ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

ENVIRONMENTAL STUDIES
PROCEDURES MANUAL

SUBTASK 7.11
WILDLIFE ECOLOGY-
BIG GAME IMPACT ASSESSMENT
AND MITIGATION PLANNING

Terrestrial Environmental Specialists, Inc.

Copy No. 16

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

ENVIRONMENTAL STUDIES
PROCEDURES MANUAL

SUBTASK 7.11
WILDLIFE ECOLOGY-
BIG GAME IMPACT ASSESSMENT
AND MITIGATION PLANNING

Submitted by

Terrestrial Environmental Specialists, Inc.

to

Acres American, Inc.

Jeffrey O. Barnes
Environmental Study Manager (TES)

Vincent J. Lucid
Environmental Study Director (TES)

Quality Assurance Coordinator (TES)

Group Leader (TES)

July 1980

This procedures manual is a controlled document. Each copy is numbered and issued in trust to an individual whose name is recorded on a distribution log maintained by Terrestrial Environmental Specialists, Inc., in Phoenix, New York. Amendments to this document, as they are issued, will be sent to the authorized holder of each copy. Upon completion of the project (or by December 31, 1982) all copies of the manual are to be returned to Terrestrial Environmental Specialists, Inc.

Table of Contents

List of Figures

I. INTRODUCTION

One of the most important aspects of the Susitna Hydroelectric Studies is the assessment of likely impacts on big game species that currently use portions of the Susitna drainage. Big game animals are very important to the Alaskan lifestyle and economy. They provide food for many state residents, support a considerable sport hunting economy, and are an integral component in the ability of the state to attract tourists. These factors are magnified on this project due to the location of the Susitna area between Fairbanks and Anchorage, the population centers of the state.

IMPACT ASSESSMENT

The general objective of this assessment is to predict the nature and magnitude of impacts that the proposed Susitna Project may have on seven big game species. The species to be considered are: moose (Alces alces), caribou (Rangifer tarandus), timber wolf (Canis lupus), black bear (Ursus americanus), brown/grizzly bear (Ursus arctos), wolverine (Gulo gulo), and Dall sheep (Ovis dalli). Each of these species will be considered in the analysis of the upstream study area, which is defined as that portion of the Susitna Basin upstream from the proposed Devils Canyon dam. Downstream from the Devils Canyon dam the type of impact will be considerably different. Here, considerations will focus on possible impacts on moose wintering areas along the river to approximately the Delta Islands.

MITIGATION PLAN

Following the preparation of an impact assessment, a detailed mitigation plan will be prepared. During Phase I (pre-license application) this plan will consist primarily of an analysis and comparison of feasible mitigation alternatives. Recommendations will be made concerning the best approach to mitigation including the type of mitigation to be undertaken, the land area to be used, and the type of research to be conducted during Phase II (post-license application). Phase II research will focus upon information needed prior to actual implementation of the plan.

II. TECHNICAL PROCEDURES

The big game impact assessment will be based on data collected by the Alaska Department of Fish and Game (ADF&G), Acres subcontractors, TES subcontractors, wildlife literature, and the experience of the author and other consultants. Details concerning the collection of the data to be used can be found in the specific plans of study and/or procedures manuals for ADF&G Big Game Studies, Plant Ecology Studies, Furbearer Ecology Studies, Hydrology, and Design Development.

IMPACT ASSESSMENT

Upper Susitna Basin

In order to determine the impact of the Susitna Project on big game species in the Upper Susitna Basin (above Devils Canyon), it will first be necessary to identify the habitat/species relationships that are operative, predict impacts on components of the system, and then

predict what changes impacts on system components will have on the entire system. Figure 1 was prepared to illustrate the major components of the system and the most likely pathways of impact that could occur throughout the system.

The following discussion is based on Figure 1 and is divided into sections concerning direct impacts, indirect impacts, and impacts on community dynamics. The discussion of impacts on community dynamics summarizes the flow of direct and indirect impacts throughout the components of the habitat/big game community.

Direct Impacts

Direct impacts may originate from the following four components of the project: the impoundments, the borrow areas, the transmission line and access roads, and increased human activity associated with the construction and operation of the facility. As illustrated in Figure 1, one or more of these four aspects of the project may directly impact moose habitat, den sites, bear populations, wolf populations, Dall sheep populations, and caribou movement patterns. This is not to imply that an illustrated impact will necessarily occur, nor does it infer the extent or ultimate importance of a specific line of impact. Figure 1 simply identifies, for consideration, potential avenues of impact.

Impoundments

The creation of two large impoundments will result in the elimination of a presently unknown quantity of key wintering habitat for moose. This is especially true in respect to the Watana impoundment which will inundate a large area including a portion of the Watana Creek drainage, an area which has already been identified as a key wintering area for moose.

The elimination of moose wintering habitat will probably be the most important big game impact associated with the project. Figure 1, shows that many components of the system can be affected by changes in the moose population. In turn, the factor most likely to affect the moose population is an alteration of habitat. Fortunately this aspect of the project will be the easiest to quantify and thus the identification of direct impact on moose habitat will be quite reliable.

The determination of impact on moose habitat will be based on the following information: 1) the location of key wintering areas for moose, (data supplied by ADF&G); 2) the distribution, acreage, and condition of key plant community types (data supplied by Subtask 7.12); and 3) the extent of inundation (data supplied by Acres). The vegetation assessment (Subtask 7.12), in conjunction with a delineation of the impoundment zone, will enable the determination of how much moose habitat will be eliminated. Not all of the habitat outlined by the vegetation assessment may necessarily be available to moose, due to factors such as snow depth. Therefore, aerial survey data from ADF&G, as well as snow course data from R&M, will be factored in to define what portion of each plant community is actually available and used by moose.

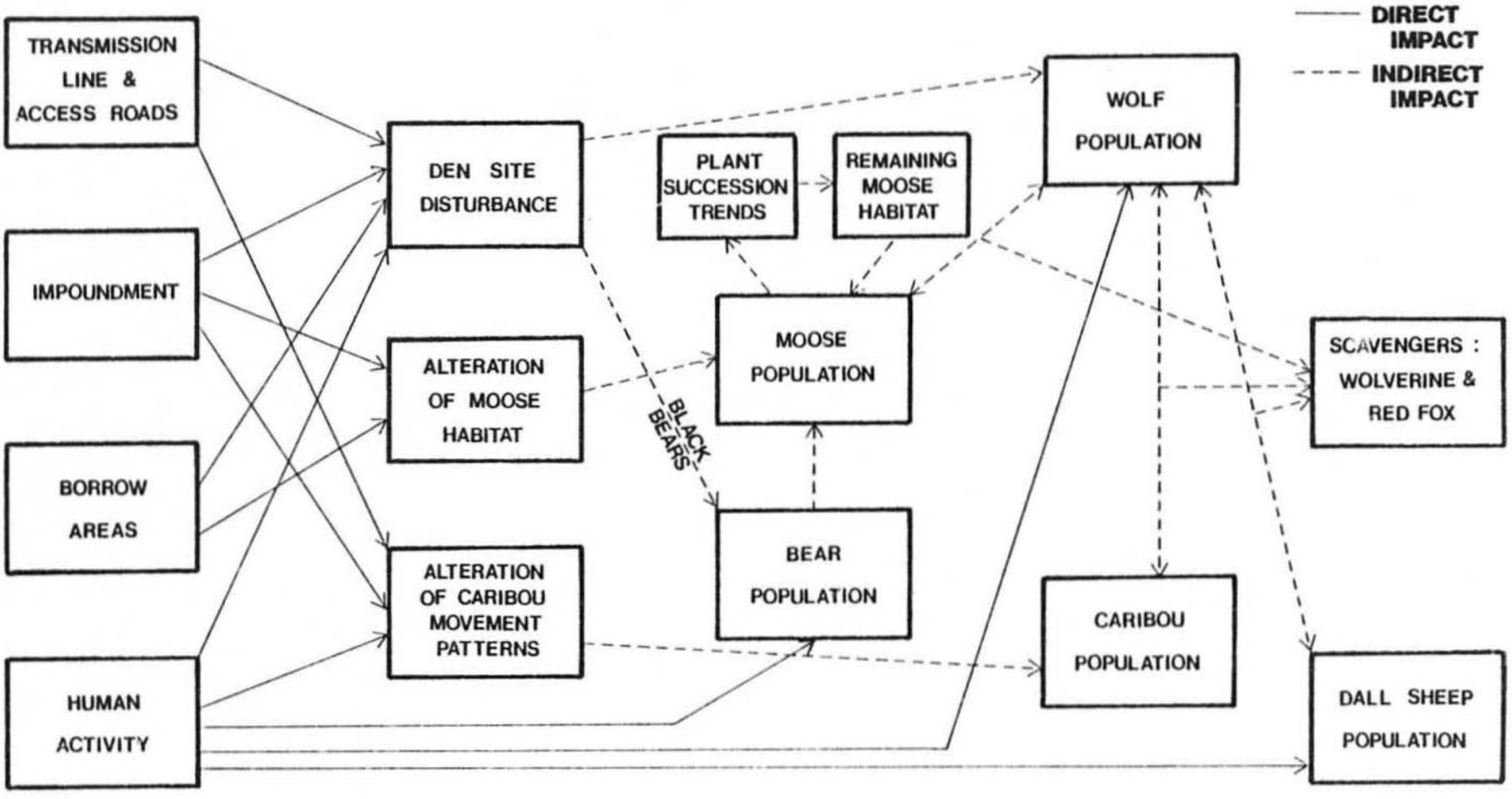

FIGURE 1. POTENTIAL AVENUES OF IMPACT ON BIG GAME SPECIES IN THE UPPER SUSITNA BASIN.

A second type of impact that could result from the creation of the two impoundments is the inundation of den sites. This is especially important in regard to wolf dens, which are often used year after year and the loss of which may result in abandonment of an established territory by a pack. Since many wolf dens are created by enlarging existing red fox dens, it will be important to also consider the elimination of existing fox dens, or suitable fox denning areas, which could represent future sources of new denning opportunities for wolves.

The impact of inundation on wolf dens will be determined by mapping the location of known wolf dens, as determined by radio telemetry (by ADF&G), in relation to the projected impoundment zone. Likewise, maps of existing red fox dens, as well as suitable areas for denning, will be mapped to determine the relative loss of potential denning opportunities.

There is also the possibility of impacting suitable bear denning areas. Although bears are not as limited as wolves as to availability of suitable den sites, certain types of areas may be preferred, or required, and loss of such areas could cause a subsequent impact to occur. Since most brown/grizzly bears den at altitudes higher than the proposed impoundment, it is unlikely their densities will be affected by this aspect of the project. Black bears, on the other hand, may use areas within the impoundment zone for denning and therefore are more likely to be affected. Data from radio-collared bears will be used by ADF&G to establish locations of dens during the winter of 1980-81 and 1981-82. This, in combination with literature on black bear denning characteristics, vegetation maps and topographic maps, will serve as the tool for predicting impact on this important aspect of black bear ecology.

One of the most controversial questions associated with the Susitna Project concerns the possible disruption of migration patterns of the Nelchina caribou herd. The upper reaches of the Watana impoundment may intersect a route which is reported to be presently used for movement to and from a calving area south of the Susitna River in the vicinity of Kosina Creek. Several questions must be answered before a prediction can be made concerning the impact on caribou movements.

The key problem concerns difficulties in predicting caribou behavior. It is anticipated that through aerial surveys and radio telemetry data, ADF&G will document the current movement patterns of the Nelchina herd and supplement that data with historical information. However, it will be very difficult to predict future movement patterns. Caribou behavior is a little understood phenomenon and any prediction will have to be tempered with appropriate qualifications.

Following the determination of current migration routes, the critical aspect of the caribou problem is the condition of the impoundment at the time of the year when they may attempt to cross it. It is possible that the predicted winter drawdown may create conditions such as ice-shelving, mud banks, or mud banks covered with extensive blocks of ice of various thicknesses. Factoring in such variables as bank topography and timing of migration, it will first be necessary to determine what types of conditions the caribou will face if they continue to cross the Susitna in the impoundment zone. This information will be

provided by Acres and R&M. Then the more speculative task of predicting the behavioral response of caribou to those conditions must be dealt with. Although some research has been done concerning caribou response to the Trans-Alaska Pipeline, it may not apply to the conditions in this case.

In summary of the caribou problem, sufficient data will be available to describe the current situation. Data should be available from the engineering and hydrology disciplines to enable a prediction of conditions that caribou face if they are still crossing the Susitna River in the zone of the proposed impoundments. A prediction of caribou response to these conditions will be speculative but will be based on all available literature and scientific opinion.

Borrow Areas

The use of certain non-impoundment land for the acquisition of construction materials (borrow areas) will result in disturbance and elimination of some big game habitat. The two likely impacts of borrow areas are further elimination of moose habitat, and possible disturbance of den sites for wolves and bears. The same approach to identifying these two areas of impact will be followed as previously discussed for impoundment-related impacts.

Transmission Line and Access Roads

It is anticipated that the most likely impact of the construction and operation of the transmission line and access roads will be on the disturbance of den sites and alteration of caribou movement patterns.

In this case, it is more likely that disturbance of den sites will result from the presence and use of the transmission line and road, rather than habitat removal as would occur in the case of the impoundments and borrow areas. The procedure to be used in predicting impact in this case will consist of first comparing the location of the line and road in relationship to known wolf dens and territories, as well as areas determined to be suitable for bear denning. Scientific literature and the experience of researchers in similiar situations will then be used in order to generate a prediction concerning likely impacts.

The prediction of impact on caribou movement is also different than that discussed in regard to the impoundments. Although the problem of predicting caribou behavior remains the same, the transmission line and access road represent unnatural structures to the caribou. Therefore, experience gained through research and comparable problems along the Trans-Alaska Pipeline may prove of use in this case. Again, data provided by ADF&G concerning caribou migration routes and calving areas will be mapped in relation to the access road and transmission line routes.

Human Activity

Predicting the impact of increased human activity on big game species will probably be the most subjective portion of the big game impact assessment. Although sufficient data will exist to enable

comparing areas of various degrees of human activity to key behavioral and habitat parameters of the big game populations, it will be difficult to project behavioral responses with the same degree of accuracy as with some other impacts. Human activity will include both construction and operation activities, including the presence of people around camps, construction sites, traffic on the access roads, and all air traffic associated with the project.

The impact analysis will consider the direct impact of human activities on den sites, caribou movement patterns, wolf populations, bear populations, and Dall sheep populations. This will be accomplished by mapping loci of human activity and ranking them in order of intensity and duration. This will then illustrate the juxtaposition of various levels of activity to caribou migration routes, wolf dens, key bear foraging areas, etc. As a result it will be possible to determine, on a relative basis, where and in regard to which species, the impact of human activity is most likely to occur. As in some other areas of concern, information gathered during the construction and operation of the Trans-Alaska Pipeline will be consulted and may prove useful in predicting behavioral responses to this aspect of the project.

The Susitna Project may result in an increased utilization of the Upper Basin by sport hunters. The extent of change will depend to a large extent on whether or not the access road is opened to the public. The big game impact assessment will consider this potential change and project what effect it will have on big game populations. Although this aspect of the project could have a significant effect, the impact can be mitigated, if deemed necessary, by altering the game regulations.

Indirect Impacts

Following the determination of direct project impacts on den sites, moose habitat, caribou movement patterns, wolf, bear and sheep populations, the process will be carried one step further to determine indirect impacts. As illustrated on Figure 1, there is some overlap where both direct and indirect impacts may be operative. The following discussion concerns the prime avenues of indirect impact including impacts of den site disturbance on wolf and bear populations, impact of moose habitat alteration on moose populations, and impact of alteration of caribou movement patterns on caribou populations.

Den Site Disturbance

The disturbance of den sites through either increased human activity, inundation, or borrow areas, could result in changes in the population of wolves and bears. Currently used wolf dens and bear denning areas, particularly those of black bears, will be mapped and compared to areas to be inundated and centers of human activity.

The degree to which wolf and bear populations may change as a result of den disturbance will be difficult to determine. It will depend to a great degree on the availability of alternative dens or areas suitable for denning. It is anticipated that sufficient data will be gathered by ADF&G concerning the physical characteristics of den sites, associated territories, and foraging areas to predict the relative extent of impact on wolf packs and black bears.

Alteration of Moose Habitat

The most important aspect of altering moose habitat will be the reduction of key wintering areas. This, in turn, could cause a decrease in the moose population in much of the Upper Susitna Basin. During Phase I it will be possible to determine the relative percentage of moose winter habitat that will be lost. Phase II studies will include a detailed analysis of browse quantity and quality and will thus enable a refinement of the net loss of moose winter habitat.

In a general manner, as previously described, it will be possible to predict the extent of reduction in the capacity of the habitat to support moose populations in winter. To accomplish this will entail comparing not only the area of habitat loss, but also its relative use to various subpopulations of moose. Population data will be collected by ADF&G in the form of aerial surveys and radio telemetry studies. The mapping and quantification of population and habitat data will enable the identification of those subpopulations which will be impacted, and the degree of impact. This will be expressed as number of moose that can be supported, as well as the availability of alternative wintering areas.

Alteration of Caribou Movement Patterns

The impact on populations of altering movement patterns of caribou will be more difficult to assess than the impact of habitat alteration on moose populations because the former indirect impact can take the form of either a change in caribou utilization of the Upper Susitna Basin, or a change in the total herd size, or a combination of both. The assessment of the caribou impacts will be based on aerial surveys and radio telemetry data which will identify current migration routes, the timing of movements, and habitat needs. These data will be mapped in comparison to project aspects such as impoundment boundaries, access roads, transmission lines, and centers of human activity. A key factor in determining the extent of impact on caribou populations will be the description of ice and water conditions at likely crossing points. The ultimate prediction of impact on the Nelchina herd will have to be subjective, but will utilize all available data, literature, and scientific opinion.

Impacts on Community Dynamics

The big game community in the Upper Susitna Basin is a dynamic system. Species are constantly interacting with habitat components and other species. As a result, any impact, either direct or indirect as illustrated on Figure 1, may affect some or all components of the system. Therefore, the final impact analysis will attempt, by using the previously described direct and indirect impact predictions as tools, to describe the total change in the big game community that will take place as a result of the Susitna Project. This will require a thorough consideration of key community relationships. Figure 1 shows that the relationship between moose populations and moose habitat is critical to the entire system. Likewise the predator-prey dynamics involving bears, wolves, moose, and caribou are of paramount importance. The following is a general description of how these factors will be analyzed. A detailed discussion is not included at this time since many specifics of the approach will require some baseline data before techniques can be selected.

Moose-Habitat Dynamics

Any alteration of moose habitat will result in some level of impact on the Susitna moose population. This, in turn, will alter the interrelationship between the moose population and the remaining available habitat. As stated previously, sufficient data will be gathered from the vegetation analysis and moose population studies to determine the amount of winter habitat removed and the amount remaining. It can be assumed that additional browsing pressure will then be applied by the moose on the remaining habitat. It will therefore be necessary to determine how much browsing pressure the remaining habitat can support. This will be done using data on the moose population, the general amount of habitat remaining, the plant successional trends that are operative, and the current condition of browse in the remaining area.

Predator-Prey Dynamics

The final analysis, based upon all preceding considerations, will assess the possible alteration of predator-prey dynamics in the Upper Susitna Basin. The key predator-prey relationship is between moose and wolves, with caribou and wolves being a secondary relationship. Bear predation on moose calves will also be considered in the analysis.

As illustrated in Figure 1, the relationship between most predator and prey species is a two-way relationship. This is especially true in regard to wolves preying on moose, caribou, and sheep. The abundance of all or any of these prey species will affect the number of wolves that the area can support. Likewise the number of wolves in an area can, under certain circumstances, affect the density of one or all of these prey species. Therefore, any change in either wolf numbers or prey numbers as a result of the project can result in a shift in predation pressure and subsequent changes in the numbers of other species. By using data concerning direct and indirect impacts as previously discussed, especially impacts on moose, an analysis will be conducted to determine possible ramifications to the big game predator-prey system.

Lower Susitna Basin

The big game impact assessment concerning the area downstream from the Devils Canyon dam to the Delta Islands will be directed at determining what effect an alteration of flow regimes will have on moose habitat and subsequently on moose populations that winter along the lower Susitna. The major avenue of impact that could occur in the downstream area is a change of moose habitat resulting from both annual and long-term changes in the flow regime of the river. Data from a variety of studies will be required to assess the impacts on moose.

It is currently felt that moose move into the riparian zone along the lower Susitna during the winter and feed on browse species on islands and the flood plain immediately adjacent to the river. To determine the extent of use by moose, ADF&G will conduct aerial surveys during the winter months and also monitor radio-collared moose year round. This will enable the identification of key wintering areas along the river, as well as determine the extent of possible impact on moose for a considerable distance on both sides of the river.

Both ADF&G and TES subcontractors will assess the general status of moose browse along the river during Phase I. A more detailed browse study, including data on quantity, quality, availability, and utilization will be performed during Phase II. The Phase I data will enable a general assessment of the quality of moose habitat and, in combination with moose population data, allow for the identification of critical wintering areas.

To utilize this information in a predictive fashion, Phase I studies to be conducted by TES subcontractors will attempt to gain an understanding of plant succession trends along the river. Since it is likely that the key factor affecting the succession process is periodic flooding, the validity of the entire impact assessment will depend on predicting changes in the hydrology of the lower Susitna. A description of likely changes in river hydrology and resulting changes in river morphology will be provided by R&M. By understanding both annual and long-term hydrologic parameters it will be possible to generate a prediction of how the riparian areas and thus plant succession trends may be altered by the Susitna Project. These factors directly influence moose populations over a very large area along the lower Susitna Valley.

MITIGATION PLAN

General Approach

The mitigation plan will be based on the impact assessment as previously described. An attempt will be made to develop a mitigation plan taking into consideration not only species-specific impacts but also the impacts on community relationships.

To assure that all mitigation alternatives are thoroughly considered and developed, a mitigation team will be created. The following TES personnel or subcontractors will comprise the working core of the mitigation team. Mr. Edward T. Reed (TES), Wildlife Ecology Group Leader, will function as team coordinator. Mr. Reed will work closely with Mr. Joseph M. McMullen (TES), Plant Ecology Group Leader, Mr. William Collins, Plant Ecology Investigator (University of Alaska), and the big game expert who will perform the impact assessment. In addition, it is suggested that at least one representative from the following organizations serve on the mitigation team: Alaska Power Authority, Acres American, Inc., Alaska Department of Fish and Game, United States Fish and Wildlife Service, United States Bureau of Land Management, and Cook Inlet Region Incorporated.

Most of the planning and development work associated with this task will be performed by the core members of the team. Prior to the commencement of actual planning, input will be solicited from other team members in order to compile specific concerns, opinions, suggestions, and philosophies. It is anticipated that a series of progress meetings will be held throughout the mitigation planning process in order to brief team members on the status of the effort and to present opportunities for discussion and group decision making concerning key issues and problems.

Identification and Classification of Impacts

The first step in the preparation of a mitigation plan will be a thorough review of the impact analysis. During this review, impacts will be grouped into two catgories: impacts that may be avoided or minimized by alteration of project design and operation, and unavoidable impacts. In each case information identifying the nature of the impact, species, and land area involved will be analyzed. Then a list of feasible mitigation alternatives will be developed and analyzed.

Analysis of Mitigation Alternatives

Avoidable Impacts

Detailed consideration will be given to means of avoiding impacts. Depending on the nature of the impact, a variety of actions can be recommended. Aspects of the Susitna Project that will be considered include, but are not limited to: extent of the impoundment zone, alteration of downstream flow regimes, location of access roads and transmission line, and timing of certain construction and operation activities. The analysis of such alternatives will require input from Acres engineers.

Unavoidable Impacts

This portion of the effort will consider mitigation alternatives that could be implemented to compensate for unavoidable impacts on big game populations. Again the impact assessment will provide most of the data necessary to accomplish this analysis. The ultimate goal of this effort will be to develop a big game management program that will either allow for the maintenance of existing populations or the enhancement of other populations to the extent necessary to offset project-related losses.

The analysis will consist of three major parts: management options that can be implemented, availability of suitable land areas and the legal feasibility of executing management options, and finally, the projected cost of implementing the mitigation plan.

One question to be answered is whether or not there is sufficient land of a suitable nature available within the Upper Susitna Basin to manage for increased big game populations. If not, it will be necessary to identify alternative areas where populations can be enhanced through management practices. This will require an investigation of both present habitat conditions, game populations, land ownership, and associated regulations governing the use of such land.

Recommendations

The end product of the Phase I mitigation planning will be a recommended plan of mitigation. This will probably be a general

plan outlining the most promising management options, the best land area to be used, and an estimate of mitigation costs. It is unlikely, due to the long-term studies being conducted by ADF&G, that sufficient data will be available prior to license application to develop a plan that can be executed. The recommended plan will require refinement as additional data are received. This is especially true concerning detailed moose habitat data, which is a Phase II effort. Included in the Phase I effort will also be recommendations identifying additional research that will have to be conducted in order to fine tune the mitigation plan to the point where the maximum benefit will be realized from its implementation.

III. DATA PROCEDURES

There will not be any data collected directly by investigators working on the big game impact assessment and mitigation plan. All data used in this assessment will be provided by ADF&G, Acres, Acres subcontractors, and TES subcontractors.

IV. QUALITY CONTROL

TES will depend on quality control procedures implemented by the collectors of data to be used in the big game assessment. The actual organization of data required to produce an impact assessment will be based to a great degree on the professional opinion and philosophy of the impact investigators. To assure that the impact assessment is thorough and has adequately addressed all issues and incorporated all feasible contingencies, several experts outside of the project team will be contacted and asked to review and comment on the impact assessment and mitigation plan. This will allow for the review of all practical aspects of the situation and will avoid the possible problem of confining the assessment entirely to the expertise and opinion of one or two individuals.

V. SCHEDULE

The big game impact assessment and mitigation planning will be a continual process throughout Phase I. Since many aspects of the analysis are dependent on receipt of data from other sources, there will be an uneven distribution of time spent on these efforts. Some field time will be expended to gain an in-depth familiarity with many aspects of the species and habitat components. This will be necessary to place data into perspective with all project components. Figure 2 is a schedule of activities as currently envisioned.

ACTIVITY	1980												1981												1982					
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J
Literature Review		X	X	X							X		X	X					X	X	X									
Field Reconnaissance			X					X						X				X				X								
Coordination Meeting										X						X						X								
Impact Assessment & Mitigation Plan Prep.															X	X				X	X	X	X							
Report Preparation																		X	X					X	X					
Report Due to TES																				X						X				

Figure 2. Big game impact assessment and mitigation plan preparation schedule.

VI. PERSONNEL

The following key personnel will be involved in the preparation of the impact assessment and mitigation plan. Additional external review experts will be consulted at a later date.

Edward T. Reed - Wildlife Ecology Group Leader, TES; several years experience in assessing project impacts on wildlife populations and coordination of study efforts.

Joseph M. McMullen - Plant Ecology Group Leader, TES; several years experience in vegetation analysis and community succession process.

William Collins - Plant Ecology Investigator, University of Alaska Agricultural Experiment Station; thorough familiarity with big game habitat analysis procedures.

Impact Expert - To be selected by September 1, 1980; extensive experience with big game species and habitat in subarctic regions.