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

**Paleontological Resources Study
Study Plan Section 13.6**

Final Study Plan

Alaska Energy Authority



July 2013

13.6. Paleontological Resources Study

On December 14, 2012, Alaska Energy Authority (AEA) filed with the Federal Energy Regulatory Commission (FERC or Commission) its Revised Study Plan (RSP), which included 58 individual study plans (AEA 2012). Section 13.6 of the RSP described the Paleontological Resources Study. This study focuses on locating, documenting, and evaluating paleontological resources within the affected area. Information from these studies will be used to identify appropriate protection, mitigation, and enhancement measures. RSP 13.6 provided goals, objectives, and proposed methods for data collection regarding paleontological resources.

On February 1, 2013, FERC staff issued its study plan determination (February 1 SPD) for 44 of the 58 studies, approving 31 studies as filed and 13 with modifications. RSP Section 13.6 was one of the 31 studies approved with no modifications. As such, in finalizing and issuing Final Study Plan Section 13.6, AEA has made no modifications to this study from its Revised Study Plan.

13.6.1. General Description of the Proposed Study

AEA is undertaking studies to determine the effects of the proposed Project on paleontological resources. Information from these studies will be used to identify appropriate protection, mitigation, and enhancement measures to be proposed in the AEA License Application.

This study plan outlines the purpose and framework for evaluating the potential effects of the Project on paleontological resources. The AHPA requires the ADNR to locate, identify, and preserve information on paleontological resources. The AHPA also authorizes ADNR, prior to the undertaking of public construction or improvements by a governmental agency of the State, to survey the affected area for such resources and investigate and record information pertaining to those resources found. In addition, the BLM assesses potential impacts to paleontological resources for federal actions on public lands under the FLPMA and the NEPA.

The paleontological resources study plan outlines and describes AEA's proposal to locate, document, and evaluate paleontological resources within the affected area. The plan discusses the nexus between paleontological resources and FERC's licensing of the Project (see section 13.2.2 above), states the goals and objectives, identifies laws, regulations, and policies that may apply to the paleontological resource investigations, and explains how the proposed work is embedded within accepted scientific perspectives and practices.

Study Goals and Objectives

All work is intended to meet the requirements of the AHPA, FLPMA, NEPA, and their respective regulations.

Thomas Bundtzen and Pacific Rim Geological Consulting (Fairbanks), under contract with AEA, are currently performing a geologic literature review of the Project area, relying as much as possible on the legacy records from the 1980s. With this information, AEA is developing a geo-database of the likely locations of significant paleontological resources. The results of this initial review will be completed by December 2012, and will be used to help make any appropriate final refinements to the study plan and its implementation in 2013 and 2014.

Following the 2012 literature study, lands within the Study area will be classified into five

classes, using BLM's Potential Fossil Yield Classification (PFYC) system (http://www.blm.gov/pgdata/etc/medialib/blm/wo/Information_Resources_Management/policy/im_attachments/2009.Par.38537.File.dat/IM2009-011_att1.pdf). This system has five levels of classes, from Class 1 (geologic units that are not likely to contain significant fossils) to Class 5 (geologic units that have a high potential to yield scientifically significant fossils on a regular basis)

(http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/20080/im_2008-009.print.html).

Locations in the study area classified as Class 3 (moderate or unknown potential), Class 4 (high potential), and Class 5 (very high potential) may require field survey and testing by a qualified professional paleontologist/geologist. Areas designated as having significant paleontological potential will be revisited and mapped with survey-grade GPS and incorporated into the paleontological geodatabase.

13.6.2. Existing Information and Need for Additional Information

The potential for Pleistocene as well as much earlier vertebrate faunal remains in the study area needs to be reviewed, given that: a) Thorson et al. (1981) found approximately 29,000-year-old mammoth remains at the confluence of the Susitna and Tyone Rivers, and b) significant occurrences of dinosaur (Hadrosaur) fossils have been reported from the Talkeetna Mountains (Pasch and May 1997). During 1973, the State Geological Survey (DGGS) discovered a new Tertiary sedimentary basin that contained abundant plant flora in Watana Creek, Talkeetna Mountains D-3 quadrangle (Smith, Lyle, and Bundtzen in Hartman (1974)). Much of the Permian system at the stage level has been documented by fossil localities in the Clearwater Mountains south of the Denali Highway in the Talkeetna Mountains D-2 quadrangle (Kline, Bundtzen, and Smith (1990) and along the flanks of Mount Watana (Csejtey 1973; Csejtey et al.1978).

13.6.3. Study Area

The study area for the initial paleontological literature study encompasses a broad region around the Project area, which is co-terminus with the external boundary of the direct and indirect study area for the Cultural Resource Study Plan (Section 13.5) (Figure 13.6-1). As a starting point, the initial literature study will focus on lands within the study area that may contain fossil localities and that may be covered by existing records. Non-fossil-bearing rock units, such as metamorphic and igneous rocks, and some areas where bedrock is overlain by glacial till, will not be addressed in existing records and therefore will not be considered as part of the literature study. Rock types that are not fossil-bearing include: 1) Jurassic-to-Tertiary granitic plutons, which cover about 15 percent of lands within the study area; 2) high rank, regionally metamorphosed core complexes, which cover about 10 percent of lands within the study area; and 3) thick glacial cover sequences in broad valley basins, which cover about 20 percent of lands within the study area.

Once areas of moderate to very high (Class 3 to 5) potential landforms are determined based on the literature study, these locations will be overlaid on the Project's footprint. Areas identified as moderate to high that could be directly impacted by the Project, i.e., lands within the reservoir, dam and camp facilities area, borrow sites, and the three potential road and transmission corridors (Chulitna, Denali, and Gold Creek corridors) (Figure 13.6-1) will be surveyed. Thus,

study area for further potential study (*e.g.*, paleontological field survey) encompasses only those areas: (1) where significant paleontological resources occur as surface outcrops; and (2) that may be impacted by the construction and/or operation of the Project.

13.6.4. Study Methods

1. Identify potential impacts to paleontological resources. AEA will determine the geologic units that may be impacted by the proposed Project and the associated PFYC classes. Information about known localities and previous paleontological research will be consulted in making these determinations, requiring examination of mapped rock units and archived paleontological records at the USGS and other agencies.

Based on the PFYC class and additional resource information, AEA will evaluate the risk of impacting significant paleontological resources.

2. Determine the need for field survey and monitoring efforts. Field surveys, on-site monitoring, spot-checking during critical construction, and locality avoidance are all approaches to address potential impacts to paleontological resources.

The proposed Project is expected to impact multiple geologic units with differing PFYC classes. The need for field survey and monitoring efforts will vary by location and will be determined largely upon the basis of the PFYC classification for the particular location, as follows:

- For areas that are designated PFYC Class 1 or 2 and contain no known paleontological resources, no further assessment is typically needed.
- For areas designated PFYC Class 3a (moderate or unknown potential)—where vertebrate and scientifically significant invertebrate or plant fossils are known to occur intermittently, or where existing study data is lacking—further on-site preliminary assessment by a qualified paleontologist may be appropriate.
- For areas designated PFYC Class 4b (buried bedrock with high potential) or Class 5b (buried bedrock with very high potential), possible impacts to bedrock units will be assessed. If the protective layer may be removed, impacting the bedrock unit below, pre-work field surveys and/or on-site monitoring during disturbance or spot-checks at key times may be appropriate. If, however, the proposed Project activity will not penetrate the protective soil or alluvial layer, such further actions may not be necessary.
- For areas designated Class 4a (exposed bedrock with high potential) or Class 5a (exposed bedrock with very high potential), in most situations pre-activity field surveys of potentially impacted locations will be undertaken.

3. Field Surveys. As noted above, field surveys will generally be undertaken for Class 4 and 5 units, especially exposed bedrock areas (Class 4a and 5a). Class 3 units may or may not require a survey. Local conditions, such as vegetated areas or pockets of bedrock exposure, may affect the need and intensity of field surveys.

Discussions will be held with BLM and ADNR to determine where and to what extent paleontological surveys will be required prior to ground-disturbing Project-related activity. If surveys of areas likely to contain fossil remains are required, they will be conducted during 2013 and 2014.

Field investigations will be supported by helicopter and fixed wing aircraft. A team of two geologists will visit existing sites and examine potential new sites using standard geological field methods. The specialists will be guided by existing federal and state geological mapping of the study area.

Sample locations will be plotted using GPS. To AEA's knowledge, nearly all past fossil localities were located prior to widespread use of GPS and GIS technology.

Samples will be bagged to prevent abrasion and damage. Depending on the type and quality of fossil material present, splits of samples will be sent to appropriate university or private sector paleontologists for identification and analysis. Where collection efforts are required on federal public lands, permits under the Paleontological Resources Protection Act will be secured as appropriate.

If paleontological resources discovered during construction could be affected by the continuation of Project-related activity, appropriate consultation and other measures will be taken. Any necessary mitigation for paleontological resources will be addressed on a case-by-case basis.

13.6.5. Consistency with Generally Accepted Scientific Practice

Field investigations will be consistent with generally accepted scientific practices. During his career with ADNR, Dr. Bundtzen has made numerous fossil collections and has worked with the USGS, universities, and the private sector to obtain fossil identifications, age estimates, and interpretations. More than 100 of his fossil locales have been archived at the Museum of the North in Fairbanks.

13.6.6. Schedule

Work performed in 2013-2014 will include the following components (Table 13.6-1):

- Applying the GIS-based classification scheme developed in 2012 within the study area.
- Systematic testing in areas of high potential indicated by the classification scheme in 2013-2014.

Study products to be delivered will include

- **Initial Study Report (February 2014).** An Initial Study Report will be prepared and presented to the interested parties to provide initial results and information on study progress. The Report will include up-to-date compilation and analysis of the data and ArcGIS spatial data products.
- **ArcGIS Spatial Products.** Shapefiles of the 1980s and current paleontological resources data will be compiled into a geodatabase for the study area. All map and spatial data products will be delivered in the two-dimensional Alaska Albers Conical Equal Area projection, and NAD83 horizontal datum consistent with ADNR standards. Naming conventions of files and data fields; spatial resolution; and metadata descriptions will meet the ADNR standards established for the Project.
- **Updated Study Report (February 2015).** An Updated Study Report will be completed by early February 2015. The report will summarize the results of each field season and will be presented to resource agency personnel and other licensing

participants along with spatial data products. Reports will follow FERC and BLM protocols and will follow professionally-accepted standards. The reports will be filed with FERC to fulfill the study report requirements of 18 CFR section 5.15(c) and (f) of the Commission regulations.

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.

13.6.7. Relationship with Other Studies

Study interdependencies for the Paleontological Resources Study are presented in Figure 13.6-2. The paleontological resource investigations will produce data sets including information on site nature and location. The study expects to utilize data from the Geology and Soils Characterization Study (section 4.5) and the Geomorphology Study (Section 6.5) to further develop and inform this study. To help protect the integrity of paleontological resources, paleontological resources reports are expected to be of limited distribution and largely not shared with other study groups. Figure 13.6-2 depicts the intended flow of data amongst related Project programs.

13.6.8. Level of Effort and Cost

The work described above will take place primarily during 2013 and 2014, with the Updated Study Report to be completed by early February 2015. It is estimated that 2013-2014 fieldwork and pertinent reporting will cost approximately \$70,000.

13.6.9. Literature Cited

- Csejtey, Bela, 1973, Paleozoic island arc in Talkeetna Mountains, in, United States geological Survey Program abstracts, U.S. Geological Survey Circular 683, page 45. (reports on upper Paleozoic fossils)
- Csejtey, Bela, Nelson, W.H., Jones, D.L., Silberling, N.J., Dean, R.M., Morris, M.S., Lanphere, M.A., Smith, J.G., and Silberman, M.L., 1978, Reconnaissance geologic map of the Talkeetna Mountains Quadrangle, the northern part of the Anchorage Quadrangle and the southwest corner of the Healy quadrangle, Alaska: U.S. Geological Survey Open File report, 78-558A, scale 1:250,000 60 pages. (Reports on numerous new fossil localities)
- Kline, J.T., Bundtzen, T.K., and Smith, T.E., 1990, Preliminary geologic map of the Talkeetna Mountains D-2 Quadrangle: Alaska Division of Geological and Geophysical Surveys Public Data File Report 90-24, scale 1:63,360. (reports new Permian and Triassic fossil localities)
- Pasch, Anne D., and Kevin C. May. 1997. First Occurrence of a Hadrosaur (Dinosauria) from the Matanuska Formation (Turonian) in the Talkeetna Mountains of South-Central Alaska. Short Notes on Alaska Geology 1997, pp. 99-109, Alaska Division of Geological and Geophysical Surveys, Anchorage.

Smith, T.E., Lyle, W.M., and Bundtzen, T.K., Newly Discovered Tertiary Sedimentary Basin Near Denali, in, Hartman, D.C., 1974, 1973 Annual Report of the Department of Natural Resources, Division of geological and Geophysical Surveys, page 19.

Thorson, Robert M., E. James Dixon, George S. Smith, and Allan R. Batten. 1981. Interstadial Proboscidean from South Central Alaska. Quaternary Research 16:404-417.

Paleontological Legislation:

http://www.blm.gov/wo/st/en/prog/more/CRM/paleontology/paleontological_regulations.html

<http://www.reginfo.gov/public/do/eAgendaViewRule?pubId=200910&RIN=1004-AE13>

Paleontological Classification systems:

http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/20080/im_2008-009.html

13.6.10. Tables

Table 13.6-1. Schedule for implementation of the Paleontological Resources 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
Modeling and sample design development				—									
Pre-field preparation (logistics, equipment, maps, safety, training and aerial reconnaissance of direct and indirect APEs)					—								
Paleontological Field studies – (priority on the impoundment, followed by corridors)						—							
Initial Study Report								—	Δ				
Additional modeling from 2013 field study results and develop sample design for 2014									—				
Pre-field preparation (logistics, equipment, maps, safety training)									—				
Field studies – Continuation from 2013 field season										—			
Updated Model and Study Report											—	—	▲

Legend:

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

13.6.11. Figures

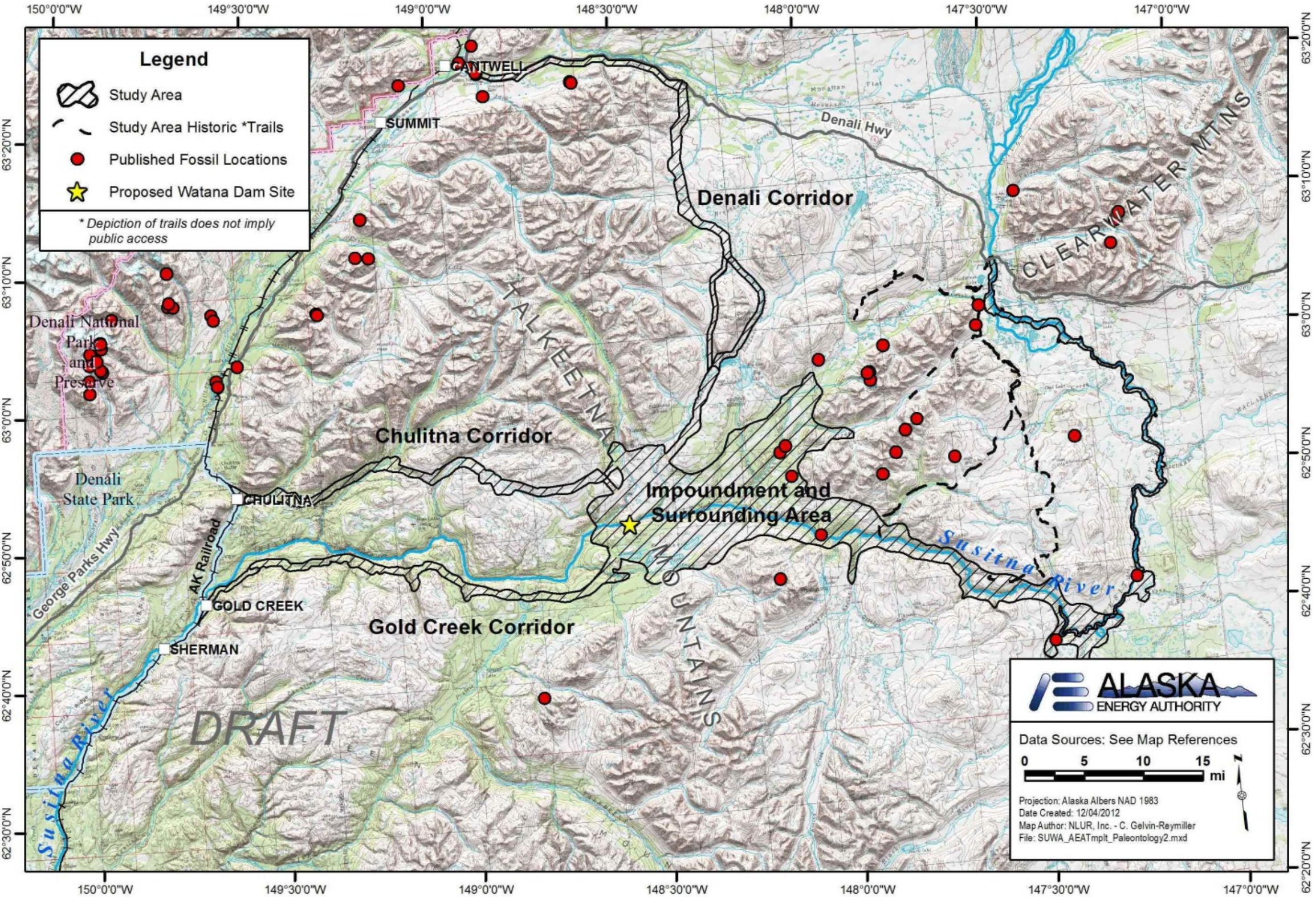


Figure 13.6-1 Study Area for Paleontological Resources Study.

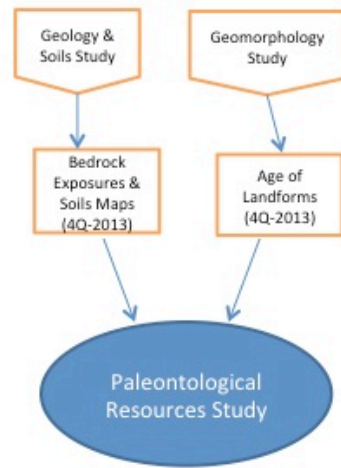
STUDY INTERDEPENDENCIES FOR PALEONTOLOGICAL RESOURCES STUDY

Figure 13.6-2. Study interdependencies for the Paleontological Resources Study.