Susitna-Watana Hydroelectric Project Document
ARLIS Uniform Cover Page

Title: Social conditions and public goods and services study, Study plan Section 15.6 : Initial study report -- Part A. Sections 1-6, 8-9	**SuWa 223**
Author(s) – Personal:	
Author(s) – Corporate: Northern Economics, Inc. and Veritas Economic Consulting	
AEA-identified category, if specified: Initial study report	
AEA-identified series, if specified:	
Series (ARLIS-assigned report number): Susitna-Watana Hydroelectric Project document number 223	**Existing numbers on document:**
Published by: [Anchorage : Alaska Energy Authority, 2014]	**Date published:** June 2014
Published for: Alaska Energy Authority	**Date or date range of report:**
Volume and/or Part numbers:	**Final or Draft status, as indicated:**
Document type:	**Pagination:** 157 pages in various pagings
Related work(s): The following parts of Section 15.6 appear in separate files: Part A ; Part B ; Part C.	**Pages added/changed by ARLIS:**
Notes: Contents: Part A. Sections 1-6, 8-9 -- Appendix A. Estimating changes in recreation demand and social welfare resulting from the Susitna-Watana Hydroelectric Project -- Appendix B. Draft: Technical memorandum on long-term modeling assumptions.	

Susitna-Watana Hydroelectric Project
(FERC No. 14241)

Social Conditions and Public Goods and Services Study
Study Plan Section 15.6

Initial Study Report
Part A: Sections 1-6, 8-9

Prepared for

Alaska Energy Authority

SUSITNA-WATANA HYDRO

Clean, reliable energy for the next 100 years.

Prepared by

Northern Economics, Inc. and Veritas Economic Consulting

June 2014

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LIST OF ACRONYMS, ABBREVIATIONS, AND DEFINITIONS

Abbreviation	Definition
ADOL&WD	Alaska Department of Labor and Workforce Development
AEA	Alaska Energy Authority
ANCSA	Alaska Native Claims Settlement Act
ARRC	Alaska Railroad Corporation
CIRI	Cook Inlet Region Inc.
FERC	Federal Energy Regulatory Commission
ILP	Integrated Licensing Process
ISR	Initial Study Report
PRM	Project River Mile
Project	Susitna-Watana Hydroelectric Project
REMI	Regional Economic Models Inc.
RSP	Revised Study Plan
RUM	Random Utility Model
SPD	study plan determination

1. INTRODUCTION

On December 14, 2012, the Alaska Energy Authority (AEA) filed with the Federal Energy Regulatory Commission (FERC or Commission) its Revised Study Plan (RSP) for the Susitna-Watana Hydroelectric Project No. 14241 (Project), which included 58 individual study plans (AEA 2012). Included within the RSP was the Social Conditions and Public Goods and Services Study, Section 15.6. RSP Section 15.6 on assessing potential changes in population, housing, public goods and services, and other quality of life factors resulting from the construction and operation of the proposed Project and potential changes in regional economic conditions resulting from the non-power effects of the Project. RSP Section 15.6 provided goals, objectives, and proposed methods for data collection.

On February 1, 2013, FERC staff issued its study determination (February 1 SPD) for 44 of the 58 studies, approving 31 studies as filed and 13 with modifications. RSP Section 15.6 was one of the 31 studies approved with no modifications.

Following the first study season, FERC's regulations for the Integrated Licensing Process (ILP) require AEA to "prepare and file with the Commission an initial study report describing its overall progress in implementing the study plan and schedule and the data collected, including an explanation of any variance from the study plan and schedule." (18 CFR 5.15(c)(1)) This Initial Study Report on the Social Conditions and Public Goods and Services Study has been prepared in accordance with FERC's ILP regulations and details AEA's status in implementing the study, as set forth in the FERC-approved RSP (referred to herein as the "Study Plan").

2. STUDY OBJECTIVES

The study objectives are established in RSP Section 15.6.1 and include the following:

- Describe, using text and appropriate tables and graphics, existing socioeconomic conditions within the study area.
- Evaluate the effects of on-site manpower requirements, including the number of construction personnel who currently reside within the study area, who would commute to the site from outside the study area, or who would relocate temporarily within the study area.
- Estimate total worker payroll and material purchases during construction and operation.
- Evaluate the impact of any substantial immigration of people on governmental facilities and services, and describe plans to address the impact on local infrastructure.
- Determine whether existing housing within the study area is sufficient to meet the needs of the additional population.
- Describe the number and types of residences and businesses that might be displaced by the Project access road and transmission corridors.

- Describe, based on other studies, what bio-physical attributes of the Susitna River system may change as a result of the Project and what those changes might mean to commercial opportunities related to fishing, logging, agriculture, mining, and recreational activities, recreation and subsistence use values, quality of life, community use patterns, non-use environmental values, and social conditions of the area.

3. STUDY AREA

As established by RSP Section 15.6.3, the study area includes communities in the Denali Borough and Matanuska-Susitna Borough that are located in relatively close proximity to the components of the Project such as the dam and powerhouse, impoundment area, or road and transmission line corridors.

4. METHODS AND VARIANCES IN 2013

4.1. Data Collection and Analysis

Except as described in Section 4.1.1 below, AEA implemented the methods as described in the Study Plan with no variances.

Existing demographic, economic, and fiscal conditions in the study area were described based on data published by a variety of state, and federal sources such as the U.S. Census Bureau, Alaska Department of Labor and Workforce Development, U.S. Bureau of Economic Analysis, and the Alaska Department of Commerce, Community and Economic Development. Data are presented for the five Alaska boroughs and ten communities in the study area and for the State of Alaska. In addition, the Regional Economic Models Inc. (REMI) model updated for 2012 was used to provide additional information on those economic sectors in the study area that are most likely to be affected by Project construction and operations. These sectors include the construction, transportation, recreation and tourism, commercial fishing, oil and gas, and electric utilities sectors.

With respect to development of the REMI model assumptions for comparing future socioeconomic conditions with and without the Project, an information collection process was initiated aimed at developing a consensus about reasonably foreseeable future activities in Alaska under the with and without scenarios.

Secondary sources were used to describe the existing local infrastructure and public services within the study area. Financial reports for governments of boroughs and incorporated communities in the study area have been collected to determine current local government revenues and expenditures. The fiscal data collected are current through 2012.

Discussions were initiated with preparers of the Transportation Resources Study (Study 15.7) to coordinate the collection of information on the primary sources and destinations of Project-related road and railroad traffic.

Primary and secondary data has started to be compiled to develop and refine the Random Utility Model (RUM) that will be used to estimate Project-related changes in demand and social welfare associated with various recreational activities (sport fishing, boating, hunting, and snow machining). Data collection efforts include the Alaska Outdoor Recreation Survey conducted by the Recreation Resources Study (Study 12.5). In addition, the recreation utility functions have been identified, and these functions are being combined with existing site characteristics. A description of the RUM methodology is provided in Appendix A.

Discussions were initiated with preparers of the Recreation Resources Study (Study 12.5) to coordinate the collection of information on the recreation resources and facilities that currently support both commercial and non-commercial recreation in the Susitna River watershed and estimates of current levels of recreational use in the region. Descriptions of existing commercial farming, logging, and mining operations in the study area were prepared based on secondary literature. Discussions were initiated with preparers of the Analysis of Fish Harvest Study (Study 9.15) to coordinate the collection of information on baseline harvest levels and harvest locations of commercial fishing operations.

An interactive map-based database available on the Matanuska-Susitna Borough's website was used to obtain the current values of selected land parcels in the study area. This database contains the current assessed value of properties in the borough and identifies the locations of the properties and their total acreage.

A preliminary list of the specific attributes of the Susitna River corridor and upper watershed that may have non-use value has been compiled based on information in the Pre-Application Document and other secondary sources.

Information on the values, attitudes, and lifestyle preferences of residents in Talkeetna, Trapper Creek, Cantwell, Chase, and the area north of Chase was collected through secondary sources. In addition, a list of potential key informants was prepared for the quality of life interviews to be conducted in the next study season.

4.2. Variances

Based on information presented in the Transportation Resources Study (Study 15.7), which describes the primary sources and destinations of Project-related road and railroad traffic, Seward, Point MacKenzie, Whittier, Wasilla, and Houston were added to the list of potentially affected communities in the study area. The inclusion of these communities is necessary to fully achieve the study objective of describing the effects of the movement of Project construction equipment, materials, and workers on local government public services, including police and medical services.

5. RESULTS

As described in Section 4 above, efforts in 2013 focused primarily on collecting data on current conditions in the socioeconomics study area to provide context for potential socioeconomic effects of the proposed Project. The preliminary results of this effort appear in Section 5.1. In

addition, the study team made progress in developing the REMI model. The preliminary results of this effort appear in Section 5.2.

5.1. Description of Existing Socioeconomic Conditions

In 2013, the study team collected data to describe current demographic characteristics of the study area, including population size and density, age composition, and race/ethnicity characteristics. In addition, sufficient data have been gathered to discuss the existing economy of the study area in terms of per capita income, employment, unemployment, and the number and composition of the workforce. These general economic development descriptions have been augmented with information on those economic sectors that are most likely to be affected by Project construction and operations. These sectors include the construction, transportation, recreation and tourism, commercial fishing, oil and gas, and electric utilities sectors. The current health and viability of each sector is measured in terms of employment, earnings, and output.

Information has been compiled on the existing local infrastructure and public services within the study area, as presented in the subsections that follow. These services include law enforcement agencies; fire departments; hospitals and other medical facilities; schools; solid waste disposal; sewer and water; and other utilities. Local government finances are described in terms of the sources and levels of revenues collected in 2012 by borough and community governments within the study area, and in terms of local government expenditures in 2012, such as operating costs for schools, public safety, and public utilities.

Drawing on analytical frameworks in the existing literature, the benefits associated with ecosystem services potentially affected by the Project are classified into two main categories: use benefits and non-use, or "passive use", benefits. Use benefits include in-river recreation (fishing, river rafting and boating), near-river recreation (hunting, snow machining), commercial natural resource extractive uses (fishing, farming, logging, mining), and aesthetic enjoyment (as reflected in property values). Non-use benefits include existence benefits and bequest benefits.

With respect to current use benefits generated by ecosystem services occurring in the Susitna River corridor and upper watershed, the Recreation Resources Study (Study 12.5) is providing a description of the recreation resources and facilities that currently support both commercial and non-commercial recreation in the Susitna River watershed and estimates of current levels of recreational use in the region. Data collection efforts include the Alaska Outdoor Recreation Survey conducted by the Recreation Resources Study (Study 12.5). This information will also be used to develop and refine the Random Utility Model (RUM) that will estimate Project-related changes in demand and social welfare associated with various recreational activities. To date, the recreation utility functions for the RUM have been identified, and these functions are being combined with existing recreational site characteristics.

The Analysis of Fish Harvest Study (Study 9.15) will describe baseline harvest levels and harvest locations for commercial fisheries for Susitna River-origin resident and anadromous fish. For other commercial extractive uses, such as agriculture, mining, and logging, adequate information has been collected from secondary sources to describe the trends of these activities in the study area. Land prices have been used to reflect the value of property attributes, including access to aesthetically pleasing ecosystem services. The appraised value of land parcels in the

vicinity of the proposed Project dam site and impoundment area are compared to the values of selected parcels in more accessible and developed areas. The per-acre value of a parcel was calculated by dividing the appraised value by the gross acreage.

A preliminary description of the specific attributes of the Susitna River corridor and upper watershed that may have non-use value has been prepared based on information in the Pre-Application Document and other secondary sources.

For the quality of life analysis information on the values, attitudes, and lifestyle preferences of residents in Talkeetna, Trapper Creek, Cantwell, Chase, and the area north of Chase has been collected using secondary sources. The first part of the quality of life analysis provides a historical overview of the development of each of the communities selected for study. The second part defines existing conditions in the communities in terms of five quality of life indicators: rural character, pace of life, self-sufficient lifestyle, community image, and community cohesiveness. The information compiled to date will be supplemented with data collected by interviews conducted with key informants in the next study season.

The first phase of this socioeconomic study, presented below, is limited to a description of existing socioeconomic conditions in the study area. This description provides context for potential socioeconomic effects of the proposed Project.

5.1.1. Demographic Characteristics

This section contains a discussion of the demographic characteristics of the study area, including population size and density, age composition, and race/ethnicity characteristics.

5.1.1.1. Population Size and Density

Table 5.1.1.1-1 provides a summary of population statistics for Alaska and the boroughs and communities within the study area. In 2010, the population of Alaska was 710,231, and 535,628 people, or about 75 percent of the state's population, resided in the Railbelt, which includes all the boroughs in the study area. Approximately 73 percent of the total population of the study area lived in the Municipality of Anchorage and the Fairbanks North Star Borough.

Population growth in the study area between 2000 and 2010 was most substantial in the Matanuska-Susitna Borough. The population growth rate in the borough was far higher than the average Alaska growth rate of 13.1 percent between 2000 and 2010. The Matanuska-Susitna Borough is in many ways an Anchorage suburb, with almost a third of the borough's residents commuting to Anchorage daily for work (Fried 2013a). While the Municipality of Anchorage has net gains from the rest of the state, it has consistently lost population to the Matanuska-Susitna Borough. During the 2000-2008 period, 14.5 percent of the average annual movement out from the Municipality of Anchorage was to the Matanuska-Susitna Borough. The movement to the Matanuska-Susitna Borough reached its peak in 2005-2006; after that, migration to the borough declined and migration from the borough increased (Williams 2010).

Most of the growth in the Matanuska-Susitna Borough has occurred in a core area that begins with Palmer and runs along the Parks Highway through Wasilla, Meadow Lakes, and Knik-Fairview and ends in Houston (Fried 2013a). Nevertheless, some of the more distant

communities, including the study area community of Talkeetna, also experienced above-average growth. The combination of data on school enrollment, age, and population growth, suggest most Talkeetna-area growth is tied to older people, retirees, and second home owners. However, growth was below average in Trapper Creek, and Chase saw a marked decrease in population between 2000 and 2010. Residents of many rural villages located off the road system in Interior Alaska appear to be migrating to Fairbanks or to Southcentral Alaska in search of better employment opportunities (Williams 2010).

Recently, Point MacKenzie has experienced rapid population growth with the opening of the Goose Creek Correctional Center, a 1,536-bed, medium-security prison. A group of around 125 inmates were housed in the facility when it opened in mid-2012. The facility became fully operational in 2013, with a total inmate population of about 1,075 (Alaska Department of Corrections 2012).

In the Denali Borough, the population is centered around the Parks Highway. The population of the Borough remained relatively unchanged between 2000 and 2010.

The highest population density in the study area in 2010 was in the Municipality of Anchorage with an average of 171.9 persons per square mile, which was the highest population density in Alaska. The lowest density of people in the study area was in the Denali Borough, which had a density of 0.1 persons per square mile. Denali National Park and Preserve accounts for 70 percent of the Denali Borough's land area, and nearly all the borough's residents live along a 70-mile stretch of the Parks Highway (Fried 2009).

5.1.1.2. Age Characteristics

Table 5.1.1.2-1 shows age characteristics of boroughs and communities in the study area in 2010. The Denali Borough had the highest proportion of working-age adults. Generally, rural areas of Alaska, such as the Denali Borough, have a smaller percentage of working-age adults because of the limited employment opportunities. However, three of the Denali Borough's five identified communities have high-paying, year-round employers that provide jobs for most of the borough's resident work force: Anderson has the Clear U.S. Air Force Station, Healy has Usibelli Coal Mine, Inc. and Golden Valley Electric Association, and McKinley Park has the U.S. National Park Service (Fried 2009).

With respect to communities in the study area, Fairbanks had a lower median age (27.9 years) than the state median age in 2010 due to the presence of the University of Alaska Fairbanks' student population. All other communities, with the exception of Point Mackenzie, had a median age higher than that of the state. Families with young children are less prevalent in many rural Alaska communities, perhaps because of limited employment opportunities.

5.1.1.3. Race/Ethnicity Characteristics

Table 5.1.1.3-1 describes the ethnic and racial composition of the boroughs and communities within the study area in 2010. The two most urbanized areas, Fairbanks and the Municipality of Anchorage, both have sizeable minority populations—37.5 percent and 36.8 percent, respectively. These percentages are close to the state average of 35.4 percent. The borough with

the lowest minority population was the Denali Borough, with 10.6 percent. All of the smaller communities in the study area had minority populations below the state average.

5.1.2. Economy

This section contains a discussion of the local and regional economy, including per capita income, employment, unemployment, and the number and composition of the workforce. In addition, this section augments these general economic development descriptions with information on those economic sectors in the study area that are most likely to be affected by Project construction and operations. The current health and viability of these sectors are measured in terms of such factors as employment, output, and earnings

5.1.2.1. Employment and Income

Table 5.1.2.1-1 summarizes resident employment in the boroughs and communities within the study area as measured by the number of jobs. The total 2011 employment in the affected boroughs was 327,655 jobs, representing about 72 percent of the statewide employment. A large portion (44 percent) of Alaska's employment is concentrated in the Municipality of Anchorage, with 202,153 jobs in 2011. Elsewhere in the study area, employment is concentrated in the Fairbanks North Star Borough, Matanuska-Susitna Borough, and Kenai Peninsula Borough, with much smaller employment totals in the Denali Borough.

Table 5.1.2.1-1 also describes the per capita personal income distribution of the boroughs within the study area in 2011. The per capita income in the Matanuska-Susitna Borough, Fairbanks North Star Borough and Kenai Peninsula Borough was less than Alaska's per capita income. The borough with the highest per capita income was the Denali Borough, at $60,191. Three of the Denali Borough's five identified communities have high-paying, year-round employers that provide jobs for most of the borough's resident work force: Anderson has the Clear U.S. Air Force Station, Healy has Usibelli Coal Mine, Inc. and Golden Valley Electric Association, and McKinley Park has the U.S. National Park Service (Fried 2009). The relatively high per capita income in the Municipality of Anchorage reflects the more robust economic conditions generated in the state's most urbanized area.

In study area communities with economies strongly tied to Denali National Park and Preserve—in particular, Talkeetna and Trapper Creek—the per capita income was lower than the rest of the borough and state because of the seasonality of work.

5.1.2.2. Unemployment

Table 5.1.2.2-1 shows that a marked variation in unemployment rates existed within the study area in 2012. The Municipality of Anchorage and Fairbanks North Star Borough had unemployment rates lower than the state average of 7.0 percent. The remaining affected boroughs had unemployment rates higher than state averages, with the highest being in the Denali Borough (10.2 percent).

Unemployment is especially high in small, rural villages, particularly during the winter when there is little alternative market-based activity (U.S. Department of the Interior 2002). With the

exception of Fairbanks, all the communities within the study area had unemployment rates higher than the state average.

It is likely that unemployment data underestimate the number of people who would like to work, particularly in more rural communities, because the unemployment rate includes only persons who are looking for work. In many rural Alaska communities, the number of employment opportunities is limited. Consequently, some people may no longer be actively searching for employment (U.S. Department of the Interior 2002; Robinson 2009). In addition, other people such as homemakers, retirees, and full-time students are often members of this group, as well as people engaged full-time in subsistence activities. As shown in Table 5.1.2.2-1, the average percentage of the working-age (16 years old and over) population that was not in the labor force from 2007 through 2011 was particularly high in the Kenai Peninsula Borough. With the exception of Fairbanks, all the communities within the study area had high percentages of adults who were not in the workforce in comparison to the state as a whole.

Several of rural Alaska's predominant industries, particularly seafood harvesting and processing, tourism, construction, and timber, are highly seasonal and result in total employment for the summer exceeding that in the winter by a large percentage. As shown in Table 5.1.2.2-2, the unemployment rate fluctuated substantially in the Denali Borough, which is heavily dependent on tourism and has the most seasonal work force of any borough in the state (Fried 2009), while the unemployment rate in large urbanized areas such as the Municipality of Anchorage and the Fairbanks North Star Borough showed relatively little seasonal variation.

5.1.2.3. Poverty Rate

Table 5.1.2.3-1 shows the average percent of people who are in poverty in the boroughs and communities within the study area. The Matanuska-Susitna Borough has a slightly higher percentage of people living below the poverty line than the state percentage. Both Trapper Creek and Talkeetna have substantially higher percentages of people living below the poverty line than the state percentage.

5.1.2.4. Workforce Number and Composition

Table 5.1.2.4-1 summarizes characteristics of the existing Alaska resident workforce in boroughs and communities within the study area. The total 2011 resident workforce in the affected boroughs was 380,635 individuals, representing 76 percent of the statewide workforce. A large portion (41 percent) of Alaska's workforce is concentrated in the Municipality of Anchorage, with 208,016 working-age (16 years old and over) residents in 2011. Elsewhere in the study area the resident workforce is concentrated in the Fairbanks North Star Borough, Matanuska-Susitna Borough, and Kenai Peninsula Borough, with much a smaller workforce total in the Denali Borough. The study area community with the largest resident labor force in 2011 was Fairbanks (18,314).

Employment by industry data compiled by the Alaska Department of Labor and Workforce Development (ADOL&WD) (2013a) for 2011 show that employment in the Municipality of Anchorage and Matanuska-Susitna Borough is dominated by trade and educational and health service jobs.

The Denali Borough economy depends heavily upon the tourist trade, primarily related to Denali National Park and Preserve. While tourism is not classified as an economic sector, tourist activity can be gauged by examining the size of the leisure and hospitality sector. About 22 percent of the resident wage and salary employment was in the leisure and hospitality sector in 2011, compared to 9 percent statewide. During the summer each year, the sector's share of employment in the borough becomes even higher due to an influx of large numbers of nonresident employees. Nearly all these seasonal workers are employed at hotels or restaurants, or a combination of the two. The remaining workers typically work for river rafting and boating companies, sled dog operations, guided fishing and hunting outfits, or for companies providing other forms of outdoor recreation (Fried 2009).

With respect to study area communities, Talkeetna, in particular, has an economy supported by the seasonal tourist industry. The community is popular for its recreational fishing, hunting, river rafting and boating, flightseeing, skiing, and dog mushing. In addition, it serves as the staging area for climbers attempting to scale Denali and other peaks in the Alaska Range. The tourism primarily booms in the summer months, May through September, with very few year-round jobs existing in the immediate area (Alaska Department of Commerce 2013c).

To a large extent the economies of the road-connected communities of Talkeetna, Trapper Creek, and Cantwell are organized around providing services to highway travelers and visiting recreationalists. However, many residents in these communities and in the Chase area, which is off the road system, are also engaged in "non-market" activities such as gardening and subsistence hunting, fishing, and gathering, along with activities that do not fit well within standard economic reporting systems, such as trapping and the manufacture and sale of arts and crafts (National Park Service 2006). The economies of these households have been characterized as "semi-subsistence" in that they are based upon use of local natural resources subsidized and supported by a cash income derived from seasonal employment (Chase Citizen's Planning Advisory Committee 1993).

The employment by industry data also reflect the continued importance of the public sector in rural Alaska economies. For example, employment for all non-federal government positions in Cantwell accounted for more than one-third of the community's total employment in 2011. The small private sector in the community is based upon services to public sector employees and to the seasonal visitors to the general recreation area.

5.1.2.5. Specific Economic Sectors

This section augments the general economic development descriptions above with information on those economic sectors in the study area that are most likely to be affected by Project construction and operations. These sectors include the construction, transportation, recreation and tourism, commercial fishing, oil and gas, and electric utilities sectors. The current health and viability of these sectors are measured in terms of employment, earnings, and output.

5.1.2.5.1. Construction

Construction employment in Alaska fell each year between 2006 and 2011, but in 2012 it changed course and grew substantially. Alaska's construction employment started falling one

year before the industry declined nationwide and three years before Alaska lost jobs across all industries. The industry likely started to soften before the national recession started in 2007 due to the end of a housing boom in the Matanuska-Susitna Borough. Public construction had been the bright spot in an otherwise dimming industry, and is likely largely responsible for the industry's turnaround in 2012. Alaska's fiscal year 2012 capital budget was $2.8 billion, which buoyed the construction industry across the state (Schultz 2013). Table 5.1.2.5.1-1 presents an overview of the construction industry in the study area in terms of employment, income, and output (sales). In 2012, construction employment statewide was approximately 25,000, with about 42 percent of those jobs occurring in Anchorage.

5.1.2.5.2. Transportation

Alaska's transportation industry is one of the state's larger employers. Transportation plays a much bigger role in Alaska's economy than it does in the rest of the nation because the vast distances and lack of highways makes it considerably more difficult to move people or goods in the state. Nationally, only three percent of all private wage and salary employment is tied to transportation, versus almost six percent in Alaska (Fried and Keith 1999).

Alaska's transportation industry is also unusually diverse (Fried and Keith 1999). It encompasses the air, water, rail, and truck transportation sectors. The air transportation sector accounts for around half of all transportation employment in Alaska versus less than one-third nationally (Fried and Keith 1999). Table 5.1.2.5.2-1 presents an overview of the air transportation industry in the study area in terms of employment, income, and output (sales). As of 2012, more than 5,600 jobs existed in the industry statewide.

In addition, no state in the continental U.S. depends on water transportation as much Alaska does (Fried and Keith 1999). Water transportation may be one of the smaller transportation sectors in terms of employment, but it handles the greatest tonnage of freight coming into the state. The Port of Anchorage, which is an enterprise department under the Municipality of Anchorage, is the largest port in the state, handling 90 percent of all consumer goods sold in the Railbelt and serving approximately 80 percent of the state's population (Fried and Keith 1999). Table 5.1.2.5.2-2 presents an overview of the water transportation industry in the study area in terms of employment, income, and output (sales).

In contrast to air and water transportation, trucking's share of the transportation industry in Alaska is considerably smaller than in the nation as a whole due to the absence of a network of interstate highways. Nevertheless, trucking businesses are major employers in the state, accounting for more than 4,000 jobs in 2012. Table 5.1.2.5.2-3 presents an overview of the truck transportation industry in the study area in terms of employment, income, and output (sales).

The Alaska Railroad Corporation (ARRC), a public corporation, owns and operates the Alaska Railroad for the State of Alaska. The ARRC employs relatively few people, but it plays an important role in moving people, materials, and equipment from Seward and Whittier n the south through Anchorage to Fairbanks in the north. Dock and handling yards are maintained by the ARRC at the ports of Anchorage, Seward, and Whittier for handling freight reaching Alaska by ship and barge (Fried and Keith 1999). Customers can load their goods onto a railcar in the Lower 48 and it will be transferred to Alaska and Railbelt communities via the contracted barge

services that operate from Seattle and Prince Rupert, British Columbia. Table 5.1.2.5.2-4 presents an overview of the rail transportation industry in the study area in terms of employment, income, and output (sales).

5.1.2.5.3. Recreation and tourism

Recreation-related businesses are a part of the recreation and tourism industry, which is one of the largest private sector employers in Alaska. Table 5.1.2.5.3-1 presents an overview of the recreation and tourism industry in the study area in terms of employment, income, and output (sales). In 2012, an estimated 43,600 people were employed in the industry, with a combined income of $1.8 billion. About 46 percent of those jobs were located in Anchorage. These numbers include companies categorized under scenic and sightseeing transportation; amusement, gambling, and recreation; accommodation; and food services and drinking places.

The Parks Highway connecting Anchorage and Fairbanks, Alaska's two largest cities, has had a large impact on the recreation and tourism industry in the study area since the highway's completion in 1971. The highway facilitated the dramatic rise in visitors to Denali National Park and Preserve. This popular tourist destination quadruples the Denali Borough's 1,000 winter jobs to more than 4,000 in the summer to cater to the 400,000 visitors that go through the borough along the Parks Highway or on the Alaska Railroad to get to the park. The borough's five identified communities, including the study area community of Cantwell, have become providers of support services to visitor traffic on the highway (Fried 2009).

The study area communities of Talkeetna and Trapper Creek are also important gateway communities to Denali National Park and Preserve. Tourism and recreation form the main basis of Talkeetna's present economy. In Trapper Creek, a few businesses, associated with tourism and highway services, provide some employment.

Existing tourist facilities in the region beginning at the Talkeetna junction of the Parks Highway and extending to the southern boundary of the national park include approximately 900 rooms. Almost 700, or 60 percent, of these rooms are contained in two hotels—the Talkeetna Alaskan Lodge and Princess Mount McKinley Wilderness Lodge (Center for Alaska Economic Development 2011). The opening of the lodges, which serve the package tour industry, has driven much of the tourism growth in Talkeetna and Trapper Creek. The Princess Mount McKinley Wilderness Lodge opened 20 miles north of Trapper Creek in 1997, while Cook Inlet Region, Inc. opened its Talkeetna Alaskan Lodge near Talkeetna in 1998. The two lodges have since become two of the largest private sector tourism-related employers in the Matanuska-Susitna Borough (National Park Service 2006). They generate substantial revenues—$12 million in 2007—that impact the regional economy through operations, employment, and bed taxes (Center for Alaska Economic Development 2011). Moreover, construction of the hotels, together with an influx of major tour companies, led to rapid expansion of tourism in the Talkeetna-Trapper Creek area. The number of visitors to the area increased from about 40,000 in the early 1990s to well over 100,000 by the early 2000s (Agnew::Beck Consulting 2002).

Table 5.1.2.5.3-1 presents an overview of the recreation and tourism industry in the study area in terms of employment, income, and output (sales).

5.1.2.5.4. Commercial fishing

From 2001 to 2011, between 3,000 and 4,000 harvesting jobs were created by the Cook Inlet commercial salmon fisheries each year. It is estimated that the Cook Inlet drift-net fishery generated $18.2 million in income for permit holders and crew members in 2011, and the set-net fishery generated $13.1 million, for a total of $31.3 million. In 2011, it is estimated that 1,617 Cook Inlet jobs were attributable to processing salmon. Both salmon harvesting and processing jobs are typically of a 2-3 month duration, coinciding with the length of the salmon fishing season. The ex-vessel value of the Cook Inlet salmon fisheries was $56.4 million in 2011, while the total processed product value (wholesale value) exceeded $94.5 million (Northern Economics 2013).

5.1.2.5.5. Oil and gas

Although Alaska's oil production has trended downward for the past two decades, oil industry employment has been on the rise as a result of increased labor needs for harder-to-reach oil as well as the drive to extract more oil under the recent high price regime. As Alaska's facilities age, additional labor is required for repair and maintenance as well as extraction (Schultz 2013). Between 2002 and 2012, the oil industry's payroll grew by 106 percent, considerably more than the 56 percent growth for all industries (Fried 2013b). Table 5.1.2.5.5-1 presents an overview of the oil and gas industry in the study area in terms of employment, income, and output (sales). Direct jobs in this sector stood at more than 4,000 in early 2012. While this figure is a small percentage of Alaska's total wage and salary employment, average earnings in the oil and gas industry are more than two-and-a-half times the average for all Alaska industries. Its payroll impact is therefore more pronounced—the industry paid $1.7 billion in 2012, or 10 percent of wage and salary payroll (Fried 2013b).

Direct employment in the oil and gas sector is concentrated in the North Slope Borough, with smaller numbers of workers in the Municipality of Anchorage, Kenai Peninsula Borough, and Fairbanks North Star Borough. However, industry draws workers from all over the state. For example, eight percent of the Matanuska-Susitna Borough's working residents commuted to the North Slope in 2011, and brought home $223 million in wages (Fried 2013b).

Furthermore, the oil and gas industry indirectly creates thousands of other private and public sector jobs in Alaska through support industries, including catering, accommodations, transportation, engineering, and logistics, and through government revenues—oil funds over half the state budget and about 90 percent of the state's general fund. It is estimated that around one-third of all jobs and personal income in the state can be traced to the oil and gas industry (Goldsmith 2007).

5.1.2.5.6. Electric utilities

Five electric utilities—Chugach Electric Association, Homer Electric Association, Matanuska Electric Association, Golden Valley Electric Association, and Anchorage Municipal Light & Power—serve a majority of Alaska's population and most of the state's commercial customers. These utilities collectively serve almost 200,000 metered locations all along the Railbelt.

In addition, utility companies are important employers in the state, creating more than 2,000 jobs in 2012. Table 5.1.2.5.6-1 presents an overview of the utilities industry in the study area in terms of employment, income, and output (sales). Counted in these numbers is employment for entities that provide all types of utilities, including electric power generation, transmission, and distribution; natural gas distribution; and water, sewage, and other systems.

5.1.2.5.7. Alaska Native Claims Settlement Act Corporations and Non-Profit Corporations

Native regional and village corporations created under the Alaska Native Claims Settlement Act (ANCSA) of 1971 play a major role in Alaska's economy and an even more important role in their individual regions by creating jobs as well as earning profits (Harrington 2012). A portion of these profits goes to shareholders in the form of dividends. Cook Inlet Region Inc. (CIRI) is the Native regional corporation that owns subsurface rights to land near Project components (dam and powerhouse, impoundment area, or road and transmission line corridors). CIRI also owns a possible resource area for sand, rock, and gravel for Project construction and owns stretches of at least one of the routes proposed for a Project access road and power lines. In addition, CIRI Alaska Tourism Corporation, a subsidiary of CIRI, operates the 212-room Talkeetna Alaskan Lodge in Talkeetna (CIRI Alaska Tourism 2013).

CIRI also served as de facto trustee for its village corporations' surface rights to land near the Project until those corporations finalized their ANCSA entitlement land selections in the area in 2013. Tyonek Native Corporation, the Tyonek tribal member's village corporation, already held title to surface estate at the proposed dam site prior to the settlement. In addition, the majority of the lands of Knikatnu, Inc., the Knik tribal member's village corporation, are near the Project (Lochner 2012).

5.1.3. Housing

A housing unit is defined by the U.S. Census Bureau as a house, apartment, group of rooms, or single room occupied or intended for occupancy as separate living quarters. There were a total of 228,493 housing units in the boroughs within the study area in 2010, about half of which were in the Municipality of Anchorage (Table 5.1.3-1). The Denali Borough had the lowest occupancy rate (45 percent), while the Municipality of Anchorage and Fairbanks North Star Borough, two of most urbanized areas in the study area, had the highest occupancy rates (95 percent and 77 percent, respectively). Housing market conditions in these urban areas tend to be tighter than in the rural areas. Median monthly rent in the boroughs within the study area was generally less than the median monthly rent in Alaska, but rent was higher than the median state rent in the Municipality of Anchorage. The Denali Borough had the lowest median monthly rent at $572.

As shown in Table 5.1.3-2, of the vacant housing units within the study area, the large majority were for seasonal, recreational, or occasional use. Temporary housing is also available in the form of daily, weekly, and monthly rentals in motels, hotels, campgrounds, and recreational vehicle parks. The availability of these accommodations may vary, particularly during any tourist season, local event, or because of demand for housing by other industries (e.g., mining).

The community in the study area with the largest number of housing units is Fairbanks, with 13,056 total units in 2010. The number of housing units in other study area communities was

considerably smaller. For example, there are 200 housing units in Cantwell. The proportion of units vacant is especially high in Point Mackenzie, Chase, and Trapper Creek because of the large number of seasonal and recreational units in those communities. Motels and other types of temporary housing in study area communities are concentrated in those communities with large tourist industries, such as Talkeetna and Fairbanks. During the summer months, the population of Talkeetna swells with students and others seeking employment in the seasonal tourism industry, and these seasonal employees often occupy all available housing in the town center area. Consequently, the vacancy rate in the summer is very low (National Park Service 2006; Talkeetna Chamber of Commerce 2012).

5.1.4. Local Infrastructure and Public Services

This section contains a discussion of the existing local infrastructure and public services within the study area. A wide range of public services and facilities are offered, with concentrations in the larger cities. Where services are not available at the community level, they are available from the borough or state. Services provided in the study area include law enforcement agencies; fire departments; hospitals and other medical facilities; schools; solid waste disposal; sewer and water; and other utilities.

The provision of public services and infrastructure across Alaska is expensive, particularly in rural areas. For example, the costs to construct public buildings—including schools, health clinics and hospitals—in remote areas is on the order of twice as much per square foot as in Anchorage (Foster and Goldsmith 2008). The higher cost per square foot for rural buildings is due to a combination of higher input costs, especially freight costs (barge and air); limited supply of specialty labor (mechanical, electrical); challenging foundation conditions—including areas with abundant permafrost; weather delays; remote logistics; and the high cost of fuel. Moreover, the harsh winter climate of Alaska shortens the useful life of roads and public buildings.

5.1.4.1. Law Enforcement/Fire/Medical Services

A listing of police and fire protection services in the boroughs and communities within the study area is provided in Table 5.1.4.1-1. Police services in the study area are only provided by local police departments in Fairbanks and the Municipality of Anchorage; law enforcement in other parts of the study area is primarily the responsibility of the Division of Alaska State Troopers under the Alaska Department of Public Safety. The Division is composed of posts that provide patrol, enforcement, and search and rescue to all areas of the state and a central headquarters (Alaska Department of Public Safety 2013). The Division has four bureaus: the Alaska Bureau of Investigation investigates major crimes; the Alaska Bureau of Alcohol and Drug Enforcement enforces laws against bootlegging and illegal drug distribution throughout Alaska; the Alaska Bureau of Judicial Services is responsible for prisoner transports and providing security for Alaska courts; and the Alaska Bureau of Highway Patrol is responsible for highway safety (Alaska Department of Public Safety 2013).

The Municipality of Anchorage, Matanuska-Susitna Borough, and Fairbanks have fire departments staffed with career firefighters. Generally, these departments are responsible for all structural firefighting within their jurisdictional boundaries. Volunteers provide fire protection services in Talkeetna, Cantwell, and Seward. Wildland fire management in Alaska is an

interagency effort involving the U.S. Bureau of Land Management, Alaska Fire Service; Alaska Department of Natural Resources, Division of Forestry; and the U.S. Forest Service. The Alaska Interagency Coordination Center located at Fort Wainwright serves as the focal point for initial attack resource coordination, logistics support, and predictive services for all state and federal agencies involved in wildland fire management and suppression in Alaska. In addition, the Alaska Interagency Coordination Center is the focal point for coordinating and providing support for all-hazard emergency response activities for federal landholding agencies in Alaska (Alaska Interagency Coordination Center 2013). The U.S. Bureau of Land Management Alaska Fire Service provides wildland fire suppression services for all U.S. Department of the Interior and Native corporation lands in Alaska (Alaska Fire Service 2013).

A listing of medical services in the communities in the study area is provided in Table 5.1.4.1-2. There are five major hospitals in the study area—three in the Municipality of Anchorage, one in Fairbanks, and one in the Matanuska-Susitna Borough community of Palmer. Health clinics are located in the majority of other communities in the study area, but trauma cases, as well as serious illness cases, must be sent to hospitals. Transport in emergency situations is usually by air (i.e., airplane or helicopter). Medical facilities in the Municipality of Anchorage, Palmer, and Fairbanks provide air medical services. Most communities provide emergency medical services, which, in many cases, are delivered by local fire departments. A number of regional and community organizations administer health and social service programs for Alaska Natives.

5.1.4.2. Schools

Information regarding the number of schools in communities within the study area, and the grade levels and student enrollment at those schools, is shown in Table 5.1.4.2-1. The highest number of schools is in the Municipality of Anchorage and Fairbanks. The 123 schools in these population centers had 59,623 students enrolled in 2011. Alaska schools vary greatly in size. High schools in Anchorage may serve more than 2,000 students. Schools in other urban areas such as Fairbanks, the Kenai Peninsula, or the Matanuska-Susitna Borough may serve hundreds and are similar to schools in small cities in the rest of the United States. In contrast, many schools in rural communities such as Cantwell are small, some with 30 or fewer students at a variety of grade levels (Alaska Teacher Placement 2013). The State of Alaska does not provide state funds for schools with fewer than 10 students. Talkeetna and Trapper Creek middle and high school students are bused to Susitna Valley School at milepost 98 of the Parks Highway.

There are no local schools in Chase or Point Mackenzie; children are home-schooled or attend schools in other areas. The State of Alaska provides parents with the option of home-schooling their children. Under state law, children schooled at home by their parents or guardians are exempt from the compulsory school attendance law. Parents are not required to register with the state or their local school district, and no testing or other requirements are placed on home-schools not funded with public dollars. The Alaska Department of Education and Early Development oversees the regulation of correspondence schools available to home-school families. This department listed 26 correspondence schools on its web site. Of the total, 14 of the schools are available to students from all over the state, while 12 of the schools serve students in individual school districts (Alaska Department of Education and Early Development 2010).

Table 5.1.4.2-2 presents the revenue per average daily membership and funding sources in school districts with affected communities. Average per-student cost in Alaska is higher than in any other state, reflecting the costs associated with maintaining educational services among often extremely widely geographically dispersed communities (U.S. Department of the Interior 2002). As shown in Table 5.1.4.2-2, the revenue per average daily membership was highest in the Kenai Peninsula Borough School District and lowest in the Matanuska-Susitna Borough School District. State law establishes a formula by which a guaranteed level of funding known as "basic need" is determined for each of Alaska's school districts. This formula is weighted in favor of small, isolated sites. It takes into consideration the total number of students enrolled in the entire district, the number of students in each school within the district, regional cost differentials ("district cost factors"), special needs funding, intensive services funding, and enrollment in correspondence programs. The components of public school funding are state aid, required local contribution, federal Title VIII impact aid, special revenues and other sources. Federal impact aid provides funds to school districts for children with parents living and/or working on federal property "in lieu of local tax revenues." Municipalities with taxing power are required to provide their coterminous school district with the local contributions to assure the equivalent of a 2.65 mill tax levy on the full and true value of the taxable real and personal property in the district; and not to exceed 45 percent of the district's basic need for the preceding fiscal year (Alaska Department of Education and Early Development 2012).

5.1.4.3. Utilities

Table 5.1.4.3-1 documents the provision of local utilities (water, sewer, solid waste, electric, natural gas) to communities within the study area by identifying the local communities' service providers by utility type. Like many rural communities in Alaska, Trapper Creek, Chase, and Point Mackenzie do not have community piped potable water or sewage treatment systems. Water in these communities is typically provided by individual household wells, and sewage treatment facilities consist of individual septic systems or communal sewage lagoons. Some households may lack flush toilets and running water. Refuse in communities within the study area is generally hauled to the borough or private landfills. Most rural communities have Class III landfills that do not meet the requirements of the federal Resource Conservation and Recovery Act (Colt et al. 2003).

Alaska's electrical energy infrastructure differs from that in the rest of the United States in that there is no extensive infrastructure of transmission interties that span the state or connect to the grid in Canada or the Lower 48. The electrical needs of communities in the study area are currently served by seven regulated public utilities that extend from Fairbanks to Anchorage and the Kenai Peninsula. These utilities include four cooperatives (Golden Valley Electric Association, Chugach Electric Association, Matanuska Electric Association, and Homer Electric Association), two municipal utilities (Anchorage Municipal Light & Power and City of Seward Electric System), and one independent power producing utility (Aurora Energy, LLC). These utilities account for nearly all of the electricity generated in the state. ENSTAR Natural Gas supplies natural gas produced in Cook Inlet to many residences and businesses in Southcentral Alaska.

When the low level of per-capita income in rural Alaska is taken into account, residents of communities in Alaska that are remote and off the road system typically pay about 14 percent of

their household income for gas, electric, and heating fuel, while Anchorage residents pay about 3 percent (Table 5.1.4.3-2). Most remote rural places rely on fuel oil for both heating homes and generating electricity. Fuel oil is far more expensive than natural gas, which is available in Anchorage and a few other communities (Goldsmith 2008). Moreover, the day-to-day operating costs of community water, sewer, and electric utility systems in rural Alaska are high. With a small customer base and limited income, many—if not most—of these utility systems are not self-supporting (Colt et al. 2003).

5.1.5. Local Government Finances

Table 5.1.5-1 identifies sources of tax revenues in the boroughs within the study area. With the exception of the Denali Borough, all of the boroughs within the study area collect local taxes, primarily in the form of property taxes or sales taxes. The Denali Borough relies upon bed taxes and severance taxes on coal extraction.

Table 5.1.5-2 presents the sources and levels of revenues collected in 2012 by borough and community governments within the study area. Property taxes accounted for a large share of revenues in the Matanuska-Susitna Borough, Fairbanks North Star Borough, and Municipality of Anchorage. In addition, a substantial percentage of local government revenues comes in the form of transfers from the state, primarily as direct state funding of local education programs, and from the federal government. A large portion of state funding is derived from state oil revenues.

Local government expenditures of boroughs and communities in the study area are shown in Table 5.1.5-3. Education accounts for a large proportion of local government spending. Alaska school districts get about two-thirds of their operating money from the state, and the rest comes from a combination of local and federal money (Goldsmith 2008).

5.1.6. Ecosystem Services

This section examines the relationships between ecosystem services that are valued by society and human actions (positive or negative). Ecosystem services are biophysical components of nature, such as a river, lake, mountain vista, fish population, or forest, that benefit humans by enhancing their welfare or well-being (Boyd and Banzhaf 2007; Fisher et al. 2009). For example, a fish population in a stream habitat with scenic surroundings is a combination of ecosystem services that can generate recreational benefits for angles. Visually available natural resources in proximity to the fishing area are a service because they contribute to the aesthetic enjoyment of the angling experience. The target fish population is a service because the possibility of a catch is also important to the experience (Boyd and Banzhaf 2007).

Ecological services are site-specific, with important place-based quality differences. Consequently, the level of benefits derived from a given ecosystem service is specific to that service. Spatial context matters for another reason as well, this one related to the economic value of the benefits of given ecosystem service (Boyd 2011). In general, the value of any ecosystem service is higher the scarcer it is—a recreational fish population is more valuable if it is the only population in a region; it would be worth less if recreational fishing opportunities in the region are plentiful. The value of an ecosystem service also depends on how many people depend on the fish population, which is a function of where they are in relation to the population. Fish stocks

important to recreation are more valuable when more people can enjoy them; therefore, sport fishing areas closer to highly populated areas or located in frequently visited tourist areas may likely generate a different set of values than more isolated areas. Further, many ecosystem services are more valuable if they are bundled with certain manmade assets. These assets are called "complements" because they complement the value of the ecosystem service. For example, roads, trails, docks, and boat ramps are spatially configured complements that can increase the value of a recreational fish population (Boyd and Banzhaf 2007; Boyd 2011).

Drawing on the analytical frameworks developed by King and Mazzotta (2000)**,** Black et al. (1998) and Colt (2001), the benefits associated with ecosystem services potentially affected by the Project can be classified into two main categories: use benefits and non-use, or "passive use", benefits.

Use benefits include:

- In-river recreation (fishing, river rafting and boating)
- Near-river recreation (hunting, snow machining)
- Subsistence
- Commercial natural resource extractive uses (fishing, farming, logging, mining)
- Aesthetic enjoyment (as reflected in property values)

Non-use benefits include:

- Existence benefits
- Bequest benefits

Use benefits derived from ecosystem services are those benefits that humans realize through direct or indirect use of an ecosystem and its services (Black et al. 1998; King and Mazzotta 2000). In the case of the Project, some of the relevant use benefits are associated with river-based ecosystem services that are traded in conventional markets with buyers and sellers and established prices. For example, commercial extraction of Susitna River-origin salmon produces marketed benefits that accrue to the fishermen as additional profits and to consumers as taste and nutritional satisfaction. Other use benefits generated by ecosystem services are not traded in conventional markets. A recreational angler, for instance, may value the activity of catching a salmon in a scenic tributary of the Susitna River despite the fact that he or she pays no explicit price for that activity. Other possible recreational benefits derived from ecosystem services that are not bought and sold in markets include sport hunting, river kayaking, snow machining, and hiking. In addition, subsistence activities, which by definition are not part of the market economy, are valued in Alaska for their nutritional, economic, cultural, and social benefits.

Whereas use benefits are based on actual use of an ecosystem and its services, non-use benefits are benefits that are not associated with actual use. For example, some individuals may simply value the knowledge that a given ecosystem service is intact (existence benefits), and that it will be conserved for future generations (bequest benefits) (Black et al. 1998).

Economic valuation and economic impact analysis are two widely used but distinctly different economic measures. As discussed in Section 5.1.2.5, economic impact analysis provides information on how policy changes affect economic activity, as measured in terms of sales/output, income, and employment, in communities, counties, or even at the state or national level. In contrast, economic valuation is a measure of net changes in human well-being or welfare—any human action that increases welfare is a benefit and any action that decreases welfare is a cost.

Economic welfare includes what economists call consumer surplus and producer surplus. Consumer surplus is the net value consumers receive from a good or service over and above what they actually pay for the good or service. Producer surplus (also called economic rent) is the difference between what producers actually receive when selling a good or service and the amount they would be willing to accept for the good or service. While not an exact measure of social welfare, the sum of the consumer and producer surplus that results from a change in the level of benefits generated by an ecosystem service provides a useful approximation of the service's net value.

The consumer and producer surplus associated with the benefits generated by an ecosystem service can be evaluated in dollar terms, at least in principle, using an array of methods developed by economists. However, no single method can capture the total value of the many, disparate benefits provided by a complex natural asset such as the Susitna River watershed. Moreover, although the values of some benefits derived from ecosystem services can be readily monetized, the values of others can be done so only with great difficulty and uncertainty (Johnston et al. 2002). For example, estimation of consumer surplus is relatively straightforward if the benefits are traded in traditional markets with market prices. The benefits derived from salmon caught in a commercial fishery is one example, and while benefits from recreational activities typically are not produced and traded in the private market economy, exceptions exist, including those associated with guided fishing, hunting, river rafting , and snow machining trips.

However, as discussed above, the benefits of some ecosystem services accrue directly to people without passing through the market economy. There are two general types of approaches for estimating gains (or losses) in welfare or well-being associated with changes in the level of benefits. The first approach, which is to conduct primary research, can be subdivided into indirect (revealed preference) and direct (stated preference) methods. Indirect methods include the travel cost method, while direct methods include the contingent valuation method. Both indirect and direct methods require the collection of new data, which may be costly and time-consuming. Consequently, some economists have adopted the second approach, commonly called benefit transfer, whereby existing valuation information for a benefit derived from an ecosystem service in one location is used to estimate the value of a benefit from an ecosystem service in another location.

As noted previously, converting the benefits of ecosystem services to a common comparable unit (dollars) often represents a major challenge to economics. However, the valuation of the benefits of ecosystem services in monetary terms is not required to enable the explicit inclusion of ecosystem services in decision making; other valuation metrics can be included in describing and measuring the benefits of ecosystem service. The following sections discuss the benefits of various ecosystem services that could be potentially affected by the proposed Project. Monetary

measures are included to the fullest extent that they can be usefully estimated, as well as qualitative measures of the benefits that are difficult to quantify but, nevertheless, important to consider.

5.1.6.1. Use Benefits

This section describes current use benefits generated by ecosystem services occurring in the Susitna River corridor and upper watershed. These use benefits can derive from market-related activities or non-market activities, and activities that are extractive or non-extractive.

5.1.6.1.1. Recreational benefits

The Recreation Resources Study (Study 12.5) will provide a description of the recreation resources and facilities that currently support both commercial and non-commercial recreation in the Susitna River watershed and estimates of current levels of recreational use in the region.

5.1.6.1.2. Commercial natural resource extraction benefits

This section describes natural resources in the vicinity of Project components (i.e., dam and powerhouse, impoundment area, and road and transmission line corridors) that are related to commercial extractive uses, including fishing, agriculture, mining, and logging.

Commercial fishing

The Susitna River and its tributaries are important producers of salmon for the Cook Inlet commercial fishery and also support high levels of sport fishing. The Analysis of Fish Harvest Study (Study 9.15) describes baseline harvest levels and harvest locations for commercial fisheries for Susitna River-origin resident and anadromous fish. This section will be completed after data from this study become available.

Agriculture

The area around some Project components, such the dam and impoundment area, is not conducive to grazing or agriculture because of the remote, mountainous location, high average elevation and scarcity of well-drained soils without permafrost.

However, small- or medium-sized commercial agricultural development occurs in the Trapper Creek area and near the Talkeetna River within areas of fairly level terrain and suitable soil conditions (Alaska Department of Natural Resources 2011; Alaska Department of Natural Resources 2012a). Most farmers fall into a "truck farmer" category, selling their goods in local markets which advertise locally-grown products, especially root vegetables and potatoes; weekend farmers' markets, such as the Denali View Farmers' Market in Trapper Creek, also draw customers within the region during the summer. Generally, farm production is small in volume (with higher unit costs), has low to medium market values, and may have a shelf life that further limits sales areas.

There are also areas near the railhead at Chulitna and Gold Creek with soils suitable for agricultural development. However, due to limited access, commercial agricultural development in these areas is not feasible at this time. The small agriculture uses and development currently

occurring in these areas is restricted to supporting local residents' rural lifestyles (RWS Consulting 2010).

Mining

Project components lie within the 5.7 million-acre Valdez Creek Mining District. This district has a long history of mining, with gold being the principal metal recovered. Nearly all gold production has come from placer deposits in the drainage of Valdez Creek, a tributary of the upper Susitna River (Kurtak et al. 1991). While some mining activity continues in the district, there is much less than in the past. However, there are still concentrations of state mineral leases and federal patented mining claims in areas such as Valdez Creek.

The U.S. Bureau of Mines' most recent mineral resource assessment of the Valdez Creek Mining District was conducted in 1987-1990 (Kurtak et al. 1991). The assessment concluded that three sites in the district had high mineral development potential. The highest of these was the Valdez Creek Mine, which contained high grades and resources well delineated by drilling. This was followed by placers on Yacko Creek and Gold Creek (East), which have lower grades and unproven resources. A total of 51 sites were given a moderate rating, 84 low, 69 unknown, and 18 unevaluated (Kurtak et al. 1991).

Various placer gold mining operations have been conducted in the Valdez Creek drainage beginning in the early 1900s (Kurtak et al. 1991). In 1992, the Valdez Creek Mine was the largest placer gold mine in North America and was operated by Cambior Alaska, Incorporated. Surface pit mining operations were used to extract gold between 1983 and 1995. Placer gold production from the mine during this period was several times greater than the total previous production for the entire district. Reclamation was conducted concurrently with mining where possible, with final reclamation completed one year after the Valdez Creek Mine ceased production in 1995 (Kell 1991; King 1997). Since then there have been no further large-scale operations in the Valdez Creek drainage. An unpaved access road leading from the Denali Highway to the Valdez Creek Mine site and several mining claims further upstream remains open (King 1997). In 2008, CA Gold, LLC began a placer gold mining operation in the Rusty Creek drainage, a tributary of Valdez and White Creeks (CA Gold 2013). As with most gold produced in Alaska, the gold is processed on site and transported by air from the mining operation because of the high value by weight.

The Broad Pass coal field is located about 160 miles south of Fairbanks along the west side of the Parks Highway and is considered a northeastern extension of the Cook Inlet/Susitna coal province, which contains Alaska's most accessible and second largest coal resource base. Identified resources in the Broad Pass coal field are estimated at 50 million short tons (Diel 1991). Between 1940 and 1954, the W.E. Dunkle Mine near the West Fork of the Chulitna River produced subbituminous coal from the Costello Creek coal basin, a small inlier of the Broad Pass coal field (National Park Service 1988; Kurtak et al. 1991). No further production has occurred in the coal field. Coal-bearing continental rocks of Pliocene age crop out along Watana Creek about 40 miles southeast of Broad Pass. The coal is reported as both subbituminous and lignite; however, its thickness and extent is not known (Diel 1991).

Oil and gas potential in the vicinity of Project components is unknown but expected to be limited because appropriate sedimentary rocks to generate and reservoir hydrocarbons are absent (Alaska Department of Natural Resources 2011).

Forestry

Forest resources in the area surrounding Project components consist of large, mostly undeveloped forested stands with spruce and hardwoods such as birch, aspen and cottonwood. Most timber stands in the area originated from fire, whether due to lightening or, more likely, from development and early operations of the Alaska Railroad (Todd and Jewkes 2006).

Commercial use of forest resources in the study area has been limited to relatively small logging operations in the lower basin of the Susitna River. Vegetation in the upper basin is almost entirely undisturbed, cannot be accessed by roads, and is not addressed in the most current forestry and land management plan for state land in the region (Alaska Department of Natural Resources 2011).Table 5.1.6.1.3-1 shows the location and scale of current forest uses on Matanuska-Susitna Borough land in the vicinity of Project components. The table describes the amount of timber available for harvest in selected natural resource management units during the 2013–2017 period. At the request of the Trapper Creek Community Council the borough is proposing timber harvests in the Susitna River Corridor Unit, which is located within the community council's area. The harvests are expected to help meet the needs of small commercial logging operators and the need for personal use firewood, wood products for crafts and woodworking, and house logs. Trapper Creek would also benefit from the opportunity for jobs, sales of fuelwood, and other ancillary items associated with timber harvest activities. The borough is also proposing timber harvests in the Rabideux Creek and Parks Highway Units, but all commercial and personal use firewood sales are eliminated from the units. These units are dedicated as a Susitna Valley High School fuel wood forest to supply the fuel wood needs of the school's proposed wood heat project (Matanuska-Susitna Borough Community Development Department 2013).

With respect to current forest uses on State of Alaska land close to Project components, the *Susitna Matanuska Area Plan* (Alaska Department of Natural Resources 2011) provides a broad-scale analysis of the types of land uses appropriate on different areas of state land in the Susitna Valley. According to the plan, forestry is an allowed use on approximately 683,000 acres of the 8.6 million acres in the planning area. As detailed in the 2014-2018 five-year schedule of timber sales, a large portion the proposed sales in the planning area is from the West Petersville Block near Trapper Creek (Curran 2013). However, the sales in that block were designed for a large-scale wood chipping operation that had ceased operating in the Matanuska-Susitna Borough by 2007. Moreover, when the chipping operation was still active in the area it had opted not to buy timber in the same block during a previous sale because it was uneconomical based on the price of the timber and the distance to its wood chipping facilities at Port MacKenzie (Bauman 2006b). The deep-water port at Point Mackenzie provides a shipping facility with the equipment to directly load wood chips or other products onto ships or barges for shipment to markets in Alaska, the Lower 48 or Asia. However, wood chips are a low unit value commodity very sensitive to the cost of transportation from the standing forest to the port facility (Metz 2007).

It is likely that the majority of the timber from timber sales on state land in the Susitna Valley will be sold for house logs and the commercial firewood business. House logs are higher quality

products used by custom home or cabin firms; there are relatively few of these products per acre and lower-quality timber generally dominates area forests. Personal use firewood demand continues to be high in Southcentral Alaska due to high fuel prices. Housing starts in the Matanuska-Susitna Valley are down, so the availability of firewood from private land clearing is also down. This has put more demand on the state to produce firewood for both personal use and commercial markets. The high demand presents a major challenge due to limited access into areas with firewood volume (Alaska Department of Natural Resources 2012b).

Currently, there is only limited commercial harvest of forest resources on private land near Project components. For example, private forested land in the Talkeetna area that has been converted to other uses (e.g., gravel pit development and subdivision clearing) has been the source for a large portion of the logs needed by a birch bowl mill in Fairbanks (Jandreau 2013), and a birch syrup producer harvests sap on a 12-acre homestead near Quiet Lake, located about 30 miles east of Talkeetna (Kahiltna Birch Works 2013). CIRI land managers have stated an interest in selling forest products associated with land clearing and fire mitigation activities. However, a possible economic disincentive is a provision of ANCSA which would require CIRI to contribute 70 percent of its revenues from timber harvest to a common pool shared with other Native regional corporations. Native village corporations are not subject to the 70 percent revenue-sharing provision, and they have been more active in timber harvesting. For example, Knikatnu, Inc. has harvested timber in conjunction with a local program of shareholder training, (Northern Economics 2009), and the village corporation is currently cutting 30 acres for a land use conversion (Jandreau 2013).

The relatively low value of Southcentral Alaska's forests is an economic hurdle for any long-term forest management program in the region. Due to a high defect rate, the paper birch and spruce forest in the Susitna Valley historically has had little economic value in comparison to the state's coastal Sitka spruce-hemlock forests or the interior spruce-hardwood forests north and west of the Alaska Range (Northern Economics 2007; Northern Economics 2009; Alaska Department of Natural Resources 2010). Moreover, limited local demand reduces the ability to pay for higher capital cost equipment, such as mechanical feller-bunchers, log skidders, firewood processors, and sawmills. These factors have made it difficult to create more than the few jobs offered by firewood suppliers, log home builders and very small sawmills (Alaska Department of Natural Resources 2010).

On the other hand, growing interest in biomass for energy may provide wider opportunities for use of Southcentral Alaska forests. This increased demand for lower-quality wood should have a positive impact on the ability of local mills to economically access higher quality timber they require to meet local manufacturing and raw lumber demands. The purchaser of a timber sale can sort higher-quality logs coming to a landing, sell the saw logs and house logs to local mills and process the remainder for firewood, chips, or other wood products (Alaska Department of Natural Resources 2012c).

5.1.6.1.3. Aesthetic benefits and property values

Aesthetics generally refer to the identification of visual and auditory resources and the quality of what can be seen or heard, or overall visual and auditory perception of the environment. People are attracted to the aesthetic provided by an ecosystem service such as woodlands, hills and

valleys, or water features, such as rivers or lakes, and are often willing to pay a premium to experience this aesthetic pleasure. The Aesthetic Resources Study (Study 12.6) describes existing aesthetic (e.g., visual, auditory) conditions in the study area.

Ecosystem services with aesthetic qualities are not just important for periodic human enjoyment, but can also have economic importance by influencing real estate prices. For example, when people purchase a home near an aesthetically gratifying ecosystem service, the housing price is related to the value of the characteristics of the house and property, including the consumer surplus derived from the ecosystem service. Moreover, the value of aesthetically-pleasing real estate used for commercial purposes, such as a tourist lodge or resort, reflects the producer surplus accruing to the property owner.

However, a beautiful vista yields use value only when people have access to it. Currently, there are no access roads to the area around the proposed Project dam site and impoundment area. This isolation, combined with a lack of public utilities and available private property, has created few opportunities for human settlement. Commercial development has been limited to a small number of fly-in lodges that have capitalized on the pristine qualities of nearby lakes and streams. For additional information on transportation assets in the study area, see the Transportation Resources Study (Study 15.7).

Given that land prices reflect the value of property attributes, including access to aesthetically pleasing ecosystem services, it is instructive to examine the appraised value of land parcels in the vicinity of the proposed Project dam site and impoundment area and compare those values to the values of parcels in more accessible and developed areas. The database provided by the MSB (Matanuska-Susitna Borough 2013) was used to describe the current values and key characteristics of selected land parcels. This database contains the current assessed value of properties in the borough and identifies the locations of the properties and their total acreage. Table 5.1.6.1.4-1 summarizes these key features for various parcels. The per-acre value of a parcel was calculated by dividing the appraised value by the gross acreage.

As shown in Table 5.1.6.1.4-1, the appraised value of undeveloped land parcels in the vicinity of the proposed Project dam site and impoundment area are relatively low. Undeveloped land bordering Stephan Lake also has a low value; however, the value of a lakeshore parcel improved with a commercial fishing/hunting lodge is substantially higher (structural components are not included in the reported parcel land value). The value of this parcel is comparable to that of a parcel along Christiansen Lake that is located on a borough-maintained road but off the electrical grid. Christiansen Lake is located about three miles from downtown Talkeetna. A parcel fronting on Christiansen Lake near a paved road and with electric and telephone access has a substantially higher appraised value.

5.1.6.2. Non-Use Benefits

As discussed above, non-use benefits are associated with the gain in a person's welfare or well-being without actually "using" an ecosystem service. They encompass the existence benefits of knowing the service exists and bequest benefits of knowing that future as well as current generations may enjoy the service.

There are no known data on individuals' non-use benefits for ecosystem services occurring in the Susitna River corridor and upper watershed, and directly measuring these benefits was beyond the scope of this analysis. Having identified that the non-use benefits are unknown, the issue that arises is how significant is this omission—in other words, what is the likely magnitude of the value of these benefits? To address this question, the current analysis presents relevant information or studies that might indicate the significance of the non-use benefits of the ecosystem services offered by the Susitna River corridor and upper watershed. First, the literature pertaining to indicators of significant non-use benefits is briefly reviewed. Next, the analysis examines how non-use benefits were measured in other contexts. Particularly relevant are two studies described by Colt (2001) that explored non-use benefits associated with Alaska wilderness areas. Lastly, the analysis describes how indicators of significant non-use benefits may apply to ecosystem services derived from the Susitna River corridor and upper watershed.

5.1.6.2.1. Literature Review

The notion of non-use benefits was first proposed by Krutilla (1967) who observed that people might be willing to pay to preserve a particular natural asset (i.e., ecosystem service) even if they knew they would never visit it because, as he put it, they "obtain satisfaction from mere knowledge that part of wilderness North America remains even though they would be appalled by the prospect of being exposed to it." By way of example, Krutilla describes "an area with some unique attribute of nature—a geomorphologic feature such as the Grand Canyon, a threatened species, or an entire ecosystem or biotic community essential to the survival of the threatened species." Krutilla also notes that non-use benefits are not generated by only natural assets; they apply equally to cultural heritage assets (cf., Navrud and Ready 2002; Noonan 2003).

Krutilla emphasizes that the uniqueness of a natural or cultural asset need not be absolute for his arguments to hold. What is essential he argues is that there be "no adequate substitutes" for the asset. Subsequent researchers have noted that non-use benefits may be present for natural assets more common than, say, an endangered species, but assets with unique and irreplaceable character likely have the highest non-use benefits (Madariaga and McConnell 1987; Harpman et al. 1994; Crowards 1997).

Further, Bishop and Welsh (1992) maintain that a person's lack of knowledge of a natural asset does not mean that the individual holds no non-use value for the asset, but may simply indicate that there have not been past opportunities or motivations for the individual to gather specific information about the asset. So, even if, as Randall (1986) suggests, "individuals place no value on resources of whose existence or usefulness they are entirely unaware", this does not deny that such individuals could suffer a loss of well-being on learning of their loss (Crowards 1997).

In principle, non-use benefits for a particular natural asset may be held by anyone because they may be held by individuals who never visit or otherwise use the asset. Moreover, there is no reason to expect non-use benefits to decline with increasing distance of individuals from the asset since, unlike the case for use benefits, there is no relationship between benefits and costs of access (Bateman et al. 2005). However, Hanley et al. (2003) suggest that there may be a cultural identity or "ownership" dimension to non-use benefits, with those who live closer to a natural asset expressing relatively higher non-use benefits. For example, the average Alaskan may hold

stronger non-use benefits for Alaska wildlife sites than the average resident of the Lower 48, because Alaskans view their state's natural resources with a higher degree of ownership or attachment. Notwithstanding these higher regional values, if interest in the affected resource is widespread, then even a small per-person or per-household value can be large when extrapolated across the entire population holding non-use benefits.

In summary, the literature emphasizes that non-use benefits are most likely to be greater where the natural asset in question is unique and/or where adverse impacts are irreversible, and where the asset is widely acknowledged to be of significance. As stated in the U.S. Department of Interior's proposed rules for natural resource damage assessment:

…an injury to a common natural resource with many substitutes (e.g., a typical small stream), may not generate large nonuse values, particularly for those residing outside the area where the injury occurred, even if the recovery takes a long time. However, a permanent injury to a unique resource (e.g., the Grand Canyon) may generate significant nonuse values, even for those residing in areas far removed geographically from the site where the injury occurred (U.S. Department of the Interior 1991, cited by Harpman et al. 1994)

5.1.6.2.2. Non-Use Benefits of Alaska Wilderness

Colt (2001) used existing studies to estimate the possible magnitude of non-use benefits for wildlife habitat and wilderness areas in Alaska. He calculated both a lower and upper bound estimate. For the lower bound estimate, Colt examined the non-use benefits used to quantify damages in the litigation arising from the *Exxon Valdez* oil spill in Prince William Sound, one of Alaska's premier ecosystems with a diversity of wildlife and habitat. In the lawsuit filed by the State of Alaska and U.S. Department of Justice the state conducted a survey to estimate the value that the American public placed on the natural integrity of Prince William Sound. It did not focus on people who lost recreational or business opportunities but looked instead at people who might not have and might not ever visit Alaska but who were nonetheless upset by the damage caused by the spill. Based on the responses, the Alaska government estimated $2.8 billion in lost non-use benefits as a result of the approximately 1,200 miles of Alaska coastline that were damaged by the spill (Carson et al. 1992). Since this figure is a one-time payment, Colt converted it to an annualized value—about $3 per U.S. household per year.

To form an upper bound estimate, Colt examined the study by Goldsmith et al. (1998), which considered the existing literature on non-use benefits in relation to the ecological values of three wildlife refuges in the Bristol Bay area. These refuges comprise 13.2 million acres, with 5.5 million acres of designated wilderness. Goldsmith et al. concluded that the existence value to U.S. households of these refuges ranged between $25 and $50 per U.S. household per year.

Colt observes that these lower and upper per household values are very high when extrapolated across the entire U.S. population that potentially holds these values. As a partial measure of the total non-use benefits of Alaska's public protected areas, he estimates that U.S. households receive up to $30 billion worth of value per year from the continued preservation of these areas in their undeveloped state. Colt concludes that while this estimate is highly uncertain, the available evidence supports the conclusion that Alaska's unique, pristine natural environment produces billions of dollars of non-use value every year for U.S. citizens.

Colt also notes that the non-use value of Alaska's functioning ecosystems far outweighs the use value. Goldsmith et al. (1998) report a similar finding in their analysis of the economic value of Bristol Bay area refuges, and they explain their study results as follows:

This huge disparity exists partly because the remoteness of the refuges, the expense of visiting them and the harsh weather during much of the year all limit refuge use. But a more important reason is that Americans as a whole place a high value on refuge lands in Alaska, whether they ever visit them or not. Alaska is still, in the minds of many Americans, the last part of the country with huge untouched areas and prime fish and wildlife habitat. As a result, the "existence value" of the Bristol Bay refuges is very high.

5.1.6.2.3. Potential Study Area Non-Use Value

From a national, regional, and local perspective, the ecosystem services offered by the Susitna River corridor and upper watershed may be sufficiently unique and important that the non-use value of these services is comparable to those for wilderness in other regions of Alaska.

A preliminary list of the specific attributes of the Susitna River corridor and upper watershed that may have non-use value is presented below based on information in the Pre-Application Document and other secondary sources.

- The Susitna River is among the four most important Alaska rivers used by salmon species when spawning, and the river and its tributaries support the second largest salmon-producing system within Cook Inlet. In 2008, Susitna River sockeye salmon were established as a stock of yield concern by the Alaska Board of Fisheries. In 2011, the Willow and Goose Creeks Chinook salmon stocks were found to be a yield concern, and the Alexander Creek Chinook salmon stock was designated a stock of management concern (Alaska Energy Authority 2011).

- The upper Susitna River drainage supports one of the northernmost populations of wild rainbow trout in North America (Alaska Energy Authority 2011).

- Wetlands cover large portions of the Susitna River basin, including riparian zones along the mainstem Susitna River, sloughs, and tributary streams. Wetlands generally support a greater diversity of wildlife species per unit area than most other habitat types in Alaska (Alaska Energy Authority 2011).

- The Susitna Flats State Game Refuge supports spectacular spring and fall concentrations of migrating waterfowl and shorebirds. As many as 100,000 waterfowl use the Susitna refuge to feed, rest, and conduct their final courtship prior to nesting. (Alaska Department of Fish and Game 1988).

- The Nelchina caribou herd near the upper Susitna River is the third largest caribou herd in Alaska and the largest herd south of the Brooks Range. The herd is the only large caribou herd in the state accessible by the road system from the major population centers of Fairbanks and Anchorage. Accessibility to human population centers makes the herd particularly vulnerable to overharvesting by sport and subsistence hunters (Alaska Energy Authority 2011).

- The 11-mile long Devil's Canyon section on the upper Susitna River is widely recognized as one of the most formidable and challenging stretches of whitewater in North America and has been called the "Mt. Everest" of whitewater kayaking. It joins the Grand Canyon of the Stikine and Turnback Canyon on the Alsek as one of North America's legendary Class V rapids (Alaska Energy Authority 2011).

  The rapids in Devil Canyon are so exceptionally violent and spectacular as to constitute a nearly unique aesthetic and recreational resource. Most Alaskan rivers occupy broad glacially scoured valleys, and whitewater beyond Class III is rare. Only three major whitewater rivers are known in Alaska: the Susitna and the Bremner in the Southcentral Region, and the Alsek in the Southeast (Jones & Jones 1975).

- Of the five stocks of beluga whales in Alaska, the Cook Inlet stock is the only one listed as endangered under the Endangered Species Act. The Susitna River mouth and delta are vital habitats for the Cook Inlet beluga whale (Alaska Energy Authority 2011).

5.1.7. Quality of Life

The quality of life analysis focuses on potential fundamental changes in lifestyle due to the influx of workers during the construction phase of the Project and increased residential and commercial development during the operations phase. Only the residents of the communities in relatively close proximity to Project components, including the dam and powerhouse, impoundment area, and road and transmission line corridors, would potentially experience these effects. These communities are Talkeetna, Trapper Creek, Cantwell, and Chase and other nearby "railroad communities."

People frequently justify the location of their home due to the perceived quality of life the area provides. However, the quality of life variable is often difficult to define, as it is inherently intangible and subjective. Quality of life can be described as the personal satisfaction (or dissatisfaction) with the attributes of the area in which one lives, including environmental, economic, cultural, or social conditions (National Park Service 2006).

The first part of the quality of life analysis provides a historical overview of the development of each of the communities selected for study. The second part defines existing conditions in the communities in terms of five quality of life indicators: rural character, pace of life, self-sufficient lifestyle, community image, and community cohesiveness.

5.1.7.1. Community Overviews

5.1.7.1.1. Talkeetna

Located at the confluence of the Susitna, Chulitna, and Talkeetna Rivers, Talkeetna is reportedly the site of a Dena'ina (Tanaina) village; Talkeetna is a Dena'ina word meaning "river of plenty" (Braund and Lonner 1982). The Dena'ina preferred to locate their village, camp, and activity sites at the confluence of streams containing anadromous fish runs, especially where clear tributaries joined with turbid streams and rivers (Matanuska-Susitna Borough Planning Department 1998) . The area developed into a mining town and Alaska Commercial Company trading post in 1896. A gold rush to the Susitna River brought prospectors to the area, and by

1910 Talkeetna was a riverboat steamer station, supplying miners and trappers in the Cache Creek, Iron Creek, and Broad Creek districts. In 1915, Talkeetna was chosen as the headquarters for the Alaska Engineering Commission, which built the Alaska Railroad, and the community population peaked near 1,000 (Alaska Department of Commerce 2013c). Talkeetna was chosen as district headquarters for rail construction because of its accessibility by river. Freight was sent up the river by steamer before being off-loaded at Talkeetna. Construction of the railroad brought new people into the area, including surveyors, engineers, teamsters and packers, foremen, timekeepers, storekeepers, blacksmiths, timber men, and carpenters (Matanuska-Susitna Borough Planning Department 1998).

The 1918 influenza epidemic and 1923 completion of the railroad resulted in a sharp drop in Talkeetna's population. However, it continued to survive with a combination of miners, haulers and packers for the mines, trappers, and homesteaders. The town remained a supply center for area miners until 1940, when most of the mining operations shut down due to the onset of the Second World War and a decline in the production of many of the richest mines. Although a small recovery in the local mining industry occurred in the late 1940s, nearly all mining activity had ended by the mid 1960s because of increased operational costs and a fixed gold price (Matanuska-Susitna Borough Planning Department 1998; Talkeetna Historical Society 2013a).

In 1964, Talkeetna connected to the Parks Highway by the 14-mile Talkeetna Spur Road, opening up the area to vehicle access and development (Talkeetna Historical Society 2013a). State land disposals and homestead programs helped the community grow through the 1970s and 1980s (Alaska Department of Commerce 2013c). In addition, the construction in 1969 of the COMSAT Station (now the Bartlett Earth Station) five miles north of Talkeetna created well-paid, year-round jobs, which strengthened the local economy (Matanuska-Susitna Borough Planning Department 1999). As people began to settle along the Talkeetna Spur Road, the community's development began to change from a compact settlement located along the riverfront to a more scattered and populated rural hinterland whose population depended on the community for a range of community services, including electricity, fire protection, and medical and education facilities (Matanuska-Susitna Borough Planning Department 1999).

5.1.7.1.2. Trapper Creek

In the early twentieth century, a road house located on the Trapper Creek side of the Susitna River served as a stopping point for freighters and miners. However, because it had the railroad, Talkeetna, and not Trapper Creek, became the center of mining activity (Braund and Lonner 1982). In 1920, the Alaska Road Commission started construction of a wagon road, known now as the Petersville Road, to Cache Creek from Talkeetna (Alaska Department of Commerce 2013c). Federal homesteading began in the area in 1948. The usable agricultural land in the Trapper Creek area attracted the first homesteaders in the mid-1950s (Braund and Lonner 1982). In 1959, the "Fifty-Niners," a group of settlers from Detroit, Michigan, moved to Talkeetna and then on to Trapper Creek to find homesteads. They lived in trailers and tents before building log cabins on land cleared by earlier settlers, primarily along the Petersville Road and Trapper Creek. Most of these homesteaders worked on the construction of the Parks Highway, which opened as far as the Petersville Road in 1967 and was completed in 1971 (Matanuska-Susitna Borough Planning Department 1998; Agnew::Beck Consulting 2006; Alaska Department of Commerce 2013c; Trapper Creek 2013a).

Since the 1960s, homesteads, state land disposal program parcels, and scattered subdivisions have provided the residential land base for Trapper Creek (Braund and Lonner 1982). In 1981, for example, two state residential subdivisions were approved—Peters Creek Subdivision, which platted about 100, mainly 5-acre lots located in the Jake Lake area and spread over three miles southward from the Petersville Road, and Kenny Creek Subdivision, which has approximately 200, typically 5-acre lots located from the Petersville Road up to 4.5 miles northward (Alaska Department of Land and Natural Resources 2012).

Trapper Creek, like Talkeetna, became more diverse and complex with the highway connection, arrival of new residents, and expansion of public services. Unlike Talkeetna, however, Trapper Creek does not have a clearly recognizable townsite. Instead, it presently has a cluster of buildings (residential and commercial) at the junction of the Parks Highway and the Petersville Road (Braund and Lonner 1982; Trapper Creek 2013b). The majority of the population lives near this intersection, and most of the land adjacent to the first two miles of the 40-mile long Petersville Road is privately owned (Matanuska-Susitna Borough Planning Department 1998). Currently, the road is paved to approximately mile 10, and year-round state maintenance ends near mile 14 (Alaska Department of Land and Natural Resources 2012).

Most of the growth in population in the Trapper Creek area is tied to an increase in retired people moving into the area. Trapper Creek is also a popular location for backcountry cabins and second homes, most of which are owned by residents of Anchorage, Palmer, Wasilla, and other population centers close to the area (Braund and Lonner 1982; National Park Service 2006; Trapper Creek 2013b).

5.1.7.1.3. Cantwell

The Native Village of Cantwell is the only federally recognized Alaska Native village in the study area. In 1980, Yedatene Na Corporation, Cantwell's Native village corporation, merged with the Native regional corporation, Ahtna, Inc. Under the terms of the merger agreement, Ahtna, Inc. assumed the management of all former village corporation lands (Ahtna 2013).

The first known inhabitants of the Cantwell area were Athabascans, the Ahtna. In 1903, gold was discovered on Valdez Creek and a small community of miners and Ahtna gathered to form the first relatively permanent settlement in the area. Eventually, Ahtna from Valdez Creek settled in Cantwell, where their descendents live today. In 1916, Cantwell was established as a construction camp for the Alaska Railroad and soon after became a jumping off point for miners and freight going to the Valdez Creek mine. In 1919, John Carlson and Jack West built a store at Cantwell, which they operated for prospectors, miners, and trappers working in the area (Simeone 2002). In the early 1920s, the Alaska Road Commission established a sled route between Cantwell and Valdez Creek. By the mid 1930s, the trail had been upgraded to a gravel road. This road would later become the Denali Highway (Bacon 1975).

By 1950, the population of Cantwell had swelled to 67 due, at least in part, to an influx of Ahtna families who moved from Valdez Creek to Cantwell to work as laborers on the railroad. Cantwell was linked to Alaska's highway system in 1957, with the completion of the Denali Highway (Simeone 2002). In 1971, the completion of the Parks Highway connected the community to Anchorage and Fairbanks.

After the Parks Highway became the principal access to Denali National Park and Preserve, Cantwell reoriented itself toward the highway and in the process began to spread out. While a few people still reside near the railroad, almost all of the businesses, including a restaurant, gas stations, a bed and breakfast, and the post office are now located at the intersection of the Parks and Denali Highways. This area, called "downtown," also includes a number of residences, the offices of the Native Village of Cantwell, and a large parking lot built to accommodate recreational vehicles driven by tourists. A second group of homes, referred to as Cantwell Heights, is located three miles from the highway in a relatively new subdivision that is on the west side of the railroad tracks. A third group of houses, called the Drashner Subdivision, is located on a lake three miles up the Denali Highway. More homes are dispersed along the Parks Highway between mile 207 and mile 217 and along the first three miles of the Denali Highway (Simeone 2002).

5.1.7.1.4. Chase and Other Railroad Communities

Chase and other nearby "railroad communities" are off the road system and are only served by flag stop on the Alaska Railroad. Chase derives its name from Nancy Chase, the daughter of R.D. Chase, who was a special disbursing agent for the Alaska Engineering Commission at Anchorage. In 1919, the railroad station at mile 236.2 of the Alaska Railroad was originally named "Nanchase." A creamery was constructed at nearby Curry in 1927. This created a market for milk produced in the Matanuska Valley. Most of the butter was sold through hotels operated by the Alaska Railroad. In 1933 the creamery equipment was transferred to the Matanuska Experiment Station in Palmer (Alaska Department of Commerce 2013c). In addition, Curry was a railroad station with a hotel which, for more than 25 years, accommodated overnight passengers and crew when the train took two days to travel between Anchorage and Fairbanks. As late as 1958, Curry was still used as a crew change point. However, a fire and a trend towards larger sections on the railroad led to the virtual desertion of the stop, and between Talkeetna and Gold Creek very little remains from the early railroad days (Braund and Lonner 1982).

Most of the land between Talkeetna and Gold Creek is owned by the State of Alaska. However, over 900 parcels passed into private control in the 1970s and 1980s through the state's land disposal programs (Chase Citizen's Planning Advisory Committee 1993; Alaska Department of Commerce 2013c). While some individuals acquired land for seasonal recreational use or as an investment, speculating that land values would increase in the future with the demand for recreational and settlement sites, others obtained land in order to live full-time on their parcels (Stanek et al. 1988). The majority of the people who settled in the area in the 1970s and 1980s were young people in their twenties or thirties, many with young children (Braund and Lonner 1982). They were motivated by a desire to live a life with a slower pace than that of the city, to live "close to nature," and to seek a "healthier lifestyle" removed from the "pollution of industrialization." These settlers believed that living in an area of low population density promoted cooperative social relationships. Additionally, they sought a perceived self-reliant way of life based on hunting, fishing, and growing their own foods (Stanek et al. 1988). Many of them as well as others who came later to the area were committed to remain on their land and learn the necessary skills to live in a remote wilderness area (Braund and Lonner 1982).

Today, the majority of residents of the Chase area live within two miles of the railroad, but some residents live along various lakes and streams several miles from the railroad tracks. The

Hurricane Turn train, one of America's last flag stop trains and which is currently operated by the Alaska Railroad Corporation, delivers individuals to their remote residences in the area as it has for the past nine decades (Alaska Railroad Corporation 2012).

5.1.7.2. Quality of Life Indicators

5.1.7.2.1. Rural Character

Residents of the selected study area communities have chosen to live in these communities because of the remoteness and peaceful character of the area. As discussed in Section 5.1.1.1, there are low human population levels in the area. Large tracts of undeveloped land surround these communities; the natural environment dominates the landscape. Forests, streams, wildlife, and viewsheds are highly valued by locals. The wild character of the area, or the feeling of Alaska as the "last frontier," is something that residents identify with and strive to maintain. The legacy value of the area, or the ability for future generations to enjoy the area essentially unchanged from its present condition, is important to local residents (National Park Service 2006). The Talkeetna Comprehensive Plan states, for example, that "…most choose to live [in Talkeetna] because of [the] simpler lifestyle and the high quality of living it affords. People are here because they value clean air and water, space to live, a safe place to raise children, a sense of community, and wilderness out the backdoor" (Matanuska-Susitna Borough Planning Department 1999).

5.1.7.2.2. Pace of Life

During most of the year, the pace of life within the selected study area communities is slow and tranquil. Residents typically value the low numbers of cars in the planning area and freedom from traffic congestion for the majority of the year (National Park Service 2006).

The summer months bring vast increases in the numbers of cars and people to the area, which in turn greatly affects the pace of life for residents of communities on the highway system (National Park Service 2006). The population of Talkeetna, in particular, substantially increases with tourists as well as with students and others seeking seasonal employment (Talkeetna Chamber of Commerce 2012). For residents living along the Petersville Road in Trapper Creek, there is also a marked increase in traffic and congestion on weekends during the winter months from snowmachiners. The road is a "snowmachiners' mecca," and the point of origin for a large trail network in the area (Matanuska-Susitna Borough Planning Department 1998). Similarly, during winter months, "…pullouts along the Parks [Highway] near Cantwell often are crowded with empty snowmachine trailers, their owners playing in deep snow on wide-open tundra" (Alaska Department of Natural Resources 2012d).

The sparse permanent population and intense seasonal public use of the area has resulted in a local debate regarding the access issue. There has been a diversity of opinion among residents regarding constructed access; some prefer a roadless system to preserve the rustic and private atmosphere of their lots, while others would like to have year-round, maintained road access to their property (Alaska Department of Land and Natural Resources 2012). Despite differences of opinion about access and other specific issues, there is considerable common ground among residents regarding the community characteristics and values they want to preserve into the

future, and as discussed below in Section 5.1.7.2.4, residents are engaged in discussions to develop workable solutions to development issues.

5.1.7.2.3. Self-sufficient Lifestyle

Residents of the selected study area communities do not have all of the modern conveniences of living in a large city. The independence and resourcefulness that is associated with this type of lifestyle is something the residents value, and keeps them living in these communities. Residents pride themselves on being creative and being able to survive with the resources at hand (National Park Service 2006). For instance, many Talkeetna residents have made a conscious choice to live their chosen lifestyle off the grid, either doing without running water, electricity, or central heating, or using modern technology (e.g., solar panel electric systems) to provide those amenities in a self-sufficient manner (Talkeetna Historical Society 2013b).

The ability to provide for oneself or one's family by subsisting on the land is vital to most local residents' quality of life (National Park Service 2006). Some households lead a semi-subsistence lifestyle based on hunting, fishing, and gardening. As one Cantwell resident remarked: "We don't have Safeway, Carrs, or Fred Meyer where we live. Our grocery store is here where we choose to live" (Simeone 2002). In the following excerpt Stanek et al. (1988) describe the "semi-subsistence" economy of Chase and other nearby railroad communities, which includes both a subsistence and cash income component:

> *This combination allows [residents of Chase, Gold Creek-Chulitna, and Hurricane-Broad Pass] to live in an area that is marginal to the economic opportunities found in more densely populated parts of the southcentral Alaska. Even the contrast between the three study communities and the road-connected areas just to the south around Trapper Creek and Talkeetna is notable. The economy of this latter area is organized around providing services to highway travelers and visiting recreationalists … Most households in the Trapper Creek - Talkeetna area use and harvest wild foods, but harvest quantities arc relatively low. In contrast, harvests at Chase, Gold Creek-Chulitna, and Hurricane-Broad Pass are much higher and approach those of other communities off the road system such as Skwentna and Tyonek. Especially when the large harvest of garden produce at Chase is considered, it is likely that most of these households are producing much of their own food supplies. This economic pattern is a product of the relatively high availability of wild resources, a low population density, a marginal cash economy, and a value orientation conducive to living in a relatively remote area.*

Given the limited number of full-time jobs in the selected study area communities, many households derive cash income from trapping, small-scale gold mining, arts and crafts sales, and seasonal or part-time employment outside the area. According to an inhabitant of Trapper Creek, "people typically need cottage industry, subsistence, and seasonal work to get by. You need to be willing to do a bit of everything" (Trapper Creek 2013b). The choice residents have made to accept the limited employment and income opportunities in their communities in exchange for the fishing, hunting, and other outdoor activities that are readily available is illustrated in the following passage:

> *Residents' incomes are stretched further because of the distance (and price of fuel) residents have to travel to obtain goods and services not available locally. Trapper Creek incomes may, on average, be lower than state averages, but residents have the advantage of direct access to world-class scenery, recreation, and subsistence resources. They enjoy a sense of freedom and remoteness that more affluent communities cannot buy. Many Trapper Creek residents have large gardens, subsistence fish and hunt, and have wilderness out their backdoors. Trapper Creek, like most Alaskan rural communities, has limited government services. This combination of local features makes it apparent why residents stay, despite limited cash based economic opportunities and the higher costs of living. It appears that Trapper Creek self selects residents who love the area, who want to be off the beaten path, and who are resourceful enough to try and make a go of generating an income in an area with limited employers* (Trapper Creek 2013b).

A concern among many local residents is the negative effect that the growing number of visitors to the area could have on their self-sufficient lifestyle. Because the area is accessible from large population centers via the Parks and Denali Highways, competition over fish and wildlife resources in the area is becoming increasingly intense. Pressure from urban hunters has, according to some local residents, caused game populations to dwindle. One consequence of this problem is that many Cantwell residents now hunt almost exclusively on Denali National Park and Preserve lands, which are closed to urban residents. As members of a resident zone community, Cantwell residents can conduct subsistence activities on land added to Denali National Park and Preserve under the Alaska National Interest Lands Conservation Act (Simeone 2002; National Park Service 2013a). However, subsistence hunters accessing the park on off-road vehicles are restricted to specific corridors located near Cantwell (National Park Service 2013b).

5.1.7.2.4. Community Image

An identifiable community image is another important quality of life indicator. Several of the communities in the area have a rich history; maintaining the historic identity of the area is important to residents. An identifiable community center (or business district) contributes to the community image. Maintaining their existing community images is important to local residents, including the perception of clean and safe communities (National Park Service 2006).

Many of the buildings in Talkeetna's contemporary downtown date from the mining and railroad era of the early 1900s. In recognition of the significance of this history, in 1993, a four-block area of the downtown was designated on the National Register of Historic Places as a National Historic District (Talkeetna Historical Society 2013a). Preservation of the contributing historic structures in the downtown historic remains a high priority for the community (Matanuska-Susitna Borough Planning Department 1999). To retain Talkeetna's rural historic village characteristics, local residents successfully organized to halt a number of development projects, including an early state proposal to route the Parks Highway through the community, and a federal proposal in 1992 to construct a large National Park Service facility in the town (Talkeetna Historical Society 2013b). Furthermore, Talkeetna residents completed a community comprehensive plan in 1998 in which they articulated their vision to ensure that the community continued to be an "end of the road" village, maintaining its small-town atmosphere, sense of community, and high quality of life.

As discussed in Section 5.1.2.4, tourism is the main industry in Talkeetna, and protecting and preserving the wilderness and natural resources while maintaining recreation and an ecologically sound tourism economy are also key values (Matanuska-Susitna Borough Planning Department 1999; Talkeetna Historical Society 2013b). Since 1978, the Talkeetna Chamber of Commerce has promoted a healthy tourist and recreation industry in the area as well as encouraged new businesses to locate in the community (Braund and Lonner 1982). For example, in 2002, the Chamber of Commerce, together with the Talkeetna Community Council, facilitated the production of a Talkeetna Community/Tourism Plan (Agnew::Beck Consulting 2002). As a result of the planning effort and community's desire to mitigate side effects of rapid tourism growth, a chapter of the document was dedicated to implementing special land use district regulations in the downtown area and along the Talkeetna Spur Road.

Over the last several years, the residents of Trapper Creek and Chase have also responded to the challenges and opportunities posed by growth. In the fall of 2003, with the assistance of the Matanuska-Susitna Borough and the National Park Service, the community organized a first ever community wide gathering called "Trapper Creek Tomorrow." In late 2004, the community, with assistance of the Borough, started the preparation of a Comprehensive Plan (Agnew::Beck Consulting 2006). In 1992, the Matanuska-Susitna Borough Planning Department assisted the Chase Citizens' Planning Advisory Committee, which included local residents, land owners, and persons with business interests in the Chase area, in preparing a comprehensive plan for the management and development of lands in the area. The plan's preface asserts "that the residents have a right to preserve—to the extent consistent with State and Borough law—their subsistence, wilderness lifestyle" (Chase Citizen's Planning Advisory Committee 1993).

5.1.7.2.5. Community Cohesiveness

Even though the selected communities in the study area have relatively small populations, and the houses are fairly spread out from one another, there is still a strong sense of community. Neighbors know one another and are willing to lend a helping hand to one another in times of need. This familiarity and cooperation with neighbors is important to local residents and distinguishes the small rural communities from larger urban communities (National Park Service 2006).

For Cantwell residents this cohesiveness is long-established and is partially rooted in traditional Alaska Native beliefs in the social and cultural importance of subsistence. As one Cantwell resident noted, "The community sustains itself on people passing meat back and forth" (Simeone 2002). This community tradition of sharing of subsistence resources and of the knowledge, skills, and equipment required to harvest those resources has been passed from generation to generation (National Park Service 2005).

For other communities, the development of a sense of cohesiveness is relatively recent. For example, it was the influx of new settlers into the Trapper Creek area after completion of the Parks Highway that "cemented" Trapper Creek's existence as a community and engendered a sense of cohesion among its residents (Agnew::Beck Consulting 2006; National Park Service 2006). In 1979, Trapper Creek residents formed the Trapper Creek Community Council, a five-member elected advisory council intended to bring local issues into the open, afford residents the opportunity for maximum participation in community self-government, and influence higher

levels of government related to community development and services (Braund and Lonner 1982). The council continues to be active in promoting the general well being of the community (Trapper Creek Community Council 2013). For instance, there is an emerging consensus in Trapper Creek that the community needs to find new ways to increase tourism and develop job and business opportunities, but do so in a manner that benefits local residents and retains the qualities that make the community unique (Agnew::Beck Consulting 2006).

Over the years local residents have demonstrated their cohesiveness on some issues and diversity on other issues. In 2006, for example, a proposed 1,286-acre state timber sale in the West Petersville Road area of the MSB prompted a lawsuit on behalf of the Trapper Creek Community and area land owners (Bauman 2006b; Bauman 2006a). An Oklahoma-based firm that produced wood chips at a large-scale facility at Port MacKenzie and exported the chips to overseas markets was expected to be the main bidder. Local residents said they saw no direct benefit to their communities from the sale. However, some issues have been more divisive. The aforementioned 1992 proposal by the National Park Service to construct a large visitor center in Talkeetna received opposing opinions from area residents as illustrated by the following excerpt from a magazine article covering the controversy:

> *Sandra Jacques, co-owner of Jake's Adventure Co., a Talkeetna-based rafting, hunting and fishing service, agrees with [Steve Mahay, owner of Mahay's Riverboat Service] that the proposed visitor center would not change the area significantly. "They (visitors to the center) would come into town, spend their money and leave," she says. Talkeetna resident Doug Smith vehemently opposes the center and adjacent hotel. He points out that the community has no zoning and that strip development along the spur road could be disastrous. He also feels the large influx of summer visitors would turn the town into a "mob scene"* (Maschmeyer 1992).

5.2. REMI Model Development

In 2013, progress was made in developing the REMI model assumptions for comparing future socioeconomic conditions with and without the Project by conducting interviews with industry and government representatives who have experience and expertise in the state's leading industries and economic policy areas. This information appears in Appendix B. In addition, preliminary discussions were held with Alaska Department of Labor and Workforce Development staff to determine the availability of Alaska residents with the skill sets and experience necessary to construct and operate the Project based on the number of persons being trained for these positions each year.

6. DISCUSSION

Data collection efforts in 2013 made good progress in meeting overall study objective of describing, using text and appropriate tables and graphics, existing socioeconomic conditions within the study area. Completion of the description of existing socioeconomic conditions will require continuing integration with other study reports, including the following:

- The description of current commercial fishing operations will require data on the baseline harvest levels and harvest locations for commercial fisheries for Susitna River-origin

resident and anadromous fish collected by the Analysis of Fish Harvest Study (Study 9.15).

- Descriptions of the recreation resources and facilities that currently support both commercial and non-commercial recreation in the Susitna River watershed and estimates of current levels of recreational use in the region will be provided in the Recreation Resources Study (Study 12.5).
- The description of the specific attributes of the Susitna River corridor and upper watershed that may have non-use value will be revised as information in other study reports becomes available.
- The quality of life analysis will be supplemented with data collected by key informant interviews and by surveys and focus groups conducted for the Recreation Resources Study (Study 12.5) and Aesthetic Resources Studies (Study 12.6).

7. COMPLETING THE STUDY

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

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9. TABLES

Table 5.1.1.1-1. Population Size and Density in Study Area

	Population			Population Density (persons per square mile)	
	2000	2010	Percent Change 2000-2010	2000	2010
STATE OF ALASKA	626,932	710,231	13.3	1.1	1.2
Matanuska-Susitna Borough	59,322	88,995	50.0	2.4	3.6
Trapper Creek	423	481	13.7	1.2	1.3
Chase	41	34	-17.1	0.4	0.3
Talkeetna	772	876	13.5	18.6	32.7
Point Mackenzie	111	529	376.6	0.8	3.5
Houston	1,202	1,912	59.1	53.7	85.4
Wasilla	5,469	7,831	43.2	--	632.4
Denali Borough	1,893	1,826	-3.5	0.1	0.1
Cantwell	222	219	-1.4	1.9	1.9
Fairbanks North Star Borough	82,840	97,581	17.8	11.2	13.3
Fairbanks	30,224	31,535	4.3	948.7	995.0
Municipality of Anchorage	260,283	291,826	12.1	153.4	171.9
Kenai Peninsula Borough	49,691	55,400	11.5	3.1	4.0
Seward	2,699	2,693	-0.2	196.0	190.8
Other--Whittier	182	220	20.9	14.5	17.9

Source: U.S. Census Bureau (2013b)

Table 5.1.1.2-1. Age Characteristics in Study Area

	Age (2010)			
	Under 16	**16-64**	**65 and Over**	**Median Age**
State of Alaska	23.4	68.9	7.7	33.8
Matanuska-Susitna Borough	25.5	66.6	7.9	34.8
Trapper Creek	16.8	70.3	12.9	48
Chase	0	94.1	5.9	52
Talkeetna	17.4	72.5	10.2	45.4
Point Mackenzie	15.9	76.0	8.1	32.8
Houston	24.0	67.4	8.6	35.4
Wasilla	26.1	63.7	10.3	32.2
Denali Borough	19.9	72.6	7.5	41.5
Cantwell	17.4	68.9	13.7	42.7
Fairbanks North Star Borough	23	70.4	6.5	31
Fairbanks	23.8	68.9	7.3	27.9
Municipality of Anchorage	23	69.7	7.2	32.9
Kenai Peninsula Borough	20.6	68	11.3	40.6
Seward	13.1	77.5	9.5	38.3
Other--Whittier	12.3	75.5	12.3	48

Source: U.S. Census Bureau (2013b)

Table 5.1.1.3-1. Racial and Ethnic Composition in Study Area

	Race/Ethnicity (2010)							
	Percent White[1]	Percent Black or African American[2]	Percent Alaska Native and American Indian[2]	Percent Native Hawaiian and Other Pacific Islander[2]	Percent Asian[2]	Percent Some Other Race[2]	Percent Hispanic or Latino[3]	Percent Minority[4]
State of Alaska	66.7	4.7	19.5	1.6	7.1	2.1	5.5	35.4
Matanuska-Susitna Borough	84.9	1.8	10.1	0.6	2.4	1.2	3.7	16.8
Trapper Creek	86.5	0.4	6.4	0	1	0	1	13.9
Chase	100	0	0	0	0	0	0	0.0
Talkeetna	91.4	0.7	6.4	0.5	1.1	0.3	1.8	9.2
Point Mackenzie	67.7	4.5	23.3	0.4	0.6	0.6	3.2	34.2
Houston	82.2	1.3	13.9	0.3	1.3	1.6	3.3	19
Wasilla	83.4	2.4	9.6	0.5	3.2	1.7	4.3	18.1
Denali Borough	89.6	0.6	6.4	0.1	2.2	1.2	2.3	10.9
Cantwell	77.2	0.5	20.5	0	0	1.8	1.4	21.9
Fairbanks North Star Borough	77	6.1	10.9	0.8	4.3	2.1	5.8	25.4
Fairbanks	66.1	11.7	14	1.4	5.3	3.4	9	37.5
Municipality of Anchorage	66	7.7	12.4	2.8	10.3	3.1	7.6	36.8
Kenai Peninsula Borough	84.6	1.0	11.6	0.5	2.1	0.9	3.0	16.8
Seward	68.5	4.2	22.9	1.0	3.3	1.3	3.6	32.5
Other--Whittier	69.5	0.9	15	3.6	10.9	0.9	5	33.2

[1] Alone

[2] Alone or in combination with one or more other races

[3] Of any race

[4] Minority = Total – (White Alone + Some Other Race Alone + Two or More Races, White and Some Other Race) + (Hispanic, White Alone + Hispanic, Some Other Race Alone)

Source: U.S. Census Bureau (2013b)

Table 5.1.2.1-1. Employment and Per Capita Income in Study Area

	Number of Workers/Jobs (2011)[1]	Per Capita Personal Income ($) (2011)[1]
State of Alaska	454,201	45,665
Matanuska-Susitna Borough	33,143	41,905
Trapper Creek	167	28,383
Chase	17	46,962
Talkeetna	470	30,390
Point Mackenzie	83	38,072
Houston	718	33,539
Wasilla	3,366	38,349
Denali Borough	2,085	60,191
Cantwell	95	37,044
Fairbanks North Star Borough	59,014	42,626
Fairbanks	10,380	33,944
Municipality of Anchorage	202,153	50,958
Kenai Peninsula Borough	31,270	41,772
Seward	972	33,699
Other--Whittier	106	31,851

[1]Community data are for Alaska residents only.

Source: U.S. Department of Commerce, Bureau of Economic Analysis (2013); Alaska Department of Labor and Workforce Development, Research & Analysis Division (2013b)

Table 5.1.2.2-1. Annual Unemployment and Labor Force Participation Rate in Study Area

	Unemployment Rate[1]	Percent Not in Labor Force (2007-2011)
State of Alaska	7.0	28.3
Matanuska-Susitna Borough	8.0	33.6
Trapper Creek	7.3	39.8
Chase	0	44.7
Talkeetna	10.9	37.5
Point Mackenzie	22	85.1
Houston	14.6	33.6
Wasilla	12.4	35.2
Denali Borough	10.2	23.7
Cantwell	15.5	30.2
Fairbanks North Star Borough	6.2	26.6
Fairbanks	8.1	28.3
Municipality of Anchorage	5.4	25.6
Kenai Peninsula Borough	8.4	36.4
Seward	9.2	45.8
Other--Whittier	14.6	28.4

[1] State and borough data are for 2012. Community data are for 2007-2011.

Source: U.S. Census Bureau (2013a); Alaska Department of Labor and Workforce Development, Research & Analysis Division (2013b)

Table 5.1.2.2-2. Monthly Unemployment Rate in Study Area

	Unemployment Rate (2012)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
State of Alaska	8.1	8.1	7.8	7.2	6.9	7.3	6.6	6.2	6.1	6.1	6.5	7
Matanuska-Susitna Borough	9.7	9.9	9.6	8.3	7.7	8.4	7.6	6.9	6.7	6.4	7.2	7.7
Denali Borough	24.4	25	22.6	18.5	7.6	4.7	4	3.9	4.6	15.7	19.3	20.6
Fairbanks North Star Borough	7.5	7.4	7.2	6.5	6	6.6	6	5.5	5.2	5.1	5.6	6.1
Municipality of Anchorage	6	6	5.9	5.6	5.6	6.1	5.6	5.2	5	4.7	4.8	5.1
Kenai Peninsula Borough	10.6	10.6	10	8.7	8	8.1	7.2	6.8	7.2	7.4	8	8.5

Source: Alaska Department of Labor and Workforce Development, Research & Analysis Division (2013b)

Table 5.1.2.3-1. Poverty Rate in Study Area.

	Percent of Individuals Living in Poverty[1]
State of Alaska	10.8
Matanuska-Susitna Borough	11.6
Trapper Creek	24.1
Chase	0.0
Talkeetna	15.9
Point Mackenzie	0.0
Houston	13.5
Wasilla	12.8
Denali Borough	5.8
Cantwell	6.0
Fairbanks North Star Borough	9.5
Fairbanks	10.5
Municipality of Anchorage	8.5
Kenai Peninsula Borough	10.6
Seward	4.1
Other--Whittier	18.0

[1] State and borough data are for 2011. Community data are for 2007-2011.

Source: U.S. Census Bureau (2013c); U.S. Census Bureau (2013a)

Table 5.1.2.4-1. Current Resident Labor Force and Workforce Composition in Study Area

	Working Age Residents (2011)	Top Industries by Employment (2011)
State of Alaska	501,704	Trade, Transportation and Utilities (21%)
		Local Government (15%)
		Educational and Health Services(14%)
Matanuska-Susitna Borough	65,562	Trade, Transportation and Utilities (21%)
		Educational and Health Services(15%)
		Local Government (12%)
Trapper Creek	411	Trade, Transportation and Utilities (29%)
		Local Government (20%)
		Leisure and Hospitality (16%)
Chase	39	Leisure and Hospitality (35%)
		Natural Resources and Mining (35%)
		Trade, Transportation and Utilities (12%)
Talkeetna	813	Trade, Transportation and Utilities (33%)
		Leisure and Hospitality (17%)
		Local Government (12%)
Point Mackenzie	186	Construction (24%)
		Trade, Transportation and Utilities (19%)
		Local Government/Educational and Health Services (12%)
Houston	1,384	Trade, Transportation and Utilities (20.6%)
		Educational and Health Services (15.3%)
		Construction (12.7%)
Wasilla	5,933	Trade, Transportation and Utilities (22%)
		Educational and Health Services (16.8%)
		Construction (11.5%)
Denali Borough	1,453	Leisure and Hospitality (25%)
		Natural Resources and Mining (16%)
		Local Government (16%)
Cantwell	174	Leisure and Hospitality (22%)
		Local Government (21%)
		State Government (13%)
Fairbanks North Star Borough	63,061	Trade, Transportation and Utilities (22%)
		State Government (13%)
		Educational and Health Services (13%)
Fairbanks	18,314	Trade, Transportation and Utilities (24%)
		Educational and Health Services (15%)
		Leisure and Hospitality (13%)

	Working Age Residents (2011)	Top Industries by Employment (2011)
Municipality of Anchorage	208,016	Trade, Transportation and Utilities (22%)
		Educational and Health Services(15%)
		Leisure and Hospitality (12%)
Kenai Peninsula Borough	42,543	Trade, Transportation and Utilities (20%)
		Educational and Health Services(15%)
		Local Government (14%)
Seward	1,586	Trade, Transportation and Utilities (24%)
		Leisure and Hospitality (16%)
		State Government (12%)
Other--Whittier	183	Leisure and Hospitality (20.8%)
		Local Government (20.8%)
		Trade, Transportation and Utilities (19.8%)

Source: Alaska Department of Labor and Workforce Development (2013a)

Table 5.1.2.5.1-1. Construction Industry Employment, Income, and Output in Study Area[1]

Region	Employment (Thousands)	Compensation (Millions of Current Dollars)	Output (Millions of Fixed (2005) Dollars)
State of Alaska	24.908	1.538	2.897
Fairbanks North Star Borough	3.671	0.256	0.465
Kenai Peninsula Borough	2.163	0.080	0.186
Municipality of Anchorage	10.570	0.802	1.406
Matanuska Susitna Borough	3.412	0.130	0.299
Denali Borough	0.015	0.001	0.001

[1] Data are for 2012

Source: Regional Economic Models Inc. (REMI) Policy Insight Model (2013)

Table 5.1.2.5.2-1. Air Transportation Industry Employment, Income, and Output in Study Area[1]

Region	Employment (Thousands)	Compensation (Millions of Current Dollars)	Output (Millions of Fixed (2005) Dollars)
State of Alaska	5.678	0.399	1.388
Fairbanks North Star Borough	0.603	0.034	0.129
Kenai Peninsula Borough	0.165	0.009	0.035
Municipality of Anchorage	2.674	0.238	0.766
Matanuska Susitna Borough	0.119	0.005	0.022
Denali Borough	0.003	0.000	0.001

[1] Data are for 2012

Source: Regional Economic Models Inc. (REMI) Policy Insight Model (2013)

Table 5.1.2.5.2-2. Water Transportation Industry Employment, Income, and Output in Study Area[1]

Region	Employment (Thousands)	Compensation (Millions of Current Dollars)	Output (Millions of Fixed (2005) Dollars)
State of Alaska	1.094	0.101	0.472
Fairbanks North Star Borough	0.000	0.000	0.000
Kenai Peninsula Borough	0.111	0.007	0.037
Municipality of Anchorage	0.257	0.022	0.105
Matanuska Susitna Borough	0.013	0.000	0.002
Denali Borough	0.000	0.000	0.000

[1] Data are for 2012

Source: Regional Economic Models Inc. (REMI) Policy Insight Model (2013)

Table 5.1.2.5.2-3 Truck Transportation Industry Employment, Income, and Output in Study Area[1]

Region	Employment (Thousands)	Compensation (Millions of Current Dollars)	Output (Millions of Fixed (2005) Dollars)
State of Alaska	4.126	0.226	0.679
Fairbanks North Star Borough	0.925	0.051	0.153
Kenai Peninsula Borough	0.185	0.009	0.027
Municipality of Anchorage	2.347	0.134	0.399
Matanuska Susitna Borough	0.105	0.003	0.011
Denali Borough	0.000	0.000	0.000

[1] Data are for 2012

Source: Regional Economic Models Inc. (REMI) Policy Insight Model (2013)

Table 5.1.2.5.2-4. Rail Transportation Industry Employment, Income, and Output in Study Area[1]

Region	Employment (Thousands)	Compensation (Millions of Current Dollars)	Output (Millions of Fixed (2005) Dollars)
State of Alaska	0.001	0.000	0.000
Fairbanks North Star Borough	0.000	0.000	0.000
Kenai Peninsula Borough	0.000	0.000	0.000
Municipality of Anchorage	0.001	0.000	0.000
Matanuska Susitna Borough	0.000	0.000	0.000
Denali Borough	0.000	0.000	0.000

[1] Data are for 2012

Source: Regional Economic Models Inc. (REMI) Policy Insight Model (2013)

Table 5.1.2.5.3-1. Recreation and Tourism Industry Employment, Income, and Output in Study Area[1]

Region	Employment (Thousands)	Compensation (Millions of Current Dollars)	Output (Millions of Fixed (2005) Dollars)
State of Alaska	43.564	1.784	2.145
Fairbanks North Star Borough	5.166	0.181	0.254
Kenai Peninsula Borough	4.083	0.111	0.168
Municipality of Anchorage	19.921	0.925	0.973
Matanuska Susitna Borough	3.198	0.110	0.119
Denali Borough	1.081	0.059	0.077

[1] Data are for 2012

Source: Regional Economic Models Inc. (REMI) Policy Insight Model (2013)

Table 5.1.2.5.5-1. Oil and Gas Industry Employment, Income, and Output in Study Area[1]

Region	Employment (Thousands)	Compensation (Millions of Current Dollars)	Output (Millions of Fixed (2005) Dollars)
State of Alaska	4.273	0.770	4.965
Fairbanks North Star Borough	0.000	0.000	0.000
Kenai Peninsula Borough	0.332	0.046	0.311
Municipality of Anchorage	2.033	0.385	2.484
Matanuska Susitna Borough	0.000	0.000	0.000
Denali Borough	0.000	0.000	0.000

[1] Data are for 2012

Source: Regional Economic Models Inc. (REMI) Policy Insight Model (2013)

Table 5.1.2.5.6-1. Utilities Industry Employment, Income, and Output in Study Area[1]

Region	Employment (Thousands)	Compensation (Millions of Current Dollars)	Output (Millions of Fixed (2005) Dollars)
State of Alaska	2.256	0.243	1.232
Fairbanks North Star Borough	0.446	0.046	0.236
Kenai Peninsula Borough	0.253	0.030	0.151
Municipality of Anchorage	0.620	0.093	0.451
Matanuska Susitna Borough	0.185	0.020	0.101
Denali Borough	0.024	0.003	0.013

[1] Data are for 2012

Source: Regional Economic Models Inc. (REMI) Policy Insight Model (2013)

Table 5.1.3-1. General Housing Characteristics in Study Area

	Total Units (2010)	Occupied Units (%) (2010)	Median Value of Owner Occupied Units ($) (2007-2011)	Median Gross Rent ($) (2007-2011)	Number of Vacant Housing Units (2010)
State of Alaska	306,967	84.1	235,100	1,017	48,909
Matanuska-Susitna Borough	41,329	77	216,500	969	9,505
Trapper Creek	499	45.1	100,000	743	274
Chase	209	8.6	120,500	--	191
Talkeetna	744	60.3	156,800	700	295
Point Mackenzie	257	43.6	308,700	--	145
Houston	973	75.1	172,100	800	242
Wasilla	3,277	90.4	217,900	922	315
Denali Borough	1,771	45.5	179,500	572	965
Cantwell	200	52	162,500	725	96
Fairbanks North Star Borough	41,783	87.2	212,800	1,105	5,342
Fairbanks	13,056	88.3	197,900	1,120	1,522
Municipality of Anchorage	113,032	95	276,200	1,058	5,700
Kenai Peninsula Borough	30,578	72.5	200,000	812	8,417
Seward	1,124	82.6	192,000	815	196
Other--Whittier	280	40.7	49,000	688	166

Source: U.S. Census Bureau (2013b)

Table 5.1.3-2. Vacant Housing Characteristics in Study Area

	Number of Vacant Units (2010)	Units for Sale	Units for Rent	Vacant for Seasonal, Recreational, or Occasional Use	Other Vacant
		% (2010)			
State of Alaska	48,909	5.9	13.8	57.0	19.2
Matanuska-Susitna Borough	9,505	5.6	6.2	71.8	14.5
Trapper Creek	274	4	1.1	84.7	9.1
Chase	191	0.5	0	96.3	2.1
Talkeetna	295	1.4	5.8	74.2	15.6
Point Mackenzie	145	0.7	0.7	89.7	9
Houston	242	2.5	2.4	13.8	5.9
Wasilla	315	1.6	3.7	1.4	2.5
Denali Borough	965	2.4	5.2	77.1	14
Cantwell	96	6.3	13.5	64.6	15.6
Fairbanks North Star Borough	5,342	9.5	28.1	31.4	27.8
Fairbanks	1,522	15.2	51.8	12.0	18
Municipality of Anchorage	5,700	14.9	30	26.3	22.7
Kenai Peninsula Borough	8,417	4.8	7.8	72.3	13
Seward	196	5.6	15.8	54.6	23.5
Other--Whittier	166	2.1	17.9	37.1	1.1

Source: U.S. Census Bureau (2013b)

Table 5.1.4.1-1. Police and Fire Protection Services in Study Area

Area	Police Department	Alaska State Trooper Post	Nearest Law Enforcement Facility	Fire Department	Volunteer Firefighters
Trapper Creek	No	No	Talkeetna State Troopers Post	No	No
Chase	No	No	Talkeetna State Troopers Post	No	No
Talkeetna	No	Yes		No	Yes
Point Mackenzie	No	No	Palmer State Troopers Post	No	No
Houston	Yes	No	Palmer State Troopers Post	No	Yes
Wasilla	Yes	No	Palmer State Troopers Post	No	Yes
Cantwell	No	Yes		No	Yes
Fairbanks	Yes	Yes		Yes	No
Anchorage	Yes	Yes		Yes	Yes
Seward	Yes	Yes		Yes	Yes
Whittier	Yes	No	Girdwood State Troopers Post	Yes	Yes

Source: Alaska Department of Commerce, Community and Economic Development (2013c)

Table 5.1.4.1-2. Medical Services in Study Area

	Hospitals	Health Clinics and Federally Qualified Health Centers	Emergency Medical Services
Trapper Creek	No	Sunshine Community Health Center	Trapper Creek EMS
Chase	No	No	No
Talkeetna	No	Sunshine Community Health Center	Talkeetna Fire
Point Mackenzie	No	No	No
Houston	No	No	No
Wasilla	Yes	Mat-Su Health Services; Mat-Su Public Health Center; Providence Matanuska Health Care	Matanuska-Susitna Borough EMS
Cantwell	No	Cantwell Clinic	Cantwell Volunteer Ambulance
Fairbanks	Fairbanks Memorial Hospital; Bassett Army Community Hospital	Interior Community Health Center; Chief Andrew Isaac Health Center and others	Chena-Goldstream Fire and Rescue; Fairbanks Fire Department; and others
Anchorage	Alaska Native Medical Center; Alaska Regional Hospital; Providence Alaska Medical Center; Anchorage Military	Anchorage Neighborhood Health Center	Anchorage Fire Department

	Hospital		
Seward	No	North Star Health Clinic-Chugachmiut; Seward Public Health Center	Bear Creek Fire/EMS Department; Seward Volunteer Ambulance Corps.
Whittier	No	Whittier Clinic; Whittier Community Health Center	Whittier Volunteer Fire/EMS Department

Source: Alaska Department of Commerce, Community and Economic Development (2013c)

Table 5.1.4.2-1. Number of Schools, Grade Levels, and Enrollment in Study Area

	Number of Schools	Grades Served[1]	Enrollment (FY 2013)
Matanuska-Susitna Borough	45	P-12	17,494
Trapper Creek	1	P-6	42
Chase	--	--	--
Talkeetna	1	P-6	113
Point Mackenzie	--	--	--
Houston	3	P-12	1,189
Wasilla	22	P-12	9,804
Denali Borough	4	P-12	899
Cantwell	1	K-12	22
Fairbanks North Star Borough	35	P-12	14,406
Fairbanks	27	P-12	10,760
Municipality of Anchorage	96	P-12	48,863
Kenai Peninsula Borough	43	P-12	9,256
Seward	3	P-12	601
Other--Whittier	1	P-12	39

[1]P = Pre-Elementary; K = Kindergarten.

Source: Alaska Department of Education and Early Development (2013)

Table 5.1.4.2-2. Revenue per Average Daily Membership and Funding Sources

School District	Revenue Per Average Daily Membership ($) (2012)	Share of Funding by Source (2012)
Matanuska-Susitna Borough School District	13,687	20.2% local, 71.9% state, 0.4% federal, 1.1% other, and 6.3% special revenue
Denali Borough School District	12,368	23.4% local, 71.9% state, 0.2% federal, 1.4% other, 3.1% special revenue
Fairbanks North Star Borough School District	15,728	20.7% local, 64.2% state, 6.3% federal, 0.5% other, 8.3% special revenue
Anchorage School District	14,477	28.0% local, 50.5% state, 2.9% federal,0.9% other, 9.7% special revenue
Kenai Peninsula Borough School District	16,273	29.6% local, 62.6% state, 0.4% federal, 0.6% other, 6.8% special revenue

Valdez City School District (Valdez-Cordova Census Area)	22,911	52.5% local, 41.0% state, 0.1% federal, 0.6% other, 5.8% special revenue

Source: Alaska Department of Education and Early Development (2013)

Table 5.1.4.3-1. Utility Providers in Study Area

	Community Piped Water System Operator	Community Piped Sewage System Operator	Landfill Facility Operator	Electric Utility Operator	Natural Gas Utility Operator
Matanuska-Susitna Borough					
Trapper Creek	No	No	Transfer facility that also serves Denali State Park	Matanuska Electric Association	No
Chase	No	No	No	Matanuska Electric Association-Golden Valley Electric Association Intertie	No
Talkeetna	Borough	Borough	Private	Matanuska Electric Association	No
Point Mackenzie	Private	Private	No	Matanuska Electric Association	No
Houston	No	No	Borough	Matanuska Electric Association	No
Wasilla	City, Private	City, Private	Borough	Matanuska Electric Association	ENSTAR
Denali Borough					
Cantwell	No	No	Borough transfer facility	Golden Valley Electric Association	No
Fairbanks North Star Borough					
Fairbanks	Private	Private	Borough; Ft. Wainwright	Golden Valley Electric Association	Fairbanks Gas
Municipality of Anchorage	City, Private	City	Private, Municipality	Chugach Electric Association; Anchorage Municipal Light and Power	ENSTAR
Kenai Peninsula Borough					
Seward	City	City	Borough	Seward Electric System	No
Other--Whittier	City	City	Private	Chugach Electric Association	ENSTAR

Source: Alaska Department of Commerce, Community and Economic Development (2013c)

Table 5.1.4.3-2. Percentage of Household Income Spent on Gas, Electricity, and Heating Fuel

	Percentage of Household Income Spent on Gas, Electricity, and Heating Fuel
United States	4.1
State of Alaska	4.7
Anchorage	3.2
Remote Rural Alaska	14.4

Source: Saylor et al. (2008)

Table 5.1.5-1. Local Tax Revenue Sources in Study Area

Area	Type of Area	Property Tax[3]	Oil and Gas Property Tax	Sales Tax	Special Tax
Matanuska-Susitna Borough	Second-Class Borough[1]	9.691 mills	Yes	No	5% Bed Tax; 5.74% Cigarette & Tobacco Tax
Denali Borough	Home-Rule Borough[2]	No	--	No	Severance Tax $.05/yard gravel-$.05 ton-coal; 7% Bed Tax
Fairbanks North Star Borough	Second-Class Borough[1]	12.97 mills	Yes	No	8% Bed Tax; 8% Tobacco Tax; 5% Alcohol Tax
Municipality of Anchorage	Unified Home-Rule Municipality[2]	15.57 mills	Yes	No	12% Bed Tax; 8% Car Rental Tax; 113.2 mill Cig & 55% Tobacco Tax
Kenai Peninsula Borough	Second-Class Borough[1]	4.5 mills	Yes	3.0%	No

[1] First-class/second-class borough: A main difference between a first-class and second-class borough is the authority to assume powers. A first-class borough may exercise any power not prohibited by law on a non-area-wide basis (i.e., in the area of the borough outside cities) by adopting an ordinance. A second-class borough, however, must gain voter approval for the authority to exercise many non-area-wide powers.

[2] Home rule borough/city: A city or borough that has all the legislative powers not prohibited by law or charter. Typical area-wide powers include education, planning, animal control, fireworks control, health and environmental protection, library, mass transit, zoning, taxicab, rights-of-way use, parking, and sewers. Non-area-wide powers include building safety and police.

[3] Mills, or millage rate, is the measure of a tax per $1,000 of assessed value.

Source: Alaska Department of Commerce, Community and Economic Development (2013a); Alaska Department of Commerce, Community and Economic Development (2013d)

Table 5.1.5-2. Local Government Revenues by Source in Study Area

	Property Tax	O&G Property Tax	Other Taxes	Other Fees and Charges	Inter-governmental Transfers	Other General Fund Revenues	Non-General Fund Revenues	Enterprise/ Business Funds	Total
	$ Thousands (2012)								
Matanuska-Susitna Borough	76,243	109	4,224	3,417	24,457	237	64,162	4,293	177,141
Trapper Creek	--	--	--	--	--	--	--	--	--
Chase	--	--	--	--	--	--	--	--	--
Talkeetna	--	--	--	--	--	--	--	--	--
Point Mackenzie	--	--	--	--	--	--	--	--	--
Houston	413	0	0	83	276	11	674	0	1,457
Wasilla	0	0	0	2,007	2,137	116	1,561	6,014	11,835
Denali Borough	0	0	2,685	0	1,076	27	260	352	4,400
Cantwell	--	--	--	--	--	--	--	--	--
Fairbanks North Star Borough	90,342	9,002	3,622	2,002	16,196	2,135	32,311	14,057	169,667
Fairbanks	13,971	157	5,546	7,787	4,997	866	18,249	598	52,171
Municipality of Anchorage	488,741	3,964	45,962	50,970	48,818	5,711	143,628	288,274	1,076,070
Kenai Peninsula Borough	26,244	3,748	0	0	9,749	2,349	37,272	156,157	235,519
Seward	1,033	0	346	2,708	1,953	109	4,444	35,910	46,504
Other--Whittier	436	9	251	253	531	90	1,129	1,770	4,469

Source: Alaska Department of Commerce, Community and Economic Development (2013b); Alaska Department of Commerce, Community and Economic Development (2013a)

Table 5.1.5-3. Local Government Operating Expenditures by Category in Study Area

Area	Transportation and Public Works	Education	Public Welfare	Health (including utilities)	Public Safety	Environment & Housing	Government Administration	Debt Service	Other
	$ Thousands (2012)								
Matanuska-Susitna Borough	4,177	48,048	0	0	7,236	3,545	16,998	0	0
Trapper Creek	--	--	--	--	--	--	--	--	--
Chase	--	--	--	--	--	--	--	--	--
Talkeetna	--	--	--	--	--	--	--	--	--
Point Mackenzie	--	--	--	--	--	--	--	--	--
Houston	260	0	0	0	264	0	315	47	17
Wasilla	2,167	0	0	0	6,161	1,835	2,791	420	65
Denali Borough	0	2,070	0	0	0	0	1,162	0	6
Cantwell	--	--	--	--	--	--	--	--	--
Fairbanks North Star Borough	6,223	47,359	0	0	1,829	12,235	19,570	0	2,436
Fairbanks	7,530	0	0	0	14,319	0	9,899	885	719
Municipality of Anchorage	43,955	231,070	0	12,204	202,327	35,482	20,618	55,615	47,084
Kenai Peninsula Borough	5,574	43,898	0	0	598	0	14,878	0	0
Seward	1,766	0	0	0	3,260	1,678	2,652	809	0
Other--Whittier	315	0	0	0	714	0	677	14	0

Source: Alaska Department of Commerce, Community and Economic Development (2013a)

Table 5.1.6.1.3-1. Timber Harvest in Selected Natural Resource Management Units of the Matanuska-Susitna Borough

Unit Name	Operable Net Cubic Feet Available For Harvest (rounded)	Proposed Harvest (Cubic Feet)				
		2013	2014	2015	2016	2017
Chulitna River (South Subunit)	4,104,000	--	--	--	--	--
Mile 233	5,384,000	--	--	--	--	--
Moose Creek	1,302,000	61,848	--	--	--	--
Parks Highway	2,604,000	--	--	42,950	TBD	--
Rabideux Creek	2,726,000	--	67,002	67,002	TBD	67,002
Susitna River Corridor	5,087,000	549,760	--	--	--	1,023,298
Whiskers Creek South	13,097,000	--	--	--	--	--

Source: RWS Consulting (2010); Matanuska-Susitna Borough Community Development Department (2013)

Table 5.1.6.1.4-1. Property Values of Selected Land Parcels in the Study Area

Location	Parcel ID	Owner	Gross Acreage	Land Appraised Value (2013)	$/Acre
Parcel borders Susitna River downstream from mouth of Watana Creek	2446	Tyonek Native Corporation	583.36	$160,400.00	$275
Parcel borders Susitna River and lower portion of Watana Creek	45432	Ninilchik Native Association	583.36	$160,400.00	$275
Parcel borders north shore of Stephan Lake	62264	Tyonek Native Corporation	595.7	$148,900.00	$250
Parcel borders west shore of Stephan Lake and includes a commercial fishing/hunting lodge	24052	Stephan Lake Holdings LLC	5.00	$10,000.00	$2,000
Parcel borders Christiansen Lake near Talkeetna with road access	41027	Matanuska-Susitna Borough	38.45	$85,300.00	$2,218
Parcel borders Christiansen Lake near Talkeetna with road, electric, and telephone access	36573	Private	5.48	$99,600.00	$18,175

Source: Matanuska-Susitna Borough (2013)

PART A - APPENDIX A: RANDOM UTILITY MODEL METHODOLOGY

Estimating Changes in Recreation Demand and Social Welfare Resulting from the Susitna-Watana Hydroelectric Project

Preliminary, Interim-Draft Report — For Review and Discussion Purposes Only

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1. Introduction

This report presents a preliminary, interim draft of the Alaska Energy Authority's (AEA) efforts to characterize changes in recreation demand and social welfare for the recreator populations that are most likely to be affected by the Susitna-Watana Hydroelectric Project (Project). AEA is developing recreation demand models to estimate changes in recreation demand and social welfare associated with the Project. The report describes the methodology that AEA is using to develop the demand models for the following four recreation activities that may be affected by the Project:

- Fishing
- Recreational boating
- Snow machining and
- Hunting.

The report also presents a detailed description of the Fishing Demand Model that AEA has developed using existing and new survey data. Because this report is a preliminary, interim draft, it does not include the results from the demand models; however, it does describe the policy scenarios and the structure of the results the models are designed to address.

Section 1.1 presents project background and describes its relationship to the methodology needed to assess changes in recreation demand and social welfare. Section 1.2 presents an overview of the steps that AEA is conducting to develop the recreation demand models and assess the changes in social welfare resulting from the Project. Section 1.3 presents an overview of the results that the models will produce, and Section 1.4 presents an overview of the remainder of the report.

1.1 Relevant Background and Methodology Overview

AEA is considering a hydroelectric project on the Susitna River at Watana Creek. Figure 1.1 shows the location of the proposed dam for the hydroelectric project. Undertaking the hydroelectric project would have a number of implications for Alaska's outdoor recreators. Constructing the dam would require creating new access roads and associated construction efforts. Construction efforts could be disruptive in the short run. For example, blasting and construction noise could impact hunting opportunities while the building of coffer dams and short term river re-routing could impact fishing. As the construction project winds down and the dam begins its normal operations different effects would occur.

Figure 1.1: Location of the Proposed Susitna-Watana Hydroelectric Project

In the long run the access provided during the project (and possibly enhanced subsequently) would provide a new way into Game Management Unit 13, one of Alaska's most popular game management units. This improved access would allow hunters an easier way to reach Game Management Unit 13, but also could have detrimental effects on big game in the area, potentially affecting harvest rates.

Above the dam, what was previously free-flowing river would become a 49-mile-long, 2-mile wide lake. Because the dam would separate the river, salmon passage upstream would be affected. Downstream, river flow would change. The way in which flow will change will depend on how the dam is operated. Generally speaking, dams not operated as run-of-the-river would be expected to cause changes in water flow, temperature, and turbidity. These changes could impact fisheries production. It has also been noted that dam operation may decrease ice pack stability on the Susitna, potentially limiting snow machining opportunities and changing winter accessibility. The degree of these effects will depend on any mitigation measures such as restoration activities or dam management that includes controlling water temperature and flow.

To estimate the welfare changes of the hydroelectric project, AEA is developing a mathematical representation of outdoor recreation preferences for the population expected to be affected by the Project. The mathematical representation identifies recreation preferences across site characteristics that occur in both the Baseline (Without-Project) and With-Project Conditions. Important modeling features include fusing behavioral (choice-based) preference functions to spatially represented population data. This fusing process produces integrated partial equilibrium models that are used to simulate conditions under Baseline (Without-Project) and With-Project Conditions. The differences between these two states determine the social welfare changes associated with the Project.[1]

Preference functions are used to identify how outdoor recreators tradeoff the characteristics of alternative recreation sites when they choose how and where to recreate. Using fishing as an example, when anglers take a trip, they have a choice of which site to visit. The sites from which they can choose have numerous characteristics such as the distance from their home, fishing quality, facility amenities (e.g., presence of a boat launch), and water-body characteristics and surroundings (e.g., fresh versus saltwater, level of crowding, and remoteness of the surroundings).

Preference functions include the (nonmarket) price of outdoor recreation as the costs recreators incur in traveling from their homes to recreation sites. These "prices" vary according

[1] As described in EPA's *Guidelines for Conducting Economic Analysis*, equilibrium modeling using the With- and Without-Impact approach is central to all sound welfare estimation processes (EPA 2010).

to recreator locations. When new recreation sites are created or existing sites have their features changed, the preference functions allow interpreting the value of the quality change in terms of travel costs. Recreators respond to site quality changes by reallocating their trips so as to maximize the value of their recreation experience. For example, if a high-quality fishing site is closed, an angler who typically visits that site might travel farther to achieve a similar recreation experience. This recreator would incur higher travel and time costs. Alternatively, the angler could choose a closer, but lower quality experience or forgo angling trips while the site is closed. In these cases, angler costs go down, but the value they receive from their angling opportunities is also diminished.

1.2 Steps in Developing the Structural Recreation Demand Model

AEA took the following steps to develop the spatial, travel-cost-based representations of recreation demand that it uses to evaluate changes in fishing, recreational boating, snow machining and hunting:

- Step 1—Identify important recreation conditions and outcomes.
- Step 2—Assess available recreation data.
- Step 3—Identify relevant recreation utility functions.
- Step 4—Identify recreation demand by combining utility functions and site characteristics (under Baseline and With-Project Conditions)
- Step 5—Identify aggregate demand using population data and recreation participation rates.

1.2.1 Step 1—Identifying Recreation Outcomes

In this step, AEA identifies recreation outcomes that are likely to occur under With-Project Conditions. Example outcomes to be considered include those that affect the quality of a recreation trip, such as changes in access, solitude, crowding, and harvest. Each section of the report that presents the individual recreation demand models describes policy-relevant variables that AEA identified to be able to evaluate changes in the demand for each recreation activity and the effect on social welfare.

1.2.2 Step 2—Assess Currently Available Recreation Data

In this step, AEA gathers population data and recreation participation rates to define and estimate the size and characteristics of the affected population. For example, to identify the angler population that will most likely be affected by the project, AEA reviewed and compiled information from the 2010 Census Bureau, ADF&G's 2010 Sport Fishing Survey, annual fishing license sales, the 2013 Alaska Outdoor Recreation Survey, and recreation participation rates from Alaska's Statewide Comprehensive Outdoor Recreation Plan (SCORP) (AKDNR 2009).

1.2.3 Step 3—Identify Recreation Utility Functions

In this step, AEA first identifies recreation utility functions and then spatially calibrated specifications of these functions to capture important recreator behavioral responses that are expected to occur under With-Project Conditions (e.g., changes in trip-taking behavior as a result of changes to the fishery). The accuracy of this methodology is limited only by the ability to calibrate an already estimated utility function to a different population using appropriate economic methodologies (Smith, van Houtven, and Pattanayak 2002).

1.2.4 Step 4—Identify Recreation Demand

In this step, AEA identifies recreation demand by combining the existing utility functions with site characteristics under Baseline (Without-Project) and expected With-Project Conditions. The representation of recreation opportunities in a demand system allows identifying an individual's (or like-minded and located group's) likelihood of visiting a site under the specified site characteristics. Under this approach, Baseline (Without-Project) Conditions and site visits are used to identify the econometric model. Under With-Project Conditions, site characteristics will be different from Baseline (Without-Project) Conditions to reflect expected outcomes (i.e., changes in site availability, access, and harvest).

With the new set of opportunities and site characteristics under With-Project Conditions, AEA conducts participation and site-choice simulations to identify expected changes in the affected population's visits across the directly affected project site and all relevant substitute sites included in the recreation demand model. This allows estimating visitation at sites under conditions that are not currently occurring at those sites. In addition, because these forecasts arise from simulations of a structural demand system, it is possible to recover sophisticated economic metrics such as changes in respondents' consumer surplus (i.e., willingness to pay) by making comparisons across Baseline (Without-Project) and With-Project specifications of the demand models. Consumer surplus provides the appropriate measure of changes in social welfare.

1.2.5 Step 5—Identify Aggregate Demand

In this step, AEA identifies *aggregate demand* using 2010 Census data and participation rates to reflect changes in demand and social welfare for the entire affected population (i.e., anglers, hunters, boaters, and snow machiners). AEA also scales the results of the evaluation for the residential population to reflect changes in demand and social welfare for the non-resident population based on rates of resident to non-resident participation for each recreation activity.

1.3 Summary of Results

Table 1.1 presents the structure of the summary results that AEA will produce from its evaluation of recreation demand and social welfare changes resulting from the Project. The evaluation covers the 30-year time period from 2015 through 2045. The changes in recreation demand and social welfare are estimated as differences between Baseline (Without-Project) and With-Project Conditions over this 30-year time period. The results present the number of affected recreators (both resident and non-resident), the average annual trips they take under Baseline (Without-Project) Conditions, the difference in the average annual trips they take between Baseline (Without-Project) and With-Project Conditions, and the total and annual change in social welfare associated with this change in trips.

Table 1.1
Summary of Results

Category	Recreation Activity				
	Fishing	Paddling	Hunting	Snow-machining	Boating
Evaluation Time Period	2015 – 2045				
Number of Affected Recreators					
Resident					
Non-Resident					
Total					
Average Total Annual Trips by the Affected Population					
Resident					
Non-Resident					
Total					
Annual Change in Trips [Increase / (Decrease)]					
Total Change in Social Welfare [Increase / (Decrease)]					
Annual Change in Social Welfare [Increase / (Decrease)]					

1.4 Report Organization

The report contains 3 sections and 2 appendices. Section 2 presents a detailed description of the methods that AEA used and the information required to model changes in recreation demand and social welfare associated with the creation of the Susitna-Watana Hydroelectric Project. The section uses changes in social welfare resulting from changes in

fishing demand as a conceptual example. Section 3 describes the Fishing Demand Model that AEA developed to assess changes in angling demand and social welfare resulting from the Project. Appendix A presents the site characteristics included in the Fishing Demand Model, and Appendix B presents the 2013 Alaska Outdoor Recreation Survey.

2. Conceptual Mathematical Foundations and Information

This section presents an overview of the conceptual mathematical methodology. This conceptual methodology informs the modeling approach and information requirements AEA uses to estimate changes in recreation demand and social welfare under the With-Project Conditions. The approach is a general-purpose, policy-modeling framework developed by Vining (1984) that Bingham and Kinnell 2012) have adapted as a dam-management policy framework . Vining's general methodology is at a higher level than the specific recreation economics that are relevant for this portion of the Watana project. However, the methodology is entirely consistent with sophisticated recreation demand modeling techniques and provides an elegant overarching framework for the complex ecologonomic systems that characterize the interface between dams and fisheries.

Section 2.1 presents a generalized overview, and Section 2.2 presents the application of the structure to assessing changes in recreation demand and social welfare. Section 2.3 presents an example using changes in fishing demand.

2.1 Overview of Mathematical Structure for Valuing Changes in the Susitna River System

Simulation modeling is used to conduct the evaluation. Figure 2.1 presents a flow diagram representation of the Susitna River system with the addition of mathematical notation.[2] The mathematical notation, characterizes the Susitna River system as (S,Θ). In this framework S represents the integrated physical, hydrologic, ecological, environmental, and socioeconomic relationships that link dam development and management alternatives with socioeconomic outcomes.

The selection of dam development alternatives directly and indirectly affects numerous physical, hydrologic, ecological, and environmental characteristics of the Susitna River system. Of these characteristics, those that are relevant to local socioeconomic conditions are represented by Θ. Prime notation is used to represent level of control. Factors that can be directly controlled are typically closely coupled to alternative-related physical characteristics, such as the existence and operational status of the dams and presence or absence of fish passage technology.[3] Relevant, indirectly controllable hydrologic, ecologic, and environmental

[2] The model's conceptual foundation follows Vining's (1984) public policy modeling approach that "the real thing that is being reacted to and talked about," in this case recreators' trip-taking decisions and well being, "does in fact exist; it lies there in time and space ready to be depicted" (page 13).

[3] "Closely coupled" refers to changes that can be known with certainty.

characteristics are represented by Θ' and Θ''.[4] Consequently, the specification of a resource characteristic as Θ means that it is both relevant to socioeconomic processes and either directly or indirectly related to the physical status of the Susitna River.

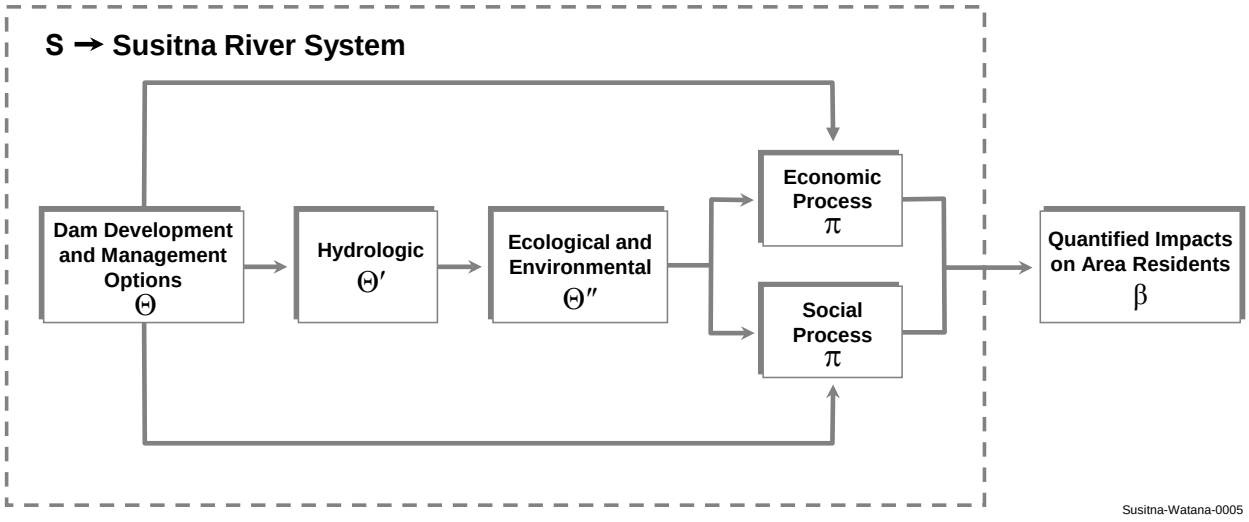


Figure 2.1: Mathematical Notation for the Susitna River System
In this figure, "S" mathematically denotes the Susitna River system. The character Θ represents relevant system parameters over which decision-makers have some control. Socioeconomic processes are represented by π and measured outcomes related to these processes are denoted β.

Socioeconomic processes that are impacted by changes to Θ are represented by π. These are specific, continually occurring collections of events. A particular person choosing how to spend a day off for recreation is an example of a socioeconomic process as is a real estate transaction from listing to sale.[5] Because of the number and complexity of these socioeconomic processes, their complete properties are rarely observed. Consequently, quantitatively assessing the performance of these systems requires the use of indicators. For example, the number of trips taken to the Susitna is an indicator that informs an assessment of the Susitna River's performance as a socioeconomic asset with respect to recreation.[6] In the mathematical structure, these indicators are identified as β.

[4] The use of prime notation to represent degree of control (and thus degree certainty) recognizes that expert judgment and reduced form modeling (as opposed to detailed structural modeling) may be used to identify changes to the Θ.

[5] Mathematically this is represented with subscripting by i for time periods and j for individuals and superscripting by R for recreation π_{ij}^{R}.

[6] The collection of additional information can refine this assessment. For example, information on distances traveled provides information about values.

To ensure that they are both mathematically tractable and useful for policy analysis, indicators must have the following qualities:

1. They are generated through socioeconomic activities.
2. They are real numbers that can be measured.
3. Evaluating their statistical properties conveys a sense of system performance.

The selection of performance indicators for the Susitna River is informed by assessing these properties. Recreational pressure provides an example. Recreational pressure estimates clearly meet requirements 1 and 2 because the number of trips taken to the Susitna River over a particular time period is a measurable quantity that is generated through a socioeconomic process.

With respect to requirement 3, although pressure estimates are based on actually occurring events, they are typically random variables.[7] An evaluation of the statistical properties of recreational pressure does indeed provide an indication of system performance. For example, an estimate of recreational pressure that is "high" combined with an estimate of variation in pressure that is "low" could indicate "good" performance. When possible, this evaluation is furthered by identifying the historical statistical properties of the indicator. Specifically, historical pressure estimates and associated value estimates provide norms upon which performance of the system as currently operating can be evaluated.[8]

With this structure informing the identification of relevant conditions, required information for socioeconomic modeling of the system includes the following:

1. Recreation site attributes—Θ
2. Dam creation and operation characteristics—Θ
3. Recreational use patterns and values—β

This exposition identifies information needed to evaluate the current status of the Susitna River as a socioeconomic asset. The identification of changes to these indicators associated with dam-management alternatives via mathematical simulation requires additional information as identified in the following subsections.

[7] "Random variable" refers to estimates of real numbers. Random variables are identified by frequency distributions containing parameters that indicate central tendency and degree of certainty of the estimate.

[8] Value estimates are also a β. Subscripting β by t represents the inclusion of these temporal considerations.

2.2 System Structure and Parameter Specification

The backdrop for the Susitna-Watana Hydroelectric Project on recreation is one of state policy-making. The identification of variables influencing socioeconomic processes (Θ) and indicators of the performance of these processes (β) underlie hopes of improving the performance of the system. Alternatives are evaluated through the simulation of changes in β (as opposed to actual changes in Θ and observations of β). For this reason, identifying expected changes in β requires mathematically modeling the relationship between Θ and β. This modeling task consists of identifying and specifying circumstances (Θ, S) that generate both the variation currently being observed in β and the variation expected in β under potential dam development and management alternatives.

Given an acceptable specification of the mathematical structure that generates observables of interest, the system (Θ, S) must then be parameterized. This is accomplished by identifying those parameters associated with S and those control variables associated with Θ within the appropriate mathematical structures. Because numerous statistical models have been estimated, it is often possible to identify parameters from existing studies.

A mathematical form that is particularly important for evaluating changes across multiple characteristics is based on hedonic price theory as developed by Rosen (1974). The hedonic concept decomposes the total utility of a multi-attribute good into values that are implicitly associated with each characteristic.[9] The characteristics of a fishing trip include distance from home to the site, availability of a boat launch, and expected catch, among other things. Hedonic forms are employed in the mathematical modeling of recreation pressure and value and property value. Advantages of this specification include both conceptual correctness and ability to simulate socioeconomic outcomes β under policy-relevant specifications of site characteristics Θ.

The accuracy of transferred functions depends upon the analyst's ability to calibrate previously estimated functions to different geographic areas and populations (Smith, van Houtven, and Pattanayak 2002). Calibration needs are minimized by relying on scientifically sound studies that evaluate socioeconomic processes similar to those under consideration. In some cases, available functions are estimated in situations that are dissimilar to the situation being evaluated. In others, there is no statistical model available. In such cases, a combination

[9] Rosen's original application addressed residential property values. Since then hedonic forms have been used to evaluate most multi-attribute goods, including less obvious applications such as pharmaceuticals and wine.

of expert judgment and mathematical calibration is employed to both refine the parameters and link the recreation models.

Until this point, the mathematical system has been presented as deterministic. In fact, the system is best characterized as being inherently uncertain. For this reason, specifying uncertainty in system parameters is important. When system parameters are transferred directly from a high-quality empirical study of the same process and population, uncertainty estimates are directly transferred.

When the uncertainty in a parameter is not directly available, it is specified and updated via statistical calibration. Once specified in this manner, downstream uncertainties can be evaluated by using Monte Carlo analysis. This approach can appropriately account for uncertainty in transferred parameters, calibrated parameters, and those parameters that are specified based on professional judgment.

2.3 Modeling Changes in Recreation Demand and Social Welfare

Complexities in recreational demand modeling arise because the use of recreation resources does not take place in a traditional marketplace and because there are numerous types of recreation taking place, including several different types of fishing, hunting, boating, and snow machining. Section 2.3.1 describes the structure for evaluating changes in recreation demand and social welfare. This description is generic across all recreation types. The section containing each recreation demand model presents the unique model specification for each activity. Section 2.3.2 presents the information requirements needed to develop this demand specification.

2.3.1 System Structure for Recreation

The mathematical structure for recreation is the probabilistic site choice model. This modeling structure, based on choice theory, has the advantages of being professionally accepted, useful for policy-simulation predictions, consistent with economic theory, and capable of identifying trip values and changes in social welfare.[10]

These models identify the probability of a specific outcome (in this case, the selection of a recreation site), conditioned on the site characteristics of all relevant choices for recreators (e.g., distance from the site to the angler's home, expected catch, etc.). In the site choice framework, a recreator chooses a site by comparing characteristics across all sites. The mathematical structure is presented in Equation 2.1 below.

[10] The statistical basis for choice theory is the standard conditional logit model (McFadden 1974; McFadden 1981).

$$P_i(j) = \frac{\exp(V_{ij})}{\sum_{j=1}^{J} \exp(V_{ik})}$$

$$\text{where } V_{ij} = f(\Theta, S) \qquad \textbf{(2.1)}$$

This equation represents the probability that on any particular recreation choice occasion, a recreator (identified by *i*) will choose to visit a particular site (identified by *j*). Note that this likelihood, identified by $P_i(j)$, is determined on the basis of both site characteristics (Θ) and parameters representing the value the recreator holds for those site characteristics (S).

This mathematical construct identifies visitation likelihood. However, the probability that a recreator will visit a site is not an observable β that can be used to evaluate the performance of the system. Pressure is a closely related and commonly employed β. To estimate pressure for any given site *j*, $P_i(j)$ is summed over all recreators' choice occasions.[11]

The motivation underlying the identification of the mathematical structure that generates recreation trips is to allow evaluation of changes in trips (and other metrics as well) that are associated with policy decisions. The hedonic decomposition of recreation sites into site characteristics and the representation of these site characteristics in the site-choice framework allow an evaluation of important information, including changes in visitation probability, changes in site pressure, and changes in resource value. This is accomplished by developing an equivalent mathematical structure with appropriately altered Θ for policy alternatives and finding the difference in trips between this policy simulation model and the base case. Equation 2.2 presents the mathematics for an individual.

$$\text{Annual Choice Occasions}_i \left[\frac{\exp(V_{ij})}{\sum_{j=1}^{J} \exp(V_{ik})} - \frac{\exp(\overline{V}_{ij})}{\sum_{j=2}^{J} \exp(\overline{V}_{ik})} \right]$$

$$\text{where } Vij = f(\Theta, \mathbf{S}) \;\; \overline{V}ij = f(\overline{\Theta}, \mathbf{S}) \qquad \textbf{(2.2)}$$

Aggregating over individuals identifies changes in trips for each site due to the policy that changes Θ to $\overline{\Theta}$.

Estimates of changes in economic value improve the ability to assess resource performance. The distance from an individual's home to a site is a critical variable in a site-choice model because it represents the fuel cost and travel time required to visit any site. When

[11] In the simulation context, this is accomplished by multiplying the likelihood of selecting each site (Equation 1) by the total number of trips.

distance is converted to travel cost, the site-choice framework supports the calculation of monetary changes in value associated with changes in site characteristics. The mathematical form used to identify dollar-based changes in value associated with a policy that changes Θ to $\overline{\Theta}$ is the difference between the utility levels scaled by the relative impact of travel costs. Equation 2.3 presents the mathematical structure used to evaluate the change in annual value that a recreator attributes to the policy that changes Θ to $\overline{\Theta}$. φ is the parameter that accounts for the impact of travel costs on site choice.

$$CV_i = \frac{Annual\ Trips_i}{\varphi_i}\left[ln\left(\sum_{j=1}^{J} e^{V_{ij}}\right) - ln\left(\sum_{j=1}^{J} e^{\overline{V}_{ij}}\right)\right]$$

$$\text{where } Vij = f(\Theta, \mathbf{S}) \quad \overline{V}ij = f(\overline{\Theta}, \mathbf{S}) \qquad \textbf{(2.3)}$$

CV_i refers to the compensating variation or dollar-valued, willingness to pay that recreator *i* has for the change from Θ to $\overline{\Theta}$. This is the amount of money that would make the recreator indifferent between the two states of the world specified under Θ and $\overline{\Theta}$.[12]

2.3.2 Information Requirements for Recreation

Operationalizing the powerful site-choice framework requires a significant amount of information. The information that must be identified includes

1. the population of affected recreators,
2. relevant site characteristics for both the site being evaluated and potential substitute sites,
3. assessment of recreator preferences, and
4. travel costs from recreator origins to sites.

The first step identifies information relevant to the local population of recreators. Identifying the affected population of recreators and their characteristics is critical. Based on publicly available information about typical travel distances, the likely users of the affected site are identified within a defined geographic scope. Publicly available information on population densities, license purchases, and other measures of recreation participation are then used to assess the size and total number of annual trips across each affected recreator population.

The next step involves identifying substitute sites and site characteristics for each recreation activity. Available information on recreation in the area and typical travel distances are used to develop an appropriate area for substitute sites. For the Susitna River assessment,

[12] This information is useful for evaluating changes via a utilitarian perspective, such as benefit-cost analysis (Dower 1989).

its substitute sites should reflect similar and nearby rivers and inland lakes. Very popular sites by activity within the evaluated area are included as substitute sites along with the policy relevant sites. The least frequented sites within the affected area, because they have a negligible effect on aggregate recreation demand, need not be included.[13] Once the representative substitute sites are selected, publicly available sources are used to collect the site characteristics for the affected and substitute sites.

The last critical piece of information is distances from all recreator origins (ZIP codes) to all specified policy and substitute sites. The distance traveled to a site directly influences the travel cost to each site for each angler. These distances are calculated using the most recent version of a popular transportation routing software called PC*Miler (ALK Technologies 2010). Travel costs reflect both direct costs and travel time costs. Direct costs are calculated by multiplying the round-trip miles by the standard per mile reimbursement. The average hourly wage of each ZIP Code within the affected population is calculated by dividing household income from the U.S. Census by 2,000 work hours per year. Travel time in minutes is also calculated by PC*Miler. The round-trip time estimate is multiplied by one-third of the average hourly wage rate to reflect the opportunity cost of time. The travel cost included in the model is the sum of the direct travel cost and the opportunity cost of time. Because some sites are not accessible by road, direct costs are calculated using the costs to fly to those sites. For sites that are only accessible by boat, the direct costs are calculated from the ZIP Code to the launch nearest the site.

2.4 Modeling Changes in Fishing Demand—A Conceptual Example

Evaluating changes in recreation demand and social welfare under the With-Project Conditions requires developing a mathematical model that identifies the relationship between trips, travel costs, and other site quality features. The concept of an individual's demand for recreation (e.g., fishing trips) to sites is the foundation for the economic valuation of a recreational impact resulting from a project or an event because it provides the basis for measuring recreators' willingness to pay (WTP) for the recreation opportunity. The demand function describes the maximum number of trips a person would be willing to take at each price over a given time period. It also describes the WTP for another trip—the so called marginal value of a trip—given the number of trips. For a nonmarket service like recreational fishing, "price" is the cost of taking a trip to that site. This cost may include transportation costs, the opportunity cost of time, entrance fees, and other trip-related costs. When these costs are

[13] This varies by activity.

considered as an implicit price, an individual's demand function can be interpreted as his maximum WTP for an additional trip at each quantity of trips. Differences across demand functions under Baseline (Without-Project) and With-Project Conditions are used to identify changes in social welfare.

Using fishing as an example recreation activity, an important task is identifying affected anglers' demand curves for sites in the fishery. To be consistent with welfare economic concepts, the estimation of demand for fishing trips to a site considers the number and quality of substitute sites. The characteristics of each fishing site, such as total catch, presence of facilities like a boat ramp, and distance to the site from the angler's home distinguish one site from another. Because each geographic area contains a unique set of sites and anglers, the most precise way to identify each site's demand curve is by observing the behavior of anglers that could potentially use the site of interest. With information about the trips of anglers and the costs and site characteristics of substitute sites, it is possible to econometrically identify site-demand curves. The data required to do so are trip-taking behavior (i.e., number of trips to sites) and site characteristic information, including catch and travel costs. This information may be collected by on-site interviews, phone surveys, or other methods.

Economists have long used random utility models (RUMs) to facilitate the estimation of demand curves (Bockstael, Hanemann, and Strand 1986; Bockstael, McConnell, and Strand 1991; Feenberg and Mills 1980; Caulkins, Bishop, and Bouwes 1986; Bockstael, Hanemann, and Kling 1987; Morey, Shaw, and Rowe 1991, Bingham et. al 2011).[14] The RUM is based on welfare theory and posits that individuals make choices that maximize their utility, subject to constraints. A fishing area is divided into discrete sites, each site being a plausible destination for fishing. In this framework, anglers choose which sites to visit, based on costs and fishing opportunities at the sites. Because anglers trade off factors, such as the cost of getting to the site against the quality of the fishing opportunity, this approach can evaluate the relative influence of these variables as revealed by anglers' decisions. Incorporating the relevant substitute sites allows evaluating the importance of site characteristics at each of these sites to identify the site-demand curves, which form the foundation for appropriately estimating changes in social welfare that result from changes in site attributes, such as catch improvements.

Site-demand curves are identified from data on anglers' trip taking using a RUM. Identification of demand curves allows the simulation of choice behaviors for a specific site and

[14] RUMs are also widely accepted in other areas of the economics profession. RUMs have been used in transportation (Beggs, Cardell, and Hausman 1981; Hensher 1991), housing (McFadden 1997), and electricity demand estimation (Cameron 1985).

embodies trade-offs between money (the costs of travel) and fishing opportunities, measured in terms of catch. This links WTP to changes in catch.

Figure 2.2 shows an example econometrically estimated demand curve for recreational fishing trips.[15] Because the demand curve represents the angler's marginal WTP for each fishing trip to the site, the angler's total WTP for all fishing trips to this site is the entire area under the demand curve.

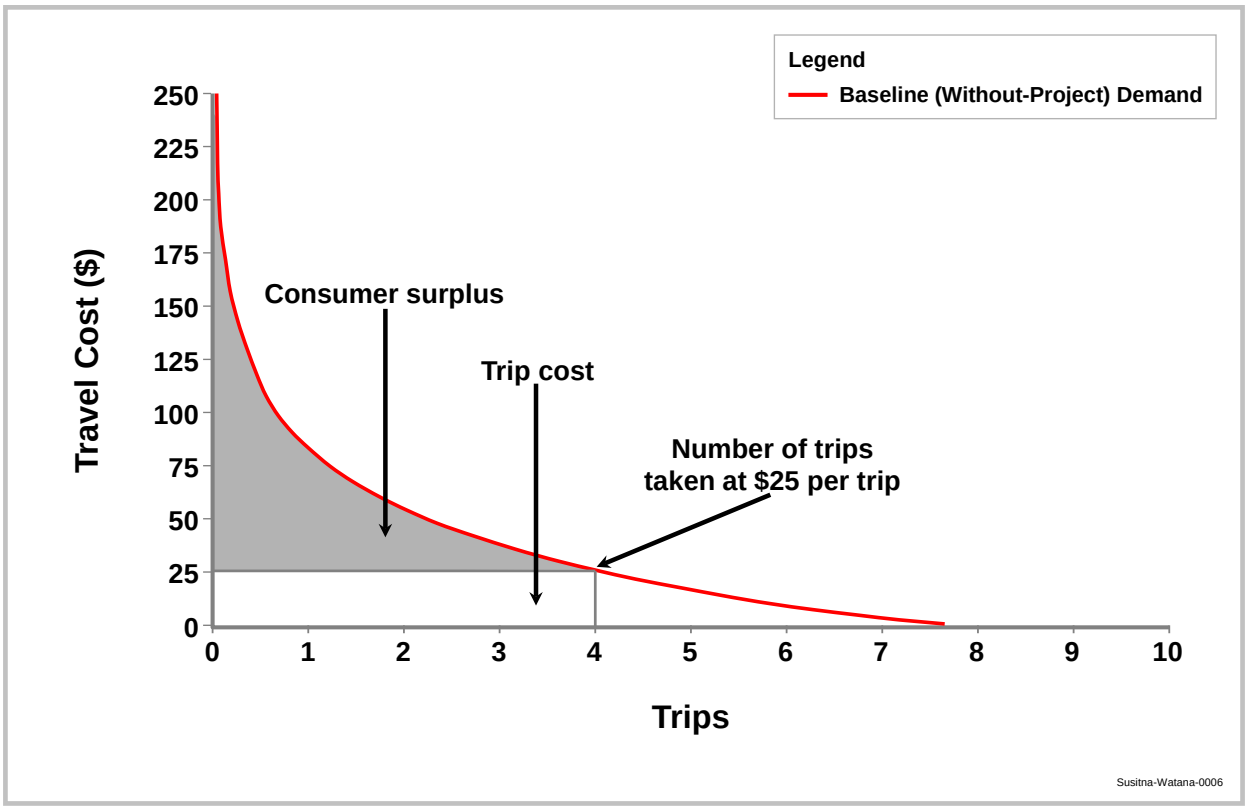


Figure 2.2: The Site Demand Curve and Consumer Surplus

The downward slope of the curve indicates that anglers are willing to pay less for each additional trip. Thus, the second trip has a lower value than the first and so forth. To maximize his own welfare, an angler does not take a trip to the site when the cost of doing so exceeds its value. In the figure above, the angler's round-trip travel cost is $25.[16] The first, second, third, and fourth trips are valued at more than travel cost (demand curve above $25). The fifth (and higher) trip is valued at less than travel cost. Therefore, the angler maximizes his utility by taking four trips. In the figure, the area bounded by four trips and $25 shows the individual

[15] There is a demand curve for every combination of sites and trip origination location. In a RUM, the choice among sites depends on the costs and fishing opportunities at all sites, and so each site's demand curve depends on costs and fishing opportunities to all sites, even those the angler does not visit.

[16] Travel cost consists of direct expenditures and the value of time going to and from the site.

expenditures on recreational fishing trips to the site, which are calculated as 4 * $25 = $100 (cost per trip x number of trips). The gray area above the per-trip cost and below the demand curve is the difference between what an angler pays for fishing trips to a site and the value (WTP) that the angler has for those trips.

This surplus value a consumer retains; the difference between what a consumer is willing to pay and what a consumer has to pay (cost) is measured to determine the consumer's welfare. The value of this area is called consumer surplus, and it is the dollar measure of the satisfaction received from trips to the site. It can also be viewed as the amount of income that is equivalent to the satisfaction of the fishing alternative. Consumer surplus is widely accepted as the appropriate measure of the social value of environmental goods (Zerbe and Dively 1994). Consumer surplus is identified by calculating the area under the demand curve and above expenditures.

As the example shows, in order to estimate the total number of trips expected to occur as a result of the project and determine the value of those trips, the analysis requires the entire demand curve to truly support evaluations of outcomes under conditions that do not currently exist. In addition, there may be cases for specific recreation activities where the project causes a decrease in current trips of that activity to the study area and recreators switch to a different location or chose a different activity. These cases require both developing the estimate of current demand as illustrated in Figure 2.2 and estimating how much that curve shifts to the left if site conditions for the recreation activity decrease in quality as a result of the project (improvements in quality would result in shifts to the right).

Figure 2.3 provides an example of conditions at the current site improving under the With-Project scenario. In this example, consider the case where fishing is currently occurring at the site and catch for an individual species improves as a result of a project.[17] Figure 2.3 depicts the process where there is a single species pursued by the angler and the catch rate for that species has improved as a result of the impoundment's creation. In the figure, the red demand curve reflects Baseline (Without-Project) catch. The blue curve depicts demand when the site has the higher With-Project catch. This new demand curve is to the right of the Baseline curve. For each level of visitation, the trip is more valuable (higher WTP) because of the higher catch. Consequently, the angler takes more trips to the site (five trips rather than four) and these trips have a higher value.

[17] An alternative example could consider the case where catch below the dam decreases under With-Project conditions. That example would lead to a decrease in social welfare and would be illustrated as the inverse of the example presented here—i.e., demand under the With-Project conditions would shift left instead of right and there would be a decrease in consumer surplus between the Baseline (Without-Project) and With-Project conditions.

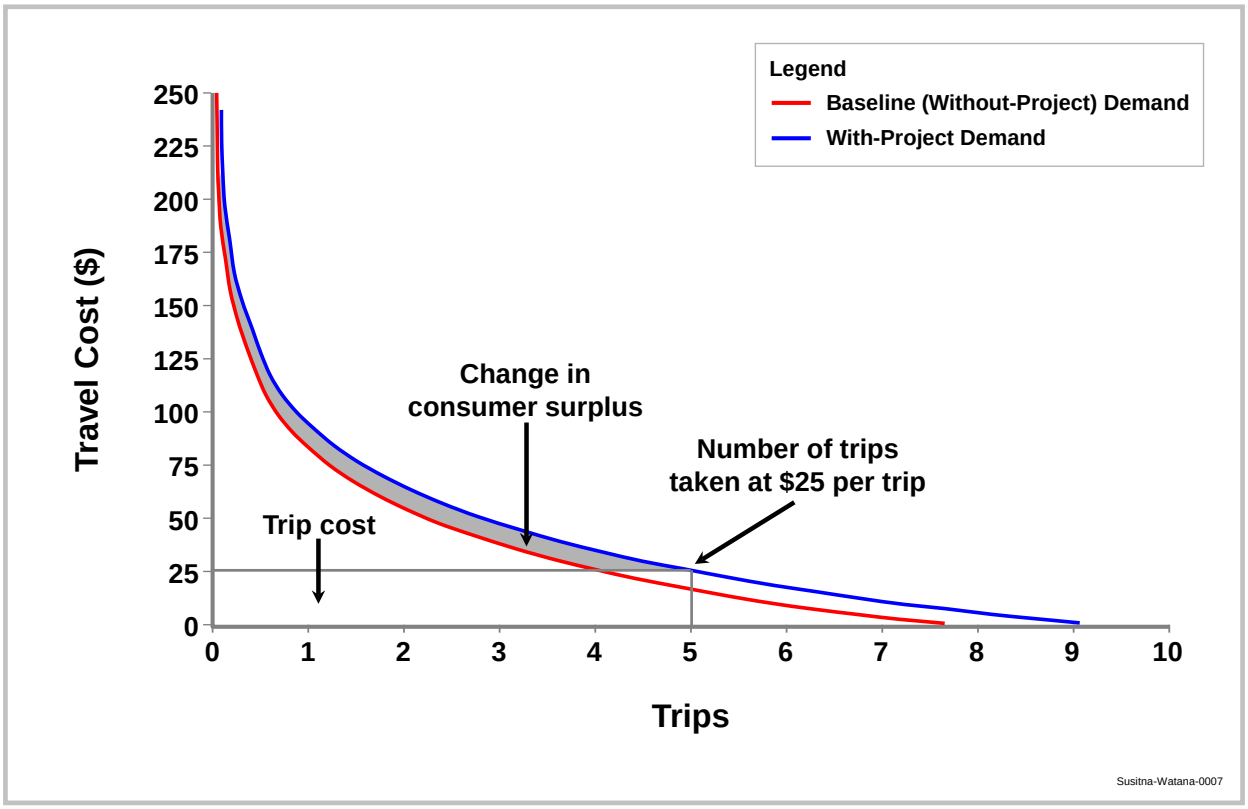


Figure 2.3: Increase in Consumer Surplus from Increase in Catch

The change in consumer surplus is the difference between the Baseline (Without-Project) and With-Project demand curves. It is the measure of the change in the individual angler's welfare resulting from the increase in catch. Thus, the increase in welfare from the improvement in catch at that site for that angler is represented by the shaded area in Figure 2.3. The increase in trips (from 4 to 5 for this angler) is reflected in decreased trips to other sites. Also, when the choice of whether or not to fish is modeled, there can be an increase in the total amount of fishing as anglers substitute away from other activities.[18] Changes in aggregate social welfare are derived by summing the welfare changes for affected sites over all anglers who would visit the site with the increased catch. This approach constitutes the best available method for calculating consumer-surplus-based values of changes in social welfare that arise from recreational changes.

[18] In Bingham et al. (2011), approximately 1 to 2 percent of trips resulting from site-quality improvements are new trips.

3. Fishing

To assess changes in social welfare resulting from changes in fishing conditions under With-Project Conditions, the analysis relies upon first establishing Baseline (Without-Project) Conditions and models that can be subjected to counterfactual experiments under the With-Project Conditions. To accomplish this, AEA developed a Fishing Demand Model that integrates information on the angler population most likely to be affected by the hydroelectric project and their trip-taking preferences and behavior.

Section 3.1 presents the information requirements and data sources that AEA used to develop the Fishing Demand Model. Section 3.2 then presents the process of using the Fishing Demand Model to characterize the baseline fishing conditions of the population most likely to be affected under With-Project Conditions. Section 3.3 presents the process of using the Fishing Demand Model to evaluate the With-Project Conditions and changes in social welfare resulting from the differences between the Baseline and With-Project Conditions.

3.1 Information Requirements for the Fishing Demand Model

The Fishing Demand Model combines information from a number of existing sources in a manner that most accurately predicts the angling preferences and behaviors of the angling population most likely to be affected by the project. Figure 3.1 illustrates the specific data needs to develop the Fishing Demand Model and the corresponding available data sources that AEA used to develop the model.

As the left-hand box of Figure 3.1 shows, the major categories of data needs focus on information regarding each of the following:

- Anglers most likely to be affected by the project and their demographic characteristics
- Trips these anglers take
- Characteristics of the sites they visit
- Angler preferences.

The right-hand box of Figure 3.1 shows the available data sources that provide this information. The data sources are separated into the following major and supplemental categories:

- Major Data Sources
  - 2013 Alaska Outdoor Recreation Survey
  - 2010 Alaska Sport Fishing Survey
  - 2010 U.S. Census

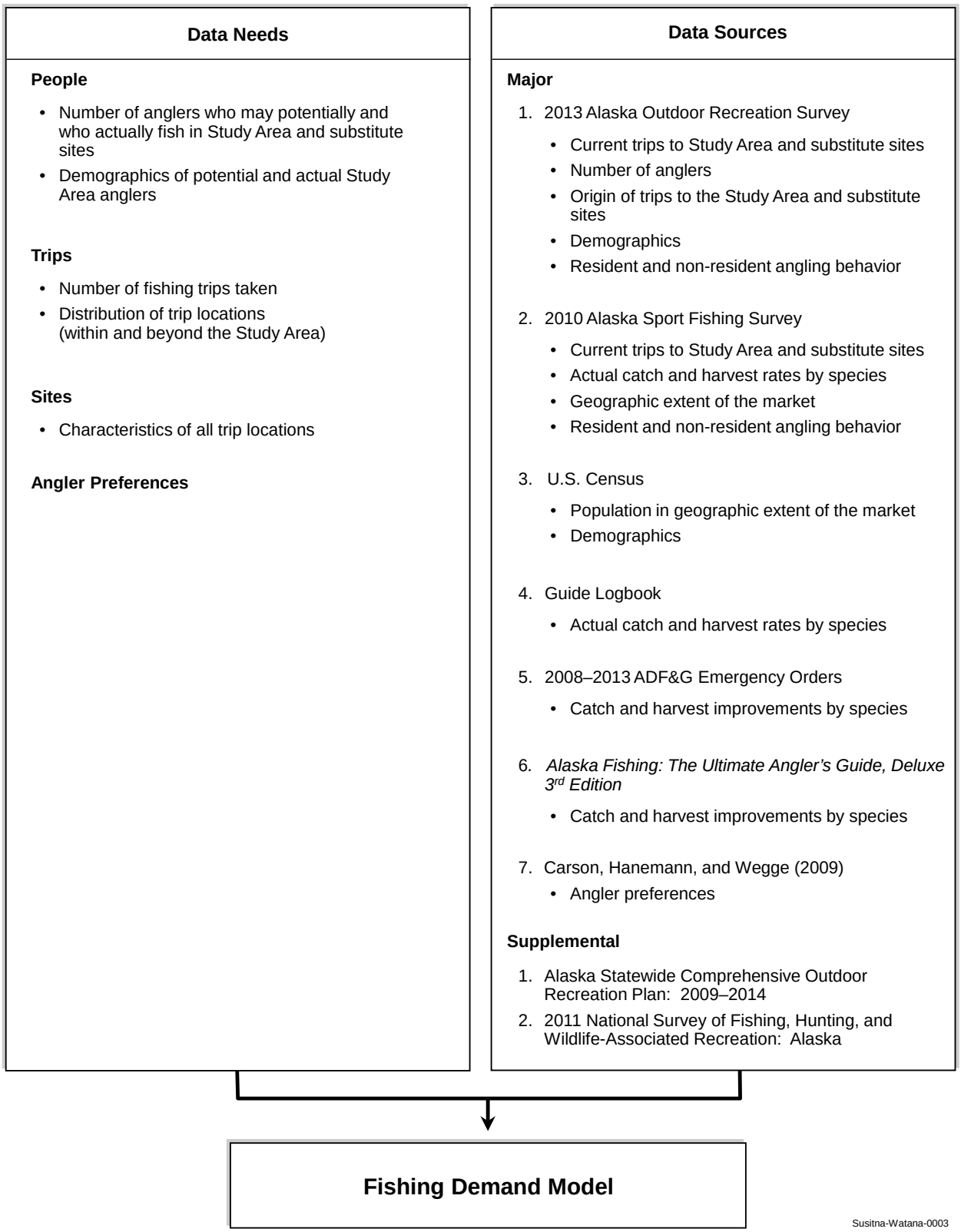


Figure 3.1: Data Needs and Corresponding Sources

- Guide Logbook Data
- 2008-2013 ADF&G Emergency Orders (EOs)
- *Alaska Fishing: The Ultimate Angler's Guide, Deluxe 3rd Edition* (Limeres and Pedersen 2011).

- Supplemental Data Sources
  - Alaska Statewide Comprehensive Outdoor Recreation Plan: 2009–2014
  - U.S. Fish and Wildlife Survey's 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation: Alaska.

Table 3.1 summarizes the role that each data component provides in the analysis and is followed by a brief summary of each source.

Table 3.1
Components of Estimating Changes in Fishing Behavior

Category	Factors	Alaska Outdoor Recreation Survey (2013)	Alaska Sportfishing Survey (2010)	U.S. Census (2010)	Guide Logbook Data (2010)	ADF&G Emergency Orders (2005-2013)	*Alaska Fishing* (2005)
Market	Geographic extent of the market	X	X				
	Sites	X	X				
	Substitute sites for AK anglers	X	X				
	Anglers	X	X				
	Evaluated ZIP Codes		X				
	Demographics	X		X			
Trips	Number of current trips to the Study Area and substitute sites	X	X		X		
	Origin of trips	X					
	Angler characteristics	X					
Catch	Species caught	X	X		X	X	X
	Quantity of fish caught	X	X		X	X	
	Quantity of fish kept	X	X				
Future (Without-Project)	Characterizing future Baseline (Without-Project) Conditions	X	X		X	X	

3.1.1 2013 Alaska Outdoor Recreation Survey

The 2013 Alaska Outdoor Recreation Survey (AKORS) collected information about outdoor recreators and trips in Alaska. The survey has two objectives for the analysis. The first is that it provides time-specific information on the number and location of trips taken by the recreators most likely to be affected by the Project. This allows us to calibrate trips under the Baseline (Without-Project) Conditions. The second objective is that it allows the option of

estimating Alaska-specific utility functions to be available in the future if such analysis is determined to be needed.

The outdoor recreation activities included in the study are snow machining, sport fishing, recreational boating, and hunting. The survey was sent to households throughout Alaska.

The survey was administered in two waves to cover different time periods of recreator trip-taking. Table 3.2 provides the time period covered for each recreational activity for each administration of the survey. Appendix B presents the first of two 2013 AKORS mail surveys.

Table 3.2
Components of Estimating Consumption Rates

Administration	Recreational Activity	Time Period
1	Snow Machining	January–April 2013
	Sport Fishing	May–October 2012
	Recreational Boating	May–October 2012
	Hunting	June–November 2012
2	Snow Machining	May–October 2013
	Sport Fishing	May–October 2013
	Recreational Boating	May–October 2013
	Hunting	May–October 2013

As part of the survey, respondents were asked if they participate in recreation activities. If yes, respondents were asked to provide trip information for each of their recreational trips. Respondents provided the location of each trip, the access point for each location (e.g., a boat ramp), and the number of days at each location.

The AKORS also collects demographic data (e.g., age, gender, race, education, and income) for all respondents (recreators and non-recreators).

3.1.2 2010 Alaska Sport Fishing Survey

The Alaska Department of Fish and Game (ADF&G) administers an annual household survey to households with at least one sport fishing licensed angler or one Alaska resident who holds a Permanent Identification (PID) or Disabled Veteran (DAV) permit. The survey is administered to residents and nonresidents and gathers information about respondents' fishing activities. Data collected include fishing sites, number of people who fished, use of a charter or guide, and species caught and kept. Resident and nonresident sportfishing anglers, days, and species-specific harvest are calculated for three regions: Southeast Alaska, Southcentral Alaska, and the Arctic-Yukon-Kuskokwim.

3.1.3 2010 U.S. Census

AEA collected and compiled demographic data (e.g., age, gender, race, education, and income) on the population from the 2010 U.S. Census for every ZIP code evaluated in the analysis.

3.1.4 Guide Logbook

The Guide Logbook Data contains data on harvest for guided fishing trips.

3.1.5 2008–2013 ADF&G Emergency Orders

The ADF&G issues Emergency Orders (EOs) in order "to open and close sport fishing seasons or areas; to increase or decrease sport fish bag limits; or to modify methods of sport fish harvest" (ADF&G). Such emergency orders include fishery closures and restrictions such as reduced bag limits, gear and bait restrictions, schedule restrictions, length restrictions, and area restrictions. EOs also include season extensions and liberalizations such as bag limits, gear and bait liberalizations, schedule liberalizations, and area liberalizations. The EOs from 2005 through 2013 provide insight into site availability under Baseline (Without-Project) Conditions.

3.1.6 Carson, Hanemann, and Wegge (2009)

Mathematically modeling fishing site-choice in Alaskan waters requires identifying both site characteristics and parameterization of the relative importance that anglers attach to each of these characteristics. Carson, Hanemann, and Wegge (2009) present an econometrically-estimated preference function that identifies the relative importance that anglers place on each site characteristic.

Carson, Hanemann, and Wegge (2009) analyzed 29 sport-fishing sites and 12 species groups (along with "no target" species) to study recreational fishing demand in Alaska. The statistical model estimated in Carson, Hanemann, and Wegge (2009) is a repeated nested logit that identifies anglers fishing choices over a 22-week time period. Carson, Hanemann, and Wegge (2009) use the repeated nested logit to delineate potential differences in angler preferences with respect to each of the following:

1. Whether to go fishing in a particular week
2. Fishing experience (Salmon, Freshwater, Saltwater, and No Target Species)
3. Individual target species (e.g., King, Silver, Red or Pink Salmon)
4. Which site to fish for the particular species.

The model output is a coefficient for each level of nest and site characteristic. Each coefficient reflects the importance of that characteristic on angler decision making and welfare. These coefficients play a key role in the approach used in this assessment.

3.1.7 Alaska Fishing: The Ultimate Guide, Deluxe 3rd Edition

The angler preference function presented in Carson, Hanemann, and Wegge (2009) uses an angler site selection choice function to determine site selection probabilities. Data from *Alaska Fishing* is used to specify these variables. These variables differ from species to species and involve either site or run time dimensions. For example, in Southcentral Alaska, silver salmon is available from late June through the middle of October, with the peak season being late July to early September.

3.1.8 Supplemental Data Sources

In addition to the sources described above, the analysis uses two supplemental data sources to inform the number of anglers:

- The Alaska Statewide Comprehensive Outdoor Recreational Plan (SCORP) 2009–2014
- The U.S. Fish and Wildlife's (USFWS) 2011 National Survey of Fishing, Hunting, and Wildlife-Related Recreation: Alaska.

The Alaska SCORP includes the results of a 600 resident household survey that collected data on outdoor recreation activity. The USFWS 2011 National Survey included fishing participation in Alaska by residents and nonresidents.

3.2 Characterization of Baseline Fishing Conditions

Baseline fishing conditions are the expected conditions without the hydroelectric project. Characterizing the baseline fishing conditions requires considering current and future recreational fishing. Understanding the baseline fishing conditions requires assessing the angling preferences and trip taking behaviors of the recreational angling population whose welfare is most likely to be affected by the creation of the hydroelectric project.

3.2.1 Background on Alaska Anglers' Trip-Taking Behavior

Alaska contains some of the worlds' most abundant and diverse fisheries. This richness is spread out over plentiful rivers, countless streams, and a coastline longer than the rest of the United States. Like many anglers, Alaskan anglers tend to be aware of historically good fishing sites. However, Alaskan fishing is unique in many ways. Sport fishing is a primary activity for many Alaskans. During periods of extended summer daylight, Alaskans can fish for trout at

dozens of places, catch several different types of salmon or target the world-class halibut fishery along with many other saltwater species including lingcod and rockfish.

Of the 20 or so important Alaskan gamefish, more than half are salmonids. These fish prefer clean, cold, highly oxygenated waters and thrive in Alaska's rivers and streams. The Pacific salmon—including Chinook, silver, sockeye, chum, and pink—are hatched in cold water rivers and streams, but spend much of their life in the Pacific where they exploit rich marine fish reserves to grow quickly. Each year, millions of Pacific salmon return to Alaska's numerous rivers, lakes, and streams to spawn. The annual return of salmon supports coastal ecosystems, and also underlies Alaskan angling behaviors.

Salmon availability is driven by run timing. Run timing can vary dramatically by species, time and location. For example, the first runs of Chinooks (the dominant and iconic species) can begin as early as mid-April in the Southeast and Southcentral regions. These runs can peak in early June and have fish typically in the 12 to 30 pound range but maxing out at perhaps 50 pounds. Mid-season Chinook runs occur throughout Alaska, peak in mid-June and can produce 60–70 pound Chinooks. The late runs occur in a few temperate lake drainages such as the Kenai River, begin in mid-June, and peak in mid-July. These runs are commonly full of 30 to 50 pound fish and 90 pounders are not uncommon.

Many of these fish travel hundreds of miles after arriving at the coast. Thus "early run" Chinooks arriving at the mouth of the Yukon in mid-April might arrive in Fairbanks in early July (Limeres and Peterson Ultimate Alaska Fishing Guide). The initial arrival of Chinook is driven by environmental conditions and are somewhat predictable; however, once they arrive, availability at inland sites becomes more predictable (Mundy and Evenson 2011).

Pacific salmon are a tremendously important economic, ecological, and cultural resource in Alaska and these partially predictable pulses of availability underlie the history and culture of Alaskan fishing. Although some people pick a site and fish for whatever is there, many target a specific fish species and then look for the best site and time (Carson, Hanemann and Wegge 2009). Many Alaskan's have the flexibility to take off work to take advantage of salmon runs. Anglers tend to be highly aware of angling opportunities and seek those with historically good catch. Publications such as Alaska Fishing guide provide general information, and ADFG puts out weekly announcements describing fishing conditions and restrictions. Fishing takes place over the entire year, but the great majority occurs over May through September.

3.2.2 Fishing Demand Model Structure and Variables

To model Alaskan fishing behaviors via choice simulation, AEA is fortunate to have an existing sophisticated choice model structure of Alaskan fishing. This model (Carson Hanemann and Wegge 2009) incorporates important features of Alaskan fishing in econometric modeling and simulations. The econometric model was developed from weekly (May 1 to September 30) data on sport fishing activities of 1,063 respondents.[19] This model follows the discrete choice RUM framework that allows forecasting trips under various conditions. Those conditions can include marginal changes (such as changes in expected catch and the opening or closing of entire sites). Importantly, the approach used to forecast trips under various conditions is consistent with utility theory. This means that welfare theoretic predictions of changes in social welfare can also be produced to support cost-benefit analysis.

The particular type of discrete choice model is the *nested logit*. Nested logit models enable decision-making sequentially. The structure of the Carson Hanemann and Wegge (CHW) model is depicted in the figure below.

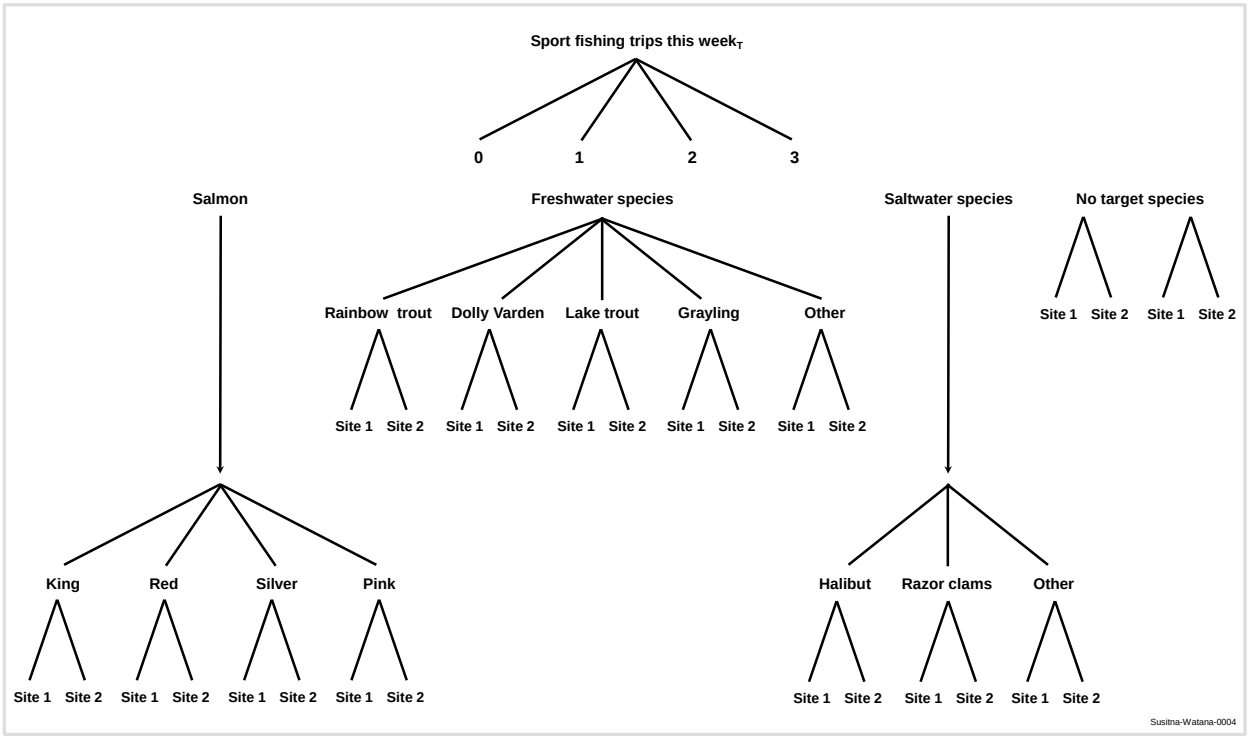


Figure 3.2: Choice Structure for Resident Angler Sport Fishing Demand

[19] This study was published in 2009, but the data were collected in 1986. Although that has been a long time, basing the study approach on old data from Alaska was judged superior to using a study with newer data from a location not as similar as the Alaska fishery.

As can be seen in the figure, the angler is modeled to first choose how many trips to take in a particular week. At the next level, the angler chooses whether to target salmon, freshwater species, saltwater species or no target. Anglers with no target then choose a site based on site characteristics. For all other anglers, before selecting a site, they choose a specific species. Anglers pursuing salmon choose from among kings, reds, silvers and pinks. Freshwater anglers can select from rainbow trout, Dolly Varden, lake trout, grayling and all other species. Saltwater anglers can pick halibut, razor clams, and "other". Following the selection of a specific species, all anglers choose a fishing site.

A couple of important features of the nested logit model that are helpful in gaining a holistic perspective on its operation include the fact that

1. Lower level choices are *conditioned on* upper level probabilities
2. Upper level probabilities are based on the inherent "quality" of trip/species group/species *and* the quality of the sites that occur in the lowest levels.

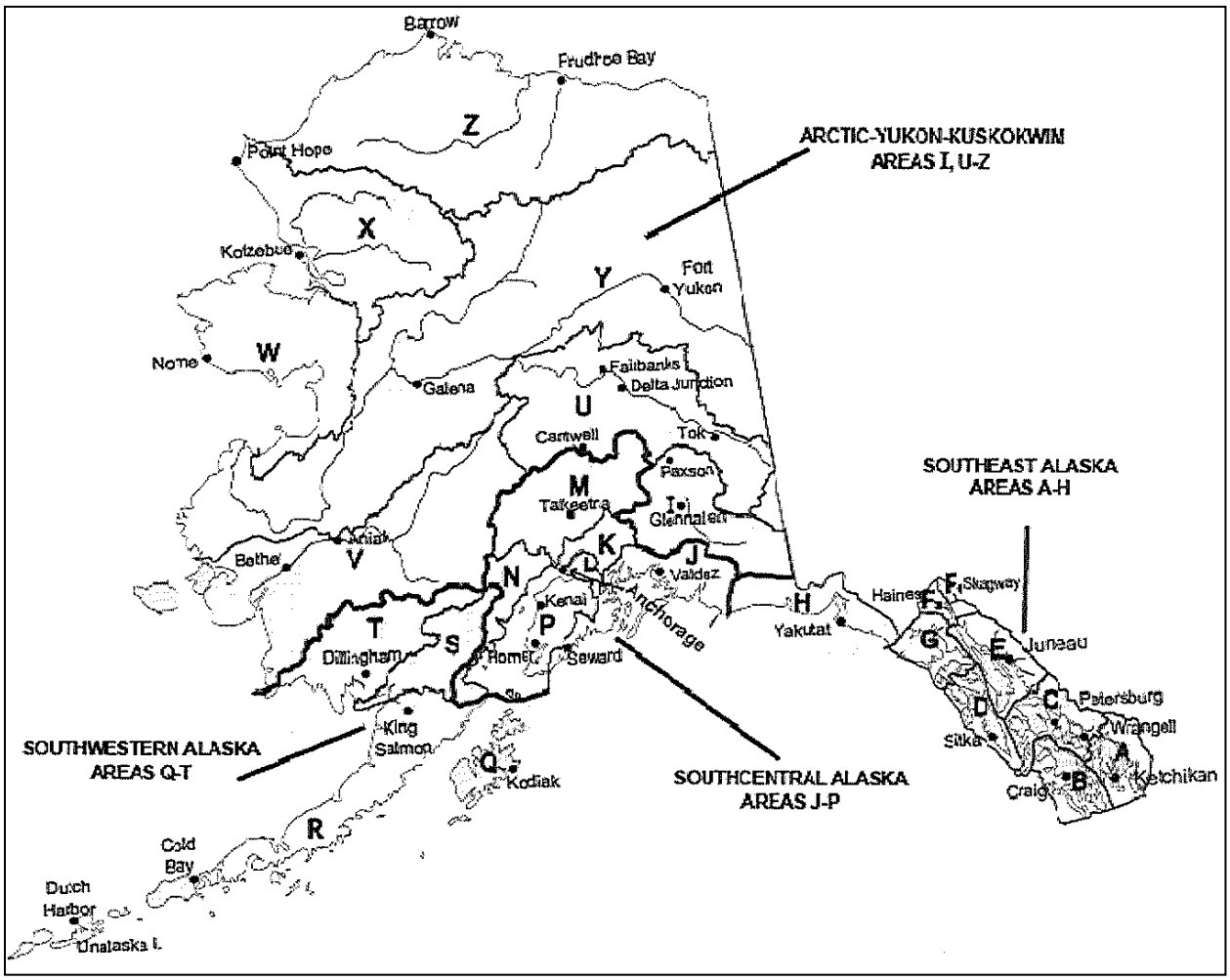
The implications of Feature 1 are that an angler who chooses to fish selects the type of fishing and that the probabilities of those fishing types sum to one (e.g. salmon = 0.35, freshwater = 0.15, saltwater species = 0.3, no target = 0.2). These probabilities are sequentially nested, meaning that the same process occurs at every level. The import of Feature 2 is that this sort of model allows changes in top level probabilities based on changes in lower level site characteristics. Thus, relatively high salmon catch in a particular week flow upward to produce more trips in that week.

The approach for modeling using the CHW results is to adopt the nested choice-based mathematical structure and to specify it over recent information for populations and sites. For populations, rather than using survey participant locations and site locations to calculate travel cost, the choice model is geospatially fused to the affected areas of Alaska. This is accomplished by "replacing" survey participants and survey weights with ZIP codes and anglers per ZIP code.[20] In addition to being necessary (the original survey data is not available) this updates the population specification to account for changes in population densities that have occurred since the data was collected. Although anglers may travel great distances to enjoy Alaskan fishing, it is necessary to limit the modeling to include anglers who are reasonably close and whose decision-making can be expected to be similar to the anglers modeled by CHW.

[20] Trip and economic welfare simulations using econometrically estimated choice models are typically done using the survey dataset. Because AEA does not have the data from CHW, "replacing" is only conceptual.

3.2.3 Specifying the Affected Population—Population Size and Annual Trips

The CHW article focuses on resident anglers and summer sport fishing. This combination of anglers and activity comprised the majority (more than 80%) of Southcentral Alaskan sport fishing trips in Southcentral Alaska in 1986. Because of the nature of the Pacific salmon fishery, these trips are also the most responsive to short run changes in site-quality conditions. This population is also the most likely to be affected by changes in the Study Area. Therefore, for this analysis, the area of the Affected Population includes anglers residing in all the ZIP Codes contained in ADF&G's Southcentral Alaska Areas J-P, I, and U—illustrated in Figure 3-2 from Jennings, Sundet, and Bingham (2011).



Source: Jennings, Sundet, and Bingham (2011)

Figure 3.3: Area of Affected Population—Southcentral Areas J–P and Areas I and U
The area of the affected population includes all the anglers residing in ZIP Codes contained in ADF&G's Southcentral Alaska Areas (J–P) plus Area I and U.

To estimate the number of anglers residing in these ZIP Codes, AEA first collects data on the population residing in each of these ZIP Codes. AEA then uses data on rates of angling participation and trip taking in Alaska from each of the following to determine both the number of anglers residing in each ZIP Code and the annual number of fishing trips they take:

- ADF&G license sales
- 2013 Alaska Outdoor Recreation Survey
- the USFWS national survey
- the Alaska SCORP.

Table 3.3 summarizes the results of this data collection and compilation for the affected population.

Table 3.3
Affected Angling Population Evaluated in the Fishing Demand Model

Data Component
Total Number of ZIP Codes in the Affected Area
Total Population Residing in those ZIP Codes
Total Anglers Residing in those ZIP Codes[a]
Average Annual Trips by Affected Angling Population
Average Trips per Angler
Annual Days[b]
Average Days per Angler
Average Days per Trip

Sources:

[a] The range of the angler population is based on the Alaska Statewide Comprehensive Outdoor Recreation Plan (SCORP); the number of licenses sold in 2011 from the Alaska Department of Fish and Game (ADFG) Statewide License Sales (ADFG 2012a); estimates from the U.S. Fish and Wildlife Services' 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation for Alaska (USFWS 2013); and the 2013 Alaska Outdoor Recreation Survey.

[b] The range of the angler days is based on 2011 Sportfishing survey from the Alaska Department of Fish and Game (ADFG 2012b); estimates from the U.S. Fish and Wildlife Services' 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation for AK (USFWS 2013); and the 2013 Alaska Outdoor Recreation Survey.

3.2.4 Specifying Relevant Fishing Sites for the Affected Population

In addition to the population of affected anglers, choice-based models of recreational angling demand require specifying the sites the population is likely to visit. CHW include 29

sites. For the current effort, this list of sites was adapted to reflect evolution in site popularity and the project focus.[21] Objectives for the fishing site list are to

1. include Watana area and sites that could have changes under With-Project Conditions
2. include a reasonably high percentage of trips from the 2013 Alaska Outdoor Recreation Survey
3. develop a list that is manageable when considering both the number of sites and weeks to be modeled. At the end of this process there was significant but not complete overlap with the CHW sites.

To create the site list AEA relies on the 2013 Alaska Outdoor Recreation Survey and additional information including Alaska fisheries and catch information. The 2013 Alaska Outdoor Recreation Survey data include 6,881 trips to 262 where anglers took at least one trip between May and October 2012 (the data are currently available only for the first wave of the survey administration). After approximately 25 sites, trip rates drop off dramatically. Some of this is the nature of Alaskan fishing which has varied opportunities; however, some of this is not true variation, but arises because survey respondents provide different names for the same site. AEA conducted text-string matching to combine sites with 10 or more trips that are to the same place, but were named differently by survey respondents.

After consolidating some sites in this manner, AEA finds that 70 percent of survey trips occur at 27 sites. These sites had 40 or more trips in the 2013 Alaska Outdoor Recreation Survey data. ADF&G's regional survey (Estimates of Participation, Catch, and Harvest in Alaska Sport Fisheries During 2010) indicates that based on days fished and species harvested in 2010 there were an additional 21 sites worth considering for inclusion. Of these, AEA could not locate sufficient site data to support modeling five of them. The remaining 16 were added to the site list making the list total 43. This site list accounts for approximately 80 percent of trips from the 2013 Alaska Outdoor Recreation Survey data.

After completing this evaluation, AEA then considered regional coverage. The regional evaluation indicated that by selecting sites with 40 or more trips, AEA gets good regional coverage. Regions with sites included in the site list account for over 97 percent of trips. Figure 3.4 shows the area containing the policy and substitute sites modeled for this affected population. This area is composed of the ADF&G Areas I, J–P, Q, S, T, U and part of Y (see Figure 3.3 for an illustration of these areas from Jennings, Sundet, and Bingham 2011).

[21] CHW was a general-purpose model built to support fishery management.

Figure 3.4: Policy and Substitute Sites for Affected Population
The outlined area includes the policy and substitute sites for the affected angling population evaluated in the Fishing Demand Model. The affected angling population includes all anglers residing in the ZIP Codes contained in ADF&G's Southcentral Alaska Areas J-P, I, and U.

3.2.5 Model Variables

Choice models rely on coefficients to identify the value of site characteristics. The CHW econometric model contains several variables that are included in the simulation model created for this effort. These include the price variable (Travel Cost), expected catch related variables (Site Rating, Species Rating, and Harvest) as well as the additional site characteristic variables (Developed, Crowd, and Cabin).

In the CHW model, travel cost is specific by respondent and site. The simulation model does not contain survey respondent data. In the geospatial fusing approach that is applied in the simulation model for this effort, the survey respondents and their weights are replaced with ZIP codes and angling populations. Then, distances are identified using PCMiler and travel costs are calculated in a process identical to CHW, but updated to reflect current costs. Also, because the vehicle ownership information available to CHW was not available for this study, average vehicle operations costs were applied.

In the CHW model, Site Rating varies by species and week. It begins as a range from 1 (very poor) to 8 (excellent). This number is then normalized by dividing each week's rating by the average rating over all weeks to create the final variable. Although CHW note that the process of creating the initial (1–8) Site Rating variable for their econometric model was complicated, no details on its construction are provided. To specify the Site Rating variable specification in the simulation model, AEA relies on information in *Alaska Fishing the Ultimate Angler's Guide*. By species, the Guide ranks sites as excellent fishing, good fishing, fishable, and rare. To create the initial Site Rating variable, these qualitative descriptions are transformed to data as 8, 4, 1, and 0. The weekly variation is included by interacting this species-level rating to create a site and species level rating based on weekly run timing information from the Guide. For example, a site rated 4 for a particular species only receives that rating during weeks the Guide anticipates runs for that species to occur at that site. This is then normalized following the CHW process.

The CHW variable Fish Rating is a quality index that operates across the CHW macro species groups (Salmon, Freshwater, Saltwater). It is used for modeling trips with no target species and is specific at the site and macro species level for Freshwater and Saltwater macro groups and at the weekly level for salmon. The index ranges from 0 (not available) to 4 (excellent). In the simulation model, for freshwater and saltwater species, this is specified based on availability information from the Guide. For salmon, the weekly index is created based on the summed and normalized species-level information.

The final variable related to catch expectations is Harvest which is specific at the site level. Harvest measures the total number of "species caught (in thousands)" in the prior year. Here again, CHW provide no additional details. However, because the total number of species caught does not number in the thousands AEA presumes this could be clarified to say either "the total number of *all* species caught" or "the total number of *fish* caught". In the simulation model, this is specified as the total harvest of all species at each site in 2010. This information is available from the Alaska Department of Fish and Game (Jennings, Sundet, and Bingham 2011).

Site characteristic variables that do not relate to expected catch include the Developed, Crowd, and Cabin variables. In the CHW econometric model the Developed variable is a dummy variable that is 1 if the site has boat and tourist facilities and 0 otherwise. This variable was specified for the simulation model based on site-level research from various sources.

In CHW, the Crowd variable is specific by site, week, and respondent. To begin, a 0 represents "not crowded", a 1 is "somewhat crowded" and a 2 is "very crowded". This quantity is then interacted with a survey response that indicates each respondent's tolerance for crowding to result in a variable that is specific by site and survey respondent and is (for example) 0 if there is either no crowding or high crowding and the respondent indicates a preference for crowding. Respondent preferences are not available for the simulation model. However, the Guide provides an indication of crowding at the site level. For preliminary specifications, this information is used to specify the crowding variable with the idea that it would be dropped or improved depending on how it impacts the model calibration process.

The CHW variable Cabin is a dummy variable which takes on the value 1 if the individual respondent owns or has regular access to a private cabin at a site and 0 otherwise. Like the Crowding variable the Cabin variable requires individual specific information that is only available from the original survey. There is however information about cabin availability. For the preliminary specification, the number of cabins to expected visitors is used to calculate a probability of any visitor having a cabin. Like the crowding variable, the usefulness of this approach will be assessed in the calibration process.

Table A.1 in Appendix A provides a summary of some of the site-characteristic data for each of the sites included in the Fishing Demand Model. Because some of the variables are indexed by individual (travel cost) or time (site rating), they are not included in the table.

3.3 Calibrated Baseline Trips

The Fishing Demand Model combines data on travel costs, harvest, and site quality with the coefficients from the Carson, Hanemann, and Wegge (2009) to allocate the estimated annual trips by the affected angling population to the policy and substitute sites (illustrated in Figure 3.4 and listed in Appendix A). Total trips to the policy relevant sites are calibrated to correspond to the best available visitation information for these sites from the 2013 Alaska Outdoor Recreation Survey and ADF&G's 2010 survey data. This process results in the following distribution of trips to affected policy sites (Table 3.4).

Table 3.4
Estimated Average Annual Trips to Affected Policy Sites

Location	Average Annual Trips under Baseline (Without-Project) Conditions
Total	

The remaining trips are calibrated to be distributed among the substitute sites using the best available visitation information from the 2013 Outdoor Recreation Survey and ADF&G's 2010 survey data.

3.4 Changes in Social Welfare Under With-Project Conditions

Baseline (Without-Project) Conditions are represented by specifying the data to be used by the choice model as previously described and then calibrating the model to produce the appropriate number of trips for each week, species group, species, and site. Having Baseline Conditions specified in this way, it is possible to change the data so as to quantitatively represent With-Project Conditions. Estimates of With-Project trips are then produced by evaluating this With-Project Fishing Demand Model.

Along with trip predictions, each specification (i.e., Baseline and With-Project Conditions) produces estimates of social welfare. Social welfare in this model represents the value of all sites under that specification. It is calculated as the sum of the consumer surplus across sites. Changes in social welfare resulting from changes in the recreational fishery are calculated as the difference in consumer surplus across Baseline and With-Project states.

Consumer surplus is evaluated using demand functions. Demand functions describe the maximum number of trips a person would be willing to take at each price over a given time period. For a nonmarket service like recreational fishing, "price" is the cost of taking a trip to that site. This cost may include transportation costs, the opportunity cost of time, entrance fees, and other trip-related costs.

Developing these estimates of demand and changes in consumer surplus requires estimating changes in angler utility under the With-Project Conditions. In mathematical terms, an individual angler's utility, U_{ipwj} (the well-being they receive from a fishing trip), is treated as a random variable composed of a deterministic component and a random component. The utility associated with a recreation trip to site j of waterbody type w after making participation decision p by angler i can be expressed as:

$$U_{ipwj} = V_{ipwj} + \varepsilon_{ipwj} \quad \textbf{(1)}$$

where V_{ipwj} is the deterministic part of the utility function and ε_{ipwj} represents the random terms, which are assumed to be jointly distributed according to the generalized extreme value (GEV) distribution. V is a function of site characteristics (here p and w omitted for brevity):

$$V_{ij} = \beta_{TC} TC_{ij} + \sum_n \alpha_{1n} WBV_{jn} + \sum_n \alpha_{2n} SR_{jn} \quad \textbf{(2)}$$

where

TC_{ij} = Travel cost to site j by individual i

WBV_{jn} = Waterbody-related variables for site j

SR_{jn} = Species rating for species n at site j.

The probability of site choice can be expressed as a product of conditional probabilities. The probability of making participation decision p choosing waterbody type w and site j is as follows (i is suppressed for the sake of notational simplicity):

$$Prob_{pwj} = Prob_{j|wp} \times Prob_{w|p} \times Prob_{p} \quad \textbf{(3)}$$

The first probability is the probability of choosing site j conditional on making participation decision p and choosing waterbody type w and is expressed as the following:

$$Prob_{j|wp} = \frac{\exp(V_j)}{\sum_j \exp(V_j)} \quad \textbf{(4)}$$

The second probability in equation (3) is the probability of choosing waterbody type w conditional on making participation decision p and is expressed as the following:

$$Prob_{w|p} = \frac{\exp(\gamma_w I_w)}{\sum_w \exp(\gamma_w I_w)} \quad \textbf{(5)}$$

where

$$I_{pw} = ln\left[\sum_j \exp(V_j)\right] \quad \textbf{(6)}$$

The third probability in equation (3) is the probability of making participation decision *p,* that is, whether to go fishing or not:

$$Prob_p = \frac{\exp(\theta_p Q_p)}{\sum_p \exp(\theta_p Q_p)} \quad \textbf{(7)}$$

where

$$Q_p = ln\left[\sum_w \exp(\gamma_w I_{pw})\right] \quad \textbf{(8)}$$

Utility changes from site improvements and additions are calculated as

$$\Delta U = (ln\, D_1 - ln\, D_0) \quad \textbf{(9)}$$

where

$$D = \sum_p\left[\sum_w \sum_j \exp\left(\frac{V_j}{\gamma_w}\right)^{\frac{\gamma_w}{\theta_p}}\right]\theta_p \quad \textbf{(10)}$$

Changes in economic well-being are calculated as changes in consumer surplus or *compensating variation* (the amount of money required to restore utility to its initial level). This is accomplished by scaling the utility change by the marginal utility of money in the following manner:

$$CV = \frac{-1}{\beta_{TC}} \text{ x } (ln\, D_1 - ln\, D_0) \quad \textbf{(11)}$$

where the marginal utility of money is identified as $\beta_{TC,}$ the travel cost coefficient. D_0 and D_1 represent angling demand under the Baseline and With-Project states.

The Fishing Demand Model calculates the welfare impact under With-Project Conditions for Alaskan angling residents. However, the 2010 Alaska Sport Fishing Survey indicates that approximately 58 percent of licensed anglers are nonresidents, and the USFWS 2011 National Survey indicates that 61 percent of anglers taking trips to Alaska are nonresidents. Although nonresidents make up over 60 percent of the number of anglers, they take on average 10 trips fewer than residents per year.

To account for welfare impacts to non-resident anglers, AEA scales the resident welfare impacts based on relative rates of resident to nonresident participation in each benefit category. The relative rates of resident to nonresident participation (anglers and trips) are calculated using data from the 2010 Alaska Sport Fishing Survey and the USFWS 2011 National Survey.

3.5 Watana With-Project Conditions and Trips and Welfare Implications

Predicting changes in total trips, species targeted, site-level pressure, and economic welfare requires mathematically specifying site characteristics under With-Project Conditions. Information requirements include differences in site conditions across modeled site characteristics between Baseline and With-Project Conditions. Ultimately, this will be accomplished with input from AEA regarding the final proposed characteristics of the hydroelectric project. For this assessment, affected sites can be categorized as upstream and downstream from the location of the potential dam.

In the Baseline, the Watana site, which represents areas above the dam, are essentially nonexistent. Fishing quality there is low. Moreover, because there is no road or suitable airplane landing spot there is no access. Below Watana Creek are 7 sites which could be affected under the With-Project Conditions. Two of these are along the Talkeetna (a major Susitna tributary). The Chase Trail site is at the confluence of the Chase Trail creek and the Talkeetna. The Chunilna Creek site is at the confluence of Chunilna Creek (also called Clear Creek) and the Talkeetna. The remaining 5 sites are downstream on the Susitna and are located at the confluence of the Susitna and Sunshine Creek, Montana Creek, Kashwitna River, Deshka River, and Willow Creek. In the Baseline, the Species Ratings of the downstream sites are specified as shown in Table 3.5.

Table 3.5
Baseline (Without-Project) Conditions: Species Ratings for the Downstream Sites

Site	King	Red	Pink	Chum	Silver	Rainbow	Grayling
Deshka River	8	4	8	2	8	4	4
Montana Creek	8	0	8	4	8	4	4
Sunshine Creek	8	0	8	4	8	4	4
Kashwitna River	8	0	8	4	8	4	4
Willow Creek	8	0	8	4	8	4	4
Chase Trail	8	4	8	8	8	8	4
Chunilna Creek	8	4	8	8	8	8	4

Under With-Project Conditions, species ratings at the new impoundment are specified to be identical to Lake Louise. Travel costs to the new site are specified based on distance for road travel and availability of air travel. With-Project Conditions below the dam are currently specified as being slightly degraded for fishing as seen in the table below. All of these are preliminary and will be informed by discussions with the project team.

Table 3.6
With-Project Conditions: Species Ratings for the Downstream Sites

Site	King	Red	Pink	Chum	Silver	Rainbow	Grayling
Deshka River	7	3	7	1	7	3	3
Montana Creek	7	0	7	3	7	3	3
Sunshine Creek	7	0	7	3	7	3	3
Kashwitna River	7	0	7	3	7	3	3
Willow Creek	7	0	7	3	7	3	3
Chase Trail	7	3	7	7	7	7	3
Chunilna Creek	7	3	7	7	7	7	3

Table 3.7 presents the structure of the summary results that AEA will produce from its evaluation of recreation demand and social welfare changes resulting from the Project. The evaluation covers the 30-year time period from 2015 through 2045. The changes in fishing demand and social welfare are estimated as differences between Baseline (Without-Project) and With-Project Conditions over this 30-year time period. The results present the number of affected anglers, the average annual trips they take under Baseline (Without-Project) Conditions, the difference in the average annual trips they take between Baseline (Without-Project) and With-Project Conditions, and the total and annual change in social welfare associated with this change in trips.

Table 3.7
Summary of Fishing Results

Category	Result
Evaluation Time Period	2015–2045
Number of Affected Recreators	
Average Total Annual Trips by the Affected Population	
Annual Change in Trips [Increase / (Decrease)]	
Total Change in Social Welfare [Increase / (Decrease)]	
Annual Change in Social Welfare [Increase / (Decrease)]	

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Appendix A
Fishing Sites and Site Characteristic Data

Table A.1
Selected Alaska Fishing Sites and Site Characteristic Data

		Example Site Characteristic Variables used in the Fishing Demand Model														
				Total Harvest, 2010 (not including subsistence fishing)												
Site Name	Sportfish Caught in Waterbody	Latitude	Longitude	Total Harvest	King (Chinook) Salmon	Red (Sockeye) Salmon	Silver (Coho) Salmon	Pink (Humpy) Salmon	Rainbow Trout, Land-Locked Salmon	Dolly Varden, Arctic Char	Lake Trout	Arctic Grayling	Other Fresh-water	Halibut	Razor Clams	Other Salt-water
Anchor Point	Hardshell and razor clams, other saltwater	59.774121	-151.867371	4,075	364	10	2,863	48		790						
Ship Creek Anchorage	Chum, king, pink, and silver salmon; Dolly Varden	61.223452	-149.888967	2,287	1,095		743	377		15			57			
Bird Creek, Anchorage	Chum, pink, and silver salmon; Dolly Varden	60.973172	-149.466602	2,584			974	1,433		29			148			
Birch Lake Fairbanks	Arctic char, grayling, king and silver salmon, and rainbow trout	64.315199	-146.646066	3,299					2,021	648		108	522			
Chena Lakes Recreation Area	Arctic grayling, rainbow trout, Dolly Varden, and other freshwater	64.768836	-147.222762	3,547					2,662	319		8	558			
Chunilna Creek	King, red, silver, and pink salmon; rainbow trout, Dolly Varden, arctic grayling, and other freshwater	62.37	-150.008889	2,008	485	124	1141	12	26	29		82	109			
Clam Gulch	King, red, silver, and pink salmon; Dolly Varden, Halibut, razor clams, and other saltwater	60.239425	-151.400878	411,412	2,310	1,623	2,272	644		278				74,226	325,440	4,619
Clearwater Creek	King, red, and silver salmon; and other freshwater	62.199166	-151.607778	1,507	143	61	334						969			
Copper Center, Klutina River	Dolly Varden, grayling, king and red salmon, rainbow trout, whitefish	61.953829	-145.321667	1,4397	964	12,946	8		66	268		57	88			
Deep Creek Marine	Dolly Varden; king, pink, red, and silver salmon; other saltwater	60.03053	-151.680543	2,006	249	52	1,484	12		209						
Deshka River	King, pink, red, and silver salmon; northern pike; rainbow trout; whitefish	61.695774	-150.314433	10,646	3,381	33	5,690	77	122	29		67	1,247			
Finger Lake Ramp	Arctic grayling, land-locked Chinook salmon, Dolly Varden, northern pike, rainbow trout	61.608892	-149.264867	3,431					1,520	345		8	1,558			
Jim Creek	Chum, pink, red, and silver salmon; Dolly Varden	61.525498	-148.940749	11,086		2,440	8,442	57		147						
Kachemak Bay at Homer Spit	Clams; capelin; halibut; king, pink, red, and silver salmon; lingcod; rockfish (sea bass)	59.607683	-151.431198	93,405	5,098	6,076	4,656	1,133		230				57,619	5,825	12,768
Kashwitna River	Arctic grayling; chum, king, pink, red, and silver salmon; Dolly Varden; northern pike; rainbow trout	61.923685	-150.071032	1,058	214	149	660		9				26			
Kasilof River at Kasilof Beach	Coho, king, pink, and red salmon; Dolly Varden; steelhead	60.386517	-151.295256	11,330	3,549	4,470	2,327	553		134						
Kenai River Cooper Landing	Arctic grayling; Dolly Varden; lake and rainbow trout; Pacific salmon: chum, king, pink, red, and silver; whitefish	60.492597	-149.822622	38,796	404	32,182	4,864	448	368	438	28	45	19			
Kenai River Soldotna at Centennial Campground	Arctic grayling; Dolly Varden; lake and rainbow trout; other saltwater; Pacific salmon: chum, king, pink, red, and silver; smelt; whitefish	60.481906	-151.098789	295,130	8,754	226,484	39,164	10,976	1,339	1,781		25	6,607			
Kepler Lake Palmer AK	Grayling, rainbow trout	61.554562	-149.220174	1,957					1,916			41				
Knik Arm Eklutna Tailrace	Chum, king, pink, red, and silver salmon; Dolly Varden	61.476354	-149.162296	4,692	168	689	3,233	343		259						
Kodiak, Chiniak Bay	Broad whitefish; chum, king, pink, red, and silver salmon; Dolly Varden; Dungeness and Tanner crab; halibut; lingcod; other saltwater; Pacific cod; rockfish	57.785625	-152.407992	5,532	322	565	1,284	244	14	258	1			1,153	1,691	
Kvichak River, Kaskanak Flats	King, red, silver, and pink salmon; rainbow trout, Dolly Varden, Lake trout, Halibut, and razor clams	59.317783	-156.07044	1,522	52	884	261	59	26	27	75	94	45			
Lake Creek	Burbot; chum, king, pink, red, and silver salmon; Dolly Varden; grayling; northern pike; rainbow trout	61.909879	-150.905001	7,157	1,644	407	4,572	175	154	11		115	79			
Lake Louise	Arctic grayling, burbot, lake trout, whitefish	62.287869	-146.541699	3,507							579	1,286	1,642			
Little Susitna River Public Use Facility near Point Mac	Burbot; chum (dog), king (Chinook), pink (humpy), red (sockeye), and silver (coho) salmon; Dolly Varden; northern pike; rainbow trout; whitefish	61.559705	-149.213662	13,516	889	1,257	10,662	292	203	189			24			
Ninilchik River	Dolly Varden; king, pink, red, and silver salmon	60.052839	-151.666567	1,211	358	81	711	13		48						

Table A.1, Selected Fishing Sites in Alaska, continued

		Example Site Characteristic Variables used in the Fishing Demand Model													
				Total Harvest, 2010 (not including subsistence fishing)											
Site Name	Sportfish Caught in Waterbody	Latitude	Longitude	Total Harvest	King (Chinook) Salmon	Red (Sockeye) Salmon	Silver (Coho) Salmon	Pink (Humpy) Salmon	Rainbow Trout, Land-Locked Salmon	Dolly Varden, Arctic Char	Lake Trout	Arctic Grayling	Other Fresh-water	Halibut	Razor Clams	Other Salt-water
Montana Creek Campground	Chum, king, pink, red, and silver salmon; Dolly Varden	62.104086	-150.05831	4,013	371	134	2,498	506		53			451			
Nushagak River, Ekwok	King, red, silver, and pink salmon; rainbow trout, Dolly Varden, lake trout, arctic grayling, and other freshwater	59.346378	-157.478646	2,806	502	368	480	68	37	186	7	72	1,085			
Peters Creek	King and silver salmon	62.176944	-150.877778	236	36		200									
Prince William Sound Valdez fishing pier	Pink salmon, other saltwater	61.124144	-146.362135	126,335	1,815	1,473	78,005	16,489						12,348	16,205	
Prince William Sound, Whittier Passage Canal	Broad whitefish; chum, king, pink, red, and silver salmon; cutthroat trout; Dolly Varden; halibut; lingcod; other saltwater; rockfish; shark; shrimp	60.776993	-148.68948	56,570	619	7,620	10,624	1,598		42				14,703		21,364
Quartz Lake Fairbanks	Dolly Varden, land-locked salmon, rainbow trout	64.199012	-145.827284	4,765					2,952	194			1,619			
Resurrection Bay Seward	Broad whitefish; chum, king, pink, red, and silver salmon; Dolly Varden, halibut; other saltwater; rockfish; shark; shrimp; steelhead	60.115999	-149.439443	30,973,539	2,158	4,515	30,906,658	2,357		30				27,952		29,869
Russian River Hamiltons Place	Dolly Varden; other freshwater; pink, red, and silver salmon; rainbow trout	60.486488	-150.002614	35,519		32,745	2,581	51	97	45						
Salcha River State Recreational Site	Arctic grayling, burbot, chum and king salmon, northern pike, whitefish	64.469779	-146.930128	1,868	143							1,556	169			
Sheep Creek	King, red, pink, and silver salmon; rainbow trout, Dolly Varden, arctic grayling, and other freshwater	61.936318	-147.674946	2,476	153	15	1,641	88	288	41		14	236			
Sunshine Creek	King, red, pink, and silver salmon; and other freshwater	62.176111	-150.125555	1,323	56	17	1,123	56					71			
Talachulitna River	King, red, pink, and silver salmon; rainbow trout, Dolly Varden, arctic grayling, and other freshwater	61.876222	-151.414167	2,094	323	424	681	12	59	193		165	237			
Talkeetna River near Chase Trail	Burbot; chum, king, pink, red, and silver salmon; Dolly Varden; rainbow trout	62.327416	-150.112043	5,944	528	3,258	1,588	81	59	193			237			
Tangle Lakes North	Burbot, grayling, lake trout, whitefish	63.044674	-146.026798	3,599							657	2,656	286			
Willow Creek/Little Willow Creek	Chum, king, pink, and silver salmon; Dolly Varden; rainbow trout	61.775666	-150.162281	4,790	387	15	3,492	335	219	15			327			
Yukon River, Birch-Beaver Creek System	King, red, and silver salmon; Dolly Varden, Lake trout, arctic grayling, and other freshwater	66.563314	-145.274725	5,908	161	20	575			364	23	1,778	2,987			

Appendix B
2013 Alaska Outdoor Recreation Survey

2013 Alaska Outdoor Recreation SURVEY

Alaska Outdoor Recreation

Thank you for helping us learn more about outdoor recreation activities in Alaska. The next four pages contain questions about your snow machining, fishing, boating, and hunting outings. Below is a tutorial of how to complete the questions. The text in red illustrates the type of information that you would provide as answers to your questions. **Please review this tutorial before going to Question 1 on the next page.**

Tutorial for your review and reference

Snow Machining Anywhere In Alaska

1. Do you **ever** snow machine recreationally in Alaska? **(Circle the correct choice)** (Yes) GO TO QUESTION 2 / No GO TO NEXT PAGE

2. In the table below, please list all of the locations where you snow machined recreationally between January and April 2013. If you **did not** snow machine on any day between January and April 2013, please check this box ☐ and go to the next page.

Snow Machining between January and April 2013

Describe the location where you snow machined Please be as specific as possible.	**Write the name where you accessed this location** Trailhead name, nearest town or point of interest, highway milepost	**Number of snow machining days** How many days did you snow machine at this location?	**Snow Machining Location**
Turnagain Pass Trail	*Trailhead in Sunnyside*	*6*	0
Denali Highway (South Parks Highway)	*North of Willow by Susitna North*	*3*	1
Willow Lake Loop Trail	*Willow*	*2*	2
Sterling Highway (Resurrection Pass Trail)	*Cooper Landing*	*1*	3
			4
			5
			6
			7
			8
			9

If you snow machined at more than 9 locations and would like to complete additional trip summaries, you can complete them online at *www.alaskarecreationsurvey.com/ExtraPages.pdf* or check the box to the right and we will mail you additional summaries once we receive this completed questionnaire.

☐ Yes, please send me additional summaries

When did you snow machine at each location?
Please write the number of each **Snow Machining Location** in the calendar below. **The Snow Machining Location** numbers are presented in the column to the left. Write in the **Snow Machining Location** number for each day that you snow machined at that location between January and April 2013.

2013

January

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

February

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16 0
17 0	18	19	20	21	22	23
24	25	26	27 1	28		

March

S	M	T	W	T	F	S
					1 0	2 1
3 1	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23 2
24 2 31	25	26	27	28	29	30

April

S	M	T	W	T	F	S
	1	2	3	4	5	6 0
7 0	8	9	10	11 0	12	13
14	15	16	17	18	19	20 3
21	22	23	24	25	26	27
28	29	30				

3. What is the total number of days you snow machined between January and April 2013? *12* days

PLEASE CONTINUE TO NEXT PAGE

Recreational Snow Machining Anywhere In Alaska

If you have any questions on how to complete this summary, please refer to the tutorial on Page 1.

1. Do you **ever** snow machine recreationally in Alaska? **(Circle the correct choice)** Yes → GO TO QUESTION 2 / No → GO TO NEXT PAGE

2. In the table below, please list all of the locations where you snow machined recreationally between January and April 2013. If you **did not** snow machine on any day between January and April 2013, please check this box ☐ and go to Question 4 on the next page.

Snow Machining between January and April 2013

Describe the location where you snow machined Please be as specific as possible.	**Write the name where you accessed this location** Trailhead name, nearest town or point of interest, highway milepost	**Number of snow machining days** How many days did you snow machine at this location?	**Snow Machining Location**
Example: Turnagain Pass Trail	*Trailhead in Sunnyside*	*6*	0
			1
			2
			3
			4
			5
			6
			7
			8
			9

If you snow machined at more than 9 locations and would like to complete additional trip summaries, you can complete them online at *www.alaskarecreationsurvey.com/ExtraPages.pdf* or check the box to the right and we will mail you additional summaries once we receive this completed questionnaire.

☐ Yes, please send me additional summaries

When did you snow machine at each location?

Please write the number of each **Snow Machining Location** in the calendar below. The **Snow Machining Location** numbers are presented in the column to the left. Write in the **Snow Machining Location** number for each day that you snow machined at that location between January and April 2013.

2013

January

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

February

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16 0
17 0	18	19	20	21	22	23
24	25	26	27	28		

March

S	M	T	W	T	F	S
					1 0	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24 / 31	25	26	27	28	29	30

April

S	M	T	W	T	F	S
	1	2	3	4	5	6 0
7 0	8	9	10	11 0	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

PLEASE CONTINUE TO NEXT PAGE

3. What is the total number of days you snow machined recreationally between January and April 2013? _____ days

Sport Fishing Anywhere In Alaska

If you have any questions on how to complete this summary, please refer to the tutorial on Page 1.

4. Do you **ever** sport fish in Alaska? **(Circle the correct choice)**

   Yes ☛ What type of species do you target **(circle all that apply)**? Halibut Rockfish Trout Coho Sockeye Chinook Chum Pink Salmon Grayling Dolly Varden/Arctic char Other

   No ☛ GO TO NEXT PAGE

5. In the table below, please list all of the locations where you sport fished between May and October 2012. If you **did not** fish on any day between May and October 2012, please check this box ☐ and go to Question 7 on the next page.

Sport Fishing between May and October 2012

Describe the waterbody where you fished Please be as specific as possible.	**Write the name where you accessed this location** Boat launch, nearest town or point of interest	**Number of fishing days** How many days did you fish at this location?	**Fishing Location**
Example: Kenai River	*Cooper Landing Boat Launch*	*10*	0
			1
			2
			3
			4
			5
			6
			7

If you sport fished at more than 7 locations and would like to complete additional trip summaries, you can complete them online at *www.alaskarecreationsurvey.com/ExtraPages.pdf* or check the box to the right and we will mail you additional summaries once we receive this completed questionnaire.

☐ Yes, please send me additional summaries

When did you fish at each location?

Please write the number of each **Fishing Location** in the calendar below. The **Fishing Location** numbers are presented in the column to the left. Write in the **Fishing Location** number for each day that you fished at that location between May and October 2012.

2012

May

S	M	T	W	T	F	S
		1	2 0	3 0	4 0	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

June

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9 0
10 0	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

July

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12 0	13	14
15	16	17	18	19	20	21
22	23 0	24	25	26	27	28
29	30	31				

August

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

September

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15 0
16 0	17	18	19	20	21	22
23 30	24	25	26	27	28	29

October

S	M	T	W	T	F	S
	1	2	3	4 0	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

6. What is the total number of days you sport fished between May and October 2012? _____ days

PLEASE CONTINUE TO NEXT PAGE

Recreational Boating Anywhere In Alaska

If you have any questions on how to complete this summary, please refer to the tutorial on Page 1.

7. **Other than fishing**, do you **ever** go **recreational boating** in Alaska? Yes ☛ What type of recreational boating do you do **(circle all that apply)**?
   (Circle the correct choice)
   Canoeing Kayaking Motor/Air boating Drift boating Rafting Sailing Other
   No ☛ GO TO NEXT PAGE

8. In the table below, please list all of the locations where you went recreational boating between May and October 2012. If you **did not** go recreational boating on any day between May and October 2012, please check this box ☐ and go to Question 10 on the next page.

Recreational Boating between May and October 2012

Describe the waterbody where you went recreational boating Please be as specific as possible. If you went fishing, please complete a fishing summary.	**Write the name where you accessed this location** Boat launch, nearest town or point of interest	**Number of recreational boating days** How many days did you go recreational boating at this location?	**Recreational Boating Location**
Example: Valdez Harbor	*Valdez*	*9*	0
			1
			2
			3
			4
			5
			6
			7

If you went recreational boating at more than 7 locations and would like to complete additional trip summaries, you can complete them online at *www.alaskarecreationsurvey.com/ExtraPages.pdf* or check the box to the right and we will mail you additional summaries once we receive this completed questionnaire.

☐ Yes, please send me additional summaries

When did you go recreational boating at each location?
Please write the number of each **Recreation Boating Location** in the calendar below. The **Recreational Boating Location** numbers are presented in the column to the left. Write in the **Recreational Location** number for each day that you went recreational boating at that location between May and October 2012.

2012

May

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18 0	19 0
20 0	21	22	23	24	25	26
27	28	29	30	31		

June

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

July

S	M	T	W	T	F	S
1	2	3	4 0	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20 0	21
22	23	24	25	26	27	28
29	30 0	31				

August

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11 0
12 0	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

September

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23 30	24	25	26	27	28	29

October

S	M	T	W	T	F	S
	1 0	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

9. What is the total number of days you went recreational boating between May and October 2012? _____ days

PLEASE CONTINUE TO NEXT PAGE

Hunting Anywhere In Alaska

If you have any questions on how to complete this summary, please refer to the tutorial on Page 1.

10. Do you **ever** hunt in Alaska? **(Circle the correct choice)** Yes ☛ What type of game do you hunt **(circle all that apply)?**
Big game Small game Upland Birds Waterfowl Other

No ☛ GO TO NEXT PAGE

11. In the table below, please list all of the locations where you hunted between June and November 2012. If you **did not** go hunting on any day between June and November 2012, please check this box ☐ and go to the next page.

Hunting between June and November 2012

Describe the location where you hunted Please be as specific as possible.	**Write the name where you accessed this location** Highway milepost, nearest town or point of interest	**Number of hunting days** How many days did you hunt at this location?	**Hunting Location**
Example: Denali Highway	*Cantwell*	*6*	0
			1
			2
			3
			4
			5
			6
			7
			8
If you hunted at more than 8 locations and would like to complete additional trip summaries, you can complete them online at *www.alaskarecreationsurvey.com/ExtraPages.pdf* or check the box to the right and we will mail you additional summaries once we receive this completed questionnaire.			☐ Yes, please send me additional summaries

When did you hunt at each location?
Please write the number of each **Hunting Location** in the calendar below. The **Hunting Location** numbers are presented in the column to the left. Write in the **Hunting Location** number for each day that you hunted at that location between June and November 2012.

2012

June

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

July

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15 0	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

August

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

September

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14 0	15 0
16 0	17	18	19	20	21	22
23 30	24	25	26	27	28	29 0

October

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17 0	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

November

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

12. What is the total number of days you hunted between June and November 2012? _____ days

PLEASE CONTINUE TO NEXT PAGE

Recreation in the Study Area

Next, we would like to ask you about your recreational activity in a specific Study Area of Alaska. A map displaying the Study Area is found on the next page (page 7).

13. Do you live within the Study Area highlighted on the map on page 7?

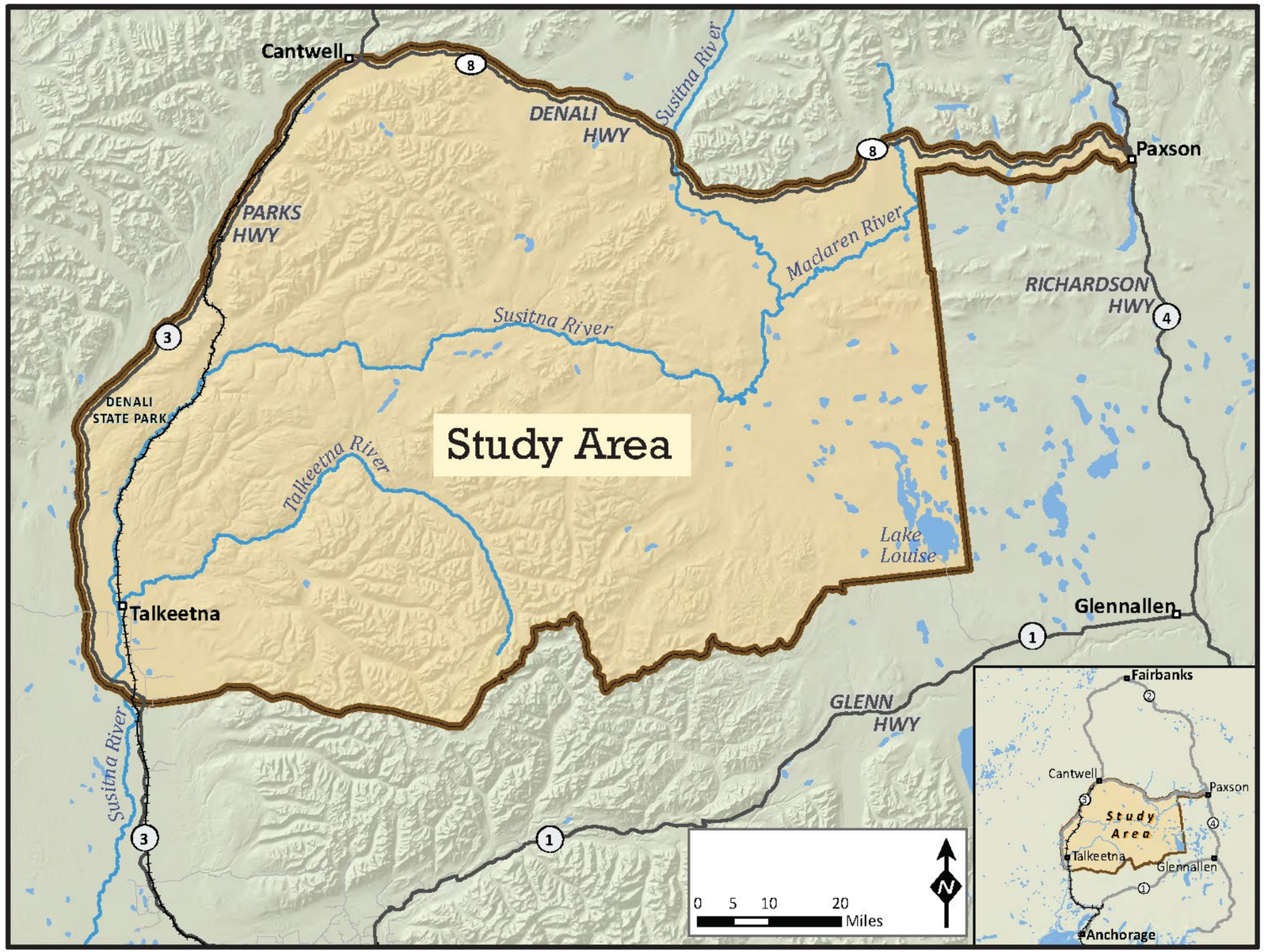
1 ☐ Yes (skip to Q14a) 2 ☐ No

14. Between May 2012 and April 2013, did you recreate in the Study Area?

1 ☐ Yes (continue to Q14a-c) 2 ☐ No (skip to Q33 on page 14)

Recreation Activities	RECREATION Between May 2012 and April 2013		Most Recent Trip
	14a. Check box for each activity that you participated in within the Study Area.	14b. About how many days (all or part of a day) did you participate in this activity within the Study Area?	14c. What activities did you participate in on your most recent visit to the Study Area?
A. Riding the Alaska Railroad	1 ☐	# _____ days	1 ☐
B. Bird watching	2 ☐	# _____ days	2 ☐
C. Bicycling	3 ☐	# _____ days	3 ☐
D. Camping - remote tent/cabin	4 ☐	# _____ days	4 ☐
E. Camping - RV/campground/roadside	5 ☐	# _____ days	5 ☐
F. Collecting berries/mushrooms	6 ☐	# _____ days	6 ☐
G. Dog sledding	7 ☐	# _____ days	7 ☐
H. Fishing for salmon	8 ☐	# _____ days	8 ☐
I. Fishing for other species	9 ☐	# _____ days	9 ☐
J. Flightseeing	10 ☐	# _____ days	10 ☐
K. Hunting	11 ☐	# _____ days	11 ☐
L. Hiking/backpacking	12 ☐	# _____ days	12 ☐
M. Motorized boating (jet, prop, air)	13 ☐	# _____ days	13 ☐
N. Rafting/canoeing/kayaking/pack raft (non-motorized)	14 ☐	# _____ days	14 ☐
O. Riding ATV's	15 ☐	# _____ days	15 ☐
P. Skiing	16 ☐	# _____ days	16 ☐
Q. Snow machining	17 ☐	# _____ days	17 ☐
R. Snowshoeing	18 ☐	# _____ days	18 ☐
S. Walking/running	19 ☐	# _____ days	19 ☐
T. Wildlife viewing	20 ☐	# _____ days	20 ☐
Please write in any additional recreational activities you participated in while in the Study Area between May 2012 and April 2013			
U. Specify other activity_____	21 ☐	# _____ days	21 ☐
V. Specify other activity_____	22 ☐	# _____ days	22 ☐
W. Specify other activity_____	23 ☐	# _____ days	23 ☐
X. Specify other activity_____	24 ☐	# _____ days	24 ☐

PLEASE CONTINUE TO NEXT PAGE


Cantwell
8
DENALI HWY
Susitna River
8
Paxson
PARKS HWY
Maclaren River
RICHARDSON HWY
4
Susitna River
3
DENALI STATE PARK
Study Area
Talkeetna River
Lake Louise
Talkeetna
Glennallen
1
GLENN HWY
Susitna River
3
1
0 5 10 20 Miles
N
Fairbanks
2
Cantwell
Paxson
3
Study Area
4
Talkeetna
Glennallen
1
Anchorage

Your Most Recent Outing to the Study Area

15. What was your primary recreational activity on your most recent outing in the Study Area?

CHECK ONLY ONE PRIMARY ACTIVITY

01 ☐ Riding the Alaska Railroad
02 ☐ Bird watching
03 ☐ Bicycling
04 ☐ Camping-remote tent/cabin
05 ☐ Camping-RV/campground/roadside
06 ☐ Collecting berries/mushrooms
07 ☐ Dog sledding
08 ☐ Fishing for salmon
09 ☐ Fishing for other species
10 ☐ Flightseeing
11 ☐ Hunting
12 ☐ Hiking/backpacking
13 ☐ Motorized boating (jet, prop, air)
14 ☐ Rafting/canoeing/kayaking/pack raft (non-motorized)
15 ☐ Riding ATV's
16 ☐ Skiing
17 ☐ Snow machining
18 ☐ Snowshoeing
19 ☐ Walking/running
20 ☐ Wildlife viewing
21 ☐ Other activity_____

15a. (IF HUNTING WAS YOUR PRIMARY ACTIVITY)
Which of these was your primary harvest objective? (Do not include trapping.)

Please select only one.

01 ☐ Caribou – Federal subsistence
02 ☐ Caribou – State draw permit one bull
03 ☐ Caribou – State registration permit any caribou
04 ☐ Caribou – State community harvest
05 ☐ Caribou – Non-resident
06 ☐ Moose – Federal subsistence
07 ☐ Moose – State draw permit any bull
08 ☐ Moose – State draw permit cow
09 ☐ Moose – State community harvest
10 ☐ Moose – State harvest ticket
11 ☐ Moose – Non-resident
12 ☐ Bear (brown or black)
13 ☐ Waterfowl
14 ☐ Upland game birds
15 ☐ Other _____

16. Where did you participate in your primary activity on your most recent outing in the Study Area? **Grid #**_____
(Please write in the grid number/s found on the map **on page 10.**)

17. Had you ever been to the Study Area for this primary activity prior to your most recent trip?
1 ☐ Yes 2 ☐ No (skip to Q18 on the next page) 3 ☐ Live in study area

17a. What year did you first visit the study area for this primary activity? Year _____
(If you live within the Study Area, please indicate what year you moved there.)

17b. In general, how often do you participate in this primary activity in the Study Area?

01 ☐ More than 10 times per year
02 ☐ Two to ten times per year
03 ☐ Once every year
04 ☐ Once every few years
05 ☐ Less than once every few years

PLEASE CONTINUE TO NEXT PAGE

Your Most Recent Outing to the Study Area

18. Did you hire a guide for any portion of your most recent outing to the Study Area? 01 ☐ Yes 02 ☐ No (skip to Q19)

18a. Did you hire the guide for your primary activity? 01 ☐ Yes 02 ☐ No

19. On your last outing, did you spend a night anywhere in the Study Area (besides your primary residence if you live in the Study Area)**?**

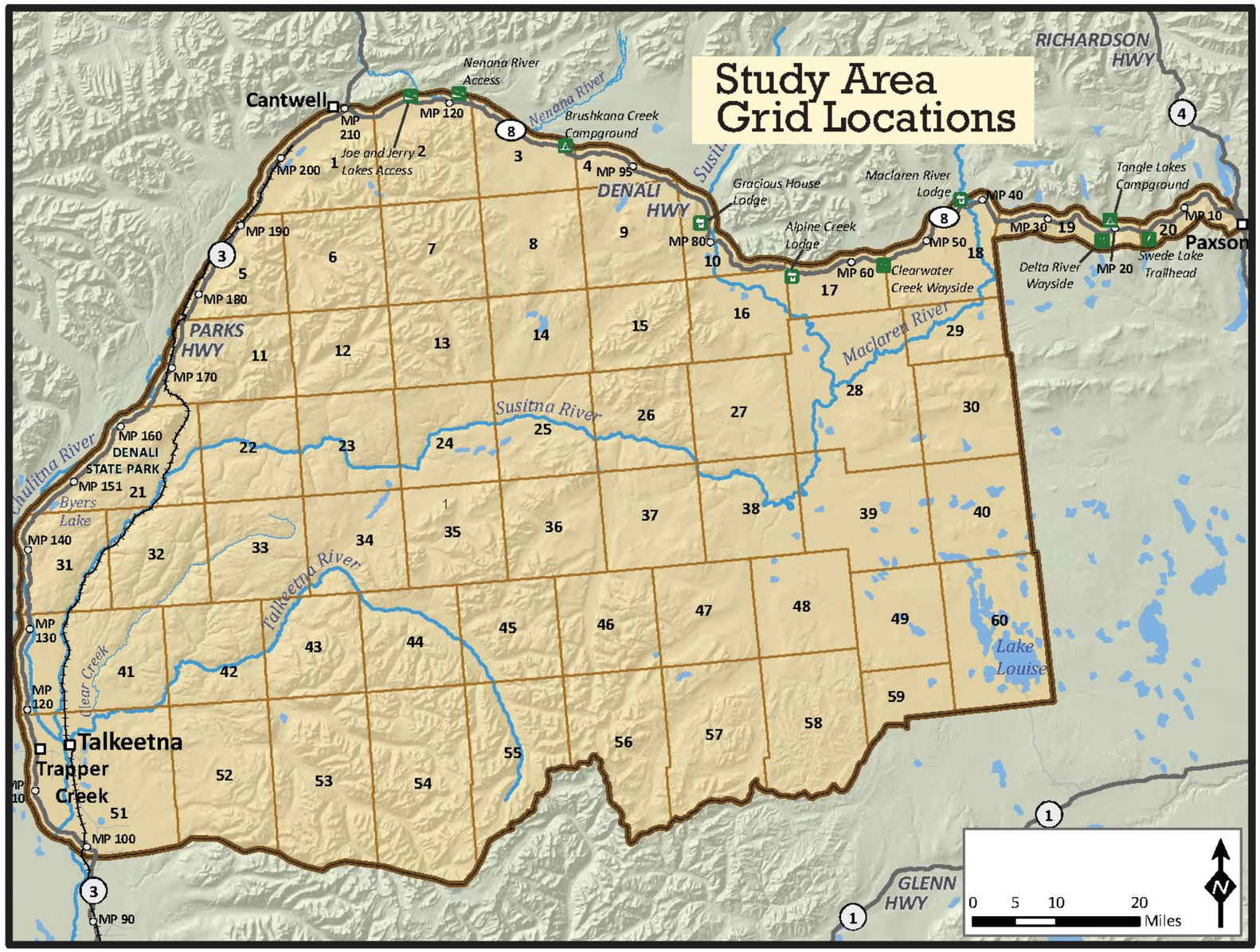
01 ☐ Yes 02 ☐ No (skip to Q22 on page 11)

20. How many nights did you spend in the Study Area on your last outing? # _____ (If you live in the Study Area, count only nights away from home.)

21. Please record how many nights you spent in each location below and the type of lodging used during your most recent outing. For additional locations, write in the location name and the grid number found on the map on page 10.

	Grid Number	Hotel/motel/ B&B	Lodge	Private home	Established campground (RV/tent/etc.)	Undeveloped/ roadside RV/ camper/car/tent	Remote tent/cabin	Other
EXAMPLE: Denali Hwy Mile 45	#3					4	2	
Talkeetna	#51							
Trapper Creek	#51							
Byers Lake	#21							
Cantwell	#1							
Brushkana Creek Campground	#3							
Tangle Lakes	#19							
Lake Louise	#60							
Additional location:								
Additional location:								
Additional location:								
Additional location:								
Additional location:								
Additional location:								

PLEASE CONTINUE TO NEXT PAGE


Study Area
Grid Locations
Cantwell
MP 210
MP 200
MP 190
MP 180
MP 170
MP 160
DENALI STATE PARK
MP 151
MP 140
MP 130
MP 120
MP 100
MP 90
MP 120
MP 95
MP 80
MP 60
MP 50
MP 40
MP 30
MP 20
MP 10
Paxson
Nenana River Access
Joe and Jerry Lakes Access
Brushkana Creek Campground
Gracious House Lodge
Alpine Creek Lodge
Clearwater Creek Wayside
Maclaren River Lodge
Delta River Wayside
Tangle Lakes Campground
Swede Lake Trailhead
Talkeetna
Trapper Creek
Byers Lake
Clear Creek
Chulitna River
Nenana River
Susitna River
Maclaren River
Talkeetna River
Lake Louise
PARKS HWY
DENALI HWY
RICHARDSON HWY
GLENN HWY
0 5 10 20
Miles
N

Your Most Recent Outing to the Study Area

22. Including yourself, how many people were traveling in your immediate PARTY, sharing expenses such as food, lodging, and transportation on your most recent outing in the Study Area?

_____ in party

23. Including yourself, what was the total number of people traveling in your GROUP on your most recent outing in the Study Area?
(A "group" is defined as friends or relatives traveling with you, but not necessarily sharing expenses.)

_____ in group

24. Was there anyone in your party with a disability or special need related to outdoor recreation activities?

1 ☐ Yes → **24a. Specifically, what type of needs do they have?**
2 ☐ No

1 ☐ Wheelchair access to trails
2 ☐ Wheelchair access to facilities
3 ☐ Other: _____

25. On your last outing in the Study Area, did you feel very crowded, somewhat crowded, or not crowded?

01 ☐ Very crowded 02 ☐ Somewhat crowded 03 ☐ Not crowded (skip to Q26)

25a. If somewhat or very crowded: Do you recall any places in particular where you felt crowded? 1 ☐ No (continue to Q26)
Please write in the name of the location/s below and the grid numbers of those locations (Map on page 10).

Place names	Grid #
_____	_____
_____	_____
_____	_____

26. On your last outing did you experience any conflict with other individuals or groups that negatively impacted your recreation experience in the Study Area?

1 ☐ Yes 2 ☐ No (skip to Q27)

26a. What type of activity was the other individual or group engaged in? (This could be recreation or other activity.)

_____

26b. What specifically caused the conflict?

_____

27. What signs, if any, of infrastructure or human activity detracted from the scenic quality within the Study Area? (Check all that apply)

01 ☐ Nothing
02 ☐ Communication towers
03 ☐ Power lines
04 ☐ Railroad
05 ☐ Trash
06 ☐ Roads
07 ☐ Trails
08 ☐ Roadside camping areas
09 ☐ Vehicles (RV, ATV, motorcycles, cars, etc.)
10 ☐ People
11 ☐ Other: _____

PLEASE CONTINUE TO NEXT PAGE

Your Most Recent Outing to the Study Area

28. What noises, if any, detracted from your enjoyment of the Study Area? (Check all that apply)

01 ☐ Nothing
02 ☐ Gunshots
03 ☐ Airplanes
04 ☐ Jet aircraft sonic boom
05 ☐ Helicopters
06 ☐ Boats
07 ☐ Four wheeler/ATV
08 ☐ Cars/trucks/RV
09 ☐ Noise from other people
10 ☐ Heavy equipment (road work, quarries, construction)
11 ☐ Chainsaw
12 ☐ Snow machine
13 ☐ Other_____

29. On your most recent outing, did you travel more than one-half mile from a trailhead or main road into the Study Area?

1 ☐ Yes 2 ☐ No (skip to Q30)

29a. Which modes of transportation did you use to travel more than one-half mile into the Study Area? (Check all that apply)

01 ☐ Off-road vehicle/ATV
02 ☐ Motorized watercraft (skip to Q29c)
03 ☐ Non-motorized watercraft (canoe, kayak, raft, etc.) (skip to Q29c)
04 ☐ Airplane (Landed more than one-half mile into the Study Area (skip to Q29c)
05 ☐ Snow Machine
06 ☐ Ski
07 ☐ Snoeshoe
08 ☐ Walked/hiked
09 ☐ Other: _____

29b. Did you travel on established trails, off-trail, or both?

1 ☐ Established trails 2 ☐ Off-trail 3 ☐ Both

29c. Did you camp in the Study Area more than one-half mile from a trailhead or main road? 1 ☐ Yes 2 ☐ No

30. When considering your most recent outing, how important were the following factors in your decision to recreate in the Study Area?
(Please circle your answer)

	Very important	Somewhat important	Not important
a. Wildlife viewing opportunities	1	2	3
b. The opportunity to hunt	1	2	3
c. The opportunity to fish	1	2	3
d. The opportunity to experience remote Alaska	1	2	3
e. The opportunity to experience solitude	1	2	3
f. The opportunity to challenge yourself	1	2	3
g. The scenery	1	2	3

PLEASE CONTINUE TO NEXT PAGE

Your Most Recent Outing to the Study Area

31. Do you agree or disagree with each of the following statements? (Please circle your answer)

I recreate in the Study Area because...	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
a. This area means a lot to me.	1	2	3	4	5
b. No other place can compare to this area.	1	2	3	4	5
c. Recreating here is more important to me than doing it in any other place.	1	2	3	4	5
d. This area is close to my home.	1	2	3	4	5
e. My family has been coming to this area for generations.	1	2	3	4	5

32. Below is a list of outdoor recreation facilities, infrastructure, and sources of information in the Study Area. Please indicate whether there should be more, less or the same in the future. (Please circle your answer)

	A lot more	A little more	The same	A little less	A lot less
a. Maintained roads	1	2	3	4	5
b. Designated parking areas	1	2	3	4	5
c. Roadside toilets	1	2	3	4	5
d. RV accessible sites at campgrounds	1	2	3	4	5
e. Trail maps	1	2	3	4	5
f. Designated trails for non-motorized use	1	2	3	4	5
g. Designated trails for off-road vehicles	1	2	3	4	5
h. Directional road signs	1	2	3	4	5
i. Visitor information	1	2	3	4	5
j. Visitor centers	1	2	3	4	5
k. Public use cabins	1	2	3	4	5
l. Boat launches	1	2	3	4	5
m. Facilities for the disabled	1	2	3	4	5

PLEASE CONTINUE TO NEXT PAGE

Demographics

33. In what year were you born? 19_____

34. Your gender: 1☐ Male 2☐ Female

35. Are you married? 1☐ Yes 2☐ No

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

37. Do children under the age of 18 live in your household? 1☐ Yes 2☐ No

38. Which category best describes your household income before taxes for 2012?

01☐ Less than $20,000
02☐ $20,001 to $35,000
03☐ $35,001 to $50,000
04☐ $50,001 to $75,000
05☐ $75,001 to $99,999
06☐ $100,000 to $149,999
07☐ $150,000 or more

39. Which categories (or categories) best describe your race? (Check all that apply)

01☐ White
02☐ Black or African American
03☐ Hispanic
04☐ American Indian or Alaska Native
05☐ Asian
06☐ Native Hawaiian or Other Pacific Islander
07☐ Some other race

40. What is the highest degree or level of school you have COMPLETED?

01☐ Less than 9th grade
02☐ 9th to 12th grade, no diploma
03☐ High school graduate, GED, or alternative
04☐ Some college, no degree
05☐ Associate's degree
06☐ Bachelor's degree
07☐ Graduate or professional degree

41. Are you a professional guide for any recreation activities?

1☐ Yes → **Q 41a. What type of activities do you guide?** (Check all that apply)
2☐ No (continue to Q42)

01☐ Snow machining
02☐ Fishing
03☐ Hunting
04☐ Boat/float tour
05☐ Other_____

42. Do you or your family own a cabin in Alaska?

1☐ Yes → **Q42a. Approximately where is your cabin located?** _____
2☐ No

Cabin location

43. As part of this recreation study we may be conducting additional research. Would you be willing to participate in a follow-up survey? Your contact information will not be used or shared for any other purpose.

1☐ Yes 2☐ No

43a. To follow up with you, may we have your email address or phone number?

Email address or phone number_____

Thank you for participating in this survey!


Please enclose your completed survey in the
postage-paid envelope provided and mail to:
McDowell Group, Inc.
9360 Glacier Hwy., Suite 201
Juneau, Alaska 99801-9947
PASSWORD

PART A - APPENDIX B: TECHNICAL MEMORANDUM ON LONG-TERM MODELING ASSUMPTIONS

Northern Economics

Memorandum

Date: December 13, 2013

To: The Project File

From: Marcus Hartley, Patrick Burden, and Leah Cuyno

Re: **Draft: Technical Memorandum on Long-term Modeling Assumptions (LTMAs)**

This technical memorandum summarizes our long-term modeling assumptions (LTMAs) which will form the basis for the analyses of socioeconomic impacts under the **"With Watana Dam"** and the **"Without Watana Dam"** scenarios. In general, the LTMAs create a qualitative framework within which the quantitative economic impact models and analyses will be developed. The description of future events or activities provided in this memorandum is general in nature, without any specific amounts or terms provided except for a few of the key assumptions directly related to the proposed Watana project. These long-term sets of assumptions represent two logical futures of the Alaska economy. Choosing any one of the assumptions may preclude use of another assumption. While some of the assumptions may be mutually exclusive in this regard, they are not necessarily independent from each other as assumptions about events that occur later in time are path-dependent and the selection of an earlier assumption may preclude certain activities in later years.

Sources of LTMAs

The LTMAs are the result of an information collection process aimed at deriving a consensus of the most probable economic future for Alaska. The LTMAs reflect the combined information from published reports, project proponents, statements from industry and government representatives, and opinions from other stakeholders. In addition to a review of published reports and news articles, the study team interviewed more than 30 Alaskan stakeholders with experience and expertise in the state's leading industries and policy areas. These interviews took place from August–November 2013 and their collective responses played a significant role in shaping many of the LTMAs. The list of persons interviewed, and the businesses and organizations that they represent, are listed in the table at the end of the document. Ultimately, Northern Economics was responsible for assessing the likelihood of the future outcomes identified by these sources and compiling the information into the consistent set of assumptions presented in the memorandum.

Organization of the LTMAs

There are 25 LTMAs organized into different categories. The categories start at the national level (LTMAs 1–3), then move on to describe Alaska oil and gas production and prices (LTMAs 4–9). From there a description of the future power generation infrastructure in the Railbelt is provided (LTMA 10), followed by assumptions on other major industries in the state (LTMAs 11–16). The State of Alaska's fiscal assumptions are described in LTMAs 17–20, followed by assumptions on large transportation (road and port) projects (LTMA 20–21). Finally, the memo describes assumptions on statewide population, labor availability, and rural issues (LTMAs 22–25).

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1 U.S. Economy

No Action / Without Watana Dam
The REMI model generates a baseline forecast that incorporates a time series of historical data about the U.S. economy over the last three decades. The REMI model's baseline forecast covering the entire project timeline (2013–2060) will be used in the Without Watana Dam or No Action analysis.
With Watana Dam
This set of assumptions will include additional economic activity from construction and operation of Watana Dam.

2 U.S. Oil Prices

No Action / Without Watana Dam
EIA forecasts for oil prices out to 2040 will be taken from the 2013 Annual Energy Outlook. The EIA assumes increased prices as the world economy recovers from the recent recession. By 2040, oil is expected to cost $163 per barrel (Brent[1] crude oil price in 2011 dollars). Oil prices from 2041 to 2060 will be extrapolated based on the trend of EIA prices from 2031–2040.
With Watana Dam
The study will use the same assumptions as in the Without Watana Dam Scenario.

3 Federal Spending and Permitting Activities in Alaska

No Action / Without Watana Dam
Federal per capita spending will remain at current levels in real terms through the remainder of the study period. Permitting policies are also assumed to remain generally constant with those in place today.
With Watana Dam
The study will use the same assumptions as in the Without Watana Dam Scenario.

[1] In the 2013 Annual Energy Outlook, the Brent crude oil price is tracked as the main benchmark for world oil prices. The WTI crude oil price has recently been discounted relative to other world benchmark crude prices. The divergence between WTI and other world crude oil prices over the last few years has made WTI a less reliable indicator of U.S. average refiner crude oil costs and petroleum product prices (EIA). Note that Alaska North Slope oil is delivered aboard tankers almost exclusively to West Coast refineries. It competes against foreign oils priced off Brent for space in the refineries. Lately, however, West Coast refineries have also been bringing in crude oil by rail from the Midwest and Canada.

4 Alaska On-shore Oil Production

No Action / Without Watana Dam
Oil production from currently producing on-shore fields continues to decline and will follow the forecasts of the Alaska Department of Revenue annual production through 2022 (the endpoint of ADOR's forecasts). Beyond 2022, production from these existing fields will continue to decline at a rate equal to the projected rate of decline from 2013–2022 (an average annual decline of 8 percent). The "2013 More Alaska Production Act" (2013 MAP Act) reforming Alaska's oil and gas tax regime is expected to create incentives that will result in an increase in oil production. The ADOR projects that new oil would increase total ANS oil production by 10 percent in 2014, and about 27 percent by 2022. The study will also assume that the construction of the Alaska-LNG project will further induce onshore oil production. The following future activities/development are assumed to take place in the North Slope: • Liberty is developed and comes on line in 2021 with peak production in 2023. • Point Thomson condensates production will commence in 2016. With the start-up of Alaska-LNG project in 2025 condensate production increases significantly. • Permitting delays push first production in NPRA to 2017. Production peak occurs in 2027. • The development of the Trans-NPR-A pipeline (TNP) to move oil from the Chukchi to TAPS will spur additional development of previously marginal fields in the NPR-A. These marginal fields will contribute an average of 70,000 bod from 2030–2060. • Some of the North Slope shale oil fields will be sanctioned in 2015 and subsequently developed with first oil production in 2022. However, regulatory and capital constraints as well as technical and cost issues result in limited field development until 2030. After that date, shale oil begins to add significant oil production to total North Slope production and TAPS throughput for the remainder of the study period. • The combination of the 2013 MAP Act and later on the construction of the Alaska-LNG project will lead to oil production from previously marginal or sub-economic oil fields beginning in 2016. • Development in ANWR will not be permitted during the study period.
With Watana Dam
The study will use the same assumptions as in the Without Watana Dam Scenario.

5 Alaska OCS Oil Production

No Action / Without Watana Dam
OCS oil production from the Chukchi Sea and the Beaufort Sea will begin in 2030 and 2034, respectively. Oil produced in the Beaufort Sea will be transported through TAPS. Oil produced in the Chukchi Sea will be transported through an onshore pipeline across the NPR-A to TAPS with construction beginning in 2027. There are no changes from the current rules for federal OCS royalties; the State of Alaska will not receive any portion of the royalties from OCS activity that are paid to the federal government. OCS production will create a significant number of jobs both in the oil and gas sector and the support sectors.
With Watana Dam
The study will use the same assumptions as in the Without Watana Dam Scenario.

6 TAPS

No Action / Without Watana Dam
With increased production from the 2013 MAP Act, induced production related to Alaska LNG, and most importantly development of large OCS oil fields in the Beaufort and Chukchi Sea, the owners of TAPS make the necessary investments to keep the pipeline open and flowing. With throughput from the OCS expected to continue through the study period, and with the development of the shale oil plays, TAPS is reauthorized to operate for another 30 years in 2033.
With Watana Dam
The study will use the same primary assumptions as in the Without Watana Dam Scenario.

7 North Slope/Arctic OCS Natural Gas Production

No Action / Without Watana Dam
Prior to the Alaska LNG project, natural gas will be produced in sufficient quantities to meet localized demand in the NSB and for field consumption. Long-term purchase agreements with one or more of the Fairbanks natural gas utilities results in the construction of a small-scale (16 to 25 mmcfd) modular LNG plant on the North Slope that begins production in 2016. When the Alaska LNG project begins operations, the small LNG plant supplies LNG to industrial users on the North Slope. The Alaska LNG project is sanctioned and export of gas (LNG) starts in 2027. An average of 3.0 bcfd of ANS natural gas will be supplied to the Alaska LNG pipeline starting in 2027 through the end of the study period. Several off-take points are built along the route to supply natural gas to communities with large populations or large industrial users that can justify the capital cost of the facilities (e.g., Livengood gold mine). The study assumes that most of the NGLs (liquid petroleum gases) associated with ANS gas will also be exported; with some propane distribution to communities on the road system. The route of the Alaska LNG pipeline will transit from Livengood south along the Tanana River to Nenana and will not parallel the existing road system. As a result, a spur pipeline will be required to bring gas from an off-take point to Fairbanks. This spur pipeline is not part of the Alaska LNG project but will be another construction project to incorporate into the assumptions. Prudhoe Bay and Point Thomson will be primary gas sources for the Alaska LNG project during the early years of operation. Later, gas production from other fields will begin to meet Alaska LNG needs, primarily from NPR-A, and the Foothills of the Brooks Range. Gas production from Beaufort Sea OCS will begin in 2043 and will be transported to markets via the Alaska LNG project. Some Chukchi OCS gas is used for field use with the balance re-injected and not fully developed until after the study period.
With Watana Dam
The study will use the same assumptions as in the Without Watana Dam Scenario except that the Livengood gold mine is assumed to use electric power from Watana after transmission lines are built.

8 Cook Inlet Natural Gas Production

No Action / Without Watana Dam
Natural gas production in Cook Inlet recovers as a result of state incentive programs and long-term contracts with Southcentral gas and electric utilities. Gas production from Cook Inlet continues at levels sufficient to meet regional utility needs throughout the study period, although the natural gas storage facilities must be expanded in 2015 to ease winter peak demand issues. Some Southcentral utilities purchase gas from the Alaska LNG project when it begins operation to seek diversity in their fuel supplies. The ConocoPhillips LNG facility in Nikiski re-opens in 2014 and operates through 2030; the facility continues to operate on a seasonal basis beyond 2030. The Agrium fertilizer facility in Nikiski also reopens (in 2015) and operates using a single train through 2030. Other discussions related to in-state use of natural gas are described under **Prices for Users of Natural Gas in Alaska** and **Mining**.
With Watana Dam
Watana reduces the demand for gas from Southcentral electrical utilities, which leaves enough supply of Cook Inlet gas for both the ConocoPhillips LNG plant and Agrium to remain in operation using Cook Inlet Gas. The Agrium plant closes in 2030, but the Conoco LNG Plant operates through 2040 and then seasonally after that year. With Watana, the natural gas storage facilities are expanded again in 2022 to ease winter peak demand issues.

9 Prices for Users of Natural Gas in Alaska

No Action / Without Watana Dam
Natural gas prices for consumers in Alaska will be higher than Lower 48 prices in order to generate adequate returns to local gas producers that operate in a high-cost Alaskan environment. In general, prices paid by consumers for natural gas will not be subsidized by the state and will equal the sum of the wellhead value of the gas plus transportation costs. Prior to the beginning of operations of the Alaska LNG project, the wellhead value of the gas will be linked to the sales price of ANS oil sold on the West Coast and the ratio of $5.71 per mmBtu (the current prevailing value for Cook Inlet gas) of gas to $100 per barrel oil, with a floor of $5.00 per mmBtu. According to AIDEA project documents for the Interior Energy Plan (2013), natural gas prices in Fairbanks prior to the operations of the Alaska LNG project are expected to range between $14.50 and $17 for the end user. After the Alaska LNG project is operating, ANS gas will be purchased by utilities on long term contracts (20+ years). The cost of natural gas to Southcentral Alaska customers will be a blend of ANS and Cook Inlet pricing, and it is anticipated that ANS gas prices will be higher than prices for natural gas from Cook Inlet production. It is assumed that the wellhead value of ANS gas will be the netback price from LNG sold in Asia.
With Watana Dam
When Watana comes online, demand for Cook Inlet (CI) gas by utilities will decline, and result in Cook Inlet gas becoming a smaller percentage of the total gas supply. Cook Inlet gas prices may not drop because production will be negatively affected by the decline in demand. Since ANS gas is priced higher than CI gas, the blended gas price in Southcentral increases. Other assumptions in the Without Watana Dam scenario hold.

10 Electrical Generation Infrastructure

No Action / Without Watana
HEA's Soldotna LM6000 turbine comes online in 2014, and MEA's Eklutna Generation Station (EGS) comes online in 2015. ML&P's George M. Sullivan Plant 2 Generation Replacement Project comes online in 2016 with a 120-MW capacity. The Healy Clean Coal plant comes online in 2015. In Fairbanks, GVEA converts one of their North Pole generator units to natural gas in 2016 with the availability of LNG from the North Slope. Proposed upgrades to the existing Railbelt electrical transmission system are completed in 2020. Beginning in 2027, the availability of propane and LNG from the Alaska LNG project leads to the replacement of diesel powered generation plants use by Copper Valley Electric Association (CVEA) and other Railbelt communities on the road system that are not served by the Railbelt transmission system. No additional thermal generation plants are developed in the Railbelt, although aging plants are replaced with similar-sized but more efficient gas-fired generators as maintenance costs increase. Some relatively small renewable energy projects are brought online, but the goal to generate 50 percent of electricity from renewable sources by 2025 is not achieved. The Mount Spur geothermal project is built as a private/public partnership and comes online in 2026. LNG and propane from Alaska LNG are shipped to rural Alaska to replace high-cost diesel generators in communities that have year-round road or marine access.
With Watana
Power from Watana dam becomes available in 2024. The goal of generating 50 percent of electrical power from renewable sources is met. Because energy from Watana is available, the state elects

not to partner with the developer of the Mt. Spur geothermal project and plans are shelved.

Additional transmission lines connect CVEA to the Railbelt transmission system in 2028 and to Tok in 2030.

Unless otherwise discussed here the Without Watana Dam scenario holds.

11 Alaska In-state Oil Refining and Imports of Petroleum Fuels

No Action / Without Watana Dam
In-state refineries are assumed to continue to operate at current levels through 2026. With the opening of Alaska LNG in 2027, and the availability of low cost natural gas, refineries in North Pole (Flint Hills and Petro Star) convert to natural gas as their primary source of energy. This situation results in cost savings for the refineries and operations at current levels through the end of the study period. However, the cost of petroleum imports is higher than production from in-state refiners which means there is no noticeable reduction of in-state gasoline or distillate prices.
With Watana Dam
The study will use the same assumptions as in the Without Watana Dam Scenario.

12 Mining

No Action / Without Watana Dam
Mining activity expands with development of several large prospects and expanded resource utilization at existing operations. In general, mine developers determine that they cannot afford to wait for the state to develop energy infrastructure and therefore provide their own infrastructure in a way that allows future flexibility if new energy sources become available. The major new mining projects are described separately below, but other smaller mining operations also come on line during the study period. 1) The Donlin Creek Mine begins production in 2019. The project would require 150 megawatts of electricity to power the mill and facilities. The power would be produced using on-site natural gas fired generation. The gas is transported to Donlin Creek via a gas pipeline from Cook Inlet. Revitalized production of Cook Inlet natural gas (see LTMA #8) generates sufficient gas supply until the opening of Alaska LNG in 2027. The mine operates for 27+ years (from 2019–2046 and produces a total of 30 million ounces of gold. 2) Pebble begins production in 2040, after permitting delays. The mine has a smaller footprint than currently envisioned, but is still able to access known mineral resources. The mine utilizes natural gas as its primary energy source. The gas is transported to the mine via a sub-sea pipeline from Anchor Point to Insikin Bay and then a 90-mile pipeline that runs from Iniskin Bay to the mine. The mine operates throughout the remainder of the study period. The copper and gold are exported via the port facility in Iniskin Bay. 3) Livengood mine comes on line in 2028, two years after the opening of Alaska LNG. A gas off-take point at Livengood enables the mine to generate its own electricity and to use co-generated steam in the milling process. The mine would produce 16 million ounces of gold during the study period. 4) Red Dog Mine expands operations to adjacent resource deposits and operates through 2045. 5) Coal exports increase from the Usibelli Mine through the Port of Seward. 6) Smaller unspecified mines with road/port access and access to energy will generate additional mining jobs each year from 2013–2060. These have the effect of replacing jobs from older mines that are reaching the end of their production cycles.
With Watana Dam
The study will use the same assumptions as in the Without Watana Dam Scenario with the following difference: Livengood mine comes on line in 2024, two years after the opening of Watana Dam. Livengood builds a transmission line from GVEA's distribution system to access electricity. The mine would produce 16 million ounces of gold during the study period.

13 Fisheries

No Action / Without Watana Dam
Harvest volumes of most species are expected to stay within the ranges of the last 10 years. Revenues from seafood are expected to increase as demand in Asia continues to grow and wild-caught seafood attains a premium over farm-raised seafood in the marketplace. Trends associated with global climate change continue with some northward movement of fish stocks and densities. The industry is able to adapt to the gradual changes, as stocks that were formerly found in more southerly waters are now more abundant in Alaska waters. Commercial fish harvests in the Chukchi and Beaufort Seas continue to be prohibited.
With Watana Dam
The study will use the same assumptions as in the Without Watana Dam Scenario. Assumptions on Watana's impact on salmon stocks in Cook Inlet or on recreation fishing in the main stem of the Susitna River will await more information from fisheries related studies.

14 Tourism

No Action / Without Watana Dam
Growth in Alaska's tourism industry continues, but at a lower rate than in the past decade due to competition from other global tourist destinations, and a limited number of communities that can meet the needs of the cruise ship industry. The growth rate in the tourism sectors is constrained to two-thirds of the prior decade's growth rates.
With Watana Dam
Watana Dam is assumed to have no net impact on the number of out-of-state visitors to Alaska. There may be in-state distributional impacts resulting from enhancement of certain sites as a result of the dam. The studies on recreational impacts will inform these assumptions when they become available.

15 Air Transportation

No Action / Without Watana Dam
Air cargo support in Alaska will continue to grow, but at lower rates than in prior decades. Tourism accounts for a substantial portion of air transportation activity and future growth rates are constrained to two-thirds of the prior decade's growth rates.
With Watana Dam
The study will use the same assumptions as in the Without Watana Dam Scenario.

16 Economic Diversification

No Action / Without Watana Dam
A liquid petroleum gas (LPG) handling facility and marine terminal is developed at Nikiski to export the LPGs to the Pacific Rim countries. The facility uses gas liquids from the Alaska LNG project as inputs. Some of the propane is shipped to rural Alaska ports with ice-free access.
With Watana Dam
The study will use the same assumptions as in the Without Watana Dam Scenario.

17 State Revenues

No Action / Without Watana Dam
The State of Alaska will continue to depend on revenues from the oil industry. Long-term projections on state revenues will therefore depend on assumptions regarding future oil production and prices (as stated in the LTMAs above). The "2013 More Alaska Production Act" is expected to incentivize additional investments in exploration and development of oil and gas resources that would result in additional oil and gas production, and State revenues. When significant volumes of OCS oil begin to flow through TAPS, the value of TAPS will increase substantially. Prior to the value increase, the legislature is assumed to rewrite the existing oil and gas property tax statutes to limit the local government take of the shared tax and increase the amount available to the state. The oil and gas property tax mill rate is also assumed to increase at the same time. However, despite near and medium-term assumptions regarding new fields coming on line that would slow down the decline rate of producing oil fields, in the long run, it is anticipated that the State of Alaska will need to create additional revenue sources from new taxes in order to fund government services. The fiscal model will determine the level of taxes that would have to be generated in order to balance the operating budget. The operating budget will be consistent with assumptions stated in the LTMA regarding state spending. Any taxes that are implemented would be considered temporary and would be eliminated or reduced if operating budget surpluses are generated. The timing of imposition of these taxes, if they are required, would be determined by initial model runs specific to the Without Watana Dam Scenario.
With Watana Dam
The study will use the same assumptions as in the Without Watana Dam Scenario, except the timing of imposition of taxes, if required, would be determined by initial model runs specific to the With Watana Dam Scenario.

18 Permanent Fund and Permanent Fund Dividends

No Action / Without Watana Dam
As mandated by the Alaska Constitution, 25 percent of state oil and gas royalties continue to be paid into the Permanent Fund (PF) and the principal balance of the PF continues to grow. Earnings from the PF continue to be paid as dividends (PFDs) unless it is determined by initial model runs that state budget deficits have fully depleted the Constitutional Budget Reserve (CBR). At that time, all PFD payments are eliminated and investment earnings from the PF are used to balance the state budget. PFDs would resume only if the PF earnings are not required to balance the budget.
With Watana Dam
The study will use the same assumptions as in the Without Watana Dam Scenario.

19 Spending by the State of Alaska

No Action / Without Watana Dam
Unless constrained by budget deficits, the state operating budget plus the capital budget and receipts from the federal government is set to equal state revenues less dedicated contributions to the Permanent Fund, the CBR, Education Fund, and other accounts. In years when the CBR is needed to balance the budget, the operating budget is reduced by two percent per year, and in years after the CBR is depleted and a budget deficit is facing the state, the operating budget, plus a modest capital budget of $200 million (in 2013 $ and adjusted for inflation in future years), is set to equal total revenues. In years when there is a budget surplus, the state capital budget is assumed to be approximately 75 percent of the available surplus (total revenues less operating budget), with 25 percent going into the CBR. Future capital projects include: • Railbelt transmission upgrades • North Slope LNG facility for Fairbanks • Port MacKenzie rail • Port of Anchorage upgrade • State investment in Alaska LNG pipeline (including at least some of off-take points and a pipeline to supply gas to Fairbanks.) • Road projects (see State Funded Road projects)
With Watana Dam
The study will use the same assumptions as in the Without Watana Dam Scenario. In addition, the State of Alaska will subsidize the cost of the Watana Dam construction. The project will be funded in a manner similar to the Bradley Lake hydroelectric project. Project financing assumptions will be further fine-tuned in collaboration with the Alaska Energy Authority.

20 State Funded Road Projects

No Action / Without Watana Dam
Because of the recognition that the state government needs to spend within its means, only those new road projects that appear to generate positive economic development will be built. In general, the state will require these road projects to be funded through private/public partnerships and local improvement programs. The only road projects that are foreseeable under these conditions is an upgrade of the road from Iniskin Bay to Pebble, the Umiat Road on the North Slope, and the road to Ambler. Following construction of the Alaska LNG project, the Parks Highway, and the Dalton Highway and the Glenn Highway between Anchorage and Palmer are refurbished to repair construction related damage.
With Watana Dam
The road projects assumed under the “Without Watana” Scenario will be undertaken. In addition, a new road providing access to Watana Dam and the Watana Reservoir will be developed in 2018. This road may or may not be accessible to the public; public access will be determined in the decision-making process.

21 Port Projects

No Action / Without Watana Dam
Port of Seward improvements will be completed in 2020 to support coal exports. An expanded LNG port will be developed at Nikiski by 2022. The port in Iniskin Bay will be built to support development of the Pebble Mine in 2035. A port on the Chukchi Sea coastline will be developed in 2026 to support OCS and TNP development. The Port of Anchorage expansion will be completed in 2018 (this is included in the list of State-funded projects).
With Watana Dam
All port projects assumed under the Without Watana Dam Scenario will be built.

22 Statewide Population growth

No Action / Without Watana Dam
Statewide population is an output of the REMI model; no specific assumptions regarding population will be made.
With Watana Dam
The study will use the same assumptions as in the Without Watana Dam Scenario. Population will be determined independently for the With Watana Dam Scenario.

23 Rural and Urban Changes

No Action / Without Watana Dam
Population for modeled boroughs and census areas will be an output of the REMI model. Borough and census area totals from the model will be allocated down to the community level using existing trends, but modified by any of the model assumptions that are specific to individual communities. Other assumptions that affect community populations include: • State funding of schools in communities as long as 10 students remain. • Revenue sharing formulas that are currently in place will remain unchanged. • Bypass mail subsidies continue.
With Watana Dam
The study will use the same assumptions as in the Without Watana Dam Scenario.

24 Resident v. Non-Resident Labor

No Action / Without Watana Dam
The trends of resident versus non-resident labor over the past 10 years will continue through the study period and any differences by major industry groups will be utilized.
With Watana Dam
Specific assumptions regarding resident and non-resident workforce for construction and operation of the Watana Dam, in-migration, and similar topics will be developed in concert with ADOLWD. Otherwise, the study will use the same assumptions as in the Without Watana Dam Scenario.

25 Subsistence

No Action / Without Watana Dam
Subsistence activities are not addressed in the REMI or the fiscal model.
With Watana Dam
Subsistence activities are not addressed in the REMI or the fiscal model.

Persons Interviewed

Person Interviewed	Company or Organization	Title
Mr. Phil Steyer	Chugach Electric Association	Government Affairs Manager
Mr. Lee Thibert	Chugach Electric Association	Vice President, Regulatory Affairs
Mr. Arthur Miller	Chugach Electric Association	Director, Regulatory Affairs
Mr. Mark Fouts	Chugach Electric Association	Marketing Director
Mr. Cory Borgeson	Golden Valley Electric	President & CEO
Mr. Brad Janorschke	Homer Electric Association	General Manager
Mr. Joe Griffith	Matanuska Electric Association	General Manager
Mr. James Posey	Anchorage Municipal Light and Power	General Manager
Mr. Ed Fogels	Alaska Department of Natural Resources	Deputy Commissioner
Mr. Kevin Banks	Alaska Department of Natural Resources	Petroleum Market Analyst
Ms. Karen Matthias	Council of Alaska Producers	Executive Director
Mr. Jeff Cook	Flint Hills Refinery	Refinery Manager
Mr. Dan Dickinson	Dan Dickinson, CPA	CPA
Ms. Cindi Bettin	Alaska Mental Health Trust Authority	Senior Lands Manager
Mr. Glen Haight	Alaska Department of Commerce, Community, & Economic Development	Executive Director
Mr. Andrew Halcro	Anchorage Chamber of Commerce	
Ms. Deantha Crockett	Alaska Miners Association	Executive Director
Mr. JR Wilcox	Cook Inlet Energy	President
Mr. Neal Fried	Alaska Department of Labor & Workforce Development	Economist
Mr. Scott Goldsmith	University of Alaska, Institute of Social & Economic Research	Economist
Mr. Larry Persily	Federal Pipeline Coordinator	
Ms. Colleen Starring	ENSTAR Natural Gas Company	President
Mr. Curtis McQueen	Eklutna, Inc.	CEO
Mr. James Hemsath	Alaska Industrial Development & Export Authority	Deputy Director
Ms. Sarah Leonard	Alaska Travel Industry Association	President
Mr. Bill Popp	Anchorage Economic Development Corporation	President & CEO
Mr. Robert Wilkinson	Copper Valley Electric Association	CEO
Mr. Jim Dodson	Fairbanks Economic Development Corporation	President & CEO
Mr. Kurt Gibson	Hillcorp	Vice President, AK Midstream
Mr. Jim Jansen	Lynden Transportation	
Mr. John Parrott	Ted Stevens Anchorage International Airport	Manager
Ms. Lorali Simon	Usibelli Coal	Vice President, External Affairs
Mr. Scott Jepsen	ConocoPhillips Alaska, Inc.	Vice President, External Affairs
Mr. Tim Buller	Agrium US Inc.	Senior Specialist, Engineer