contingency if an unusual condition occurs during the 2013 field data collection season, such as earthquakes and floods, or significant closures to fishing and hunting seasons. Any recommended changes to any study areas will be included in AEA's Initial Study Report, which will be prepared and distributed in early February 2014.

Third, the Recreation Facilities Study Area (see Figure 12.5-1) encompasses a broader area than the Recreation Use Study Area. The western and northern boundaries (Parks and Denali highways) are the same as the Recreation Use Study Area. The eastern and southern boundaries of the Recreation Facilities Study Area are defined as:

- The Richardson Highway corridor and areas west, from Paxson to the Glenn Highway intersection.
- The Glenn Highway corridor and areas north, from Glennallen west to Chickaloon.
- Joining the Recreation Use Study Area along the line running north from Chickaloon, following the Chickaloon River to its headwaters at the Chickaloon Glacier. From there, turning west from the Chickaloon Glacier to connect at the Y Junction on the Parks Highway.

12.5.4. Study Methods

The Recreation Resources Study will analyze both water and land-based recreation uses; access considerations; and seasonality in the Recreation Use Study Area. Seasonal uses that relate to winter use of the river corridor for recreation also will be analyzed. In addition, specialized study of river flow-dependent activities will be conducted (described in Section 12.7).

Regional Recreation Analysis

The regional recreation resources context was defined in coordination with agencies, Technical Workgroups, and other participants. Regional and local data related to recreation use has been

and will continue to be collected and analyzed, including examination of various land management regimes within the Recreation Use Study Area. Existing resource management plans relevant to the recreational resources have been reviewed and will be used for further analysis throughout the study. The analysis will consider and rely on the existing and proposed community and regional plans, and private sector plans. These plans include:

- Alaska Department of Transportation and Public Facilities (ADOT&PF). 2008. George Parks Highway Scenic Byway Corridor Partnership Plan. Published online at: http://dnr.alaska.gov/parks/interp/pdf/georgeparkshwyscenicbyway.pdf.
- Alaska's Outdoor Legacy Statewide Comprehensive Outdoor Recreation Plan (SCORP) 2009–2014 (Alaska Department of Natural Resources [ADNR] 2009)
- Alaska Recreational Trails Plan (ADNR 2000)
- Chase Comprehensive Plan (MSB 1993)
- Cultural Resource Management Plan for the Denali Highway Lands (VanderHoek 2005)
- Denali State Park Management Plan (Alaska Division of Parks and Outdoor Recreation [DPOR] 2006)
- DPOR Ten Year Strategic Plan 2007–2017 (DPOR 2007)
- East Alaska Resource Management Plan (Bureau of Land Management [BLM] 2006)
- MSB Comprehensive Development Plan (MSB 2005)
- MSB Trails Plan (MSB 2008)
- MSB Comprehensive Economic Development Strategy (TIP Strategies Inc. 2010)
- MSB Parks and Recreation Open Space Plan (MSB 2000)
- South Denali Implementation Plan and Environmental Impact Statement (National Park Service [NPS] 2006)
- Susitna Area Plan (ADNR 1985)
- Susitna Basin Recreation Rivers Management Plan (ADNR 1991)
- Susitna Matanuska Area Plan (ADNR 2011)
- Talkeetna Comprehensive Plan (MSB 1999)

Each of these plans will also be analyzed for information related to anticipated recreation needs in the Recreation Use Study Area/Recreation Supply and Demand Analysis Area.

Trails

There are a wide range of formal and informal trails and routes found within the Recreation Use Study Area. Recreational ORV and snowmachine use are also major recreational uses within this study area, and repetitive use has contributed to an extensive network of user-created trails throughout the study area. Several methods, described below, will be used to gather information needed to map and confirm which trails might be affected by the Project. Existing trails in the immediate Project area will be mapped at a scale that will ensure sufficient accuracy for analysis across studies.

Non-snow covered trails within or leading into or out of the Project area have been mapped using aerial imagery, and GIS datasets derived from multiple agency sources. These include multiple formal and informal trails and routes, several formally identified Revised Statute (RS) 2477 trails, and Alaska Native Claims Settlement Act (ANCSA) 17(b) trails. Additions and edits to the comprehensive map and inventory will be derived from field identification, agency interviews, and surveys. Many trails and access routes will be verified via helicopter due to the remote and dispersed nature of the Recreation Use Study Area. The focus will be on trails and access routes that may be affected by development of the Project.

If a common and repetitive use pattern can be discerned, snow-covered trails, such as ski and snowmachine trails, will be located according to winter aerial photography, field observations, winter intercept surveys, and executive interviews.

A trail classification system will be utilized once all relevant trails to be included in the study have been identified and mapped. The U.S. Forest Service has adapted a National Trail Classification System that has been adopted by most federal land management agencies (Federal Register 2006). The Alaska Department of Natural Resources has utilized an adaptation of this system (ADNR 2008). AEA will coordinate with the BLM Glennallen Field Office in undertaking this effort, as BLM has already completed trail inventories for some trails off the Denali Highway.

Each trail with a Project nexus will be classified into one of five Trail Classes, ranging from least developed (Trail Class 1) to most developed (Trail Class 5). Descriptors will be refined to reflect typical attributes of trails in each class. These attributes include:

- Tread and traffic flow
- Obstacles
- Constructed features and trail elements
- Signs
- Typical recreation environment and experience (using Recreation Opportunity Spectrum classifications)
- Level of trail management (what type/level of use the trail is managed to accommodate).

The majority of trails within the Recreation Use Study Area, particularly those stemming from the Denali Highway, could be categorized as Trail Class 1 (least developed). Sub-classes of Trail Class 1 can also be uniquely developed according to access use, such as "ATV hunting route." Trails that have historical use, and are legal under State "generally allowed uses," but have not been named or identified by ADNR, will also be included. Land management of trails, including that of 17(b) easement trails, will also be identified.

Recreation Use Areas

Recreation Activity Areas identified in the SCORP will be used in the analysis. The ROS (USFS 1979) framework will be used to describe recreation opportunity areas. The ROS is a framework for classifying and defining different classes or types of outdoor recreation environments, activities, and experience opportunities (USFS 1979). The original ROS inventory system embodied six land classes: primitive; semi-primitive non-motorized; semi-primitive motorized; roaded natural; rural; and urban. Each class is described by a "typical" setting based on factors such as size, naturalness, and the presence or absence of motorized vehicles and other sights and sounds of humans (More et al. 2003). The Natural Resource Recreation Setting (NRRS) analysis

is an expansion of the BLM's system, and will also be utilized (BLM 2010). The NRSS analysis adds emphasis on social and operational characteristics.

The BLM Glennallen Field Office has conducted an inventory of the existing recreation opportunities available across the East Alaska planning area (BLM 2006). BLM completed a trail inventory in 2005, which had an effect on ROS class boundaries within the planning area, particularly along the Denali Highway. Most of the BLM-managed lands within the Recreation Use Study Area are managed as primitive. Additional ROS classes also found on BLM-managed lands within this area include semi-primitive non-motorized, semi-primitive motorized, remote developed lakeside, backcountry roaded, and special (BLM 2006).

The NRRS analysis is an adaption of ROS analysis. The ROS was developed to describe the mix of possible outdoor recreation settings based on the assessment of physical, social, and operational (administrative) recreation site characteristics (RSCs). To make the ROS easy to interpret, the spectrum was sub-divided into classes ranging from primitive to urban. Traditionally, the ROS process mapped all RSCs separately then merged all maps together into one final composite map. This often resulted in inconsistencies between the physical, social, and operational settings. The conflicts were resolved by emphasizing the physical character of the landscape or averaging the differences. Unfortunately, this often resulted in a misrepresentation of the social and operational qualities of the recreation area, making ROS difficult to understand and implement. The NRRS is different in that it allows the physical, social, and operational RSCs to be displayed individually. Displaying RSCs individually helps to accurately depict the current recreation settings, displays the complexity of the recreation setting, provides clear implementation direction, and creates adaptive and useful planning products. A NRRS analysis will be conducted for existing conditions and post-project conditions within the Recreation Use Study Area. Results will be displayed in narrative, graphical, and tabular format.

Scenic Byways, Wild and Scenic Rivers (WSRs), and other special resource use designations will be identified and described, as applicable.

Recreation Supply, Demand, and Use

Currently, recreation uses of the Recreation Use Study Area are widely dispersed. Visitors to the area (both visitors to Alaska and regional Alaska residents) participate in a wide variety of seasonal activities including sport hunting, sport fishing, recreational boating, skiing, snowshoeing, ATV and/or ORV use, hiking, wildlife viewing, and snow-machining. Sport hunting and fishing are major recreation uses in the Recreation Use Study Area. It is noted that sport hunting, fishing, and other resource gathering activities are distinguished from subsistence activities, which are described in Section 14.

A baseline of developed and dispersed recreation uses, including types, levels, and access will be estimated and described. High use locations will be identified by activity, along with daytime and overnight visits, and seasonal patterns. User preferences and opinions about the quality of recreation resources and recreational experience will also be described based on survey results (outlined in the following sections) as well as other secondary sources. Data will be collected through a literature review (e.g., economic impact analyses of various recreation uses, visitor industry impact analyses, recreation resource planning documents), data-mining of agency databases (e.g., Alaska Department of Fish and Game fish harvest and hunting records) and a comprehensive survey and interview program, described below.

Future recreation supply and demand, including latent demand, will be assessed, based on the SCORP; Matanuska-Susitna Borough planning documents; other published sources; information derived from the intercept and mail surveys; and interviews. Effects of the Project features (e.g., reservoir and access roads) on consumptive uses such as hunting, trapping, berry picking, and fishing opportunities, and on non-consumptive uses such as bird-watching, wildlife-viewing, hiking, camping, boating in the Recreation Effects Analysis Area will be assessed. Additionally, the recreation effects of Project-induced changes in ice formation on the Susitna River will be evaluated within this area. Recreation demand within the Recreation Use Study Area will be estimated from a variety of sources outlined above for a 50-year period.

Recreation Facilities and Carrying Capacity

There are no existing developed recreation facilities on the Susitna River near the proposed Watana Dam site. Both public and private developed recreation facilities exist, however, on other lands in the Recreation Facilities Study Area. These facilities are primarily located along the road system. In addition to developed recreation facilities, dispersed recreation use areas are important recreational components to be considered. Dispersed recreation use areas include undeveloped day use and overnight recreation sites/use areas that are user-defined and may be accessible by foot, watercraft, or vehicle.

Developed public recreation facilities within the Recreation Facilities Study Area have been mapped and initially inventoried. Methods for the recreation site facility inventory and evaluation will include review of published information, consultation with agencies, facility owners, and operators, and site-specific field investigations. Site attributes will be further inventoried according to field observations, and facility owner/operator data. Public access to recreation sites will also be described, including consistency with relevant accessibility standards, including the Americans with Disabilities Act (ADA), as appropriate.

The existing physical carrying capacity of developed recreation resources in the Recreation Facilities Study Area will be estimated. Public facilities will be inventoried and described as to condition, capacity, adequacy and operational cost. Private facilities will also be inventoried to the extent practicable.

The capacity of additional reasonably foreseeable recreational facilities will be identified. Carrying capacity guidelines and standards will be applied to help develop recommendations for future recreation facilities and sites. Data on the social aspect of carrying capacity (such as crowding) will be collected in the recreation use surveys.

In addition to developed recreation facilities, dispersed recreation sites and use areas and trails that access the Recreation Effects Analysis Area are important recreational components to be considered. Dispersed recreation sites and use areas will include undeveloped day use and overnight recreation sites/use areas that are user-defined and may be accessible by foot, watercraft, or vehicle. Objectives of the dispersed recreation sites and use areas study include the following:

- Describe dispersed recreation use areas and sites in the study Recreation Facilities Study Area (types of locations, access, vegetation, and presence of campfire rings, tables, cleared camping areas, etc.). Attributes of well-used sites and representative occasional use areas will be inventoried.

- Evidence of trampling, vegetation damage or removal, exposed soil or compaction, litter and debris, or sanitation issues will be identified.
- Potential effects of potential future Project operations on dispersed recreation use areas, sites, and access will be identified.

This information will be collected in 2013 field visits, from agencies, recreation providers, and in results of multiple surveys described below. GPS coordinates will be taken as appropriate, and included on geo-referenced facility maps. An analysis of existing recreation facilities is necessary in order to estimate the capacity to accommodate projected recreation use levels, or those associated with changes created by the proposed Project.

Recreation carrying capacity encompasses biophysical/ecological, social, and managerial aspects (Stankey and Manning 1986). These three parameters of capacity can be further described as follows:

- Biophysical (ecological) capacity – typically related to the biophysical characteristics of the natural resource base, including the ability of the resource base to absorb potential recreation-related impacts without an unacceptable level of deterioration.
- Social capacity – typically associated with the characteristics of the visitor base, including preferences, demand, and needs, including the ability to absorb potential recreation-related impacts without unacceptable impacts to the character and quality of the recreation experience.
- Managerial capacity – typically concerned with recreation provider-controlled resources and policies, including legal directives, policy guidelines, goals and objectives, and funding priorities.

Recreation carrying capacity investigations are typically conducted with two purposes in mind: as a research tool; and as a monitoring/management tool. As a research tool, recreation carrying capacity studies define the biophysical, social, and managerial capacity of an area based on existing opportunities and constraints that can later be applied to future use level estimates. As a monitoring/management tool, recreation carrying capacity studies are often used to identify specific indicators and standards/guidelines of quality and experience to be used to keep existing and anticipated future recreation use within established parameters. For the purposes of this study, the recreation carrying capacity analysis will be used as a research tool. Indicators and standards/guidelines for the Project may be developed at a later date if necessary.

Capacity will be assessed at developed recreation sites, major dispersed use areas and trails, and within the Recreation Facilities Study Area (Figure 12.5-1). The analysis will involve the following steps:

- Compile and review existing data related to recreation carrying capacity
- Analyze data to determine indicator measures that characterize existing conditions
- Recommend potential carrying capacity indicators and standards/guidelines for future use

Survey Data Collection

The collection of recreation user data will be accomplished through multiple methods, including literature reviews, secondary data compilation, intercept, on-line, mail and telephone surveys, and executive interviews. Incidental observation and draft intercept survey instruments have been designed to collect information typical of and compatible with other FERC efforts. All

surveys will collect data for use in the recreation, aesthetics, and recreation flow studies in this section, as well as data for the transportation and socioeconomic studies.

Identification and Analysis of Salient Data from Existing Survey Research

Recreation supply and demand data from other recreation planning sources applicable to the region will be synthesized. Existing data can inform estimates of levels (e.g., "recreation days") and types of participation in recreation uses. The estimates will include a discussion and comparison of participation rates in activities regionally and, where secondary data is readily available, at the statewide and national level. Recreation trends, as forecast in other studies, will also be described.

Survey data from the 1985 studies **(**Harza-Ebasco 1985) and other surveys such as the SCORP (ADNR 2009), Alaska Residents Statistics Program (ARSP) (Fix 2009) and the Alaska Visitor Statistic Program VI (AVSP VI) (McDowell 2012) have been reviewed.

SCORP (ADNR 2009) included a statewide telephone (600 households), mail (517 surveys), and online survey (2,338 surveys) to identify what Alaskans currently do for outdoor recreation and what opportunities are desired for the future.

The ARSP Survey (Fix 2009) was a statewide mail survey that gathered information regarding Alaska residents' travel in Alaska, recreation activities in which they participate, use of facilities, visitation patterns, and factors contributing to the quality of life.

The AVSP VI Survey (McDowell 2012) was a statewide survey research program commissioned by the Alaska Department of Commerce, Community and Economic Development. The year-round survey program included 6,747 visitors to Alaska in the summer of 2011 and 1,361 visitors in Fall/Winter/Spring 2011/2012.

These data will be utilized to describe year-round nonresident (non-Alaskan) experiences by visitors in three major communities in the MSB (Palmer, Wasilla, and Talkeetna), passengers on the Alaska Railroad, and cruise passengers (visiting McKinley Princess Lodge).

The existing data include:

- Lodging types
- Activities
- Length of stay
- Purpose of trip
- Previous travel to Alaska
- Modes of transportation used within the state
- Trip spending
- Communities visited (overall and overnight)
- Demographics (origin, age, income, party size).

Nonresident data will be evaluated along with existing data relating to recreation use by Alaska residents, in the context of the overall study plan.

Incidental Observation Survey (IOS)

The purpose of the IOS is to capture information from field researchers about dispersed recreational use within the Recreation Use Study Area. The survey was deployed in 2012 and will help gather information on the date and time of day recreation activity was observed, the

type of activity observed, number of people engaged in the activity, and the location of the observed activity. This survey does not have statistical value, but it helps to identify types and patterns of recreational use in the Recreation Use Study Area. A protocol accompanies the survey to inform field crews how to complete and submit the survey. The survey will be used throughout the entire study period (see Attachment 12-1).

Intercept Surveys and Structured Observation Visitor Counts

The purpose of the in-person intercept surveys is to gather recreation user data, which includes uses, frequency, quality of recreation and/or aesthetic experience, recreation spending, and other perceptions of the Recreation Use Study Area.

The remote nature of the Recreation Use Study Area significantly determines where recreation users can be intercepted for surveying. The proposed Recreation Use Study Area is largely bounded by paved and unpaved highways, which provide primary access to the area. Recreation users penetrate further into the core of the proposed Recreation Use Study Area via:

- Paved and unpaved roadways
- The Alaska Railroad, with some trains carrying passengers through the area and the Hurricane train providing whistle stop service within the area
- Fixed wing aircraft and helicopters, used for sightseeing and to access remote lodges, lakes, streams, and hunting areas
- Campgrounds and trailheads
- ATV/ORV trails, both official and unofficial

Intercept surveyor teams will survey recreation users throughout 2013. More so than calendar date — with perhaps the exception of opening days for hunting and trapping seasons — weather will likely dictate the beginning and end of the seasonal survey periods. Contingencies for unforeseen circumstances, such as snowstorms, flooding, road closures, etc., will be considered in the sampling plan (for example, altering or extending the sampling period, selecting "make up" sampling days, etc.) and a component of the survey team training. Flexibility will be necessary, particularly during the shoulder seasons, to operate safely in the field and gather an adequate sample of recreation users during those periods.
Multiple survey teams will be used to compensate for sampling schedules that require long distances to be traveled between intercept points, limited daylight hours, and potentially difficult seasonal travel. For personal safety reasons, each team will include two people.

All surveyors will be trained and supervised by experienced survey managers. Surveyors will wear protective clothing (for safety reasons) and will have visible badges and/or uniforms (such as vests, hats, coats, etc.) to indicate their official capacity.

In addition, AEA will notify BLM prior to surveying campgrounds on federal lands administered by BLM.

Incentives for participation in the surveys (intercept, mail, or online) will be used. Incentives, such as small tokens of appreciation or an opportunity to enter a drawing for a prize will motivate some respondents and will result in higher response rates than would otherwise be achieved.

Online Survey Option

To gather as much recreation information as possible, the intercept survey will be supplemented with an equivalent online version of the survey. To accommodate the different methods of delivery, survey design will differ between the personal intercept survey and the online version. A specially designed invitation card with instructions on how to participate in the online survey will be left by surveyors on vehicles at intercept points when users are not present. A statement will be added to the card to discourage littering of the invitation by non-respondents.

It is anticipated that use of the cards will increase the number of completed recreation surveys. However, it is not possible to predict how many recreation users might complete an online version of the survey via this methodology.

The invitation card will be printed on waterproof paper and include a map of the proposed Project Area on the backside. The front side will provide a brief description of the Project and the purpose of the recreation user survey, an invitation to participate, and a URL link to the survey. Each card will include a unique password, allowing users one time access to a secure online survey site.

As with mail surveys, self-selection bias is a consideration in online surveys. Demographics, and potentially other data, can be used to compare online survey results with the results from the random intercept surveys to determine if self-selection bias is an issue. If necessary, weighting could be used to adjust for any bias.

Observational Tallies

On sample days, the survey crews will observe key characteristics of recreation use (e.g., the number of people present, the number of vehicles entering/exiting the access site, types of recreation activities evident) and record this information on pre-printed tally forms. Users to be surveyed in person will be selected by availability and willingness to participate.

Intercept Locations

Many of the intercept locations are privately owned or managed. Under these circumstances, permission to intercept recreation users will be sought prior to fielding. Public lands managers will be notified to alert them of the study, survey fielding methodology, and sample schedule prior to fielding.

Once in the field, a better understanding of recreation use patterns (especially seasonal use) may necessitate further refinement of the intercept points. In addition to sampling from the identified key locations, surveyors will conduct surveys with observed recreation users as circumstances allow (such as private aircraft owners in Talkeetna and Willow). Figure 12.5-2 is a map indicating key intercept locations. Included in Figure 12.5-2 are:

Deshka Landing, Willow Air, Susitna Landing, and Talkeetna

- Deshka Landing
- Willow Air float and air strip
- Susitna Landing
- Talkeetna
    - Talkeetna boat launch
    - Alaska Railroad terminal

  - Local air carriers at the Talkeetna Airstrip and area float plane lakes
  - Mahay's Dock
  - Talkeetna Gravel Bar
  - Downtown Talkeetna

Parks Highway Intercept Locations

- Sunshine Creek Stream access
- Susitna Bridge River access (gravel bar)
- West-side pull-out just past Susitna River Bridge
- Trapper Creek Inn and RV Park
- Mt. McKinley Princess
- Boy Scout High Adventure Scout Base
- Troublesome Creek Trailhead and campground
- Byers Lake Trail head and campground
- Honolulu Creek bridge
- Denali Viewpoint North and South
- East Fork Chulitna Wayside/Campground
- Jack River bridge
- Additional small pull-outs

Denali Highway Intercept Locations

- Joe/Jerry Lakes
- Brushkana Creek Campground (MP 104)
- Gracious House
- Susitna River Bridge (MP 79.5)
- Alpine Creek Lodge (MP 86)
- Clearwater Creek Wayside/Trail (MP 55.5)
- Maclaren River Lodge (MP42)
- Osar Lake Trail
- Alphabet Hills Trail
- Swede Lake Trail
- Denali Highway Tours and Cabins
- Sevenmile Lake OHV Trail

- Tangle River Inn (MP20)
- Tangle Lakes Campground (MP 21.5)
- Tangle Lakes Boat Launch (MP 22)
- Delta National Wild and Scenic River BLM Wayside (MP 21.5)
- Numerous pull-outs, gravel pits, informal campsites, and ATV/ORV trailheads

Glennallen and Lake Louise Access Intercept Locations

- Lake Louise/Susitna Lake
- Glennallen Airport

Winter Sample Plan

Survey Fielding: Late February through April, and late October through early November 2013

Winter activities primarily consist of snowmachining, dog sledding, cross-country skiing, snowshoeing, and trapping.

Winter surveys will be fielded from late February through spring thaw, and again in late October/early November when sufficient snow is present. While there is some activity in January, early February, late November and December, extended darkness, extreme cold, and poor road conditions create potentially unsafe conditions for surveyors. The conditions are potentially too extreme and Recreation Use Study Area use too limited to justify risking staff safety. Survey instrument design will allow the study team to capture January/early February and late November/December recreation activities from users encountered during other sampling periods.

The final winter sample plan will primarily focus on the following intercept areas:

- Deshka and Susitna Landings
- Talkeetna
- Parks Highway from Talkeetna to Cantwell
- Plowed sections of the Denali Highway from both Cantwell and Paxson (entire highway only maintained by the Alaska Department of Transportation and Public Facilities from mid-May through mid-October).
- Lake Louise area

Survey sampling will take place primarily on weekends and during special events, with some weekday sampling.

It is anticipated that the survey teams will work an average of two eight-hour days per week.

Spring/Summer/Fall Winter Sample Plan

Survey Fielding: May through October 2013

The following sample plan is based on surveying approximately every week during the spring, summer, and fall periods. However, because of recreation use patterns in the Recreation Use Study Area, certain periods have significantly less use, while other periods have higher use (e.g.,

moose and caribou hunting season during the fall). Sample periods will be shorter during low recreation use periods and additional sampling may occur around peak activity periods.

A stratified random sampling will be used to collect a statistical sample of recreation users. The sample plan will first be stratified by month, day, and to some degree day parts. This will be overlaid with selected survey locations throughout the study area. Intercept sampling is based on the following pattern: Week One – travel (on a randomly selected start day and section of the day) from Willow Air and Deshka Landing, then proceed to Talkeetna, Cantwell, then Glennallen/Lake Louise over the next five days. Week Two – the survey period would begin one day of the week later and the route would be reversed. Surveyor teams will alternate their direction of travel, and departure days and times to allow a higher degree of random sampling during various days of the week and times of the day.

As surveyors proceed north to Willow (after completing Deshka Landing), they will stop at all key survey locations for a specified time and randomly survey as many recreating people as possible. They will also conduct incidental observation tallies of recreation participants and vehicles at all key sample locations. Online survey invitation cards will be left with unattended vehicles at intercept points on the northern portion of the Parks Highway, the Denali Highway, and at Lake Louise.

The team will work five 10-hour days traveling and surveying plus 10 hours per sampling period on paperwork and travel to and from the Recreation Use Study Area. Surveying will take place only during daylight hours. During peak summer months, surveying will take place between 8:00 a.m. and 8:00 p.m., with adjustments as needed for shoulder season light conditions. During this 12-hour time period, surveyors will work 10 hours and take two-hour breaks for rest and meals. Surveyors will travel by and camp in an RV (rented by the study team for the summer season) at appropriate locations along the route.

The variety of user groups and the multiple key survey locations identified in and around Talkeetna will result in surveyors spending one full day in this area (this includes sampling at the Willow airport and Deshka Landing).

Survey Instrument Design

The design of the intercept survey instrument will be iterative and a collaborative effort, not only capturing data needs for recreation resources, but also for aesthetics, socioeconomics, and other disciplines. A preliminary draft of the intercept instrument is included as Attachment 12-2. AEA will seek agency input on the final survey instruments in early 2013.

The intercept survey instrument (and its online equivalent) will include, but not necessarily be limited to the following information:

- Number in party
- Demographics
- Community of residence
- Day/overnight use and location
- Participation in type and location of recreation activity
- Rating of quality of recreation experience

- Level of satisfaction with facilities/recreation activities
- Aesthetic values
- Interest in potential new recreation facilities and opportunities
- Social aspects of the carrying capacity (i.e., crowdedness)
- Guided or unguided use
- Past use and intention for future use
- Trip expenses
- Means of access to the recreation area

Regional Resident Households Mail Survey

The purpose of the regional resident household mail survey is to gather information from a sample of regional households about their recreation activities in the Recreation Use Study Area, and to collect perspectives about recreational opportunities. Results of the survey will support development of a ratio of households that have visited the Recreation Use Study Area and identify the types of recreational activities in which they have engaged, essential data for estimating recreation days, and quality of recreation experiences, as well as provide reliable regional recreation spending data to be used in the socioeconomic study.

These data are particularly important in the analysis of the current and potential demand for recreation resources (to be completed in 2014).

A sample of 10,000 regional households, randomly-selected from an Alaska voter registration list, will receive a mail survey. The sample area for the mail survey includes the Fairbanks North Star Borough, Denali Borough, Matanuska-Susitna Borough, Municipality of Anchorage, and proximal communities within the Southeast Fairbanks and Valdez-Cordova census areas. The voter registration database is readily available, screens for those over age 18, and also contains a mailing address in addition to a physical address of those registered to vote. While it is understood that not all regional residents are registered to vote, this database represents a wider diversity of names and addresses than commercially purchased mailing lists.

Recipients of the mail survey will have the option of accessing the same survey at a secure URL site through the use of a unique password. This is an effective approach, as many respondents will prefer the convenience of responding to an online survey rather that completing and returning a paper survey. This option is anticipated to result in a higher response rate.

As mail surveys have the potential for self-selection bias, a nonresponse test utilizing a random sample telephone survey of 400 households (likely from three to seven questions) will be conducted to determine nonresponse patterns. This will include demographics, such as residency, gender, or age. Mail survey data may be weighted if warranted. Both land lines and cell phones will be included in the nonresponse telephone survey sample.

Although the response rate for the mail/online survey is difficult to predict, 15 to 25 percent is expected (1,500-2,500 surveys). An incentive to complete the survey, such as entry into a drawing for a prize, will be used. Incentives are anticipated to result in higher responses rates than would otherwise be achieved.

This large mail sample size will allow for contact with a statistically significant number of households that have visited and used the Recreation Use Study Area for recreational purposes. However, even with a large overall sample size, a statistically significant sample for some of the smaller recreational user groups (such as dogsledding, rock climbing) may not be found. In all cases, qualitative and analogous research will be used to supplement the quantitative survey research.

Regional Resident Household Mail Survey Fielding: Late March/Early April 2013

The mail survey will be targeted to randomly selected households in the Fairbanks Northstar, Denali, and Matanuska-Susitna boroughs, Municipality of Anchorage and other areas in proximity to the Recreation Use Study Area, such as the Glennallen and Paxson in the Valdez-Cordova census area and Delta Junction in the Southeast Fairbanks census area.

The Dillman methodology for maximizing mail survey responses will be used, including pre-survey and reminder postcards, and two survey mailings. The sample will be mailed a postcard informing them that a mail survey will be arriving shortly, asking them for their cooperation in completing and returning the survey, and providing them the option to complete the survey online using their unique passcode. Approximately one week later, the mail survey will be sent, and followed up by a thank-you/reminder postcard, which will also provide them the option to complete the survey online. Approximately three weeks after the first survey mailing, a second survey will be sent to those who have not responded.

Regional Resident Household Mail Survey Content/Design Process

The survey will include a map in the survey booklet to allow respondents the opportunity (at their leisure) to visually review the boundaries of the Recreation Use Study Area. Other potential benefits of having a map include the ability to color code portions of the map to demark areas of potential recreation interest.

The content of the regional resident household mail survey will have overlap with the intercept survey. The following briefly outlines a few expected differences between the regional resident household mail survey content and the intercept survey, as well as consideration of overall survey length limitations and differing formatting requirements between a self-administered mail survey versus intercept or online methodologies.

- ***Residence*** - These questions are not necessary to ask in the mail survey. Residence data can be captured from the mailing list with the use of a control number.
- ***Day/Overnight Use and Location*** - Similar or the same questions as in the intercept survey, however, these questions may occur later in the survey flow than as seen in the intercept survey.
- ***Recreational Activities/Guide Use in the Recreation Use Study Area*** - This will be the first series of questioning in the mail survey. In addition to recreation use in the Recreation Use Study Area, respondents will be asked to provide estimates of their annual recreation days by activity anywhere in Alaska. Respondents who have visited the Recreation Use Study Area in the last 12 months will be asked to provide specific information on their most recent trip to that area.
- ***Study Area Access*** – Similar or same questions as in the intercept survey.

- ***Quality of Experience*** - Similar or same questions as in the intercept survey.
- ***Recreation Facilities and Services*** - Similar or same questions as in the intercept survey.
- ***Aesthetics*** - Similar or same questions as in the intercept survey. However, additional questions on cultural identity, identity with place, dependence on place, social bonding with place, and expected aesthetics impacts of the Project will be considered.
- ***Spending and Party Size*** – Similar or same questions as in the intercept survey.
- ***Demographics/Characteristics*** - Similar or same questions as in the intercept survey.

Content coordination with other study discipline research

Because of the ability to collect broader survey questions with the mail survey format (as compared to an intercept survey), space may be available to add survey questions that provide data to support other research, such as spending, as needed for the socioeconomic study. Inclusion of these types of questions will require continued collaboration and cooperation with, as well as review, by other study team members (primarily socioeconomics).

Once the regional resident household mail survey is finalized, the online version will be developed using content identical to the regional resident household mail survey.

Executive Interviews

Executive interviews, conducted with representatives from a variety of organizations and businesses, are an important source of information from people with recreation use knowledge of the Recreation Use Study Area. Executive interviews are a systematic way (using an interview guide "protocol") of collecting qualitative and quantitative data from individuals through structured or semi-structured conversations.

The purpose of the executive interviews is to gather specific information about how businesses, organizations, and individuals use the Recreation Use Study Area; the volume of recreation users, and their thoughts on the quality of recreation; as well as satisfaction with current facilities and potential recreation facility needs. The executive interview process introduces the Project to the interviewees and establishes a relationship that will be helpful if additional information is needed during the recreation demand analysis phase of the study. For recreation activities where the survey sample size from the mail, online, and intercept surveys is small, executive interviews with key individuals and organizations engaged in those activities will inform efforts to quantify use.

A structured executive interview protocol and preliminary interviewee contact list was developed. The protocol form is shown as Attachment 12-3. Interview topics include, but are not limited to, the following:

- Nature of business/service (e.g., guide, tour operator, accommodations, etc.)
- Season(s) of operation (e.g., year-round, summer, winter, hunting, etc.)
- Means of access to recreation activity site (e.g., fly-in, boat, road, etc.)
- Specific areas of operation within the Recreation Use Study Area
- Years of operation

- Estimated number of clients/members per year
- General information about clients/members, including origin, party size, demographic features
- Ways that use might change under the various operational alternatives identified and potential impacts on area image, fishing, hunting, and other recreation activities
- Past and current plans, programs, business operations, membership, activity, etc.
- Geographic areas of highest recreational interest (and reasons why)
- Recreation infrastructure used or needed
- Identification of any trends (anecdotal and data sources) in recreational use levels or patterns
- Information about other projects proposed in the Recreation Use Study Area that could directly or indirectly affect recreation, tourism, or access to the previously inaccessible areas
- Suggestions for prioritizing the highest potential recreation demand in the area
- Suggestions for additional interview candidates

A minimum of 50 interviews, largely conducted by telephone, will be conducted over the study period, beginning with a number already conducted in 2012.

A preliminary interviewee candidate list was developed through existing and referred contacts, internet searches, and interviews. The list includes, but is not limited to: sportfishing guides; hunting guides; commercial jet boat tour operators; commercial rafting operators; State and/or facility lessees (including campgrounds and boat launches); recreation organizations and clubs; Boy Scouts of America Great Alaska Council; commercial visitor accommodation providers; services and tour providers (such as dogsledding, biking tours, etc.); communities councils (such as the Talkeetna Community Council), Alaska Native entities; and local, borough, state, and federal government agencies. The preliminary interviewee candidate list may be augmented with additional interviewees suggested by licensing participants if it is determined that a group is not currently represented by the existing list, or that an individual may have unique experience or knowledge on recreation uses in the study area. Interviewees will also have an opportunity to suggest additional candidates for interview consideration.

Most of the executive interviews will be conducted during Q1 and Q2 2013; however, others are expected to be conducted throughout the course of the 2013 and 2014 study periods. Some interviews will be scheduled to avoid high season recreation conflicts (when many interview candidates are away from their offices or too busy to schedule an interview). Other disciplines (such as Socioeconomics, Recreational River Flow) will be conducting executive interview research. Efforts will be made to coordinate this research to avoid duplication of research effort and minimize the demands on the interview candidate's time and availability.

GIS Maps and Figures

Recreational sites, facilities, and access routes (RS 2477 rights-of-way, 17(b) easements, and other recreation use trails) have been and will continue to be identified and digitized in a GIS using existing agency and licensing participant datasets and aerial photography. Recreation features will be geo-referenced. Group interviews, discussions with licensing participants, coordination with other resource study disciplines, and user intercept surveys will augment recreation facilities and trails mapping. Recreation facilities, examples of dispersed use areas, and access points will be photographed for inclusion in the Initial Study Report and Updated Study Report.

12.5.5. Consistency with Generally Accepted Scientific Practice

The methods and work efforts outlined in this Study Plan are the same or consistent with analyses used by applicants and licensees and relied upon by FERC in other hydroelectric licensing proceedings. The proposed methodology for analysis for demand and capacity estimates and survey sampling are commonly employed in the development of hydroelectric project License Applications.

12.5.6. Schedule

Upon approval for implementation, it is estimated that the term of the study would be approximately two years. In 2014 and 2015, licensing participants will have opportunities to review and comment on the study reports (Initial Study Report in early February 2014 and Updated Study Report in early 2015). Input from agencies to finalize study survey instruments will be sought in early 2013. Updates on the study progress will be provided during Technical Workgroup meetings which will be held quarterly in 2013 and 2014.

Table 12.5-1. Schedule for implementation of the Recreation Study.

Activity	2012				2013				2014				2015
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q
Data Collection & Baseline Inventory			—	—	—	—	—	—	-----	-----	-----		
Analysis						—	—	—	—	-----	-----		
Intercept Survey Design and Fielding					—	—	—	—	-----	-----	-----		
Mail Survey Design and Fielding					—	—							
Executive Interview Research				—	—	—	-----	-----	-----				
Survey Data Analysis							—	-----	—				
Recreation Demand Analysis				—	—	—	—	—	—	—	—	—	
Initial Study Report								—	Δ				
Updated Study Report											—	—	▲

Legend:

— Planned Activity
----- Follow up activity (as needed)
Δ Initial Study Report (February 2014)
▲ Updated Study Report (February 2015)

12.5.7. Relationship with Other Studies

Interdisciplinary coordination will be an essential component of the Recreation Resources Study, and will result in efficient collection and analyses of data common between studies for the Susitna-Watana Hydroelectric Project. Coordination will occur with Project engineering feasibility studies, and other biological, social, and physical resources on an iterative basis as data are collected. Coordination with biological resources will include Fish and Aquatics resources (Section 9.15) and Wildlife resources (Section 10.20). The Fish and Aquatics Resources Study will provide fish harvest data characterizing baseline harvest levels and harvest locations for commercial, sport, personal use, and subsistence fisheries for Susitna-origin-resident and anadromous fish (Q3 2013). These data will be used to understand the geographic distribution and abundance of and fisheries-based recreation opportunities within the Recreation Effects Analysis Area. The results of the impact analysis will be incorporated to understand potential changes in fisheries-based recreation opportunities that may result from changes in fisheries abundance and distribution (Q1 2015). The Wildlife Resources Study will provide baseline wildlife harvest data (Q1 2014, Q3 2014), and will be used to characterize existing conditions and anticipated impacts to game species abundance, hunting opportunities, and hunter distribution.

Coordination with social resources includes Socioeconomics and Transportation Resources (Section 15) to obtain data from the Social Conditions and Public Goods and Services study

(Section 15.6), including any anticipated post-Project changes to use, commercial opportunities related to recreational activities (e.g., fishing, hunting, sightseeing). Data inputs will focus on access, recreation and subsistence use values, quality of life, community use patterns, non-use environmental values, and social conditions of the area (Q1 2014). Additional data will be obtained from the Transportation Resources Study (Section 15.7) to assess current transportation conditions and assist in understanding access constraints to recreation use (Q3 2013; Q1 2014).

Coordination with physical / biophysical resources includes Instream Flow (Section 8), Hydrology-Related Resources (including Ice Processes) (Section 7.0), and Geomorphology (Section 6.0). The Fish and Aquatics Instream Flow Study (Section 8.5) will provide hydraulic routing model data to estimate water surface elevations and average water velocity under alternative operational scenarios. This information will provide data on potential changes in channel, sandbar and floodplain formation that may result from operation of the proposed project, and will be used to assess potential changes in recreation access and use (Q4 2014). Because these data are not projected to be available until Q4 2014, they will be used to refine the recreation resources impact analysis, and provide added detail that will be used in the formation of a Recreation Management Plan.

The Hydrology-Related Resources study will inform our understanding of potential changes in the hydrologic regime, including water timing, quantity, and quality (Section 7.0). Data will be used to understand aquatic reservoir conditions and potential water-dependent recreation uses, and will inform eventual development of a Recreation Management Plan. The Ice Processes in the Susitna River component of this study (Section 7.6) will provide information about expected changes in the type, distribution, and seasonality of ice cover on the Susitna River, downriver of the proposed dam (Q4 2013). These data will inform the impact assessment for winter recreation, including the more specific focus on ice dependent river recreation (Section 12.7.4). Results from the ice processes modeling will also be used to determine the longitudinal extent of downriver impacts to winter recreation, and inform the decision of whether to expand winter recreation studies downriver of the Parks Highway Bridge (Q1 2014).

The recreation use surveys (intercept and mail) will provide for multi-use data collection to support other studies, such as the Social Conditions and Public Goods and Services Study (Section 15.6.4.1). As an example of the interdisciplinary coordination, some space will be reserved in the Regional Residents Household Mail survey to include questions to gather recreational spending data as an input to the REMI modeling being conducted for the Regional Economic Evaluation Study (Section 15.5.4.1). Inclusion of these types of questions will require on-going collaboration and cooperation with, as well as review by, other study team members to identify and refine data collection to efficiently meet multiple needs. Anticipated coordination actions and outcomes are graphically depicted in Figure 12.5-3.

12.5.8. Level of Effort and Cost

The estimated cost of the two-year Recreation Resource Study is $1.6 million. Included in this total is the cost of the survey effort and demand analysis estimated at $935,000.

12.5.9. Literature Cited

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12.5.10. Figures

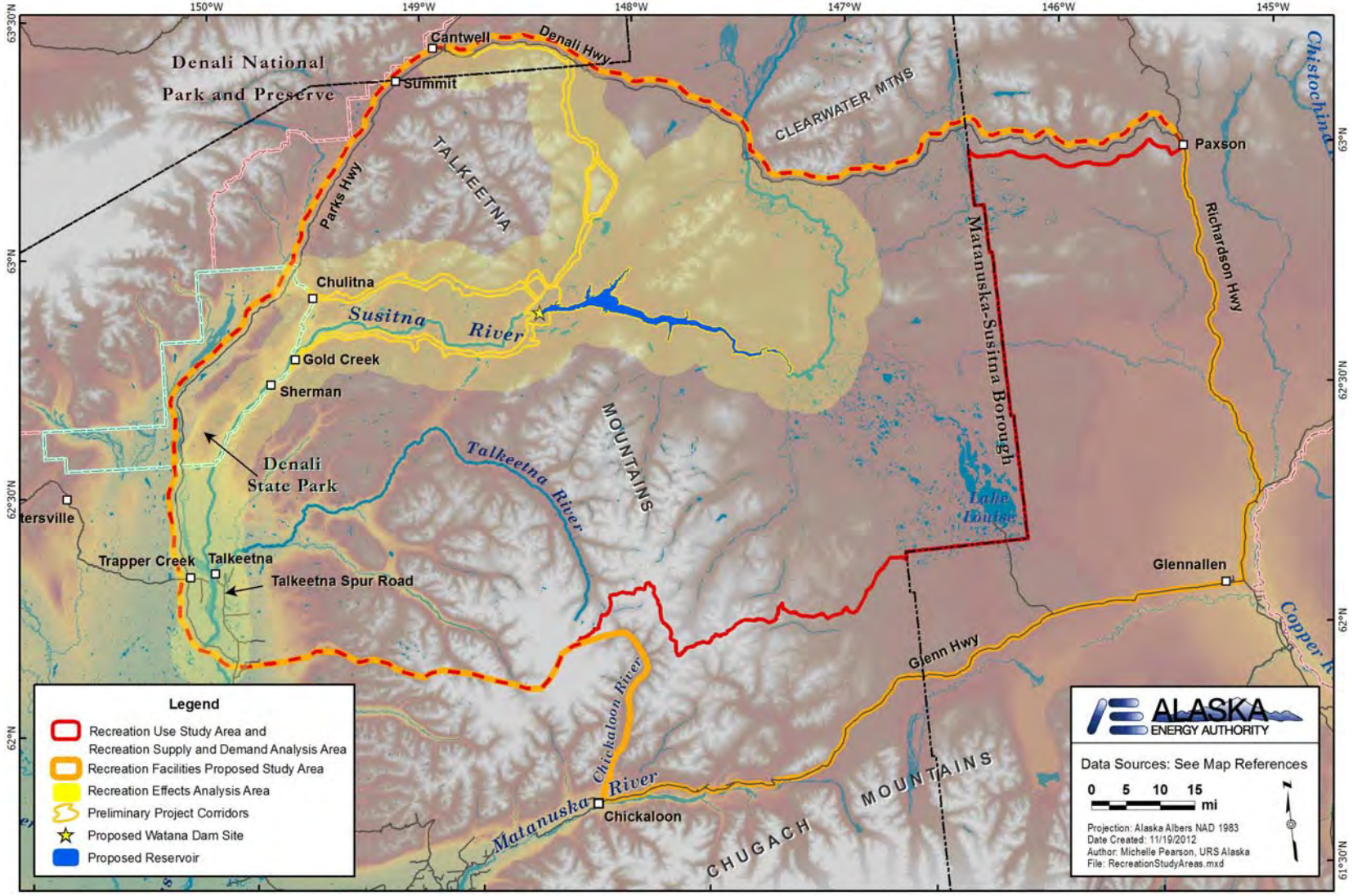

Figure 12.5-1 Recreation Resources Study Area.

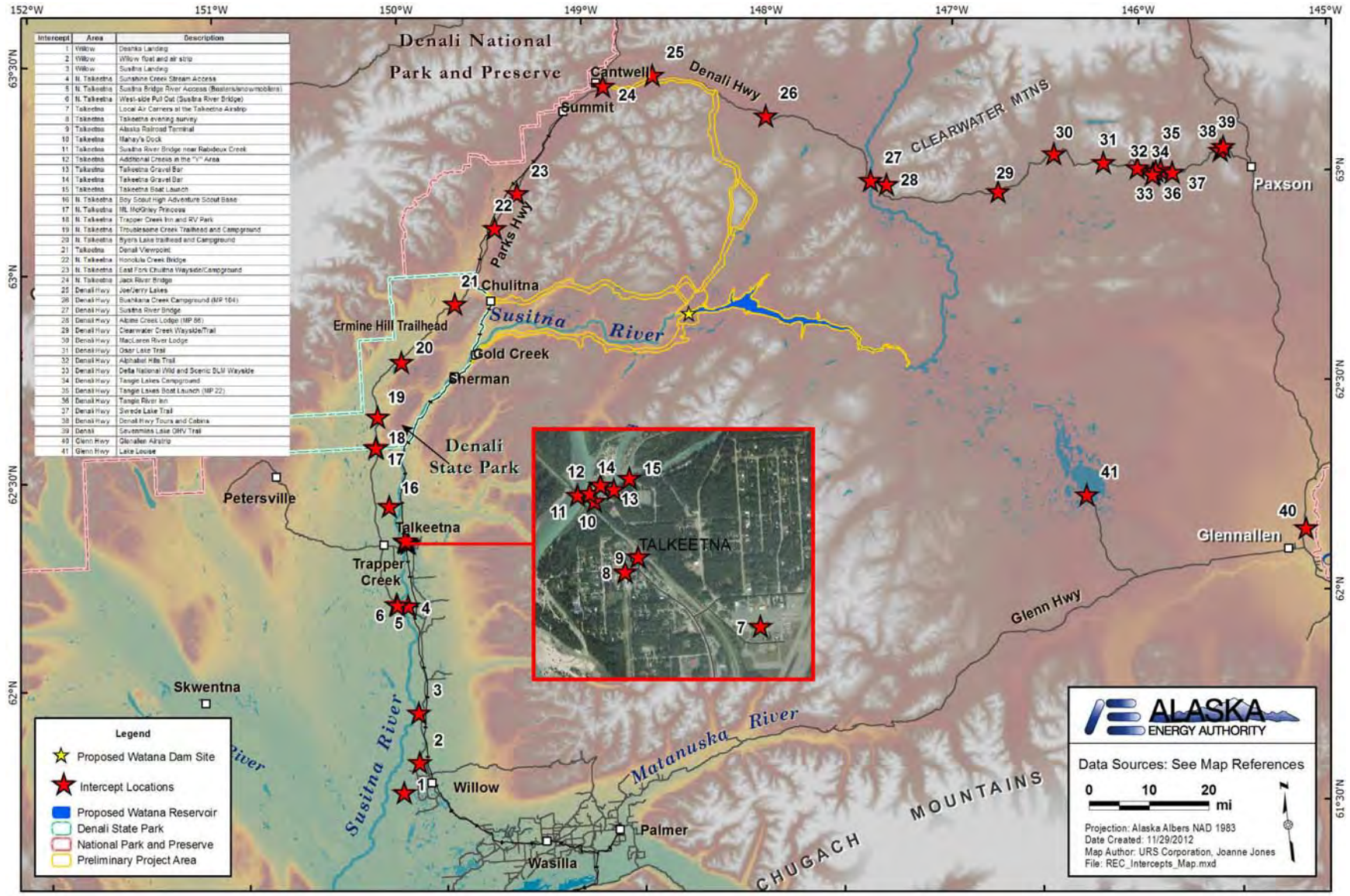

Figure 12.5-2 Survey Intercept Locations.

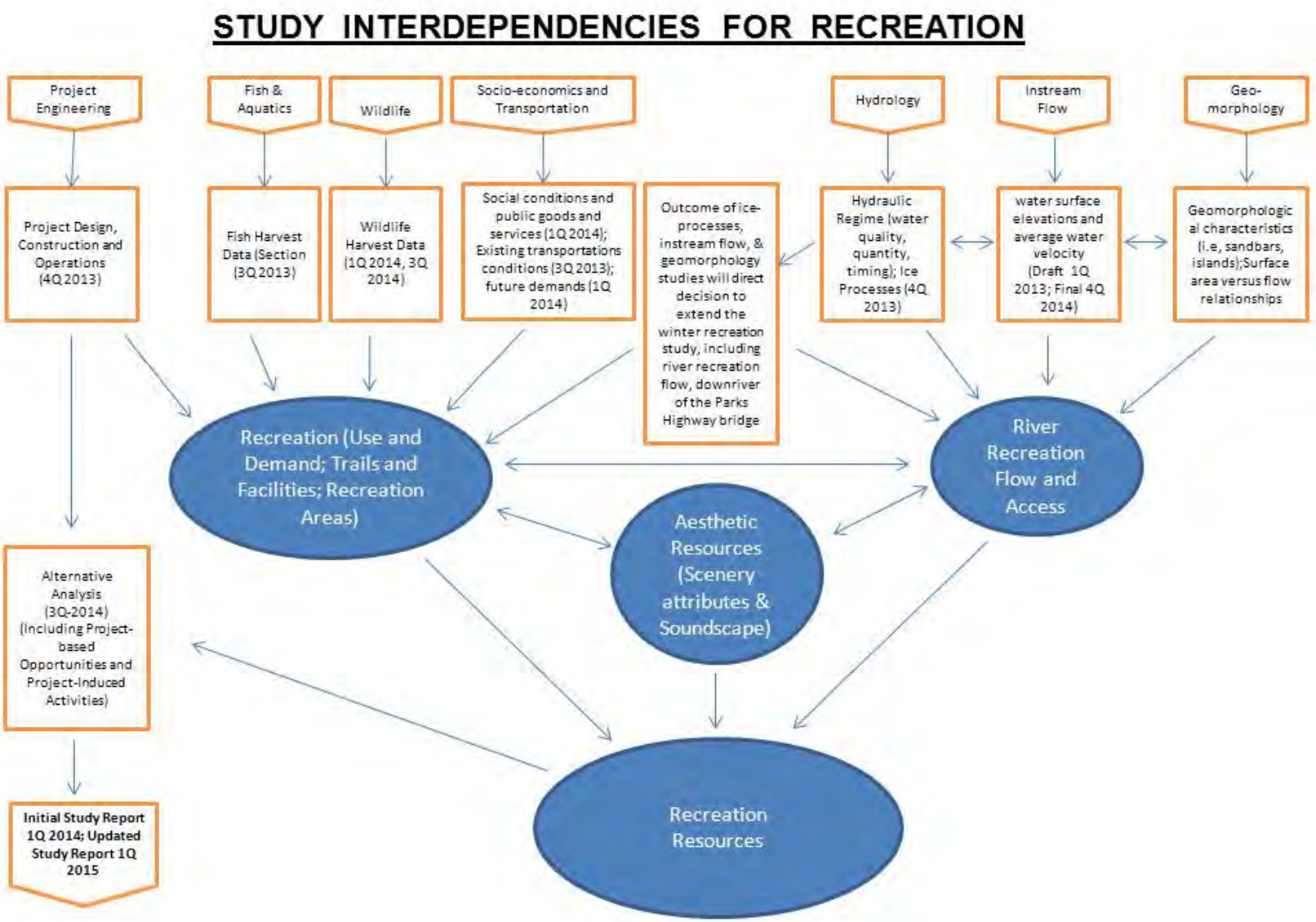

Figure 12.5-3 Study interdependencies for recreation.

12.6. Aesthetic Resources Study

12.6.1. General Description of the Proposed Study

The goals and objectives for the Aesthetic Resources Study are to inventory and document baseline aesthetic (e.g., visual, auditory) conditions within the Aesthetic Resources Study Area and evaluate the potential effects to aesthetic resources that may result from construction and operation of the proposed Project. The analysis will focus on assessing these potential impacts and will help identify potential design and other mitigation options.

12.6.2. Existing Information and Need for Additional Information

Existing information on aesthetic resources is provided in BLM Anchorage District planning documents, and in AEA's PAD (AEA 2011b). The Aesthetic Resources Study Area is located within the planning area boundary of the BLM Anchorage District. Although the Study Area is located within the lands managed under the East Alaska Resource Management Plan (RMP), the southwestern portion of the Study Area includes lands administered by the Ring of Fire RMP. As part of the RMP development process, the Bureau of Land Management completed a visual resource inventory (VRI) of BLM-administered lands within the Study Area. The VRI data consist of 3 components: scenic quality, visual sensitivity, and visual distance zone data. This information can be used to understand existing visual (aesthetic) resources at a planning level, and refine where necessary to better convey project-level information.

The PAD includes aesthetics resource data collected during the 1985 Susitna Hydroelectric Project Application for License for Major Project (APA 1985). These data included a description of landscape character within portions of the Study Area, a ranking of aesthetic value and visual absorption capability, and identification of notable landscape features. As part of the 2012 work, each component, described below, was assessed to determine its completeness and applicability to the proposed Project. An aesthetic resources study was initiated in 2012 to gather data to inform the 2013-2014 study plan. As part of this effort, data collected during the 1985 Susitna Hydroelectric Project Application for License for Major Project (APA 1985) was field verified. The nexus between each landscape character type and the proposed project was re-assessed to help inform the selection of Key Observation Points (KOPs) and indicators to be used in the impact analysis.

Additional elements of the 2012 aesthetic resources study included the following:

- Review of relevant federal, state, and local land use planning documents
- Viewshed modeling of the existing Susitna River, from approximately 5 miles downriver of the proposed dam site to approximately 5 miles upriver of the inundation zone
- Viewshed modeling of the proposed reservoir
- Field reconnaissance, including an assessment of existing cultural modification, lighting, and soundscapes
- Collection of photography
- Planning for the soundscape analysis
- Initiation of interdisciplinary coordination

In order to analyze potential impacts from the proposed Project (beneficial or adverse), additional baseline data is required. Collection of these data will focus on establishing the type and distribution of scenic quality attributes present within the Study Area, visual sensitivity to change within the Aesthetic Resources Study Area (assessed throughout a larger geographic area), and existing visual distance zones within the Study Area. These data will be used to support the impact analysis, including direct, indirect, and cumulative impacts to aesthetic resources.

Using information obtained from existing data, the 2012 aesthetic resources study, the FERC scoping process and incorporation of Agency and licensing participant recommendations, indicators proposed for the impact analysis were identified and study methods for 2013-2014 were developed.

12.6.3. Study Area

The Aesthetic Resources Study Area is shown in Figure 12.6-1. It is designed to be sufficient in size to address likely established indicators of change, including potential direct and indirect effects to recreation, cultural resources, subsistence, socioeconomics, geomorphology/ice processes, and riparian vegetation.

The Aesthetic Resources Study Area will be divided into primary and secondary study areas. The primary study area will be defined by a 30-mile radius surrounding all Project components, including: the proposed dam and camp facilities including construction sites, the reservoir, transmission corridors, access road corridors, borrow sites, and rail sidings. The Project viewshed will be defined in Q1 2013 using the most current Project design information. The analysis will focus on the following broadly defined viewer areas:

- The Susitna River corridor, downstream of Devils Canyon to Talkeetna
- The Susitna River corridor, from Devils Canyon to the proposed dam site
- The Susitna River, upstream of the proposed dam site to the upriver extent of the inundation zone
- Upland areas adjacent to the Susitna River, with emphasis on those areas within the viewshed of the inundation zone, proposed access roads, and proposed transmission corridors
- Common air transportation routes used for transportation and recreational air tours

The secondary study area for this study will include all lands located between the Denali Highway, south to the Glenn Highway and from the Richardson Highway, east to the mouth of the Susitna River (Figure 12.6.2). This area will be evaluated using existing information and used to understand the distribution of on aesthetic resources within a larger geographic context.

The aesthetics resource study area could be adjusted in 2014 to include areas within the river corridor located downriver of Talkeetna if 2013 studies in the lower reach indicate a possible Project-related effect on aesthetic resources in this area. Any recommended changes to any study areas will be included in AEA's Initial Study Report, which will be prepared and distributed in early February 2014. Such recommendation will be based on an assessment of modeling completed as part of the hydrology and ice processes analyses, including potential changes in the hydrologic regime, such as water timing, quantity, and quality (Section 7.0), and the expected

change in the type, distribution, and seasonality of ice cover on the Susitna River, downriver of the proposed dam (4Q 2013).

12.6.4. Study Methods

The visual resource impact analysis will generally follow methods developed by the BLM (BLM 1986). This methodology will be used to gather baseline data, complete the impact analysis, and inform design and mitigation options. Baseline data collection will occur across the primary and secondary study area. The primary study area will be evaluated using a combination of desktop and field-based observations. The secondary study area will be evaluated using desktop analyses and existing information. Data collection and analysis will be completed across all four seasons. Components of the study include:

- Viewshed Modeling
- Interdisciplinary Coordination
- Identification of Analysis Locations
- Baseline Data Collection
- Impact Analysis (Photosimulations, Contrast Rating, Visual Resource Inventory Analysis)
- Identification of Design and Other Mitigation Options

Viewshed Modeling

Viewshed models will be generated for all Project features, including the proposed reservoir, roads and transmission lines. Viewshed models will be developed for pre-and post-Project conditions of the inundation zone of the Susitna River to depict expected changes in viewshed areas (i.e., creation of new views, loss of others). Additional viewsheds will be created from identified analysis locations, described below. Maps displaying the viewsheds will be created, and used to direct the identification of important views and vistas considered in the analysis.

Identification of Analysis Locations

Standard analysis locations will be established that represent: (1) common and/or sensitive views within the Aesthetic Resources Study Area, and (2) areas used to measure anticipated change in scenic quality, and/or new opportunities for views, based on potential configuration of access roads/transmission corridors. These locations, referred to as Key Observation Pints (KOPs), will be used to evaluate baseline aesthetic values (including visual resources and soundscape), and will be carried forward through the impact analysis. Analysis locations will differ by landscape analysis factors (i.e., distance from the Project, predominant angle of observation, dominant use), and may be applicable to one or more seasons.

KOPs will be categorized as follows:

- *Observation Points (OPs)*: Observation Points represent specific locations or viewpoints. The viewer experience at these locations is typically stationary and from a single vantage point. Views experienced from OPs may be directional (i.e., a focal view) or not (i.e., a 360 degree panoramic).
- *Observation Areas (OAs):* Observation Areas represent large geographic areas where views could be experienced from a variety of locations. Views are typically transient, and experienced by viewers moving through the area (i.e., dispersed recreation; subsistence).

The likelihood of viewers standing in the same spot during repeated visits is low. The degree of variability of views experienced from OAs will depend on a variety of landscape characteristics.

- *Observation Corridors (OCs)*: Observation Corridors, also called "linear KOPs", represent linear viewing experiences, in which scenic attributes are experienced as a continuum. They may be focal (i.e., leading toward a noteworthy natural feature; entrance way), and/or transient (i.e., passing through a landscape).
- *Landscape Character Points (LCPs)*: Landscape Character Points will be established to provide standardized locations in which to evaluate changes in scenic quality. These locations are not tied to a particular viewer experience; however, they will provide information regarding the change in the visual resource of the area (beneficial or adverse) that may result from the proposed Project.

Preliminary recommendations for analysis locations are described in Table 12.6-1. Each location is targeted to address potential impacts (beneficial or adverse) to aesthetic resources, and is based largely on the anticipated nexus between the proposed Project and aesthetic resources identified in 2012. Locations used to assess new access to views / viewer experience that may result from access roads and/or transmission corridors will be selected through review of topographic maps and viewshed modeling. Final draft target analysis locations will be selected and mapped. Input from agencies on analysis locations will be sought through a TWG meeting in 2013, and will be considered when establishing final analysis locations.

Baseline Data Collection

Baseline data collection will include a combination of desktop (primary and secondary study area) and field data collection (primary study area).

Desktop data collection will include existing spatial and geospatial data describing aesthetic attributes, including scenic quality, visual distance zones, and visual sensitivity of the primary and secondary study areas.

Field data collection will be implemented using methodology developed by the BLM (BLM 1986). Data collection will target analysis locations sited within the primary study area. Data collection and analysis will focus on identifying existing aesthetic resource values including scenic quality, visual sensitivity, and distance zones.

Data on scenic quality will include the basic landscape components of form, line, color and texture, carried forward through the contrast rating procedure (BLM 1986) used in the impact analysis.

Visual sensitivity will be assessed through: (1) review of existing data collected during the Visual Sensitivity Level Analysis (SLA) completed during the RMP planning process for the BLM Ring of Fire and East Alaska RMP, and (2) Project-specific analysis. BLM planning-level data will include spatial data defining Sensitivity Level Rating Units (SLRUs), and the associated sensitivity-level analysis completed for that unit.

The Project-specific visual sensitivity analysis will be completed through intercept surveys, mail surveys, and executive interviews completed in coordination with recreation resources, socioeconomics, and subsistence resources. Survey instruments will be finalized during Q12013

study year. Focus groups will be held in 2014 to address visual preference of each alternative. Simulations created from KOPs under each alternative will be used to collect input on aesthetic attributes of each. A total of three focus groups will be held, targeting: (1) public agencies, (2) local tour operators/outfitters and guides/lodge owners, and (3) Alaska Native populations.

Visual distance zones represent the distance from which the landscape is most commonly viewed. These zones are established by buffering common travel routes and viewer locations at distances of three miles, five miles, and 15 miles using GIS (BLM 1986). Existing visual distance zones completed during the RMP planning process for the BLM Ring of Fire and East Alaska RMP will be used to describe baseline characteristics. Project-level visual distance zones will be developed based on an understanding of local travel routes, including those used for recreation and tourism (i.e., the Susitna River corridor below Devils Canyon; flightseeing tours).

One goal of the Aesthetic Resources Study will be help identify potential design and mitigation options to address potential impacts to aesthetic resources. A preliminary assessment of expected visual contrast of all Project components will be completed. This information will allow AEA to identify the mechanism of change in visual resources that may result from construction and operation of the Project and assist in identifying design features or other potential mitigation measures that could be implemented to reduce impacts.

Photo simulations

To support the visual resource effects analysis and to illustrate expected visibility of Project components from various locations, photo simulations will be prepared for a subset of analysis locations. Simulations will be produced by rendering Project components (dam structure, reservoir, access roads, transmission corridors) with 3-dimensional (3-D) computer models and superimposing these images onto photographs taken from analysis locations. Simulations will be produced to illustrate (1) the dam structure, (2) reservoir landscape characteristics, (3) access roads and transmission lines, (4) views of reservoir from upland areas, and (5) views of potential construction-related impacts. Simulations will be completed for all seasons and under daylight and nighttime/darkness conditions. An estimated total of 30 visual simulations will be produced. All images will be available for other Project uses.

Analysis

The aesthetics analysis will focus on identifying potential changes to aesthetic resources that may result from the proposed Project. The analysis will include a disclosure of anticipated effects, and a description of new aesthetic attributes (i.e., access; viewer experience). The analysis will address the following indicators of change:

- the mechanism of change in to aesthetic resources, measured by the degree of visual contrast in form, line, color, and texture created by construction and operation of the proposed Project;

- change in existing scenic quality, visual sensitivity, and distance zones within the Aesthetic Resources Study Area due to construction and operation of the proposed Project – change may result from inundation of the river channel, operation of the reservoir, introduction of new access roads and transmission lines (informed by siting and design), and/or alteration of downstream flow regime (including potential effects to

geomorphology, ice processes, water quality, riparian vegetation, river flow regime, and access/recreation);

- change in viewshed *of* and *from* the Susitna River due to inundation of the river channel and creation of the reservoir;

- change in access to views, due to the presence of the reservoir, access roads, and transmission corridor(s), and potentially improved navigability through Devils Canyon;

- change in mechanism of view (i.e., transition from mobile view traveling downriver, to static view when situated on the reservoir);

- change in visibility that may result from Project-related dust; and

- effect on dark sky due to light and glare.

Methodology used to address each indicator is described below:

- *Contrast Rating Analysis* - The BLM Contrast Rating procedure will be used to determine visual contrast that may result from the construction and operation of the Project using photo simulations depicting Project features. This method assumes that the extent to which the proposed Project affects visual resources is a function of the visual contrast between the proposed Project and the existing landscape character. Impact determinations will be based on the identified level of contrast and are not a measure of the overall attractiveness of the Project (BLM 1986). At each analysis location, Project features will be evaluated using photo simulations and described using the same basic elements of form, line, color, and texture used during the baseline evaluation. The level of perceived contrast between the proposed Project and the existing landscape will be classified using the following definitions:

    - None: The element contrast is not visible or perceived.
    - Weak: The element contrast can be seen but does not attract attention.
    - Moderate: The element contrast begins to attract attention and begins to dominate the characteristic landscape.
    - Strong: The element contrast demands attention, would not be overlooked, and is dominant in the landscape.

    The level of contrast will be assessed for all Project components used during construction, operations and maintenance, and decommissioning of the proposed Project.

- *Visual Resource Inventory Analysis*: The VRI analysis will be used to identify expected change to scenic quality, visual sensitivity, and/or distance zones that may result from operation of the proposed Project. Impacts will be evaluated by ranking each factor used to classify scenic quality, visual sensitivity, and distance zones under operational conditions, and comparing those values to baseline conditions.

- *Light and Glare:* The impact analysis for light and glare will focus on potential change that may result from nighttime artificial lighting and/or daytime glare. The analysis of

artificial lighting will identify sources, intensity and spatial extent of anticipated impacts. Photo simulations will be produced to demonstrate views of the proposed Project under dark conditions from select analysis locations.

- *Change in Viewshed Area and Mechanism of View:* Viewshed analysis performed for both pre- and post-Project conditions will be compared to identify the changes in viewshed and mechanism of view. These data will quantify the extent of changes in views, and the degree to which access to views changes with the development of roads and the elevation of the viewer within the inundated portions of the reservoir.
- *Change in Visibility:* Data generated by the Air Quality Resource discipline will be used to determine the potential for changes in visibility that may result from construction and/or operation of the proposed Project and related recreation resource values. Should it be determined that changes in air quality would be detectable, additional visibility analyses will be performed.

Soundscape Analysis

A systematic sound study will be conducted to characterize the existing ambient sound environment in the vicinity of the proposed Project and estimate the potential effect of Project construction and operational activities on that environment. The analysis will focus on:

- Quantifying existing soundscape data
- Determining consistency of existing soundscape with management objectives pertaining to sound (i.e., ROS data)
- Identifying anticipated changes in soundscape based on construction and operation phases of the Project (predictive sound emission modeling)
- Determining expected post-Project conformance with existing ROS designations

The analysis will include an assessment of Project-induced effects based on the assessment of future recreation use and demand and Project-related opportunities (Section 12.5.4).

The steps in the sound analysis are described below.

Review Documentation and Develop Data Needs

Relevant Project data will be reviewed, including the most current Project description, operating and construction equipment inventories, and construction schedules. Existing ambient sound data recorded within the secondary study area will be obtained. Based upon this review, itemized data requirements will be developed that will be needed to perform predictive sound emission modeling. A set of outdoor ambient sound level surveys in the vicinity of the Project Area will be obtained. The data requirements will include anticipated categories of stationary and mobile construction equipment and their frequency of operation, locations of nearest representative noise-sensitive receivers (NSR), recreation sites (RS), and sound data or specifications associated with intended operating dam systems and processes. Laws, ordinances, regulations, and standards that may influence the sound impact assessment for this study will also be inventoried.

Seasonal Surveys of Ambient Sound Levels

Ambient sound level measurements will be collected in the Aesthetic Resources Study Area, with the goal of establishing baseline soundscape data. Analysis locations will coincide with

KOPs identified for the visual resource assessment, including both viewer [receptor]-based (OPs, OAs, and OCs), and landscape-based (LCPs). Landscape-based sound measurements will be used to understand current and future conformance with ROS designations. Based on input from the wildlife resource study, additional sound monitoring locations may be added to areas with documented wildlife concentration. Sound measurements will include unattended long-term ([LT]", a minimum of 24 continuous hours, up to a single week) sound level monitoring at up to a total of four representative NSR or RS locations, and up to a total of 16 attended short-term ([ST], e.g., 15-20 minutes duration each) daytime and nighttime sound measurements to help characterize the affected environment. Observations of perceived and identifiable sources of sound contributing to the ambient sound environment and the conditions during which they occur will be documented as part of the field survey. This survey will be conducted up to four times, associated with up to four distinct seasons (e.g., summer, fall, winter, spring) but for a minimum of two seasons consistent with NPS Natural Sounds Program (NSP) published guidelines (NPS 2012). To the extent practicable, the survey locations will be the same for each surveyed season.

Modeling of Project Sound Levels.

Up to three scenarios or alternatives of future Project operational sound levels will be estimated with System for the Prediction of Acoustic Detectability (SPreAD) (Reed 2010). Computer Aided Noise Abatement (CADNA/A), an industry-accepted outdoor sound propagation modeling program, could also be used (Sound Advice Acoustics Ltd, 2012). Predicted sound level isopleths or "sound contours" will be superimposed on suitable aerial photographs or maps of the Project vicinity and will include specific sound level prediction at selected measurement and/or assessment locations from the ambient sound field surveys of Task 2. Predicted sound emissions associated with both Project construction and operation using different transportation route options will also be assessed.

GIS Maps and Figures

Viewsheds, analysis locations, and soundscapes will be mapped using GIS following Project geospatial standards. Mapping will also identify relevant management standards within the study area. Significant visual features will be photographed for inclusion in the Aesthetic Resources Report. Visual simulations depicting the appearance of the proposed Project will be produced for a subset of KOPs, and used to inform the impact analysis.

12.6.5. Consistency with Generally Accepted Scientific Practice

The methods and work efforts outlined in this Study Plan are the same or consistent with analyses used by applicants and licensees and relied upon by FERC in other hydroelectric licensing proceedings. The visual resource studies are based on the BLM's visual resources methodology. The sound analysis is consistent with NPS Guidelines.

12.6.6. Schedule

Upon implementation, the term of the Aesthetic Resources Study will be two years. In 2014 and 2015, licensing participants will have opportunities to review and comment on the study reports (Initial Study Report in early 2014 and Updated Study Report in early 2015). Updates on the study progress will be provided during Technical Workgroup meetings which will be held quarterly in 2013 and 2014 (See Table 12.6-1).

12.6.7. Relationship with Other Studies

Interdisciplinary coordination will be an essential component of the Aesthetic Resources Study and will result in efficient collection and analyses of data common between studies for the Project. Coordination will occur with other Project studies focused on recreation, cultural resources, subsistence, socioeconomics and transportation, geomorphology, ice processes, water quality, and riparian vegetation. Data collected by other studies will inform the approach to and eventual development of an Aesthetics Resources Report by identifying locations of common, sensitive, or valued aesthetic resources and/or areas where potential changes to biophysical processes could impact scenery attributes within the primary study area.

Coordination with Recreation Resources (Section 12.5) (including Recreation River Flow and Access [Section 12.7]) will include identification of recreational use areas, including areas of targeted use (i.e., trails, river/stream corridors, access points, State Parks) and areas of dispersed use. Analysis locations will be established in these areas to quantify aesthetic experience, including both scenery attributes and soundscape. Data pertaining to recreation use and demand, experiential preferences, and place-base value obtained from household and intercept surveys will inform the visual sensitivity analysis. Because of the integration between Aesthetics Resources and Recreation, it is expected that data will be shared in an ongoing manner (i.e., Q1 2013- Q4 2013).

Coordination with Cultural Resources (Section 13.0) will include identification of eligible or identified TCPs within the primary study area and establish analysis locations through collaboration with cultural resource study leads. It is expected that data will be shared in an ongoing manner throughout 2013-2014, recognizing restrictions applied to protect sensitive data.

Coordination with Subsistence Resources (Section 14.0) will focus on identifying areas within the primary study area that are used for subsistence purposes, or to access other areas used for subsistence to establish analysis location for both scenery attributes and soundscape. Additional coordination with subsistence resource study leads will identify questions pertaining to visual sensitivity and place-based value to be added to both household surveys and traditional and local knowledge interviews (Q3 2013- Q1 2014).

Input from the Socioeconomics and Transportation (Section 15.6 and 15.7) studies will include data on recreation and subsistence use values, quality of life, community use patterns, non-use environmental values, and social conditions of the area to inform the visual sensitivity level analysis. Socioeconomics data is expected to be available in Q1 2014. Data obtained from the Transportation Resources Study (Section 15.7) will be evaluated to understand anticipated changes related to transportation demands that could affect aesthetic resources (Q3 2013– Q1 2014).

Coordination with Riparian Instream Flow Study (Section 8.6) will be used to understand potential changes in riparian vegetation that would result in detectable changes in scenic attributes of the river corridor. Riparian instream flow data is expected Q4 2014, and will be used to refine the aesthetics resources impact analysis.

Coordination with Water Quality (Section 5.0) will focus on identifying expected changes in water quality parameters that would be detectable to viewers situated on or near the river (3Q 2014).

Coordination with Water Quality (Section 5.0) will focus on identifying expected changes in water quality parameters that would be detectable to viewers situated on or near the river. Water quality data is expected to be available Q3 2014.

Input from the Geomorphology Study (Section 6.5) will include determination of whether the geomorphic response to Project operations will result in detectable changes in downstream scenery attributes (Q1 2013 – Q4 2014).

Coordination with Hydrology-Related Resources (Section 7.0) will be used to understand hydrologic conditions that may affect scenic attributes and soundscape. A major focus will be on reviewing results of the Ice Processes in the Susitna River Study (Section 7.6) to better understand expected changes in the type, distribution, and seasonality of ice cover on the Susitna River, downriver of the proposed dam (Q4 2013).

Anticipated coordination actions and outcomes are graphically depicted in Figure 12.6-2.

12.6.8. Level of Effort and Cost

The estimated cost of the Aesthetics Resources Study is $835,000.

12.6.9. Literature Cited

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12.6.10. Tables

Table 12.6-1. Preliminary Recommendations for Analysis Locations.

	Analysis Goal	Locations Being Considered	Outcome
Mid Susitna River Valley	Evaluate potential impacts of transmission and access routes to aesthetic resources of the Mid Susitna River Valley.	Include upland and river-based Analysis Locations, including: • Susitna River, view downriver from perspective of a boater • Susitna River, view upriver from perspective of a boater (jetboat) • View from rail line • Upland, from perspective of existing trails • Upland, from dispersed recreation and/or subsistence use areas • Aerial views, from common flight path used for flightseeing	• Understand landscape absorption • Identify changes in scenic quality due to introduction of cultural modification • Where possible, inform engineering team to consider potential design options
	Evaluate new access to views of both the Susitna River Basin, and the surrounding areas that may be created from access routes and transmission corridors Evaluate each proposed route to determine where new views to focal or large-scale panoramic views would be accessible. Use viewshed modeling to support the selection of analysis locations	• Select locations on and adjacent to proposed access routes and transmission line corridors	• Identify areas where increased access to focal or panoramic views may increase exposure to certain viewsheds • Identify areas where access to noteworthy natural features may change • Use information to inform understanding of post-Project visual sensitivity
	Evaluate the change in appearance of downstream river attributes as a result of the proposed Project.	• View downriver, from perspective of a boater. Identify islands and/or riparian areas influenced by hydrologic regimes (i.e. multi-aged stands / varied vegetation communities) • View from existing winter trail toward ice bridge (note that this analysis will be coordinated to the outcome of the ice processes study) • View from upland trail, and/or dispersed recreation / subsistence use area • At transect locations for ice	• Define anticipated changes to riparian vegetation and related perceivable potential indirect impacts to aesthetic resources (i.e., increased enclosure, potentially decreased heterogeneity/contrast across vegetation communities) • Characterize existing scenic quality attributes of ice bridges, with a focus on

	Analysis Goal	Locations Being Considered	Outcome
		processes/geomorphology/riparian vegetation studies	those areas where ice bridge formation has been recorded across multiple years; evaluate anticipated change in these attributes (spatially and/or temporally) based on input from ice processes work • Define anticipated change in landscape character of the Valley
		• View of river valley from upland area, i.e., locations with existing view of the Mid Susitna River Basin (i.e., Denali State Park; rail line; trails)	• If determined to be detectable by the study, define anticipated changes to character of the river that may result from operation of the Project • Demonstrate differences in ability to detect change as a function of distance from the Project
Devils Canyon	Evaluate the change in the appearance, if any, of riverflow within Devils Canyon as a result of the proposed Project	• View downriver from perspective of a low flying aircraft	• Define anticipated change to aesthetic attributes based on possible change in flow regime
		• View upriver from perspective of a jet boat operator (base of DC)	• Define anticipated change to aesthetic attributes based on change in flow regime
	Evaluate potential impacts of transmission and access routes to aesthetic resources of Devils Canyon	• View from river canyon, south toward corridor (visibility questionable)	• Define impacts to scenic quality attributes of Devils Canyon that may result from access roads and transmission lines
	Evaluate new access to views of Devils Canyon due to access roads and transmission corridors	• If determined that views would be accessible, select locations on and adjacent to proposed access routes	• Describe scenic quality attributes of views accessed by roads and/or transmission corridors
Susitna River / Vee (River) Canyon	Evaluate change in mechanism of view(s) within the inundation zone	• View upriver / downriver from within Susitna River corridor (existing)	• Disclose anticipated changes in viewer experience due to formation of the reservoir
	Evaluate change in landscape features (landform, vegetation, waterform, cultural modification)	• View upriver / downriver from within Susitna River corridor (existing), with analysis location established at height of reservoir	• Identify change in scenic quality attributes of landform, vegetation, waterform, cultural modification

	Analysis Goal	Locations Being Considered	Outcome
	Evaluate change in *views of* the existing river corridor (waterform) following inundation and formation of the reservoir	• Views of the river from existing access trails, and upland areas used for dispersed recreation and/or subsistence	• Identify changes in scenic quality attributes and associated scores based on introduction of prominent water feature in viewshed
Susitna Upland Wet Tundra Basin	Evaluate change in *views of* the existing river corridor (waterform) following inundation and formation of the reservoir	• Views of the river from existing access trails, and upland areas used for dispersed recreation and/or subsistence	• Identify changes in scenic quality attributes and associated scores based on introduction of prominent water feature in viewshed
Portage Lowlands	Evaluate change in seasonal attributes of river downstream of the proposed dam site as a result of varied flow regimes	• Views from existing trail; views from mouth of creek	• Identify change in scenic quality attributes of landform, vegetation, waterform, cultural modification. Consider focus on flow-based aesthetic qualities
	Evaluate potential impacts to landscape character that may result from access roads and/or transmission lines	• Views from proposed access roads and transmission lines	• Identify changes in scenic quality attributes that may result from introduction of roads and transmission corridors. • Use information gleaned from analysis to inform engineering design and design options
	Evaluate new access to views of Portage Lowlands and Portage Creek due to access roads and transmission corridors.	• Select locations on and adjacent to proposed access routes and transmission line corridors.	• Describe scenic quality attributes of views accessed by roads and/or transmission corridors
	Evaluate potential impacts to landscape character that may result from access roads and/or transmission lines	• Views from existing trails; dispersed recreation and/or subsistence use areas	• Identify changes in scenic quality attributes that may result from introduction of roads and transmission corridors. • Use information gleaned from analysis to inform engineering design options

	Analysis Goal	Locations Being Considered	Outcome
Chulitna Moist Tundra Uplands	Evaluate new access to views of Portage Lowlands and Portage Creek, Devils Canyon (noteworthy natural feature), Devils Creek Falls (noteworthy natural feature), the dam structure and reservoir due to access roads and transmission corridors.	• Views from proposed access roads and transmission corridors.	• Describe scenic quality attributes of views accessed by roads and/or transmission corridors
	Evaluate potential impacts to landscape character that may result from access roads and/or transmission lines	• Views from existing trails; dispersed recreation and/or subsistence use areas • Views from Tsusena Butte / Lake • Views from Denali Highway, with emphasis on existing pull-outs/established vistas	• Identify changes in scenic quality attributes that may result from introduction of roads and transmission corridors. • Use information gleaned from analysis to inform engineering design options
Wet Upland Tundra	Evaluate new access to views of Deadman Creek, the dam structure and reservoir due to access roads and transmission corridors	• Views from proposed access roads and transmission corridors	• Describe scenic quality attributes of views accessed by roads and/or transmission corridors
	Evaluate potential impacts to landscape character that may result from access roads and/or transmission lines	• Views from the Susitna River • Views from rail line • Views from Sherman interpretive signs • Views from existing trails; dispersed recreation and/or subsistence use areas	• Identify changes in scenic quality attributes that may result from introduction of roads and transmission corridors • Use information gleaned from analysis to inform engineering design options
Talkeetna Uplands	Evaluate new access to views of Devils Canyon, the Mid-Susitna River valley due to access roads and transmission corridors, including cumulative effects due to existing transmission corridor	• Views from proposed access roads and transmission corridors	• Describe scenic quality attributes of views accessed by roads and/or transmission corridors
	Evaluate change in *views of* the existing river corridor (waterform) following inundation and formation of the reservoir	• Views of the river from existing access trails, and upland areas used for dispersed recreation and/or subsistence	• Identify changes in scenic quality attributes and associated scores based on introduction of prominent water feature in viewshed

	Analysis Goal	Locations Being Considered	Outcome
Talkeetna Mountains	Evaluate potential impacts to landscape character that may result from the dam structure, access roads and/or transmission lines	• Views from Fog Lakes • Views from Stephan Lake • Views from dispersed recreation and/or subsistence use areas	• Identify changes in scenic quality attributes that may result from introduction of roads and transmission corridors • Use information gleaned from analysis to inform design options to enhance aesthetic attributes of the project
Susitna Upland Terrace	Evaluate change in *views of* the existing river corridor (waterform) following inundation and formation of the reservoir	• Views of the river from existing access trails, and upland areas used for dispersed recreation and/or subsistence	• Identify changes in scenic quality attributes and associated scores based on introduction of prominent water feature in viewshed
	Evaluate new access to views of Devils Canyon, the dam structure, and the reservoir (including Watana Creek) due to access roads and transmission corridors, including any cumulative effects due to existing transmission corridor	• Views from proposed access roads and transmission corridors • Consider views of portions of the river located directly downriver of the dam where ice formation may change as a result of Project Operations	• Describe scenic quality attributes of views accessed by roads and/or transmission corridors • Demonstrate open water area below dam during winter
	Evaluate change in *views of* the existing river corridor (waterform) following inundation and formation of the reservoir	• Views of the river from existing access trails, and upland areas used for dispersed recreation and/or subsistence	Identify changes in scenic quality attributes and associated scores based on introduction of prominent water feature in viewshed (i.e., does this feature enhance or distract)
Susitna Upland	Evaluate impacts to landscape character when viewed from the air	• Views from common flightseeing routes.	• Identify changes in scenic quality attributes that may result from introduction of the reservoir, dam facility, roads and transmission corridors.
Air Tour Routes[1]	Evaluate change in scenic attributes of the river as a result of changes in flow volume	• Montana Creek Recreation Site	• Understanding of how specific metrics of scenic quality related to river flow could change as a result of operation of the Project

	Analysis Goal	Locations Being Considered	Outcome
Susitna River, downstream of Talkeetna	Evaluate potential changes to aesthetic attributes related to changes in ice processes and/or river flows; note that the extent to which these areas are evaluated will depend on the outcome of analysis of modeling completed relating to ice processes and river flows	• Montana Creek Recreation Site • Winter Trail(s) at Delta Islands • Iditarod NHT Winter Trail	• Identify potential changes to aesthetic attributes related to changes in ice processes and/or river flows, if any

Table 12.6-2. Aesthetic Resources Study Schedule.

Activity	2012				2013				2014				2015
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q
Viewshed Modeling					—								
Baseline Data Collection (Aesthetics and Soundscape)						—	—	—		--------	-------		
Simulation Development / Sound Modeling						—	—	—		--------	-------		
Effects Analysis							—	—		--------	-------		
Initial Study Report								—	Δ				
Updated Study Report										—	—	—	▲

Legend:

— Planned Activity
Δ Initial Study Report (February 2014)
▲ Updated Study Report (February 2015)

12.6.11. Figures

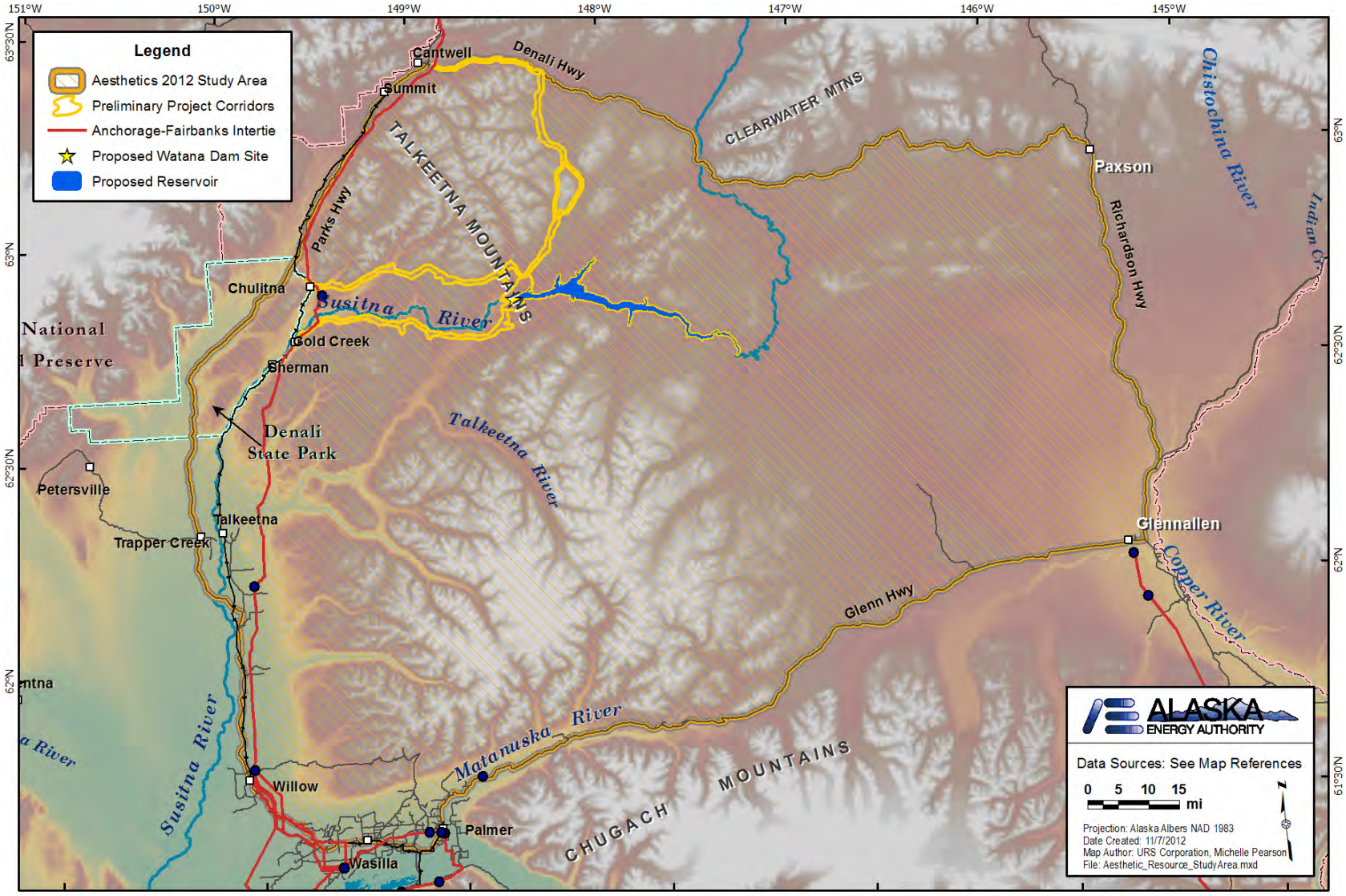

Figure 12.6-1 Aesthetic resources study area.

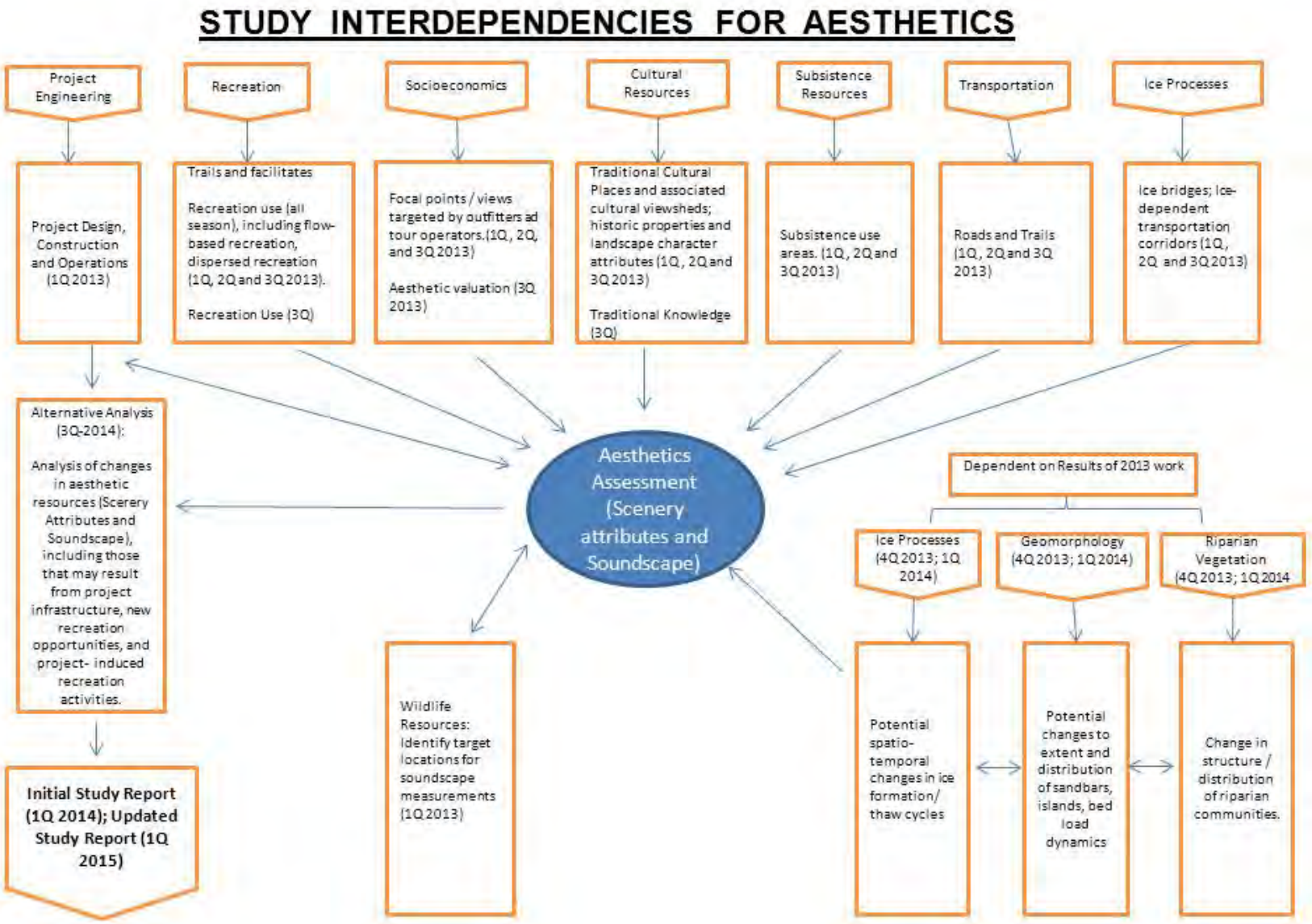

Figure 12.6-2 Study interdependencies for aesthetics.

12.7. River Recreation Flow and Access Study

12.7.1. General Description of the Proposed Study

This study incorporates and contributes to data and analysis conducted as part of the Recreation Resources Study (Section 12.5). In the overall recreation study, river recreation, boating uses, and river access points will be identified. Current and future use of the Susitna River by both motorized and non-motorized boat users will also be estimated. Because the Project will affect river flow regimes, including the inundation of about 39 miles of the river, and possible ice formation, and because changes in river flow regimes and ice formation may impact recreation activities on the river corridor, a specific methodology of recreational flow analysis is also proposed.

The goals and objectives of the River Recreation and Access Study are to contribute data to the Recreation Resource Study concerning the relationship between river flows and river recreation opportunities and uses, by:

- Documenting river recreation use and experience for the respective river recreation and transportation opportunities on three mainstem Susitna river reaches
- Describing the potential effects of altered river flows on existing and potential boating activity and other river recreational uses of the Susitna River
- Understanding river ice preferences for the respective river ice dependent winter recreation and transportation on the Susitna River
  Describing new boating or other flow-dependent recreational opportunities that may be created by Project construction and operation.

12.7.2. Existing Information and Need for Additional Information

Existing recreation resources information was compiled in the Recreation Data Gap Analysis (AEA 2011a) and recreation resource descriptions and inventory presented in AEA's PAD (AEA 2011b). A recreation study was conducted in 2012 to gather data to inform the 2013-2014 Study Plan, including the following elements:

- Interviews with key representatives of agencies and organizations knowledgeable about river recreation in the Project area and state recreation management
- Incidental Observation Survey Data (completed by field crews)
- Geo-referenced mapping
- Identification of future trends and issues
- Description of the management framework
- Compilation of existing baseline river recreation information and access
- Hydrology data review
- Field reconnaissance and photography
- Identification of future trends and issues
- Description of the management framework and special river designations

Information from 2012 data collection has been used to develop the Revised Study Plan. The FERC scoping process, Technical Workgroup meetings, and licensing participant recommendations have also been used in development of the 2013-2014 Study Plan.

12.7.3. Study Area

During the 2012 recreation study, three distinct river recreation reaches were identified on the Susitna River, shown in Figure 12.7-1, for gathering baseline river recreation information on the Susitna River. The three river recreation reach breaks are described as follows: River Recreation Reach 1) the section of river from the Susitna River bridge (RM 291) on the Denali Highway to Fog Creek (RM 177); River Recreation Reach 2) Fog Creek to the confluence with Portage Creek (RM 149) downstream of Devils Canyon; and River Recreation Reach 3) Portage Creek to the confluence with the George Parks Highway Bridge (aka Sunshine) downstream of the confluence with the Talkeetna and Chulitna Rivers (RM 83). The three river recreation reach designations overlap other reach breaks delineated for other resource studies. The pertinent information from these other disciplines will be summarized for the river recreation reaches as warranted.

River Recreation Reach 1—Denali Highway Susitna River Bridge (RM 291) to Fog Creek (RM 177): This section of the Susitna River contains 140 miles of remote Class I to II moving water with broad views of the surrounding mountain ranges. River Recreation Reach 1 includes the location of the proposed Watana Dam and reservoir.

This section of the river is suitable for motorized (jet boats and air boats) and non-motorized (rafts, canoes, kayaks and packrafts). This section of river offers single day (motorized users) or multi-day river trip opportunities. River campsites are available on islands and bars. User groups may include river recreationists, hunters, anglers, adventure racers, and adventure schools.

Motor vehicle access is generally limited to the Susitna River Bridge on the Denali Highway. The current site has an unimproved access that does not have a launch for trailered boats. Access to the river may also be gained through private or commercial air taxis. River users may also float into the mainstem Susitna via tributaries using float planes to headwater lakes and/or overland travel.

Non-motorized boaters lacking the expert skills to negotiate the Class V whitewater in Devils Canyon must arrange an exit from the Susitna River prior to entering this more difficult whitewater section. The exit options in this remote section of the Susitna River include air taxi, motorboat pick-up, overland routes or a combination thereof. One route using a 17B trail was described by Embick (1994) and Jettmar (2008) connecting the Susitna to the Talkeetna via Stephan Lake and Prairie Creek.

River Recreation Reach 2—Fog Creek (RM 177) to Portage Creek (RM 149): This section of the Susitna River contains Class III to V+ whitewater. Recreation use is primarily limited to a few expert whitewater boaters in kayaks although there are reports of users with other watercraft. Recreation users may use other watercraft such as packrafts on short stretches of the mainstem upstream of the Devils Canyon section to link up overland routes or tributaries.

River Recreation Reach 3—Portage Creek (RM 149) to the George Parks Highway Susitna River Bridge (RM 83): The Susitna River from Portage Creek to the George Parks Highway Bridge, near Sunshine, contains Class I-II water. This reach is suitable for a variety of motorized

and non-motorized watercraft. Commercial and non-commercial users utilize various sections of River Recreation Reach 3. Commercial uses include jet boat tours, river rafting, and guided fishing trips. Non-commercial uses include motorized (jet boats and air boats) and non-motorized watercraft (canoes, kayaks, inflatable kayaks, rafts, and packrafts). River access is available at multiple locations via the train to Gold Creek. For launching points further upstream, a motorized boat shuttle is required. Motorized and non-motorized trips range from single to multi-day with numerous river campsites on islands, tributary confluences and gravel bars. Some recreational boaters, particularly packrafters, may utilize tributaries such as Portage or Gold Creek to float into the main-stem Susitna.

If 2013 study results from other resource studies including ice processes, hydrology, and geomorphology, indicate that the Project may affect river flows in a way that changes the way recreationists currently use that reach of the river, the 2014 Project survey effort and impact analysis may extend further downstream of the confluence with the Talkeetna and Chulitna Rivers.

The flow preferences for respective river recreation opportunities observed in River Recreation Reach 3 will likely be applicable to river uses downstream. Recreation use data collected through intercept and resident surveys described in Section 12.5 for downstream locations will be used to analyze Project effects on recreation frequency, timing, and quality.

12.7.4. Study Methods

This Study is designed to document the range of flows for a variety of motorized and non-motorized watercraft using the Susitna River for recreation as well as a transportation corridor. Likewise, the Study is designed to document river ice dependent recreation and transportation activities during the winter period. River ice variables likely include temporal and spatial extent for channel bridging, and longitudinal length for transportation. The methods and analysis will use practices and survey techniques for recreational flow study design, as described in Whittaker et al. (1993) and Whittaker et al. (2005).

River Recreation Surveys

The River Recreation and Access Survey (Attachment 12-4) will be used to gather information on river recreation uses, location, frequency, seasonal patterns, primary trip purpose, secondary activities, access, campsites and river recreation quality relative to trip flow evaluation. The survey will be posted on the internet and will serve as the primary means for gathering information from river users. Utilizing the internet for the survey tool will help geographically expand the collection of responses on dispersed river recreation use. The expansive study area, remote location, dispersed access points, and anticipated low number of annual user days would normally be cost prohibitive for an on-site intercept survey. Furthermore, the electronic survey provides a means for capturing both past and current recreation use.

Survey participation will be solicited by advertising the river recreation survey electronically through a multitude of forums including but not limited to national and regional whitewater groups, forums for outdoor recreation including adventure races, fishing, hunting, motorized and non-motorized user groups, message boards, commercial outfitters and guides, adventure schools and transportation services to the study area. Posters will also be delivered at key locations such as outdoor retail shops, key convenience stores in the study area, and train station and commercial transportation service locations for the study area. Postcards will also be distributed

at key access points and staging areas. Hardcopy surveys identical to the internet survey will be administered in the field for chance encounters. For the internet surveys, the platform allows for restriction of Internet Protocol (IP) addresses for entry, therefore unique responses can be identified.

Whitewater organizations at the national and regional level serve as a portal for disseminating information to the paddling community through websites, journal articles, and electronic communication. The internet link for the Susitna whitewater survey will be forwarded to the national and regional paddling groups as well as whitewater message boards in Alaska. In addition, efforts will be made to identify boaters known to have paddled Devils Canyon about the whitewater survey available on the internet. A fairly comprehensive list of paddlers that have attempted or completed runs on the Devils Canyon stretch dating back to the 1970s was assembled as part of the 2012 field reconnaissance efforts. Individuals on this list will be contacted for interviews and directed to the internet survey. Formal and informal interviews will be conducted to supplement the internet survey data as well as gather additional information about user groups, trip purposes, use patterns, access, flows and other recreation information. A set of pre-established executive interview questions (Attachment 12-5) will be asked in each interview. A form will be completed for each interview including the name of the interviewee, date, name of individual being interviewed, responses to interview questions and additional comments and discussion in the interview.

Recreation use information obtained through the interviews will be summarized for respective recreation opportunities including primary purpose, secondary activities, flow preferences, seasonal use patterns, frequency of use, access points, campsites, trip length, comparisons with recreation opportunities on other Alaska rivers, and recreation quality on the Susitna.

Identifying and contacting individuals that have recreated on the Susitna River will be challenging for some of the recreational users that tend not to be part of organized groups such as trappers, hunters, and cabin owners. Recreation contact lists will be generated through outreach to recreation groups, resource agency land managers, and commercial providers such as air taxis, lodges, hunting outfitters, rental shops, rafting companies, jet boat companies, tourism services, and adventure schools. Although the commercial operators currently utilize the Susitna River, resource agency staff as well as owners and employees of commercial companies may have personal experience on this reach of the Susitna or provide names of individuals that have recreated. Non-commercial contacts will include paddling clubs, university recreation centers, adventure racers, outdoor clubs, as well as area residents potentially using the river corridor for recreation and/or transportation purposes.

River recreation use information obtained through the interviews will be summarized for respective recreation opportunities including primary trip purpose, secondary activities, flow levels necessary for navigation, transportation and recreation for respective watercraft types, seasonal use patterns, frequency of use, access points, campsites, trip length, comparisons with recreation opportunities on other Alaska rivers, and recreation quality on the Susitna.

Data analysis and reporting will include summaries of the internet survey data and interviews. River recreation use information obtained through the electronic internet survey and interviews will be summarized for respective recreation opportunities including primary purpose, secondary activities, demographics of the respective recreational user groups, flow preferences, seasonal use patterns, frequency of use, access points, campsites, trip length, comparisons with recreation

opportunities on other Alaska rivers and quality of experience. The intercept survey and incidental observations described in section 12.5 will be used to supplement data obtained through the internet survey and interviews. Likewise, information gathered through the River Recreation and Access Survey will supplement the analysis of recreation activities described in Section 12.5.

The report will include an analysis of the potential effects of Project construction and operation on existing river recreation opportunities, attributes, and access. The annual number of days under the baseline hydrologic record will be summarized by month for respective river recreation opportunities based on the range of flows during which use was observed and compared to the annual days available under the proposed Project operations.

The analysis will include changes in the area of the proposed reservoir from a riverine to lacustrine system. The report will also include an inventory of the reservoir recreation opportunities for various operating alternatives.

River Ice Dependent Winter Recreation

The Susitna River during the winter ice period provides motorized and non-motorized winter recreation opportunities and serves as a transportation corridor for residents along the Susitna. Construction and operation of the Project could alter the timing and longitudinal extent of ice formation, and impact such uses. The study area for the River Ice Dependent Winter Recreation investigation will be partitioned using the same reach breaks as described for the River Recreation and Access Study. The three reaches are described as follows: River Recreation Reach 1) the section of river from the Susitna River bridge (RM 291) on the Denali Highway to Fog Creek (RM 177); River Recreation Reach 2) Fog Creek to the confluence with Portage Creek (RM 149) downstream of Devils Canyon; and River Recreation Reach 3) Portage Creek to the confluence with the George Parks Highway Bridge (aka Sunshine) downstream of the confluence with the Talkeetna and Chulitna Rivers (RM 83).

Information on winter recreation activities and transportation on the ice covered Susitna River will be obtained through interviews with regional officials, winter recreation users, event organizers, event participants, and other knowledgeable area residents. Contact lists will also be initiated in a similar fashion to that described for river recreation. Commercial providers such as lodges, snowmobile service and rental shops, and winter recreation vendors will be contacted. If possible, trappers using the river corridor will be interviewed. A few winter residents in cabins upstream of Talkeetna will be queried relative to their use patterns on the river corridor. Periodic aerial flights during periods of ice cover as part of the ice processes study will be used, in part to map areas of winter recreation and transportation activity through aerial observations of tracks on the snow. Winter recreation activities will be documented during monthly winter site visits. Efforts will be made to time visits with winter festival events that may occur in the area.

A set of pre-established winter recreation and transportation questions will be asked in each interview. Interview questions will be tailored specifically to activities associated with winter ice conditions on the Susitna. Questions will focus on timing, frequency and location of activities, type of activity, ice thickness, trip lengths, trip purpose, crossing river channel vs. using river corridor as a route, alternative transportation routes, and alternative winter recreation locations. The draft interview questions will be circulated for review and comment by agencies prior to finalizing in early 2013.

A form will be completed for each interview including the name of the interviewer, date, name of individual being interviewed, responses to interview questions and additional comments and discussion in the interview.

River ice dependent winter recreation and transportation information obtained through the interviews will be summarized for respective recreation opportunities including primary purpose, secondary activities, ice thickness required, need for ice bridges verses longitudinal ice cover, seasonal use patterns, frequency of use, access points, duration of trip (days), campsites, trip length, comparisons with winter recreation opportunities on other frozen Alaska rivers and winter recreation quality on the Susitna.

Information obtained from interviews will be supplemented with data obtained from the intercept survey described in section 12.5.

Desired outcomes of this study process include the following:

- A physical description of each River Recreation Reach including length, put-ins and take-outs (i.e., access points), river difficulty, character, portage requirements, river campsites, and type of experiences
- Summary of motorized and non-motorized boating opportunities and associated attributes including distinctions between commercial and non-commercial uses for the three river reaches
- Summary of river recreation opportunities on Susitna tributaries in the three study reaches
- Summary of existing river access points, modes of transportation to the river and costs for the three study reaches under existing conditions as well as project alternatives allowing public access to the reservoir and project transportation corridor
- Flow ranges observed for respective river recreation opportunities on the three river reaches
- Annual frequency and timing (number of days per month) for respective recreation opportunities under baseline flow conditions and potential alternative flow regimes

12.7.5. Consistency with Generally Accepted Scientific Practice

The methods and work efforts outlined in this Study Plan are the same or consistent with analyses used by applicants and licensees and relied upon by FERC in other hydroelectric licensing proceedings. The proposed methodology is often used in analysis for development of hydroelectric License Applications to fulfill the FERC's Exhibit E requirements for documentation and development of mitigation measures for flow dependent recreation. The methods and analysis will use survey techniques and practices for recreational flow study design, as described in Whittaker et al. (1993) and Whittaker et al. (2005).

12.7.6. Schedule

Upon implementation, the term of the River Recreation and Access Study, including the River Ice Dependent Winter Recreation component, will be two years. Table 12-7.1 lists the schedule for the River Recreation Flow and Access Study. In 2014 and 2015, licensing participants will have opportunities to review and comment on the study reports (Initial Study Report in early

February 2014 and Updated Study Report in early 2015). Updates on the study progress will be provided during Technical Workgroup meetings which will be held quarterly in 2013 and 2014.

12.7.7. Relationship with Other Studies

Interdisciplinary coordination will be an essential component of the Recreation River Flow Study across all seasons and will result in efficient collection and analyses of data common between studies for the Susitna-Watana Hydroelectric Project. Coordination will occur with other Project studies focused on instream flow (Section 8.6), hydrology (Section 7.0) (including ice processes) (Section 7.6), geomorphology (Section 6.5), recreation (Section 12.5), and project engineering feasibility studies. Data collected by other studies will inform the approach to and eventual development of the Initial Study Report (early February 2014) and Updated Study Report (early 2015).

Information collected on river recreation use and experience will be coordinated with hydrologic data including flows, water quality, and ice formation timing and extent collected through other studies to refine current river use characteristics. As described in Section 12.5.4, the Hydrology study will provide data on potential changes to the hydrologic regime, including water timing, quantity, and quality (Section 7.0). Data will be used to understand aquatic reservoir conditions and potential water-dependent recreation uses, and will inform eventual development of a Recreation Management Plan. The Fish and Aquatics Instream Flow Study will provide hydraulic routing model data to estimate water surface elevations and average water velocity under alternative operational scenarios. This information will provide data on potential changes in channel, sandbar and floodplain formation that may result from operation of the proposed project, and will be used to asses potential changes in river-based recreation access and use (Q4 2014).

Additional data inputs will be gathered from the geomorphology study (Section 6.0). This study will provide data describing the extent to which geomorphological processes of the river could change under operational flows. Coordination will focus on those attributes most relevant to river-based recreation, such as beaches, sandbars, and islands (Q1 2013 – Q4 2014).

Coordination with the ice processes study (Section 7.6) will provide information about expected changes in the type, distribution, and seasonality of ice cover on the Susitna River, downriver of the proposed dam (Q4 2013). These data will provide baseline data, and inform the impact assessment for ice dependent river recreation (Section 12.7.4). Results from the ice processes modeling will also be used to determine the longitudinal extent of downriver impacts to winter recreation, and inform the decision of whether to expand winter river ice-dependent recreation studies to areas located downriver of the Parks Highway Bridge (Q1 2014). Anticipated coordination is graphically depicted in Figure 12.7-2.

12.7.8. Level of Effort and Cost

The estimated cost of the two-year River Recreation and Access Study is $643,000.

12.7.9. Literature Cited

AEA (Alaska Energy Authority). 2011a. Susitna-Watana Hydroelectric Project, Socioeconomic, Recreation, Air Quality and Transportation Data Gap Analysis. Prepared by HDR, Inc., Anchorage.

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Whittaker, D., B. Shelby, and J. Gangemi. 2005. Flows and recreation: a guide to studies for river professionals. Report for Hydropower Reform Coalition and National Park Service – Hydropower Recreation Assistance.

12.7.10. Tables

Table 12.7-1. Recreational Boating / River Access Study Schedule.

Activity	2012				2013				2014				2015
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q
Baseline Data Collection					—	—	—	—					
Field Studies						—	—	—					
Analysis						—	—	.....	.....				
Impact Analysis								—	—	—	—		
Initial Study Report								—	Δ				
Updated Study Report										—	—	—	▲

Legend:

— Planned Activity
..... Follow up activity (as needed)
Δ Initial Study Report (February 2014)
▲ Updated Study Report (February 2015)

12.7.11. Figures

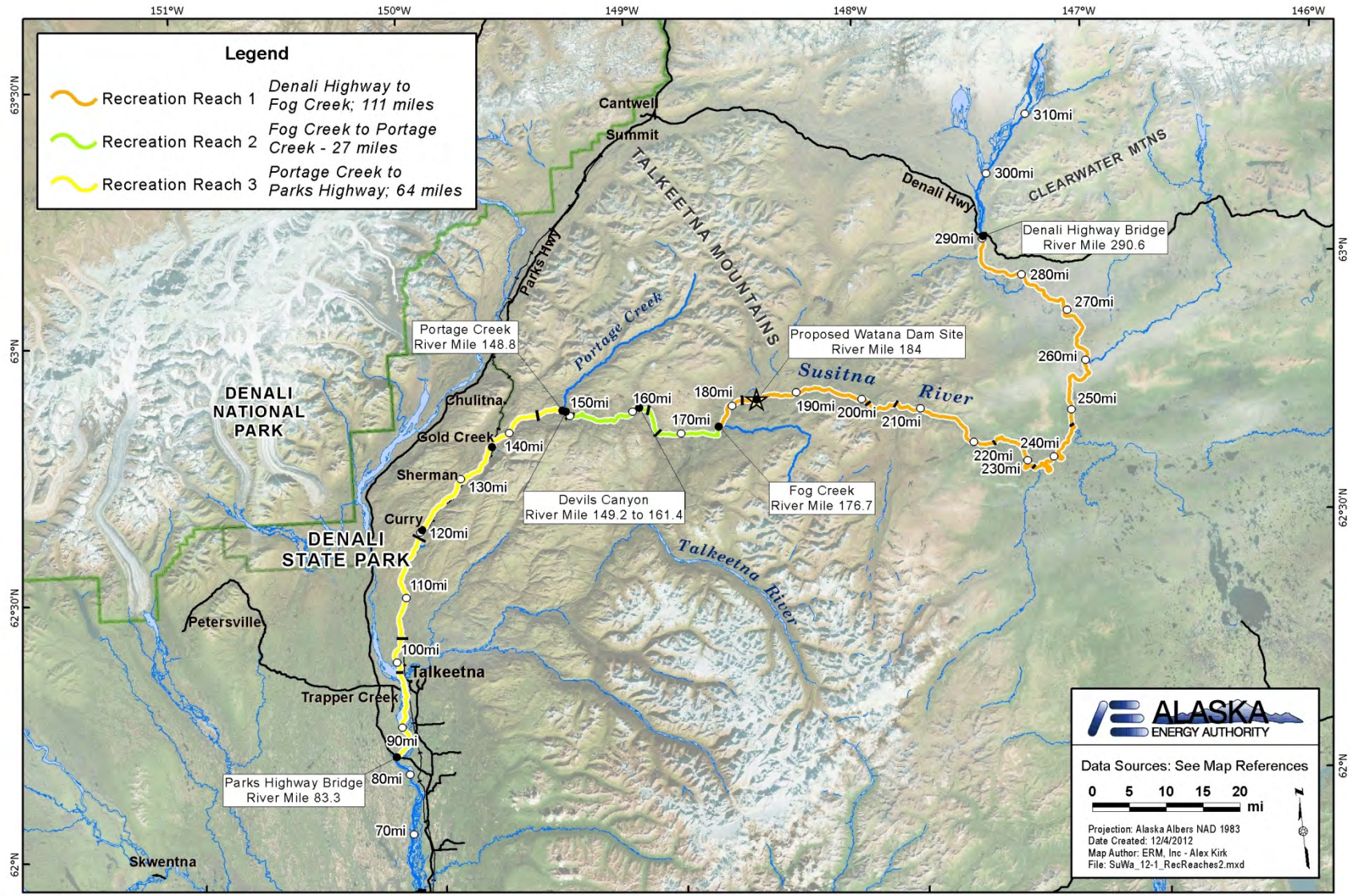


Figure 12.7-1 River Recreation - Reaches Study Area.

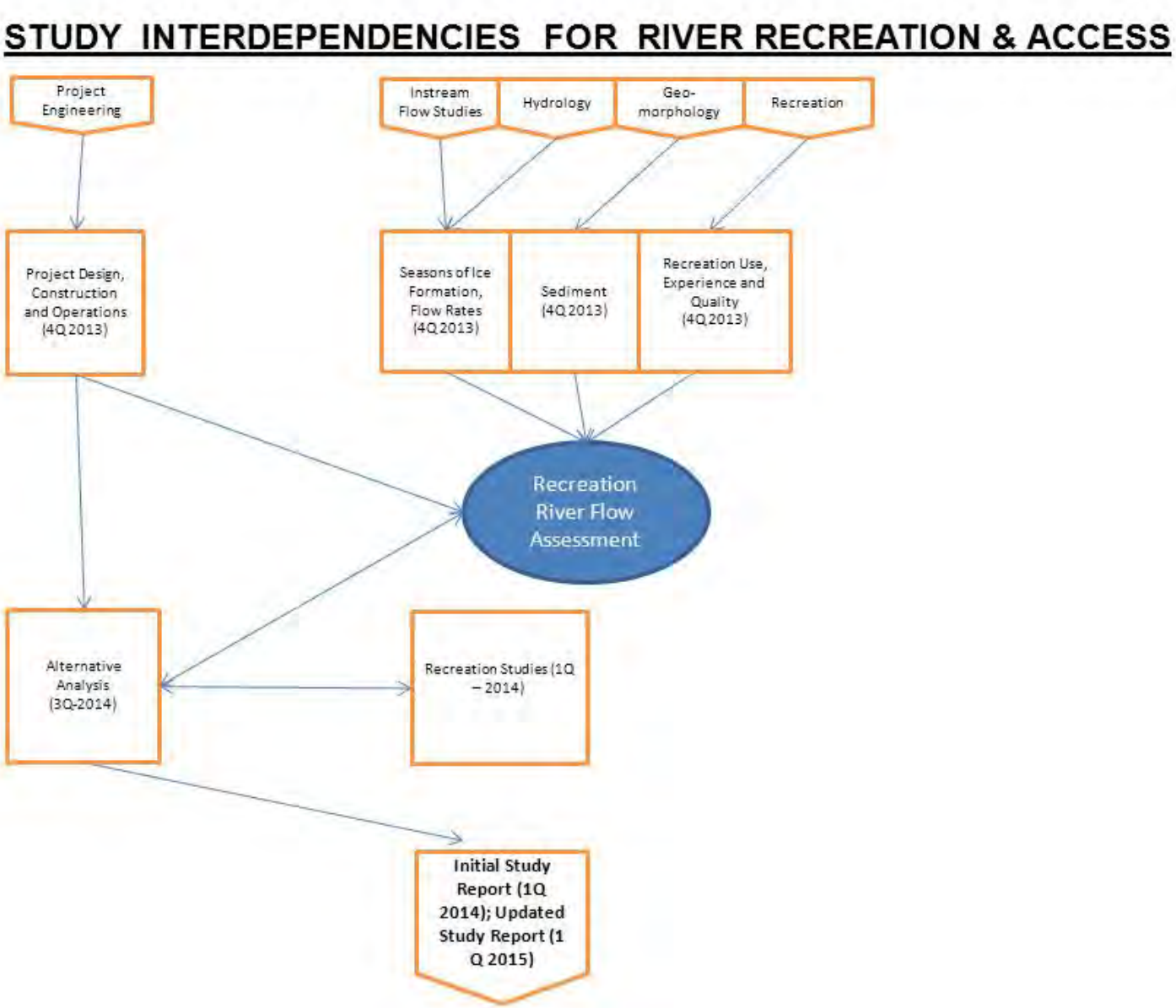


Figure 12.7-2 Recreation River Flow Study Interdependencies.

12.8. Attachments

ATTACHMENT 12-1. INCIDENTAL OBSERVATION FORM.

ATTACHMENT 12-2. RECREATION INTERCEPT SURVEY INSTRUMENT (DRAFT).

ATTACHMENT 12-3. RECREATION EXECUTIVE INTERVIEW PROTOCOL (DRAFT).

ATTACHMENT 12-4. RIVER RECREATION AND ACCESS SURVEY INSTRUMENT (DRAFT).

ATTACHMENT 12-5. RIVER RECREATION AND ACCESS EXECUTIVE SURVEY INTERVIEW PROTOCOL (DRAFT).

ATTACHMENT 12-1
INCIDENTAL OBSERVATION FORM

Susitna-Watana Hydroelectric Project Recreation Resources
Incidental Observation Survey

This important survey is designed to capture observed recreation use in the Susitna-Watana study area and should be completed by all crews while they are conducting their field research. To avoid duplication, only **one** survey needs to be completed for each observed activity by a designated field crew member.

Observer Name: _____ **Observer Firm:** _____

Observer Telephone: _____ **Observer Email:** _____

For each observed activity, please indicate the following: **date (mm/dd/yy), time, location (GPS coordinates/place name/general description of location), the activity number, and number of people in the party**.

In addition to the written description of the location below, please indicate the approximate location with an "X" on the reverse side of this survey along with the Observation Number.

Activity Numbers:

1 Berry picking
2 Bicycling
3 Camping
4 Dogsledding
5 Four-wheeling/off-roading
6 Canoeing
7 Kayaking
8 Pack rafting
9 Rafting
10 Propeller boating
11 Jet boating
12 Float plane
13 Hiking
14 Horseback riding
15 Hunting
16 Skiing
17 Snow-machining
18 Sport fishing
19 Other: (specify)

Observation No.	Date (mm/dd/yy)	Time	Location (GPS/Place Name/General Description)	Activity (enter #)	# People	Additional Notes
1	/ /	AM / PM				
2	/ /	AM / PM				
3	/ /	AM / PM				
4	/ /	AM / PM				
5	/ /	AM / PM				
6	/ /	AM / PM				
7	/ /	AM / PM				
8	/ /	AM / PM				
9	/ /	AM / PM				
10	/ /	AM / PM				

If there are any questions, please contact: Donna Logan, McDowell Group, 907.274.3222.

THANK YOU FOR YOUR HELP!

Please return this survey through the most convenient method:
Mail: McDowell Group 1400 W. Benson Blvd., Suite 350 Anchorage, AK 99503
Fax: 907.274.3201 **Scan and E-mail:** donna@mcdowellgroup.net

ATTACHMENT 12-2
RECREATION INTERCEPT SURVEY INSTRUMENT (DRAFT)

Susitna-Watana Hydroelectric Project
Recreation Intercept Survey Instrument (DRAFT)

Interviewer Name _____ **Survey Location (grid number)** _____

Date _____ **Survey Location (additional info)**_____

Hi I'm _____ **with the McDowell Group. We're conducting a study of people who recreate in this area as a part of the Alaska Energy Authority's Susitna-Watana Hydroelectric Project. We would like to ask you some questions about your recreational use within this area.** [SHOW MAP OF STUDY AREA].

Residence

1. Do you live in the United States?

1❒ Yes

2❒ No (skip to Q2) 3❒ Refused

1a. What is your home zip code?_____ 01❒ Refused
(if refused, try and determine AK residency, check box if AK resident) 02❒ Alaska resident

2. In what country do you live? [Add country code blocks] 1❒ Refused

Day/Overnight Use and Visit and Location

3. On this visit to the Study Area, are you here for a day visit, overnight visit, or are you just passing through on your way to somewhere else?

1❒ Just passing through →**Q3a. Did you drive the Denali Highway?**

1❒ Yes 3❒ Don't know

2❒ No 4❒ Refused

→**Q3b. Did you ride on the Alaska Railroad?**

1❒ Yes (skip to Q6) 3❒ Don't know (skip to Q6)

2❒ No(skip to Q6) 4❒ Refused (skip to Q6)

2❒ Day visit specifically to this area (skip to Q6)
3❒ Overnight visit →**Q3c. How many nights will you spend in the Study Area on this trip?** # _____ 1❒ Don't know
4❒ Live in the study area (skip to Q7)

4. Did you overnight in any of these places? (Q. 4 list 1-8)

Did you overnight anywhere else in the Study Area? (Show map) (Probe for specific locations on Denali Hwy. If not available, check code 18)

5. How many nights did you spend in_____? In what type of lodging?

Q 4/5. Name/grid #	Hotel/ motel/ B&B	Lodge	Private home	Established Campground (RV/tent/etc.)	Undeveloped/ On-Road Area RV/camper/car	Wilderness Camping (tent)	Other	Q6. DAY VISIT?
01❒ Susitna Landing								01❒
02❒ Deshka Landing								02❒
03❒ Willow								03❒
04❒ Talkeetna								04❒
05❒ McKinley Princess								05❒
06❒ Talkeetna Lodge								06❒
07❒ Trapper Creek								07❒
08❒ Glennallen								08❒
09❒ Lake Louise								09❒
10❒ Other_____								10❒
11❒ Other_____								11❒
12❒ Other_____								12❒
13❒ Other_____								13❒
14❒ Other_____								14❒
15❒ Other_____								15❒
16❒ Other_____								16❒
17❒ Other_____								17❒
18❒ Denali Highway								18❒
19❒ Alaska Railroad								19❒

6. Did you visit anywhere in the Study Area <u>without</u> spending the night?

1❒ None

Recreational Activities in the Study Area

7. Please tell me if you have participated, or will participate, in any of the following recreation activities within the Study Area on this trip. Please do not include any subsistence activity. (Show list, read if necessary, check all that apply)

7a. Where did you _____ on this trip? (Show map, ask for each activity)

8. Which activity was the primary reason for <u>this</u> trip to the Study Area?

_____ (Enter activity letter) 1❒ Don't know 2❒ Refused

9. Which of these activities have you participated in on <u>other</u> trips within the Study Area in the last 12 months? (Show list, check all that apply)

10. On how many trips in the last 12 months within the Study Area did you participate in _____?

	Q7 This trip	Q7a Where did you _____? Record grid number(s)	DK /REF	Q9 Past 12 months	Q10- Number of trips
Example:	0❒	*3, 6, 10 14, 27*	0❒	0❒ →	*4*
a. Fishing (non-subsistence)	1❒		1❒	1❒ →	
b. Hunting (non-subsistence)	2❒		2❒	2❒ →	
c. Motorized boating (jet, prop, air)	3❒		3❒	3❒ →	
d. Non-motorized boating (rafting/canoeing/kayaking/pack raft)	4❒		4❒	4❒ →	
e. Four-wheeling	5❒		5❒	5❒ →	
f. Wildlife viewing	6❒		6❒	6❒ →	
g. Collecting berries/mushrooms (non-subsistence)	7❒		7❒	7❒ →	
h. Driving/sightseeing	8❒		8❒	8❒ →	
i. Camping	9❒		9❒	9❒ →	
j. Hiking/backpacking	10❒		10❒	10❒ →	
k. Alaska Railroad	11❒		11❒	11❒ →	
l. Flightseeing	12❒		12❒	12❒ →	
m. Photography	13❒		13❒	13❒ →	
n. Attending a special event or race	14❒		14❒	14❒ →	
o. Bicycling	15❒		15❒	15❒ →	
q. Bird watching	17❒		17❒	17❒ →	

	Q7 This trip	Q7a Where did you _____? Record grid number(s)	DK /REF	Q9 Past 12 months	Q10- Number of trips
r. Snowmachining	18❒		18❒	18❒ →	
s. Dog Sledding	19❒		19❒	19❒ →	
t. Snow shoeing	20❒		20❒	20❒ →	
u. Skiing	21❒		21❒	21❒ →	

Desired Experience and Quality of Experience

11. Which areas within the Study Area have the highest recreational value to you?

Enter Grid #"s_____

12. In general, when you spend nights recreating in the outdoors do you prefer to overnight in...
(Read 1-4, check only one)

01❒ Remote wilderness with no other people present
02❒ Undeveloped roadside pull-outs with no amenities
03❒ Semi-developed campgrounds with some basic amenities
04❒ Fully developed campgrounds with full amenities
05❒ Don't know
06❒ Refused

13. Please tell me how important each of the following factors were in your decision to make this trip to the Study Area.

	Not important	Somewhat important	Very important	Not applicable	DK	Ref.
a. Being with friends and family	1	2	3	4	5	6
b. Getting exercise	1	2	3	4	5	6
c. Experiencing solitude	1	2	3	4	5	6
d. Teaching your outdoor skills to others	1	2	3	4	5	6
e. Enjoying the sights and smells of nature	1	2	3	4	5	6
f. Growing and developing spiritually	1	2	3	4	5	6

14. Overall, how crowded did you feel while in the Study Area using a scale of 1 – 10, where 1 means "not at all crowded" and 10 means "very crowded"? (Circle answer)

Not at All Crowded Very Crowded

1	2	3	4	5	6	7	8	9	10	99❒ DK/Ref.

Recreation Facilities and Services

15. I am going to read you a list of outdoor recreation facilities and infrastructure. Please tell me whether you think there should be more of these in the Study Area, fewer in the Study Area, or leave them as they are now.

15a. Where specifically within the Study Area would you like to see more.. _____? (Show map)

Q15	*Fewer*	*Leave as is*	*More*	*DK*	*Ref*	*Q15a. Where? (grid number/s)*	*DK*	*Ref*
a. Boat launches	1	2	3	4	5		4	5
b. Parking areas	1	2	3	4	5		4	5
c. Picnic areas	1	2	3	4	5		4	5
d. Public use cabins	1	2	3	4	5		4	5
e. RV accessible sites at campgrounds	1	2	3	4	5		4	5
f. Trailheads for non-motorized use	1	2	3	4	5		4	5
g. Miles of trail for non-motorized use	1	2	3	4	5		4	5
h. Trailheads for off-highway vehicle use	1	2	3	4	5		4	5
i. Miles of trail for off-highway use	1	2	3	4	5		4	5
l. Trash containers	1	2	3	4	5		4	5
m. Signage with cultural, historic, geologic, and points of interest information	1	2	3	4	5		4	5
h. Visitor centers	1	2	3	4	5		4	5
i. Roadside toilets	1	2	3	4	5		4	5
m. **Facilities for the disabled**	1	2	3	4	5		4	5

Aesthetics

16. What areas, if any, within the Study Area are most visually important to you?

1❒ No areas are visually important

Enter Grid #"s_____

17. During your visit to the study area, do you recall seeing anything that detracted from the scenic quality within the area?

1❒ Yes
2❒ No (skip to Q22)
3❒ Don't know (skip to Q22)
4❒ Refused (skip to Q22)

17a. What did you find visually detracting?

01❒ Roads
02❒ Communication towers
03❒ Powerlines
04❒ Railroad
05❒ Trash
06❒ Trails
07❒ Other: _____
08❒ Other: _____
09❒ Don't know
10❒ Refused

Spending and Group/Party Size

18. Including yourself, how many people are traveling in your immediate party? By party, I mean those sharing expenses such as food, lodging, and transportation.

1❒ # _____ in party
2❒ Don't know
3❒ Refused

19. Including yourself, what is the total number of people traveling in your group? By group I mean friends or relatives that are traveling with you, but not necessarily sharing expenses.

1❒ # _____ in party
2❒ Don't know
3❒ Refused

20. Next, I'd like you to estimate your traveling party's total spending specifically for this trip for each of the following categories. Your best guess is fine. (If "none," enter $0. If "don't know," enter DK.)

20a. Of the $_____ you spent on lodging about how much did you spend in Anchorage? How about Mat-Su Borough, etc. [Surveyor may need to show map and explain Alaska Boroughs if respondent is unfamiliar]

	Total	ANC	Mat-Su Borough	Denali Borough	FAI	Kenai Pen. Bor.	Other AK
a. Lodging	$	$	$	$	$	$	$
b. Gifts/souvenirs/clothing	$	$	$	$	$	$	$
c. Food/beverage	$	$	$	$	$	$	$
d. Transportation (vehicle/boat rental, fuel, etc.)	$	$	$	$	$	$	$
e. Tour/excursion/ charters	$	$	$	$	$	$	$

	Total	ANC	Mat-Su Borough	Denali Borough	FAI	Kenai Pen. Bor.	Other AK
f. Guide/outfitter/transporter	$	$	$	$	$	$	$
g. License/tag fees	$	$	$	$	$	$	$
h. New equipment or gear							
i. Package	$	$	$	$	$	$	$

[Read] [Insert description of the reservoir, etc. to read to the respondent]

21. If the Susitna-Watana Hydroelectric Project is developed would you be very likely, somewhat likely or not likely to return to this area in the future for (their main activity for this trip**)?**

1❒ Very likely (skip to Q22) 4❒ Don't know (skip to Q22)

2❒ Somewhat likely 5❒ Refused (skip to Q22)

3❒ Not likely

21a. If you were somewhat likely or not likely to would not return to this area for (their main activity for this trip**) would you be very likely, somewhat likely, or not likely to...**

	Very Likely	Somewhat Likely	Not Likely	DK	Ref.
a. Go to a different area within the Study Area (skip to Q22)	1	2	3	4	5
b. Go to a different area outside the Study Area	1	2	3	4	5

21b. Where would you likely go for (their main activity for this trip**)?**

[Insert code blocks.]

Demographics/Characteristics

***READ:* I have just a few more questions for demographic purposes.**

22. In what year were you born? 19____ 01❒ Refused

23. Including yourself, how many people live in your household for at least six months of the year?

#_____ 01❒ Refused

24. Are you married?

1❒ Yes 3❒ Refused

2❒ No

25.Do children under the age of 18 live in your household?

1❒ Yes
2❒ No
3❒ Refused

26. Which category best describes your total household income in 2012?

01❒ Less than $10,000
02❒ $10,000 t0 $14,999
03❒ $15,000 to $24,999
04❒ $25,000 to $34,999
05❒ $35,000 to $49,999
06❒ $50,000 to $74,999
07❒ $75,000 to $99,999
08❒ $100,000 to $149,999
09❒ $150,000 to $199,999
10❒ $200,000 or more
11❒ DK/Refused

27. Is anyone in your party disabled or have special needs related to outdoor recreation activities?

1❒ Yes
2❒ No (Thank and end survey)
3❒ Don't know (Thank and end survey)
4❒ Refused (Thank and end survey)

27a. Specifically, what type of needs do they have?

1❒ Wheelchair access to trails
2❒ Wheelchair access to facilities
3❒ Other: _____
4❒ Don't know
5❒ Refused

Thank you for participating in this survey!

28. Gender (DO NOT ASK)

1❒ Male
2❒ Female
3❒ Unknown

ATTACHMENT 12-3
RECREATION EXECUTIVE INTERVIEW PROTOCOL (DRAFT)

Susitna-Watana Hydroelectric Project
Recreation Executive Interview Protocol (DRAFT)

(revised DRAFT 10/26/2012)

Introduction:

Hi I'm _____.with McDowell Group, a research firm located in [Anchorage/Juneau].

We are working for the Alaska Energy Authority on the Watana-Susitna Hydroelectric Project studying recreation resources in the Susitna River area. We are contacting businesses, organizations, and individual users to get a better sense of the recreational use of the area and we would like to conduct an interview with you. Is now a good time or can I schedule a time that is more convenient?

Before we start I would like to read you a brief description of the project.

The proposed Susitna-Watana Hydroelectric project would be located on the Susitna River roughly 90-river miles north of Talkeetna and approximately 34 miles upstream of the Devils Canyon rapids. As currently envisioned, the Project would include a roughly 750-foot tall dam with a 41-miles long, 2-miles wide (at widest) reservoir. Susitna-Watana Hydro includes a single dam, located below Watana Creek. Preliminary studies have indicated the surface powerhouse should have three generating units with an installed capacity of 600 megawatts of renewable energy. The powerhouse, dam, and related facilities would be linked by a transmission line (or lines) connecting to the Railbelt Intertie

[If more information is needed, refer to:http://www.susitna-watanahydro.org/project/project-description/

Next, I want to describe the area we are interested in learning about recreation opportunities and uses. We are studying the recreational use and attributes of the Susitna River area from the confluence of the Talkeetna and Chulitna rivers to the Denali Highway river crossing. We are interested in recreation information for the lands and waters south of the Denali Highway from Cantwell to Paxson. Also we are interested in the area from access points along the east side of the Parks Highway, along the west side of the Richardson Highway, and from the north side of the Glenn Highway, including access from the Lake Louise area. Are you familiar with this area?

1) First of all, can you please describe your business/organization/agency?
    a. Areas of operation
    b. Years in business
    c. Services/tours provided
    d. Membership
    e. Other information

2) Does your [organization/business/agency] have any [knowledge/or use] of the described study area?
   Can you please provide me with some background on this?
   a. Type of use
   b. Time of year used
   c. Level of use (ex. heavy, light, etc.) –[look for hard numbers]
   d. Client/membership base – Anchorage? Fairbanks? Nonresidents? Local area residents?
   e. Any other information?

3) Are you noticing any trends in recreational use of the area? Seasonal changes? Is use and interest growing? Lessening? About the same? Is the mix of recreational use changing?

4) Would you consider this area a unique setting for recreation use in Alaska? Why or why not? What, if any, other areas with similar features to the upper Susitna River valley do you use for recreational outings? [*prompt*, if necessary, like the Talkeetna River for fishing or boating; or Hatcher Pass for snowmachining]

5) How do [you/your members/business/agency] access the area?

6) Is current access sufficient? If not, what might help improve this access?
   Would you prefer access not be improved? [If yes] Why?

7) Are there any other recreational infrastructure needs in the area, such as campgrounds, boat launches, day use facilities, etc. that you think might be helpful to [the general public/your business/your organization/your agency]?

8) Are there any other issues regarding recreational use or access of the area that we should be aware of?

9) Are there any specific people that you think it would be important for us to include in our interview research?

*Depending on contact, will explain our 2013 survey work and needs (contacts, clients, intercept access/permission)

We really appreciate the time you gave us. We might have some follow-up questions. Would it be okay if we contacted you again?

Thank you.

ATTACHMENT 12-4
RIVER RECREATION AND ACCESS SURVEY INSTRUMENT (DRAFT)

Susitna-Watana Hydroelectric Project
River Recreation and Access Survey Instrument (DRAFT)

Please read this introductory section before starting the survey.

This survey is part of a study to determine river recreation opportunities, use patterns, access and quality of experiences for three river reaches on the Susitna River. The Alaska Energy Authority is studying the feasibility of building the Susitna-Watana Hydroelectric Project. The proposed Project would be located on the Susitna River roughly 86 river miles upstream from Talkeetna and approximately 34 miles upstream of the Devils Canyon rapids. As currently envisioned, the project would include a roughly 750-foot tall dam located below Watana Creek and would result in a 23,500 acre, 42-mile long reservoir. The proposed project would have an installed capacity of 600MW. Project construction and operation will alter river flows in the Susitna downstream. The dam and reservoir will alter downstream navigation and access. When completed, the project would produce nearly 50 percent of the Railbelt's electrical demand, or an annual average of 2,800,000 megawatt hours (MWh) of renewable energy generation.

This survey is designed to collect information on existing motorized and non-motorized river recreation opportunities using a variety of watercraft. Please complete this form if you are using the Susitna for recreation or for transportation purposes.

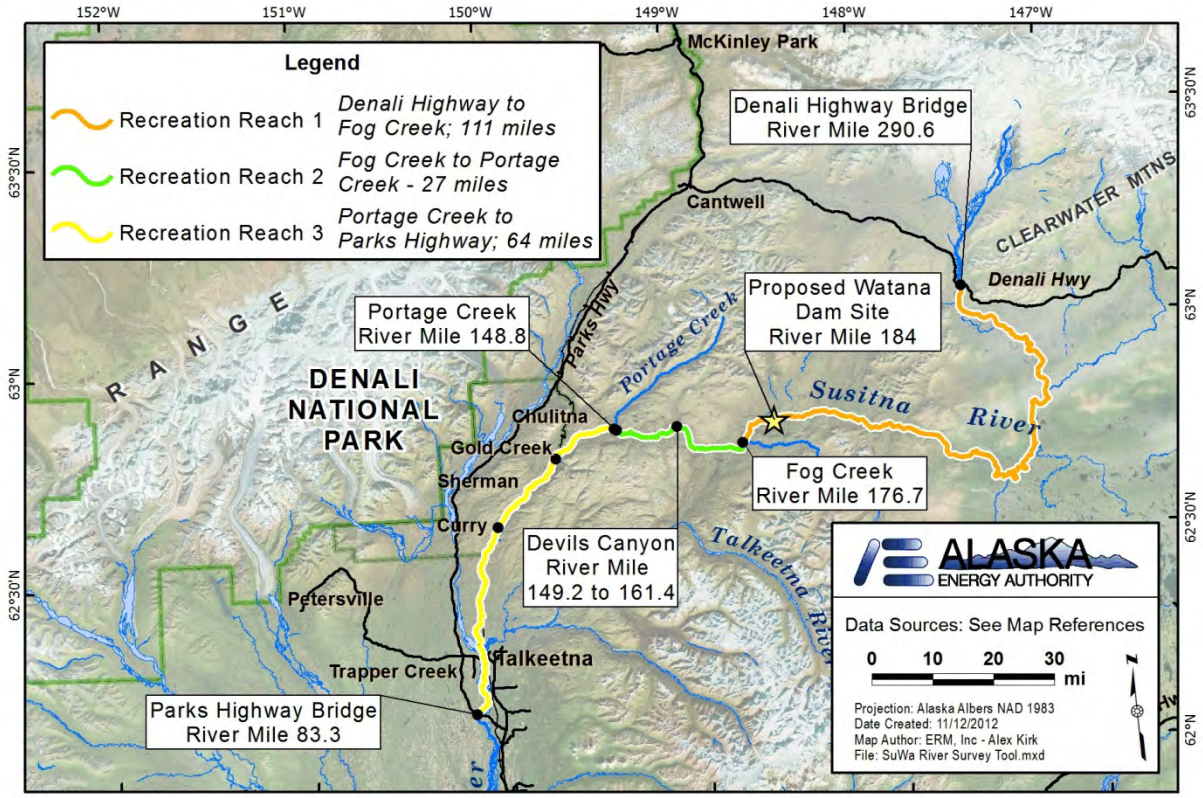
The river has been divided into three distinct reaches (see map below). The survey will direct you to questions specific to reaches 1, 2 and 3. If you have completed multiple trips using different watercraft and/or river reaches please complete a new survey for each trip and reach.

Your participation in this survey is important to the study's success. Please base responses on your direct experience from your trip rather than guidebooks, group opinions or historic flow preferences. Advances in boat design have expanded the range of suitable flows on many rivers.

Lastly, please encourage fellow boaters to participate in this study. If you have friends that recreate on the Susitna, please refer them to this webpage. The more responses we get the more useful our results will be. Alaska Energy Authority will publish the results of this study.

Click "Next" to view map of the **Susitna River Recreation Reaches** for the survey.

River Recreation Reaches 1, 2 and 3 on the Susitna River



Susitna River Recreation and Access Study
Section 1: Background Information

1. As part of this study, we are interviewing recreational users to gain additional information about recreation opportunities on the Susitna. Would you like to participate in an interview?

   ___Yes

   ___No

2. If you answered yes to Question 1, please provide contact information for a phone interview.

   Phone Number: ___-___-____

3. Please specify your gender.

   ___Female ___ Male

4. What is your age?

   _____yrs

5. Are you an Alaska resident?

   ___Yes

   ___No

6. Are you using the Susitna as a member of a commercial (guided) trip or a non-commercial (private) trip?

   ____Commercial trip

   ____Non-Commercial trip

7. Please provide the start and end date for this trip on the Susitna River (MM/DD/YYYY):

   Start Date: ____/____/_____

   End Date: ____/____/_____

8. Do you typically check flow conditions prior to doing a trip?

   ___Yes

   ___No

   8a. If yes to the previous question, how do you obtain flow information prior to doing a trip?
      1. Internet gage for the river where I'll be recreating
      2. Internet gage for representative river
         a. Visually check a river staff gage
         b. Observe the river firsthand
         c. Contact friends with local knowledge

d. Rely on weather patterns to predict flows
e. Other (name) _____

9. Rank in numerical order (1 through 5) the importance of the following factors for determining if you do a river trip?

___suitable river flow conditions

___weather

___vacation time scheduled

___hunting/fishing season

___time with family/friends

10. Is this the first time you have participated in the Susitna River Recreation survey?

___Yes

___No

11. Prior to this trip, how many times have you recreated on the Susitna River (select one)?

___0 times

___1 time

___2 to 5 times

___6 to 10 times

___11 to 20 times

___More than 20 times

12. What type of craft did you use for this trip?

Non-Motorized

___Hardshell kayak

___Cataraft

___Inflatable kayak

___Raft

___Open canoe

___Closed-deck canoe

___Packraft

Motorized

___Jetboat

___Airboat

___Prop boat

___Aircraft (floats) on Susitna

___Aircraft (wheeled) on Susitna gravel bar

___Other (specify) _____

—

13. How many years have you been using this type of craft?

_____yrs

14. How would you rate your skill level with this type of craft?

___Novice

___ Intermediate

___ Advanced

___Expert

15. In general, how many days a year do you spend using this craft?

___1 day

___2-5 days

___6-10 days

___11-20 days

___21-30 days

___31-50 days

___>50 days

Susitna River Recreation and Access Study

Section 2: Information About this River Trip

16. What reach did you recreate on (select all that apply)?

___Reach 1 (Denali HWY Bridge to Fog Creek--RM 290 to 177)

___Reach 2 (Fog CK to Portage Ck including Devils Canyon--RM 177 to 149)

___Reach 3 (Portage CK to George Parks HWY--RM 149 to 86)

17. Some people come to the Susitna for recreation while others use it as a transportation corridor. What was the primary purpose of this trip on the Susitna? (select one)

___Scenic trip

___Whitewater

___Hunting

___River floating

___Camping

___Transportation corridor

___Wilderness/solitude

___Fishing

___Other (specify) _____

18. What were the secondary activities of this trip on the Susitna? (select all that apply)

___Scenic trip

___Whitewater

___Hunting

___River floating

___Fishing

___Camping

___Wilderness/solitude

___Transportation corridor

___Other (specify) _____

19. Did you use a commercial shuttle service to access the river at the put-in or the take-out?

Access	Yes	No
Put-in?		
Take-out?		

20. Please check the box that represents the transportation you used to reach the put-in.

Reach	Car/Truck	ATV	Motorized boat	Hike	Snowmobile	Train	Float Plane	Wheeled Plane	Helicopter
Reach 1									
Reach 2									
Reach 3									

21. Please check the box that represents the transportation used to exit the river at the take-out.

Reach	Car/Truck	ATV	Motorized boat	Hike	Snowmobile	Train	Float Plane	Wheeled Plane	Helicopter
Reach 1									
Reach 2									
Reach 3									

22. If you were on Reach 1, please place a check mark for the put-in and take-out location. Please identify approximate River Mile for put-in and take-out or Tributary floated or trail hiked to access mainstem Susitna.

Put-in	Take-out
___Float in from upstream of Denali Hwy	___Denali Highway Bridge
___Denali Highway Bridge	Pick-up by Air (specify RM_____)
Drop off by Air (specify RM_____)	___Wheeled Plane
___Wheeled Plane	___Float Plane
___Float Plane	___Helicopter
___Helicopter	___Hike out (specify RM_____)
___Hike in (specify RM_____)	___Float through to Reach 2
___Access via tributary float (specify stream name_____)	___Exit via tributary (specify stream name_____)

23. If you were on Reach 2, please place a check mark for the put-in and take-out location. Please identify approximate River Mile for put-in and take-out or Tributary floated or trail hiked to access mainstem Susitna.

Put-in	Take-out
___Float in from Reach 1	___Denali Highway Bridge
Drop off by Air (specify RM_____)	Pick-up by Air (specify RM_____)
___Wheeled Plane	___Wheeled Plane
___Float Plane	___Float Plane
___Helicopter	___Helicopter
___Hike in (specify RM_____)	___Hike out (specify RM_____)
___Access via tributary float (specify stream name_____)	___Float through to Reach 3
	___Exit via tributary (specify stream name_____)

24. If you were on Reach 3, please place a check mark for the put-in and take-out location. Please identify approximate River Mile for put-in and take-out or Tributary floated or trail hiked to access mainstem Susitna.

Put-in	**Take-out**
___Float in from Reach 2	___Float through to Reach to lower Susitna
Drop off by Air (specify RM_____)	Pick-up by Air (specify RM_____)
___Wheeled Plane	___Wheeled Plane
___Float Plane	___Float Plane
___Helicopter	___Helicopter
___Hike in (specify RM_____)	___Hike out (specify RM_____)
___Jet Boat or ___Train (specify location below)	___Jet Boat or ___Train (specify location below)
___Portage Creek	___Portage Creek
___Gold Creek	___Gold Creek
___Indian Creek	___Indian Creek
___Curry	___Curry
___Sherman	___Sherman
___Other (RM_____)	___Other (RM_____)
___Talkeetna	___Talkeetna
___Susitna Highway Bridge (aka Sunshine)	___Susitna Highway Bridge (aka Sunshine)
___Access via tributary float (specify stream name_____)	___Exit via tributary (specify stream name_____)

Susitna River Recreation and Access Study
Section 3: Evaluating this River Trip

25. Please rate the flows for this trip for each trip purpose that applies to your recreation activity. Consider your trip purpose, watercraft and skill level for each of the trip attributes. (check one for each row).

Trip purpose	1. Flow too low	2. Flow neither too low or too high	3. Flow too high	NA
River transportation corridor				
Motorized boating				
Non-motorized boating				
Multi-Day River Trip				
Whitewater boating				
Technical boating				
Powerful hydraulics				
Whitewater play areas				
Number of portages				
River Safety				
Flow Aesthetics				
Speed of travel				
River Camping				
Bank fishing				
River fishing				
Overall rating				

26. For the previous question, please identify the primary reach for which you were evaluating flows. (select all that apply)

    ___Reach 1 (Denali HWY Bridge to Fog Creek--RM 290 to 177)

    ___Reach 2 (Fog CK to Portage Ck including Devils Canyon--RM 177 to 149)

    ___Reach 3 (Portage CK to George Parks HWY--RM 149 to 86)

27. In general, would you prefer a flow that was lower, higher or about the same as this flow?

    ___Much lower flow

    ___Slightly lower flow

    ___About the same flow

    ___Higher flow

    ___Much higher flow

28. Would you return to boat the flow you just rated in the future?

    ___Yes

    ___No

29. Please estimate the number of hits, stops, boat drags and portages you had on this run.

    Number of times I hit rocks and other obstacles (but did not stop):_____

    Number of times I was stopped after hitting rocks or other obstacles (but did not have to get out of my boat to continue upstream or downstream):_____

    Number of times I had to get out to drag or pull my boat off rocks or other obstacles:_____

    I had to abandon trip due to boat running aground:_____

    Number of times I had to portage around unnavigable sections, log jams, or other obstacles:_____

30. Was water clarity a contributing factor to the hits, stops, drags and boat running aground?

    ___Yes

    ___No

31. Was your trip length (upstream or downstream) reduced because flows were.....?

Flow	No	Yes	Not applicable
Flows too high			
Flows too low			

32. Reach 1 river recreation opportunities on the Susitna River are ....? Please respond for each row. Please respond "NA" if you don't know.

Region	NA	Below Average	Average	Above Average	Among the best
Compared to other rivers in a 200 mile radius					
Compared to other rivers in Alaska					
Compared to other rivers in the Pacific Northwest and Canada					
Compared to other rivers in the U.S.					

33. Reach 2 river recreation opportunities on the Susitna River are ....? Please respond for each row. Please respond "NA" if you don't know.

Region	NA	Below Average	Average	Above Average	Among the best
Compared to other rivers in a 200 mile radius					
Compared to other rivers in Alaska					
Compared to other rivers in the Pacific Northwest and Canada					
Compared to other rivers in the U.S.					

34. Reach 3 river recreation opportunities on the Susitna River are ....? Please respond for each row. Please respond "NA" if you don't know.

Region	NA	Below Average	Average	Above Average	Among the best
Compared to other rivers in a 200 mile radius					
Compared to other rivers in Alaska					
Compared to other rivers in the Pacific Northwest and Canada					
Compared to other rivers in the U.S.					

35. Are you likely to use the Susitna River more often if river recreation reaches are more accessible in the future? Please respond for each row.

Reach	Less	More	No Effect
Reach 1			
Reach 2			
Reach 3			

36. What is your opinion on Susitna River access? Please respond for each row.

Reach	No opinion	In favor of improvements to access river	Current access is sufficient	Oppose additional access
Reach 1				
Reach 2				
Reach 3				

37. Do you have other comments you would like to make about river recreation on the Susitna River?

Thank you for your participation! Please forward this survey link to individuals recreating on the Susitna River.

ATTACHMENT 12-5

RIVER RECREATION AND ACCESS 2013 EXECUTIVE INTERVIEW PROTOCOL (DRAFT)

Susitna-Watana Hydroelectric Project
River Recreation and Access 2013 Executive Interview Protocol (DRAFT)

(revised DRAFT 10/10/2012)

Introduction:

Hi I'm _____with OASIS ERM, a consulting firm located in Anchorage.

We are working for the Alaska Energy Authority on the Susitna-Watana Hydroelectric Project studying river recreation resources in the Susitna River area. We are contacting agencies, commercial providers, organizations, and individual users to get a better sense of river recreation use patterns on the Susitna River. We would like to conduct an interview with you. Is now a good time or can I schedule a time that is more convenient?

Before we start I would like to read you a brief description of the project.

This survey is part of a study to determine river recreation use patterns, access and flow preferences for three river reaches on the Susitna River. The Alaska Energy Authority is studying the feasibility of building the Susitna-Watana Hydroelectric Project. The proposed Project would be located on the Susitna River roughly 86 river miles upstream from Talkeetna and approximately 34 miles upstream of the Devils Canyon rapids. As currently envisioned, the project would include a roughly 750-foot tall dam located below Watana Creek and would result in a 23,546 acre, 42.5-mile long reservoir. Project construction and operation will alter river flows in the Susitna downstream. The dam and reservoir could alter downstream navigation and access. When completed, the project would produce nearly 50 percent of the Railbelt's electrical demand, or an annual average of 2,800,000 Megawatt Hours (MWh) of renewable energy generation.

This survey is designed to collect information on existing motorized and non-motorized river recreation opportunities using a variety of watercraft. The river has been divided into three distinct reaches: Reach 1, Denali Highway bridge to Fog Creek (RM 290 to 177); Reach 2, Fog Creek to Portage including Devils Canyon (RM 177 to 149); and Reach 3, Portage Creek to the George Parks Highway Bridge (RM 149 to 86).

1. First of all, can you please describe your business/organization/agency or individual?
    a. Areas of operation/activity relative to the three river recreation reaches
    b. Years in business/doing activity
    c. Services/tours provided
    d. Client / membership base – Anchorage? Fairbanks? Non-residents? Local area residents?
    e. Other information

2) Do you or your [organization/business/agency] have any [knowledge/or use] of river recreation activities on the three river recreation reaches on the Susitna River?

Can you please provide me with some background on the following?

a) Types of river recreation use by river reach/location
b) Type of watercraft
c) Time of year the river is used
d) Frequency of use
e) Level of use (ex. heavy, light, etc.) –[look for hard numbers]
f) Any other information?

3) For your river recreation trips on the Susitna River what is the….?

a) Primary trip purpose
b) Secondary activities associated with trip
c) Type of watercraft
d) Trip length (days and miles)
e) Time of year the river is used
f) Frequency of use
g) For commercial providers--Client / membership base – Anchorage? Fairbanks? Non-residents? Local area residents?
h) Any other information?

4) Please describe the flow levels when you participate or observe river use for:

a) Transportation
b) Recreation
c) Whitewater

5) Relative to river flows, what flow related factors most influence your decision to initiate a trip on the Susitna River? Please elaborate for each factor that applies and identify high and low flow levels that trigger you to initiate vs. cancel a trip.

a) river safety
b) speed of travel
c) navigation
d) access to river camps
e) portages (lack thereof or access to river-level portages around difficult rapids)
f) whitewater opportunities: challenging rapids, powerful hydraulics, play spots
g) access for fixed wing aircraft on floats or wheels (specify)
h) Other

6) How do you estimate the flow levels in the River?

a) Internet
b) Direct observation
c) Communication with other river users
d) Other
e) Do not check flow levels

7) How and where do you access the river?
   a) Access locations for respective river reaches
   b) Modes of transportation to access each location
   c) Approximate cost for each mode of transportation to the river

8) Are you noticing any trends in recreational use of the area?
   a) Seasonal Changes?
   b) Is use and interest growing?
   c) Lessening?
   d) About the same?
   e) Is the mix of recreational use changing?

9) What types of new infrastructure might help improve river access? Would you prefer river access not be improved? [If yes] Why?

10) Are there any other issues regarding river recreation use or access that we should be aware of?

11) Would you consider this area a unique setting for river recreation use in Alaska? Why or why not?

12) What other rivers with similar features to the Susitna do you use for recreational outings.

13) Are there any specific people that you think it would be important for us to include in our interview research?