Feasibility Study

Copper Valley Intertie

State of Alaska, Department of Community and Regional Affairs, Division of Energy

Volume 2

Environmental Report and Initial Public Comment Electric System Analysis

April 1994

R·W·BECK

in association with

Dames & Moore, Inc.
Power Technologies, Inc.

Copper Valley Intertie Feasibility Study

(PROVIDED AS A SEPARATE BOUND DOCUMENT.) **VOLUME 1**

VOLUME 2

(PROVIDED AS A SEPARATE BOUND DOCUMENT.) **VOLUME 3**

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3.0 COMPARISON OF POTENTIAL IMPACTS ASSOCIATED WITH RESOURCE ALTERNATIVES

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SUPPLEMENT TO ENVIRONMENTAL REVIEW

As part of the feasibility evaluation for the Copper Valley Intertie, the Alaska Department of Community and Regional Affairs (DCRA) contracted with R. W. Beck, Inc. and Dames & Moore to perform a feasibility study. Reports were prepared and public meetings were held. During the public meetings, a number of entities raised issues regarding the social and environmental impacts and costs related to cultural, tourism, recreation, quality of life, and "wilderness-related" resources that may be affected if the Intertie is constructed.

The primary purpose of this Supplement to Environmental Review is to identify and describe methods that may be used at a later date to determine the value of these environmental and socioeconomic resources impacts. R. W. Beck reviewed existing reports, documentation of the public meetings, and comments received on the draft Feasibility Study and prepared this supplement. The supplement discusses environmental resources valuation methods, regulatory issues and necessary compliance that could be expected if the Copper Valley Intertie is built, and provides a comparison of potential impacts associated with the Intertie and other resource alternatives considered in the Feasibility Study. A comparative matrix of potential impacts for the various resource alternatives is shown on page 18 of this supplemental report.

1.0 ENVIRONMENTAL RESOURCES VALUATION METHODS

Nonmarket values of environmental resources can be determined using various direct and indirect methods. Methods for evaluating environmental effects associated with proposed project development against the value of the existing environment were initially proposed in the late 1950s. Applications of these methods came into greater use following enactment of NEPA in 1970. Executive Order 12291 issued by President Reagan in 1981 requires the federal government to prepare benefit-cost analyses of major regulations. Courts are requiring valuation information for assessing natural resource damages. State public utility commissions consider this information in establishing environmental cost elements of proposed rates for utility services.

Models are employed to estimate damage from pollution and environmental costs resulting from development, and are often employed in trade negotiations. A review of a variety of literature identified direct and indirect methods and presented applications. The most consistent theme encountered in the literature is the need for adequate, comprehensive, and current data in order to assess the varying levels of public acceptance of proposed development.

1.1 Direct Approach to Assessing Nonmarketed Environmental Resources

Direct approach models identify and quantify public reactions to hypothetical changes. A comprehensive baseline estimate of environmental effects due to normal occurrences (no action alternative) is essential to measure various levels of expected effects due to proposed development. Several direct approach models are discussed below.

1.1.1 Contingent Valuation Method

The two concepts most widely employed in assessing potential reactions to development proposals are the willingness to pay (WTP) for an environmental benefit, and the willingness to accept (WTA), representing compensation for a loss of environmental quality. According to the literature reviewed as part of this study, the fastest growing nonmarket valuation technique is the Contingent Valuation Method (CVM), also referred to as the Bidding Method. CVM uses the WTP/WTA concept to elicit how people would respond to hypothetical changes in some environmental resources. In the absence of actual market data, CVM seeks to discover how people would value certain environmental changes by directly questioning a sample of the affected population. CVM is applicable either as the singular method of investigation or in combination with other valuation techniques.

Hypothetical scenarios are developed and in the initial phase, participants are asked for their response to the proposed hypothetical change. These initial responses are then correlated with responses to a later question that poses the question in a direct relationship to a choice that can be made (similar to the hypothetical example).

Respondents are asked to indicate their value for a public good, usually by specifying the maximum amount they would be willing to pay to obtain or retain it. Information is gathered through surveys involving direct valuation questions; discrete take-it-or-leave-it questions; and matching, ranking, quantity, bidding, or double-bounded formulations (Bergstrom and Stoll 1993). The total value of a good or service is estimated by multiplying the average willingness to pay by the number of households in the relevant population.

A number of techniques are available, including an approach adopted by the U.S. Department of Interior, discussed below and used by the U.S. Fish and Wildlife Service since 1975 as part of its National Survey of Fishing, Hunting, and Wildlife Associated Recreation. All CVM techniques employ instruments designed to elicit individuals' preference for specific environmental conditions and the monetary value placed on retention. Studies have employed more sophisticated techniques that attempt to eliminate biases by simulating real market behavior by assigning fixed budgets and requesting participants to trade off one choice against another.

The most common application employs questionnaire surveys using a sample of the population representing all perspectives. A check on participants' total and disposable income and education is recommended to rule out clearly unrealistic statements and improve the accuracy of the process. The standard CVM survey involves:

- Description of a simulated or hypothetical market to the respondent. For example, the respondent is asked to assume that payment into a special trust fund is the only way society can finance protection and management of the particular area or species of concern.

- The respondent is requested to use this market to indicate his or her maximum willingness to pay for protection of the area or species rather than do without it, assuming this is the only way it can be financed.

- The specific wording of the question is often pretested to make the question as nonthreatening and believable as possible. Internal checks within the questionnaire (called protect checks) are made to see if bids reflect true values, or are simply a reaction against some aspect of the hypothetical market.

Results from the survey are employed to represent total valuation likely to be placed by the whole population. The aim of the exercise is to discover individuals' rate of substitution between environmental quality and hard cash.

1.1.1.1 Case Studies

Case studies demonstrating empirical valuation of benefits have been performed for grizzly bears, bighorn sheep, whooping cranes, and other endangered species, wilderness areas, wild and scenic rivers, water quality, and air quality using the CVM method (Loomis and Walsh 1986).

Protection of water quality was the first resource for which empirical estimates of option, existence, and recreational values were estimated using CVM (Walsh et al. 1978). In this study, annual values (based on 1978 dollars) were established of $56 per household for recreation use, $22 per household for option value, $25 per nonuser, and $34 per user household for existence value, which is defined as clean water as a basic requirement for natural habitat for plants, fish, and wildlife, assuming that the respondent would not actually use the river for water-based recreation, and $17 per nonuser household and $33 per user household as bequest value. In 1983, a similar study performed by Desvouges et al. calculated annual existence values of improved water quality from $42 for nonusers and $66 for users. CVM is used in litigation over liability and damages under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA).

A recent highly publicized evaluation use of CVM was in litigation regarding natural resource damages due to the Exxon Valdez oil spill. The WTP method has also been used to evaluate timber harvest against wilderness preservation, avoiding migratory bird kills, and preventing damage from small versus "all" oil spills.

A study of wildlife viewing values for Wyoming bighorn sheep and grizzly bears based on data collected in 1978 and published in 1983 estimated the expected recreational benefits and existence values at $21 and $23 per respondent at an annual basis, respectively. The existence values per survey respondent on an annual basis averaged $24 for grizzly bears and $7 for bighorn sheep (Brookshire 1983). In 1984, a CVM survey of the value of endangered whooping cranes, including visitors to the Arkansas National Wildlife Refuge in Texas and a companion direct mail survey to selected residents of several locations in Texas and the metropolitan centers of Atlanta, Chicago, Los Angeles, and New York, resulted in an average annual household option price of $17 for visitors, $10 for Texas residents, and an average of $13 for the sampled cities. Existence values averaged $9 on an annual basis for visitors and a little over $1 for others. The aggregated estimate for the United States for option and existence values for the cranes was $573 million annually (Stoll and Johnson 1984).

The CVM method has also been used to assess society's willingness to pay for preservation of threatened, endangered, or rare species and related habitat. Information regarding the species and habitat of concern, including an animal's characteristics and endangered status are required. Preservation bids tend to be low where the population size is assumed to be adequate to assure continued existence or if extinction is considered inevitable. Physical attractiveness of the species has been found to be influential in studies performed (Samples, Dixon and Gowen 1986).

A 1985 study surveying average households' willingness to pay to protect threatened and endangered species estimated that $58 (1985 dollars) in higher taxes and prices would be acceptable to improve management programs to facilitate removal of all listed and candidate fish and wildlife species from the Threatened and Endangered Species Lists in the United States. The breakdown was 29 percent for recreation, 20 percent for option values, 23 percent for existence values, and 28 percent for bequest values (Walsh et al. 1985).

1.1.1.2 Shortcomings/Limitations of CVM

The underlying weakness of CVM is that it does not use observations of actual market behavior and does not require consumers to back up choices with cash. WTP is often several times lower than the WTA amount; WTP requires valuing a benefit while WTA relates to imposition of a cost.

In addition, the assessed value of a public good is demonstrably arbitrary in that willingness to pay can vary over a wide range depending on whether the good is assessed on its own or embedded as part of a more inclusive package. WTP estimates can be larger when payment is extended over several years as opposed to a one-time outlay. Where a range of options are presented, WTP can vary depending on whether the item appears first or third in the list, as was determined in a 1983 survey of opinions regarding improved visibility in the Grand Canyon performed by Tolley and Randall for the USEPA.

1.1.2 Discussion of Department of the Interior Experience

The U.S. Department of the Interior promulgated regulations in 1986 to guide federal agencies, states, and Indian tribes acting as trustees of natural resources in calculating damage that remains following Superfund cleanups based on the CVM method. Interior's regulations were largely upheld by a federal appeals court in 1989. Interior proposed a new draft regulation to meet the court's objections and issued them for comment. Several commenters stated that there was new information about the reliability of CVM that Interior should consider. Interior decided to ask for another round of comments and on March 14, 1994, issued a notice requesting additional comments by September 7, 1994, on several items:

- Whether standards should be set up for the working of poll questions.
- Whether focus groups should be used to test the questionnaire.
- Whether questions should be open-ended (e.g. "How much would you pay?") or closed-ended (e.g. "Would you pay X dollars to ...?").
- Whether polling should be done by mail, telephone, or in person.
- Whether results should be tested for consistency with standard economic theory (e.g. that choices do not change abruptly with small changes in price).

- Whether trustees should be asked to document whether they were dealing with long-lived damage to resources with few substitutes. (If there are many substitutes, such as undamaged habitat of the same type as that contaminated, eventual damage should be less.)

1.1.3 Existence Values

Existence, or nonuse, values refer to the corresponding welfare change given a change in a public good that does not alter purchasing behavior. Such values require weak separability of nonmarket goods from market goods, and serve as a catch-all for values that are nonconsumptive or indirect. Pure existence value is dependent on subjective representation of individuals' choice contexts.

John Krutilla first identified the possibility of existence values in 1967 and developed an argument in terms of decisions that might irretrievably alter a unique natural environment. Krutilla proposed that it was important to consider the assets of natural resources to one's personal sense of well-being by describing services provided. Services ranged from on-site enjoyment to just knowing that "it" is there. Values are set based on elements of the natural environment and are not confined to people who never use a resource.

1.2 Indirect Approach to Assessing Nonmarketed Environmental Resources

Most indirect approaches are based on the revealed preference approach, which is similar to the customer recreation demand economic theory. Examples of this approach include the recreation demand model, the household production function model, and the hedonic property value application.

The revealed preference approach relies on the concept that an individual's choice among alternatives, given their prices, conveys information. Employing this approach to nonmarketed environmental resources requires detailed assumptions so that demands can be estimated and predictions developed.

The basis of this approach is to focus on the marginal rate of substitution (MRS) between the nonmarketed environmental service and some number as an economic measure of the individual's real value for the last unit consumed.

The literature demonstrates that experience with indirect methods confirms their use in determining nonmarket values, even though they are made outside of direct markets for commodities being valued (Smith 1993). In the case of recreation sites and the travel cost recreation demand framework, the record is reasonably good. With hedonic models (see below), the empirical record is very limited.

Several indirect approaches to assessing nonmarketed environmental resources are discussed below.

1.2.1 Travel Cost Method

The Travel Cost Recreation Demand Model (TCM) is the most straightforward of the indirect methods. This method was initially proposed in 1947 by Harold Hotelling, revised by Clawson and Knetsch in 1966, and is often touted as one of the "success stories" of nonmarket valuation. Consumer surplus for outdoor recreation has traditionally been estimated using TCM, a model which recognizes that visitors to a recreation site pay an implicit price for their experience equal to the cost of travel, including the opportunity cost of their time. The Clawson-Knetsch model is referred to as the Zonal Travel Cost Method (ZTCM); an alternative developed by Willis and Garrod is referred to as the Individual Travel Cost Method (ITCM). Both of these models are discussed below.

The TCM method has been applied mainly to public recreation sites with free or minimal admission charges, where it is argued that the cost of travel is analogous to an entry fee. Visitation rate is related to the cost of travel. It has been used widely in the United States and the United Kingdom to measure the value of public recreation locations and has also been applied to wildlife viewing sites.

1.2.1.1 Variations of the Travel Cost Method

Zonal Travel Cost Method

The Zonal Travel Cost Method works well where sites are subject to substantial use as the method assesses the travelers willingness to pay and where data of some kind on total annual visitor numbers is available.

Data requirements are met by performing surveys of the number of visitors to the site, their place of origin for the journey, and basic socioeconomic features, including income, education, etc. The surveys can be designed to classify visitors into constituent elements, including wildlife viewing, hunting, fishing, wildlands experience, hiking, climbing, off-road vehicle recreation, subsistence use, and cultural activities. Visits are often multipurpose and clusters of related activities may be appropriate. The duration of their journey and direct travel expenses need to be computed and a value placed on their time. The total population in each travel zone is estimated.

The technique is straightforward and in its simplest form begins by dividing the area surrounding the site into concentric circles and thence into zones. The areas of concern are identified and benefits are estimated by deriving a demand (marginal valuation) curve for the various areas of concern. In order to build up a marginal value schedule, the number of trips that take place at a range of prices must be observed. Visitors are sampled to determine where they began their travels and where they are going within the area. Visitation rates are calculated for each zone. The price to visit a specific area is comprised of the visitors' travel cost and the value of what visitors forgo by using their time to undertake the trip in question rather than using it some other way.

Sampling would occur throughout the recreational season with surveys covering week and weekend days in proportion to known patterns of visitor behavior. This pattern would be established by interviewing outfitters, local Chambers of Commerce or Visitors Bureaus, and tourism businesses. Two interviewers would be used in each specified area of concern covering two visitor points within each area. Surveys are compiled and a statistical regression is carried out for each zone relating visitation rates to travel cost. Other socioeconomic variables may also be introduced, such as income. Data on income and socioeconomic characteristics can be derived from surveys of visitors and, if appropriate, from the most recent population census for the area of origin of the visitors.

A demand curve is estimated from a regression equation relating trips per person from each zone to the travel cost from that zone. Consumer surplus per person for each zone is derived and a total consumer surplus estimated.

The model is developed to address differences in preferences or incomes across zones, variations in travel times, differences in the availability of substitute areas to visit, and changes in environmental quality at different areas. The survey should include reasonable substitute areas to visit in order to assess whether adequate substitute sites are available for the activities that attracted visitors to the study areas.

This method is fully described in *The Benefits of Environmental Improvement: Theory and Practice*, written by A. Myrick Freeman III in 1979.

Individual Travel Cost Method

Willis and Garrod (1991) developed an alternative to the Clawson-Knetsch model for instances where the number of observations is small in relation to areas and population and where individuals do not simply wish to purchase recreation, but desire combinations of views, wildlife, streams, and other site attributes. The Willis and Garrod model samples individuals across many sites in order to permit variability in attributes and is referred to as the Individual Travel Cost Method (ITCM). ITCM resulted in significantly lower estimates than ZTCM. ITCM would appear to require a more labor-intensive survey and has not been widely reported in the literature.

1.2.1.2 Limitations of TCM

General limitations of TCM methods and models include the following:

- Formal assumptions are made about individuals' behavior in order to construct the demand curve: all users get the same total benefit from the visit and use of the site; and people in all distance zones would make the same number of visits at a given monetary cost.

- The method requires a great deal of data.

- The shadow value of a recreational traveler's time is a difficult concept. Using salary as a basis is problematic, particularly where the trip takes place in leisure hours or involves people not active in the labor market (i.e. elderly, children, and unemployed). Studies vary regarding the value of time taken outside of working hours, and a range of one-fourth to one-half the wage rate is used in one of the studies assessed (Freeman 1979).

- Some trips are multi-purpose.

- Travel may be part of the pleasure of the visit.

- Benefits rely on consumer surplus thereby ruling out direct comparability with valuation techniques that do not, for example the Contingent Valuation Method. TCM generally provides an estimate of the upper limit of indications of willingness to pay. However, TCM does provide minimum estimates in the sense that it omits option and existence values, as well as benefits enjoyed by people who value the site for wildlife, clean air, but who do not visit the area.

- The main virtue of TCM is that it rests on observed behavior of people. It does not, however, provide valid information regarding projected changes in site conditions as its purpose is to measure the enjoyment of the existing site conditions.

1.2.2 Household Production Function Model

A second class of indirect valuation methods attempts to infer an individual's value for some aspect of environmental quality where that individual's actions can influence how it is experienced. This method is called the Household Production Function (HPF) Model. The HPF framework uses people's actions to isolate features of their values. Choices involve reallocating expenditures on market commodities or time to adjust to a change in the amount of some nonmarketed resource. The HPF framework offers a rationale for imposing restrictions on preferences so observable decisions can provide the necessary valuation information.

Physical damage functions are the most common application of HPF. The HPF model can also be used to analyze changes in behavior to mitigate damage, such as purchasing a filter to remove water pollutants. The model can also help evaluate expenditures for a commodity that is assumed to be a perfect substitute for the services of an environmental resource.

1.2.3 Hedonic Price Method

The Hedonic Price Method (HPM) can be used to value certain types of environmental assets by linking wages or house prices to environmental attributes. HPM provides information regarding the marginal rate of substitution and describes how a set of prices for each commodity defines the equilibrium. Given a large number of different commodities, equilibrium is characterized by a price function that describes how prices change with the characteristics of the commodities. The model requires an extensive database regarding site-specific characteristics. Market participants must also be aware of the site connection and share a common basis for recognizing it if these characteristics are to influence the price.

This method works well where there are enough residents located near the area of concern and enough cases of house sales to provide a base. This is not the situation posed by the proposed Intertie and therefore the HPM method is not appropriate for the lands that would be affected by the Intertie.

2.0 REGULATORY COMPLIANCE

This section presents an overview of the laws, statutes, regulations, and other project approvals that will be required in the future if the Copper Valley Intertie investigations proceed.

2.1 Federal Statutes and Regulations

The following discussion of permit requirements is not considered exhaustive. Further investigation of required permits is recommended so that all permitting can be coordinated.

2.1.1 National Environmental Policy Act (NEPA) and Implementing Regulations

The proposed Copper Valley Intertie would occupy lands of the United States managed by the U. S. Bureau of Land Management (BLM) and stream and wetland crossings would require review under the Clean Water Act, Section 404, by the U. S. Corps of Engineers. The proposed project will be reviewed under NEPA to determine the extent of environmental review required. The BLM and the Corps would be expected to serve as lead agencies. Other agencies may elect to be cooperating agencies.

NEPA requires in Section 102(C) that all agencies of the federal government "include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on (i) the environmental impact of the proposed action, (ii) any adverse environmental effects which cannot be avoided should the proposal be implemented, (iii) alternatives to the proposed action, (iv) the relationship between local, short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and (v) any irreversible and irretrievable commitment of resources which would be involved if the proposed action should be implemented.

Six specific objectives are listed in NEPA: (1) responsibility to future generations; (2) provision of a quality environment for all Americans; (3) prevention of undesirable impacts; (4) preservation of national heritage; (5) achievement of a population-resource balance; and (6) enhancement of renewable resources and recycling of nonrenewable ones.

The scoping and environmental impact statement processes are two important aspects of the NEPA process. These are discussed briefly below.

2.1.1.1 Scoping

Scoping is the initial stage of formal review under NEPA. The following activities occur under scoping:

1. Determination of Lead Agency — Federal agencies who will be involved in project approvals (probably Bureau of Land Management [BLM], who will issue rights-of-way across Federal lands and the U. S. Army Corps of Engineers, who will review project activities under the Clean Water Act Section 404 regarding activities in the vicinity of wetlands and waterways) determine who will be lead agency and identify cooperating agencies. Cooperating agencies may include the U. S. Fish and Wildlife Service, who will identify any Threatened or Endangered Species and conduct consultation under Section 7 of the Endangered Species Act if any adverse effects are identified. The National Park Service, the BLM Archaeologist, Native American Entities, and the State Historic Preservation Officer (SHPO) will review the proposed project for any potential effects on properties or resources protected under Section 106 of the National Historic Preservation Act and related statutes. Other Federal requirements may also be identified. The lead agencies establish a work plan and schedule for reviewing the proposed project under NEPA and other relevant statutes.

2. Scoping Document 1 — A document presenting the proposed action (project) and its alternatives and identifying issues of concern is prepared and provided by the lead agency or agencies to the public for review and comment. In the document, the public and agencies are noticed that public meetings will be held. Usually, two meetings are held in each primary location: one in the afternoon and one in the evening.

3. Scoping Meetings — Scoping meetings and, if requested, a site visit are held usually within two weeks to one month of issuance of Scoping Document 1. Agencies conduct and determine the locations of these meetings. Project applicants may request an opportunity to present their project at the meetings. A 30-day period within which to provide comments on Scoping Document 1 and any other issues of interest follows these meetings. Comments may include requests for additional studies.

4. Scoping Document 2 — A second document is prepared following after comments noted in item 3 above are received. Scoping Document 2 refines the description of the issues of concern; identifies necessary information that must be acquired in order to assess the environmental impacts; and states whether the proposed action is determined to be a major federal action requiring preparation of an environmental impact statement (EIS) or may be addressed by preparing an environmental assessment (EA).

For projects that exhibit much public concern and potential opposition and involve many resource issues, an EIS is usually required. Federal regulations provide that EISs may be prepared by third party contractors for the Federal agencies. This usually ensures that the EIS begins and is completed within a defined schedule. If the Federal agency itself is to prepare the EIS, Congressional appropriation of funds is required.

2.1.1.2 Environmental Impact Statement

Preparation of the Draft and Final EIS follows the decision made at the close of scoping to prepare an EIS. Major activities are as follows:

1. Scoping for the Environmental Impact Statement — Using Scoping Document 2, the lead agencies confer with other agencies and identified parties regarding the extent of investigations that will be required in order to prepare the EIS. If additional public meetings are determined necessary, an additional round of scoping meetings could be held. A work plan to prepare the EIS is prepared and studies begin.

2. Preparation of the Draft Environmental Impact Statement — Field and office environmental, engineering, and economic investigations, studies, and analyses are conducted. Additional consultations with resource agencies are conducted as appropriate.

   The Draft EIS is issued for public review and comment and a comment period established. Additional public hearings may be held to receive comments on the Draft EIS in addition to written comments.

   Comments are reviewed and additional investigations, studies, and consultations, if required, are conducted.

3. Preparation of the Final Environmental Impact Statement Comments received regarding the draft are responded to in the Final EIS. Additional study results and other information are incorporated. Final statements in support of the preferred alternative are presented.

   The Final EIS is published and provided to the public. The Final EIS serves as the substantive backup for any Record of Decision and other approvals, including rights-of-way and permits.

2.1.1.3 Summary of Costs to Comply with NEPA

The range of costs presented below represents those costs that will likely be incurred to comply with the NEPA process through the scoping and EIS preparation tasks discussed above. These costs assume that a third party contractor prepares and publishes the documents and arranges for public meetings and hearings. The designated lead agency or agencies will probably serve the document on consulted entities.

1. Scoping Document 1 . . . . . $30,000 - 50,000
   Includes startup meetings between third party contractor, lead agencies, cooperating agencies, and State of Alaska/CVEA.

2. Public Meetings . . . . . $15,000 - 25,000
   Depends on the number of locations and personnel required.

3. Scoping Document 2 . . . . . $20,000 - 35,000
   Includes decision process to determine whether EIS is required and to prepare outline of required information for use in preparing study plans.

4. Environmental Studies . . . . . $300,000 - 750,000
   Includes consultation with agencies in preparing study plans and conducting studies.

5. Draft EIS . . . . . $250,000 - 500,000

6. Public Hearings . . . . . $20,000 - 30,000
   Depends on the number of locations and personnel required.

7. Final EIS . . . . . $200,000 - 450,000

ESTIMATED TOTAL COST . . . . . $835,000 - 1,840,000

2.1.2 Clean Air Act and Regulations Regarding Siting and Operation of Fossil-fuel Generation for Diesel and Natural Gas Alternatives

Pursuant to the Clean Air Act of 1990 and legislation enacted by the Alaska Legislature in 1993, operators of certain fossil-fuel generation units are required to obtain Operating Permits and bring units into compliance with air quality standards by the year 2000. Compliance requirements may include: retrofit of existing equipment to reduce emissions; installation of "scrubbers" or other technologies to reduce emissions; installation of Continuous Emission Monitoring Systems (CEMS); and, in certain cases, substitution of fuel supply to reduce emissions.

2.1.3 Clean Water Act and Regulations Implementing Section 404

The 404 permit is prepared by the U.S. Corps of Engineers and may involve Nationwide or Individual permits, depending on the complexity and controversy associated with the proposed action. In the case of the Copper Valley Intertie, this involves issuing a number of permits for stream crossings and any activities that may directly affect wetlands. If there are significant issues involved, the EPA may elect to elevate the 404 permit activities to its jurisdiction. The application requires a significant level of detailed information; it is expected that the EIS would be used to support this permit application. The Alaska Department of Conservation uses the Corps permit for any dredge or fill activities.

2.1.4 Endangered Species Act

The primary activity that will be associated with the Copper Valley Intertie is consultation under Section 7 of the Endangered Species Act, which concerns the presence of any candidate or listed species and their critical habitat in the project area. Consultation is held to determine whether the project can proceed without jeopardizing the continued existence of such species and habitat. A formal study is performed and a Biological Opinion prepared to support the decision of the jurisdictional agency. The U. S. Fish and Wildlife Service has jurisdiction over non-marine fish, wildlife, and botanical species and related habitat; the National Marine Fisheries Service has jurisdiction over marine species and habitat.

2.1.5 Federal Land Policy Management Act and Bureau of Land Management Implementing Regulations and Guidance Regarding Rights-of-Way

The BLM manages lands of the United States that will be crossed by the Intertie. The BLM will entertain applications for rights-of-way over these lands. The NEPA EIS discussed above will serve as the decision document for these rights-of-way. Under the Federal Land Policy Management Act, the BLM may mandate terms and conditions that must be followed for the life of the Project.

2.1.6 Federal Power Act and Regulations Implementing Parts I and II — Allison Lake Alternative and Qualifying Facilities — Coal-fired and Cogeneration Alternatives

The Federal Energy Regulatory Commission (FERC) would be involved in licensing Allison Lake or Silver Lake under Part I of the Federal Power Act (FPA). A FERC license also triggers other federal, state, and local agency and government approvals and permits that are considered during the licensing.

If any of the fossil-fuel generation alternatives are developed by non-utilities, the FERC could entertain a request for Qualifying Facility or Exempt Wholesale Generator status under Part II of the FPA.

2.1.7 Other Federal Permits and Approvals

The Federal Aviation Administration (FAA) will require a notice of proposed construction for transmission line segments that could be an obstruction or hazard to plane traffic. Obstruction marking plans must be approved by the FAA.

The Federal Communications Commission (FCC) must issue a radio license and permit to operate radio equipment if such equipment is planned for use with the Intertie.

Because construction of the proposed Intertie will involve more than 5 acres, a U. S. Environmental Protection Agency National Pollution Discharge Elimination System (NPDES) permit will be required.

2.2 State Statutes and Regulations

A Coastal Project Questionnaire must be completed for the Alaska State Division of Governmental Coordination under the Alaskan Office of Management and Budget. This questionnaire initiates the review process for consistency under the Alaska Coastal Management Program (ACMP). During the review, state agencies determine the permits and authorizations required for proposed projects in or affecting the coastal areas of Alaska. Principal state permits likely to be required are discussed below.

2.2.1 Alaska Department of Fish and Game

An anadromous fish protection permit, Title 16 Fish Habitat Permit, is required as anadromous fish streams will be crossed. The permit application requires a detailed project description, including maps. The application is submitted with the General Waterway/Waterbody Application to the Alaska Department of Fish and Game (ADFG). Plan details should include time frame requested for decision. This permit also applies to bridges placed across streams.

The ADFG is also to be consulted regarding the need for additional permits if silt, gravel, rock, or other materials are introduced into the water; if the stream is used as a road, even when frozen, or the stream is crossed with tracked or wheeled vehicles; if explosives are used; if a bridge or culvert is installed; or if a Critical Habitat Area, State Game Refuge, or State Sanctuary is affected.

2.2.2 Alaska Department of Natural Resources, State Historic Preservation

No specific permits are required. The level of study efforts that must be performed under NEPA is determined by the State Historic Preservation Officer (SHPO). Based on preliminary information presented in the draft Feasibility Study, an archaeological survey of the proposed right-of-way and adjacent areas will be required. An ethnographic survey may also be required if Native American properties are affected. This study/survey effort is performed under the regulations established pursuant to Section 106 of the Historic Preservation Act and related statutes and is required for the Intertie due to use of Lands of the United States and the need for federal permits and other approvals.

2.2.3 Other State Approvals

The Alaska Department of Natural Resources (DNR) must be consulted regarding permit requirements and other rights-of-way approvals for portions of the Intertie that will cross and occupy State-owned lands. DNR is also to be consulted for timber removal and burning. If over 40 acres are to be cleared during the life of the project, the burn would be regulated by the Alaska Department of Environmental Conservation (DEC). If less than 40 acres would be cleared, the burn would be regulated by DNR, Division of Forestry.

The DEC is to be consulted if any discharge of wastewater, including stormwater, occurs during operation; if any wastewater disposal system is constructed; regarding dredge and fill near or in wetlands or other waterbodies; if solid waste is produced; if the project requires application of oil or pesticides to the land surface; or if fossil fuel is the source of energy. As noted above in the Federal Statutes and Regulations section, the DEC would use the 404 permit issued by the Corps and would issue the related Water Quality Certificate.

If the Intertie would affect the right of way of the Glenn Highway, a utility permit from the Alaska Department of Transportation and Public Facilities would be required.

2.3 Regional and Local Plans, Ordinances, and Other Regulatory Requirements

The Matanuska-Susitna Borough regulates land use in the Sutton, Chickaloon, and Glacier View areas. A Conditional Use Permit is required from the Matanuska-Susitna Planning Commission for construction of a transmission line in the Chickaloon Special Land Use District. Similar regulations are being considered in the Glacier View area. The Matanuska-Susitna Borough could also require land use permits and utility permits for any use of Borough lands.

3.0 COMPARISON OF POTENTIAL IMPACTS ASSOCIATED WITH RESOURCE ALTERNATIVES

This section presents combinations of potential environmental and other impacts associated with the four most competitive resource alternatives presented in the Feasibility Study. For example, we have combined the impacts associated with the Intertie with those of natural gas generation that is expected to be trasmitted across the Intertie to serve CVEA loads.

The following matrix presents a ranking of potential environmental and other impacts that may be associated with the four alternatives. The relative rankings are based on comments received in response to the draft reports; review of information regarding the proposed Allison Lake project; and information available in publications (USDOE 1982). The categories regarding potential environmental impacts are as specified in 3AAC 94.060.

Potential Impacts	Major Alternatives Considered in Feasibility Study			
	Intertie and Natural Gas Generation	Diesel Generation in Valdez and Glennallen	Allison Lake and Diesel Generation	Coal Generation in Valdez
Community Preferences	Mixed*	Mixed*	Mixed*	Mixed*
Impact on Community Infrastructure	Unknown	Unknown	Unknown	Unknown
Timing in Relation to Other Capital Projects	Unknown	Unknown	Unknown	Unknown
Air Quality	Low	High	Medium	High
Water Quality	Low	Medium	Medium	Medium
Fish and Wildlife	Medium	Low	Low	Low
Land Use and Ownership Status	High	Low	Low	High
Terrestrial	Medium	Low	Low	Low
Recreation Resource Value	High	Low	Low	Low
Visual/Aesthetics	High	Low	Low	Medium

* Depends on community. The Mat-Su Borough residents generally prefer alternatives to Intertie. Glennallen and Valdez residents generally prefer the Intertie.

The following sections discuss the potential impacts of each of the four alternatives listed in the matrix in further detail.

3.1 Intertie and Natural Gas-fired Combustion Turbines

3.1.1 Community Preferences

Community preference was mixed. Comments indicate that residents of the Mat-Su Borough generally prefer alternatives to the Intertie, while residents of Glennallen and Valdez generally support the Intertie.

Community concern regarding potential adverse impacts on cultural resources is high. The apparent preferred route parallels the Nelchina Trail, where indigenous peoples are reported to have traveled along Anthracite Ridge. The possibility that the proposed Intertie alignment would affect archaeological or cultural sites and properties is high. Under Section 106 of the Historic Preservation Act, a cultural resources survey and associated field investigations will be required in order to determine whether sites and properties eligible for listing on the National Register occur in the vicinity of the proposed alignment.

There is no available information about community preference regarding the use of natural gas-fired generation to be used to supply power to be transmitted over the proposed Intertie.

3.1.2 Impact on Community Infrastructure

At this time, we do not have adequate information to determine the level of potential impacts associated with a combination of the Intertie and natural gas combustion turbines (CTs).

3.1.3 Timing in Relation to Other Capital Projects

At this time, we do not have adequate information to determine the level of potential impacts associated with a combination of the Intertie and natural gas CTs.

3.1.4 Air Quality

Potential air quality impacts associated with construction and operation of the Intertie and combustion turbines that would supply energy are assumed to be low.

Minor air quality impacts would occur during construction of the Intertie. However, implementing Best Management Practices generally used by the industry would reduce their severity.

CTs that use natural gas are relatively clean burning. Only NOx emissions tend to be a problem because of high combustion temperatures. NOx can be controlled with either

water or steam injection into the CT combustor to reduce NOx emissions to 25 parts per million (ppm) at 15% excess O_2, eliminating up to 80% of the NOx. Water use and visible steam plumes may become an environmental concern, but water use can be minimized by reusing the condensed exhaust steam for steam injection.

Because CTs tend to be sited close to existing gas transmission infrastructure, effects on urban environments need to be considered. Specific impacts may include noise if not silenced. Unsilenced CTs can run 65 to 70 decibels at 1,200 feet from an operating turbine. Silencing can reduce this to 51 decibels at 400 feet.

If the units are combined cycle, potential environmental impacts include the combined impacts of waste heat boiler plants and combustion turbines. However, given the plant efficiencies related to the amount of fuel combusted, environmental impacts are proportionately less than if a combination of separate gas and oil fired units are operating.

EPA and Alaska regulations governing combustion turbines burning natural gas would be followed in selecting and installing the unit and during operation. Natural gas-fired CTs have a low level of environmental effects as compared to diesel or coal-fired generation.

Air pollutants expressed in tons per average megawatt per year for the fuel cycle associated with natural gas-fired combined cycle combustion turbines and also expressed in lbs/kWh during operation, based on a GE Frame 7 unit, are presented in the following table:

Potential Impacts	**Gas Extraction (Tons/MW/Year)**	**Transportation (Tons/MW/Year)**	**Generation (lbs/kWh & Tons/MW/Year)**
Sulfur Oxides	94.600	0.0004	0.0000089 2.80
Oxides of Nitrogen	5.630	0.266	0.0011 0.04
Particulates	0.126		0.000064 2.33
Carbon Dioxide			0.00032 4,174.00
Volatile Organic Compounds			0.00011

3.1.5 Water Quality

Implementation of Best Management Practices common to the construction industry should prevent adverse effects. For this reason, a low rating regarding potential impacts to water quality is appropriate.

Fourteen anadromous fish streams would be crossed or located directly downstream of the proposed Intertie route alignment. Soil erosion and related sedimentation were identified as potential adverse environmental impacts that may cause harmful effects on nearby water bodies. Eventually, these effects are realized in downstream waterways. Turbidity may increase, water quality may be impaired, flooding may occur, and water supply may be affected. Erosion and sedimentation may also adversely affect terrestrial and aquatic habitat and associated populations. Soil erosion in the vicinity of roads and highways may adversely affect drainage patterns.

Soil erosion may result from construction activity, including formation of ruts and compaction of soils that may create excessive runoff when natural infiltration of rainwater is impeded. Excavation for pole placement and site preparation may create problems related to soils disposal. Where vegetation is cleared or disturbed, soil is further exposed to erosion.

During construction of the Intertie and related access roads, streams would need to be protected from adverse impacts associated with soil erosion or spills. Specific practices and procedures that would be followed during construction and operations/maintenance would be defined in a soil erosion and water quality management protection plan.

Water quality impacts per average megawatt per year of energy generation associated with natural gas CTs are related primarily to extraction and generation, assuming that the pipeline is constructed. The table on the following page presents expected effects associated with the CT fuel cycle on water quality. A low level of environmental effects is assumed.

Potential	Extraction	Generation
Consumption (acre-feet)		8.44000
Thermal Discharge (MMBtu)		28,800.00000
Discharge (acre-feet)	0.576 drilling mud	0.00810
Biological Oxygen Demand (tons)	0.11	0.68600
Chemical Oxygen Demand (tons)	0.74	
Oil/Grease (tons)	2.28	
Chromium (tons)	0.006	
Zinc (tons)	0.002	
Total Dissolved Solids (tons)	30.36	1.06000
Total Suspended Solids (tons)		1.14000
Ammonia (tons)		0.00012
Chloride (tons)	5.69	
Sulfate (tons)	4.55	

3.1.6 Fish and Wildlife

Potential adverse impacts on fish resources were ranked medium to low; potential adverse impacts on wildlife resources were ranked medium to high. Therefore, an average ranking of medium was assigned to these resources.

3.1.6.1 Fish

Although none of the 14 anadromous streams that would be crossed support large populations of fish, even slight impacts on water quality would be detrimental. Information presented in the Feasibility Study recognizes that Intertie construction or improvement of access roads could lead to increased erosion affecting water quality.

Streams would be crossed at times stipulated in right-of-way permits. Specific practices and procedures that would be followed during construction and operations/maintenance would be defined in a soil erosion and water quality management protection plan, including any required mitigation measures addressing possible damage to streams and riparian vegetation.

3.1.6.2 Wildlife

Increased access to previously undeveloped areas could increase hunting pressure on existing populations of moose, the Nelchina caribou herd, dall sheep, and brown bears. Specific locations of proposed access roads are necessary to assess project-related effects. Wildlife in the project area frequent a 12-foot-wide "trail" that parallels much of the proposed alignment. Additional access could enable hunters from the Anchorage metropolitan area to compete with locals who use the area for subsistence hunting. Trumpeter swans were identified as a species of concern as they are particularly vulnerable to collisions with powerlines. Areas used by bald eagles are subject to protection under the Bald Eagle Protection Act.

The Intertie would need to be constructed and operated in compliance with requirements for raptor protection and under measures required by agencies pursuant to the Fish and Wildlife Coordination Act and the Bald Eagle Protection Act.

Effects on fish and wildlife resources are site specific. Possible water quality impacts described above could adversely affect fishery resources and wildlife. However, no information is available regarding the sites occupied by the CTs.

3.1.7 Land Use and Ownership Status

Local residents and entities who use lands that would be occupied by the Intertie have raised a number of issues related to land use and ownership status that result in a ranking of high for potential impacts associated with the Intertie/Natural Gas option.

The Intertie could adversely affect local residents' quality of life due to the intrusion of development into current primitive areas, specifically in the areas of Sutton, Chickaloon, and Glacier View. Lands that would be occupied by the Intertie are currently used by local residents and persons traveling from other areas for recreation and tourism. Specific activities are discussed below in Section 3.1.9, Recreation Resource Value. Concern was expressed by a number of local businesses that changes in use from wildlands to a managed energy corridor would adversely affect revenues associated with recreational and tourism uses.

Much of the area that would be affected by the proposed Intertie and access roads can be classified as wildlands (see Section 3.1.8, Terrestrial Resources). Threats to wildlands and current use/ownership include impaired scenic value due to presence of manmade structures; increased access and related degradation due to increased access roads and human activity; and reduction in scenic value due to conversion to utility corridors requiring manipulation of soils and vegetation and continued access for maintenance.

The main economic interest of wildlands is their contribution to biodiversity, provision of critical habitat, and protection of watersheds and soil. They also provide a base for primitive experience recreation and tourism, as well as vicarious consumption.

Potential long-term adverse effects related to the presence of the Intertie include loss of revenues associated with current use of lands for recreation and tourism associated with present wildlands status, and reduced value of privately-owned lands in the vicinity of the Intertie alignment.

Potential annual environmental impacts, based on a national average, per average megawatt per year of energy generation for natural gas-fired combined cycle turbine fuel cycle on land use are identified in the following table. On a national average, disposal of solid waste in tons per average megawatt per year are estimated to be 22.35 tons of drill cuttings over the life of a natural gas well. A rating of medium to high is anticipated for potential environmental effects.

Potential Impacts	Extraction (Well) (Tons/MW/Year)	Transportation (Pipeline) (Tons/MW/Year)	Generation
Acreage (Permanent)	2.65	4.18	0.1 per MW capacity
Acreage (Temporary)	3.15		

3.1.8 Terrestrial Resources

Concerns regarding terrestrial resources are closely related to wildlife (see Section 3.1.6). A medium level of environmental impacts would occur due to construction and permanent occupation of lands by structures related to the Intertie. If critical habitat for any species would be adversely affected or if significant wetlands would be disturbed, mitigation would be required and the level of impact could increase to a high level.

Much of the area that would be affected by the proposed Intertie can be classified as "wildlands." Wildlands can be defined as natural and water areas which have been only slightly, or not at all, modified by modern society (Ledec and Goodland 1988). Wildlands do not contain sizeable numbers of people. However, they are valuable because of their biodiversity, opportunity for primitive recreational enjoyment, and the range of environmental functions they provide.

These wildlands provide valuable habitat for wildlife; potential adverse impacts are noted in Section 3.1.6, Fish and Wildlife). Construction and operation of the Intertie would be subject to mitigation measures proposed by the U.S. Fish and Wildlife Service and the Alaska Departments of Natural Resources, Environmental Conservation, and Fish and Game.

The proposed Intertie would cross approximately 65 miles of wetlands listed in National Wetland Inventory. Approximately 100 miles of permafrost wetlands would be affected by Intertie construction and operation.

Information regarding terrestrial impacts associated with natural gas generation that would supply the needs delivered by the Intertie were not available.

3.1.9 Recreation Resource Values

Adverse environmental and socioeconomic effects associated with the proposed Intertie indicated that a high rating of potential impacts would be associated with recreation and tourism. Specific areas of concern included the historic Chickaloon Knik Nelchina Trail, Nelchina Public Use Area, and Hiking Trails in the Hicks Creek/Chitna Pass areas.

Recreationists using the area for skiing, snowmobiling, hiking, and bicycling could experience adverse effects because of the Intertie. Specifically, the Intertie would be visible from Chickaloon-Knik-Nelchina trail and from several State recreation sites, including King Mountain Recreation Area, Bonnie Lake Recreation Area, Long Lake Recreation Area, Caribou Creek Recreation Mining Area, and Matanuska Glacier Recreation Area. Aerial recreational opportunities could also be affected, specifically persons using hang gliders east of Knob Hill in Sutton area and small planes.

Local recreation and tourism businesses expressed concern that the presence of the Intertie would adversely affect their businesses as it is perceived to reduce the attractiveness of the area for tourism. The Matanuska Valley is a popular destination for Anchorage residents who use the area for day trips to engage in hiking, biking, skiing, and backpacking. Nearly 100% of tourism-based businesses operate on north side of Matanuska River. Because of narrow configuration persons taking day trips to the area would have to pass under or near powerline.

Locally owned tourism-based businesses in the area include hiking, hunting and fishing guides; horseback outfitters; river rafters; campgrounds; and commercial services. Persons engaging in activities at higher elevations than the Intertie corridor would be presented with a long view of the powerline and its right-of-way.

Long-term adverse effects include potential loss of revenue in the local vicinity due to degraded quality of the experience associated with the intrusion of an energy corridor into present scenic and primitive areas.

Information regarding recreational impacts associated with natural gas generation that would supply the needs delivered by the Intertie were not available.

3.1.10 Visual/Aesthetics

Construction and operation of the Intertie were the subject of numerous concerns, therefore a high rating is assigned to this category.

The effects on aesthetic and visual resources associated with construction and operation of transmission lines are determined by five factors: the width and appearance of the right-of-way; the methods used to clear the corridor (selective or clear-cut); the design and size of the transmission towers; the nature of the landscape; and placement of structures in the landscape. Among the most important aesthetic factors in design of the towers are color, structural configuration, and the type of material used.

Specific concerns were raised by the following entities and provided the basis for a high ranking of potential impacts. The Glacier View Community Council presented a Resolution recommending that the Intertie be located north of Anthracite Ridge. Specific concerns raised by the Council include: concern regarding indigenous peoples' use for travel on Anthracite Ridge; generally unstable slopes; and approximately seven stream crossings that would be required.

The Glenn Highway is one of most scenic highways in Alaska. As currently routed and based on field reviews, the Intertie would not be visible from the Glenn Highway for most of its length. However, potential adverse visual impacts on persons visiting the Lake Louise Road viewshed due to the presence of the Intertie may occur. The view from Lake Louise Road is reported to be one of most spectacular in this region. The Draft Feasibility Study acknowledged in the discussion of Segment 23-24 (pg III-25) that an Intertie or the southernmost route would be a dominant feature in the viewshed from Lake Louise Road. Visual simulation studies would be performed to select a route north of Crater Lake, seeking to take maximum advantage of terrain to limit the visual impact.

Potential adverse impacts to local residents due to visual intrusion to private property along the highway from Cascade Creek to Hicks Creek may occur. During final route selection, detailed ground reviews and attention to individual property views would identify if and to what extent a proposed route would affect this viewshed.

Information regarding adverse effects on visual and aesthetic impacts associated with natural gas generation that would supply the needs delivered by the Intertie were not available.

3.2 Diesel Generation

The all diesel case presented in the feasibility report assumes that the Intertie is not constructed and diesel generation would be added to meet future needs. Retirement and replacement options are presented. Upgrades to existing equipment are mentioned.

Assuming that the diesel generation is located in an industrial use area, potential impacts on fish and wildlife, land use and ownership status, terrestrial, recreation resource value, and visual and aesthetics would be presumed to be low.

General operating requirements include: make-up fresh water source of 4-5 cubic feet per second within 0.5 mile; rail or highway delivery of fuel, with maximum of 0.25 mile distance from existing railway or paved highway; and 1,200 feet distance from inhabited areas due to noise levels.

Site specific information regarding the all diesel case was not available. Therefore, potential air and water quality impacts are based on information generic to the resource.

3.2.1 Air Quality

Air pollutant emissions associated with diesel generation were ranked high based on similar analyses of alternative sources of generation. Diesel generation would result in sulfur dioxide pollution. SOx exhaust gas can be mitigated with scrubbers, which add to the cost of generation. NOx emissions can be controlled with either water or steam injection. Significant amounts of CO_2, a "greenhouse" gas, and waste are produced. Additional air emissions include: total suspended particulates, hydrocarbons, carbon monoxide, and heavy metal particulates.

If potential air emissions exceed the regulatory thresholds established by the EPA and ADEC, air quality operating permits, and associated state user fees established by ADEC, may be required. Additional diesel emissions may also require a Prevention of Significant Deterioration (PSD) Permit unless operation can proceed under a PSD Avoidance Permit.

Estimated levels of air quality emissions associated with operation of two types of diesel engines, the Delaval Enterprise R-46 and the Caterpillar 3608, are presented in the following table. Environmental effects associated with extraction and transportation of diesel fuel would be similar to those associated with the natural gas generation discussion under the Intertie and Natural Gas alternative discussed above.

Potential Impacts	DE R-46 (lbs/kWh)	CAT 3608 (lbs/kWh)
Oxides of Nitrogen	0.03800	0.0220
Carbon Monoxide	0.00510	0.0049
Particulates	0.00015	0.0019
Volatile Organic Compounds	0.00098	0.0025
Sulfur Oxides	0.00460	0.0046

3.2.2 Water Quality

Water is used for cooling purposes during operations. Water quality impacts during operation of diesel generators may include adverse effects on biochemical oxygen demand, chemical oxygen demand, total suspended and dissolved solids, and ammonia. Thermal discharge may adversely affect fishery resources in receiving waters. These effects are assumed to be of medium level.

3.3 Allison Lake and Diesel Generation

The Allison Lake Project would convey additional water to the existing Solomon Gulch Project and is assumed to provide 3,145 KW of firm capacity during winter peak. Upgrades and additional diesel generation would be required. Approximately one-half of the energy at Allison Lake would be produced at Solomon Gulch.

Environmental effects associated with diesel generation are discussed in Section 3.2, Diesel, above and would be additional to the effects associated with Allison Lake presented below.

3.3.1 Air Quality

Minor air quality emissions and fugitive dust would occur during construction. Construction permits would most likely specify procedures to reduce or mitigate for these impacts. A low ranking for Allison Lake combined with a high ranking for diesel generation would result in a medium level for the combination.

3.3.2 Water Quality

Data collected by the Army Corps of Engineers (COE) during May of 1979 indicate that physical, chemical, and biological water conditions within Allison Lake are of good quality (see Attachment A). Parameters tested meet all state and federal surface water quality standards. Turbidity levels were negligible (0.01 NTU) during the time of sampling.

Based on the COE information, no potential for contamination of Solomon Gulch Reservoir or the downstream fish hatchery are anticipated. In addition, no turbine operations complications related to increased water turbidity are expected. Additional studies may be necessary to (1) respond to allegations by hatchery entities that increased turbidity would result at Solomon Gulch Hatchery if water is brought in from Allison Lake and (2) to confirm that no disease-carrying fish or organisms would be introduced as a result of mixing Allison Lake waters with hatchery deliveries. Based on available information, a low to medium level of effect could occur. In combination with diesel generation, a ranking of medium is assumed.

3.3.3 Fish and Wildlife

Most of the major streams and rivers entering Port Valdez support salmon spawning. Intertidal areas of many streams are used for spawning by pink and chum salmon in sand, gravel, and/or silt fans at the mouths of many streams, including Solomon Creek and Allison Creek. Spawning occurs 1.5 miles below the outlet of Allison Lake and 0.25 mile from the mouth of Allison Creek.

Most birds in the Port Valdez area are classified as either waterfowl, shorebirds, seabirds, or raptors. There are no known bald eagle nests in the study area, except along Dayville Road approximately 3 miles from the project area. A survey of eagle nests will be required prior to construction.

Wildlife species include brown bear, black bear, mountain goat, wolf, wolverine, marten, porcupine, and snowshoe hare. Solomon Creek drainage provides good habitat for black bear and the coastal area is prime habitat. Inland populations of black bear occur in the semi-open forested areas. Brown bears also inhabit the coastal areas, which provide a richer food supply than the upland areas. There are no known endangered or threatened species of flora and fauna in the study area.

Further evaluation of effects on fish and wildlife will occur during the licensing and permitting process. A low level of effect is assumed.

3.3.4 Land Use and Ownership Status

All lands associated with the Allison Lake Project are located inside the city limits of Valdez. The entire area has no land use zoning designation. The study area is located on State of Alaska land under management of the Alaska Department of Natural Resources. The Dayville Road is managed by the Alaska Department of Transportation and Public Facilities. A low level of effect is assumed.

3.3.5 Terrestrial

There are several wetlands in the general project area. The proposed second powerhouse, staging area, and access road at Solomon Reservoir would not affect significant wetlands. A low level of environmental effects is assumed.

3.3.6 Recreation Resource Value

The area is not readily accessible for recreational use. Therefore, a low level of effect is assumed.

3.3.7 Visual/Aesthetics

Allison Lake and Solomon Reservoir can only be viewed by air, and only a few would see the impact of Allison Lake drawdown. The visual quality of the natural landscape could be marred by deposition of tunnel tailings. A revegetation plan could be initiated if this becomes a concern. A low level of effect is assumed.

3.4 Coal Generation

A 22-MW coal facility in Valdez is proposed to be constructed and on line in 1998. The proposed coal plant would use fluidized bed combustion to accomplish greater heat rates and related higher thermal efficiencies and greatly reduced emissions compared to the conventional steam cycle coal plant.

At this time, we do not have adequate information to determine the level of potential impacts on fish and wildlife; land use and ownership; terrestrial resource values; and visual/aesthetics that may be associated with coal plant development. With the exception of visual/aesthetics, a low level of effects is assumed for these resource categories. Emissions from the coal plant could, however, affect scenic vistas in the vicinity of the plant and along the pathway of the "plume." Therefore, a medium level of effect is assumed.

3.4.1 Air Quality

Atmospheric fluidized-bed combustion (AFBC) is an advanced coal technology that employs a fluid such as air, steam, or oxygen conveyed to the reactor vessel. With assistance of a fluidizing agent (such as sand), the fluid entrains fuel particles in its stream and bubbles or fluidizes them in the combustion zone of the reactor. Limestone is mixed with coal in the bed to trap sulfur. Removal of the majority of sulfur reduces or eliminates flue gas cleanup of the combustion gases.

NOx and SOx emissions are dramatically reduced as compared to conventional coal-fired plants. Other emissions and pollutants resulting from fluidized bed plants are similar to conventional coal. Mining, transportation, fuel handling, ash disposal, and cooling water problems are similar. A high level of effects is assumed for purposes of this analysis in that we do not have plant-specific information and cannot verify that the "plume" would not pose adverse effects to nearby Class I airsheds.

The table on the following page measures air quality emissions per average megawatt of energy generation per year based on generic information regarding AFBC.

Potential Impacts	Mining and Processing (MW/Year)	Transportation (MW/Year)	Generation (MW/Year)
SO_2 (tons)	0.009	0.14	1.8
NOx (tons)	0.140	0.128	15.3
Particulates (tons)	0.007	4.08	1.6
CO_2 (tons)			9,313.0
CO (tons)	0.028	0.189	1.54
Fugitive Dust (tons)	0.020	12.0	
Heavy Metals (lbs)			2.8
Radium 226 (curies)			0.000004
Methane (tons)			7.01

3.4.2 Water Quality

Water quality impacts per average megawatt of energy generation per year are estimated in the following table based on generic information. A medium level of effect is assumed.

Potential Impacts	Mining and Processing	Generation
Consumption (acre-feet)		17.40
Thermal Discharge (MMBtu)		44,200.0
Oil and Grease (tons)		0.032
Total Suspended Solids (tons)		0.063
Chloride (tons)		0.063
Iron (tons)		0.00002
Copper (tons)		0.00002
General Discharge (acre-feet)	0.243 (alkaline)	

3.4.3 Land Use

Acreage requirements per average megawatt of energy generation per year of generation result in an average 0.228 per megawatt in permanent change in landscape for mining and processing activities and 1.5 acre per megawatt capacity of the plant.

Waste streams average 2,354 tons of solid waste during mining and 1,024 tons of solid waste during generation. Solid waste includes boiler bottom ash, boiler fly ash, and scrubber sludge.

Because the plant is assumed to be sited in an industrial area, a high level of environmental effects is assumed.

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ATTACHMENT A

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WW-1559-HA1-BB
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MEMORANDUM

April 15, 1994

To: John Heberling

From: Jenna Getz

Subject: Allison Lake Water Quality Review

You requested that I prepare a letter report summarizing existing water quality conditions in Allison Lake based on data collected by the Army Corps of Engineers (CORPS) in the late seventies. The purpose of this summary was to determine if "Allison Lake water will pollute the water in Solomon Gulch Reservoir". A review of the limited data available on Allison Lake water quality was performed. However, because no data was available to determine the quality of water within Solomon Gulch Reservoir, a comparison of the two water bodies could not be made.

Data collected by the CORPS during May of 1979 were used to determine water quality conditions within Allison Lake. Water quality data was collected at a depth six feet and seventy feet. It is assumed for the purposes of this review that water samples were collected on one day at only one station location and that all approved QA/QC procedures were followed throughout sampling and analysis.

Results from the CORPS report indicate that physical, chemical, and biological water conditions within Allison Lake are of good quality (Table 4B). Parameters tested meet all state and federal surface water quality standards. Turbidity levels were negligible (.01 NTU) during the time of sampling.

Based on the CORPS information, no potential for contamination of Solomon Gulch Reservoir or the downstream fish hatchery are anticipated. In addition, no turbine operations complications relate to water turbidity are expected.

TABLE 4B
ALLISON LAKE
WATER QUALITY
May 1979

SAMPLE DEPTH	6 Feet	70 Feet
Alkalinity mg/l as $CaCO_3$	11.0	11.4
Aluminum mg/l as Al	0.00	0.00
Ammonia mg/l as N	0.23	0.31
Arsenic mg/l as As	0.00	0.00
Barium mg/l as Ba	0.00	0.00
Cadmium mg/l as Cd	0.03	0.02
Chloride mg/l as Cl	1.15	0.90
Chlorine mg/l as Cl	0.33	0.36
Chromium mg/l as Cr	0.01	0.01
Color pt-co unit	0.00	0.00
Copper mg/l as Cu	0.02	0.02
Flourine mg/l as F	0.0	0.0
Iron mg/l as Fe	0.01	0.01
Iron Bacteria	none	none
Lead mg/l as Pb	0.01	0.01
Magnesium mg/l as Mg	0.02	0.02
Manganese mg/l as Mn	0.01	0.02
Mercury mg/l as Hg	0.00	0.00
Nickel mg/l as Ni	0.00	0.00
Nitrate mg/l as N	0.11	0.08
Nitrite mg/l sd N	0.004	0.006
Kjeldahl mg/l as N	0.14	0.11
Petroleum or derivatives mg/l	0.00	0.00
ph	7.52	7.81
Potassium mg/l as K	0.09	0.08
Silver mg/l Ag	0.00	0.00
Sodium mg/l as Na	0.06	0.07
Sulfate mg/l (SO_4)	6.5	7.2
Total Dissolved Solids mg/l @ 103C	20.0	19.0
Total Settleable Solids mg/l	0.0	0.0
Turbidity NTU	0.01	0.01
Zinc mg/l	0.00	0.00

Appendix N

ENVIRONMENTAL REVIEW BY DAMES & MOORE, INC. AND PUBLIC COMMENTS

Copper Valley Intertie Project
Environmental Analysis

Prepared for

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2101 Fourth Avenue, Suite 600
Seattle, Washington 98121-2375

Prepared by

DAMES & MOORE
5600 B Street, Suite 100
Anchorage, Alaska 99518

12023-032-020

October, 1993

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SUMMARY

Introduction

The Alaska Energy Authority (the Authority) is studying the feasibility of constructing a 138-kV transmission line intertie between Sutton and Glennallen, Alaska. The intertie would be constructed and owned by the Copper Valley Electric Association (CVEA) and would allow CVEA to purchase power from Chugach Electric Association or other electric utilities in the Anchorage area. CVEA serves customers throughout the Copper River Valley area, including Glennallen and Valdez. The transmission line would span approximately 134 miles between the communities of Sutton and Glennallen. This environmental analysis was designed to identify environmental issues along the proposed routes and identify any areas that would need to be further addressed in the permitting and construction phases.

Routes

There are two primary routes analyzed in this report (referred to as the northern route alignment and the southern route alignment), although there are more than two alternative segments in some areas. The proposed route alignments span the area between Sutton and Glennallen, a distance of approximately 134 miles. The routes begin at a proposed new substation approximately one mile west of Sutton and end at CVEA's existing Pump Station 11 Substation southeast of Glennallen. The route alignments are primarily located on the north side of the Glenn Highway, with the exception of the last 13 miles of the southern alignment and the last seven miles of the northern route alignment, which lie south of the Glenn Highway west of Glennallen. Within the project area, the Glenn Highway runs generally east-west through the Matanuska Valley and across the Copper River Valley. An apparent preferred route has been selected.

Neither the northern nor southern route has been identified as a preferred route based on this environmental analysis. However, for the purpose of focusing the feasibility study the engineering portion of the study identifies an apparent preferred route alternative, based on several evaluation criteria including limited preliminary environmental analysis. This apparent preferred route alternative generally follows the northern route except for the segments between Simpson Cabin and Alfred Creek where it generally follows the southern route. The general findings and observations in this environmental analysis are applicable to the apparent preferred route alternative to the extent it shows route segments with the northern and southern routes.

Construction

The intertie route will span varying terrain including valley areas, steep slopes and mountain passes. Many areas along the alternative routes have no road access. Much of the line would be constructed using helicopters to transport materials, equipment, and construction crews. Helicopters will also be used for conductor stringing and setting of the transmission line structures. Clearing widths for the transmission line may vary according to topography and vegetation, but the overall clearing width is expected to be approximately 50 to 75 feet. Much of the construction of the Copper River Valley portion of the transmission line could occur in winter in order to minimize impacts to wetland areas and streams.

Public Involvement

The Authority held two rounds of public meetings during the development of the Feasibility Study. An additional round of public meetings is anticipated at the completion of the Draft Feasibility Study. Public meetings were held in communities located along the proposed routes, including Sutton, Chickaloon, Glacier View, Glennallen and Valdez. The public meetings were well attended by concerned citizens and community leaders. The public meetings were used by the Authority to present information on the feasibility study, the need for the project, the routes being proposed, and issues to be addressed. The Authority also used these meetings as a means of documenting the concerns of local residents. Many issues were raised, some of which were addressed through modifications to the routes. Other issues, such as aesthetic impacts, are addressed in this environmental report. Additional concerns may be addressed in planning documents required by the National Environmental Policy Act (NEPA) such as an Environmental Assessment (EA) or an Environmental Impact Statement (EIS) if the project proceeds beyond the feasibility study.

R. W. Beck and Dames & Moore, as consultants for the Authority, met with regulatory agencies in March 1993 to provide preliminary information on possible intertie corridor alignments and to gather information from the agencies on sensitive resource areas and issues to be considered during the feasibility study. Agencies attending the meeting included the Matanuska-Susitna Borough, U.S. Fish & Wildlife Service, U.S. Army Corps of Engineers, Alaska Department of Fish & Game, Alaska Department of Environmental Conservation, and the State of Alaska Office of History and Archaeology.

Potential Environmental Impacts

The most significant impacts resulting from this project would be visual and recreation impacts in the project area. The Matanuska Valley is a highly scenic area with many businesses in the small communities oriented toward tourism. Use of a backcountry route could mitigate the visual impacts along the scenic Glenn Highway but could still result in an impact on

recreational users, such as backpackers, rafters, skiers and snowmobilers, using trails in the backcountry. Other lesser impacts could include increased pressure on wildlife and recreation resources due to increased access to the area. These impacts could be mitigated by limiting additional access roads associated with the project.

Short-term economic benefits are likely for construction-related industries as the project could increase jobs, wages and sales of materials throughout southcentral Alaska. Long-term benefits may be anticipated by customers of CVEA. In addition, residents of the Copper River Valley and Valdez could experience economic benefits if the intertie provides lower electric rates which could contribute to an increase in economic growth in the area. Long-term air quality benefits in CVEA's service area could be realized if use of the intertie reduces usage of diesel engines for power generation in Glennallen and Valdez.

Conclusions

The types of environmental impacts associated with the two proposed route alternatives are similar, but the level of the impacts differs between the alternatives. The most significant impacts are likely to be visual and recreational impacts for both route alternatives. However, the northern alternative may reduce any visual and recreation impacts to some degree by decreasing the number of people impacted, since the northern route is farther from the Glenn Highway.

CHAPTER 1 - INTRODUCTION

1.0 Introduction

This environmental report was prepared for R. W. Beck and the Alaska Energy Authority (the Authority) as a section of the Feasibility Study for a possible intertie between Sutton and Glennallen, Alaska, to be constructed and owned by the Copper Valley Electric Association (CVEA). In general, this report follows the format and subject matter of a federal Environmental Assessment (EA) and is intended as a basis for preparing an EA should that become necessary.

1.1 Purpose and Need

CVEA provides electric service to approximately 3,000 customers and a population of approximately 8,000 in the Copper River Valley area, reaching from Valdez to Glennallen. CVEA's energy is currently generated primarily by a hydroelectric facility and supplemented with diesel generators which have been in service for over 15 to 30 years. CVEA has been studying alternatives for replacing its diesel generators for over 20 years. The proposed intertie would allow CVEA to purchase power from electric utilities in the Anchorage area and offset the use of diesel generators in CVEA's service territory. The need for the project, including demand forecasts and an economic analysis of the intertie and other alternatives, is discussed further in the Feasibility Study.

1.2 Public Involvement

The Authority held two rounds of public meetings during preparation of the Feasibility Study. The first round of meetings was held in March 1993. These first meetings introduced the need for the project, outlined the schedule and scope of the project, presented preliminary route alignments, and gathered public input. After receiving public comment on these preliminary routes, the alignments were revised to place the routes further away from the Glenn Highway and to avoid privately owned lands. The second round of public meetings was held in June 1993. Information was presented on the status of the Feasibility Study, the revised route alignments, land status and ownership, and electromagnetic fields. Public meetings were held in Sutton, Chickaloon, Glacier View, Glennallen and Valdez. The meetings were generally well attended and the public actively participated in the discussion. Comment sheets were provided to gather public input. Meeting summaries are provided in Appendix A.

R. W. Beck and Dames & Moore, as consultants for the Authority, met with regulatory agencies in March 1993 to provide preliminary information on possible intertie corridor alignments and to gather information from the agencies on sensitive resource areas and issues to be

considered during the Feasibility Study. Agencies attending the meeting included the Matanuska-Susitna Borough, U.S. Fish & Wildlife Service (USFWS), U.S. Army Corps of Engineers (COE), Alaska Department of Fish & Game (ADF&G), Alaska Department of Environmental Conservation (ADEC), and the State's Office of History and Archaeology (SOHA). A summary of this meeting is included in Appendix A.

1.3 Issues Identified

The major issues identified by the public were the potential adverse aesthetic impact of the project and concerns about the health impacts of electromagnetic fields (EMF). Another major issue was the belief that this project was not the best alternative for providing power to CVEA and that more effort needed to be put into researching alternatives. Negative impacts cited included a potential impact on recreational users of the area (e.g., hunters, hikers, and rafters), economic impacts on tourism-dependent businesses, environmental impacts on wetlands and wildlife, a decreased quality of life for area residents, increased access resulting in increased pressure on resources for hunting and recreation, impacts of construction in areas with bark beetle infestation, and impacts on small airplane landing strips. Positive impacts mentioned were the potential for economic growth spurred by lower electric rates, air quality benefits from reducing dependence upon diesel generators and potential economic benefits for the Copper River Valley institutions, residents and businesses within the CVEA service area.

Approximately 80 letters and comment sheets had been received from the public at the time of this report. Approximately 35% of the letters received expressed concerns regarding potential negative impacts on the scenic nature of the Matanuska Valley. Concerns about EMF, a diminished quality of life, and the belief that this was not the best alternative to meet CVEA's needs were expressed in 30% of the letters. Negative impacts on recreation and the businesses dependent on recreational tourism were cited in 16% of the letters. The potential for increased access to backcountry areas and the resulting pressures on popular hunting and recreation areas was mentioned in about 10% of the letters. Approximately 16% of the letters received supported the project and cited the positive economic benefits to the Copper River basin area. Letters received are included as Appendix B.

In addition to letters from the general public, resolutions regarding the project were received from the Greater Sutton Chamber of Commerce, the Matanuska-Susitna Borough Assembly, the Matanuska-Susitna Borough Planning Commission, the Sutton Community Council, the Chickaloon Community Council, the Glacier View Community Council, and the Chickaloon Village Traditional Council, and the Copper Valley School District. These resolutions are attached as Appendix C.

Issues raised at the agency meeting included measures to be taken to avoid impacts on raptors (USFWS); measures to be taken to minimize impacts on trumpeter swans, caribou, dall sheep and moose (ADF&G); impacts on trails and recreational users (Matanuska-Susitna Borough); wetlands permitting requirements (COE); and impacts on historic and archaeologic sites (SOHA).

1.4 Permits

Construction of a transmission line along the proposed corridors would require permits from local, state and federal agencies. The Matanuska-Susitna Borough regulates land use in the Sutton, Chickaloon and Glacier View areas. A Conditional Use Permit is required from the Matanuska-Susitna Planning Commission for construction of a transmission line in the Chickaloon Special Land Use District. Similar regulations are being considered in the Glacier View area. The Matanuska-Susitna Borough could also require land use permits and utility permits for any use of Borough lands. State permits that may be required include a Fish Habitat (Title 16) permit from ADF&G if structures would be placed below the ordinary high water line or if equipment crosses anadromous fish streams for project access; an Alaska Department of Transportation & Public Facilities (ADOT&PF) utility permit if the line would impact the right-of-way of the Glenn Highway; and a right-of-way permit and land use permit from the Alaska Department of Natural Resources (ADNR) for construction of the project on state lands. Written approval is required for slash burning during construction. If over 40 acres are to be cleared during the life of the project, the burn would be regulated by ADEC. If less than 40 acres are to be cleared, the burn would be regulated by ADNR, Division of Forestry. In either case, a burn plan would need to be submitted to the regulating agency prior to any burning. A federal COE permit could be required for construction in wetlands under the Clean Water Act (Section 404), in which case ADEC would issue the related Water Quality Certification. A right-of-way permit would also be required from the Bureau of Land Management (BLM) for crossing federal lands. If a federal permit (COE or BLM) is required, the project would also have to be in compliance with Section 106 of the National Historic Preservation Act, which would likely require an archaeological survey of the proposed route.

faulting, local wrench faulting and folding. Rock types in the area include a wide variety of diabase, basalt, dacite, andesite, rhyolite, tuff, amphibolite, shale, marble, limestone, conglomerate, sandstone, siltstone, mudstone, claystone and coal.

Unconsolidated surficial deposits include glacial, colluvial, alluvial and lacustrian sediments. Rock outcrops and shallow bedrock covered by a thin mantle of rocky colluvium occur on the mountain slopes at the mid to higher elevations in the Talkeetna Mountains. Thick colluvium and steep narrow alluvial valleys characterize the recent sediments in the mountainous drainages where rock glaciers and landslides are common in the area. The lower valley sides and bottoms are typically covered with glacial deposits and modern alluvium. Glacial deposits consist of moraines, outwashes, and terraced benches. Recent lacustrian deposits can locally be hundreds of feet thick where lakes formed by glacier dams once occurred.

Active landslides, avalanches and permafrost are other geotechnical concerns along the proposed alignments. Snow avalanches commonly occur in mountainous terrain in steep gullies and on steep open slopes. Ridges, rock outcrops, and terraces often form natural barriers to avalanches. Avalanches tend to occur on smooth, straight to convex slopes which range in slope angles from approximately 20 to 65°. Rough, rocky and heavily forested slopes help provide stability to avalanche prone areas. Leeward slopes usually receive more deposited snow and are more dangerous than the scoured windward slopes. South-facing slopes are typically less dangerous than north-facing slopes during the winter, but become more dangerous during the spring when wet-snow avalanches are more likely to occur.

The project area lies in the discontinuous permafrost zone. Relatively warm permafrost can be expected to be nearly continuous in sheltered, higher elevation areas, particularly on north-facing slopes. Sparse, dwarf black spruce vegetation provides an indication of permafrost. On southern exposures and at lower elevations, the permafrost may be mostly absent but highly variable and locally sporadic. Near-surface permafrost is generally not expected to occur in the project area in the low, modern, alluvial valley bottoms.

The southern alignment traverses soils which are predominantly alluvial and glacial and not frozen in the Matanuska Valley. As it extends up the Hicks Creek Valley, alluvial and glacial soils are expected to become narrower and thinner. Rock outcrops and moderately thin to less steep, moderately thick colluvial soils are expected on narrow valley walls. Thicker colluvial soils are expected on the broader valley sides of Caribou and Squaw Creeks, and glacial and alluvial soils are expected along the lower reaches of Caribou and Squaw Creeks. The colluvial soils may be locally sporadically frozen on southern exposures, discontinuously frozen on lower northern exposures and frozen at higher protected elevations. East of Syncline Mountain, soils are expected to be predominantly glacial and lacustrian and range from being discontinuously frozen to relatively warm ice-rich permafrost. Alluvial soils are likely to be encountered along the Tolsona Creek drainage and near the Tazlina River at the eastern end of the route.

The northern alignment heads northeast from the Matanuska Valley to near Boulder Creek Flats and continues up Boulder Creek Valley over Chitna Pass. Alluvial and glacial soils are expected to become narrower and thinner up valley. Moderately thin to steeper thin colluvial

soils and rock outcrops are expected on the narrow valley walls. The colluvial soils may be locally sporadically frozen on southern exposures to discontinuously frozen on the northern exposures. Colluvial, alluvial, and glacial soils should thicken down Chitna and Caribou Creeks and thin up Alfred and Pass Creeks. Rock outcrops are expected at various locations along this portion of the alignment. The colluvial soils may be frozen at the higher protected elevations, discontinuously frozen on lower northern exposures, and locally sporadically frozen on southern exposures. From Pass Creek to Old Man Creek there are fewer rock outcrops, thicker colluvial soils, and glacial and lacustrian soils which are expected to be generally frozen. The alignment then extends over a low broad ridge and down the northeastern flank of Syncline Mountain. Fewer rock outcrops, thicker colluvial soils, and glacial and lacustrian soils are expected to be generally frozen down this portion of the alignment. From Moose Lake eastward, the soils are generally expected to be glacial and lacustrian with alluvial soils likely to be encountered along the Tolsona Creek drainage and near the Tazlina River at the eastern end of the route. In general, there is a shallow permafrost layer throughout this area.

2.3 Wetlands/Vegetation

2.3.1 Wetlands/Vegetation

Wetlands within the Matanuska River and Copper River drainages have been delineated by the USFWS National Wetlands Inventory Program with the exception of a small section in the Kings River drainage and a larger section west of the Nelchina River and east of Crooked Creek. This later section was delineated using high altitude air photos (scale 1:62,750) to locate potential wetland and upland areas without the aid of ground truthing. To ensure that all wetlands are located and to determine the exact extent of the wetlands impacted, ground truthing would be required during the permitting process.

The classification system used by the USFWS follows Corwardin et al. (1979) and defines wetlands according to ecological characteristics and not according to regulatory guidelines of the COE. Therefore, not all wetland types mapped by the USFWS and shown on Figure 2.3-1 come under jurisdiction of the Clean Water Act (Section 404).

Wetland types along the proposed transmission corridor alignments include palustrine wetlands, freshwater wetlands dominated by woody plants or emergents and shallow ponds; and riverine wetlands, areas contained within the outer limits of river or stream channels. Lake habitat is crossed only by the northern route alignment segments at one location, a small lake about four miles east of Lake Louise Road. After the two alignments merge, north of mile 167 of the Glenn Highway, the route alignment passes near two large lakes; Mud Lake, located two miles east of Tolsona Creek and Moose Lake, just west of Tolsona Creek. Small ponds are scattered throughout the project area and may be crossed depending upon final alignments.

The predominant palustrine wetland types along the routes include saturated shrub bogs, forested wetlands, and seasonally flooded shrub wetland adjacent to rivers and streams. Some small ponds within wetland complexes may be encountered but this would depend on the exact

alignment of the corridor. Distribution of major wetland and upland habitat types along routes are presented in Figure 2.3-1 and Table 2.3-1.

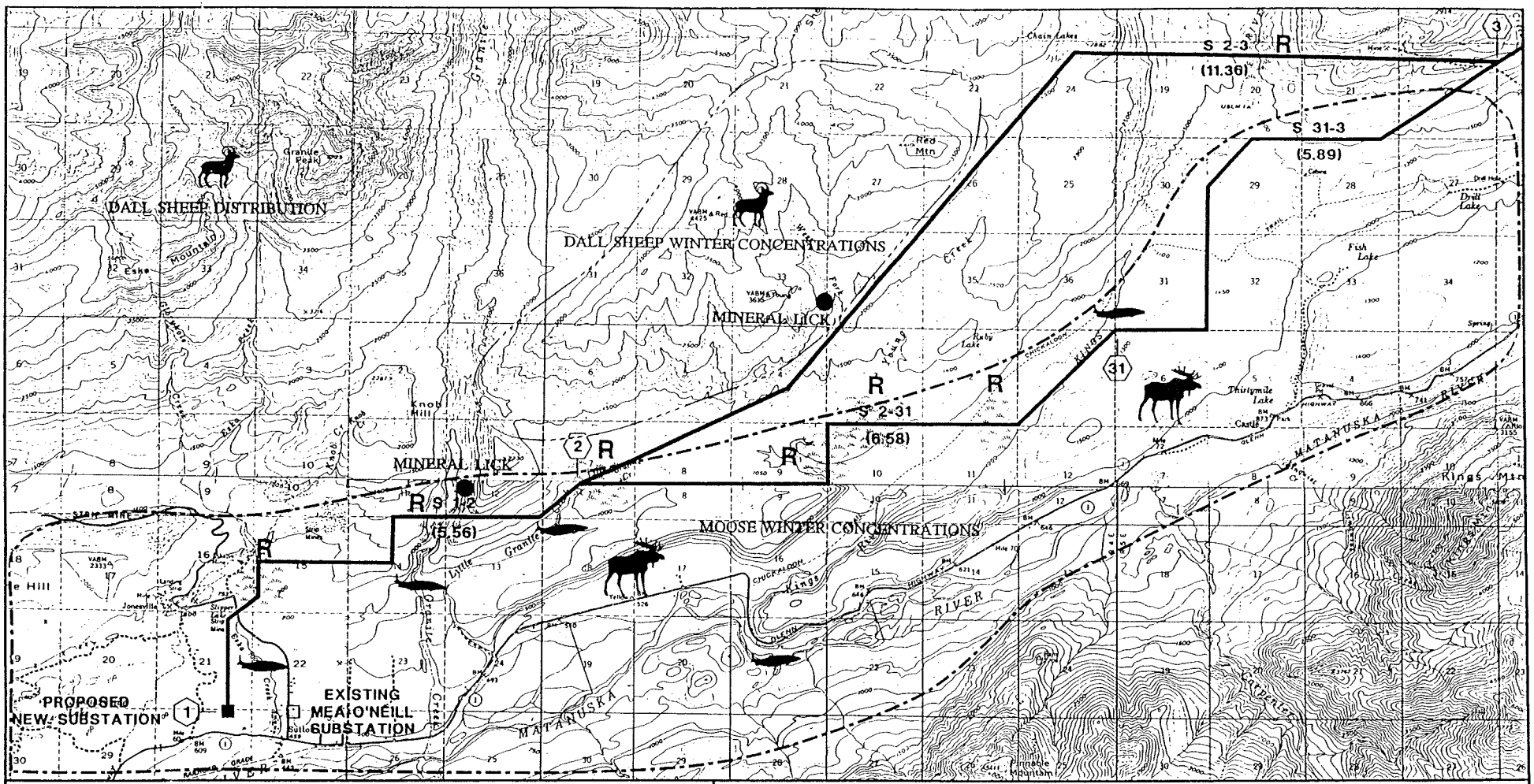
Over 90 percent of the palustrine wetland areas intersected on the route segments are in areas of low relief in the Copper River basin east of Slide Mountain. This is largely a function of the permafrost which occurs irregularly in portions of the Copper River Valley and prevents downward movement of water and results in saturated soils over these areas during the growing season.

The palustrine saturated shrub bog (PSS1B, PSS1/EM1B) is the typical wetland type encountered along the proposed alignments and is the most common wetland type in the region. The common species associated with this wetland type in this region include sweet gale (Myrica gale), thin-leaf alder (Alnus tenuifolia), dwarf birch (Betula nana), stunted black spruce (Picea mariana), Labrador tea (Ledum decumbens), shrubby cinquefoil (Potentilla fruiticosa), bog blueberry (Vaccinium uliginosum), lowbush cranberry (V. vitis-idaea), black crowberry (Empetrum nigrum), bog rosemary (Andromeda sp.) and several species of willow (Salix spp.). Shrub birch (B. glandulosa) and stunted black spruce (Picea mariana) are also prominent components of shrub bogs. Emergent species include several species of sedge (Carex spp.), cottongrass (Eriophorium spp.), bluejoint grass (Calamagrostis canadensis), swamp horsetail (Equisetum fluviatile) and several types of sphagnum moss (Sphagnum spp.). These wetlands function primarily as wildlife habitat and food chain support (biomass production).

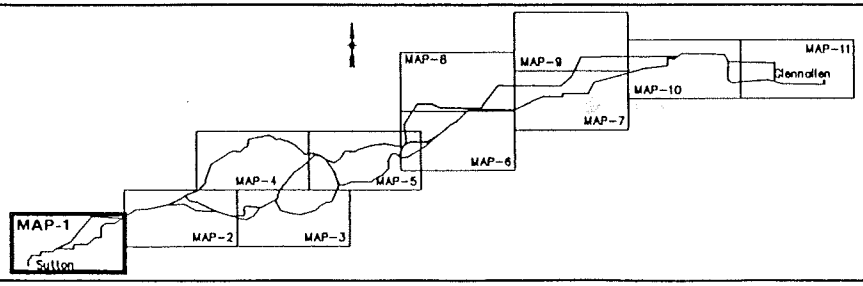
Seasonally flooded and temporarily flooded shrub wetland habitats (PSS1/EM1C and PSS1C) occur along old bars of rivers and streams corridors which have stabilized enough to support woody plants. These wetlands are found in areas within the floodplains of the rivers and small streams along the alignments. Typical vegetation includes thin-leaf alder and several willow species (Salix spp.) with undergrowth of bluejoint grass, swamp horsetail, marsh cinquefoil (Potentilla palustris) and nagoon berry (Rubus arcticus). Stunted black spruce (Picea mariana) may also occur on the higher terraces in small amounts. These wetlands have a high functional value as wildlife habitat for furbearers, black bear and moose.

Saturated black spruce bogs (PSS4/1B, PFO4/1B, PFO4B and PFO4/SS1B) are another common wetland type encountered along the routes. These areas are typically open black spruce forests with an understory of deciduous shrubs similar to scrub bog areas. This type of wetland is extensive along the eastern portions of the route alignments in the Copper River basin. The functional value of these wetlands is primarily wildlife habitat. They are used by moose in the winter and spring and by caribou during the winter.

The major riverine habitats (R3SBC, R3FLC, R3OWH) which will be crossed by the route alignments include the Granite Creek, Kings River, Chickaloon River, Boulder Creek and the Little Nelchina River. Approximately 65 smaller streams of a wide range of physical characteristics intersect the route alignments. The final number could be significantly less depending on the final alignment. These areas have high functional value and are primarily used as fish habitat (for fish passage to spawning and nursery areas), wildlife habitat for furbearers, and feeding areas for bears. These systems also function to maintain surface and groundwater regimes.



MAP INDEX



ENVIRONMENTAL RESOURCES LEGEND

- MOOSE HABITAT
- CARIBOU HABITAT
- DALL SHEEP HABITAT
- TRUMPETER SWAN NESTING AREA
- WATERFOWL HABITAT
- ANADROMOUS FISH STREAMS
- PALUSTRINE WETLANDS
- LACUSTRINE WETLANDS
- RIVERINE WETLANDS
- MINERAL LICK
- DALL SHEEP CONCENTRATION AREA
- MOOSE CONCENTRATION AREA
- WATERFOWL CONCENTRATION AREA
- ALTERNATIVE ROUTE SEGMENTS

0 1
APPROXIMATE SCALE IN MILES

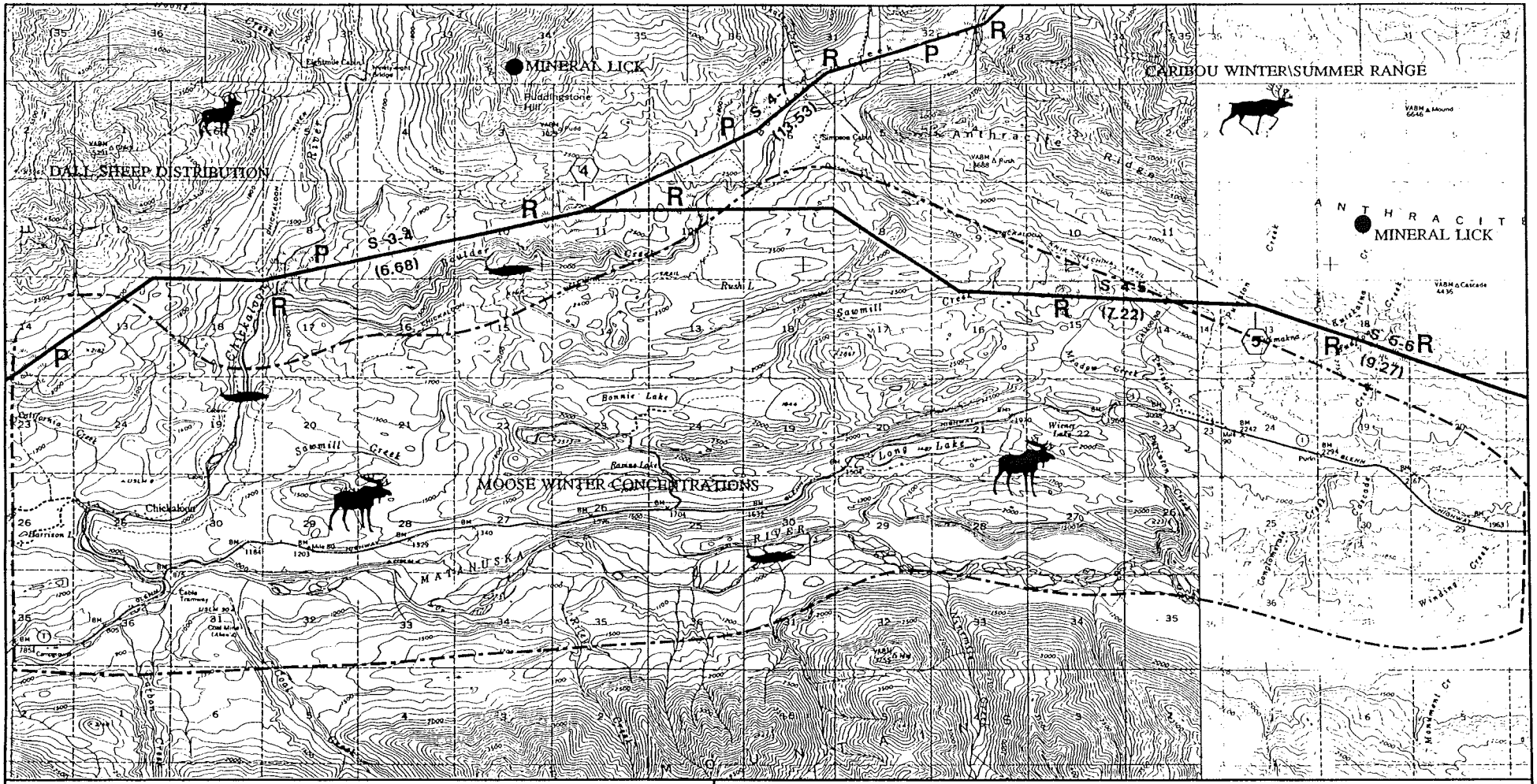
ALASKA ENERGY AUTHORITY

COPPER VALLEY INTERTIE FEASIBILITY STUDY

FIGURE 2.3-1
ENVIRONMENTAL RESOURCES
MAP-1 OF 11 MAPS

SEPTEMBER 1993

DAMES & MOORE



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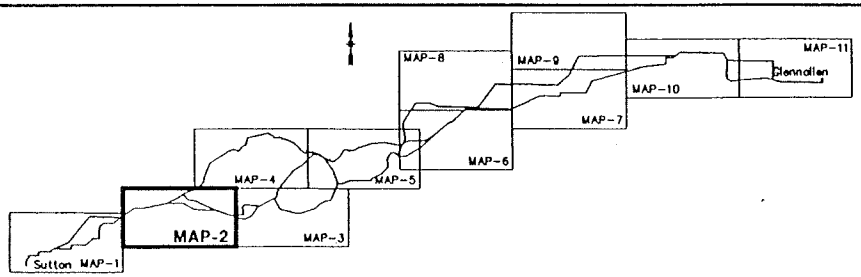

ENVIRONMENTAL RESOURCES LEGEND

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- ALTERNATIVE ROUTE SEGMENTS

0 1 APPROXIMATE SCALE IN MILES

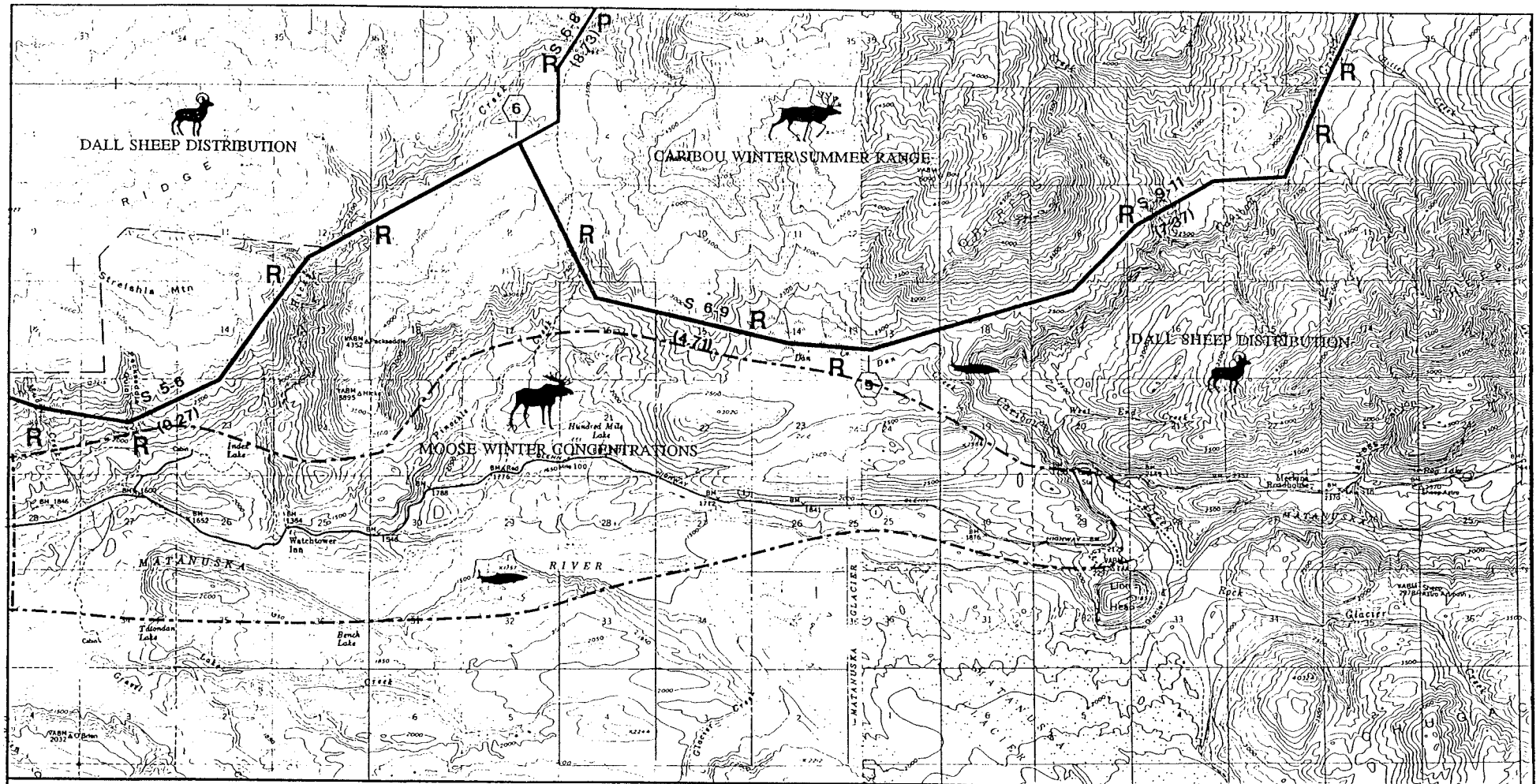
ALASKA ENERGY AUTHORITY

COPPER VALLEY INTERTIE FEASIBILITY STUDY

FIGURE 2.3-1
ENVIRONMENTAL RESOURCES
MAP-2 OF 11 MAPS

SEPTEMBER 1993

DAMES & MOORE


DALL SHEEP DISTRIBUTION
CARIBOU WINTER\SUMMER RANGE
DALL SHEEP DISTRIBUTION
MOOSE WINTER CONCENTRATIONS
MATANUSKA RIVER
Strelsha Mtn
Hundred Mile Lake
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Tdiondan Lake
Bench Lake
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Glacier
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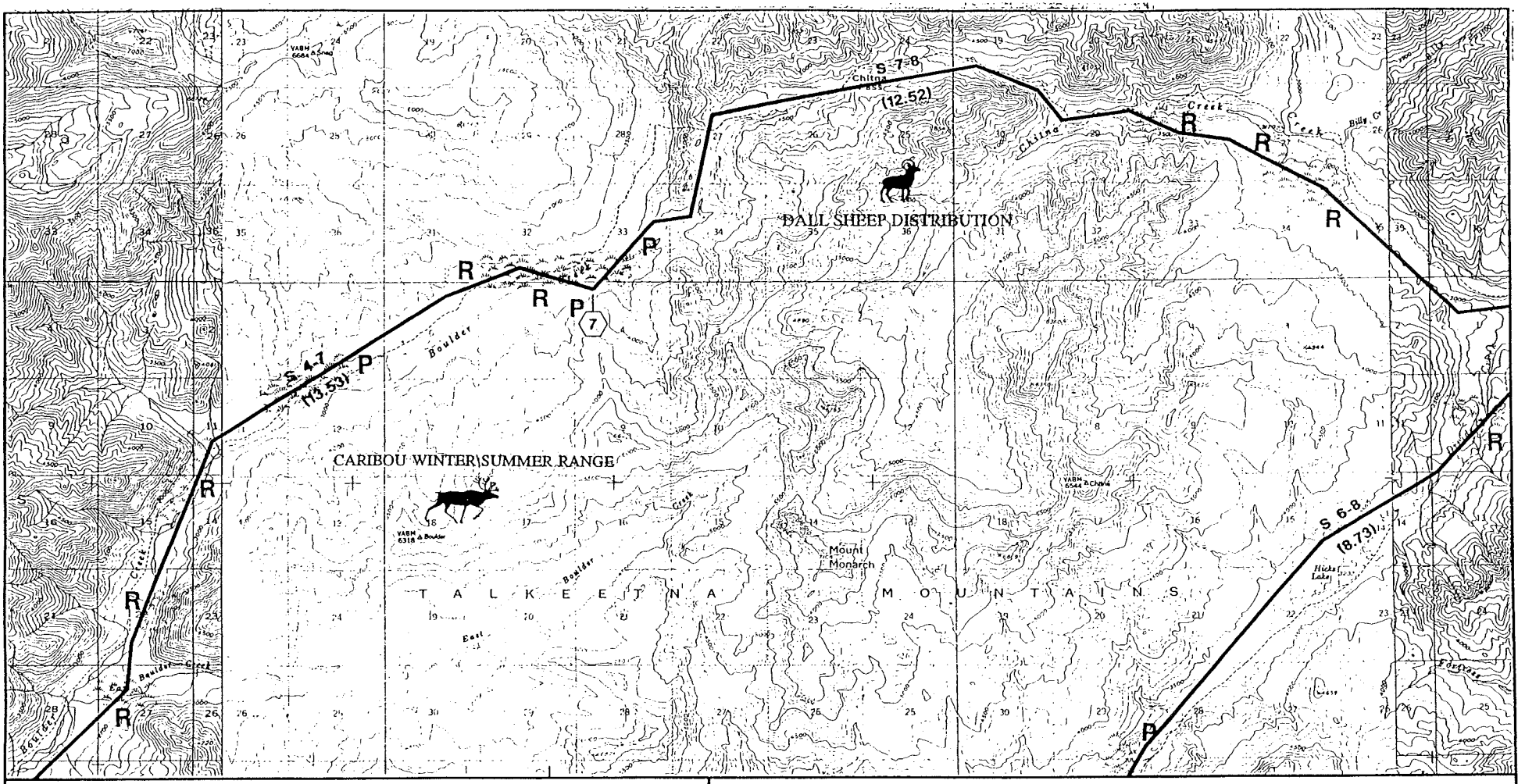
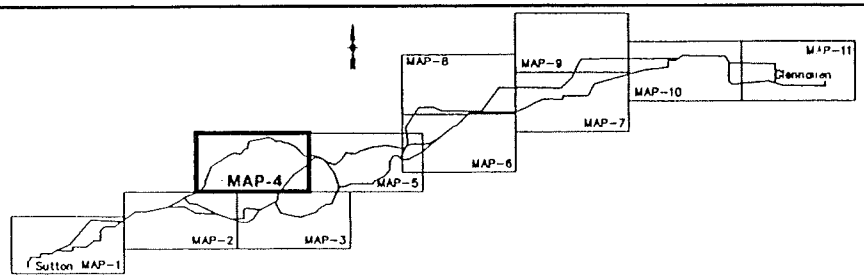
WATERFOWL CONCENTRATION AREA
ALTERNATIVE ROUTE SEGMENTS
APPROXIMATE SCALE IN MILES
ALASKA ENERGY AUTHORITY
COPPER VALLEY INTERTIE FEASIBILITY STUDY
FIGURE 2.3-1
ENVIRONMENTAL RESOURCES
MAP-3 OF 11 MAPS
SEPTEMBER 1993
DAMES & MOORE



MAP INDEX



ENVIRONMENTAL RESOURCES LEGEND

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- TRUMPETER SWAN NESTING AREA
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- ANADROMOUS FISH STREAMS
- P — PALUSTRINE WETLANDS
- L — LACUSTRINE WETLANDS
- R — RIVERINE WETLANDS
- MINERAL LICK
- DALL SHEEP CONCENTRATION AREA
- MOOSE CONCENTRATION AREA
- WATERFOWL CONCENTRATION AREA
- ALTERNATIVE ROUTE SEGMENTS

0 1
APPROXIMATE SCALE IN MILES

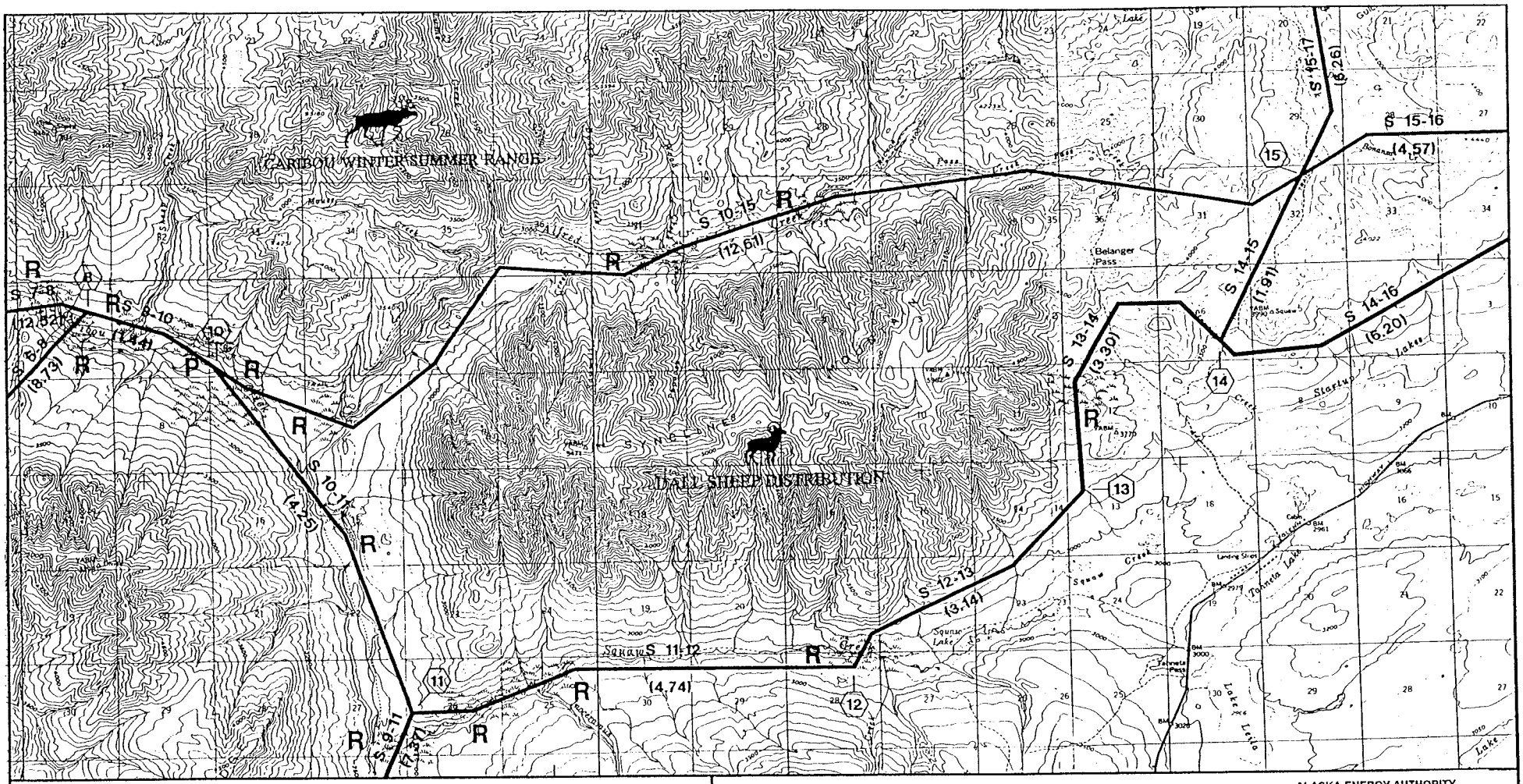
ALASKA ENERGY AUTHORITY

COPPER VALLEY INTERTIE FEASIBILITY STUDY

FIGURE 2.2-1
ENVIRONMENTAL RESOURCES
MAP-4 OF 11 MAPS

SEPTEMBER 1993

DAMES & MOORE



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APPROXIMATE SCALE IN MILES

ALASKA ENERGY AUTHORITY

COPPER VALLEY INTERTIE FEASIBILITY STUDY

FIGURE 2.3-1
ENVIRONMENTAL RESOURCES
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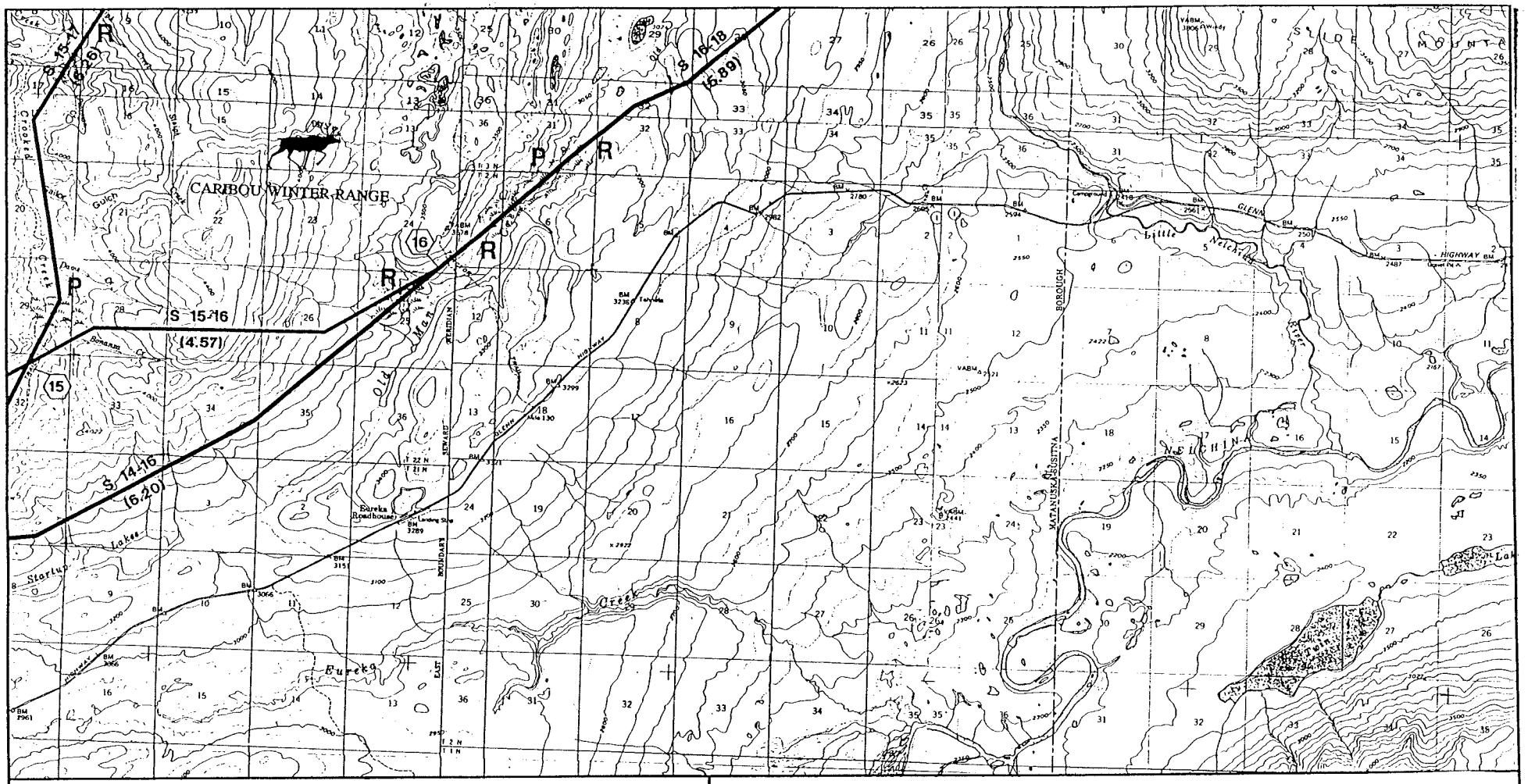

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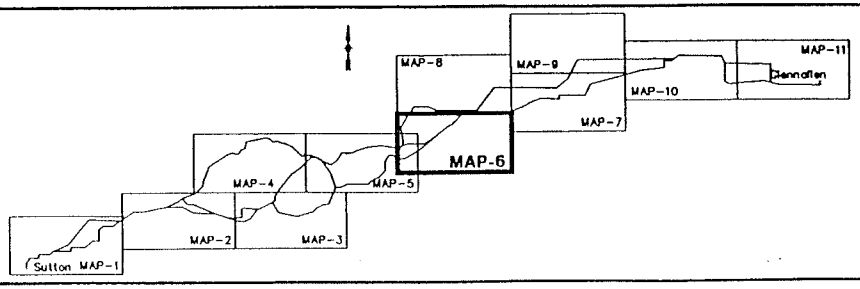

ENVIRONMENTAL RESOURCES LEGEND

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0 1
APPROXIMATE SCALE IN MILES

ALASKA ENERGY AUTHORITY

COPPER VALLEY INTERTIE FEASIBILITY STUDY

FIGURE 2.3-1
ENVIRONMENTAL RESOURCES
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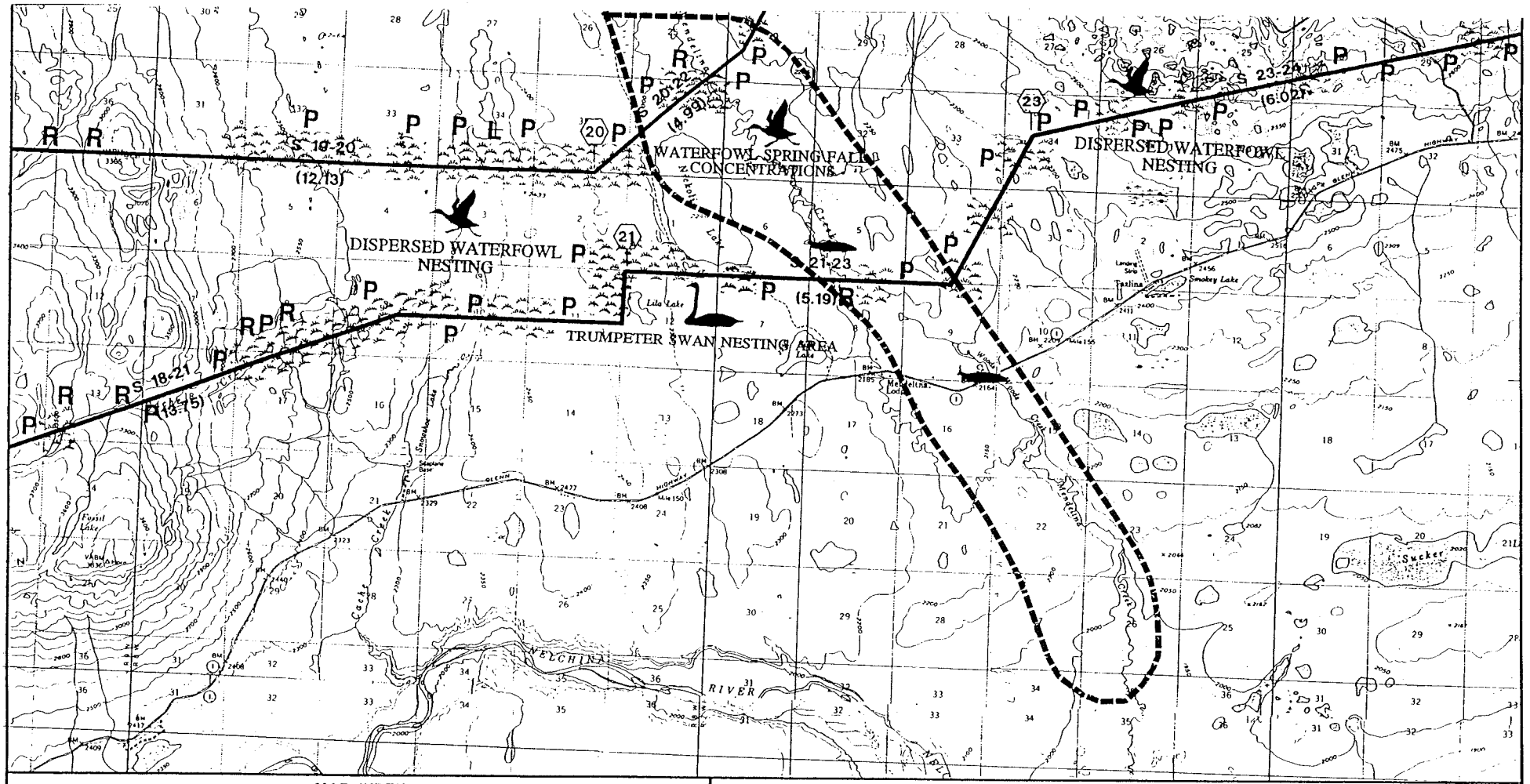

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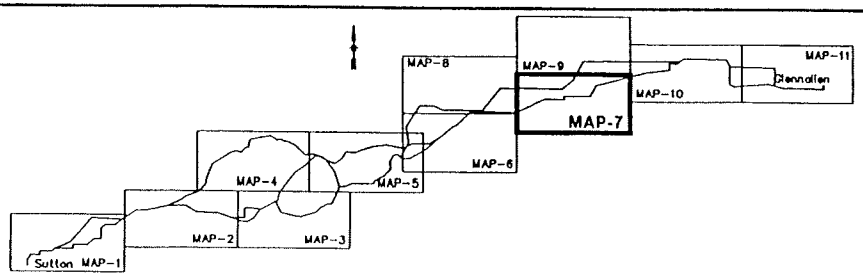

ENVIRONMENTAL RESOURCES LEGEND

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ALASKA ENERGY AUTHORITY

COPPER VALLEY INTERTIE FEASIBILITY STUDY

FIGURE 2.3-1
ENVIRONMENTAL RESOURCES
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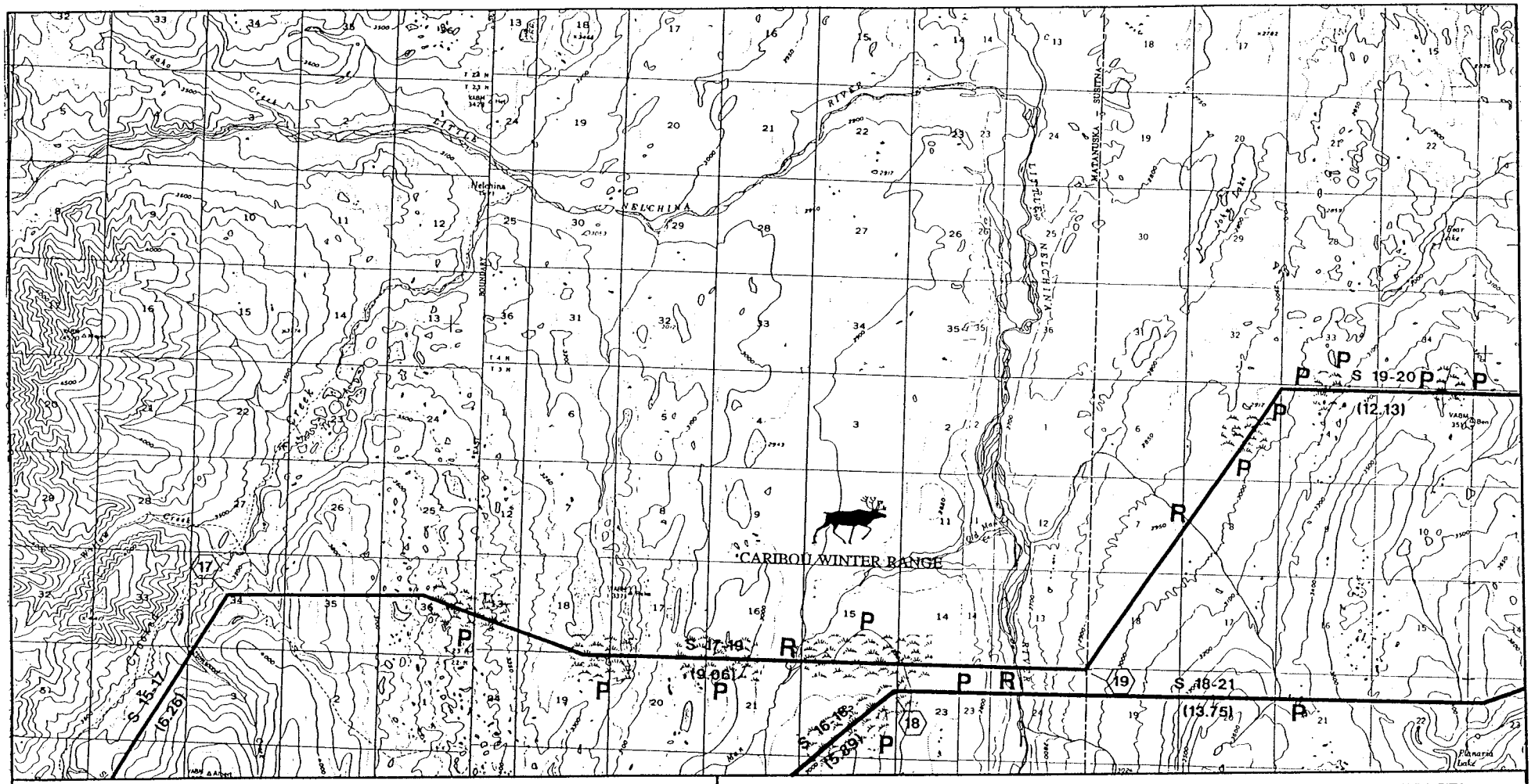

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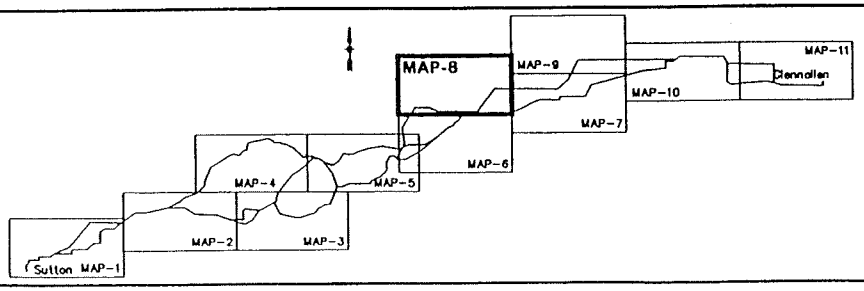

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0 1 APPROXIMATE SCALE IN MILES

ALASKA ENERGY AUTHORITY

COPPER VALLEY INTERTIE FEASIBILITY STUDY

FIGURE 2.3-1
ENVIRONMENTAL RESOURCES
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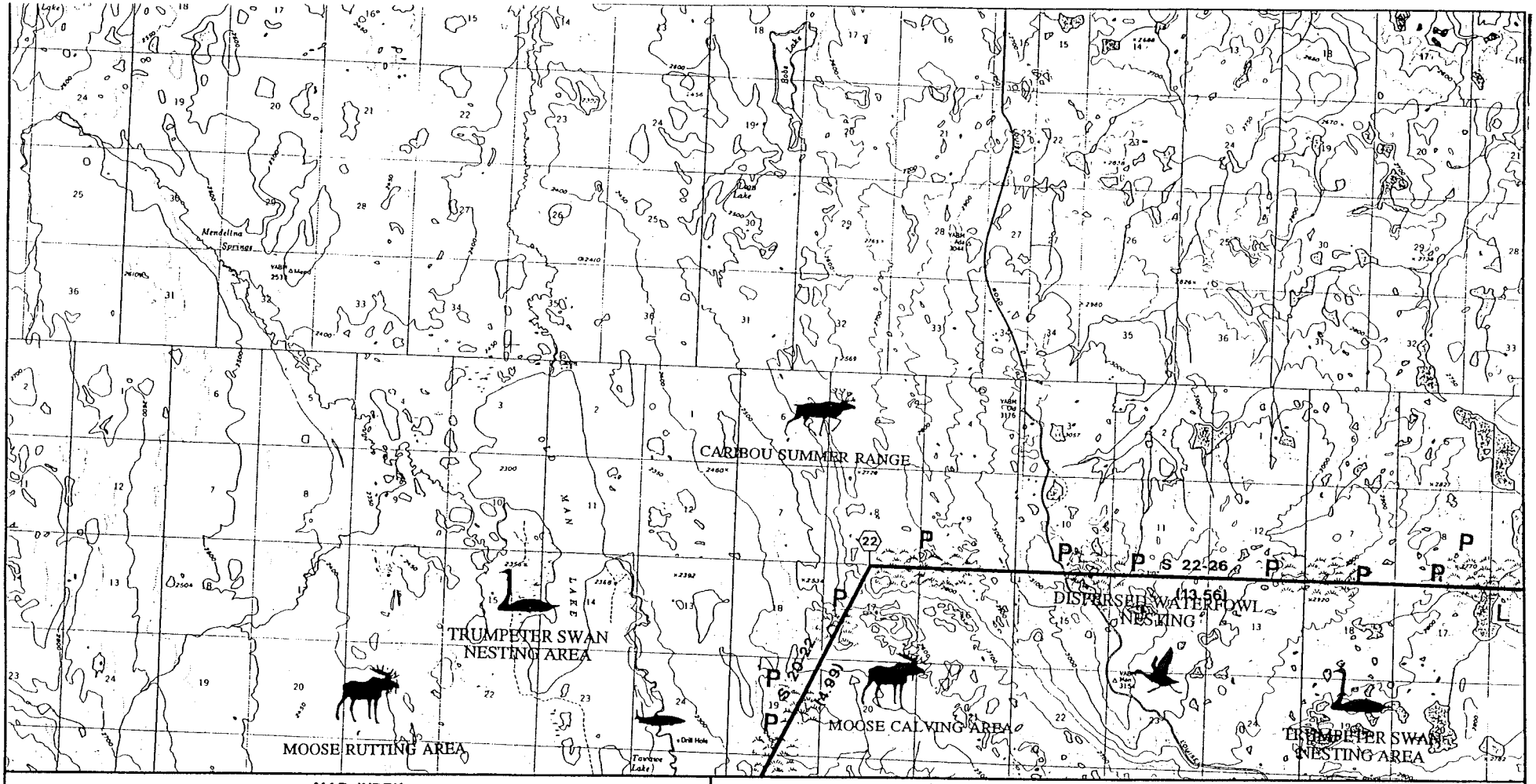

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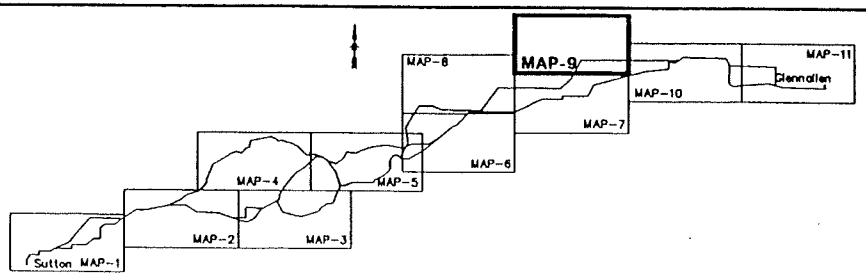

ENVIRONMENTAL RESOURCES LEGEND

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APPROXIMATE SCALE IN MILES: 0 1

ALASKA ENERGY AUTHORITY

COPPER VALLEY INTERTIE FEASIBILITY STUDY

FIGURE 2.3-1
ENVIRONMENTAL RESOURCES
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SEPTEMBER 1993

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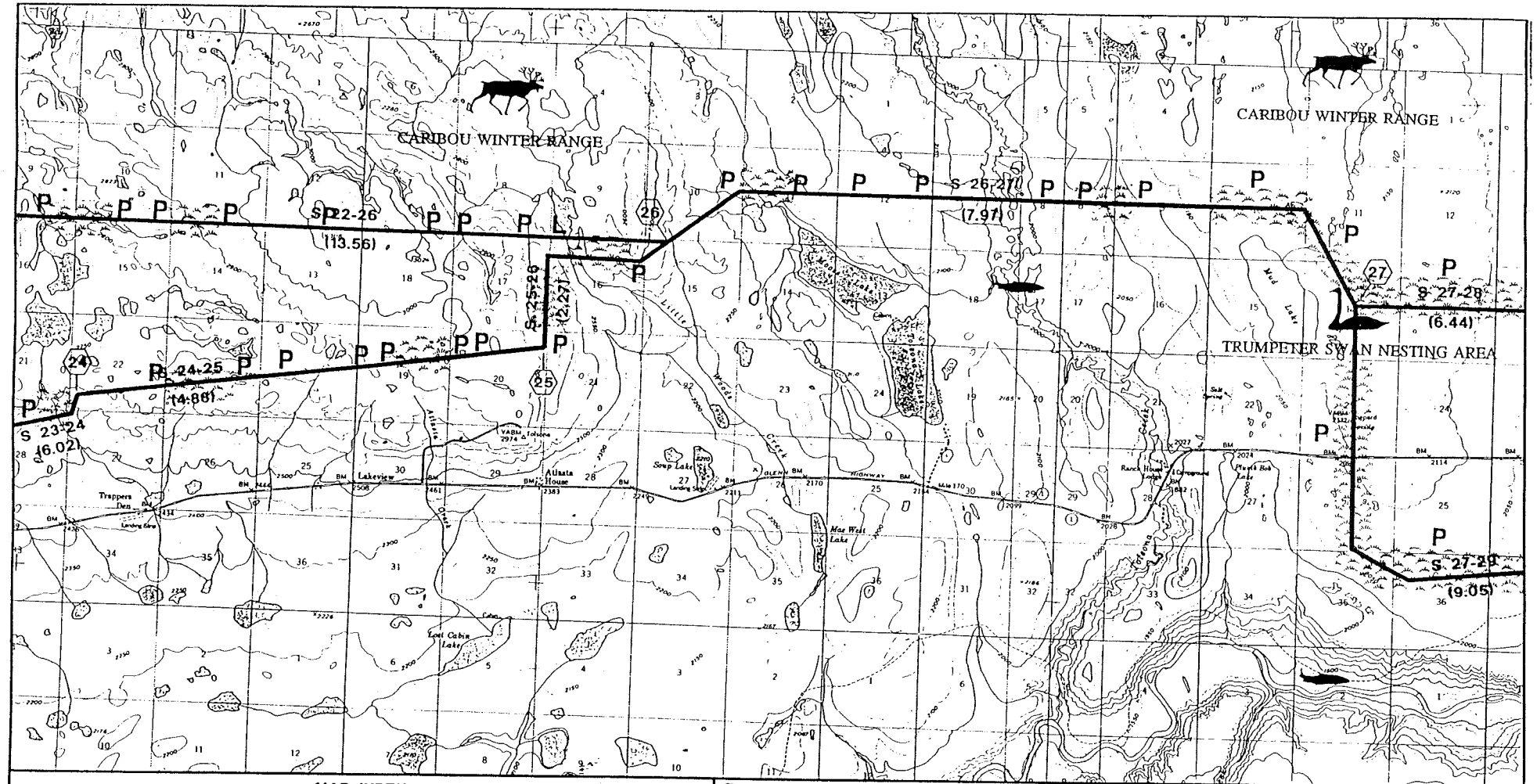

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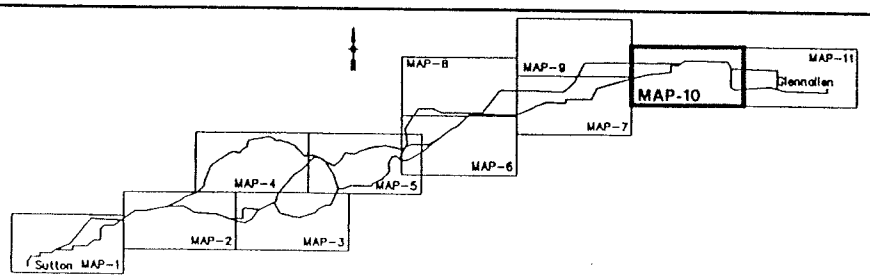

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0 APPROXIMATE SCALE IN MILES

ALASKA ENERGY AUTHORITY

COPPER VALLEY INTERTIE FEASIBILITY STUDY

FIGURE 2.3-1
ENVIRONMENTAL RESOURCES
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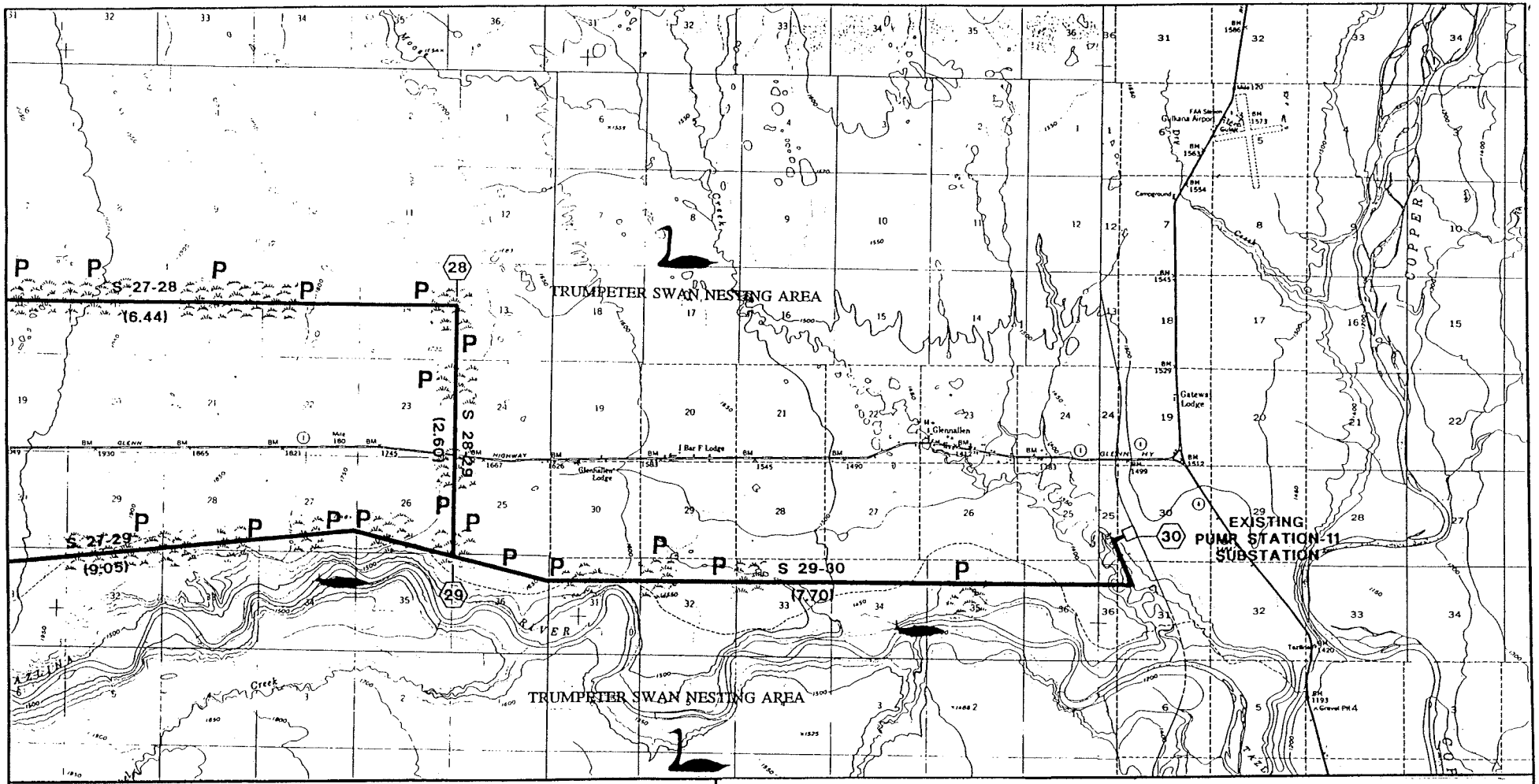

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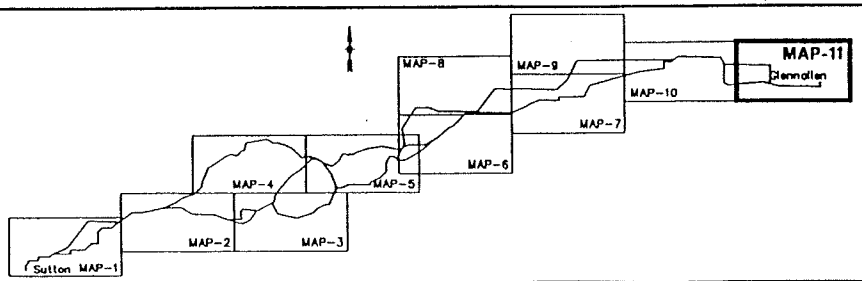

ENVIRONMENTAL RESOURCES LEGEND

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0 1
APPROXIMATE SCALE IN MILES

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COPPER VALLEY INTERTIE
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FIGURE 2.3-1
ENVIRONMENTAL RESOURCES
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DAMES & MOORE

Table 2.3-1
Description of Major Wetland Classes Found Along Proposed Alignments

Wetland System	NWI Class	Wetland Description	Dominant Species
Palustrine	PEM1B	Saturated, persistent emergent marsh generally on peat soils	Cottongrass Sedges Buckbean Sphagnum
	PEM1C	Seasonally flooded, persistent marsh, usually along floodplain of small streams or ponds	Sitka Sedge Beaked Sedge Water horsetail
	PEM1F	Semipermanently flooded persistent marsh usually along ponds or lake margins	Water sedge Pond Lily Water horsetail
	PEM1/SS1A	Temporarily flooded broad-leaf deciduous shrub bog.	Bluejoint Sedges Willows Thinleaf alder
	PEM1/SS1B PSS1/EM1B PSS4/EM1B	Saturated broad-leaf deciduous shrub bog or stunted black spruce shrub bog with emergent vegetation	Thinleaf alder Dwarf birch Labrador tea Bog blueberry Black spruce Willow
	PSS1/FO4B PFO4/SS1B PFO4/SS4B	Saturated needle-leaf evergreen bog with deciduous shrub or stunted evergreen shrub understory	Black spruce Dwarf birch Blueberry Cloudberry
	PFO4/SS1A	Temporarily flooded areas on river floodplains with open canopy needle-leaf evergreen trees and deciduous shrubs	Black spruce Thinleaf alder Horsetail Bluejoint
	PFO4B	Saturated needle-leaf ever-green forest often occurring as fringe bordering uplands or "islands" in pattern bogs	Black spruce Sweet gale Labrador tea Sedges Marsh cinquefoil Black Cottonwood
	PFO4/EM1B PEM1/FO4B	Saturated needle-leaf evergreen forest with emergent ground layer	Black spruce Sweet gale Sedge Horsetail Marsh Cinquefoil

Table 2.3-1
Description of Major Wetland Classes Found Along Proposed Alignments

Wetland System	NWI Class	Wetland Description	Dominant Species
	PAB3H	Small permanently flooded ponds with rooted vegetation	Water sedge Pond lily
	POWH	Small permanently flooded ponds with unknown bottom type	Not vegetated
Lacustrine	L1OWH	Permanently flooded large lake with unknown bottom type	Not vegetated
	L2AB3H	Permanently flooded shallow lake with rooted vascular plants	Water sedge Pond lily
Riverine	R3FLC	Seasonally flooded river flats and bars	Not vegetated or less than 30% shrub cover
	R3OWH	Permanently flooded, perennial stream with unknown substrate	Not vegetated (flowing water)
	R3SBC	Seasonally flooded, perennial stream bed, braided stream complexes	Not vegetated or less than 30% shrub cover

Source: USFWS (1985), Vierick et al. (1982), Hall (1991)

Small ponds of less than two acres could be encountered along the routes depending on the final alignment. These wetland types are generally a complex of open water and emergent and shrub bog habitats (POWH, PEM1, PEM1/SS1). The primary function of these areas is for wildlife habitat and waterfowl nesting and brood rearing.

Much of the western portions of the proposed alignments are within the Matanuska Valley Moose Range and activities are subject to wetland buffer guidelines. Buffer widths for all wetlands are set at 100 feet landward of the wetlands edge and should be adjusted to reduce potentially adverse impacts on wetlands from development on side slopes. Buffers are also recommended along streams (200 feet from each side for anadromous fish streams and encompassing the riparian vegetation or 100 feet if no anadromous fish present). Lake buffers should be 200 feet for lakes up to five acres, 300 feet for lakes 5 - 100 acres and 400 feet for lakes larger than 100 acres. Buffer widths should be increased 25% for slopes 20-40% and increased 50% for slopes over 40%.

Activities allowed within wetland and lakeshore buffers include access to wetlands for utility lines such as powerlines as approved by ADF&G and ADNR. Utility systems should not be located so they parallel wetlands or lake shorelines. Power lines should cross streams in a perpendicular fashion to the extent feasible and prudent.

Non-wetland vegetative communities making up the project area are fairly diverse. In the lowland areas of the Matanuska Valley bottomland spruce-poplar forests persist. Plant species common in this relatively dense forest system include white spruce (Picea gluaca), black cottonwood (Populus balsamifera ssp. trichocarpa), balsam poplar (Populus balsamifera ssp. balsamifera), quaking aspen (Populus tremuloides) and paper birch (Betula papyifera spp. humilis). At higher elevations in the Matanuska Valley upland spruce-hardwood forests persist. Upland spruce-hardwood forests consist of basically the same tree species as the bottomland spruce-poplar forest though are less dense and are shorter in stature. In the alpine areas above the spruce-hardwood forests, alpine tundra and barren rock communities dominate. Alpine tundra communities sustain many of the species found in the moist tundra community that persists on the eastern slopes of the Talkeetna Mountains and to the area east and south of Lake Louise in the Copper Basin. These tundra communities are variable in composition and include species such as dwarf birch (Betula nana ssp. exilis), willow (Salix spp.), green alder (Alnus crispa ssp. crispa), blueberry (Vaccinium spp), cottongrass (Eriophorum spp.), sedges (Carex spp.), and a variety of wild flowers, mosses and lichens. Across the remainder of the Copper Basin, lowland spruce-hardwood forest persists. In the Copper Basin the lowland spruce-hardwood community is an open forest system of evergreen and deciduous trees, including pure stands of black spruce. Willows and other brush species are also abundant in the lowland spruce-hardwood forests.

The 1990 Forest Resource Practices Act requires the salvage of certain cleared timber and requires that any white spruce trees cleared during construction activities must be either removed for salvage/sale or treated onsite in order to prevent the spread of bark beetles. This treatment may take the form of controlled burning, chipping or effective crushing by clearing equipment. Before approving significant land clearing actions, ADNR determines whether the timber is worth salvaging and adopts appropriate salvage methods. In general, salvage of cleared timber will be required wherever environmental and economic efficiency can be achieved. ADNR determination

is based on a transactional evidence appraisal method which compares the project to other projects of similar size, access conditions and forest types over the five previous years. Spruce trees, not found to meet these criteria must be treated onsite. Other hardwood trees or deciduous trees may be piled to decompose or left scattered on the ground.

2.3.2 Threatened or Endangered Species

According to Robert Lipkin, botanist with the Alaska Natural Heritage Foundation, there are no plant species listed on the Federal Threatened & Endangered Plant Species List within the project study area. However, Taraxcium carneocoloratum, a pinkish colored dandelion found in the vicinity of Bonnie Lake, is listed by the USFWS as a "Category 2" plant. A "Category 2" listing means that the USFWS considers the plant rare enough to list it as a candidate threatened and endangered species but that more data must be gathered regarding the occurrence and distribution of the plant before its status could be elevated to "Category 1" designation. "Category 1" candidate plants are awaiting congressional decision as to their inclusion on the Federal Threatened & Endangered Plant Species List.

2.4 Water Resources

2.4.1 Climatic Setting

The route alignments begin in an area which lies in the state's Transitional Climatic Zone and end in the state's Continental Climatic Zone. The Transitional zone is influenced by Cook Inlet and is dominated by cool summers, moderate winters, and a high incidence of cloudiness and rainfall. The climate becomes progressively less moderate as the distance from Cook Inlet increases. The Continental zone is less moderate with more extreme temperatures and varying rainfall from moderate to high amounts in upper elevations to less rainfall in the basins. The variety of terrain traversed by the proposed alignments leads to the probability of encountering microclimates where temperature, precipitation and/or winds differ significantly from the general project area.

2.4.2 Surface Water

Numerous lakes, creeks, rivers, and muskegs (swamps, bogs) are situated in the vicinity of the proposed alignments. Major lakes include Ruby Lake, Fish Lake, Bonnie Lake, Long Lake, Rush Lake, Index Lake, Tahneta Lake, Snowshoe Lake, Nickoli Lake, Moose Lake, Tolsona Lake and Old Man Lake. These lakes range from less than one square mile to greater than two square miles in size. Lakes along the routes range in elevation from approximately 500 feet above sea level to 6,000 feet above sea level. One small lakes is crossed by the northern alignment as discussed in Section 2.3.1. Small ponds are scattered throughout the project area and may be crossed depending upon the final alignment of the transmission line.

Larger named creeks and rivers along the route include Granite Creek, Kings River, Chickaloon River, Boulder Creek, Hicks Creek, Caribou Creek, Alfred Creek, and Squaw Creek. The proposed alignments also cross many small tributary drainages to the larger creeks.

Stream gradients along the route alignments vary widely and may range from 10 to 1,000 feet per mile. In large valleys, the tributary gradients decrease abruptly once the main valley floor is reached. Erosional environments resulting from high gradients and subsequent high stream velocities occur in the upper tributaries to the major drainages. Depositional environments are also commonly found in both the lower tributaries and the main streams.

2.4.3 Hydrology

The surface hydrology of southcentral Alaska and the project area is dominated by the occurrence of high seasonal precipitation and spring snow melt. Stream and river flow characteristics are typified by peaks occurring in winter and spring as a result of rainfall runoff, snowmelt from higher elevations, and rain or snow events. Low flows occur between June and September. Baseflows are maintained during the dryer months by limited ground-water contribution to streams.

Precipitation supplies surface water to local streams and rivers in two methods: direct runoff and base flow. Direct runoff is directly associated with rain and snowmelt which forms the bulk of the stream and river flow. Base flow or runoff represents the sustained flow during dryer conditions and originates as water percolated into the ground-water system or which was retained in the soil or alluvial materials.

The combination of steep slopes, heavy precipitation, and limited water-holding capacity of the watershed results in rapid rise and fall of hydrographs, and fairly uneven flow characteris tics. This is especially true of streams and rivers without lakes in their watersheds.

2.4.4 Water Quality

In general, surface water quality in streams, lakes, and rivers in the project area can be considered very good, closely reflecting precipitation quality. Most surface water has short residence time in watersheds, and is derived from recent precipitation, short-term storage in the snow pack, or in shallow ground-water reservoirs in surficial sediments. This conclusion is evidenced by watershed information, such as steepness of the terrain tending to cause rapid runoff, low permeability bedrock near the ground surface with little ground-water storage (except where large fracture systems are present) and minimal concentrating effects of evaporation, due to low evapotranspiration relative to local precipitation (Patric and Black, 1968). Since the residence time of water is short, the chemical composition of precipitation has little time to be affected or modified by geochemical interactions and concentrating effects.

Sediment is water-transported earth material transported as either suspended load or bedload. Sediment content in the project area is generally high due to the glacial influence on the streams.

2.4.5 Groundwater

Groundwater supplies in the area are limited, and occur in shallow alluvial and glacial sediments in river and stream valleys, and in fractured bedrock.

2.4.6 Water Use

Water use in the project area is mainly recreational and residential use.

2.5 Aquatic Ecology

The project area falls in two major watersheds; the Matanuska Valley drainage and the western portion of the Copper River Valley drainage area. The region has recreational (sport) fisheries resources, and to a limited extent subsistence fisheries resources. The common sport and subsistence fish species harvested are presented in Table 2.5-1.

Table 2.5-2 and Figure 2.3-1 provide summaries of anadromous fish streams crossed or directly downstream of the potential route alignments. There are numerous other fish streams crossed by various route segments that likely support resident fish species. Resident fish species found in the study area include rainbow trout, Dolly Varden, burbot, whitefish, Arctic grayling, longnose sucker, and sculpin. In addition to these species, the Matanuska Moose Range Management Plan lists the nine-spine stickleback, and the three-spine stickleback, as present within the Matanuska Moose Range. Discussions below focus on anadromous fish streams that are crossed or are directly downstream of the potential route alignments.

Table 2.5-1
Commonly Harvested Sport and Subsistence Fish

Species	Sport	Subsistence
Pink salmon (Oncorhynchus gorbuscha)	X	X
Chum salmon (Oncorhynchus keta)	X	X
Coho salmon (Oncorhynchus kisutch)	X	X
Sockeye salmon (Oncorhynchus nerka)	X	X
Chinook salmon (Oncorhynchus tshawytscha)	X	X
Rainbow Trout & Steelhead (Oncorhynchus mykiss)	X	
Dolly Varden char (Salvelinus malma)	X	

Source: ADF&G, Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes. 1992.

Table 2.5-2
Anadromous Fish Streams Crossed or Directly Downstream
of Potential Route Alignments

Stream Name	ADF&G Stream Number	Crossed or Downstream	Fish Usage	Route Alignment
Matanuska River	247-50-10220	Downstream	CH, S, K, CO, P	n/a
Eska Creek	247-50-10220-2095	Crossed	CHs	Both
Tributary of S. Matanuska River	247-50-10220-2098	Downstream	CHs, COs	n/a
Tributary of S. Matanuska River	247-50-10220-3015	Downstream	CHs, COs	n/a
Granite Creek	247-50-10220-2105	Crossed	P, COs, CHs	Both
Little Granite Creek	247-50-10220-2109	Crossed	Ks	Both
Tributary of N. Matanuska River	247-50-10220-3012	Downstream	P, COr, Ssr, CHs	n/a
Kings River	247-50-10220-2115	Crossed	CHs, Ks	Both
Chickaloon River	247-50-10220-2171	Crossed	CHs	Both
Caribou Creek	247-50-10220-2341	Crossed	CHs	South
Mendeltna Creek	212-20-10080-2431-3142	Crossed	Ks, Ss	Both
Tolsona Creek	212-20-10080-2431-3082	Crossed	Kr, Ss, Ks	Both
Durham Creek	212-20-10080-2431-3075	Downstream	SH	n/a
Tazlina River	212-20-10080-2431	Downstream	K, SH, S	n/a

Source: ADF&G, Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes. 1992.

Legend:

CH: Chum Salmon	CO: Coho Salmon
K: Chinook (King) Salmon	P: Pink Salmon
S: Sockeye Salmon	SH: Steelhead
r: Rearing Area	s: Spawning Area

2.5.1 Matanuska Valley Drainage

Matanuska River

The Matanuska River flows westerly from its headwaters at the Matanuska Glacier to Knik Arm in Cook Inlet. The Matanuska River is used by all of the Alaskan salmon species (chinook, sockeye, coho, chum and pink salmon), as well as by resident fish species. There are numerous small, unnamed tributaries and sloughs that provide spawning and rearing habitat for sockeye, coho, and chum salmon along the entire length of the river. While no salmon are documented in the Matanuska River above its confluence with Caribou Creek, ADF&G sports fish biologists report pink salmon occurring in pools beneath the Matanuska Glacier. Although neither of the potential route alignments cross the Matanuska River, six anadromous fish streams and several non-anadromous fish streams that drain into the Matanuska are crossed by the route alignments within three miles of the Matanuska River.

Eska Creek

Eska Creek flows from north to south into the Matanuska River. The proposed route alignments cross the creek approximately one mile to the northwest of Matanuska Electric Association's (MEA's) O'Neill Substation west of Sutton. Chum salmon are known to spawn in this creek.

Granite Creek and Little Granite Creek

Both Granite and Little Granite creeks are crossed by the proposed route alignment east of Sutton near the point where the northern and southern alignments split. The northern route alignment also crosses the headwaters of Little Granite Creek. Both creeks enter the Matanuska River about three miles downstream of the route crossing. Granite Creek provides coho and chum salmon spawning habitat from approximately one half mile upstream from the Matanuska River up to the area beneath Knob Hill. Pink salmon utilize the lower reaches of Granite Creek. Chinook salmon spawn in Little Granite Creek slightly south of where the alignments cross the creek. Little Granite Creek drains into a slough of the Matanuska River where sockeye and chum salmon spawn, and where sockeye and coho salmon rearing occurs.

Kings River

The Kings River drainage is supplied with water from numerous streams originating in the Talkeetna Mountains and drains into the Matanuska River. The river is crossed by both the northern and the southern route alignments. The northern alignment crosses the Kings River approximately eight miles upstream from the Matanuska River and the southern alignment crosses the river about three miles upstream from the Matanuska River and parallels the Kings River for about one mile. Chinook and Chum salmon spawn in the river from three miles downstream of the northern crossing to the Matanuska River.

Chickaloon River

The Chickaloon River drainage is approximately six miles to the east of the Kings River watershed and drains from the Talkeetna Mountains to the Matanuska River. The proposed route alignment crosses the Chickaloon River approximately four miles upstream from the Matanuska River near the confluence with Boulder Creek. Chum salmon use the Chickaloon River for spawning from the area where the route alignment crosses downstream to the Matanuska River. No other salmon species are listed by ADF&G in the *Catalog of Waters Important to Spawning, Rearing, or Migration of Anadromous Fishes* for the Chickaloon River, but the Matanuska Moose Range Management Plan lists chum and coho salmon as also being present in the Chickaloon River.

Boulder Creek

The Boulder Creek drainage originates beneath Chitna Pass in the Talkeetna Mountains and is supplemented by waters from East Boulder Creek draining the watershed between Boulder Mountain and Mount Monarch. Boulder Creek is crossed by the northern alignment in the Boulder Creek Flats area just west of Anthracite Ridge. This alignment closely parallels the creek for approximately 14 miles, crossing the creek three times. East Boulder Creek is also crossed by the northern alignment. The southern alignment crosses Boulder Creek approximately one mile northwest of Rush Lake. According to the Matanuska Valley Moose Range Management Plan, chum salmon occur in Boulder Creek.

Caribou Creek

Caribou Creek, which flows into the Matanuska River, is the easternmost anadromous fish stream crossed by the potential route alignments in the Matanuska Valley. The creek drainage is closely paralleled and then crossed by the southern route alignment between Sheep Mountain and Fortress Ridge. Chum salmon are known to spawn in the lower reaches of Caribou Creek more than ten miles downstream from where it would be crossed by the southern alignment.

2.5.2 Copper River Valley Drainage

Mendeltna Creek

Mendeltna Creek, which flows into the Copper River drainage via Tazlina Lake and the Tazlina River, is the westernmost anadromous fish stream crossed by the proposed alignments in the Copper River Valley drainage area. The creek is crossed by the northern alignment in the area just northeast of Nickoli Lake and crossed by the southern alignment southeast of Nickoli Lake near the Mendeltna Lodge at mile 153 of the Glenn Highway. Chinook salmon spawn in the creek from approximately one mile downstream of the area where the northern alignment crosses the stream to Tazlina Lake. Sockeye salmon and Arctic grayling also occur in Mendeltna Creek. Sockeye salmon are known to spawn in the creek from where the northern alignment

crosses the creek upstream to Old Man Lake. The crossing of the southern alignment occurs within the sockeye salmon spawning area.

Woods Creek, a small tributary three miles downstream from the southern alignment's crossing of Mendeltna Creek, supports chinook salmon rearing. East of the area where the southern alignment crosses Mendeltna Creek, Woods Creek extends north to within a mile of the southern alignment.

Tolsona Creek

Tolsona Creek is the easternmost anadromous fish stream crossed by the potential route alignments. The northern and southern route alignments are the same in this area. Tolsona Creek is crossed by the route alignment just northeast of Moose and Tolsona lakes around mile 170 of the Glenn Highway. The crossing occurs within an approximately four mile section of the creek used by chinook salmon for spawning. Chinook salmon rearing and sockeye salmon spawning occurs from three miles below where the alignment crosses the creek to the Tazlina River. Arctic grayling are also resident in this creek.

Tazlina River

The Tazlina River flows from west to east, from Tazlina Lake to the Copper River. The southern route alignment closely parallels the river within a mile from 12 miles west of Glennallen to the end of the route. The northern alignment joins the southern alignment approximately five miles west of Glennallen. Chinook and sockeye salmon occur in the Tazlina, as do Arctic grayling and steelhead trout.

2.6 Wildlife

2.6.1 Birds

Approximately 150 bird species inhabit the Matanuska Valley and many of these same species are common to the Copper River Valley.

Waterfowl

Waterfowl habitats along the proposed route alignments are located in the many lakes and ponds along the lower elevations of the Matanuska Valley and in the Copper River Valley. Both areas are also used as migration corridors for waterfowl in the spring and fall.

Small ponds and lakes scattered throughout the Matanuska Valley provide nesting habitat for waterfowl species. These areas would not likely be intersected by either route alignment.

The Copper River basin, with its many lakes and small ponds, supports dispersed waterfowl nesting and brood rearing throughout the lowland areas from the Talkeetna Mountains to Glennallen. Common waterfowl species found in this area include diving ducks such as the Greater and Lesser Scaup, and dabbleres such as the Green-winged Teal, American Wigeon and Mallards. Wetland complexes along Mendeltna Creek, east of Slide Mountain near Tazlina Lodge, are used as a spring and fall concentration area for waterfowl and will be crossed by both potential route alignments.

The trumpeter swan, a species of concern, nests throughout much of the Copper River Valley and has been documented to nest in areas near Mendeltna Creek. Trumpeter swan nesting occurs in the immediate vicinity of the route alignments near Mud Lake about 13 miles west of Glennallen. Known trumpeter swan nesting also occurs near Moose Creek and the Lake Louise Road, both within one mile of the proposed route alignments. Trumpeter swans could be encountered on other small lakes in this region since nesting concentrations occur in much of the area just to the north of the route. These swans are particularly vulnerable to collisions with powerlines and this is a major cause of death in this species. According to Dennis Gnath, an ADF&G habitat biologist, trumpeter swan nesting areas are not legislatively protected by a "Critical Habitat Area Designation" nor are they on the Federal Endangered Species List. However, the nesting habitat areas across the Copper Basin are considered "Documented High Value Trumpeter Swan Nesting and Concentration Areas" by the Copper River Basin Area Plan, and as such are managed to protect the nesting habitats of trumpeter swans. Restrictions listed in the Copper River Basin Area Plan are discussed further in Section 2.7.2.

Raptors

Bald and golden eagles and their nests are protected under the Bald Eagle Protection Act. A raptor nest has been identified along lower Granite Creek approximately 1-2 miles south of the first section of the proposed route alignment but it has not been documented as an eagle nest. According to raptor specialists with the USFWS, no eagle nests have been documented in the immediate vicinity of the potential route alignments. However, there is the possibility of encountering a nest along the larger rivers, so a survey of potential habitat may be necessary to check for active nests. Restrictions could apply regarding ground clearing activity within 330 feet of an eagle nest if any are located near either of the route alignments.

The American peregrine falcon (Falco peregrinus anatum), listed as an endangered species, is protected under the Endangered Species Act and could occur in the area. Arctic peregrine falcons (Falco peregrinus tundrius) are listed as a threatened species. These most likely only occur in the project area during migration. Peregrines and other raptors are known to move between the Copper River Basin and the Matanuska River in the spring and fall. No peregrine nest sites have been documented in the vicinity of the proposed alignments. There is a remote possibility of a recently established nest site in the general project area since the American peregrine falcon population has been expanding its range in the last several years. A raptor survey would likely be required if this project proceeds to the permitting and construction phase.

Other raptors, not listed above, may also be present in the study area. No information on other raptor nests was available from federal or state sources.

Federal wildlife officials have indicated that raptor protection measures should be taken within a quarter mile of anadromous fish streams. Input from USFWS and ADF&G should be incorporated on marking transmission lines to minimize the potential for raptor collisions.

2.6.2 Mammals

Five species of mammals are of particular importance in the project area because of their subsistence, recreational and/or ecological importance: black bear, brown bear, caribou, moose and Dall sheep. Distribution of these species and important use areas are presented in Figure 2.3-1.

Black Bears

Black bears occur throughout much of the study area and use a wide range of habitats, although they prefer open forest and mixed habitat types. No areas of concentration have been delineated along the proposed route alignments.

Brown Bears

Brown bears are relatively common in higher elevations of the drainages of the Talkeetna Mountains and occupy more remote areas than black bears. The northern route alignment in the Boulder Creek, Chitna Creek, and Alfred Creek areas would pass through brown bear habitat. In addition, the route alignment along the upper watershed of Caribou Creek, where the northern and southern alignments join for a few miles, passes through brown bear habitat.

The mountains east of Chickaloon River are listed as potential brown bear denning habitat and denning could occur throughout this area. No brown bear concentration areas along fish streams have been documented near either route alignment.

Brown bears also occur throughout the Copper River basin. No concentration areas have been delineated along the proposed route alignments within the Copper River basin.

Moose

Moose are widespread throughout the Matanuska River drainage in the western portion of the project area and in much of the Copper River drainage. They utilize the higher elevations of the Talkeetna Mountains in the spring, summer and fall, then move to the lower valley bottoms as snow forces them out in early winter. During the winter, moose tend to concentrate along rivers and streams such as the Matanuska River, Kings River, and Chickaloon River.

The proposed alignment routes pass through portions of the Matanuska Valley Moose Range. The southern route alignment passes through moose range from Sutton to Caribou Creek. The northern route alignment takes a higher course through the Talkeetna Mountains which is primarily used as summer habitat for moose.

Moose are also distributed throughout the Copper River drainage. Winter moose habitat occurs in areas of lower elevation between Slide Mountain and the Tolsona River. These low-lying areas are also utilized by moose for fall rut and calving in the spring and early summer. Both the northern route alignment and the southern route alignment pass through moose calving concentrations between Mendeltna Creek and the Tolsona River.

Caribou

The project study area passes through the range of the Nelchina caribou herd. Animals from this herd utilize the area at or above timberline in the Talkeetna Mountains for summer range. During the fall and winter, many of the caribou move through the lowland foothill area east of the Eureka Roadhouse in the Copper River basin, although the higher elevations are utilized to some extent in parts of the range.

All of the northern route alignment passes through caribou winter and/or summer range in the Talkeetna Mountains and primarily caribou winter habitat east of Slide Mountain.

The herd's calving area on the eastern slopes of the Talkeetna Mountains in the Lake Louise/Johns Lake/Slide Mountain area is the focal point for the herd's yearly movements. This area is north of the proposed route alignments.

Dall Sheep

Dall sheep range on much of the higher elevations of the Talkeetna Mountains from Sutton to Eureka. Much of the northern route alignment west of the Copper River basin passes through Dall sheep habitat. The south facing slopes between Granite Creek and Kings River are a winter concentration area for Dall sheep. The northern route alignment passes within a mile of some these slopes near Red Mountain.

An important feature of Dall sheep summer habitat is the proximity to mineral licks which provide nutritional requirements and social interaction between members of the herd. Five mineral licks have been documented within the project area. The beginning of the proposed route alignment passes directly over a mineral lick where it crosses Granite Creek beneath Knob Hill. The northern alignment passes within a 1/4-mile of another mineral lick approximately 1/2-mile west of Young Creek. No other areas of the route are within one mile of identified mineral licks.

Other wildlife species common to the study area include snowshoe hare, hoary marmots, arctic ground squirrel, red squirrel, beaver, muskrat, porcupine, red fox, coyote, gray wolf, marten, short-tailed weasel, mink, wolverine, land otter and lynx.

2.6.3 Threatened and Endangered Species

The American peregrine falcon (endangered) and the Arctic peregrine falcon (threatened) may be found in the project area, especially during spring and fall migration. Trumpeter swans, listed as a species of special concern, are commonly found in the area. Management policies for trumpeter swans are described in Section 2.7.2 under the Copper River Basin Area Plan. Bald and Golden eagles and their nests are protected under the Bald Eagle Protection Act. Although no eagle nests have been documented along the route, there is the potential for these nests in the study area. Any eagle or peregrine falcon nest located in the study area would require a buffer of undisturbed natural vegetation for a 330 foot radius around the nest.

2.7 Land Use and Land Status

2.7.1 Land Use and Community Characteristics

Primary land uses in the project area are public recreation use and wildlife habitat. Other land uses in the general project area include minerals and materials mining and forestry. Coal mining occurs in the Chickaloon area and numerous mining and mineral claims are staked along the Caribou Creek, Alfred Creek and Squaw Creek drainages. The proposed routes have been designed to avoid private lands as much as possible. Land use is regulated by the Matanuska-Susitna Borough for the area between Sutton and Eureka. Uses on state lands are regulated by ADNR.

Population concentrations in the project area occur along the Glenn Highway in the communities of Sutton, Chickaloon, Glacier View and Glennallen. Sutton, Chickaloon and Glacier View are all within the boundaries of the Matanuska-Susitna Borough and have active Community Councils which provide input to the Borough regarding land use issues. These communities have a rural character with low density residential development and limited commercial and service development. Businesses in the Chickaloon and Glacier View areas tend to be recreation oriented with a number of small businesses offering rafting, horseback riding, and other wilderness recreation opportunities.

The Matanuska-Susitna Borough is the only municipality located within the project area. The Borough has designated the Chickaloon area as a Special Land Use District and has adopted land use regulations within this area. The Borough is currently drafting a comprehensive plan for the Glacier View area and is expected to adopt similar land use regulations in the Glacier View area. The proposed route alignments are outside of the Borough's Coastal Management District boundaries as well as the Borough's federally designated flood hazard area.

The majority of the proposed route alignments are located on state and federal lands. ADNR is responsible for managing state lands for the maximum public benefit. In order to fulfill this responsibility the state develops area plans which set guidelines for the use of state lands and management plans which provide detailed guidance for special areas like the Matanuska Valley Moose Range. State lands in the project area are covered by the Susitna Area Plan, the Matanuska Valley Moose Range Management Plan and the Copper River Basin Area Plan.

2.7.2 Area Plans and Designated Areas

Chickaloon Special Land Use District

The Matanuska-Susitna Borough has adopted a comprehensive plan for the Chickaloon area. The implementing ordinance designates the area within the Chickaloon Community Council boundaries as the Chickaloon Special Land Use District and requires that certain uses, such as transmission lines, must apply for a Conditional Use Permit (CUP). A CUP is required for uses which are generally considered appropriate for the area, but which required controls and safeguards to ensure their compatibility with permitted principal uses, and to protect the public health, safety and welfare.

Susitna Area Plan

The Susitna Area Plan was adopted in 1985 and covers over nine million acres of state land. The Glenn Highway Subregion of this plan covers the project study area from Sutton to Eureka. Within this subregion, the northern route alignment crosses Management Units 6, 11 and 12 as shown in Table 2.7-1. The southern alignment crosses Management Units 6, 7, 8, 10, 11 and 12.

The Susitna Area Plan states that most state lands are to be managed for multiple use and that uses not indicated for areas in the plan may be permitted if ADNR determines that the use is consistent with the statement of management intent for the area. The management intent for the Glenn Highway Subregion is to protect and improve recreation, fish and wildlife and visual values, while developing the area's resources and selling some state lands for resource development and settlement. Transmission lines and other utility uses are not listed as prohibited uses in any of the management units crossed.

Fish and wildlife habitat policies state that all land use activities should avoid or minimize foreseeable or potential adverse effects on fish and wildlife populations and their habitats. If loss of habitat cannot be minimized, restoration and rehabilitation is required.

Recreation policies are designed to support recreational opportunities of regional or statewide significance. These policies include promoting use of under-utilized recreation areas where appropriate and achieving maximum use of recreation site while maintaining high quality recreation experiences and environmental quality. River, stream and lake buffers are established to help implement these policies.

Table 2.7-1
Management Units within the Glenn Highway Subregion
of the Susitna Area Plan Crossed By Route Alignments

Management Unit Number	Management Unit Name	Primary Land Use Designations	Secondary Land Use Designations	Other Comments	Route Alignment
6	Matanuska Valley Moose Range	6a:C,F,PR,WH 6b:PL	6a:G 6b:n/a	Legislatively Designated Area; Mineral Licks	Both
7	Bonnie Lake	7a:PR,S,WH	7a: F		Southern Alignment
8	Purinton	8a:PR,WH	8a:F	Mineral Licks	Southern Alignment
10	Matanuska Glacier	10f:PR,WH 10g:PL	10f:F 10g:n/a	Mineral Licks	Southern Alignment
11	Gunsight Mountain	11b:PR,WH 11c:PL 11d:PL 11e:PR,WH	11b:F 11c:n/a 11d:n/a 11e:n/a	Legislatively Designated Area (Nelchina Public Use Area)	Both
12	Alpine Areas	12a:PR,WH 12b:PR,WH	12a:n/a 12b:n/a	12a and 12b: Mineral Licks 12b: Legislatively Designated Area (Nelchina Public Use Area)	12a: Southern Alignment 12b: Northern Alignment

Source: ADNR, Susitna Area Plan, 1985

Abbreviations:

C: Coal
F: Forestry
G: Grazing
PL: Private Lands
PR: Public Recreation
S: Settlement
WH: Wildlife Habitat
n/a: Not Applicable

River and stream buffers are required on waters which provide public recreational opportunities. Rivers with important recreational values require a buffer of between 200 feet and a quarter-mile and include Mendeltna Creek, Kings River and Little Nelchina River. Rivers with exceptional recreational values are proposed for legislative designation. None of the rivers which have been legislatively designated is crossed by the proposed route alignments. Buffers are also required around lakes with important public recreational values. No such lakes are crossed by the proposed route alignments.

Mineral licks used by significant numbers of wildlife are located throughout this area as indicated as Figure 2.3-1. These areas are used primarily during the spring and early summer. The Plan identified specific management guidelines for resource development occurring near these areas. These guidelines require that the developer minimize, to the extent feasible, the potential impacts on wildlife use of the areas. Site specific stipulations are developed for each development project to address the following concerns:

- avoidance of direct and indirect impact on the mineral licks, animal trails leading to them and other areas of concentrated animal use associated with the mineral lick;
- compensation for the destruction or loss of a lick; and
- methods and routings of access roads to these areas.

Forestry is listed as a secondary land use designation in parts of the study area. Forestry goals in the Plan include promoting economic development; meeting personal use needs of Alaskans; managing forest resources for long term productivity; and protecting forests from fire, insects, disease and other destructive agents. Management guidelines include salvaging timber from lands cleared for other uses, such as utility corridors. ADNR's Division of Forestry is charged with reviewing proposals for land clearing and determining whether timber salvage is appropriate. In general, salvage of cleared timber will be required wherever environmental and economic efficiency can be achieved.

Matanuska Valley Moose Range Management Plan

The proposed northern and southern route alignments traverse approximately 6.5 miles and 24 miles, respectively, of the Matanuska Valley Moose Range (MVMR), established by the State Legislature. The MVMR was established to protect and enhance moose populations and their habitat and to set guidelines for various land uses. In addition to moose, the area has a high value for fishing as well as materials and mineral resources, including coal, shale and limestone. Surface-disturbing land uses may be allowed but must meet stringent reclamation requirements for enhancement of moose habitat.

The MVMR is divided into three management units, the Western Management Subunit, the Middle Management Subunit and the Eastern Management Subunit. Both proposed route alignment cross all three subunits. Management policies for the MVMR include preserving

wildlife habitat; allowing for recreational uses including hunting, fishing and other harvesting of wildlife resources; materials and minerals development; and timber harvesting. To achieve these goals, the Plan establishes buffers around streams, lakeshores, wetlands and trails, as discussed below. Management guidelines in the Plan call for protection of scenic views such as the views of Granite Peak and Castle Mountain from the Glenn Highway and the view of Puddingstone Hill from the Chickaloon River Trail and the Chickaloon-Knik-Nelchina Trail system. Cultural and historical resources located in the area are to be protected until an evaluation of the resource's value can be completed.

The Plan outlines buffers for streams, lakeshores, wetlands, and trails. Stream buffers of 200 feet on each side are required for anadromous fish streams and 100 foot buffers are required for perennial streams not known to have anadromous fish. Stream buffers may be reduced on non-anadromous streams if the riparian zone is less than 100 feet wide. Utility lines are allowed within the buffers if approved by ADNR and ADF&G. Utilities should cross streams in a perpendicular fashion rather than parallel streams to the extent feasible. Lakeshore buffers vary from 200 feet to 400 feet depending on the size of the lake. No lakes within the MVMR are crossed by the proposed route alignments. Wetland buffers are set at 100 feet from the limit of wetland vegetation and should be increased for slopes above 20%. Again, utilities are allowed in wetland buffers. Buffers are required for the Chickaloon-Knik-Nelchina, Chickaloon River and Old 98 trails. The minimum buffer is 100 feet of vegetated buffer but this may increase up to 300 feet based on the summer line-of-sight. Utility lines may cross these trails and their buffers if no feasible or prudent alternative exists. These crossings should be perpendicular if possible.

Prohibited uses outlined for the three management units do not include transmission lines or other utility projects.

Nelchina Public Use Area

The Nelchina Public Use Area is the largest legislatively designated public use area on state land in Alaska. The area is managed by ADNR for multiple use with a goal to perpetuate and enhance public recreation and enjoyment of a quality environment. The area contains more than 250,000 acres including several creeks such as Alfred Creek, Caribou Creek and Pass Creek. The northern route alignment crosses through this area for approximately 60 miles while the southern route alignment crosses about six miles.

Copper River Basin Area Plan for State Lands

The Copper River Basin Area Plan was adopted in 1986 and addresses the management of 3.3 million acres of state lands in the Copper River basin. The basin is divided into 33 Management Units. Both route alignments traverse lands in Management Units 3, 4 and 5 as shown in Table 2.7-2. Within Unit 5, the northern route alignment crosses subunits 5c, 5f, 5g and 5h while the southern alignment crosses subunits 5c, 5d and 5h.

Table 2.7-2
Management Units within the Copper River Basin
Area Plan Crossed By Route Alignments

Management Unit Number	Management Unit Name	Primary Land Use Designations	Secondary Land Use Designations	Other Comments	Route Alignment
3	North of Tazlina River	3c: Forestry, Wildlife Habitat	3c: Public Recreation		3c: Both
4	North of Glenn Highway Near Snowshoe Lake	4a: Wildlife Habitat	4a: Forestry, Public Recreation		4a: Both
5	Lake Louise Road Area	5c: Public Recreation	5c: Wildlife Habitat	5c: Proposed Legislative Designation Kettlehole Lakes - Mendeltna Creek Area	5c: Both
		5d: Settlement	5d: Forestry, Water Resources, Wildlife Habitat		5d: Southern Alignment
		5f: Public Recreation, Wildlife Habitat	5f: Forestry	5f: Proposed canoe trail system on small lakes	5f: Northern Alignment
		5g: Settlement	5g: Wildlife Habitat		5g: Northern Alignment
		5h: Wildlife Habitat	5h: Forestry, Public Recreation		5h: Both

Source: ADNR and ADF&G, Copper River Basin Area Plan for State Lands (1986)

Forestry goals in the Plan include promoting economic development; meeting personal use needs of Alaskans; managing forest resources for long term productivity; and protecting

The majority of lands in the management units crossed are designated for public recreation, wildlife habitat and forestry. Goals and management guidelines relevant to these land uses are described in the following paragraphs.

Fish and wildlife goals identified in the plan are to maintain and protect publicly owned habitat base; ensure access to public lands and water; mitigate habitat loss; and contribute to economic diversity. Management guidelines include avoiding the loss of natural fish and wildlife habitat; minimizing unavoidable loss through proper planning, siting and design of projects; restoration of areas where damage was not minimized; and compensation for substantial and irreversible loss where habitat loss has not been avoided, minimized or restored. Structures in fish habitat should be designed to minimize impacts on fish migration, spawning and rearing. Activities in important waterfowl habitat which require a permit and produce high levels of acoustical or visual disturbance are to be avoided during sensitive periods. Specific management guidelines for trumpeter swans are described below.

Management Unit 4 is an area designated to be managed to protect the nesting habitats of trumpeter swans and to minimize disturbances to them. Guidelines in these areas call for the prohibition of overland access from May 1 to August 31 unless the activity is compatible with the protection of trumpeter swans and their habitat, or unless DNR determines that it is not feasible and prudent to prohibit these activities. If DNR determines it is not feasible to prohibit certain activities, restriction may be placed on areas within a quarter mile of current or potential swan nesting or staging areas. The Plan specifically restricts transmission lines in trumpeter swan habitat. These habitats are to be avoided for construction of transmission lines. If lines are built in this type of habitat, they should be sited in forested areas and kept close to treetop level. Transmission line wires are to be strung in a horizontal plane and where they cross open spaces should be marked so that they are visible to swans.

Forestry goals in the Plan include promoting economic development; meeting personal use needs of Alaskans; managing forest resources for long term productivity; and protecting forests from fire, insects, disease and other destructive agents. Management guidelines include salvaging timber from lands cleared for other uses, such as utility corridors. ADNR's Division of Forestry is charged with reviewing proposals for land clearing and determining whether timber salvage is appropriate. In general, salvage of cleared timber will be required wherever environmental and economic efficiency can be achieved.

Public recreation goals include providing convenient outdoor recreation opportunities to Alaska's residents and visitors; protecting natural and cultural resources; promoting economic development; and protecting the historic and archaeological resources of Alaska. Management guidelines include a review of construction projects or land uses for potential conflict with cultural resources.

Stream corridor goals include providing opportunities for recreation; protecting riparian fish and wildlife habitats; providing for private ownership of land near streams; protecting water

quality; and providing for the harvest of timber from riparian forests where appropriate. Management guidelines call for stream buffers of varying widths depending on topography, vegetation, land ownership, recreational use, habitat value and other factors. Activities are to avoid altering natural hydrological conditions and soil erosion is to be minimized by restricting the removal of vegetation adjacent to streams and by stabilizing disturbed soil as soon as possible.

The goal of the wetlands management guidelines is to protect the hydrologic, habitat and recreational values of important public wetlands. Wetlands covered under these guidelines are those meeting the wetland definition in the Alaska Coastal Management Program. Permits for operating heavy equipment in wetlands will require that damage to wetlands and wetland vegetation be avoided if possible. These activities should be limited to winter when feasible.

Subunits 5c and 5f are identified as important recreational areas in the Plan and are proposed for legislative designation as a recreation area. The outlet of Old Man Lake into Mendeltna Creek is identified as an important spring and fall staging area for trumpeter swans. The management guidelines would restrict recreation use and construction activities in this area from April 15 through June 1 and from September 15 through November 15.

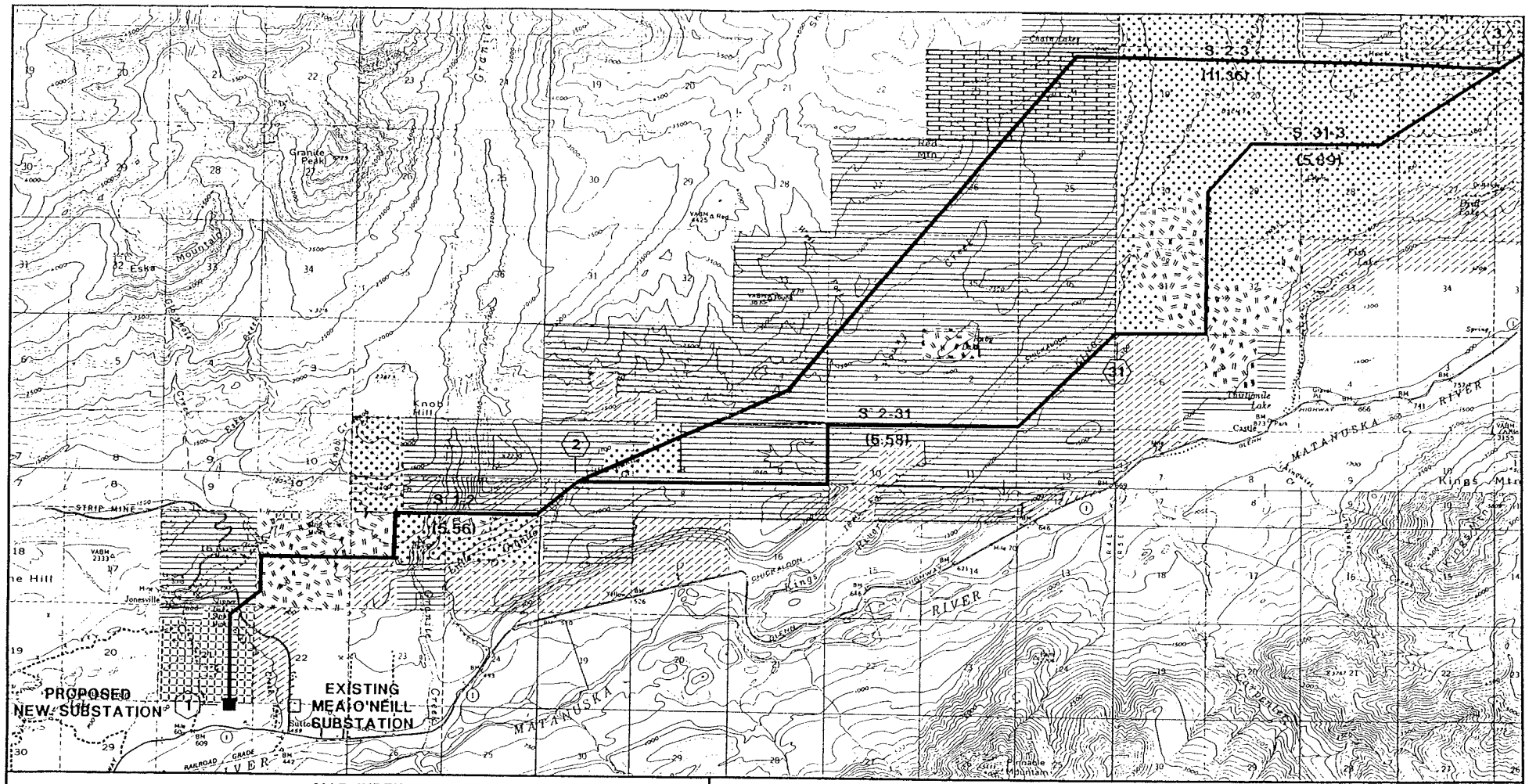
Prohibited uses outlined for the three management units do not include transmission lines or other utility projects.

2.7.3 Land Status

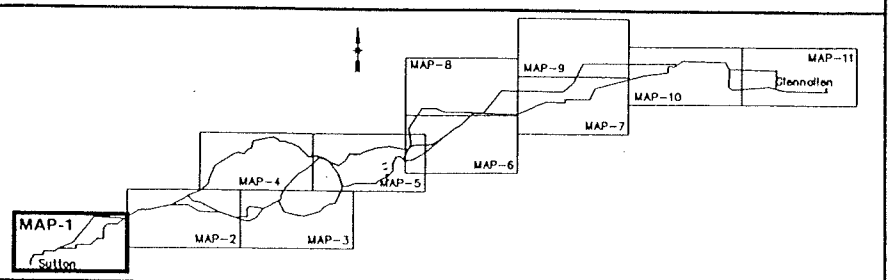
The proposed route alignments traverse federal, state, Native, borough, and private lands. The majority of each route is on public lands and an effort has been made to avoid private land holdings wherever possible. Land status is shown on Figure 2.7-1. Information on this map was gathered from ADNR, the Matanuska-Susitna Borough and the Bureau of Land Management. This maps shows general land status and does not represent status of individual lots. Representatives of the Chickaloon Village Traditional Council attended one of the public meetings and stated that their lands were not accurately depicted on this map. The Authority requested that they provide maps or information to allow the map to be revised, but no information has been received. The categories of land status are described further below.

Private

Private land holdings are any properties owned by individuals or business, but not by Native corporations, municipal governments, or the state or federal government. The route alignments were designed to avoid private lands. Areas where the route alignments run along private lands include the beginning of both routes, west of Granite Creek, and near where the southern route alignment crosses Kings River. Other private landholdings within one mile of the routes are concentrated in the first 20 miles of the southern route alignment and the first five miles of the northern route alignment.



MAP INDEX



LAND STATUS LEGEND

- PRIVATE
- MATANUSKA-SUSITNA BOROUGH
- NATIVE
- FEDERAL
- NATIVE SELECTED
- MENTAL HEALTH
- STATE
- ALTERNATIVE ROUTE SEGMENTS
- SEGMENT DESIGNATION S1-2 I.e. BETWEEN POINTS 1 AND 2
- MILEAGE BETWEEN POINTS IN ( )

0 1
APPROXIMATE SCALE IN MILES

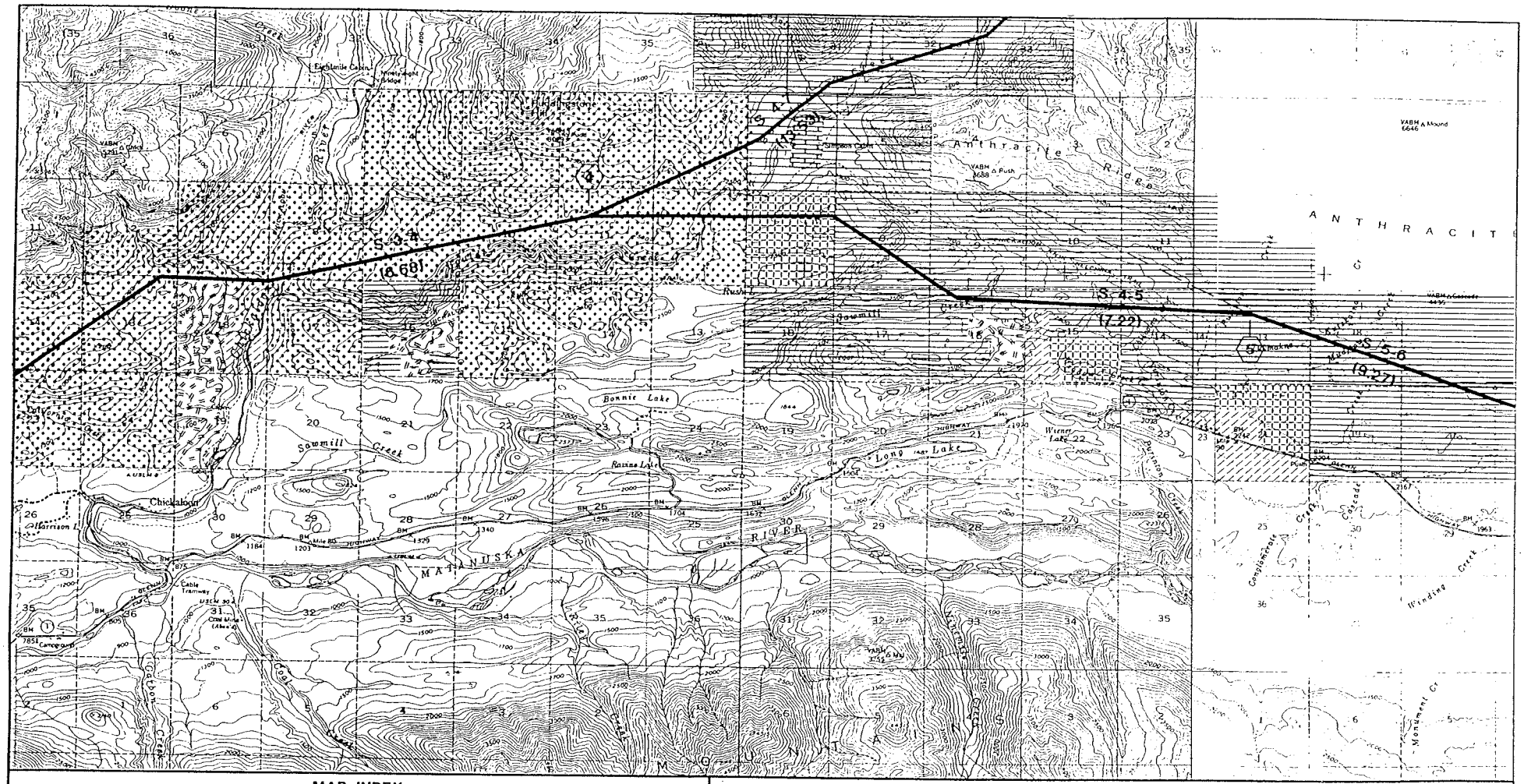
ALASKA ENERGY AUTHORITY

COPPER VALLEY INTERTIE FEASIBILITY STUDY

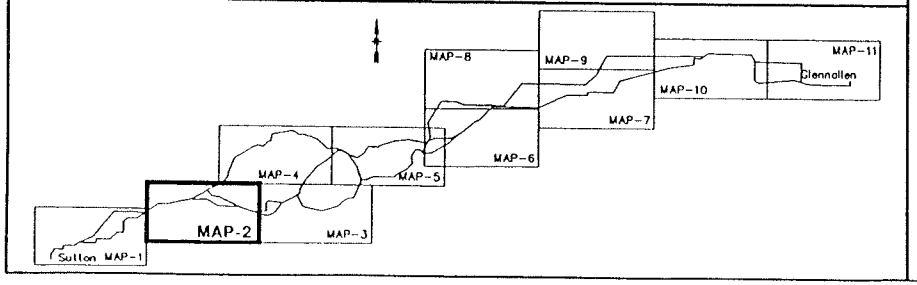
FIGURE 2.7-1
LAND STATUS
MAP-1 OF 11 MAPS

SEPTEMBER 1993

DAMES & MOORE



MAP INDEX



LAND STATUS LEGEND

- PRIVATE
- MATANUSKA-SUSITNA BOROUGH
- NATIVE
- FEDERAL
- NATIVE SELECTED
- MENTAL HEALTH
- STATE
- ALTERNATIVE ROUTE SEGMENTS
- SEGMENT DESIGNATION S1-2 i.e. BETWEEN POINTS 1 AND 2
- MILEAGE BETWEEN POINTS IN ( )

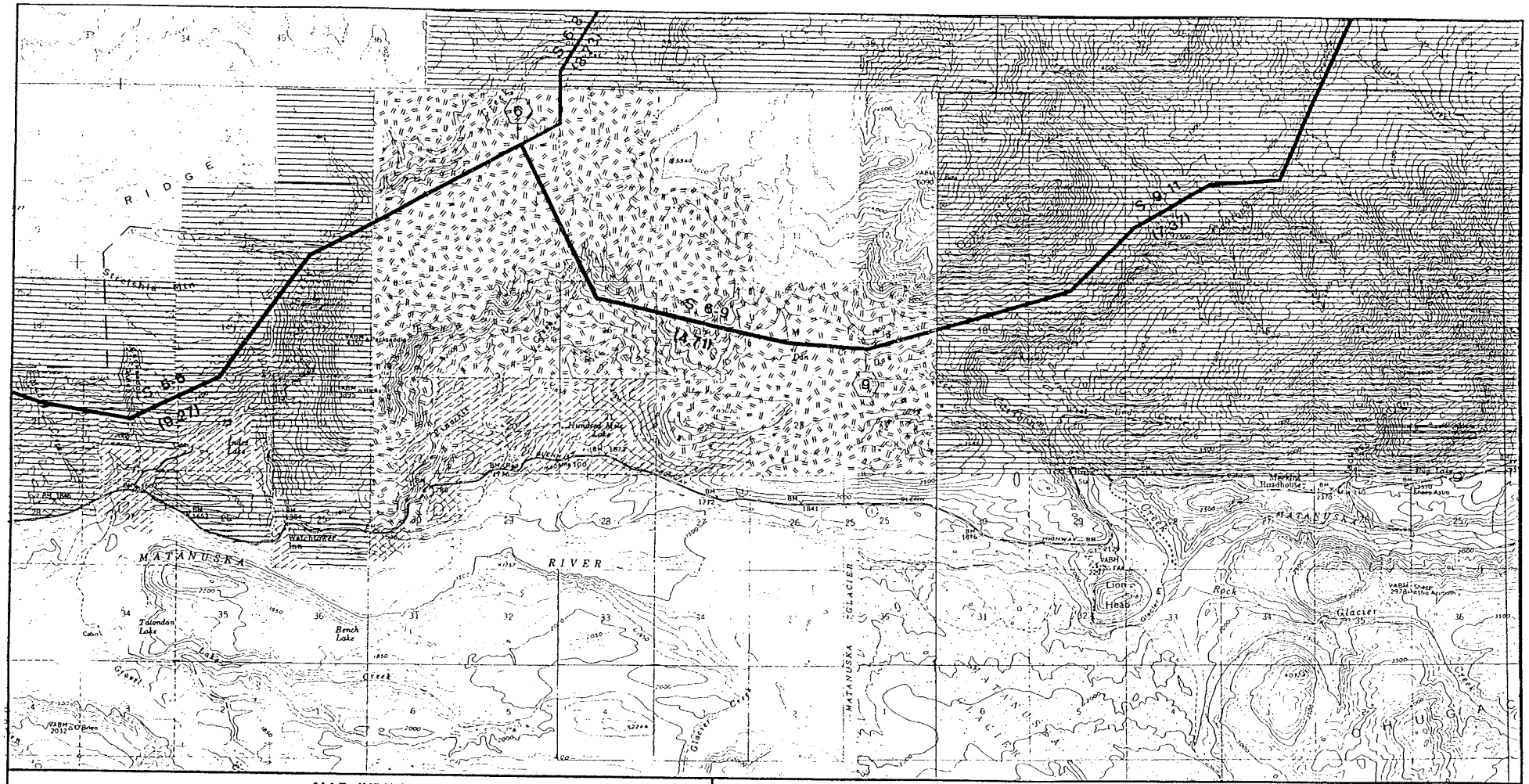
0 1
APPROXIMATE SCALE IN MILES

ALASKA ENERGY AUTHORITY

COPPER VALLEY INTERTIE FEASIBILITY STUDY

FIGURE 2.7-1
LAND STATUS
MAP-2 OF 11 MAPS
SEPTEMBER 1993

DAMES & MOORE



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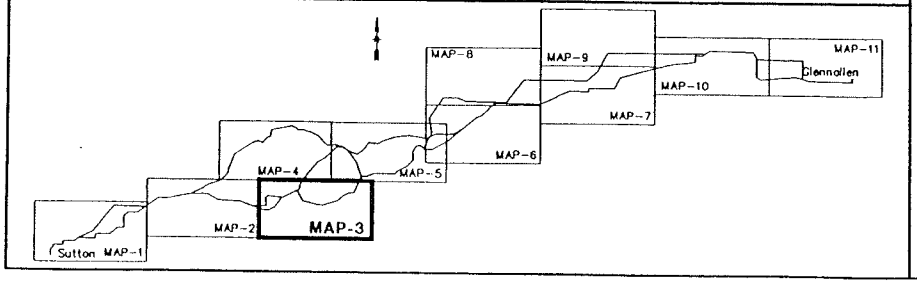


LAND STATUS LEGEND

- PRIVATE
- MATANUSKA-SUSITNA BOROUGH
- NATIVE
- FEDERAL
- NATIVE SELECTED
- MENTAL HEALTH
- STATE

ALTERNATIVE ROUTE SEGMENTS
SEGMENT DESIGNATION S1-2
i.e. BETWEEN POINTS 1 AND 2
MILEAGE BETWEEN POINTS IN ( )

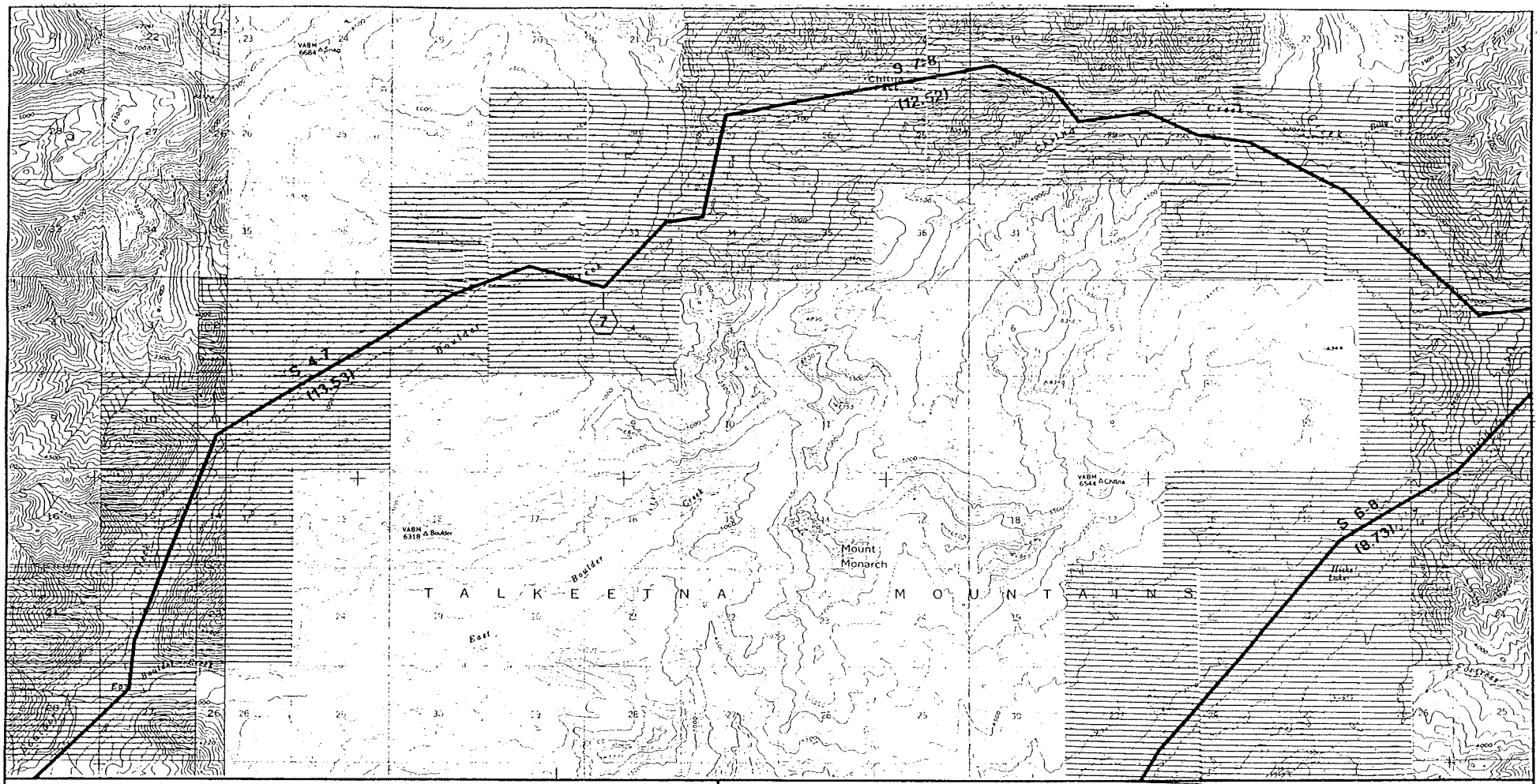
0 1
APPROXIMATE SCALE IN MILES

ALASKA ENERGY AUTHORITY

COPPER VALLEY INTERTIE
FEASIBILITY STUDY

FIGURE 2.7-1
LAND STATUS
MAP-3 OF 11 MAPS
SEPTEMBER 1993

DAMES & MOORE



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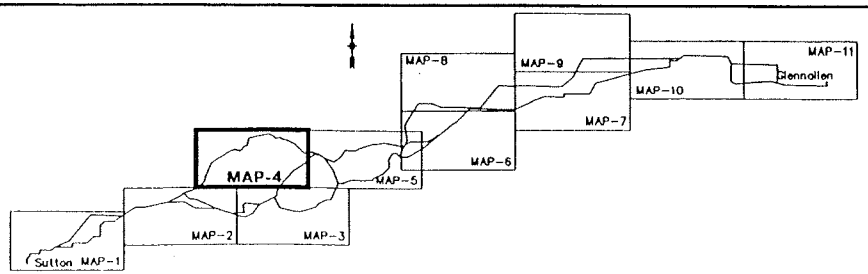


LAND STATUS LEGEND

- PRIVATE
- MATANUSKA-SUSITNA BOROUGH
- NATIVE
- FEDERAL
- NATIVE SELECTED
- MENTAL HEALTH
- STATE

APPROXIMATE SCALE IN MILES (0 to 1)

ALTERNATIVE ROUTE SEGMENTS
SEGMENT DESIGNATION S1-2
I.e. BETWEEN POINTS 1 AND 2
MILEAGE BETWEEN POINTS IN ( )

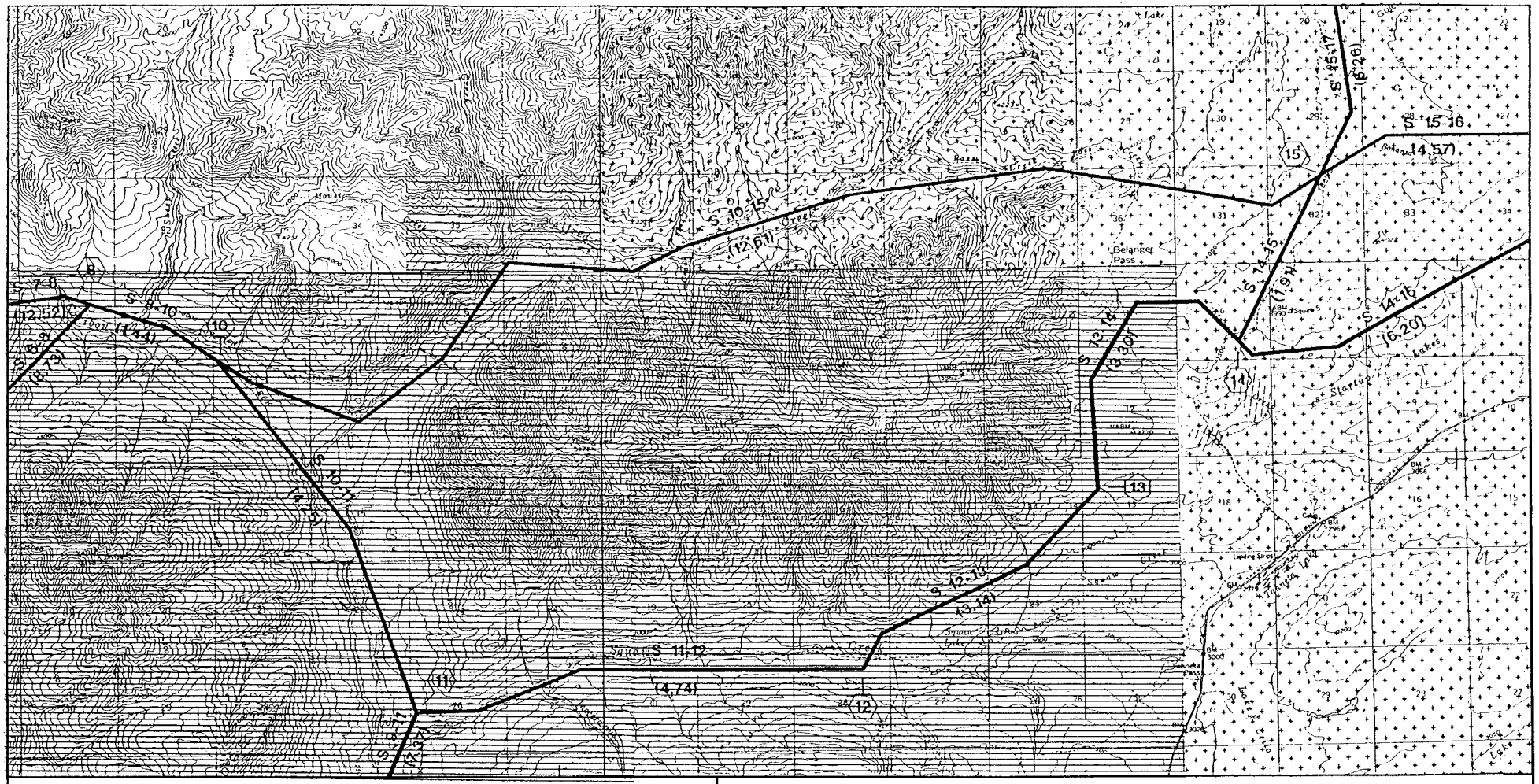
ALASKA ENERGY AUTHORITY

COPPER VALLEY INTERTIE
FEASIBILITY STUDY

FIGURE 2.7-1
LAND STATUS
MAP-4 OF 11 MAPS

SEPTEMBER 1993

DAMES & MOORE



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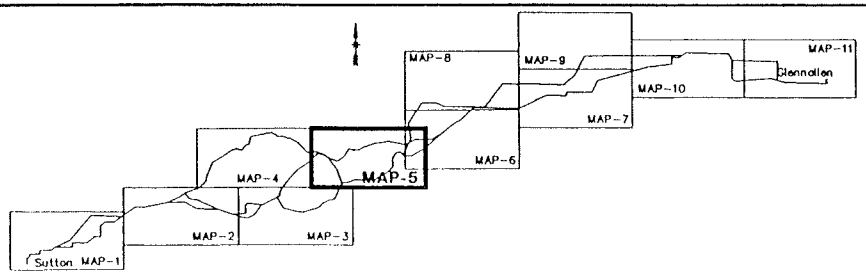


LAND STATUS LEGEND

- PRIVATE
- MATANUSKA-SUSITNA BOROUGH
- NATIVE
- FEDERAL
- NATIVE SELECTED
- MENTAL HEALTH
- STATE
- ALTERNATIVE ROUTE SEGMENTS
- SEGMENT DESIGNATION S1-2 i.e. BETWEEN POINTS 1 AND 2
- MILEAGE BETWEEN POINTS IN ( )

0 1
APPROXIMATE SCALE IN MILES

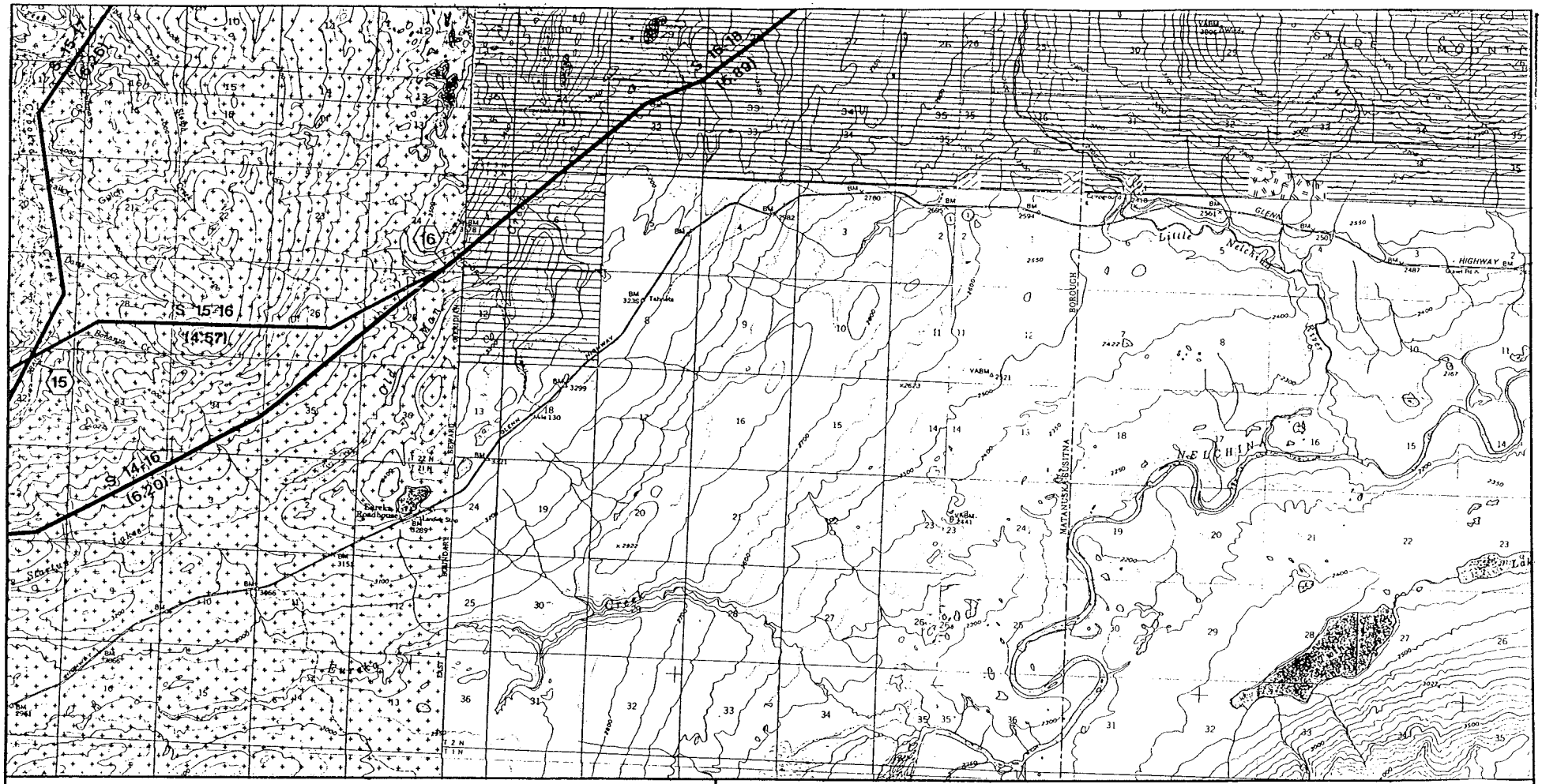
ALASKA ENERGY AUTHORITY

COPPER VALLEY INTERTIE FEASIBILITY STUDY

FIGURE 2.7-1
LAND STATUS
MAP-5 OF 11 MAPS

SEPTEMBER 1993

DAMES & MOORE



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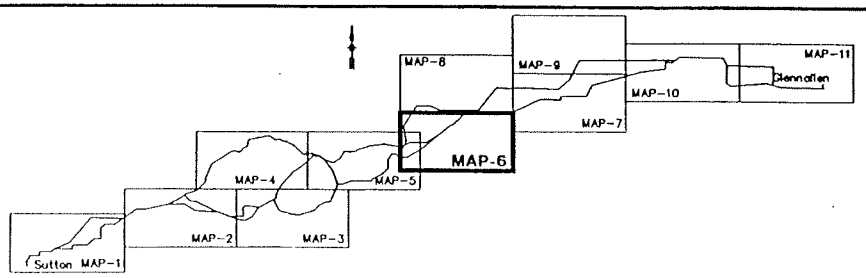


LAND STATUS LEGEND

- PRIVATE
- MATANUSKA-SUSITNA BOROUGH
- NATIVE
- FEDERAL
- NATIVE SELECTED
- MENTAL HEALTH
- STATE
- ALTERNATIVE ROUTE SEGMENTS
- SEGMENT DESIGNATION S1-2 i.e. BETWEEN POINTS 1 AND 2
- MILEAGE BETWEEN POINTS IN ( )

0 — 1 APPROXIMATE SCALE IN MILES

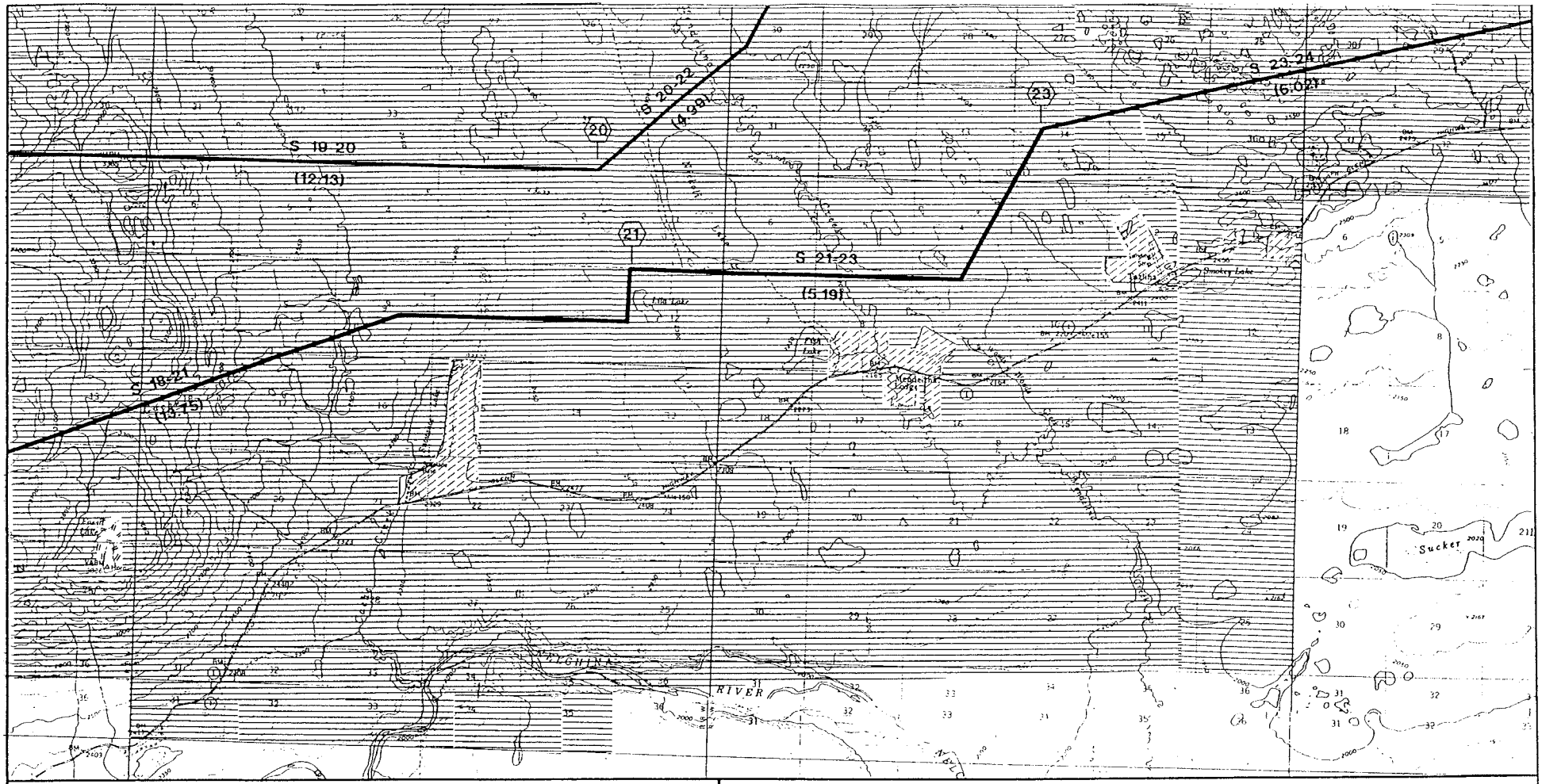
ALASKA ENERGY AUTHORITY

COPPER VALLEY INTERTIE FEASIBILITY STUDY

FIGURE 2.7-1
LAND STATUS
MAP-6 OF 11 MAPS

SEPTEMBER 1993

DAMES & MOORE



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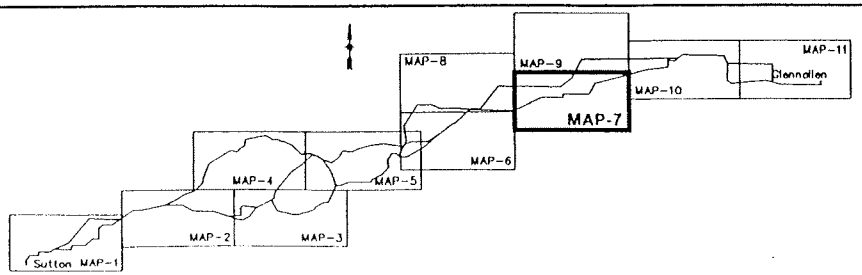


LAND STATUS LEGEND

- PRIVATE
- MATANUSKA-SUSITNA BOROUGH
- NATIVE
- FEDERAL
- NATIVE SELECTED
- MENTAL HEALTH
- STATE
- ALTERNATIVE ROUTE SEGMENTS
  - SEGMENT DESIGNATION S1-2 i.e. BETWEEN POINTS 1 AND 2
  - MILEAGE BETWEEN POINTS IN ( )

0 — 1
APPROXIMATE SCALE IN MILES

N

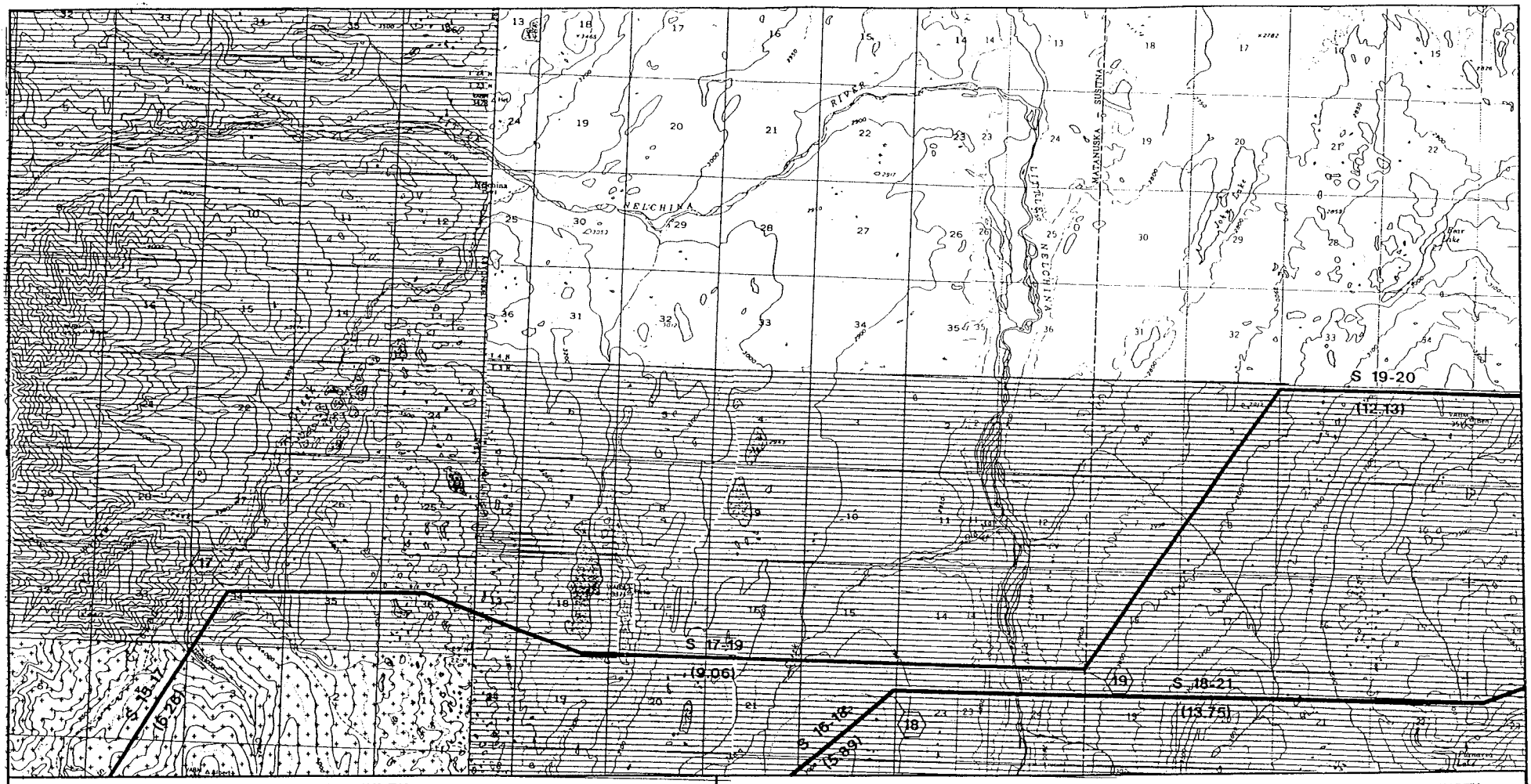
ALASKA ENERGY AUTHORITY

COPPER VALLEY INTERTIE FEASIBILITY STUDY

FIGURE 2.7-1
LAND STATUS
MAP-7 OF 11 MAPS

SEPTEMBER 1993

DAMES & MOORE



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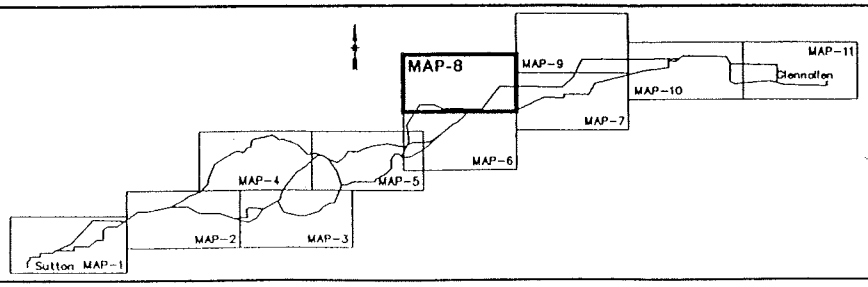


LAND STATUS LEGEND

- PRIVATE
- MATANUSKA-SUSITNA BOROUGH
- NATIVE
- FEDERAL
- NATIVE SELECTED
- MENTAL HEALTH
- STATE
- ALTERNATIVE ROUTE SEGMENTS
- SEGMENT DESIGNATION S1-2 i.e. BETWEEN POINTS 1 AND 2
- MILEAGE BETWEEN POINTS IN ( )

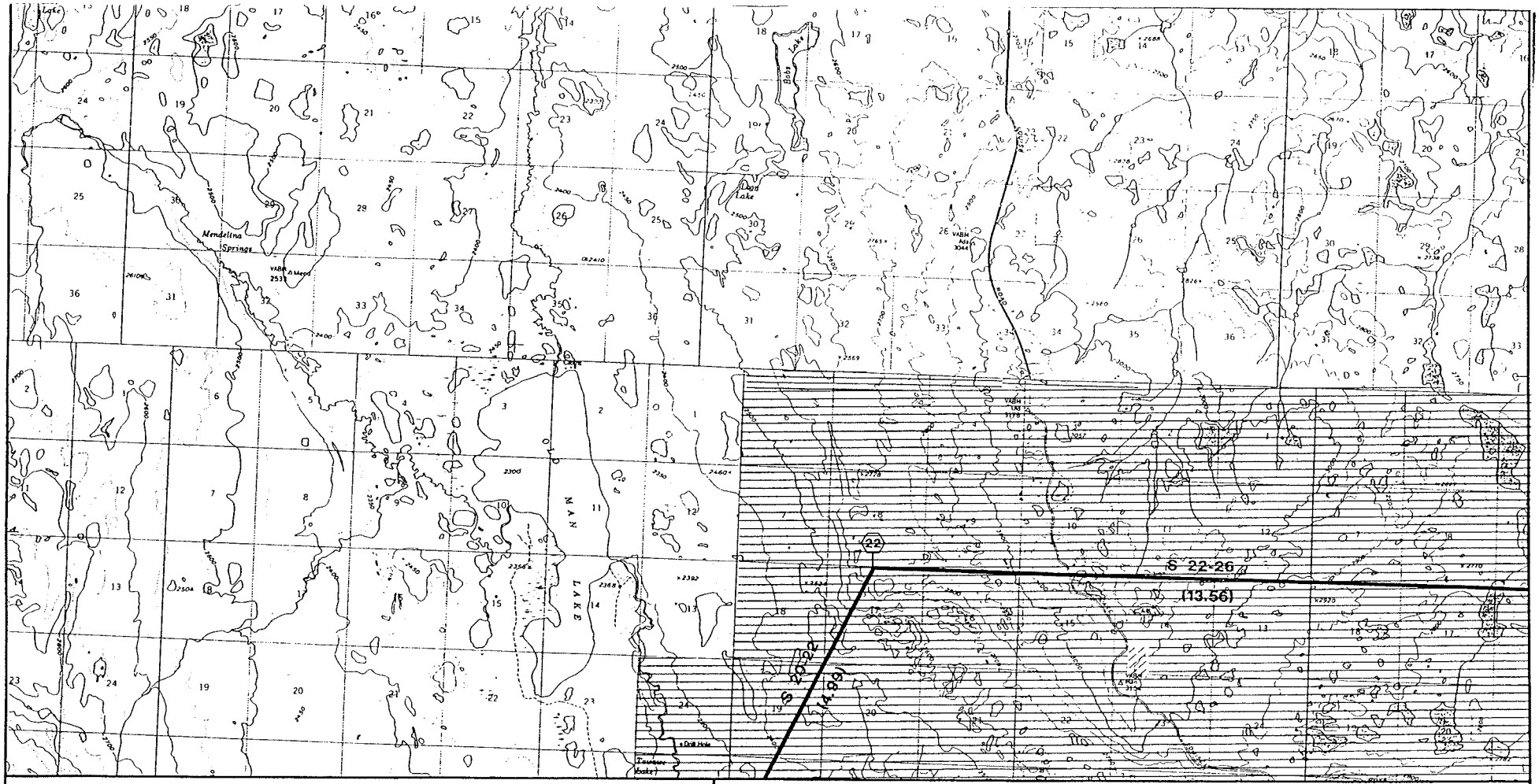
0 1
APPROXIMATE SCALE IN MILES

ALASKA ENERGY AUTHORITY

COPPER VALLEY INTERTIE FEASIBILITY STUDY

FIGURE 2.7-1
LAND STATUS
MAP-8 OF 11 MAPS
SEPTEMBER 1993

DAMES & MOORE



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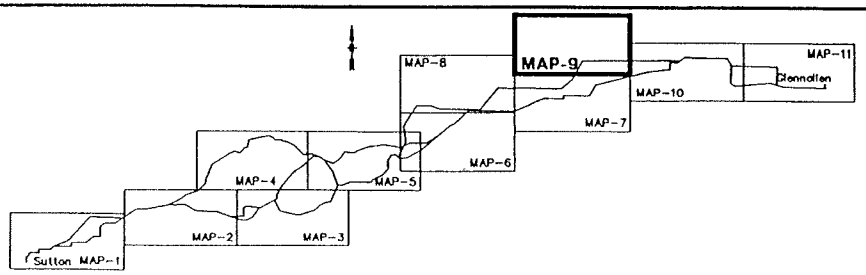


LAND STATUS LEGEND

- PRIVATE
- MATANUSKA-SUSITNA BOROUGH
- NATIVE
- FEDERAL
- NATIVE SELECTED
- MENTAL HEALTH
- STATE
- ALTERNATIVE ROUTE SEGMENTS
- SEGMENT DESIGNATION S1-2 i.e. BETWEEN POINTS 1 AND 2
- MILEAGE BETWEEN POINTS IN ( )

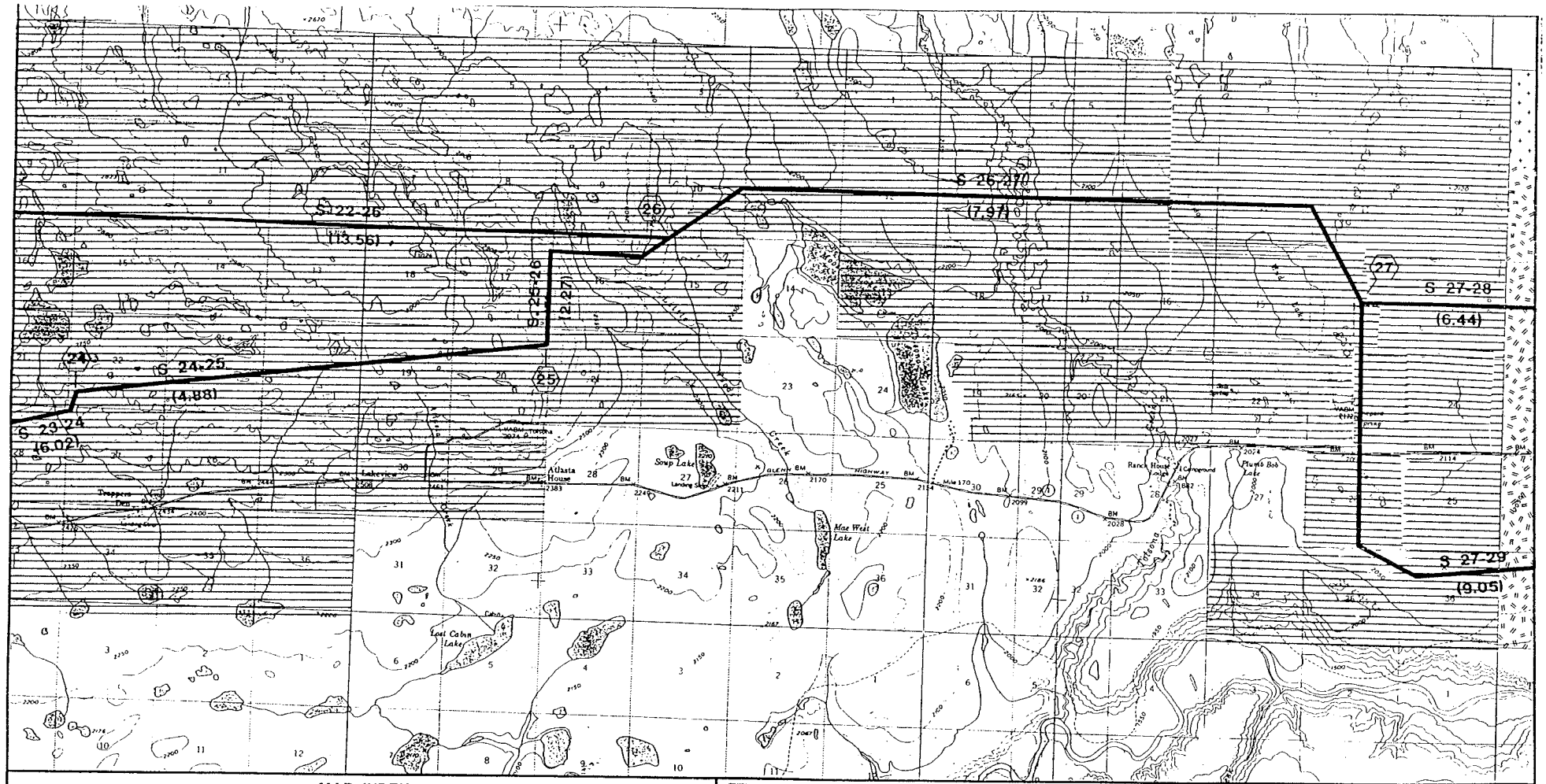
0 1 APPROXIMATE SCALE IN MILES

ALASKA ENERGY AUTHORITY

COPPER VALLEY INTERTIE FEASIBILITY STUDY

FIGURE 2.7-1
LAND STATUS
MAP-9 OF 11 MAPS
SEPTEMBER 1993

DAMES & MOORE



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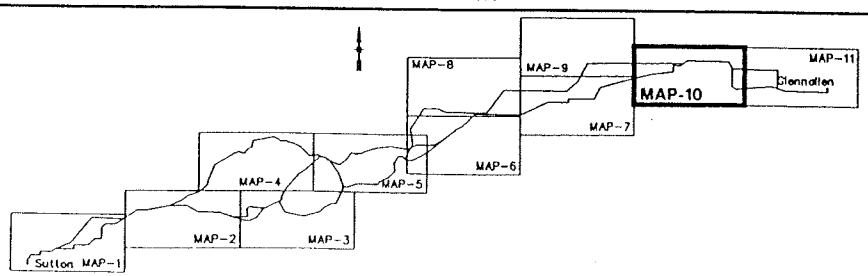

LAND STATUS LEGEND

- PRIVATE
- MATANUSKA-SUSITNA BOROUGH
- NATIVE
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- MENTAL HEALTH
- STATE
- ALTERNATIVE ROUTE SEGMENTS
- SEGMENT DESIGNATION S1-2 i.e. BETWEEN POINTS 1 AND 2
- MILEAGE BETWEEN POINTS IN ( )

0 1
APPROXIMATE SCALE IN MILES

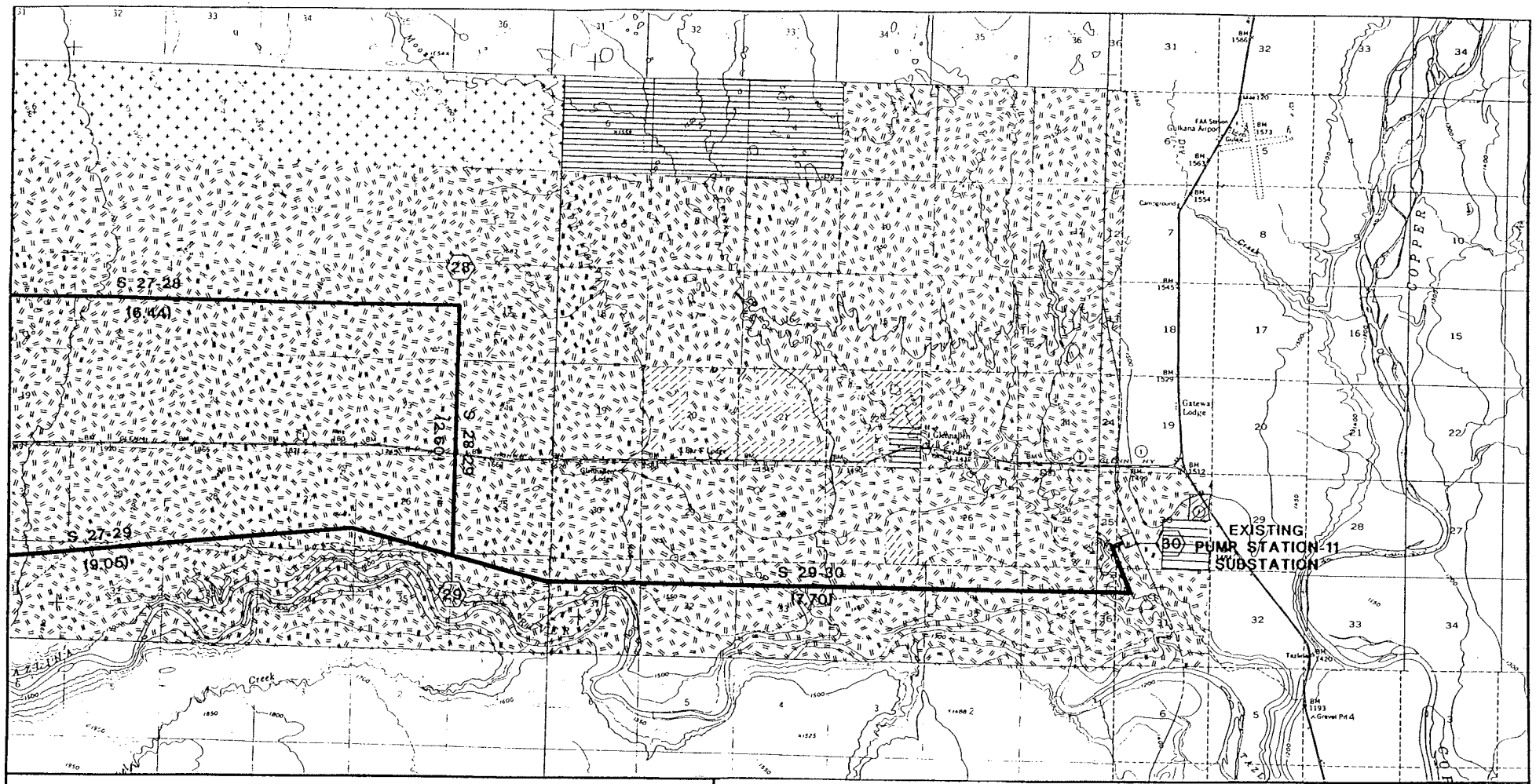
N

ALASKA ENERGY AUTHORITY

COPPER VALLEY INTERTIE FEASIBILITY STUDY

FIGURE 2.6-1
LAND STATUS
MAP-10 OF 11 MAPS
SEPTEMBER 1993

DAMES & MOORE



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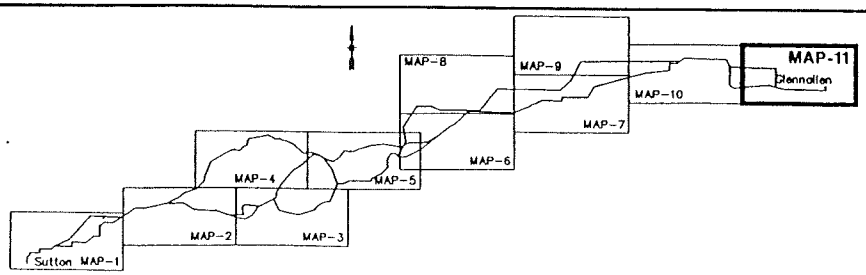

LAND STATUS LEGEND

- PRIVATE
- MATANUSKA-SUSITNA BOROUGH
- NATIVE
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- NATIVE SELECTED
- MENTAL HEALTH
- STATE

ALTERNATIVE ROUTE SEGMENTS
SEGMENT DESIGNATION S1-2
i.e. BETWEEN POINTS 1 AND 2
MILEAGE BETWEEN POINTS IN ( )

0 1
APPROXIMATE SCALE IN MILES

ALASKA ENERGY AUTHORITY

COPPER VALLEY INTERTIE FEASIBILITY STUDY

FIGURE 2.7-1
LAND STATUS
MAP-11 OF 11 MAPS

SEPTEMBER 1993

DAMES & MOORE

Matanuska-Susitna Borough

The routes are proposed to begin at a new substation site to be constructed on Borough land west of Sutton. Other Borough lands are crossed by the southern route alignment north of mile 85 of the Glenn Highway. Two other areas of Borough lands are located one-half to one mile south of the southern alignment between mile 88 and mile 91 of the Glenn Highway. Lands in the Chickaloon area have been designated a Special Use District by the Matanuska-Susitna Borough and a Conditional Use Permit is required for transmission lines crossing these lands.

Native

Several Native village corporations own land or have selected land within the project area. Under the Alaska Native Claims Settlement Act of 1971, Native corporation were allowed to select federal lands to be granted to the Native corporations. Due to conflicting selections between various Native corporations and the state, the process of granting these lands is complicated and is still ongoing. Native corporations have selected more lands than will eventually be transferred to them (over-selection). Therefore, Native selected lands may or may not eventually be owned by Native corporations. The proposed routes pass through lands owned by the CookInlet Regional Incorporated (CIRI) for approximately three miles in the area just north of Sutton. Native owned lands are crossed by the southern alignment north of mile 72 on the Glenn Highway. The surface rights to these lands belong to the Chickaloon Moose Creek Native Association (CMCNA) and the subsurface rights belong to CIRI. The northern alignment crosses CMCNA (surface) and CIRI (subsurface) selected lands for about two miles near Red Mountain. These lands may or may not be transferred to Native ownership in the future as they are part of a large Native over-selection. The two route alignments join west of Chickaloon and run along the northern boundary of CMCNA (surface) and CIRI (subsurface) lands for less than a mile just west of the Chickaloon River. CIRI owns a large amount of land (surface and subsurface rights) in the area where Hicks Creek and Pinochle Creek meet. The southern alignment runs through CIRI lands for approximately eight miles in this area. The last 15 miles of the northern alignment and the last 12 miles of the southern alignment traverse Native lands. The Tazlina Village Corporation owns the surface rights to these lands and the Ahtna Regional Corporation owns the subsurface rights.

Mental Health

State of Alaska Mental Health Trust Lands were granted to the state by the federal government prior to statehood to generate revenue to support Alaska's mental health programs. In 1978, the legislature waived the trust status of these lands and some of the land was leased for oil or gas development, sold to individuals or transferred to municipalities. In the 1980s, mental health advocates sued the state and the state was ordered to "reconstitute, as nearly as possible the holdings which comprised the trust when the 1978 law became effective." At this time, no settlement between the State of Alaska and the mental health interests has been approved. Therefore, the outcome of this continuing litigation may impact the status and use of these lands.

The proposed routes run along the edge of Mental Health Trust Lands for about two miles near Granite and Little Granite Creeks. The northern route alignment crosses through another parcel of Mental Health Trust Lands east of Little Granite Creek. Both route alignments cross Mental Health Trust Lands for approximately 12 miles from near Kings River to just west of Rush Lake.

State

The State of Alaska was granted over 100 million acres of land when it achieved statehood in 1959. The state owns the majority of the lands crossed by the potential route alignments. Some state owned areas, including the area along Alfred and Squaw Creeks, have mining and mineral claims on them.

The first portion of the northern alignment runs along or across state lands for about eight miles between Granite Creek and Red Mountain. It also crosses state lands from near Simpson Cabin to Alfred Creek. Approximately 50 miles of state lands are crossed from Crooked Creek to just west of Mud Lake.

The southern alignment traverses state lands for approximately nine miles from Granite Creek to Kings River. The route runs through state lands again for approximately 12 miles along the southern side of the Anthracite Ridge to Hicks Creek. Another 17 miles of this alignment runs through state lands along Caribou Creek, Squaw Creek and northeast along Syncline Mountain. The alignment crosses through 50 miles of state lands from Old Man Creek to south of Mud Lake.

Federal

The Bureau of Land Management manages most of the federal lands located in the project area. The northern alignment crosses federal land for about 14 miles along Alfred Creek, Pass Creek and Crooked Creek. The southern alignment crosses approximately seven miles of federal lands north of the Startup Lakes and along Old Man Creek.

2.8 Cultural/Historical Resources

Cultural resources include buildings, sites, structures, or objects which may have historical, archaeological, architectural, and/or cultural significance. The proposed routes are primarily located in undeveloped areas which have not been surveyed for cultural or archaeological resources.

The western portion of the proposed transmission line routes include areas in the Matanuska Valley Moose Range (MVMR). Although a complete archaeological survey of the MVMR has not been undertaken, the Alaska Heritage Resources Survey has identified eleven cultural resources within the Range, including Native grave sites, bridges and mines. Numerous aban-

doned mines exist in the MVMR including the Eska Mine, which has been determined to be eligible for the National Register of Historic Places. The Management Plan also lists the Chickaloon River Trail, the Chickaloon-Knik-Nelchina Trail, the Boulder Creek Trail and the Old 98 Trail as trails with historical value. Areas with a high potential for cultural value exist along the southern portion of the Kings River, the Chickaloon River and Boulder Creek.

The Matanuska-Susitna Borough currently has a federal preservation grant to identify and evaluate historic sites on portions of the Chickaloon-Knik-Nelchina. The Borough plans to continue to seek funding for evaluating the remaining portions of the trail in the future. A report will be issued in October describing the sites which have been identified for addition to the Alaska Heritage Resources Survey list and those which are eligible for nomination to the National Register of Historic Places.

At the March 1993 agency meeting, the State Office of History and Archaeology indicated that the potential transmission line routes had not been surveyed and that an archaeological survey would need to be done if the project was to proceed to completion.

2.9 Recreation

The Matanuska Valley and adjacent Talkeetna Mountains are popular areas for recreation. The Matanuska Valley Moose Range and Nelchina Public Use Area provide opportunities for a variety of recreation activities. Although close enough to Anchorage for day-trips, overall recreation use of these areas tends to be low to moderate because of lack of information about legal public access. Peak recreation use of these areas generally occurs during the fall hunting season.

The Nelchina Public Use Area (NPUA) is the largest legislatively designated public use area on state land in Alaska. From the Glenn Highway, south of the public use area, an extensive foot and all terrain vehicle trail system provides access to outstanding hunting, fishing, mining, and other recreational opportunities. The area is home to the Nelchina Caribou Herd, the third largest caribou herd in the state. The area also supports populations of Dall sheep, moose, black and brown bear, and trumpeter swans providing opportunities for wildlife viewing and photography. Both route alignments pass through this area. The northern alignment lies primarily within the NPUA from Boulder Creek to the Little Nelchina River, for a total of approximately 40 miles within the NPUA. The southern alignment passes through the NPUA periodically from Caribou Creek to the Little Nelchina River, for a total of approximately 10 miles within the NPUA.

The Matanuska Valley Moose Range is also a legislatively designated area. Created with the objective to maintain and improve moose populations, habitat, and other wildlife resources, the Matanuska Valley Moose Range also perpetuates multiple use of the area including recreation uses like fishing, hunting, trapping, and other activities that are compatible with the area's primary objective. Both route alignments traverse a large portion of this popular recreation use area from Sutton to the Boulder Creek area.

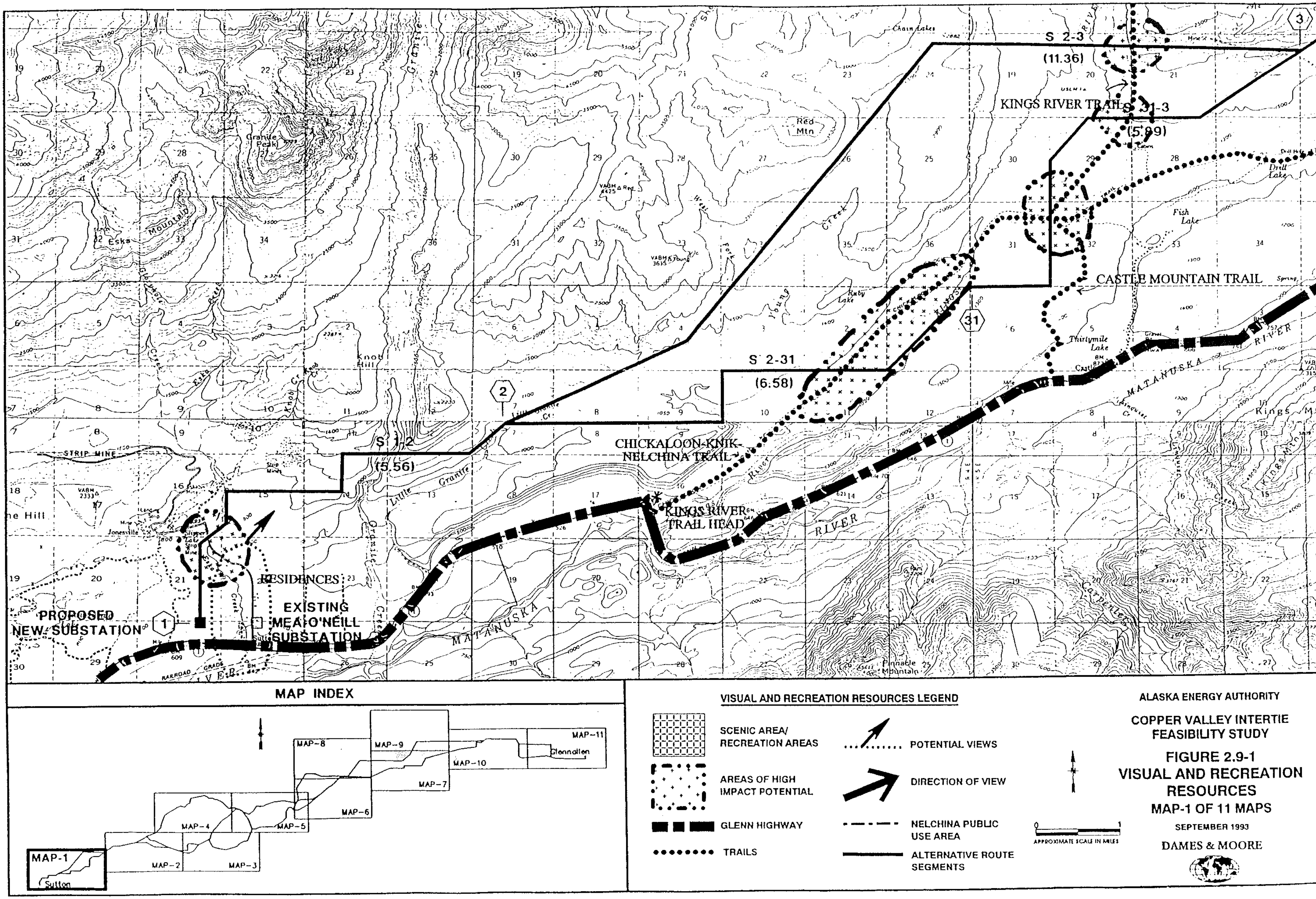
The Glenn Highway, well known for its scenic values, is frequently used by tourists and sightseers traveling from Anchorage to the interior. Sheep Mountain is an area of particular interest along the highway. Multi-colored rock outcrops and its population of Dall sheep, often visible from the highway, give this area special recreational value for tourists and sightseers. In addition, several turnouts along the highway in this area also provide outstanding views of the Matanuska Glacier. The Alaska Department of Transportation and Public Facilities is planning to realign and improve portions of the Glenn Highway providing pullouts and waysides for public use.

The proposed route alignments cross or parallel portions of the Chickaloon-Knik-Nelchina Trail system (Figure 2.9-1). Trails in this system are popular for both summer and winter recreation activities. In the fall and winter, many of the trails in the larger drainages are used by hunters on foot or horseback looking for moose, caribou, and Dall sheep. When snow-covered, trails are used extensively by snowmachines and cross-country skiers. In the spring and summer, the trails are used primarily by backpackers. Portions of the trail system are historically significant travel routes dating to the turn of the century. As mentioned earlier, the Matanuska-Susitna Borough currently has a federal preservation grant to identify and evaluate historic sites on portions of this trail. A number of the alternative route segments would cross and/or parallel many of the system trails as indicated in Table 2.9-1.

The project area includes six state recreation areas: Kings Mountain State Recreation Site, Bonnie Lake State Recreation Site, Long Lake State Recreation Site, Caribou Creek State Recreational Mining Area, the Matanuska Glacier State Recreation Site, and Tolsona Creek State Recreation Site. The route alignments pass approximately three miles north of Kings Mountain. Bonnie Lake and Long Lake are approximately two miles south of the southern alignment. The southern alignment also passes within a mile of the Caribou Creek recreation area and within two miles of the Matanuska Glacier recreation area. Both route alternatives pass approximately three miles north of the Tolsona recreation area and the southern route passes the Tolsona recreation area again about two miles east of the site.

The southern route alignment also passes one to two miles north of several lodges located along the Glenn Highway including Snowshoe Lake Lodge, Mendeltna Lodge, and Tazlina Lodge. Also, both route alignments run approximately three miles north of Tolsona Lake Lodge. Aircraft landing areas are located throughout the area and are used for hunting, recreation and airtaxi service. Landing strips and seaplane bases are located at the Watchtower Inn south of Hicks Creek, Tahneta Lake, the Eureka Roadhouse, Snowshoe Lake, Smokey Lake and the Tazlina Lodge.

Based on discussions with residents in the Sutton-Chickaloon area, an abrupt knob above Little Granite Creek east of Sutton is used by several hang-gliders as a take-off point. Both route alignments pass through areas which hang-gliders use for landing.


S 2-3
(11.36)
KINGS RIVER TRAIL
S 31-3
(5.99)
CASTLE MOUNTAIN TRAIL
S 2-31
(6.58)
S 1-2
(5.56)
CHICKALOON-KNIK-NELCHINA TRAIL
KINGS RIVER TRAIL HEAD
RESIDENCES
PROPOSED NEW SUBSTATION
EXISTING MEA O'NEILL SUBSTATION
MATANUSKA
RIVER
Red Mtn
Granite Peak
Eska Mountain
Knob Hill
Chain Lakes
Fish Lake
Drill Lake
Thirtymile Lake
Kings Mtn
Pinnacle Mountain
STRIP MINE
Jonesville
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MAP-1
MAP-2
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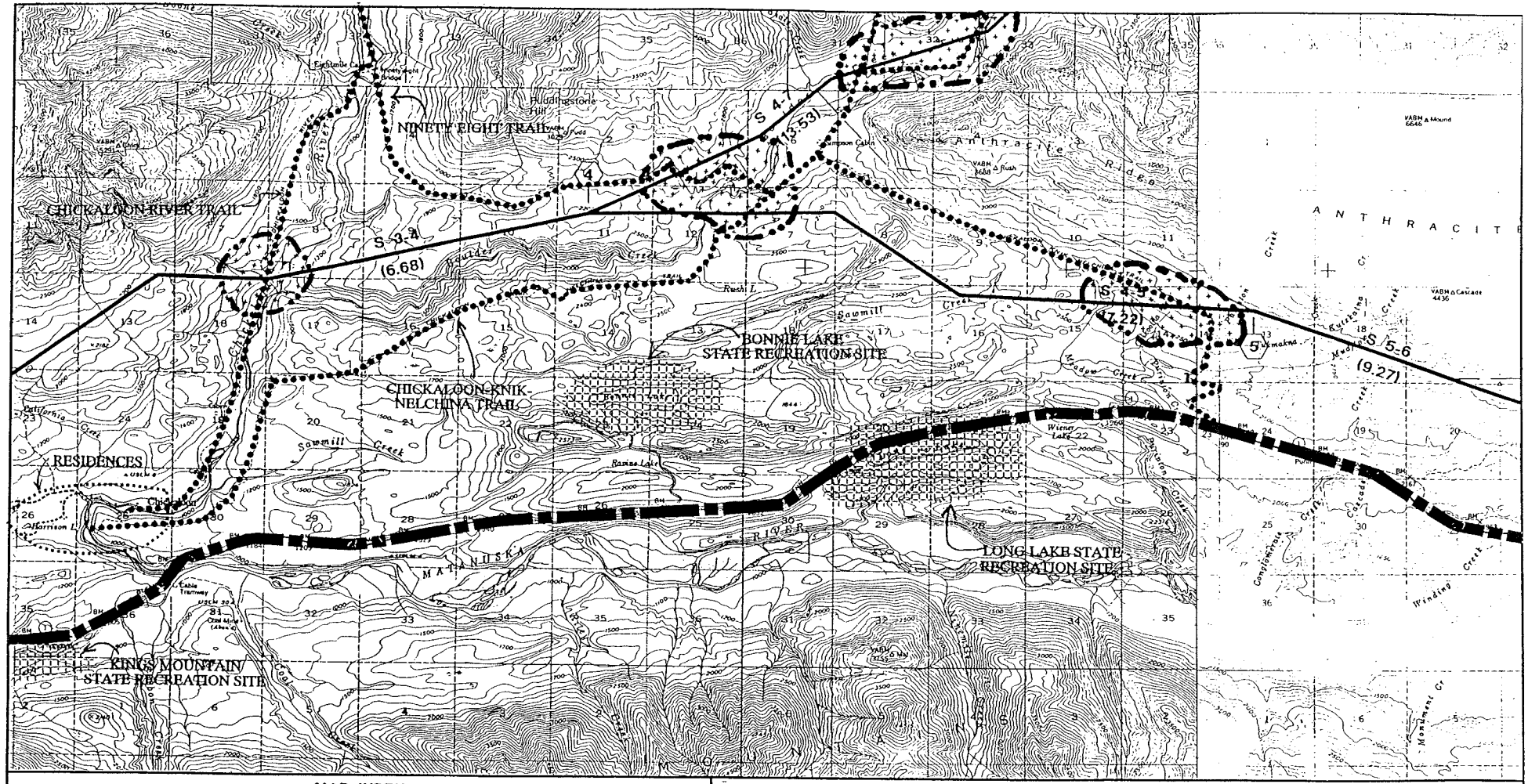
MAP-7
MAP-8
MAP-9
MAP-10
MAP-11
Sutton
Glennallen
VISUAL AND RECREATION RESOURCES LEGEND
SCENIC AREA/ RECREATION AREAS
AREAS OF HIGH IMPACT POTENTIAL
GLENN HIGHWAY
TRAILS
POTENTIAL VIEWS
DIRECTION OF VIEW
NELCHINA PUBLIC USE AREA
ALTERNATIVE ROUTE SEGMENTS
APPROXIMATE SCALE IN MILES
ALASKA ENERGY AUTHORITY
COPPER VALLEY INTERTIE FEASIBILITY STUDY
FIGURE 2.9-1
VISUAL AND RECREATION RESOURCES
MAP-1 OF 11 MAPS
SEPTEMBER 1993
DAMES & MOORE



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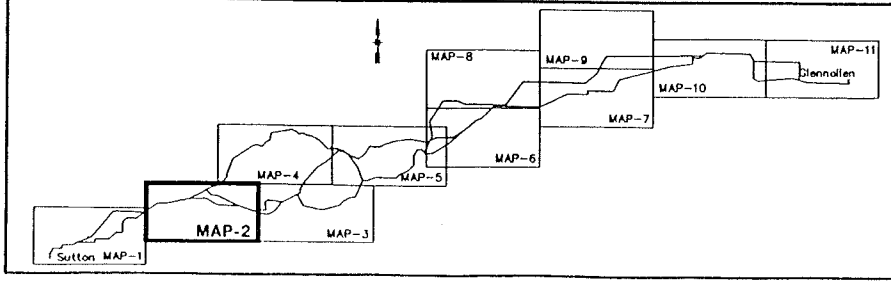


VISUAL AND RECREATION RESOURCES LEGEND

- SCENIC AREA/ RECREATION AREAS
- AREAS OF HIGH IMPACT POTENTIAL
- GLENN HIGHWAY
- TRAILS
- POTENTIAL VIEWS
- DIRECTION OF VIEW
- NELCHINA PUBLIC USE AREA
- ALTERNATIVE ROUTE SEGMENTS

APPROXIMATE SCALE IN MILES

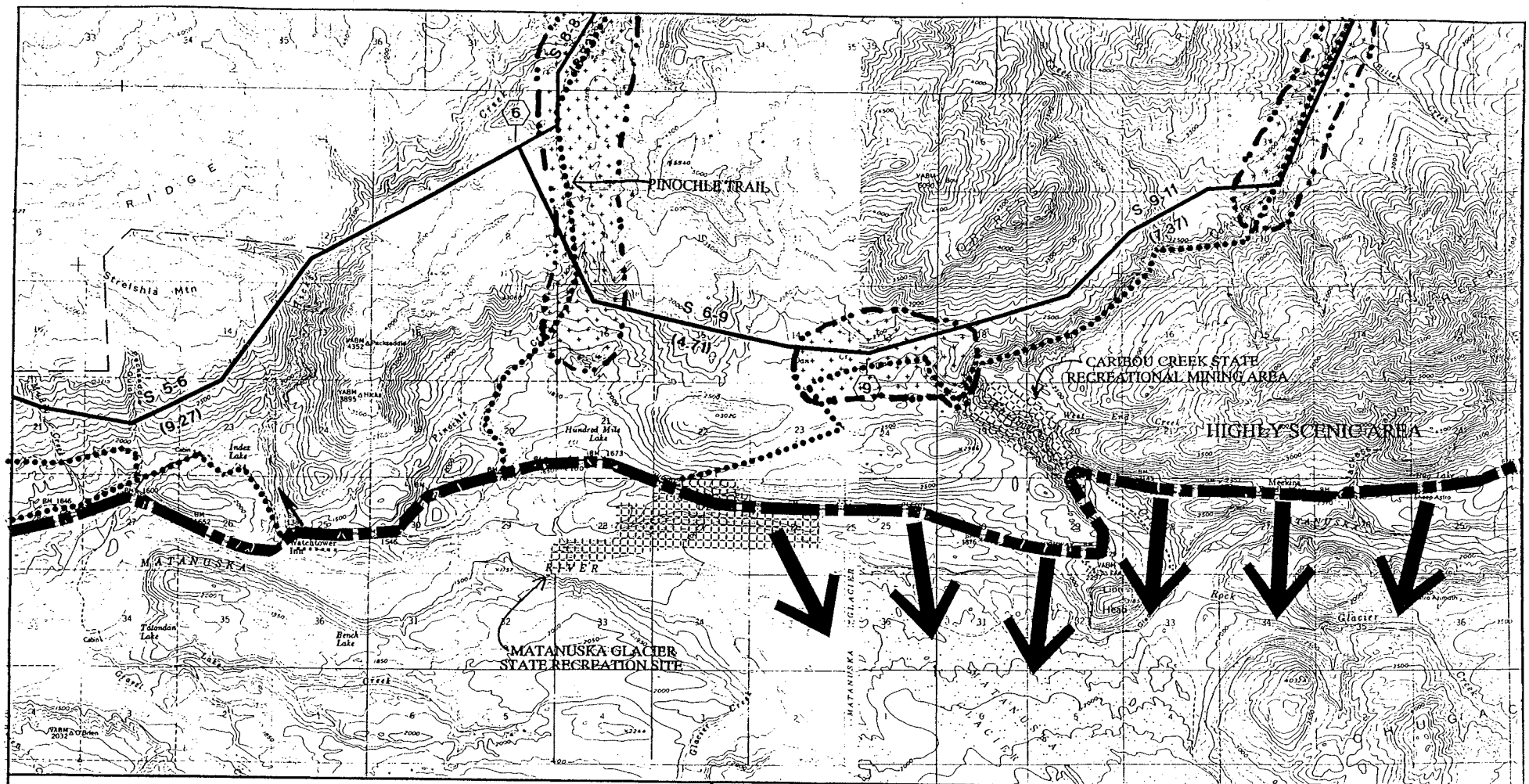
ALASKA ENERGY AUTHORITY

COPPER VALLEY INTERTIE FEASIBILITY STUDY

FIGURE 2.9-1
VISUAL AND RECREATION RESOURCES
MAP-2 OF 11 MAPS

SEPTEMBER 1993

DAMES & MOORE



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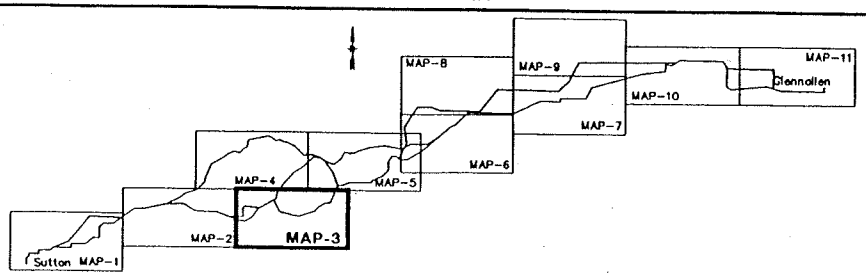


VISUAL AND RECREATION RESOURCES LEGEND

- SCENIC AREA/ RECREATION AREAS
- AREAS OF HIGH IMPACT POTENTIAL
- GLENN HIGHWAY
- TRAILS
- POTENTIAL VIEWS
- DIRECTION OF VIEW
- NELCHINA PUBLIC USE AREA
- ALTERNATIVE ROUTE SEGMENTS

0 1
APPROXIMATE SCALE IN MILES

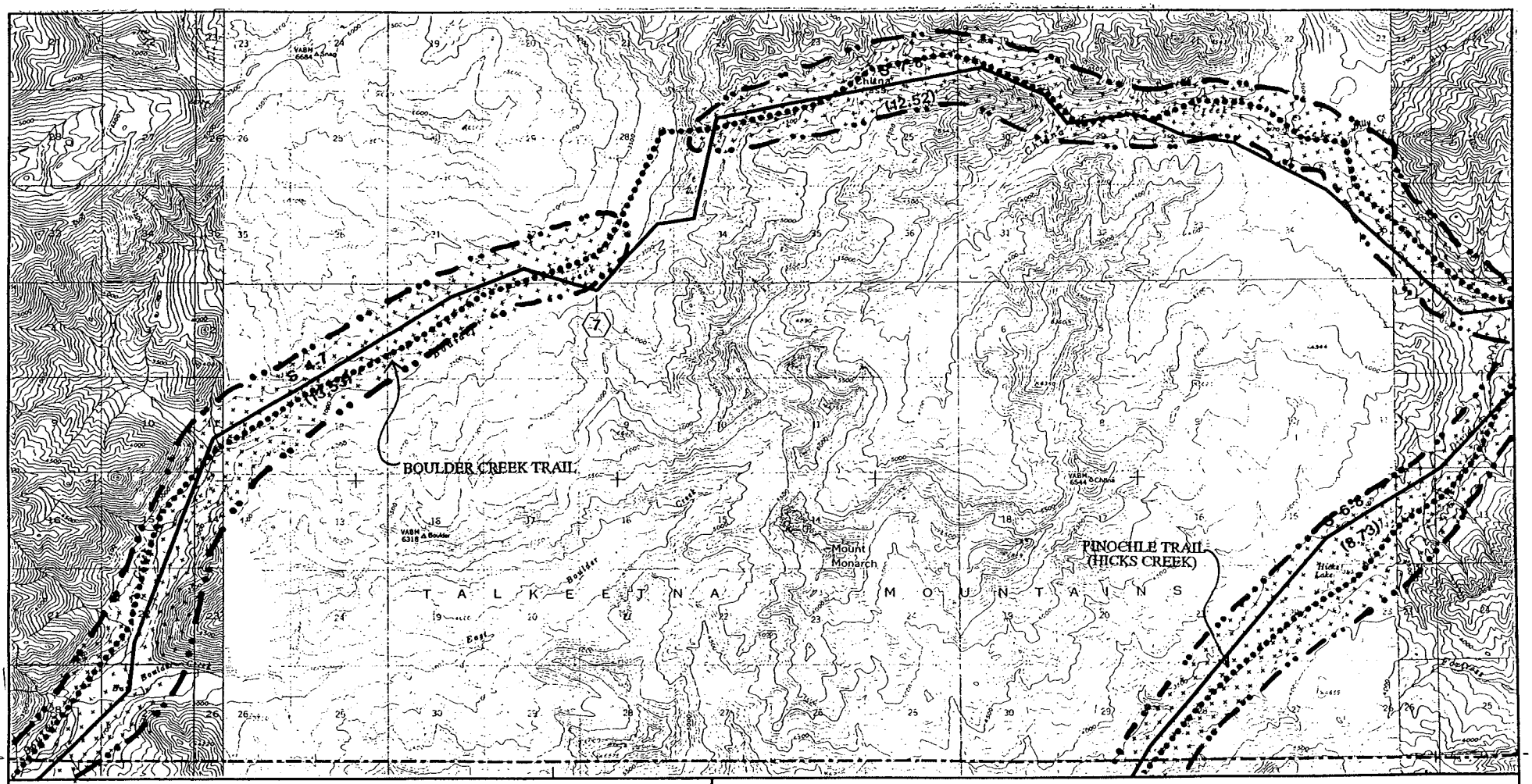
ALASKA ENERGY AUTHORITY

COPPER VALLEY INTERTIE FEASIBILITY STUDY

FIGURE 2.9-1
VISUAL AND RECREATION RESOURCES
MAP-3 OF 11 MAPS

SEPTEMBER 1993

DAMES & MOORE



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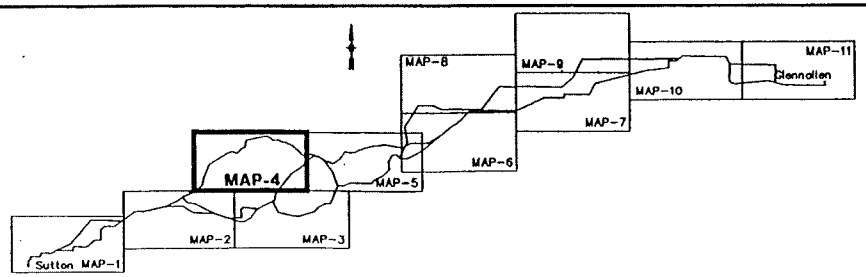

VISUAL AND RECREATION RESOURCES LEGEND

- SCENIC AREA/ RECREATION AREAS
- AREAS OF HIGH IMPACT POTENTIAL
- GLENN HIGHWAY
- TRAILS
- POTENTIAL VIEWS
- DIRECTION OF VIEW
- NELCHINA PUBLIC USE AREA
- ALTERNATIVE ROUTE SEGMENTS

0 1
APPROXIMATE SCALE IN MILES

ALASKA ENERGY AUTHORITY

COPPER VALLEY INTERTIE
FEASIBILITY STUDY

FIGURE 2.9-1
VISUAL AND RECREATION RESOURCES
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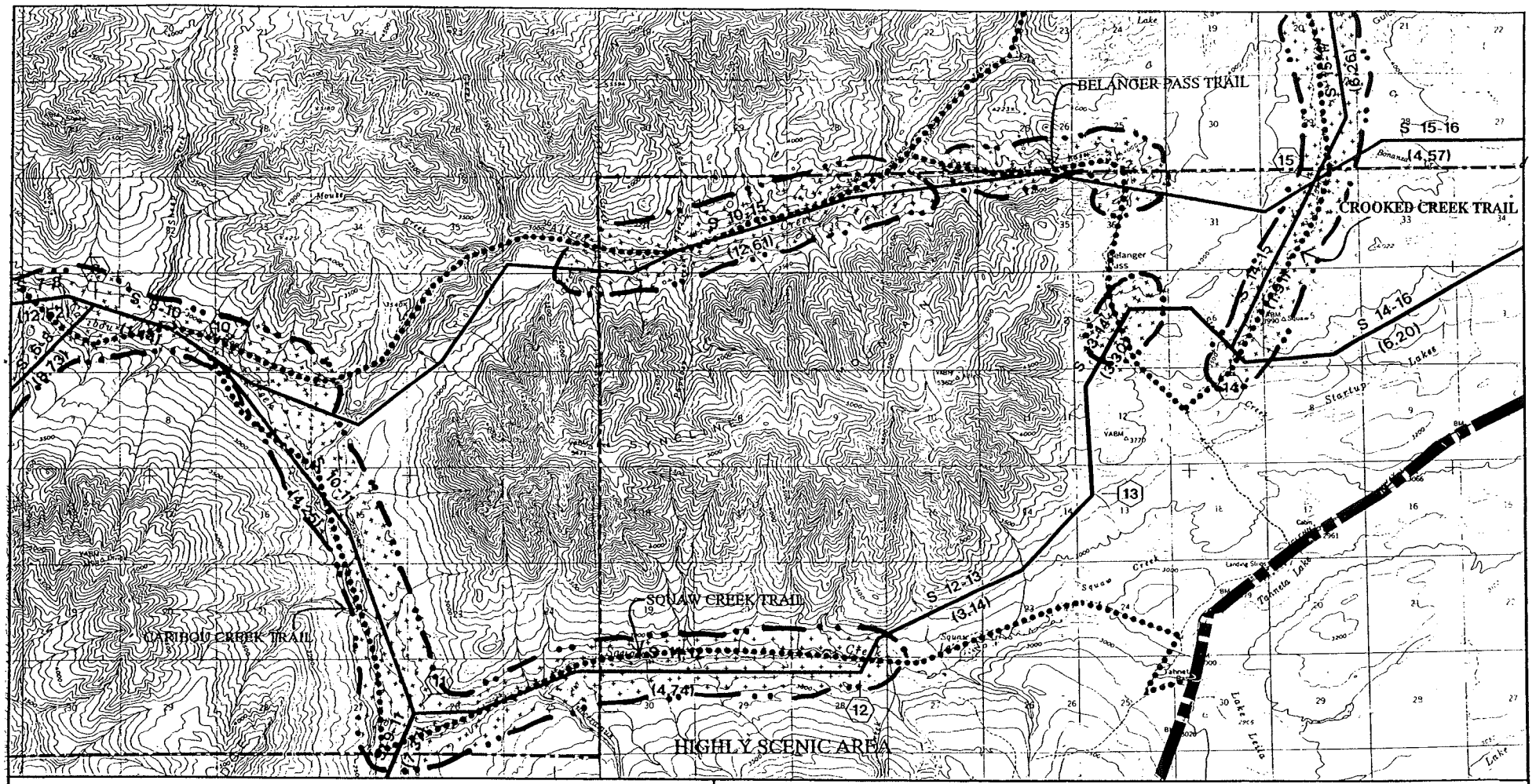
SEPTEMBER 1993

DAMES & MOORE



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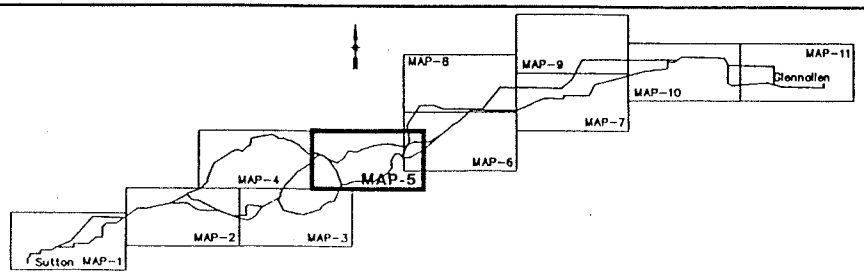

VISUAL AND RECREATION RESOURCES LEGEND

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APPROXIMATE SCALE IN MILES

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COPPER VALLEY INTERTIE FEASIBILITY STUDY

FIGURE 2.9-1
VISUAL AND RECREATION RESOURCES
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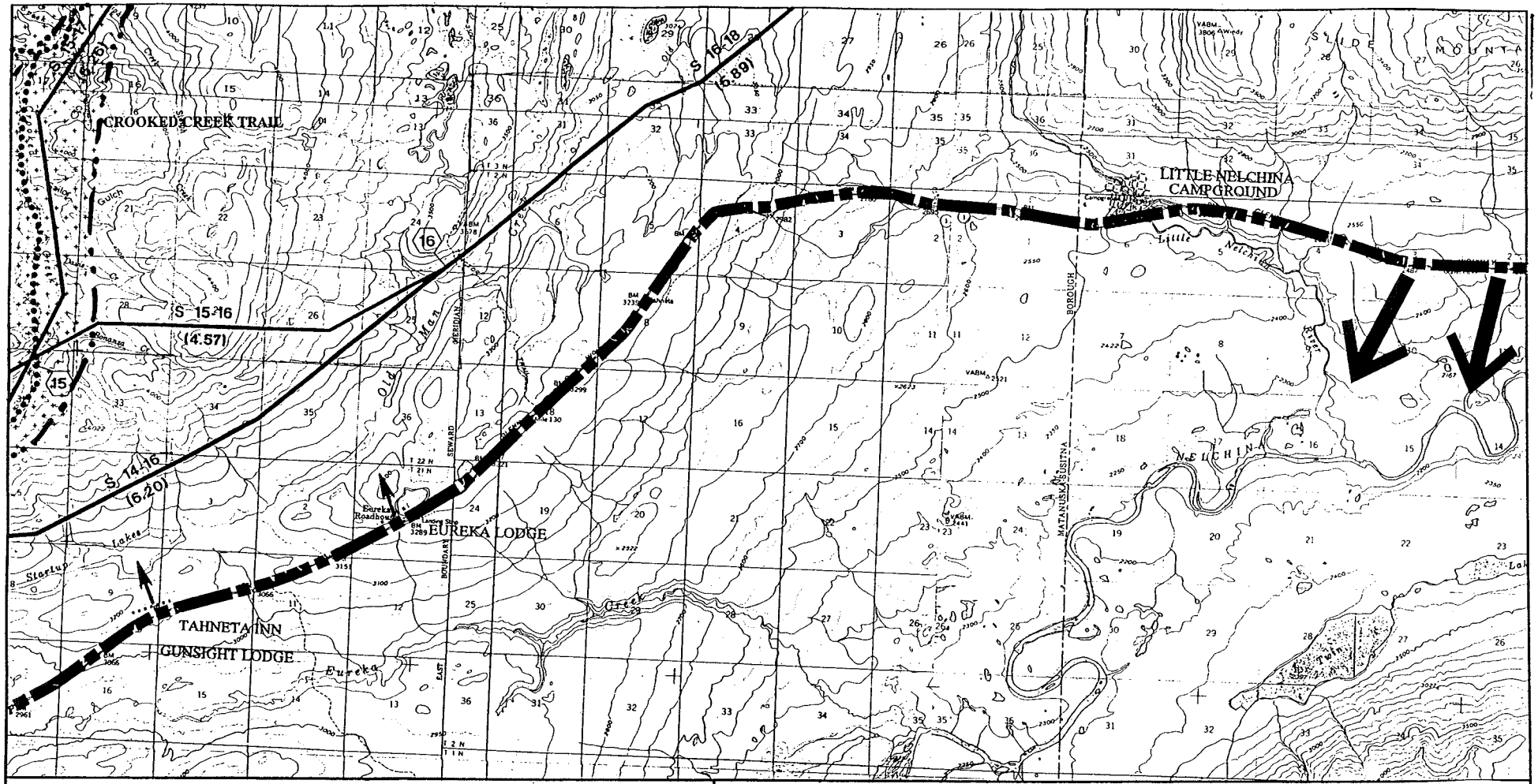

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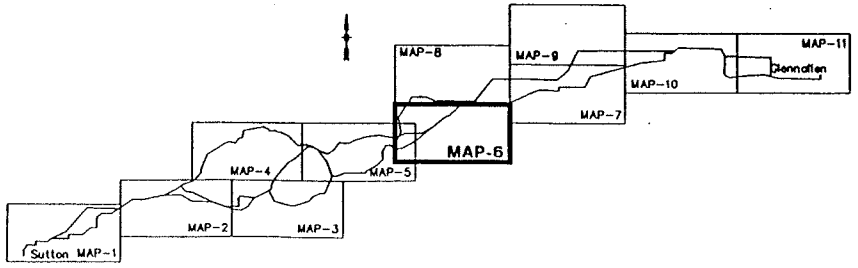

VISUAL AND RECREATION RESOURCES LEGEND

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APPROXIMATE SCALE IN MILES

ALASKA ENERGY AUTHORITY

COPPER VALLEY INTERTIE FEASIBILITY STUDY

FIGURE 2.9-1
VISUAL AND RECREATION RESOURCES
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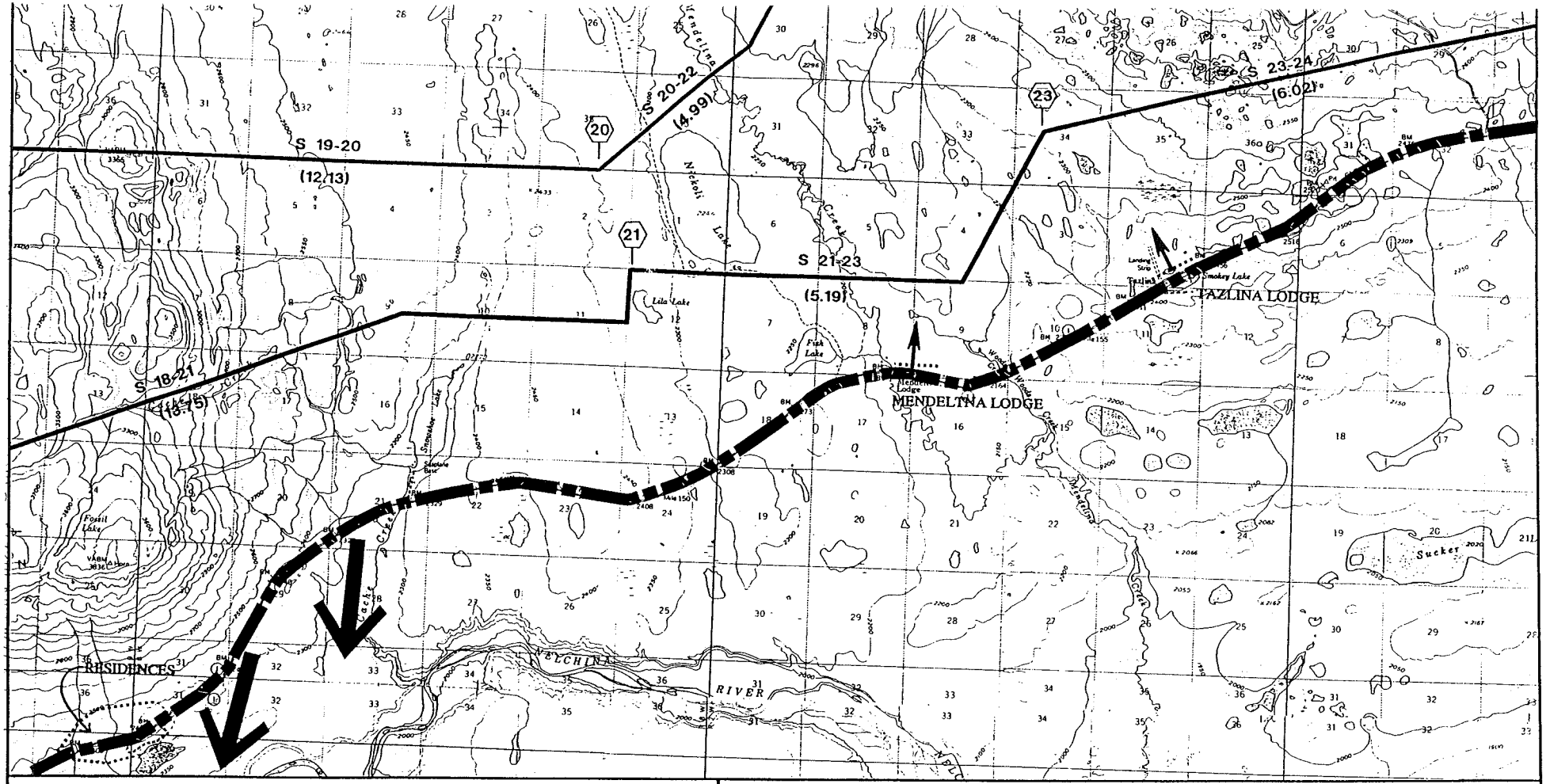

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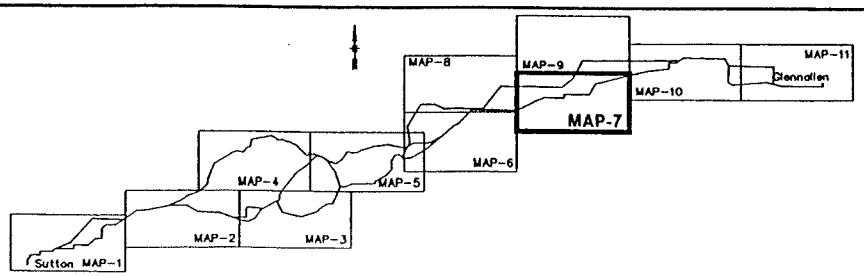

VISUAL AND RECREATION RESOURCES LEGEND

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APPROXIMATE SCALE IN MILES

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COPPER VALLEY INTERTIE FEASIBILITY STUDY

FIGURE 2.9-1
VISUAL AND RECREATION RESOURCES
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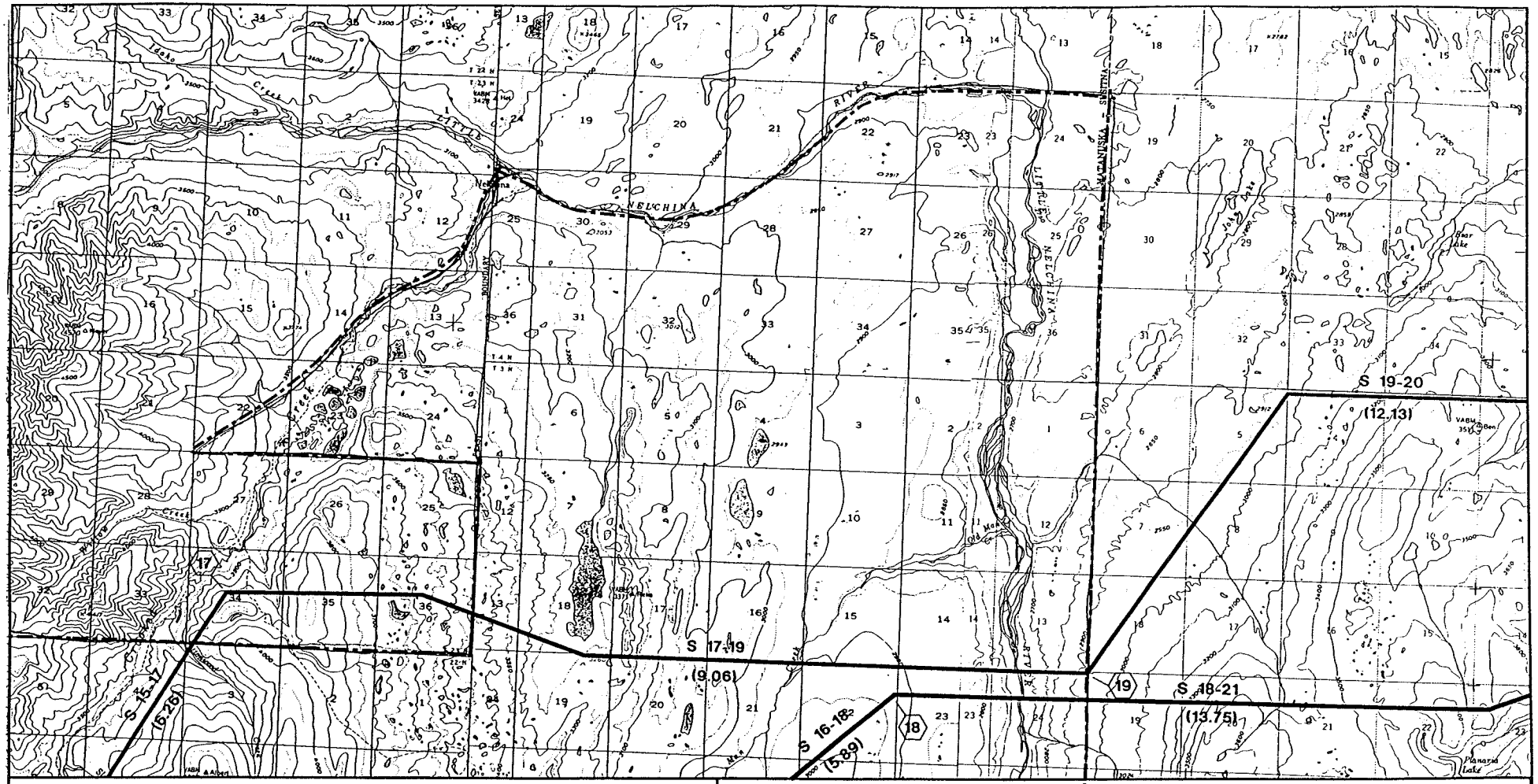
DAMES & MOORE



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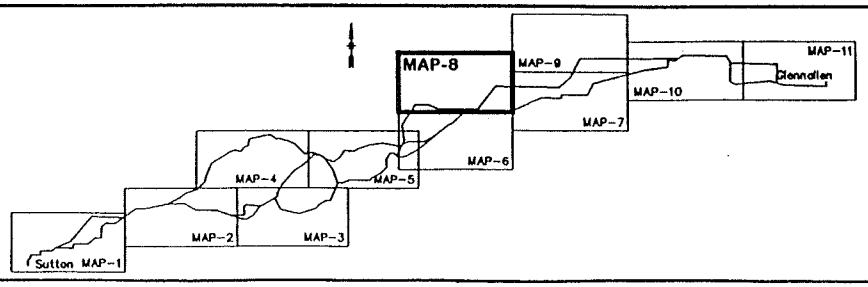

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APPROXIMATE SCALE IN MILES

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FIGURE 2.9-1
VISUAL AND RECREATION RESOURCES
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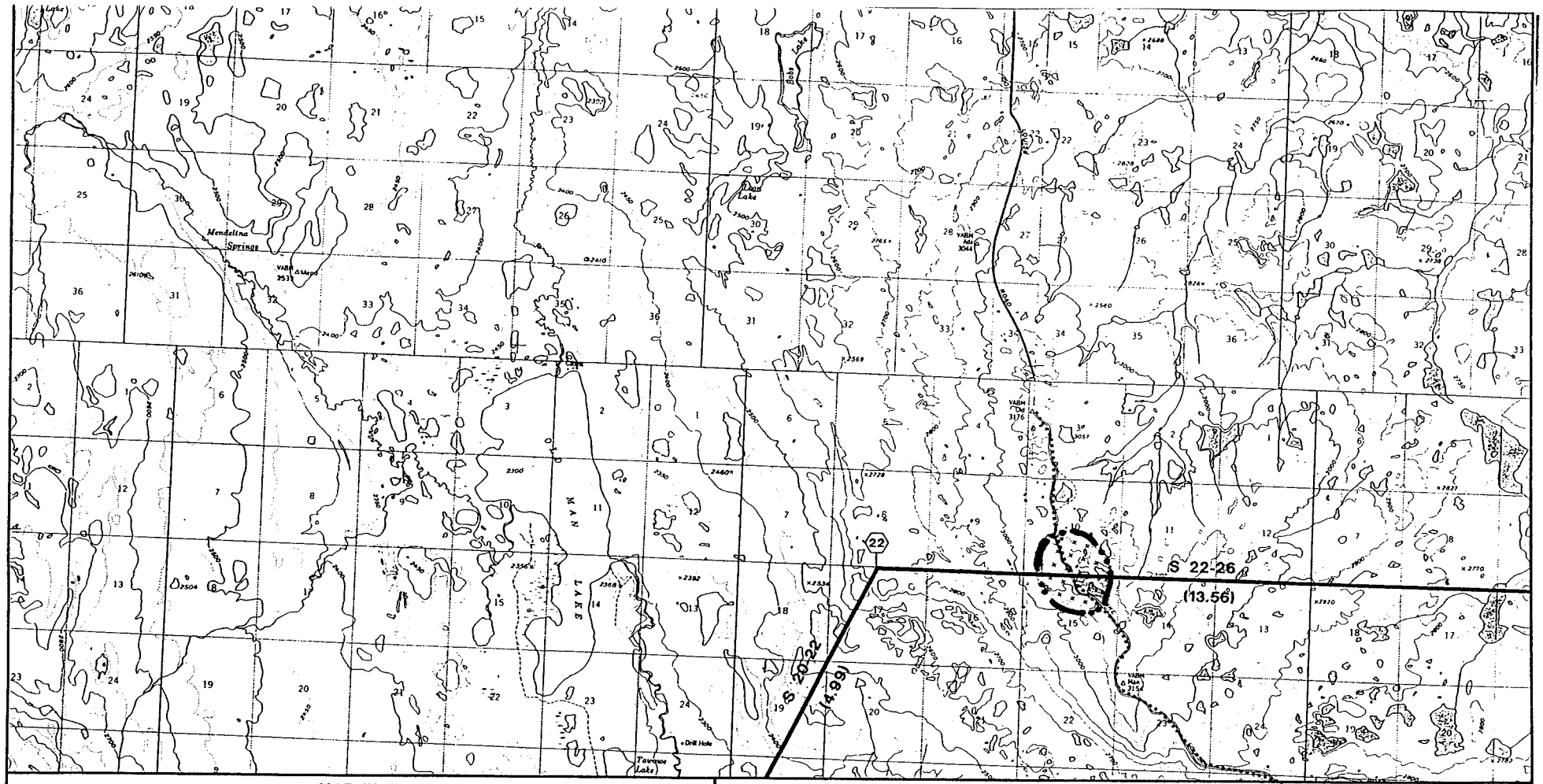

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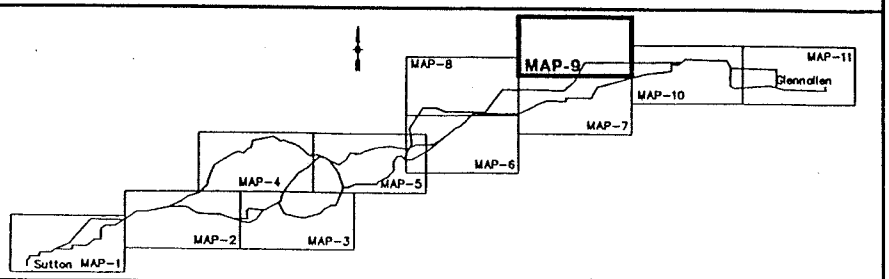

VISUAL AND RECREATION RESOURCES LEGEND

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APPROXIMATE SCALE IN MILES

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FIGURE 2.9-1
VISUAL AND RECREATION RESOURCES
MAP-9 OF 11 MAPS

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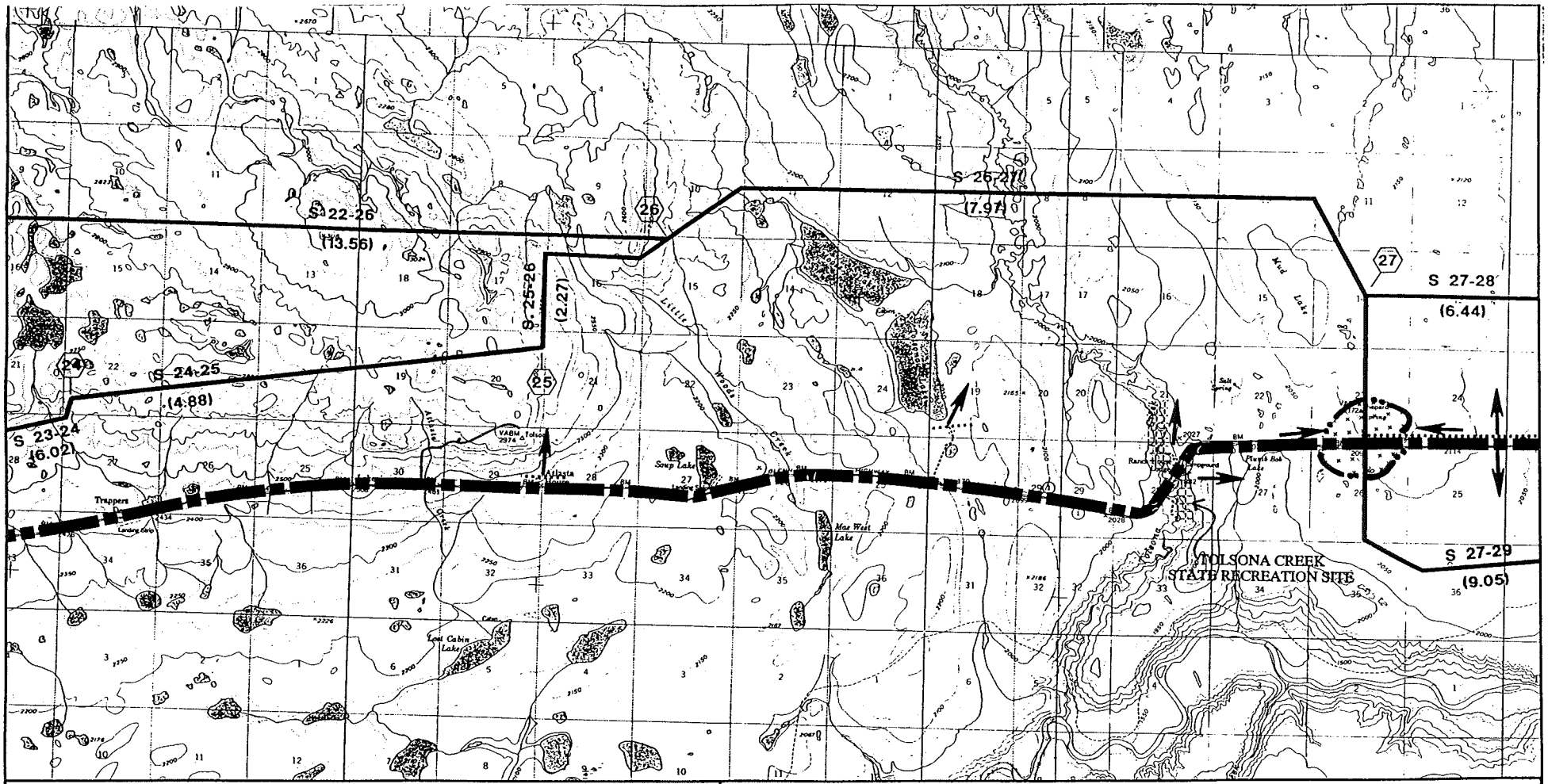

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APPROXIMATE SCALE IN MILES

ALASKA ENERGY AUTHORITY

COPPER VALLEY INTERTIE FEASIBILITY STUDY

FIGURE 2.9-1 VISUAL AND RECREATION RESOURCES

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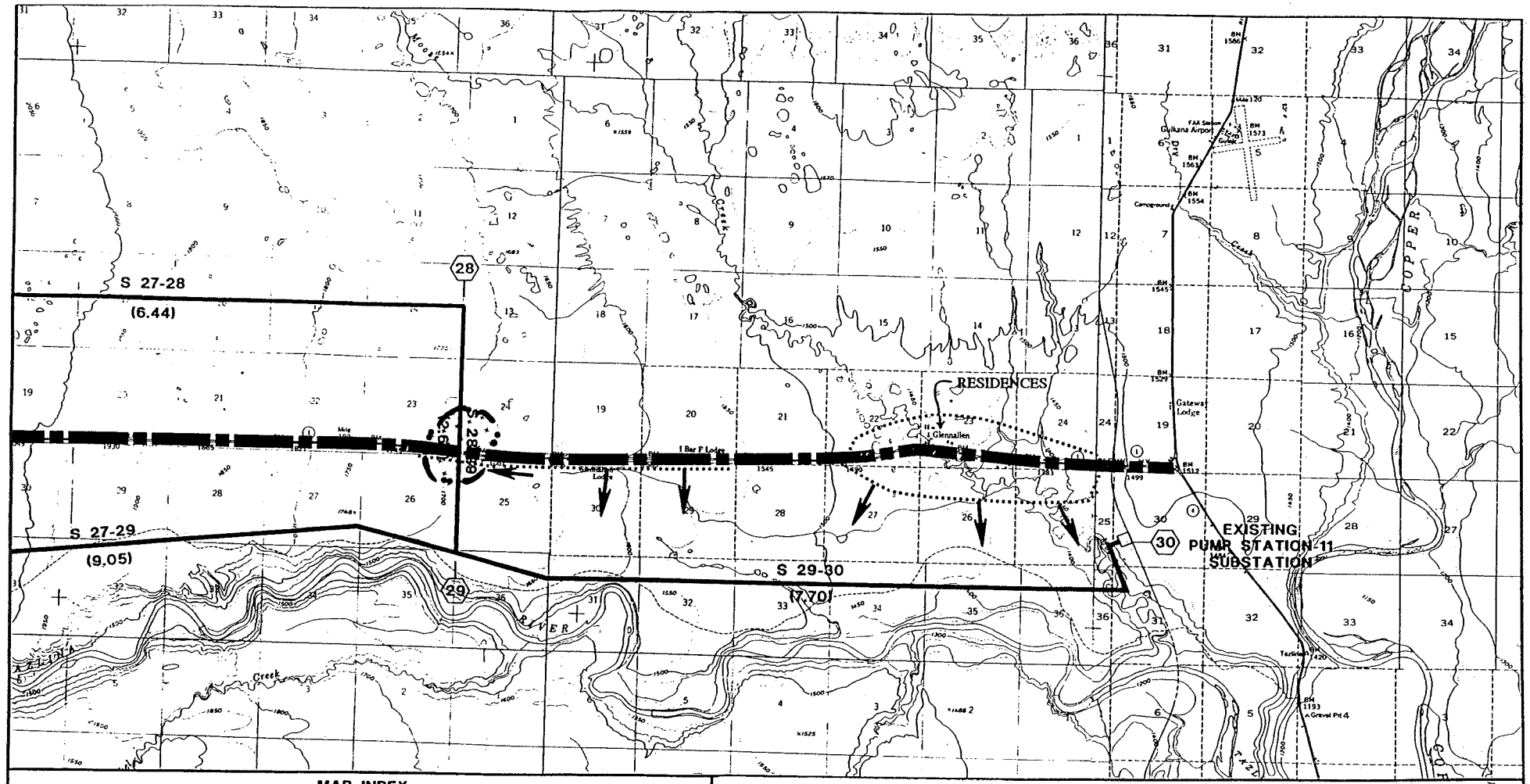

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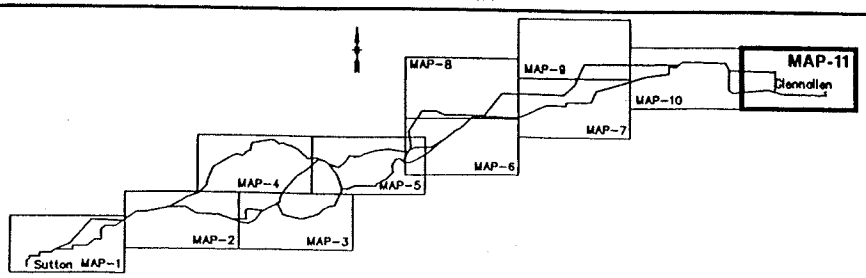

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ALASKA ENERGY AUTHORITY

COPPER VALLEY INTERTIE FEASIBILITY STUDY

FIGURE 2.9-1
VISUAL AND RECREATION RESOURCES
MAP-11 OF 11 MAPS

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DAMES & MOORE

Table 2.9-1
Matanuska-Susitna Borough Trails Crossed
By Proposed Route Alignments

Trail Name	Route Alignment
Kings River Trail	Both
Chickaloon-Knik-Nelchina Trail	Both
Chickaloon River Trail	Both
Ninety-eight Trail	Both
Castle Mountain Trail	Southern
Purinton Trail	Southern
Boulder Creek Trail	Northern
Muddy Creek Trail	Southern
Pinochle Trail (Hicks Creek)	Both
Dan Creek Trail	Southern
Caribou Creek Trail	Both
Squaw Creek Trail	Southern
Alfred Creek Trail	Northern
Belanger Pass Trail	Both
Crooked Creek Trail	Southern
Startup Lakes Trail	Southern
Old Man Creek Trail	Southern

Source: Matanuska-Susitna Borough, Comprehensive Development Plan: Trails (1985)

2.10 Visual/Scenic Resources

The visual resources study of the proposed route alignments for this project is based on review of available published and unpublished documents, topographic maps, and site photography. Field reconnaissance was limited to an overflight of the project study area and a windshield survey along the Glenn Highway. No detailed studies were performed to determine the potential visibility of the proposed transmission line in the landscapes of the project study area.

The proposed route alignments pass through two distinct landscape character types: the rugged mountains and valleys along the Matanuska Valley and the flat, open expanse of the Copper River Valley. The Matanuska Valley is well known for its scenic values. The high, rugged peaks of the Talkeetna and Chugach Mountains on either side of the valley are focal points for scenic views in the valley. Because of the access into the valley provided by the Glenn Highway and its proximity to Anchorage, the Matanuska Valley is a popular recreation destination as well as a major sightseeing corridor for tourists. Views from the Glenn Highway include scenery considered some of the most spectacular in Alaska. Travellers can view the Matanuska Glacier, Castle Mountain, Granite Peak, Matanuska River, Sheep Mountain, and the Chugach Range from the highway.

The wide, braided channel of the meandering Matanuska River is broken by occasional sections of rapids through narrow rock outcrops. Riparian vegetation communities characterize the lower areas adjacent to the river while upland areas are forest covered. Alpine areas are barren, rugged rock outcrops and exposed mountain faces. Visual interest in the Matanuska Valley varies with the seasons. In the summer, the exposed mountain faces varying from dark grays to red-browns and tans contrasting with the greens of vegetation. In the winter, vegetation appears dark against backdrops of the snow and ice.

Copper River Valley landscapes are characterized by numerous lakes of variable size scattered among low rolling hills covered with low-growing, relatively homogenous vegetation including black spruce forest and muskeg. Views are generally open and unrestricted across the wide expanse of this valley. On clear days the focal points of views tend to be distant mountain ranges at the horizon.

With the exception of the Glenn Highway and structures at several small communities, roadside lodges, dispersed residences, and telephone and electric distribution lines, the visual character of the project area appears largely natural. Views in the valley tend to be relatively confined by terrain and vegetation. Some residences and portions of the Glenn Highway are situated on high points providing extensive vistas along the valley.

2.11 Air Quality

Air quality is generally good throughout the study area, although air quality issues have been raised in Valdez. ADEC has been working with industries in the Valdez area to identify and address air quality issues, primarily benzene emissions from industrial activities.

CVEA relies on diesel generators for roughly 28% of its power generation and has seven diesel generators located in Glennallen and six diesel generators located in Valdez. These generators are usually operated between October and May to supplement energy generated at the Solomon Gulch hydroelectric plant. Diesel generators are known to generate nitrous oxides, sulfer dioxide and particulates, as well as small amounts of benzene. The CVEA generators are not currently required to be permitted under ADEC's air quality regulations. However, under recent revisions to the Clean Air Act which go into effect next year, the Glennallen facility and the Valdez facility will require air quality permits. CVEA's generators are the only stationary source in Glennallen expected to require an air quality permit next year. In Valdez, there are other stationary sources in addition to CVEA's generators which will require air quality permits under the Clean Air Act revisions.

2.12 Electric and Magnetic Fields (EMF)

2.12.1 Introduction

Over the past several years there has been an increasing public awareness and concern regarding electric and magnetic fields (EMF) and potential health effects associated with electric power systems. Generally, this increased awareness has been the result of media coverage. This coverage has highlighted findings from studies which indicate a correlation between health effects and EMF from power lines, while findings from studies which did not indicate a relationship between health effects and EMF have received limited media coverage.

An environmental health concern raised by the public during the public meetings and comment period is the potential human health effects from exposure to 60-Hertz electric and, in particular, magnetic fields. Currently, there is no consensus within the scientific community linking health risks to exposure to electric and magnetic fields at levels expected to be generated by the Intertie.

Public perception of health risks associated with EMF from transmission lines is focused on the magnetic field component of EMF. Although a large number of scientific studies have been undertaken to research various aspects of magnetic fields and possible health risks, the results of these individual studies have been contradictory.

Electric and magnetic fields occur both naturally and as a result of human activity across a broad electrical spectrum. Naturally occurring fields are caused by the weather and the earth's geomagnetic field. Fields occurring from human activity are caused by technological application of the electromagnetic spectrum for uses such as communications, appliances, and the generation, transmission, and use of electricity. Below is a description of EMF generated from 60-Hertz power lines.

Electric fields from power lines are created whenever the lines are energized with the strength of the field dependent directly on the voltage of the line creating it. Electric field strength is typically described in terms of kilovolts per meter (kV/m). Electric fields are easily

shielded by most objects or materials such as trees or houses. Electric field strength decays rapidly as the distance from the source increases.

Magnetic fields from power lines are created whenever power flows through the lines with the strength of the field dependent directly on the current in the line. Magnetic field strength is typically measured in milligauss (mG) or microTeslas (μT) where 1 mG is equal to 0.1 μT. Magnetic fields are not easily shielded by most objects or materials. Similar to electric fields, magnetic field strength decays rapidly with distance from the source.

As an example, consider a household appliance. If the appliance is energized (plugged into an outlet) but not turned on (no current flowing) an electric field will be generated from the cord and appliance, but no magnetic field will be present. If the appliance is switched on the electric field will still be present and a magnetic field will be created. The electric field strength is directly related to the magnitude of the voltage from the outlet and the magnetic field strength is directly related to the magnitude of the current flowing in the cord and appliance.

In Table 2.12-1, typical magnetic field levels due to common appliances and electric distribution systems are compared to fields expected from the Intertie. This table was made available to attendees of public meetings held in June 1993. From this table it can be seen that increases in magnetic field levels in occupied structures at least 600 feet from the centerline due to Intertie operation are expected to be well below field levels due to those other sources.

Electric power flows across transmission systems from generating sources to serve connected electrical loads within the community. The amount of power flow over a transmission line is determined by the transmission line's voltage and the current. The higher the voltage level of the transmission line, the lower the amount of current needed to deliver the power for any defined power flow. The magnetic field generated by transmission lines is directly dependent upon the amount of current in the transmission line conductors. Electric transmission systems experience different levels of power flow throughout any given period as electrical consumption varies.

Table 2.12-1
Typical Magnetic Field Levels

Source of Field	Distance from Source (ft)	Magnetic Flux Density mG (field)
Electric range (1)	1	4-40
Microwave oven (1)	3.25	3-8
Clothes washer (1)	3.25	0.1-2
Fluorescent lamp (1)	3.25	0.1-3
Fluorescent lamp (1)	1	5-20
Television (1)	3.25	0.1-2
Electric blanket (2)	less than 1	10-18
Hair dryer (1)	1	1-70
Single Phase MEA	30	4.2
Distribution Line (3)	75	0.9
Three Phase MEA	30	7.1
Distribution Line (3)	75	1.4
INTERTIE		
15 MW	ROW edge	3 (4)
15 MW	200	0.3
15 MW	350	less than 0.1
INTERTIE		
40 MW	ROW edge	8.0 (4)
40 MW	200	0.8
40 MW	600	less than 0.1
Florida Regulation - Lines up to 230 kV	ROW edge	maximum 150

(1) Data taken from Bonneville Power Administration's "Electrical and Biological Effects of Transmission Lines", 1989.
(2) Data taken from Electric Power Research Institute Journal, February 1990.
(3) Based on typical Matanuska Electric Association construction standards and 140 amp current.
(4) Note that Intertie magnetic field levels in Table 2.12-1 are higher than in the table handed out at the public meetings due to a decrease in right-of-way width from 150 to 125 feet.

2.12.2 EMF Health Effects

The body of research on EMF and public health risks remains contradictory or inconclusive and, to date, the scientific community has not been able to form a consistent conclusion as to whether or not there are any adverse health effects from EMF at the field strengths and 50- to 60-Hertz frequency associated with electric power systems. The single area of agreement within the scientific community is that more and well-controlled research is necessary.

Scientists have found that electromagnetic fields can produce a number of biological effects in humans. These range from making the hair on one's arm stand on end to changes in the rate at which the body produces various compounds. Some of these effects have been related to the electric field while others are due to the magnetic field. These effects have been difficult to determine and often are only detectable at field strengths well in excess of those the public is exposed to from power lines. Although it has been found that EMF causes certain biological effects, it remains unclear whether any of these biological effects have significant implications for public health at the levels associated with power lines.

Research into possible biological effects of power line fields has been ongoing since the 1960s. During the early years of research, electric field was the primary focus. After years of research, these studies did not provide a conclusion suggesting risks to public health from electric fields at the strength associated with power lines. More recently, research has focused on magnetic fields and potential health effects with an increasing number of studies here in the United States and abroad.

The studies can be grouped into three general categories: cellular level studies, whole animal and human experiments, and epidemiological studies. These studies have provided mixed results, with some studies showing a relationship between magnetic fields and health effects while other similar studies do not support this conclusion. The area of research which is attracting considerable media and public attention is the studies of the relationship between cancer and EMF through epidemiological information.

Epidemiology is a nonexperimental science which studies factors or agents that may cause health-related conditions in groups of people based on statistical data on the incidence of disease. Epidemiology has advantages and disadvantages over animal and cellular studies. An advantage is that since epidemiological studies pertain to the incidence of disease among humans, the results can suggest public health hazard impacts. A disadvantage is that since epidemiology studies are performed in an uncontrolled environment, it is difficult to identify and isolate other confounding factors in order to single out the impact of a particular factor or agent.

The results of epidemiological studies are typically provided as statistics indicating relative risks by comparing disease occurrence within study groups (exposed groups) to the occurrence within control groups (nonexposed) or the general public.

Epidemiology studies of EMF compare the relative risk of developing cancer for persons exposed to magnetic fields, or in some studies the association of "high current" wire configurations (study group), versus persons not exposed to the these conditions (control group).

Studies which show a statistical association between magnetic fields and certain cancers have reported a relative risk of 1.5 to 3, compared to the control group, occurring at magnetic field levels of 2 mG and above. Reference to this 2 mG level in several epidemiological studies and in the media has resulted in this level becoming a threshold for public concern or perception of risk. To put the relative risk factor in perspective, researchers view a relative risk of less than 1.5 to be a weak association, 1.5 to 3.0 a moderate association, and 3.0 to 10.0 a strong association between the factor studied and the occurrence of an effect. In comparison, the relative risk for smoking and lung cancer is 10 to 40 and is widely accepted as demonstration of the association between smoking and lung cancer. Conversely, the association between saccharin or coffee and bladder cancer continues to be debated with the relative risks found to be from 1.3 to 2.6.

2.12.3 Regulations

A number of states and local agencies have adopted or considered regulations or policies related to EMF exposure. The basis for these actions has been varied although they could generally be attributed to addressing public reaction/perception relative to EMF as opposed to incorporation the findings of any specific scientific research.

International Activity

International Radiation Protection Association in cooperation with the World Health Organization have published guidelines for electric and magnetic field exposures. For the general public the limits are 5 kV/meter (up to 24 hours a day) and 10 kV/meter (for a few hours a day) for electric fields and 1,000 mG (up to 24 hours a day) and 10,000 mG (for a few hours a day) for magnetic fields.

National Activity

Although the EPA has conducted investigations into EMF related to power lines and health risks no national standards have been promulgated. The number of studies sponsored by the EPA, EPRI and other institution has increased dramatically in the past few years.

The American Conference of Governmental Industrial Hygienists published non-ionizing magnetic field limits for occupations. At a 60-hertz frequency the limits are 10,000 mG for the general worker and for workers who have pacemakers, the limit was set at 1,000 mG.

State Activities

Several states have adopted limits of electric field strength at the edge of transmission line right-of-way. These limits range from 1 kV/m to 5 kV/m for electric field at the edge of right-of-way and 2.5 kV/m to 11.8 kV/m on the right-of-way. Florida and New York have adopted limits on the intensity of magnetic fields at the edge of transmission line right-of-way. These

limits are 150 mG and 200 mG respectively and have been based on an objective of preventing field levels from increasing beyond levels presently experienced by the public and are not based upon any link between scientific data and health risks.

Local Activity

At present EMFs are not regulated in the State of Alaska.

CHAPTER 3 - POTENTIAL ENVIRONMENTAL IMPACTS

3.0 Introduction

This chapter summarizes the potential environmental impacts on the resources described in Chapter 2. The evaluation of impacts is separated into short term impacts which occur during construction and long term impacts resulting from the continuing operations associated with the transmission line. Possible mitigation measures are discussed where appropriate.

3.1 Construction Impacts

Construction impacts are those associated only with the actual construction phase of the project and therefore are generally short term in nature. Impacts which may be anticipated during construction are loss of wetlands; erosion and sedimentation of streams; increased noise and traffic in nearby areas; disruption of wildlife and loss of wildlife habitat; increased wages and jobs; and possible increased demands on lodging facilities if construction occurs during peak tourism seasons.

3.1.1 Wetlands and Other Wildlife Habitat Impacts

Impacts to wetlands from the construction of the transmission line are expected to be minimal. The clearing of trees and tall shrubs in the right-of-way will result in the loss of some wetland habitat but it should not significantly affect the functional value of these wetlands. Impacts to wetlands and erosion and sedimentation could be minimized through the use of best management practices (BMPs) during construction, use of helicopters rather than building access roads and timing construction during winter months when the ground is frozen. Other wildlife habitat destruction during construction can be minimized through careful clearing practices and minimization of the natural vegetation to be cleared when possible.

Clearing of trees on forested lands could cause significant impacts due to habitat loss and erosion, as well as aesthetic impacts. Approximately 40 percent of the alternative route alignments pass through moderate to heavily vegetated bottomland spruce-poplar and upland spruce-hardwood forest areas. These areas primarily occur in the Matanuska Valley and could require substantial clearing of vegetation. In the upper reaches of Boulder Creek, Alfred Creek, and Squaw Creek, and across the Copper Basin, little clearing should be required except for line support structure locations which are expected to number approximately five structures per mile.

Impacts from vegetation loss can be minimized through selective minimal clearing and by limiting the number of access and maintenance roads associated with the project. Vegetation that is removed or impacted in the more densely vegetated riparian and upland forest areas of the

proposed corridor, primarily through the Matanuska Valley, should revegetate within one to three years with colonizing species such as fireweed, horsetail and bluejoint. Trees beneath and adjacent to the lines could be permanently removed as they could present a safety hazard.

Some areas of Alaska are currently experiencing problems with infestations of Spruce bark beetles. Proper clearing and disposal of trees in infested areas can minimize the potential for the spread of this infestation. State forestry regulations require that any white spruce trees cleared during construction activities must be either removed for salvage/sale or treated onsite to prevent the spread of the bark beetle infestation.

3.1.2 Noise and Traffic Impacts

Although some blasting could be necessary during construction where rock is encountered, noise impacts on the surrounding communities are expected to be minimal due to the isolated location of the proposed routes. It is possible that there would be limited impacts on backcountry skiers and snowmobile riders in areas where the route alignment passes near or across trails. Traffic impacts will be minimized through the use of helicopter construction throughout much of the area. The Sutton area may experience limited noise and traffic congestion from construction in the initial portion of the route leading out of the proposed new substation. The Glenn Highway will likely see increased traffic throughout the construction period as materials and labor are transported to the jobsite. These inconveniences would be expected to be of a limited duration. Impacts of noise on wildlife are discussed under the section on wildlife impacts.

3.1.3 Air Quality Impacts

Construction of the intertie is not likely to significantly impact air quality in the project area. Burning of slash associated with clearing of the corridor would take place in accordance with ADEC and ADNR regulations on open burning.

3.1.4 Wildlife Impacts

Some temporary disturbance and local displacement of wildlife species would occur during construction. Overall, habitat loss through right-of-way clearing along the trumpeter swan and waterfowl habitat areas would be relatively low. Temporary displacement of local moose, caribou and Dall sheep may occur during construction activities due to increased noise and activity in the area. There would be a greater potential for adverse impacts on caribou during the winter when caribou are sometimes present in the lowland foothill area east of the Eureka Roadhouse in the Copper River basin. The timing of construction in various wildlife habitat areas can be adjusted to avoid sensitive time periods in order to reduce the impact on area wildlife.

Although some raptors may be temporarily displaced during construction, the impact will be minimal. According to a 1981 report by the Raptor Research Foundation, considerably more

disturbance can be tolerated by raptors in the winter. Thus, disturbance impacts can be minimized through the timing of construction. Removal of perch or nest trees would reduce raptor habitat availability. In general, a protective buffer of 300 feet around nest trees is an acceptable form of mitigation and means of reducing impacts. A raptor survey should be conducted to update information on raptor nesting areas along the proposed alignments before final rights-of-way are determined.

Construction activities in the area of Knob Hill may have adverse effects on a mineral lick used by area Dall sheep. Animal trails leading to mineral licks should be avoided by construction activities so as to minimize indirect impacts. Special guidelines have been developed for activities in the vicinity of mineral licks. These guidelines are discussed further in Section 2.7.2.

Black bear use a wide variety of habitats in the area and may be impacted by construction of the transmission line. Black bear are adaptable and are tolerant of change or disturbance. However, development which increases human activity in black bear habitat may result in increased direct human-induced mortality of bears. Impacts on bears would increase with any temporary campsites and waste storage areas used during construction. Impacts on black bear can be reduced with appropriate construction management practices, such as requiring incineration of burnable garbage, and "pack-it-in, pack-it-out" requirements.

Brown bear are also found in the project area. Brown bear are not adaptable, and are intolerant of change or disturbance. It is especially critical for the brown bear not to be disturbed during the summer season. Again, increased human activity in brown bear habitat may result in increased direct human-induced mortality of bears. Impacts on brown bears can also be reduced with appropriate construction management practices, as mentioned above.

Some temporary disturbance of trumpeter swans due to construction noise and activities may occur during construction of the line. Although foundation installation in the Copper Valley area will occur primarily during the winter, minimizing its impacts on the swans, other construction activities will have to occur during other periods of the year. ADNR and ADF&G restrict activities in trumpeter swan nesting areas during the period May 1 to August 31, and any construction occurring in these areas during this period will be subject to approval by ADNR in consultation with ADF&G.

3.1.5 Recreational Impacts

Both route alignments pass near or cross various trails in the study area. Although recreational impacts could be limited through scheduling construction during winter as much as possible, there will still be impacts on winter trail activities such as skiing and snowmobiling. These impacts are expected to be of a limited duration. Recreational impacts are discussed in more detail in Section 3.2.3.

3.1.6 Economic Impact

Construction of the project would result in increased wages and earnings for various construction trades and materials suppliers. The number of positions and length of employment will vary depending on the contractors selected and the construction schedule. The geographic distribution of the increased earnings and materials sales revenues will depend on contractors and vendors selected for construction. Retail businesses, including restaurants and lodging establishments, could experience increased business and revenue due to the influx of construction personnel.

3.2 Operational Impacts

Operational impacts are those associated with the continued operation of the transmission line and are therefore long term in nature. Operational impacts would include the scenic/visual impact, impacts on recreation, impacts on wildlife and wildlife habitat, EMF impacts, and the economic impact of lower electric rates in the Copper River basin area.

3.2.1 Wetland and Other Wildlife Habitat Impacts

Operational impacts to wetlands will be minimal. Areas under the lines will be selectively cleared of trees and tall shrubs periodically but this should not significantly affect the functional value of the surrounding habitat. Impacts to wetlands and other habitat will be minimized through the use of best management practices (BMPs) during all maintenance activities and minimization of the natural vegetation to be cleared when possible.

Long-term impacts on non-wetland vegetation should be minimal. Some habitat will be lost as trees removed along transmission line corridors and maintenance roads will be not be allowed to regenerate. Vegetation cleared from maintenance roads could also be permanent as vehicle traffic and grading could largely inhibit regrowth. Vegetation cleared in alpine areas and across tundra areas are more prone to long-term impacts as these habitat areas tend to erode more easily and/or pool with water when the vegetation is removed. Again, these impacts may be minimized through the use of BMPs during maintenance activities.

3.2.2 Noise and Traffic Impacts

Noise impacts on the surrounding communities will be minimal during maintenance activities.

3.2.3 Air Quality Impacts

Air quality impacts from this project are expected to be minimal. Reduced use of diesel generators in the CVEA service area could result in air quality benefits for the Glennallen and

Valdez areas. However, since these generators currently contribute only about 28% of CVEA's total power generation and are usually used only between October and May to supplement power from the Solomon Gulch hydroelectric plant, this benefit is likely to be small. In addition, purchase of power from other utilities could result in increased electric generation in other areas of the state, which could offset some of the benefit realized by the CVEA service area. More detailed studies of potential benefits to air quality would need to be performed in order to conclude whether this project would significantly impact air quality.

3.2.4 Wildlife Impacts

Waterfowl

Some waterfowl may be adversely impacted by the presence of transmission lines. However, the overall incidence of collision and magnitude of loss attributed to waterfowl striking transmission lines is low when compared to total waterfowl crossings. The reason for the low collision rate is that most birds cross transmission lines ten feet or more above the wires. Young, inexperienced birds are more likely to collide with transmission line wires than older birds. Other factors which can increase the likelihood of collision include darkness, high wind velocity, fog or rain. Visibility of wires can be increased by attaching highly visible objects to the wires.

State guidelines for trumpeter swan nesting areas dictate that impacts to trumpeter swans be minimized. These guidelines require special attention to the siting of the line as well as to the marking required where transmission lines cross rivers and other open areas. Maintenance activities in these areas must be timed so as to minimize disturbance to nesting swans.

Raptors

Potential impacts on raptors associated with a transmission line include disturbance, loss of habitat, collisions with the associated structures, or poaching of birds. Possible effects on raptors are highly variable. The species of raptor, the individual, and the seasonal timing of the disturbance all contribute to a given response and the subsequent effects. Disturbance of raptors during construction and removal of perch or nest trees are discussed in Section 3.1.3 above.

Raptor collision is not a major problem with transmission lines due to the high visual acuity of raptors and the large size of transmission line conductors. Collisions are more likely to occur in foggy weather, at night in the case of owls, or when birds are distracted in some way (e.g., when chasing prey). Fortunately, even these instances are uncommon. The Raptor Research Foundation has published studies on raptor protection measures for power line projects. The major potential problem addressed is electrocution of raptors on distribution lines. Transmission lines do not pose a high threat of electrocution since transmission line wire separation is generally large enough to prevent birds spanning both wires. Research on practices to reduce raptor collisions with transmission lines include marking transmission lines for higher visibility especially in areas of high raptor use. Design and marking of transmission lines could be done in coordination with USFWS and ADF&G in order to minimize the potential for raptor collisions.

Moose

If road systems are built to access the transmission line for maintenance and repairs, vehicle access into areas may produce an increase in the demand for moose. Increased road access could increase hunter numbers to the point where area moose populations are adversely affected. Impacts could be reduced by minimizing the number of new access roads constructed for project maintenance.

Caribou

Impacts to the Nelchina caribou herd from this project are expected to be minimal. The herd's calving grounds are located north of the project study area and should not be affected. Increased road access could increase hunter numbers to the point where area caribou populations are adversely affected. Again, this impact can be reduced by minimizing the number of new access roads constructed for project maintenance.

Dall Sheep

The greatest populations of Dall sheep in the Talkeetna Mountains are found in the southern portion of the range, within the project study area. Hunting pressure on rams in this area is fairly heavy due to the relatively easy access from the highways, by air, and by all-terrain vehicles (ATVs). Increased road access could increase hunter numbers to the point where area ram populations are adversely affected. Again, the number of new access roads constructed should be limited to reduce this potential impact.

Small Mammals

Clearing activities associated with maintenance of the transmission line will likely displace small numbers of furbearers and rodents. The clearing will in some cases have the effect of opening up small areas of grasses as alternative habitat areas. Overall impacts to small mammals are expected to be minimal.

3.2.5 Recreational Impacts

The Matanuska Valley and adjacent Talkeetna Mountains are popular areas for recreation and provide opportunities for a variety of recreation activities. Peak recreation use of these areas generally occurs during the fall hunting season. Currently, most access in public use areas in the Talkeetna Mountains is by foot, horse, or all-terrain vehicle in the summer and by snowmachine or ski in the winter. New roads for transmission line maintenance would likely not affect winter access, however, they could provide for more extensive use of four-wheel drive vehicles in other seasons. Although new roads could potentially increase access for recreation use in the project

area, increased access could put pressure on existing recreation resources and potentially result in overuse of some areas. These impacts can be minimized by limiting development of new access roads.

Both route alignments cross or parallel portions of several trails including the Chickaloon-Knik-Nelchina Trail system. Trails in this system are popular for both summer and winter recreation activities. A transmission line crossing or paralleling portions of these trails could adversely affect recreation use in the surrounding area. Impacts would be largely indirect because transmission line structures can usually be placed to avoid direct conflicts with recreational uses (e.g., roads, trails, developed recreation sites, etc.). The primary concern would be the potential effect of the presence of transmission line structures and new access roads on the recreation experience of hunters, fisherman, hikers, cross-country skiers, and other recreation users who generally seek natural landscapes for their particular activity. Transmission line structures would tend to degrade scenic values by introducing structural (industrial appearing) elements into the largely undisturbed landscape of the project.

The proposed route alignments pass within three miles of six state recreation sites including King Mountain, Bonnie Lake, Long Lake, Caribou Creek Recreational Mining Area Tolsona Creek, and the Matanuska Glacier. Detailed visual impact studies of the six state recreation sites have not been performed and the following observations are based on limited ground and helicopter inspection and review of topographic maps.

King Mountain recreation site encompasses a campground on the northside of the Matanuska River and extends across the river to about elevation 1100 feet. The Intertie alignment would probably not be visible from the campground due to forest shielding and steep contours, but it could be visible from viewsheds on the higher more remote southern portion of the site.

Bonnie Lake recreation site area surrounds the lake with a campground located on the southeast shore. Due to intervening high ground and forest stands reaching to the lakeshore, views of the line on the southern alignment would probably be limited to one or two spans at a distance of 2.5 miles as it passes over the 3000-ft ridge in Section 8 on Figure 2.9-1. This observation is based on photographs taken by the R. W. Beck project engineer. The northern alignment would not be visible from the site and the route modifications shown on Map 2 of 11 in Volume 1, Section III of the Feasibility Study would likely be less visible than the southern alignment shown in Figure 2.9-1.

Long Lake recreation site surrounds the lake and extends to elevation 1800 feet to the south. Due to steep contours, the line would probably not be visible to the north for either the northern or southern alignment from the lake itself. However, the southern alignment could be visible at a distance of 4-5 miles looking northeast from the lake or from high ground looking north to northeast.

Caribou Creek Recreation Mining Area extends for about 1.5 miles along lower Caribou Creek. It encompasses the creek bed as well as its banks to about elevation 2300 feet. It is possible that the southern alignment would be visible from the creek bed if creek bed meandering

does not impede the view or from the higher elevations of the site. The northern alignment would not be visible.

Tolsona Creek recreation site is situated at lower elevations of Tolsona Creek where it meets the Glenn Highway. The campground is located on the banks of the creek from where neither alignment would be visible due to topographic contours. Dense forest also impedes the view from this area.

Matanuska Glacier recreation site is located on the north side of the river at the foot of the glacier. Views of the southern alignment to the west and up Pinochle Creek may be possible from portions of the site. The line may be visible to the north from this site, although it is more likely that people would be looking to the southeast towards the glacier.

Although none of these recreation sites would be directly affected, the presence of transmission line structures potentially visible to users of these recreation sites may affect views of surrounding scenic landscapes, and thus result in adverse impacts to visitors' recreation experiences.

The southern route alignment passes lodges located along the Glenn Highway including Snowshoe Lake Lodge, Mendeltna Lodge, and Tazlina Lodge. Both route alignments pass about three miles north of Tolsona Lake Lodge. Although the route alignments would not directly affect any of these lodges, the presence of a transmission line would potentially affect the recreational experiences sought by lodge patrons who use the surrounding area and trails. Visibility of the route from these lodges could affect the experiences of patrons pursuing a natural landscape setting, however it is likely that the line could be sited so that it would not be visible from the lodges. Also, aircraft landing areas are located throughout the area and are used for hunting, recreation and airtaxi service. Both route alignments could pose potential hazards for aircraft where they would pass near lakes used by floatplanes and other landing strips.

A discussion with local residents indicated that an abrupt knob above Little Granite Creek, east of Sutton, is used as a take-off point for hang-gliders. Both route alignments could be a potential obstruction hazard to hang-gliders in this area.

Although most direct impacts to recreation resources could likely be avoided by careful structure placement, the proposed transmission line could result in potentially significant effects on recreational use in the project area, in particular, for portions of the Chickaloon-Susitna Trail system.

3.2.6 Visual/Scenic Impacts

Visual impacts were analyzed based on topographic maps, photographs and one flight over the project area. A more definitive visual impact analysis should be performed including field verification of sight distances from the highway, recreation areas and lodges. Additionally, this impact analysis does not address all potential mitigation measures which could be taken to reduce the potential visual impacts discussed below.

In the Sutton area, the initial portion of the route alignments could be visible to some residences on Jonesville Road, north of the Glenn Highway. However, this view may be shielded by dense forest in the area. A few residences located on an escarpment east of Sutton would likely see a portion of the alignment in this area. The route alignments pass north of the Chickaloon area out of view of most residences in this area. The final portion of the route alignments may be visible to the south in the distance from residences on high ground north of the Glenn Highway in the Glennallen area. Other portions of the route alignments may also be visible from isolated residences along the Glenn Highway corridor (not specifically identified for this study).

The proposed transmission line, on either the southern or northern alignment, would be a prominent feature in the viewshed of winter and summer recreational users of the Chickaloon-Knik-Nelchina Trail system, where it crosses the trail or parallels them at relatively close distance and shielding from topographic features or forest cover is not effective. Although the portions of the routes that parallel the major drainages of Boulder Creek, Hicks Creek, Caribou Creek, Squaw Creek, and Alfred Creek would not affect views from the Glenn Highway or residences along the highway, they would affect the scenic values of these areas and be visible to recreation users of the area. Transmission line structures would introduce structural (i.e., industrial appearing) elements into the largely undisturbed landscape of the project area degrading scenic values. The presence of transmission line structures and access roads in any of the largely barren drainages in the Talkeetna Mountains would cause high visual contrasts. Because these landscapes have little to no forest cover, there is minimal potential for screening the transmission line structures from view.

Although the southern route alignment would pass to the north of the scenic areas around Sheep Mountain and the Matanuska Glacier, and be largely out of view from the Glenn Highway, this route could still potentially adversely affect some views of these scenic features of the Matanuska Valley. In addition, the southern route alignment may be more visible to airplane passengers sightseeing or traveling to and from lodges along the highway. The northern route alignment could avoid potential visual impacts to the scenic features in this area.

From Sutton to approximately milepost 90 of the Glenn Highway, both route alignments would be largely unseen as they would traverse the lower slopes of the Talkeetna Mountains above the highway behind some lower foothills. Where the southern alignment passes between Anthracite Ridge and the highway, it may be occasionally visible although trees on the lower slopes would provide some screening. The southern alignment could also be visible from the Glenn Highway just west of Victory Road.

The southern alignment would again be visible from the Glenn Highway where it traverses the largely barren foothills of the Horn Mountains, parallel and a mile north of the highway, from Startup Lakes to milepost 133 of the Glenn Highway. A portion of this route would also be visible to north views from the Eureka Roadhouse.

From Slide Mountain to Glennallen, portions of the southern route alignment could occasionally be visible by travellers on the Glenn Highway and may also be visible in the middleground and background from Snowshoe Lake Lodge and Mendeltna Lodge. There is a

slight possibility it could also be seen from the Tazlina Lodge and the Tolsona Lake Lodge. Both route alignments would be visible where they cross Lake Louise Road, a high-grade gravel road serving as the sole access road to the Lake Louise recreation area, and where they cross the Glenn Highway. The southern route alignment crosses directly over a scenic overlook located on Lake Louise Road.

The Alaska Department of Transportation and Public Facilities is planning to re-align and improve portions of the Glenn Highway. Re-aligned portions of the highway and several proposed pullouts and waysides could potentially increase the visibility of portions of the routes to sensitive viewers.

Both of the proposed route alignments would introduce structure contrasts (e.g., transmission line structures) and cause potential landform contrasts (e.g., construction access roads) in the largely undisturbed natural landscapes of the majority of the project study area and result in adverse visual impacts. Potential impacts to views from recreation trails in the Talkeetna Mountains could be significant. Visual impacts to views from the Glenn Highway, residences, lodges, and state recreation areas would likely be less significant because of existing visual contrasts in the landscapes surrounding these viewpoints.

3.2.7 Economic Impact

Economic benefits, in the form of lower electric rates, could accrue to CVEA customers as a result of this project depending on cost and financing structures. These lower rates may have an indirect effect of stimulating economic growth in the Copper River Valley area. Negative economic impacts to tourism related businesses in the Matanuska Valley area may occur but are likely to be minimal.

3.2.8 Land Use and Community Impacts

Matanuska Valley

As stated in Chapter 2, the primary land uses in the project area are recreation and wildlife habitat. The area is relatively undeveloped and provides a wilderness recreation opportunity within a short drive from the large population center in Anchorage. The Glenn Highway running through the project area is considered one of the most scenic highways in the state. While the transmission line is not expected to be visible from the Glenn Highway except in some limited locations, it is likely to have a significant impact on the scenic and recreational resources along the project corridor.

Issues addressed in public comments and summarized in resolutions passed by Matanuska Valley area community councils, the Chickaloon Village Traditional Council, the Greater Sutton Chamber of Commerce and the Matanuska-Susitna Borough Planning Commission and the Matanuska-Susitna Borough Assembly include the impacts to the popular and historically significant recreational trails; increased pressure on wildlife habitat resulting from increased

access to these areas; the spread of bark beetle infestations due to clearing for construction; visual impacts upon the scenic qualities of the project area and its related economic impact on local tourist oriented businesses; impacts on the quality of life; potential health impacts from EMFs; and the need to examine other alternatives for meeting CVEA's power needs. Although many of these issues have already been addressed, they are summarized below.

There may be an indirect (visual) impact on the recreational trails, as the potential route alignments do pass near, parallel or cross some trails. These impacts may be minimized through careful siting of the routes and trail crossings. It should also be remembered, that many backpackers and hikers currently hike along "powerline" trails both in the Matanuska Valley and in Chugach State Park.

The loss of wildlife habitat and the increased pressure on wildlife can be minimized through careful clearing of rights-of-way and limiting the number of new access roads to be constructed. The ADNR Division of Forestry regulates the clearing of forested areas and requires that white spruce trees be either removed and salvaged for timber or treated onsite in order to prevent the spread of bark beetle infestation. Treatment could include controlled burning, chipping or effective crushing.

The visual impacts of the project are addressed in detail above. Visual impacts may be reduced to some degree by using the more northern alignment and carefully siting the line. The economic impact on tourism related businesses resulting from the visual impacts of the line is hard to measure. Although the visual impact may negatively impact tourists' recreational experience, this does not necessarily mean that it will reduce the number of tourists who come to the area for the scenic views.

Impacts on the quality of life in the area are extremely hard to measure. Quality of life is a subjective criterion and the impact of this project on the area's quality of life is impossible to quantify. Components which may affect quality of life such as visual impacts and economic impacts are discussed above.

Concerns over potential health impacts from EMF were raised in the public meetings held in June. Current research has not shown a causal relationship between EMF and any specific disease but research is continuing. EMF levels outside the project's right-of-way are expected to be minimal. However, to address stated concerns, route alignments were sited at least 600 feet from all identified occupied structures wherever possible. EMF is discussed further in Section 3.2.9.

Many letters from the public and most of the resolutions received recommended that CVEA examine other means of meeting its energy needs. CVEA has examined other alternatives and an economic analysis of this project versus the other alternatives is included in the Feasibility Study.

Public comments received from the Copper River Valley area were generally in support of the project due to the economic benefits which could be expected in this area. A resolution was received from the Copper Valley School District stating that the project would have a positive impact on the school system in this area.

3.2.9 Electric and Magnetic Field (EMF) Effects

An acknowledged potential impact to public health from electric transmission lines is the hazard of electric shock. Electric shocks from transmission lines are generally the result of accidental or unintentional contact by the public with the energized wires or conductors.

As is required by the National Electrical Safety Code (NESC) and accepted engineering practice, the design of the Intertie would include safeguards to protect the public and minimize electric shock hazard. These safeguards include construction of the transmission line to maintain sufficient clearance between the energized conductors and the ground or other objects. In addition, the transmission line would be equipped with a relay system to detect and shut off the line in the event of any electrical short or other unusual condition affecting the integrity of the line.

The lack of scientific consensus regarding potential health effects from exposure to 60-Hertz transmission line magnetic fields and the absence of regulatory guidance precludes the identification of any adverse environmental health impacts that would occur as a result of the proposed Intertie.

Computations of electric and magnetic field strengths were made for the proposed Intertie using state-of-the-art computer software. Figures 3.2-1 and 3.2-2 show how electric and magnetic field strengths vary with distance from the transmission line centerline. The computations were based on a conductor height of 25 feet and typical H-frame construction with 16-ft phase spacing.and, for the magnetic fields, two levels of electrical load on the Intertie, 15 MW and 40 MW. The 15-MW load level represents the near-term peak load that might be expected on the Intertie. Current system peak load is about 10 MW, so the CVEA load must increase 50% to reach the 15-MW level. The 40-MW load level is the maximum design electric load for the Intertie.

Figure 3.2-1 shows that the electric field level at the edge of the 125-ft right-of-way will be about 0.43 kV/m, while at 600 feet from the line the field would drop to about 0.001 kV/m.

Figure 3.2-2 shows that the expected magnetic field level at the edge of the 125-ft right-of-way will be about 3.03 mG for a 15-MW load and 8.04 mG for a 40-MW load. At 600 feet away, the fields drop to 0.03 mG at 15 MW and 0.09 mG at 40 MW.

The levels of EMF from power lines can be reduced in three primary ways: through field cancellation, through shielding, or through increasing the distance from the source. Shielding is

effective for electric fields but is of limited effectiveness for magnetic fields. However, field cancellation and increased distance from a line are effective for both electric and magnetic fields. For transmission lines, the reduction of the magnetic field is based on the square of the distance from the line to the point of interest. Field cancellation is achieved by symmetrical and close spacing of conductors, as well as special split-phase and other designs. The Intertie would rely exclusively on distance from occupied structures to limit field strengths. At the 600-ft separation from the Intertie centerline to known occupied structures, other mitigation measures would not offer substantially lower field strengths and are not required.

3.2.10 Access Roads

In the foregoing discussions it is observed that minimizing new access roads and access along the Intertie corridor will limit impacts to wildlife, visual and scenic resources, etc. Activities associated with design and construction of a transmission line like the Intertie require access to and along the right-of-way. Construction is usually least expensive where overland access is practical. However, where the right-of-way is remote and/or terrain is not amenable to construction of access roads, i.e., in wetland areas, helicopters are often and economically used. In wetland areas construction activities will be mostly limited to winter time to minimize impacts.

The 125-foot right-of-way itself will contain a clear-cut swath of 50-75 feet depending on forest cover height and topography. Within this clear-cut swath, a primitive 12-ft travel way will be grubbed, i.e., stumps will be removed, to allow movement of construction and maintenance vehicles along the right-of-way where terrain permits. Occasionally, to avoid wetland or muskeg pockets and other obstacles, the travel way may leave the right-of-way. The extent of this required deviation cannot be estimated at this time. Access roads along the right-of-way will be severely limited in wetland areas subject to U.S. Army Corps of Engineers Section 404 and State permitting. The transmission line right-of-way itself will generally provide increased access to parts of the corridor, depending mostly on the amount of existing access via trails and pre-existing forest cover, i.e., the extent to which the right-of-way clearing improves unimpeded travel along its route.

The Intertie route alignments cross several existing roads. Both northern and southern alignments cross Jonesville Road in Sutton, Lake Louise Road, the Glenn Highway, an old mining road in the Chickaloon area, Martin Road near Eureka and the Tolsona Lake/Moose Lake Road. These points would provide access to a transmission line right-of-way and then via the primitive transmission line access road to approximately 40-50 miles of the right-of-way before being limited by stream crossings. Off-road vehicles (ORVs) and all terrain vehicles (ATVs) may be able to access greater lengths of the right-of-way than this. In many cases vegetation in ravines and other topographic depressions as well as riparian growth will not be cleared and will obstruct vehicular traffic between adjacent line sections.

At this stage of the environmental study and project planning, it has not been determined if or to what extent upgrading existing trails and roads or building new access roads is practical or desirable considering potential impacts. Whichever sections of the route alignments are not

accessible overland, will have to be constructed with significant helicopter assistance. This determination would take place during permitting and easement acquisition.

Temporary, non-public access roads for construction could be deliberately obstructed after construction, and typically, if not used often, will overgrow on their own over time. These roads would then not be available to utility crews for maintenance and inspection, which would have to be accomplished via helicopter at greater expense. Permanent public and non-public roads which intersect the right-of-way will provide access to the right-of-way. To the extent that these access points are more appealing and accessible to ORVs and ATVs than existing trails, these road/right-of-way intersections would increase access and impacts associated with greater access. The effect of any such increased access would be further assessed should the project proceed to an EA or EIS, if required.

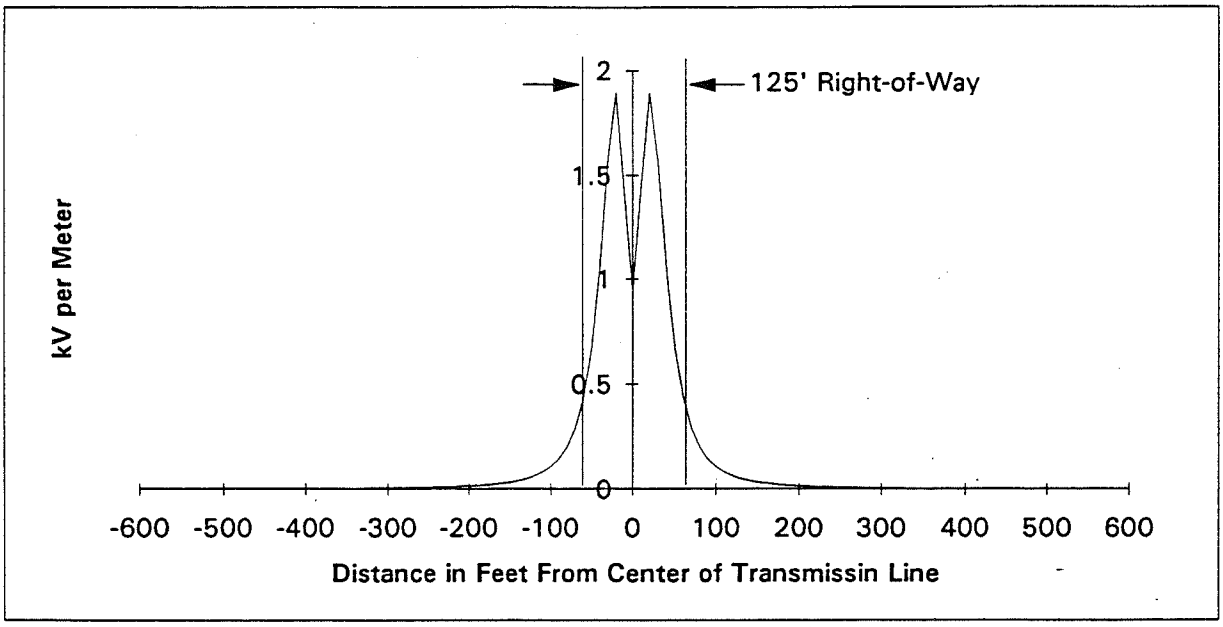

Figure 3.2-1
Sutton-Glennallen 138-kV Transmission Line
Typical Electric Fields

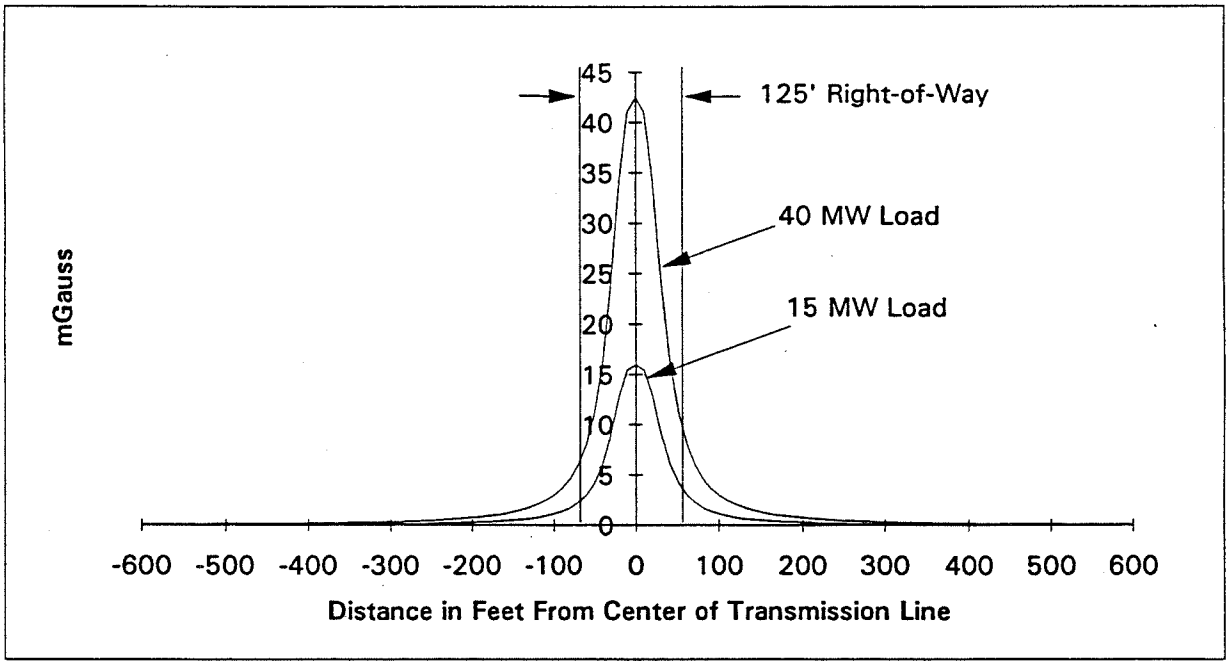

Figure 3.2-2
Sutton-Glennallen 138-kV Transmission Line
Typical Magnetic Fields

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APPENDIX A

SUMMARY OF AGENCY MEETINGS

Summary of Agency Meeting
March 17, 1993

On March 17, 1993 Dames & Moore hosted a meeting to introduce the regulatory agencies to the conceptual plan for the project and to solicit feedback on environmental sensitivities on alignment alternatives. Representatives were present from the Matanuska-Susitna Borough, U.S. Fish & Wildlife Service, U.S. Army Corps of Engineers, Alaska Division of Governmental Coordination, Alaska Department of Fish & Game, Alaska Department of Environmental Conservation and the State of Alaska Office of History and Archaeology. The attendance list is attached.

The primary areas of concern are listed below:

- visual impacts in scenic and recreation areas,
- raptor-safe designs,
- proximity to nesting raptors and the need for a raptor survey,
- trumpeter swan nesting areas along the eastern half of the route,
- transmission line strikes by migrating waterfowl,
- impacts to historic trails (state and federal),
- impacts to the Matanuska Valley Moose Range,
- impacts to the Nelchina Public Use Area,
- caribou wintering areas,
- dall sheep lambing areas,
- impacts of new access roads and construction camps,
- crossing of anadromous fish streams,
- impacts to wetlands and the need for wetlands delineation, and
- need for a major archeological survey on the preferred alignment, especially within the Matanuska Valley.

COPPER VALLEY INTERTIE PROJECT
AGENCY MEETING
MARCH 17, 1993

NAME	AGENCY	PHONE
Mary Cocklan-Vendl	Dames & Moore	562-3366
John Duffy	Matanuska-Susitna Borough	745-9850
Greg Gault	Dames & Moore	(208) 344-6140
Lawrence Dugan	U.S. Fish & Wildlife Service	271-2779
Gary Saupe	AK Dept of Environmental Conservation	563-6529
John H. Westlund	AK Dept of Fish & Game	267-2199
Bill Keller	U.S. Army Corps of Engineers	753-2716
Michele Jesperson	State Office of History & Archaeology	762-2631
Don McKay	AK Dept of Fish & Game (Habitat Div)	267-2284
Jim Hemming	Dames & Moore	562-3366
Paul Dorvel	R.W. Beck & Associates	(206) 727-4632

APPENDIX B

PUBLIC COMMENT

DOCUMENTATION OF PUBLIC COMMENTS
ALASKA ENERGY AUTHORITY
COPPER VALLEY INTERTIE FEASIBILITY STUDY

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Please submit your comments as soon as practical to the following:

Mr. Richard Emerman
Alaska Energy Authority
P.O. Box 190869
Anchorage, AK 99519-0869

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Name of Person Commenting: Dave Kurtz Hick Creek

Mailing Address: HC0 3 8410

It is unacceptable

COMMENTS:

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Name of Person Commenting: Mike Pearson

Mailing Address: Box 6
SUTTON AK 99674

COMMENTS: NO!! I DONT WANT ENTERTIE GOING THREW MY PROPERTY OR THE MAT VALLEY EVER!
THE WHOLE IDEA IS RIDICULES AND ONLY A MONEY SCHEME. YOU AND I BOTH KNOW THERE ARE CHEAPER AND BETTER WAYS OF CREATIN MORE POWER UP THERE. THIS IS JUST ANOTHER WAY OF GETTING STATE DOLLARS AT TAX PAYERS EXPENCE!

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Name of Person Commenting: Nancy Beetels

Mailing Address: P.O. Box 263
Sutton, AK 99674

COMMENTS:

I am opposed to the construction of this intertie. Copper Valley is not even trying to find alternative sources of power. My lifestyle should not be sacrificed so that the residents in the Copper Valley can have cheaper power. The intertie is an archiac solution to supplying power to residents of the Copper Valley. The search for alternative sources of power should begin NOW! (coal, hydroelectric, natural gas, etc.)

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Name of Person Commenting: Tim Bauer

Mailing Address: Box 172
Sutton AK 99674

COMMENTS:

Hopfully a better alternative can be found.

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Name of Person Commenting: Saturnah Overby

Mailing Address: PO 143
Sutton Alaska
99674

COMMENTS: I don't like it - move it to the other side of the river - or have Copper River generate its own power!
What an ugly eye sore.
To say nothing of the health risk!

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Name of Person Commenting: LINDA S. DELLINGER

Mailing Address: P O BOX 33
SUTTON AK 99674
PHYSICAL LOCATION: 1/4 MI. JONESVILLE RD.

COMMENTS: I OPPOSE THE COPPER VALLEY INTERTIE PROJECT AS IT MAY DIRECTLY AFFECT MY HEALTH BECAUSE OF OUR HOME & LAND BEING IN CLOSE PROXIMITY TO THE PROJECT. ALSO, IT MAY NEGATIVELY AFFECT THE SMALL TOURISM VENTURES IN PLACE NOW AS WELL AS DISCOURAGE FURTHER VENTURES IN THE FUTURE

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Name of Person Commenting: Margaret A Smith

Mailing Address: P.O Box 255
Sutton AK 99674

COMMENTS: I am extremly upset. I am worried about the future of my home which seems to mean nothing to the State of Alaska. It seems that the quality of living is less important than cheaper electricity in Glen Allan T [illegible] this proposition

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Name of Person Commenting: Lisa Rhoades

Mailing Address: PO Box 169
Palmer AK 99645

COMMENTS: As a resident of Sutton and live approximately 300 yards from the Sutton Substation, I'm very opposed to the installation of the Glennallen Intertie as planned. I am extremely concerned about the health risks of these people in close proximity to the line. The homeowners have been established for a long time - many have young children which would be @ health risk. Besides being @ risk for having their homes and property condemned. I urge you to reconsider your other alternatives.

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Name of Person Commenting: MERLE D JOHNSON

Mailing Address: P.O. Box 277
SUTTON AK 99674

COMMENTS: THE MONEY IT WOULD TAKE TO CONSTRUCT THIS LINE COULD BE USED TO DEVELOPE A POWER PLANT IN COPPER CENTER OR GLENNALLEN

I AM OPPOSED TO THE CONSTRUCTION OF THIS POWER LINE.

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Name of Person Commenting: JAMES A GUENDAY

Mailing Address: PO Box 326
Sutton, AK 99674-0326
907-745-0956

COMMENTS:

I firmly oppose this project
Do Something different

James A Guenday

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4-6-93

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Name of Person Commenting: Dave Dodji

Mailing Address: P.O. Box 76.
Sutton, AK 99674

COMMENTS: I strongly oppose the construction of the proposed inter-tie between Glennallen and Sutton. As per the cost of construction and the prime hunting lands and scenic passages of the line. I strongly recommend another alternative to this project and not another route.

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Name of Person Commenting: Nancy E Johnson

Mailing Address: Box 256
Sutton, AK 99674

COMMENTS: I don't want this intertie system to go through Sutton. I feel that the Copper River Valley should pursue natural gas or hydroelectric power plants for their local area.

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745-4515

Name of Person Commenting: Edward Wm "Bill" Boyce

Mailing Address: HC-03 Box 8300
Palmer AK 99645

COMMENTS:

I FEEL THAT THE COPPER VALLEY POWER AUTH. SHOULD BUILD THEIR OWN POWER HOUSE (COAL FIRED IN THE GLEN ALLEN AREA AND SUPPLY THEIR OWN POWER AND LEAVE THE SUTTON SCHOOL AND COMMUNITY & CHICKALOON COMMUNITY OF THESE POWER LINES ALSO I FEEL

Continued on Back

COMMENTS: (Continued)

THAT THESE LINES WILL DISTURB WILDLIFE
FISH + GAME AREA'S SO SOME PEOPLE CAN
THEN DEPENDDON RANCH FOR POWER.
I FURTHER FEEL THAT THESE LINE WILL
DESTROY THE CHICKALOON TRAIL, AND
MOOSE RANGE.
BUILD A POWER HOUSE.

THANKS

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Name of Person Commenting: Karl Braendel

Mailing Address: P.O. Box 1149
Chickaloon, Alaska 99674

COMMENTS:

As someone who moved to Chickaloon because of its beauty and as someone who hunts, hikes, and otherwise enjoys the area's magnificent back country scenery, this proposed Copper Valley Intertie Project Continued on Back
leaves me cold. If you can't put it underground or seam it overhead through

COMMENTS: (Continued)

I don't want to ever have to look at 80 foot towers marching horizon to horizon, and I especially don't want to see it in the Chickaloon Pass back country. I'll fight this plan tooth and nail.

Sincerely,

Karl Brandel
P.O. Box 1148
Chickaloon, Alaska
99674

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Name of Person Commenting: William L. Root

Mailing Address: P O Box 1241
Chickaloon, Ak 99674

COMMENTS: Initial negative reaction is that we not Impact the school in Sutton.
I will Reserve other comments for ~~future~~ discussions.

Continued on Back

DOCUMENTATION OF PUBLIC COMMENTS
ALASKA ENERGY AUTHORITY
COPPER VALLEY INTERTIE FEASIBILITY STUDY

You are invited to comment on the proposed Copper Valley Intertie Project which would consist of a 138-kV electric transmission line from Sutton to Glennallen. The Alaska Energy Authority is conducting the first Phase of a planned two-phase feasibility study of the Intertie. Two sets of public meetings will be held in Phase 1 at which comments may be voiced. Phase 2 of the feasibility study will follow in the second half of 1993, if funding permits, and would include one additional set of public meetings.

The comments of all parties who may be affected by the construction and operation of the Intertie are important to the study. Verbal comments will be recorded at each public meeting. In addition, this comment sheet is provided as a convenience to any party wishing to comment. However, use of this comment sheet is not necessary in order for your comments to be considered. We request that any comments be as specific and detailed as possible. Do not feel limited by the space provided; attach additional sheets as necessary. Attached for your reference are seven maps showing two preliminary route alternatives identified as a starting point for the feasibility study.

Please submit your comments as soon as practical to the following:

Mr. Richard Emerman
Alaska Energy Authority
P.O. Box 190869
Anchorage, AK 99519-0869

Comments will be included in the reports provided they are received at least two weeks prior to the publication of the reports. Tentative dates are June 15, 1993 for the Phase I report and October 1, 1993 for the draft Phase 2 report.

Name of Person Commenting: TOM LEE

Mailing Address: Box 2771
PALMER AK 99645

COMMENTS:

I suggest that you invest whatever is left of the 1/2 million "feasibility study" dollars into the feasibility and appropriateness of solar, wind and hydro powers as a clean and safe way to provide inexpensive power to the CVEA.

Continued on Back

As a first step, I would declare the intent to [illegible] the surplus Alyeska Power

COMMENTS: (Continued)

which is a little known fact... one that you need to inform your power users of.

What you really need to do is to invest in the service equipment to the CVEA. This utility is operating with very old equipment and service to the customers is sub-par. When I discovered the main objections to Compact Flouresc. Light Bulbs is because they die in their infancy (due to service equipment failure managed by CVEA) I knew the first step is not an intertie, but the need for CVEA's equipment to be brought up to 1993 standards.

CVEA has a problem - this is clear. Let's get the Alyeska power into CVEA's system, upgrade the 33 year old diesel with natural gas powered cogeneration equipment, and create value for the 23¢ CVEA users are paying. :-) Thank you for listening

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Name of Person Commenting: Becky Swanson

Mailing Address: PO Box 938
Palmer AK 99645

COMMENTS: My main concern is for the health of anyone along his route. Health hazards of EMF's are no longer imagined is some would lead us to believe. This is a hotly debated issue worldwide. The research is not conclusi but the pendulum is swinging heavily towards the danger side. (The national government of Sweden has acknowledged the link between EMF's + some forms of

Continued on Back

COMMENTS: (Continued)

cancer & is creating regulations to keep people away from these lines - Time Mag Oct 26, 1992 pg. 70)
From the Feb. 1993 Publication by the National Rural Electric Coop. Assoc - "the emerging evidence no longer allows one to categorically assert there are no risks... and a child's risk might increase from about 1 in 10,000 to 2-3 in 10,000 by living near a major electric distribu line." With this in mind, how can anyone justify putting this line through? No argument for cheaper power etc can justify putting even one persons health at risk!! Electric companies in the lower 48 have be tied up in court for years over similar controversies. Mus we follow this route? Until there is a definitive answ to all the current questions, this line must not go through!

To address the "back country route" plan: There have been 'assurances' to legislators that the line "should run at least one mile from any residence". Do you realize we don't all live along the highway? One mile from my home puts the line in the middle of the Matanuska River or on the edge of a vertical cliff. Where do you suppose the line will go? No one is naive enough to believe the power company will zigzag the line across the countryside to miss personal property. Mr. Hurless states that the people requesting this line have "access to the legitimate use of state and federal lands ... and that multiple use (of land) is for the benefit and enjoyment of all Alaska". Losing my home is not to my benefit. This is not a legitimate use of public lands - at least not until the health risks have been positive

denied. It is my feeling that where the health of people is involved, we must error on the side of caution. The questions are there and unanswered as the research goes on. To put people out of their homes or put their health at risk is not providing cheaper power to anyone - we all pay in the end. It is a step backwards for Alaska to force this line through.

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Name of Person Commenting: Patricia Lee

Mailing Address: Box 2771
Palmer AK 99645

COMMENTS:

As a property owner on Sheep Mt. and an Alaska Resident born + raised (44yrs), I completely object to the intertie as it is an outdated and unsafe (not to mention ugly) form of electrical transmission.

If an intertie is to be put in to ~~the~~ Continued on Back

state a master plan needs to be drawn up conne
[illegible] aska (state). I see no reason

for a Sutton to Glennallen Intertie.

The health risks are Monstros as was brought up in the meeting at Glacier View by Kathey (Dove) Wright - Leukemia is no laughing matter nor does it just affect one in 10 children - All are affected Again - who will be held liable in the cases ~~against~~ of contamination? I see huge lawsuits on the horizon of the intertie between Sutton + Glennallen unless it is completely removed from any and all roadways + dwellings.

Now we get to the scenic arena - Tourism is our bread + butter. When all the oil is gone + we are 'bust' tourism pulls us out of economic desaster - The beauty of this highway (gateway to largest city) MUST BE MAINTAINED - bury the intertie!

Sir - There is some incredible information out on new safe technologies - enclosed find copies we ran off from publications we receive - Please to read them. We are interested in working with you for a safe non polluting energy future for Alaska. We have the human resources ~~abroad~~ to do it right - Lets DO IT!

Thanks for listening
Patricia Lee

JANE M. WEISSMAN

Photovoltaics for Utilities: Commercialization Through Collaboration

An effort to accelerate the commercialization of photovoltaics for utility applications is under way around the country.

A nationwide collaboration of leaders in the energy policy and planning communities is working toward creating a sustainable market for photovoltaics (PV) in the domestic utility sector. It began at a December 1991 meeting in Tucson, Arizona where participants identified a series of activities that would stimulate greater near-term use of photovoltaics in the utility market. For the first time, key players in the utility sector, the photovoltaic industry, state utility regulatory commissions, state energy offices and state consumer advocacy groups agreed to work together to accelerate utilities' use of PV as a generation option.

A number of recommendations and action steps resulted from this meeting. Utility executives acknowledged the need to learn more about photovoltaics and to take a positive, proactive role in developing it as a resource option. Regulators recognized the importance of using a broader, more robust economic framework in the Integrated Resource Planning (IRP) process. IRP focuses on achieving a mix of supply- and demand-side resources that provide energy at the lowest cost to utilities and consumers. Most importantly, those groups with a stake in photovoltaic development (the "stakeholders" committed to a coordinated, joint-action strategy to facilitate the integration of photovoltaics into the utility resource portfolio.

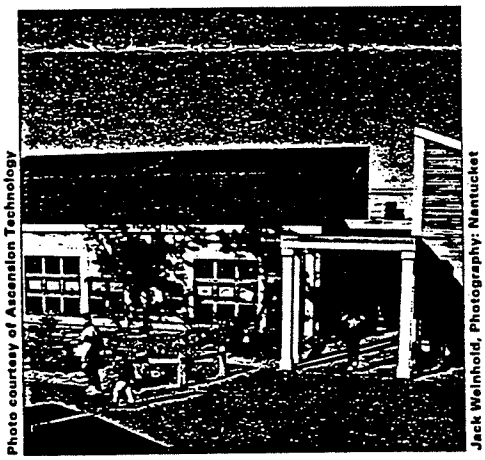


Photo courtesy of Ascension Technology

Jack Weinhold, Photography: Nantucket

A grid-connected photovoltaic system on the Nantucket Elementary School. Because Nantucket Island is not connected to the mainland power grid (Nantucket Electric Company serves the island) and demand increases dramatically during the summer tourist season, PV has high fuel, capacity and environmental value in this first U.S. island PV installation.

One action step called for the formation of a utility PV group. Another called for forming working groups at the state level, since issues vital to the adoption of PV need to be resolved within state and local jurisdictions.

Activity Begins

The Utility Photo Voltaic Group formed in 1992. Now a chartered organization, this group includes investor-owned utility companies, publicly-owned utilities and rural electric cooperatives (see sidebar on page 32).

State-based collaborative working groups also came together in 1992. A dozen states have formed or are in the process of forming Photovoltaics for Utilities (PV4U) State Working Groups. As of January 1993, Arizona, California, Colorado, Massachusetts, New York and North Carolina had organized PV4U State Working Groups and Ohio, Delaware, Maryland, Hawaii, Texas and Idaho were in the process.

PV4U State Working Groups bring together representatives from the stakeholder communities to develop mission statements and identify strategies to facilitate institutional acceptance of off-grid and grid-connected PV systems. To this end,

For the first time, key players... agreed to work together to accelerate utilities' use of PV as a generation option.

the State Working Groups are focusing on developing hardware appropriate to utility applications; identifying regulatory, policy and institutional barriers to PV deployment; and developing strategies to remove these barriers.

The Arizona group, for instance, has been meeting regularly since the spring of 1992. One subcommittee is charged with exploring the possibilities for commercial and small industrial grid-tied systems. A second subcommittee is looking at PV-covered electric vehicle parking applications.

In Colorado, the Public Utilities Commission adopted a docket to investigate the opportunities for expanding utility participation in renewable energy activities. Through this mechanism, the Commission will examine regulatory barriers to renewables, value analysis of cost-effective renewable applications, the effect of "green pricing", the impact of large orders for photovoltaics on the PV industry and recovery mechanisms to encourage large-scale utility purchases of photovoltaics and other renewable technologies. The Commission also intends to analyze issues related to "set-asides" for renewables in resource planning.

The California group has prepared a draft commercialization strategy which proposes sustained support of the PV industry through a purchase program. Such a program would stimulate production economies and produce learning curve benefits that could significantly reduce the cost of PV systems. The strategy is based on three central concepts: 1) sustained orderly development (see Donald Aitken's article "Sustained Orderly Development of the Solar Electric Technologies" in the May/June 1992 edition of **Solar Today**); 2) commercialization path life-cycle costing (see Donald Osborn's article "Using Solar Energy at the Sacramento Municipal Utility District" in the July/August 1992 edition of Solar Today); and 3) proactive leadership to stimulate early adoption.

Massachusetts PV for Utilities Collaborative is committed to educating all interested parties about the benefits and opportunities PV offers Massachusetts, today and in the future. The group's role also extends to promoting hardware projects that demonstrate PV applications with strategic importance in the commercialization process. Preliminary strategies include outreach to the Department of Public Utilities and to electric, gas and communications utilities in Massachusetts.

North Carolina's State Working Group has formed a collaborative partnership among utilities, industry, academics, consumers, regulatory bodies and government to expedite the use of photovoltaics by utilities. For their first project, North Carolina Power has offered to use 12kW of PV modules in a commercial DSM project guided by the NC PV4U Working Group.

National Endorsements

Several national associations have endorsed this framework for moving PV from currently cost-effective applications to future significant utility use. A resolution, adopted by the National Association of Regulatory Utility Commissioners (NARUC) in March 1992, supports the idea that PV's economic and system benefits should be fully explored by utilities and state commissions in their integrated resource planning (IRP). The NARUC resolution further states that regulators should support utility investment in currently cost-effective PV applications and in trials of emerging applications that will become cost-effective as PV system prices decline.

The National Association of State Utility Consumer Advocates (NASUCA) also approved a resolution in November 1992 supporting the implementation of current cost-effective PV applications in utility systems.

The Collaborative Process

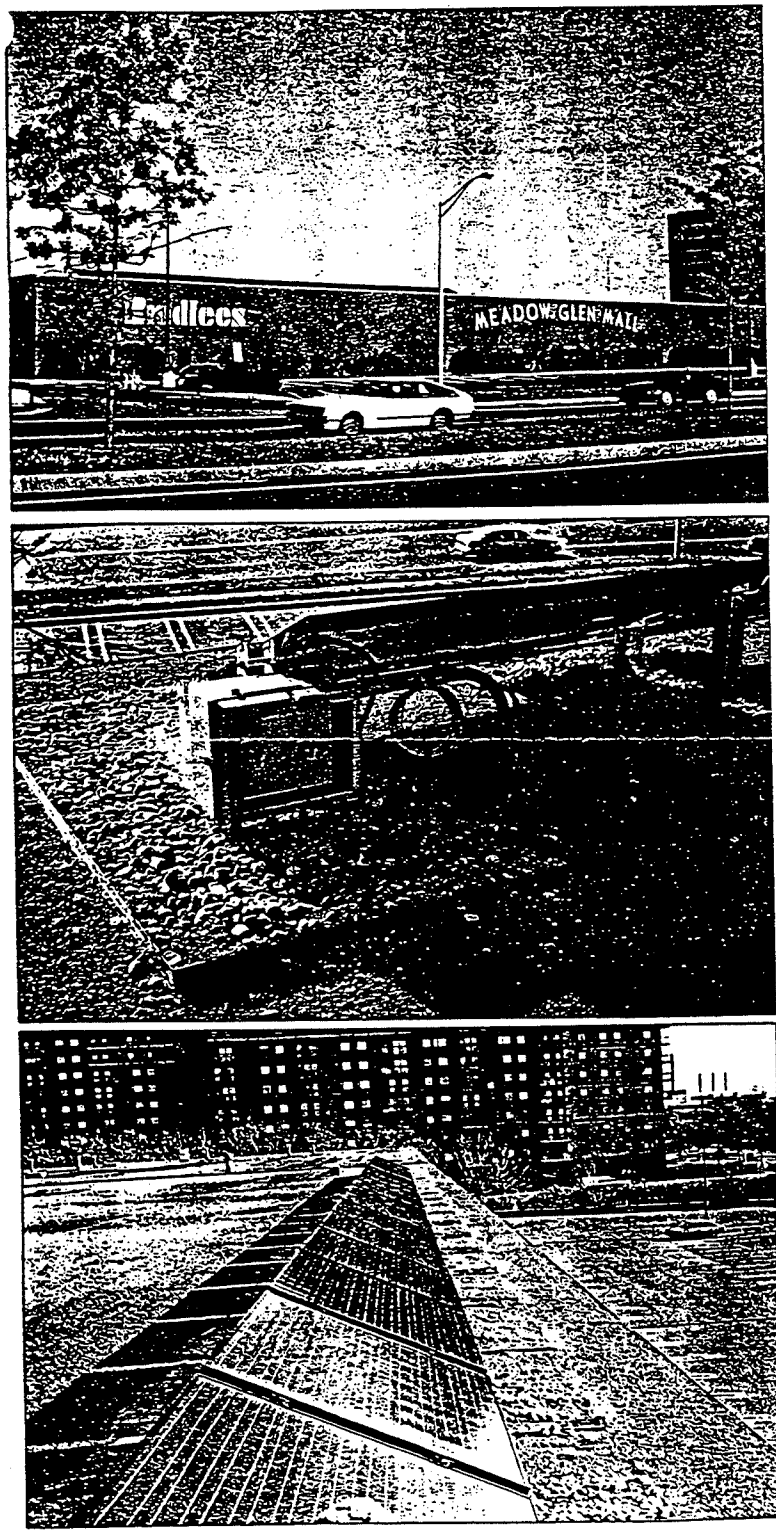
The collaborative process offers an unprecedented opportunity to focus diverse perspectives on the common goal of promoting PV commercialization. A second meeting held in Stuart, Florida in December 1992 brought the stakeholder communities together again. This national workshop refined the photovoltaic commercialization path by focusing on three key agenda items.

First, participants heard reports on new developments affecting photovoltaics as a utility option. Working sessions then focused on the development of project, policy and process options and developed action steps. The third section of this program addressed the immediate, mid-term and long-range goals of each of the stakeholder communities.

Collaborative action balances the interests of different communities while building a sustainable market for photovoltaics. Such a market would not be susceptible to policy fluctuations, scattered technology endorsements and premature or unrealistic expectations. PV's contribution to the energy resource mix goes beyond energy supply, reliability and availability. The environmental and economic benefits

Photovoltaics for Utilities — State Working Groups

Participation from:
State Energy Offices
Electric Utility Companies (Investor-Owned, Publicly-Owned, and Rural Cooperatives)
Public Utility Commissions
Utility Consumer Advocates
Photovoltaic Industry
Environmental Groups
State Government Offices (Economic Development Boards, Legislative Committees, Environmental Agencies, Transportation Departments)
Department of Energy Support Offices
Solar Advocates
Public Interest Organizations



Photos courtesy of Ascension Technology.
Photo credit: William Berg, University of Massachusetts Lowell

The Photovoltaic Assisted Lighting Project (PAL) is a multi-year research and demonstration project jointly sponsored by the Massachusetts Division of Energy Resources, the Massachusetts Electric Company and the University of Massachusetts Lowell Photovoltaic program. The PAL project has been installed in a Bradlee store at the Meadow Glen Mall in Medford, Massachusetts and will provide a portion of the store's lighting needs. This is the first commercial application of PV lighting technologies by a major retailer in the U.S.

The collaborative process offers an unprecedented opportunity to focus diverse perspectives on the common goal of promoting PV commercialization.

of accelerated PV commercialization can be shared by all of society.

Jane M. Weissman is currently the national coordinator of the PV for Utilities State Working Groups and is the former Director of the Massachusetts Photovoltaic Center. She can be reached at 15 Haydn Street, Boston, Massachusetts 02131-4013, (617) 323-7377, FAX (617) 325-6738.

Author's note: The 1991 Tucson meeting was organized by the Edison Electric Institute (EEI), the Electric Power Research Institute (EPRI), the Solar Energy Industries Association (SEIA), the National Association of Regulatory Utility Commissioners (NARUC), the National Association of State Utility Consumer Advocates (NASUCA), the National Association of State Energy Officials (NASEO) and the U.S. Department of Energy (DOE). Since the Tucson meeting, the American Public Power Association (APPA) and the National Rural Electric Cooperative Association (NRECA) have become part of this commercialization initiative.

value of a conservation measure to be greater than the costs associated with obtaining the conservation.

- Non-participating ratepayers do not want their rates to increase as a result of the "lost" utility revenues from the conservation program savings.
- All ratepayers (participant and non-participant) do not want their average bills to increase as a result of the conservation program.
- Society at large does not want the costs for the conservation program to exceed the value of the avoided fuel and environmental costs associated with the program.

(Admittedly, this series of perspectives does not include the relative economic "multiplier" benefits of a conserved dollar spent locally in comparison with a dollar spent for energy resources from out of state.)

Case Example Calculations

With this background established, Sierra Pacific evaluated two different solar homes for cost effectiveness. The first scenario was for the Neuffer Model 1300/1400 briefly described on page 24. The second was for the estimated performance of his "Suntempered" home, the Model 1775.

The following assumptions were used:

- The winter gas usage of the average Reno home is 671 therms.
- The Neuffer Model 1300/1400 passive solar home saves 50 percent of the energy (including conservation) used by an average Reno home. This model costs about $1,500 extra to build, and the utility would like to pay a "bonus" payment to the builder of $500 in excess of repayment of the incremental construction costs for each of these constructed.
- The Neuffer Model 1775 Suntempered home saves 35 percent of the energy (including conservation) used by an average Reno home and costs nothing extra to build. The utility would like to pay a "bonus" payment to the builder of $500 for each of these constructed.

The Calscreen results for three versions of these two scenarios are shown in Table 1 (on page 26). (Environmental/Societal Test is omitted for this example, to keep the discussion focused on measurable economic variables.) The first column of that table indicates that the utility realizes a benefit/cost ratio of 2.0 when reimbursing the full $1,500 incremental cost and also paying the builder a $500 "bonus". Or, the utility can pay up to $4,000 per home to obtain the 50 percent energy savings associated with the Neuffer Model 1300/1400 as a gas demand-side management program that still passes the Participant Test, and yields an acceptable Benefit/Cost ratio of 1.00 for both the Utility Cost and Total Resource Cost Tests. This is consistent, of course, with our earlier brief analysis.

But this produces a present worth revenue loss of $3,000 to the utility, which, added to the $2,000 proposed incentive for combined incremental cost reimbursement and builder bonus, represents a net loss to the utility of $1,000 in comparison with benefits. Thus, the proposed $2,000 incentive fails the Rate Impact Test. (Rates would have to increase to keep utility earnings at pre-incentive levels.)

Sierra Pacific has received a consistent message from the Public Utilities Commission staff that demand-side management programs should not put upward pressure on rates, and hence should pass the Rate Impact Test on an individual case basis with a benefit/cost ratio of 1.00 or greater, even though the Rate Impact Test can be failed under conditions of highly attractive deferred fuel costs for the utility (the Utility Cost Test). The example here is that the failed proposed incentive of $2,000 for each passive solar home would still have acquired displaced natural gas at about $0.20 per therm, or $2.00 per MMBtu, still about 50 percent less expensive than the utility's average cost of $0.39/therm.

A reduction of utility involvement by $1,000 (Column 2 in the table) produces a break-even condition in the Rate Impact Test, while increasing the benefit/cost ratios favorable to the utility investment from 2.00 to 4.00. This is because the utility would now be acquiring displaced natural gas at the bargain rate of $0.10 per therm, or $1.00 per MMBtu.

This nevertheless still leads to the attractive conclusion that if the homebuyer and Sierra Pacific share the incremental costs associated with the solar home, very cost effective energy savings can be obtained without placing any upward pressure on the utility's gas rate. This can be accomplished by the utility paying $1,000 toward the cost of the home, with $500 of this as a "rebate" to the homebuyer, and another $500 as an incentive to the builder. The homebuyer would pay $1,000 toward the incremental costs, while saving $3,000 in present-worth value of the future energy savings.

The goal of the utility's demand-side planners is to develop conservation programs that meet additional gas load requirements at a cost lower than incremental supply options.

It is important to note here that the economic analysis shows that $2,000 of those

Interior of the solar gallery in Neuffer Construction's Model 1300 passive solar home.

$3,000 in present-worth savings result from the passive solar gains over and above the savings from the enhanced energy conserving building features.

In actuality, though, the present accepted market value (price) of this specific Neuffer model would not be affected, since the incremental cost of solar construction is already included in the advertised sales price. The homebuyer would therefore see the utility payment of $500 as an up-front cash rebate against the market price of this lowest cost model offered by Neuffer Construction. This money could be applied to the downpayment for the home, and hence help the potential homebuyer to qualify for a home loan. Of course, the builder can also rebate his $500 bonus back to the homebuyer, to provide the full $1,000 cash rebate to the customer. One additional sale because of an enhanced rebate can compensate for a whole lot of forgone $500 "bonuses".

The third column in Table 1 (on this page) shows that the suntempered model, with no incremental cost to build, can also pass all utility economic tests at the same $1,000 cash incentive level, but with a slightly lower benefit/cost ratio to the utility, which means a slightly higher equivalent cost of the displaced natural gas. (It would be about $0.15 per therm, or $1.50/MMBtu, still a bargain by any standards.) This does provide an incentive to the utility to favor those passive designs with the higher solar savings.

Our analysis further demonstrates that Sierra Pacific could pay out up to $20 million in $2,000 incentives for the top-of-the-line solar model (that is, pay $2,000 each for up to 10,000 homes, representing a very satisfactory penetration rate for this type of new construction) and cause an increase in rates on the non-participating ratepayers of about $0.00273 per therm. This would raise their total average winter energy bills by only about $1.83.

By abandoning the Rate Impact Test, therefore, the utility could rebate twice as much to the builder or homeowner, probably stimulating greater builder participation in the program. The utility would still be acquiring displaced gas at half the cost of new supply and producing averaged net savings for all ratepayers, with only a negligible impact on the nonparticipating ratepayers. The corollary is that, in this instance at least, the requirement not to affect the bills of non-participating ratepayers adds unnecessary cost to the utility system as a whole. Everybody loses—participant and non-participant alike. This certainly suggests that an unwavering adherence to the Rate Impact Test ought to be seriously revisited by the appropriate regulatory commissions. Such a reevaluation would serve the larger interest of saving money for the utility as a whole while also promoting local economic development, increased energy savings and enhanced environmental quality.

Noting that Sierra Pacific's gas rates are higher than its avoided gas costs, it is very impressive that this program can be designed to pass the Ratepayer Test. This is a significant accomplishment for a conservation program in general, and especially so when valued against gas prices, rather than electricity bills. It would appear that utility incentive programs for low cost, high value passive solar construction should now be put on an equal footing with other conservation and demand-side management programs. ◇

The authors would like to thank Susan Calitri of Sierra Pacific Power and Paul Neuffer of Neuffer Construction for their contributions to this article.

Donald Aitken is a Senior Energy Analyst with the Union of Concerned Scientists, Adjunct Professor at the Frank Lloyd Wright School of Architecture and Chair of the American Solar Energy Society. He can be reached at 20100 Skyline Boulevard, Woodside, CA 94062.

Paul Bony is Supervisor, Energy Services Planning, at Sierra Pacific Power Company. He can be reached at Sierra Pacific, P.O. Box 10100, Reno, Nevada 89520-0400, (702) 689-4426.

Utility incentive programs for low cost, high value passive solar construction should now be put on an equal footing with other conservation and demand-side management programs.

SUMMARY OF CALSCREEN RESULTS

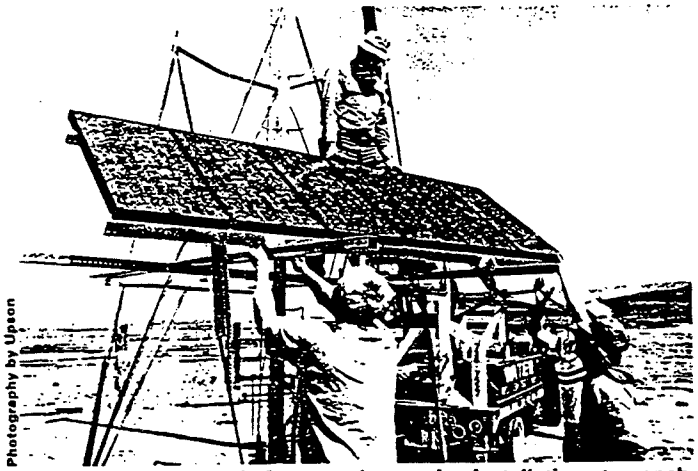
	Solar Model 1300 With Utility Incentive Payment of $2,000	Solar Model 1300 With Utility Incentive Payment of $1,000	Suntempered Model With Utility Incentive Payment of $1,000
Participant Test			
PW Bill Savings	3 K$	3 K$	2 K$
PW Incentives	0 K$	0 K$	0 K$
PW Costs	0 K$	1 K$	0 K$
PW Net Benefit	3 K$ *Passes*	2 K$ *Passes*	2 K$ *Passes*
B/C Ratio	∞	3.00	∞
Utility Cost Test			
PW Avoided Cost	4 K$	4 K$	3 K$
PW Utility Costs	2K$	1 K$	1 K$
PW Net Benefit	2 K$ *Passes*	3 K$ *Passes*	2 K$ *Passes*
B/C Ratio	2.00	4.00	3.00
Rate Impact Test			
PW Avoided Cost	4 K$	4 K$	3 K$
PW Revenue Decrease	3 K$	3 K$	2 K$
PW Utility Costs	2 K$	1 K$	1 K$
PW Net Benefit	(1) K$ *Fails*	0 K$ *Passes*	0 K$ *Passes*
B/C Ratio	0.80	1.00	1.00
Total Resource Cost Test			
PW Avoided Cost	4 K$	4 K$	3 K$
PW Utility Costs	2 K$	1 K$	1 K$
PW Customer Costs	0 K$	1 K$	0 K$
PW Net Benefit	2 K$ *Passes*	2 K$ *Passes*	2 K$ *Passes*
B/C Ratio	2.00	2.00	3 00

PAUL BONY & ROSE TAYLOR

Solar Opportunity in Northern Nevada

A Nevada utility takes advantage of abundant sunshine and the economics of solar to expand the services it offers customers.

Sierra Pacific Power Company, the largest electric and natural gas utility in northern Nevada, is in a unique position to become a leader in the development of solar utility programs. The remote nature of Sierra Pacific's service territory provides an excellent opportunity for solar energy to provide a service option for customers who cannot afford to connect to the existing distribution system. Solar is a viable, economical alternative to new line extensions that currently cost approximately $30,000 per mile.



Photography by Upson

Installing the PV panels for a stock watering installation at a ranch east of Fallon, Nevada.

Sierra Pacific serves 250,000 electric customers in a 50,000 square mile service territory that covers most of northern Nevada and portions of eastern California. The company also provides natural gas to 80,000 customers in Reno and Sparks.

Primary End Uses

Sierra Pacific's opportunities to provide solar energy service to customers are focused on three primary end uses: solar water heating, solar space heating and customer-site photovoltaics.

Solar space heating has the potential to become Sierra Pacific's largest gas demand side management (DSM) program. The company's natural gas system is winter peaking and is currently experiencing transmission capacity constraints. Solar space heating can take the gas demand-side focus for residential customers beyond energy efficiency "shell" improvements, such as added insulation, and into the reduction of heating requirements. Solar construction features could provide another option to address the efficient use of natural gas.

Solar water heating is seen as a DSM alternative for the 60,000 Sierra Pacific customers who use electricity to produce hot water, and this has the potential to reduce both summer and winter peaks on the electric system. Sierra Pacific is actively exploring the potential of providing the necessary equipment and installation costs of solar water heating systems for customers, and recovering this investment over the life of the system as with other capital investments.

This alternative should enable the utility to provide customers savings on their energy bills while reducing costs included in rates that are associated with more traditional DSM measures. Solar water heating also has the potential to become a cost-effective alternative to propane-fueled water heating.

Photovoltaics (PV) provide Sierra Pacific an excellent opportunity to bring electric service to customers in remote areas who currently rely on fossil fuel generators. PV systems can provide utility service for a lower life cycle cost than expensive line extensions. As with solar water heating, Sierra is exploring the possibility of paying the PV system installation costs and recovering these expenses over the life of the system.

To date, Sierra has completed several solar-related activities. In late 1991, the company co-sponsored a community-focused solar construction conference with the Nevada State Energy Office and the City of Reno. The conference was well received in the community. As a result of this success, Sierra provided a follow-up workshop with the Passive Solar Industries Council on the Passive Solar Design Guidelines developed by the National Renewable Energy Laboratory. Sierra Pacific is also working with the Good Cents Division of Southern Electric International to bring solar construction into the company's Good Cents residential energy efficiency program.

In addition, Sierra Pacific's Research Development and Demonstration Department is preparing a proposal for a pilot program to test the utility's assumptions on the value of solar water heating as an electric demand side measure. Sierra's goal is to have a 30-home pilot retrofit project in place by the end of 1993.

Demonstration Projects Under Way

Sierra Pacific Power Company is gathering data from two PV demonstration projects in the wide open spaces of Nevada: PVs are operating a water pump for one study, while the second installation is powering a ranch 26 miles from the nearest electric line.

Remote Water Pumping

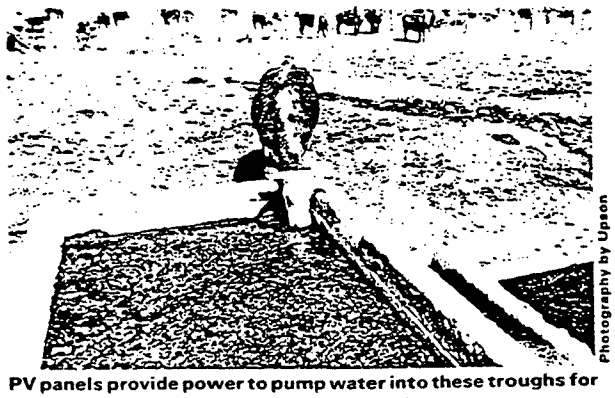
Photovoltaic panels provide the energy to pump water for cattle on a ranch east of Fallon, Nevada, in the Stillwater farming district. The system pumps approximately 10 to 12 gallons per minute into three troughs. Previously the pump was operated by both a windmill and a gasoline engine, which had to be refueled by a ranch hand every eight hours.

The Electric Power Research Institute (EPRI) and the Sandia National Laboratory provided funding for the Stillwater Photovoltaic Powered Remote Water Pumping Demonstration Project. Sierra Pacific was among 18 utilities chosen by EPRI in 1991 to participate in PV demonstration projects. The unit was installed in April of 1992.

The Stillwater project affords Sierra Pacific an opportunity to explore a new service option for livestock water pumping in remote areas. Generally, a single livestock water pumping system requires less than 1 horsepower to supply the necessary water. Depending on the daily system requirements, which range from 1,000 to 3,000 gallons per day, a typical system may consume on 500 to 1,000 KWh per year.

Advantages to Sierra from solar water pumping include increased use of service options for remote customers, decreased cost of service versus a conventional line extension and the development of new business opportunities. The initial cost of the system, which was installed by an outside contractor using an existing windmill structure and well was $8,085.

At this juncture, the customer is extremely pleased with the performance of the PV system. The installation provides a constant flow of water to the troughs and requires little or no maintenance, except for periodic inspections and cleaning.



Photography by Upson

PV panels provide power to pump water into these troughs for watering cattle at a remote Nevada ranch.

PV Runs Appliances, Lights at Ranch

Sierra's second demonstration project is providing power to a ranch north of Reno near the small community of Gerlach. The PV system installed at Charles and Lynda Greear's ranch consists of 12 solar panels with a dual solar tracker capable of providing 40 volts at 35 amps at full-rated output. The system includes a DC battery back-up and an AC conversion unit.

Installation costs totaled $20,000 and were partially subsidized by the utility. The Greears were responsible for the design, procurement, installation and inspection of the PV system equipment. The system provides 1 kilowatt of electricity for the family's washing machine, AC lights and small appliances with a DC battery back-up capable of providing 1015 ampere-hours of capacity for over 20 hours. The DC water pump for the house runs off the batteries and fills a 2500 gallon tank at a rate of 40-50 psi.

Sierra's role in the project was to review and comment on the design, specifications and equipment selected for the project. The Greears will provide the utility with monthly documentation on water output, maintenance activities and costs, system repairs and costs and system operation and owner satisfaction over the course of the first year of operation.

Although Sierra Pacific's active involvement in solar power projects is relatively recent, long-term prospects for development of this energy source are excellent. As a dual electric and natural gas utility, Sierra Pacific has the opportunity to develop solar programs for customers served by both. Both Nevada and California have established least-cost planning requirements for gas and electric utilities, which provides a framework for development of DSM programs.

Sierra Pacific's DSM investments in Nevada provide the same return on investment as traditional supply options, and, in both states, the potential exists to obtain shareholder incentives for DSM investments. ○

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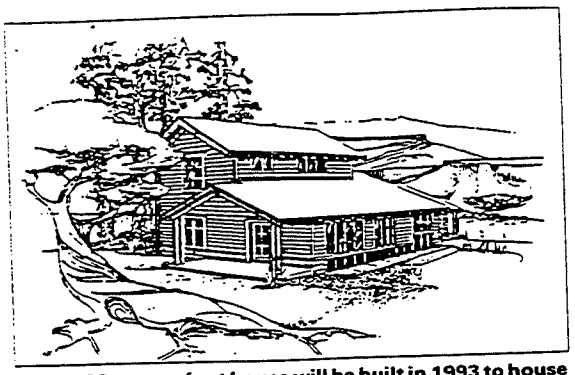


This 1582 square foot house will be built in 1993 to house National Park Service (NPS) Employees on the South Rim of the Grand Canyon National Park. It is the first of 59 planned new houses. Predictions are that the house will require only 9 percent as much space heating as typical houses in this area and cost little, if anything, extra to build. The National Renewable Energy Laboratory is working with the NPS on the design, and performance will be monitored as part of the International Energy Agency Solar R&D Task 13 on exemplary housing.

schools of architecture that had an energy curriculum have dropped it.

The Passive Solar Industries Council (PSIC) works to promote passive strategies. PSIC represents a spectrum of industries including builders, contractors, glass and window manufacturers, masonry products and other specialty products that relate to passive strategies. With support from the Department of Energy (DOE), the National Renewable Energy Laboratory (NREL) (formerly the Solar Energy Research Institute) and local groups, PSIC is disseminating builder guidelines for both new residential construction and renovation. Although they are well received, the market for these guidelines is small. PSIC, NREL and the Lawrence Berkeley Laboratory (LBL) are now jointly preparing guidelines and a PC-based design tool for smaller commercial buildings.

The DOE is funding some research on the use of passive renewable energy, principally at NREL and LBL. And some states and utilities are funding work, but the efforts are painfully small, a ghost of the efforts underway in 1979-1982.

Unlike the situation with active solar, the problem has nothing to do with the rise and fall of the solar tax credits. For the most part, the credits did not apply to passive design features. In retrospect, this was probably a blessing.

A key problem is a lack of emphasis. Passive renewable energy has fallen in a crack. In spite of the rebirth of concern with energy and environmental issues, these technologies do not seem to have strong advocates or even much of an identity.

Passive techniques are often a casualty of our technology mindset. It is seemingly not enough that something works and is economical. It must also be high-tech to grab our attention. The very name—passive—which should be an asset to anyone concerned with reliability and cost, is often viewed as a liability. We say "keep it simple" and then make it complicated. This is particularly true of engineers. We inherently distrust anything we cannot control directly and gravitate to solutions based on equipment rather than building design.

There is no powerful advocacy group for passive technologies within industry. PSIC is effective but it is small. Most component manufacturers seem content with their current products and markets. Builders are a hard sell because they perceive very little demand from either residential or commercial building clients. Design fees are already so small that architects can seldom justify any added cost for design analysis, and few, if any, really good design tools are available. All of this is exacerbated by difficult economic times.

There are almost no incentives to save energy or reduce peak demands. Energy costs are very low and do not include the environmental, health, national security and other costs of excessive energy use and increased generating capacity. Moreover, there is no mechanism that enables the ultimate utility customer to pass added design or construction costs back to the builder or owner. Thus conditions required for life-cycle costing to work do not exist. If the client doesn't want it and won't pay for it, it won't happen.

Part of the problem is that, unlike other renewable technologies, most policy analysts expect passive strategies to compete across the board and against the cheapest alternatives. For some reason, passive strategies are often denigrated because they are not viable in all situations and in all climates. (By contrast, photovoltaics, which are not viable in all situations or all climates, exist totally on niche markets.)

Suggestions for Solutions

The good news is that we don't have to start from scratch. The following suggestions are based on our current strengths and the lessons learned in previous programs.

First, we must **identify the niche markets** where passive renewable technologies are the most viable and concentrate on these markets. Examples include passive solar heating in cold, sunny climates where the alternative is electric heating; daylighting in schools and libraries, where life-cycle costing works; and cooling strategies where they are most effective.

Under the right circumstances, passive renewable buildings will develop in locations and building types where they are most appropriate. Designers and clients will be impressed and dissemination will occur naturally and logically. This is a proven model based on proven market-capture principles—walk before you try to run and concentrate on the early innovators first and then the early adopters. The rest will follow. It is a mistake to try to force the market where it doesn't make economic and practical sense, but we have a responsibility to create a friendly environment where it does.

We must also **work with utilities to develop demand-side programs** that reward good passive renewable designs. These should be performance-based and not component-based because the appropriate use of any component depends so critically on the context in which it is used (building type, climate, orientation of the facade, controls, etc.). Such programs should be monitored, probably at government expense, to establish their actual effectiveness in the field. At the moment, utilities represent the greatest hope for getting good passive renewable design techniques and products into buildings.

The development of design guidelines for both residential and non-residential buildings is also critical to this effort and should be expanded. These guidelines should combine targeted written information and carefully conceived computer-based design tools. User-friendly PC-based tools can make it fast and easy to identify effective strategies and estimate savings very early in the design process.

A series of carefully designed demonstrations that highlight renewable passive strategies could help raise public consciousness of the advantages of passive

design. These should be monitored to increase credibility and be well publicized. These projects *should not* be used as vehicles to try new and unproved concepts, but rather as integrations of established techniques and products.

Successful projects would likely be a collaboration of a established builder with a good track record of passive design, an architectural and engineering firm possibly supplemented by a passive renewable energy consultant, appropriate industries such as glazing and window manufacturers and mechanical equipment manufacturers, a National Laboratory to assist with design analysis and monitoring and possibly the local utility.

Environmental concerns must be paramount. The buildings should be reasonably priced, architecturally sound and market-relevant. They should avoid exotic products but introduce innovative ideas. The DOE Passive Solar Commercial Building Program of the early 1980s serves as a good model of how to carry out such a program.

A series of carefully conceived design competitions is another strategy to increase the visibility and credibility of passive buildings. The purpose would be to recognize good design and the judging would balance architectural and energy concerns more or less equally. A small fixed cash award could be made to cover the added costs of design, but not construction. As a target, the competitions should aim for about 50 percent acceptance of submitted designs and the winners would be well publicized. No monitoring is required and the competitions for residential and non-residential projects would be separate.

search and development. This work should emphasize the integration of both conservation and passive renewable techniques into whole designs that are carefully tuned to their particular situation. The effort should be designed to balance analytical and experimental activities—validation based on reality. To be most cost effective and practical, much of this work should be carried out in the buildings sector, augmented by laboratory activity where appropriate. In this scenario, it is important to distinguish experimental projects carried out within occupied buildings from demonstrations. This work would involve exploring and carefully evaluating promising innovative concepts.

We also need **a focused program to encourage the development of new materials and products** that enhance the efficiency and acceptability of passive designs without increasing costs. To be most effective, these efforts should combine the talents of industry, entrepreneurs and the National Laboratories. A new type of contractual mechanism, the Cooperative Research and Development Agreement (CRADA), makes this possible and protects the proprietary rights of the industry partners.

Programs to **help colleges develop curricula** that focus on the application of energy efficiency and passive renewable design techniques would help assure a constantly replenished talent pool.

We must also **build renewable strategies into all building energy standards and rating systems.** Only rarely has this been done in the past and never in a comprehensive way.

And finally, we must **evaluate, quantify and emphasize corollary benefits** of passive renewable energy design. Energy savings are only part of the picture—other considerations can double overall cost effectiveness (see sidebar, this page).

If we're serious about getting this country back on track economically and environmentally, we need to take a longer view of our future. Drawing on the information gathered over many years of experience, we could both improve the comfort and efficiency of existing buildings and ensure that new construction uses passive renewable energy strategies where appropriate. This would be a giant step in the right direction. ©

Dr. J. Douglas Balcomb is a Principal Engineer at the National Renewable Energy Laboratory.

Passive renewable energy design is important for reasons that go beyond energy savings. Here are some of the additional benefits.

Load shifting.
Reduced kilowatt savings can be as important to the utility as kilowatt-hour savings are to the customer. Passive heating displaces the load into off-peak hours, as amply demonstrated by both monitoring and analysis. This is important for electrically heated buildings, which account for about 50 percent of all new construction. Daylighting reduces demand for both lighting and cooling on clear, hot summer afternoons when utility peaks generally occur. Night-vent cooling displaces afternoon air-conditioning loads (by natural ventilation or whole-house fans in residential and by economizer cycles in commercial buildings). Added thermal mass enhances all of these load-shifting effects.

Reduced environmental damage.
Demand-side energy and generating-capacity savings create much less pollution than the energy flows they displace—energy that causes damage that accumulates throughout the lifetime of the building. Buildings last for fifty or more years whereas life-cycle cost horizons are typically two to ten years at the most. If we really care about saving the environment for future generations, buildings represent the greatest leverage that we have available.

Greater reliability.
Because passive strategies are built in, using conventional building components, they are inherently dependable. Natural processes always work. A daylit school, for example, can keep operating during a September afternoon brownout. A well designed passive house at the end of the utility extension in Colorado is essentially freeze-proof during an outage. A low-e or spectrally selective coating on a window is infinitely more reliable than a furnace, an air-conditioner, a mechanical shutter or a night-insulation device. Repairs to passive systems can be done by conventional tradespeople using locally available products.

More jobs.
Passive strategies involve the construction and construction-products industries—some of the nation's most beleaguered jobs. Better to increase the initial investment through added labor and materials costs than to spend an equal or greater amount on future energy costs that often involve imported energy.

Security for seniors.
As the nation's population ages, we should be concerned to build in safeguards for our older and retired citizens. A passive solar house carries a lifetime guarantee of good comfort with low energy costs, enhancing the financial stability of a vulnerable and growing sector of U.S. society. Other vulnerable populations such as the working poor, single mothers and the unemployed would also benefit.

SECOND WIND

BY DEREK DENNISTON

During the last decade, wind energy was synonymous with California, where as recently as 1986 wind turbines in just three mountain passes produced 95 percent of the world's wind-generated electricity. But the Golden State, and the United States with it, stand a good chance of losing the lead in wind energy to a surging European industry in just a few years, according to wind energy experts.

Building on the European Community's commitment to take action against global warming, renewable energy advocates have integrated this en-

National Commitments to Wind Power

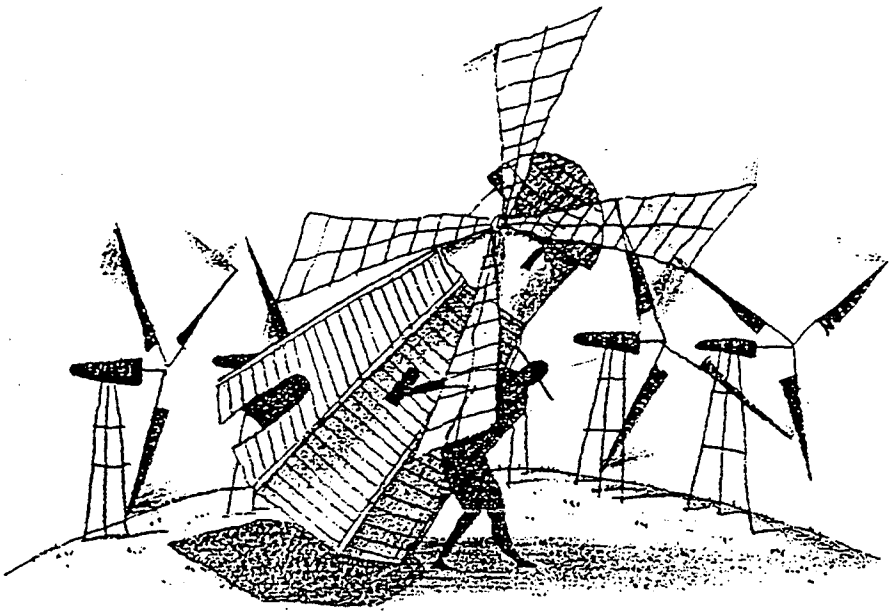
Country	Commitment *(Installed Capacity)*
Denmark	1,500 MW by 2005
Netherlands	1,000 MW by 2000
German states:	
Schelswig Holstein	1,000 MW by 2000
Lower Saxony	1,000 MW by 2005
Italy	300 MW by 2000
Spain	180 MW by 2000
United Kingdom	1,000 MW by 2000[1]
European Community	8,000 MW by 2005

[1] U.K. has made this commitment for all forms of renewable energy.

Source: Paul Gipe, American Wind Energy Association

ergy source into national energy plans across the continent, unleashing a storm of wind turbine installations.

By the end of 1992, Denmark, Germany, the Netherlands, and the United Kingdom—Europe's top wind power producers—had installed enough wind turbines to reduce the U.S. share of world wind power generation to 67 percent. The real portent of the change ahead, though, can be seen in the number of turbines being installed or planned. While projected growth of U.S. wind installations has flattened, European countries have enough capacity on schedule to be outproducing the United States by 1996, according to Paul Gipe, the American Wind Energy Association's top industry analyst.



Europe is blessed with ample amounts of what wind energy mavens call "technical potential." Wind blows hardest and steadiest along coastlines and in mountains, and Europe's geography abounds with both. In fact, the *European Wind Atlas* reports that the continent has more than enough potential wind energy to meet all of the European Community's electricity needs, although almost half of the resource is concentrated in the United Kingdom and Ireland. The European Community intends to tap into that potential. Through a renewable energy program called ALTENER, it has called for 1 percent of projected demand for electricity to be met with 8,000 megawatts of wind power capacity by 2005 (see table).

The European Wind Energy Association (EWEA), the Rome-based trade group that represents the industry's interests throughout Europe, has even grander plans. The group has set a lofty goal for the year 2030 of 100,000 megawatts, enough to supply 10 percent of Europe's electricity.

"That goal will only be achieved if the political objectives of renewable energy are clearly formulated and used to change the established systems within the utilities, planning authorities, and administrative systems," says Andrew Garrad, author of EWEA's strategy document, *Time for Action: Wind Energy In Europe*. The political momentum created by these national commitments to wind energy has begun this reform process.

On top of the support of national governments that treat global warming as a legitimate threat, Europe's wind energy producers enjoy several other advantages over their American counterparts, namely a strong green political movement and a tradition of greater government involvement in energy policy.

The success of the Green parties across Europe in the 1980s gave wind power a vital boost. To counteract the whittling away of support in their liberal wings, mainstream political parties like the Social Democrats usurped Green party platforms, including those anti-nuclear sections related to renewable energy. As the renewable technology most competitive with traditional power sources (seven cents per kilowatt-hour, compared with about five cents for a new coal-fired plant), wind energy became a logical priority in new energy plans.

After years of pressure by green groups, governments in Europe have become active partners in promoting wind energy. They fund research into better turbine designs, subsidize the installation of wind turbines, and provide premium payments for wind-generated electricity, all of which has shielded fledgling European wind companies from the boom and bust cycles that wrench California's industry, now reduced to a single turbine manufacturer.

As Europe's private wind power companies mature, the governments are shifting their focus to pushing the public utilities and local planning authorities to adopt wind power through regulations, financial incentives, and joint ventures. One noteworthy example is a recent Dutch partnership between a private technical research institute, a national utility, and the federal government to design and market a new generation of super-efficient wind turbines.

With the future looking so bright for wind power in Europe, it's doubly ironic that the primary constraint to the industry's achieving its potential is also what led to its genesis: concern for the environment. Citizens' groups have opposed and successfully blocked wind power installations by objecting

o the visual and noise pollution created by clusters of wind turbines.

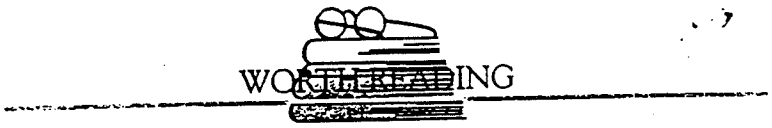
One country where this part of the drama is being played out is the Netherlands. Proposals to site wind turbines atop the country's much beloved dikes have met with fierce opposition, even though windmills have been Dutch cultural icons for six centuries. As the second most densely populated country in the world after Bangladesh, the Netherlands has few remote places to locate the thousands of turbines called for in the country's new national energy plan. Given the stark alternatives of dirty fossil fuels and dangerous nuclear power, wind power may win out. "The future of wind energy will hinge on the public accepting the visual impact of wind turbines as the small price to pay for clean energy," says C.A. Westra, a professor at the University of Amsterdam.

A possible solution to this constraint could come from efforts to build turbines out at sea. The advantage is that breezes are stronger and more frequent. The disadvantage is that the construction and transmission costs combined with the corrosive effects of salt water make off-shore wind power twice as expensive as wind power from land. Widespread use of this option will have to wait until the advances in turbine design expected around 2000 bring generation costs down to about four cents per kilowatt-hour.

Another possible solution may come from the ongoing work of Danish manufacturers Bonus and Vestas to design cost-effective turbines with at least twice as much capacity as today's biggest models. These machines would produce more electricity from fewer machines, requiring less land.

Southern European countries are lagging behind their northern neighbors in the sudden rush to wind power, not because they lack ideal locations for wind farms, but because up until recently they did not enjoy the research facilities or market development funding that their neighbors to the north can provide. A taste for what could happen in the future came last year, when the European Community provided technical assistance to Spanish wind producers, setting off a flurry of turbine installations. On the hills above the Straits of Gibraltar there are already plans to install turbines with at least 200 megawatts of capacity, an amount equal to almost one-fourth of current European capacity.

Fueled with the resolve to honor their Earth Summit commitments to reduce carbon emissions, Europeans should manage to sail through most obstacles to wider use of wind power. The challenge for their American competitors is to design a strategy for keeping the lead in the global competition to extract electricity from the wind.



BIOLOGICAL CRASH

The Diversity of Life, *by Edward O. Wilson. Harvard University Press, 79 Garden Street, Cambridge, Massachusetts 02138. 1992. 424 pages. $29.95 cloth.*

"How much force does it take to break the crucible of evolution?" If this question piques your curiosity, Pulitzer Prize-winning author and scientist Edward O. Wilson's latest endeavor—an impassioned plea for the preservation of what is left of the Earth's biological heritage—will be the page-turner you just can't put down. What's different about this story is that its ending has yet to be written: it's up to each of us.

Although there have been five mass extinctions over the past 440 million years, Wilson sets out to prove that the sixth, in which we find ourselves right now, is radically different. Writing with a lucidness that borders on poetry, he argues that if the first five extinctions were due largely to natural factors such as asteroids colliding with the earth, blame for the present paroxysm of death and destruction can be laid at the doorstep of one species that has forgotten it evolved with the rest of life on this planet.

Part of the problem Wilson describes is our enormous ignorance—rather ironic, given that much of the justification for human dominance over nature has stemmed from pride in our large brains. To begin with, we have only the vaguest idea of how many species there are in the realm we dominate. The range Wilson ventures is humbling: "close to 10 million or as high as 100 million." Whatever the number, evidence is piling up that the magnitude of the annihilation we have set in motion is massive.

Take the rain forests, believed to be home to more than half the species of plants and animals. Wilson points out that according to the fossil record, the normal pre-human "background" rate of extinction was roughly one species out of one million a year. Now, human activities have "increased the extinction between 1,000 and 10,000 times over this level in the rain forest by reduction in area alone."

Numbers can be numbing, inducing dangerous emotional and psychological detachment from the urgency of a situation. Fortunately, Wilson is

able to present his numbers in a way that never lets the reader forget the immensity of this loss of life. His attention to "keystone species" is a case in point. As their name suggests, the removal of these species can cause entire ecosystems to change drastically, with unforeseeable and often dire consequences for other life forms—including, ultimately, humans.

Not one to cry over spilled genes, Wilson turns his attention toward finding practical means of saving what biodiversity remains. His argument, favoring a kind of enlightened ecological economics, undoubtedly will leave some conservationists—those who believe in the inherent rights to life of other species—feeling squeamish. But in the end, many readers may find it persuasive.

This "New Environmentalism" focuses on the preservation of whole ecosystems, not just a handful of star species. And as Wilson points out, it also acknowledges that the old approach of declaring tracts of wilderness off-limits simply doesn't stand a chance outside the rich nations.

The fact is, the countries considered among the poorest in the world include those with the greatest wealth of biological diversity. As a result, Wilson believes, we need a radical transformation in the way we think about wealth—along with innovative strategies for making better use of land already being exploited. A key strategy for balancing human needs with the critical-care needs of the Earth is to find non-destructive ways to extract goods from wildlands.

In the campaign to save the world's waning biodiversity, Wilson suggests that the first need is to undertake a global survey of plants and animals so we know what it is we're playing God with. The second need is to formally recognize biological wealth as economic wealth by assessing the economic potential of whole ecosystems. One aspect of this assessment, for example, would be "chemical prospecting," which evaluates a region's wild species with respect to their potential for new medicines and other potentially useful products. This knowledge would then be incorporated into the area's land management policy.

Beyond making an inventory and appraisal of the Earth's assets, Wilson advocates the promotion of sustainable development—a concept that readers are likely to find agreeable but vague. People in the industrialized countries and the so-called developing countries have very different notions of what this ubiquitous buzzword means in practice. Similarly, Wilson's admonitions to save what remains, and finally to restore the wildlands, seem to chart a course that is fraught with political and economic pitfalls.

Perhaps it struck the author somewhere along the line that fine-tuning the global economy will not be enough, because the book ends on a profoundly moral note—and rightly so. Something that is emblazoned in the mind after reading *The Diversity of Life* is that *one* species out of 10 to million—Homo sapiens—is conducting an unprecedented global experiment in what is, geologically speaking, a minuscule period of time.

The question of morality lies in the fact that we are toying not just with our own existence, but with that of many other forms of life that have evolved over millions of years and whose continued presence on this planet now rests in our hands.

As Wilson poignantly notes: "If there is danger in the human trajectory, it is not so much in the survival of our own species as in the fulfillment of the ultimate irony of organic evolution: that in the instant of achieving self-understanding through the mind of man, life has doomed its most beautiful creations. And thus humanity closes the door to its past."

REVIEW IN BRIEF

Out of the Earth: Civilization and the Life of the Soil, *by Daniel J. Hillel. The Free Press, 866 Third Avenue, New York, New York 10022. 1991. 321 pages. $22.50 hardcover.*

For author Daniel Hillel, the creation of soil through the marriage of earth and water is a matter of intense personal interest. Writing about it, as he does in *Out of the Earth* is evidently a labor of love. Perhaps spending a good part of his childhood where this union of elements is incomplete—in the sun-baked desert regions of Israel—had something to do with his choice of avocation.

Hillel brings passion even to his short course on soil formation and the hydrologic cycle, before moving on to his "lessons of the past." Be it salinization, erosion, depletion of groundwater, or wetlands destruction, he reconstructs the abuses of the environment that may have contributed to the collapse of many ancient civilizations.

When one adds to this litany of ecological woes those that modern man has concocted—agricultural chemicals, toxics, industrial waste—the prognosis for humanity would seem rather bleak.

The author, however, ends on a note of "conditional optimism." The raised-bed farming systems in the wetlands of Mesoamerica and Israel's innovative irrigation techniques provide examples of how humans can meet their needs with minimal damage to the rest of the natural world. Provided that these and other environmentally sound practices find widespread application, Hillel believes it within our power to change course before it is too late.

The trick is getting people to act in what Hillel calls a "new climate of opinion" regarding humanity's relationship to the environment. This includes the growing realization that human population growth must be slowed, and that other species must be protected. The only flaw in this otherwise masterfully executed book is that the author doesn't appear to have any groundbreaking solutions to get the process under way.

—Heather Hantord

UNION OF
CONCERNED
SCIENTISTS

BRIEFING PAPER:

PUTTING RENEWABLE ENERGY TO WORK IN BUILDINGS

Buildings use more than one-third of the energy consumed in the United States. Heating and cooling systems account for 60 percent of this energy; lights and appliances use another 40 percent. Manufacturing and transporting building materials requires additional energy.

By carefully applying design principles that capture natural breezes and the sun's energy and light, and by using solar water-heating systems, energy use in buildings can be reduced dramatically. These renewable energy practices save money, and they improve the environment and strengthen the economy by reducing the need for fossil fuels and nuclear energy.

This briefing paper discusses design considerations for environmentally responsible buildings and communities. t emphasizes approaches that do not significantly alter .he initial cost of a structure but that provide substantial long-term savings and a more comfortable living environment.

Passive Solar Design

Buildings constructed in the United States today are more energy efficient than ever before; however, their energy requirements can be much further reduced. Sunlight, landscaping, natural breezes, and the choice of building materials can all reduce the need to use and pay for fuel and electricity. Passive solar design—the use of a building's structure to capture sunlight and store heat—can alone save up to 50 percent or more of the energy used in a home.

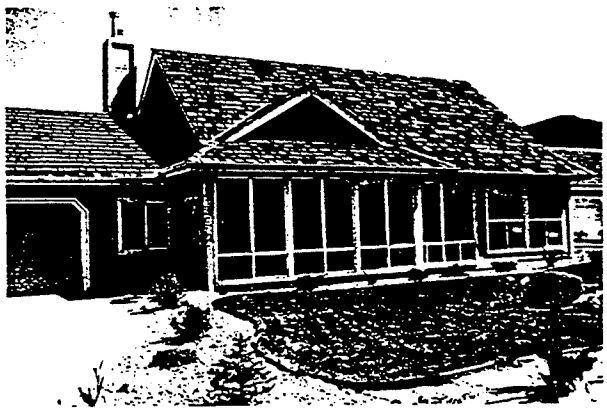
Building Orientation and Window Location. With little or no extra cost, a building can usually be oriented with its long face to within at least 30° of true south, creating energy savings without changing the design. (An orientation of within 15° is optimal; within 30° is acceptable.)

The next most important design feature is placing a high percentage of the building's windows on the south side. Conventional houses have about a quarter of their windows on the south side, and this generally averages about 3 percent of the house's total floor area. Ideally, the total area of south-facing windows should represent about 7 ercent of the house's total floor space. Such a shift would allow the building to use more of the sun's energy by absorbing it into the materials of the house. This zero-cost option can save up to 25 percent of the house's conventional heating fuel and, with protection from a shading overhang, can help reduce summer cooling bills as well. In winter, when the sun arcs low in the sky, the south-facing glass will let in the sunshine to heat the space. In summer, when the sun is high in the sky, an overhang can prevent unwanted heat gain.

The total south-side window area could be expanded to up to 12 percent of floor area without overheating and without having to manage windows (opening and closing curtains), but this increase in window area requires a commensurate design feature for storing the additional heat, such as concrete or brick. In general, keeping such thermal storage uncovered and near the heated space increases its performance.

Additional Low-cost Passive Design Features. The interior layout of a building should allow for the natural flow of heat in the winter and for the enhancement of ventilation during the summer. Keeping the most lived-in spaces to the south, and storage spaces or garages as buffers to the north and west, are common starting design features for new buildings.

The windows on the three nonsolar sides of a building must also be given careful attention. North-facing windows offer even light, but they also lose the most heat in winter. East and west windows, because of the low morn-



Passive solar tract home designed by Neuffer Construction, Reno, Nevada. These tract designs add only 1 percent to the cost of construction while delivering a more than 50 percent annual energy savings. This home is the lowest-cost model offered by the builder. Photo: Donald Aitken.

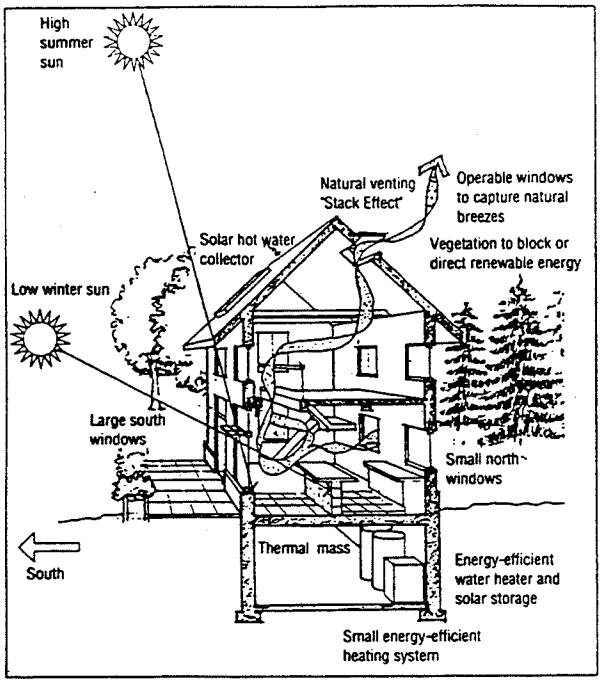


Diagram of renewable energy features for buildings. Illustration: Gunnar Hubbard.

ing and evening sun, can produce the highest air-conditioning demands. West-facing windows transmit especially large amounts of heat on summer afternoons, and they can cause extensive overheating. Double-glazing should always be the norm, and high-efficiency, low-emissivity coated glazing is almost always worth the extra cost.

To enhance passive cooling, a building's windows should be placed and designed to capture prevailing winds. A casement window that opens to the wind can allow breezes into the building. A window on the opposite side will allow stagnant air to be flushed out.

The use of breezes for cooling can be used in conjunction with the natural tendency of hot air to rise. With a high point designed in a building, the natural movement of hot air to the ceiling can be combined with an opening to the outside. This air movement is called "stack effect" and acts as a vent during the summer months. In parts of the country where the climate supports it, the same effect can be used at night to draw cool air into the building, replacing the heat built up during the day.

The color of building materials can also play an important role in helping passive design. In hot southern climates, for example, the roofs of buildings should be light colored to allow the sun's heat to be reflected rather than absorbed.

More Complex Design Options. The addition of energy-absorbing thermal mass—material that stores and slowly releases heat—inside a house can help maximize its use of sunlight; slab floors are one zero-cost to low-cost thermal mass option. Any thermal mass option requires careful design to promote adequate distribution of the solar heat.

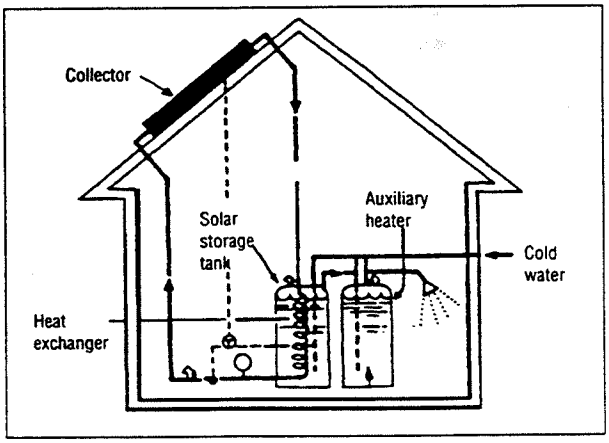
In addition, specific components can be designed into the building's shell or interior to capture and redistribute the heat from the sun's energy. Such features include glazed mass walls on the south side, and attached or integral "sunspaces"—isolated glazed rooms on the south side of the house where the solar energy is converted to heat and distributed by natural means to interior spaces.

Rooftops are important sites for electric energy resources for the future. Electric utilities in several parts of the country are currently analyzing the cost of renting rooftops for the placement of photovoltaic cells. These cells convert sunlight directly into electricity, and the systems may be tied directly into the utility grid. When the photovoltaic system produces more electricity than the house is using, the excess electricity flows back into the utility's wires, and it is purchased by the utility at a competitive rate. When the house requires more electricity than the photovoltaics can provide, it is purchased from the utility in conventional fashion.

Active Systems

Active systems involve moving parts that circulate air through a building or move a liquid, most often water. Such systems may be used either in conjunction with passive design or as stand-alone heating or cooling systems. A fan, when combined with a passive system, is a common method to pull hot air to other locations in the building. Warm air is often brought to a low point in the building to create an assisted convective loop, helping to circulate air throughout the building. These systems may also be combined with thermal storage to further increase energy savings and comfort.

Roofs can also support active systems, such as solar water heaters. Today's water heating technology is far superior to the solar water heaters of the 1970s, and utility incentives for solar water heating are on the increase. The payback period for the heaters depends on the system, on the climatic conditions, and on local utility incentives. Possible future use of the roof for photovoltaics and solar water heaters represents an additional rationale for orienting roofs to the south.



Current technology makes solar water heaters effective, even in colder climates. Source: North Carolina Solar Center Publication.

Conventional offices use half of their energy for lighting. Effective use of natural light, called "daylighting," dramatically reduces energy consumption at the time of day when the demand for electricity is the greatest. Photo: Donald Aitken.

Daylighting

Daylighting, or the use of natural light in a building, reduces the need for electric lights and improves the visual qualities of a space. It is one of the most rewarding design measures and is consistent with the heating and cooling aspects of passive design. Placing light-colored reflective surfaces close to windows will allow light to bounce farther into a room. Shades and blinds almost always enhance the ability to control the light.

It is possible for carefully controlled daylight to provide all of the necessary interior lighting with less heat emitted to the interior spaces than is released by incandescent or fluorescent lights.

Because electric lights create an excess amount of internal heat, they can cause air conditioners to be on through much of the year. Open interior plans that enable natural light to penetrate to all parts of the structure, therefore, are especially important in commercial buildings, where electric lights are used most heavily.

Additional Conditions for Environmentally Responsible Building

Environmentally responsible building cannot be achieved by design techniques alone. These techniques must be considered in conjunction with the overall healthfulness of the interior climate, the building's integrity, and the use of building materials that place the lowest demands on the environment. Ideally, buildings that incorporate these ideas will be located in communities that are also designed to maximize use of renewable energy resources.

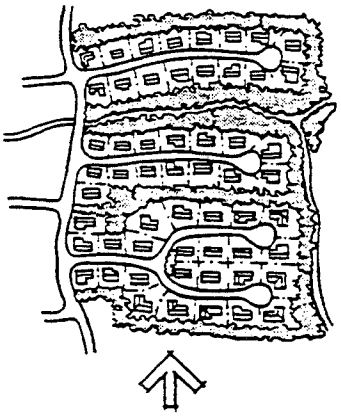
Energy Efficiency. Passive solar design must be combined with vigorous energy-efficiency measures: high levels of insulation, tight construction, and high-performance windows and doors. Going beyond the local building codes for insulation and for the energy performance of windows will always provide savings through the life of the building, thus increasing its value to the owner and to society.

Tight construction—taking care in construction to eliminate any possible penetration of air into the building envelope—is critical to energy performance. Combined with proper ventilation, it produces a building that is more comfortable because of the elimination of draft. The Energy Crafted Home project, for example, a Massachusetts program sponsored by local utilities, is encouraging such building techniques. It trains builders to build tight houses, then does a site test of each building for tightness.

Indoor Air Quality. The chemicals used in creating many building materials and furniture adversely affect indoor air quality. This issue is extremely important since we spend 75 to 90 percent of our time indoors. Adverse health effects might range from sneezing or itchy eyes to lung cancer. The answer is not to build looser buildings, but to use healthy materials and to increase the amount of fresh air circulating through a building.

To maintain healthful indoor air quality in a tightly constructed house, at least half of the air must be replaced once each hour. To replace the air without losing the heat, energy-efficient exhaust air heat-recovery systems can be used, where applicable, and are readily available. Ducts in the main living spaces of the house allow fresh air to be circulated to areas where it is needed: An open interior plan allows air to move much more freely, in some cases eliminating the need for extensive ductwork.

Fortunately, for every unhealthy building material on the market, there are also healthy options available. Their availability and price depend on the demand of the building community.



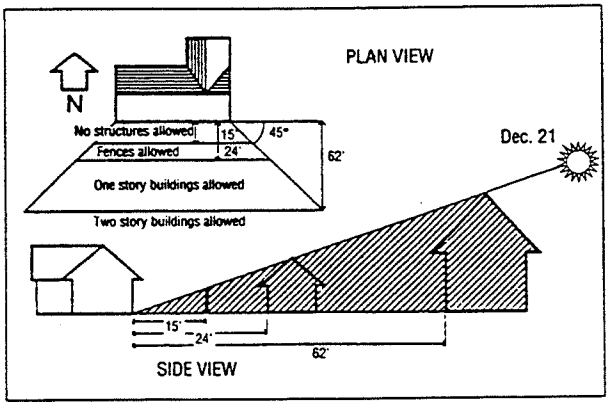
An east-west street design creates maximum southern exposure for building sites. Source: Passive Solar Industries Council.

Planning and Landscaping. The street layout in new projects should provide building sites with unobstructed southern exposure. As a general rule, street layouts that run east-west accomplish this design objective. It is important that buildings, trees, or other obstructions do not block the sun at the most critical times of the year. The main objective is to allow the south side of a building as much unshaded exposure as possible during the winter months, most critically from about 9:00 am to about 3:00 pm. Some parts of the country have solar access laws and ordinances that protect the south side of buildings.

Landscaping can maximize the availability of renewable energy to a building. Deciduous trees, for example, can provide shade in summer and permit sunlight to strike

the house directly in winter, but are not recommended directly south of the structure. North-side evergreens can provide an effective windbreak and weather barrier.

A planning scheme with tree-lined, narrow streets decreases the amount of heat absorbed during the hot summer months. This results in a cooler microclimate, creating less need for mechanical cooling. In addition, fairly dense planting around houses can direct breezes for natural cooling, or block the cold north winds during the winter months.



To ensure adequate solar access, the building site must be assessed for obstructions. Source: Energy Crafted Home Design Manual.

The Cost of Energy-Efficient Construction

Many of the design features discussed in this paper produce only very small cost increases, but more expensive changes can also make good financial sense for building buyers. If more money is spent on the construction of the house, on good windows, and on more insulation, the mechanical system can be smaller, and the resulting energy bills will be smaller. In the long term, the life-cycle costs will be decreased, and the house will be more affordable to own. Every purchase should be evaluated in terms of multiyear energy cost savings.

Energy-efficient buildings often contain the esthetic features that are in demand today: natural light; an open, spacious feeling; fresh air; and less noise (as a result of smaller mechanical systems and greater wall insulation). In most cases, the marketing of such buildings does not have to focus on their use of renewable energy. Attractiveness, coupled with state-of-the-art energy-efficiency systems and style, can sell buildings.

Everyone benefits from energy-efficient construction. Energy-efficient buildings enable the banks and the builder to make money through the higher cost of construction, and the owner will save money through the decreased operation costs. While higher construction costs of renewable systems might result in larger mortgage payments, the increased efficiency will result in lower energy bills, and the two can balance each other out. In addition, some lenders are now offering "energy-efficient mortgages" to help homebuyers with these increased costs.

Additional Energy Considerations

Planning. Any land-use development should maximize public transportation possibilities by placing mixed types of housing in close proximity to businesses and commercial operations. Thoughtful planning can protect the natural environment and the community character by reducing the need for roadway expansion, and thereby decreasing the air pollutant emissions and conserving our limited energy resources.

Any development of buildings places an extra demand on local utilities. The natural resources that are affected, therefore, must be considered in planning, not just at the current costs, but at the costs the development will place on the community throughout its life.

Embodied Energy. The construction of new buildings requires energy, and the building materials themselves embody energy. These materials have to be dug out of the ground, cut from the forest or field, or created by human technology. All these processes use energy. The distance that materials must be transported, and the intensive energy needed to prepare them for use in buildings, should be considered when choosing a material.

Construction materials should be durable, recyclable, or reusable. In virtually all cases, buying a durable product up front is more cost effective than buying a less expensive, less durable product. If something will last 50 years rather than 10 years, the payback is attractive in a life-cycle cost analysis. It will certainly create less waste, reducing disposal costs to society.

The Impact 2000 house uses many of the design features discussed in this briefing paper. The two photos show the dramatic differences between the south (top) and the north (bottom) faces of the house. Photos: Solar Design Associates, Inc.

A Renewable Energy Checklist

Orientation

- ☐ Is the long face of the building oriented to within 30° of due south? (15° is even better)
- ☐ Is there unobstructed southern exposure? Will trees grow to block the sun? Might a building be built in the future that could block the sun?

Energy Efficiency

- ☐ Are you going beyond the code requirements for insulation? For the performance of windows?

Air Infiltration

- ☐ Are you taking extra care to ensure tight construction?

Windows

- ☐ Have you increased the south-facing window area to the maximum for your design choices?
- ☐ Could casement windows be used to capture breezes?
- ☐ Have you planned for cross-ventilation?
- ☐ Are you using energy-efficient windows?
- ☐ Have you considered using different windows for each face of the building?
- ☐ Is there adequate shading on the south, east, and west windows?

Interior Design

- ☐ Are the main living spaces near south-facing windows?
- ☐ Are unused spaces such as closets and storage rooms on the north and west sides of the building?
- ☐ Does the floor plan allow for the movement of heat in the winter and ventilation in the summer?
- ☐ Is the garage located on the east, west, or north side?

Daylighting

- ☐ Does your design maximize the use of natural light?
- ☐ Do you have light-colored interior surfaces?

Materials

- ☐ Are you using healthy building materials obtained from local sources?

Mechanical

- ☐ Have you downsized your mechanical system for the decreased energy demand?
- ☐ Have you provided a means for ventilation in all living spaces of the building? Does your open plan allow for ease of air movement?

Solar Water Heaters

- ☐ Have you considered using a solar water heater?

Utilities

- ☐ Have you checked for financial incentive programs for energy-efficient construction or the use of solar energy?

Financing

- ☐ Have you looked for lenders that offer lower-rate energy-efficient mortgages?

What the Building Community Can Do

Town Planners

- ◆ Pay close attention to the layout of building lots to allow for solar orientation and energy-efficient landscaping.
- ◆ Suggest the redesign of new developments and renovations that do not consider the simple principles of renewable energy.
- ◆ Assess how people will get to and from the development, or how effectively job and workplace opportunities are provided within the development.

Building Inspectors

- ◆ Educate builders and planners about the ideas presented in this paper. Your efforts will increase local expectations for energy performance.
- ◆ Enforce energy-efficiency standards.

Developers

- ◆ Develop energy-efficient buildings that take advantage of renewable energy opportunities. Doing so will increase the marketability of your product, help your customers save money, and contribute to a healthier environment.

Real Estate Brokers

- ◆ Promote energy-efficient buildings by educating the buyer and builder about the benefits of saving energy.
- ◆ Highlight desirable energy features when marketing buildings or developments.
- ◆ Emphasize the attractiveness and comfort of buildings that use renewable energy.

Contractors

- ◆ Educate building tradespeople about the advantages of renewable energy technologies and practices.
- ◆ Work with tradespeople who promote environmentally responsible building.
- ◆ Go beyond the energy codes in your community.

Builders

- ◆ Exceed local building codes in terms of insulation, windows, mechanical units, and construction quality.
- ◆ Educate owners, architects, inspectors, and others involved in the building trades.
- ◆ Use durable, healthy building materials that come from local sources.
- ◆ Minimize waste on the construction site.

Architects

- ◆ Become knowledgeable about design practices that incorporate renewable energy and energy efficiency.
- ◆ Educate clients and builders.

Suppliers

- ◆ Provide energy-efficient, healthy materials.
- ◆ Work to create a market for recycled products and renewable energy.
- ◆ Promote interest in energy efficiency with educational displays and special incentives.

Organizations for Further Information

American Institute of Architects
1735 NY Avenue NW
Washington, DC 20006
(202) 626-7300
Environmental Resource Guide

American Solar Energy Society (ASES)
2400 Central Avenue, Unit G-1
Boulder, CO 80301
(303) 443-3130

Building Energy Technology Program
National Renewable Energy Laboratory (NREL)
1617 Cole Boulevard
Golden, CO 80401
(303) 231-7303

Center for Resourceful Building Technology
PO Box 3413
Missoula, MT 59806
(406) 549-7678
Guide to Resource Efficient Building Elements

Conservation and Renewable Energy Inquiry and Referral Service (CAREIRS)
Renewable Energy Information
PO Box 8900
Silver Spring, MD 20907
(800) 523-2929

Energy Crafted Home
180 Lincoln Street
Boston, MA 02111
(800) 628-8413

National Appropriate Technology Assistance Service (NATAS)
US Department of Energy
PO Box 2525
Butte, MT 27902-2525
(800) 428-2525

Passive Solar Industries Council (PSIC)
1511 K Street NW
Suite 600
Washington, DC 20005
(202) 628-7400

Suggested Readings

Hashem Akbari, et al., *Cooling our Communities: A Guidebook on Tree Planting and Light-Colored Surfacing.* Washington, D.C.: Environmental Protection Agency, EPA Document #055-000-00371-8, 1992.

John Bower, *The Healthy House: How to Buy One, How to Build One, and How to Cure a Sick One.* New York: Carol Publishing Group, 1989.

G. Z. Brown and V. Cartwright, *Sun, Wind, and Light.* New York: John Wiley & Sons, 1985.

David Pearson, *The Natural House Book.* New York: Fireside, 1989.

John Spears, *Designing and Building Healthy Homes: A Guide for Home Builders.* Baltimore: Energy Conservation Management, Inc., 1992.

Andrew St. John, *The Sourcebook for Sustainable Design: A Guide to Evironmentally Responsible Building Materials and Processes.* Boston: The Boston Society of Architects, 1992.

Steven J. Strong, *The Solar Electric House: Energy for the Environmentally Responsive, Energy-Independent Home.* Still River, Mass.: Sustainability Press, 1991.

Les Tumidaj, et al., *Solar Access Design Manual.* Office of Environmental Services, City of San Jose, Calif., 1992.

Brenda and Robert Vale, *Green Architecture: Design for an Energy-Conscious Future.* Boston: Bulfinch, 1991.

Sim Van der Ryn and Peter Calthorpe, *Sustainable Communities: A New Design Synthesis for Cities, Suburbs, and Towns.* San Francisco: Sierra Club Books, 1991.

January 1993

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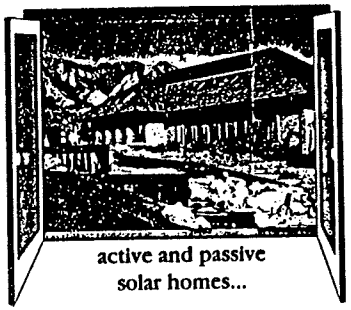

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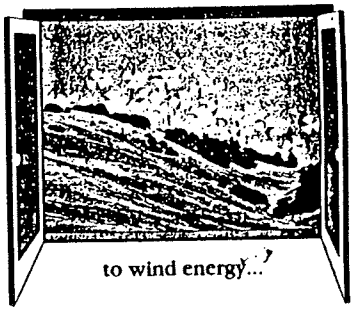

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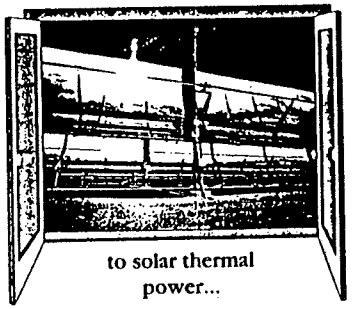

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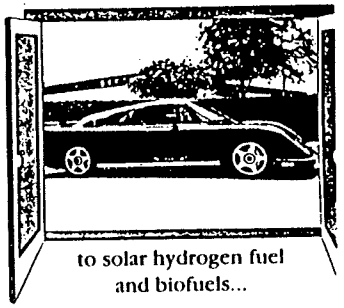
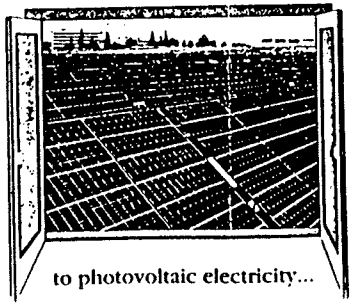


to solar hydrogen fuel and biofuels...



to photovoltaic electricity...

...the American Solar Energy Society is opening doors for environmentally sound and renewable sources of energy.

merican Solar Energy Society

SES is the national organization dedicated to dvancing the use of solar energy for the benefit f U.S. citizens and the global environment.

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Complete and current information on the status of solar technologies. Conference proceedings, *Advances in Solar Energy*, and other titles from the ASES Catalogue are available.

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ASES chapters offer programs and services on the state and regional levels, enabling members to become involved locally in promoting solar energy.

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Solar Action Network (SAN)

ASES activists make their voices heard in Washington. Action Alerts explain legislative and policy issues affecting solar energy, and urge SAN members to contact appropriate legislators and officials. Open to ASES members and non-members.

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International Solar Energy Society

The International Solar Energy Society (ISES) wa founded in 1954. ASES is the United States Section of ISES, and continues to work closely with ISES to promote solar energy worldwide.

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- Your membership supports the exchange of solar technology among nations.
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- You receive *SunWorld*, a quarterly maga zine of worldwide solar applications .
- You receive *ISES News*, a biannual newsletter for members.
- You receive discounts for the biennial ISES Solar World Congress.

Photo credit (at left): National Center for Atmospheric Research/Univer sity Corporation for Atmospheric Research/National Science Foundatio

ALL THE COAL IN CHINA

Unless this giant nation embraces a new strategy for producing and using energy, its fast-growing economy could overwhelm international efforts to control greenhouse warming.

BY NICHOLAS LENSSEN

The mushroom cloud, for four decades a haunting and omnipresent symbol of the greatest threat ever faced by humanity, has finally begun to fade from the global consciousness. Today's generation of children may be the first since World War II to grow up not instantly recognizing—and shivering at—its apocalyptic shape.

But even as it fades, it is being replaced by another kind of cloud—one that is all but invisible. And the new threat is not a symbol, but a physical reality: the steadily building cloud of greenhouse gases that scientists say is likely to lead to a massive disruption of the earth's climatic system, making the planet warmer than at any time in the last million years. Just how hot the planet ends up getting will be partly determined by the actions of one country—China.

In the popular literature of global warming, China has received only passing mention. After all, since 1950, it has been the industrial countries of the West and former Soviet bloc that were responsible for 79 percent of the fossil fuel-derived emissions of carbon dioxide, the leading greenhouse gas. But in the future those proportions are expected to shift dramatically. Future growth is expected to come more from China and other developing countries than from all the industrial nations combined.

Carbon emissions in China have increased 65 percent in the past decade, largely due to a sharp rise in its burning of coal. This boosted the country's share of global carbon emissions to 11 percent—still less than its share of global population. And China still emits only half as much carbon as the United States, and only one-ninth as much per capita. But this is already more than the total amount generated by Russia, and in China the real boom may be just beginning.

China's fast-growing economy is what's driving its carbon dioxide emissions upward. Bolstered by economic reforms, the country's economy grew by nearly 10 percent annually over the last decade and, after a government-induced slowdown late in the decade, is back in high gear. Analysts forecast that high growth will continue far into the next century.

Unfortunately, all this growth could have dire consequences for the planet's atmosphere. Indeed, China is forecast to emit more carbon dioxide by 2025 than the current combined total of the United States, Japan, and Canada, according to a United Nations panel studying climate change. It is now apparent that redirecting China's energy economy may be as important to the global atmosphere as changing those of the United States and Europe.

China's leaders don't share this view. They readily dismiss the notion that concern over global warming should alter their energy

strategy. Besides, they argue, since carbon dioxide remains in the atmosphere for well over 100 years, it is largely the industrial West that caused the accumulation now hanging over us—through decades of burning coal in Manchester, or oil in Los Angeles. The Chinese government says the country has little to do with the 27 percent increase in atmospheric concentrations of carbon dioxide that has taken place since the dawning of the industrial revolution. Environmentalists say this argument is specious, however, since any increase will take the world further away from the 80 percent *reduction* scientists believe necessary to stabilize the climate.

While they don't seem particularly worried about global warming, China's leaders are thinking hard about what it will take to provide adequate living standards for the 1.1 billion people who live within the country's borders. If increased carbon dioxide emissions are what it takes to meet human needs—so goes the argument—then increase they must.

The salient question, though, is not whether the Chinese have the right to follow a carbon-intensive energy path, but whether it's in their interest to do so. The promise of development based on heavy industry, often fueled by coal, is a mirage that was pursued with a notable lack of long-term success by the Soviet bloc countries in the past—and is still being pursued by China. Industrial facilities in China, like those in the former Eastern Bloc, are less productive than factories in Europe or Japan. They also use more energy and emit far more pollution.

Rather than attempt to resolve a false dilemma between economic growth and the environment, China would better serve its own interests—and thereby the world's—by simultaneously improving living standards and reducing its growth in carbon dioxide emissions. Indeed, the country may really have no choice but to do this. Fortunately, some younger planners are acutely aware of this imperative.

Economic Boom, Energy Brake

In environmental and energy circles, China is notorious for its heavy dependence on coal, which generates 76 percent of all its energy. Only Poland and South Africa rely so heavily on this highly polluting and inherently inefficient fuel—a fuel selected not through economic competition, but through centralized government planning. In fact, the energy production system in China is still

ILLUSTRATIONS BY TRACEY WALKER

largely based on the Stalinist model of production quotas, enormous government investments, and subsidized prices, which result in gross economic inefficiencies.

Low energy prices have long been the keystones to centrally planned economies, including China's. In 1987, according to the World Bank, the Chinese government directly subsidized energy prices by $17 billion, and many of the subsidies appear to be continuing. Most oil in China, for example, was sold for slightly more than $5 a barrel in 1992, far below the international price of roughly $18 a barrel. And coal marketed by state-owned mines, which produce nearly half of the country's total, was priced below the cost of extraction—costing the treasury some $2 billion in 1991.

Low prices encourage—or at least fail to discourage—wasteful use of limited supplies. In fact, just one-third of all fuel burned in China ends up as useful energy, according to Vaclav Smil, a geographer at the University of Manitoba. That's far below the 50 to 60 percent levels found in the United States and Japan. The inefficiencies further exacerbate shortfalls in energy supplies, since larger supplies are needed to accomplish the same amount of work. At last report in 1987, a shortage of coal had led to electrical power deficits that idled one-fourth of the country's factories.

The Chinese government has typically responded to energy shortages by pouring scarce capital into building more mines, power plants, and oil wells. More than half of the industrial capital expenditures in state-owned enterprises in 1989 went to energy production. Yet despite this Brobdingnagian investment, energy shortages are expected to ease little if at all over the next two decades, as efforts to boost energy production face daunting obstacles.

China already produces more energy than Saudi Arabia and is the world's largest producer of coal—accounting for 25 percent of global output. Yet efforts to further boost coal production face imposing hurdles. Coal already accounts for more than 40 percent of the country's railway shipments by weight. Hauling endless trainloads of coal from mines in the north to the eastern economic heartland has led to transport gridlock and supply shortfalls. On the other hand, the obvious alternative—burning coal at power plants near the mines, and transmitting energy by wire instead of by train—has been stymied by shortages of water (needed for coal-fueled power production) in the coal-rich but arid northern and northwestern provinces.

The government hopes to reduce coal's importance for electricity generation by promoting large hydroelectric dams and nuclear power, but those too face formidable obstacles. A decade ago, China planned to have 10 nuclear power plants running by the turn of the century, but nuclear power is now estimated to be four times as costly as coal-generated power—cutting the likely number of nuclear plants back to the three now nearing commercial operation. For the time being, it is unclear how many more plants China is likely to complete.

Hydropower holds more promise, especially since less than 10 percent of the country's potential has been tapped. Cracks have begun to appear, however, in the consensus for building dams. In April 1992, the Chinese People's Congress, usually a rubber-stamp body, finally approved the Three Gorges Dam project—first proposed for the Yangtze River in the 1920s. But nearly a third of the delegates abstained or voted against the project, largely due to its cost—as high as $100 billion—and its plan to resettle more than 1 million people by force if necessary.

Efforts to boost oil production, which accounts for 17 percent of the country's commercial energy use, continue to face difficulties as well. Despite large government expenditures, guided by the expertise of dozens of foreign oil companies, China's oil output has failed to keep pace with its consumption since the mid-1980s. One result has been a 70-percent decline in net proceeds from international oil sales since 1985. Within another three years, China could find itself a net oil importer.

By now, it is clear that simply pouring money into expanding conventional energy supplies—even if such money were available to pour—would be unlikely to solve China's energy dilemma. Even if its central planners somehow managed to patch together an ad-

equate supply of coal, there is a whole host of reasons beyond the economic for not burning it in such immense quantities. China's people, cropland, forests, and waterways simply could not survive the air pollution that would result.

In Beijing and other major cities, sulfur dioxide concentrations—mainly from coal—regularly violate international guidelines. The level of suspended particles in Chinese cities—also from coal—is 14 times that in the United States. Acid rain falls on at least 14 percent of the country and is spreading, not just through China but into Japan and South Korea, damaging forests, crops, and water ecosystems.

Global warming portends other serious problems, according to a 1992 study by the Chinese State Meteorological Administration (SMA) and the World Wide Fund for Nature. A warmer atmosphere would raise sea levels, which in turn would flood China's coastal regions, especially in river deltas, where rice production is concentrated. Rice production would also fall if the predicted reduction in available water due to warmer temperatures holds true. Indeed, Luo Jibin, deputy director of SMA, asserted last year that global warming was already exacerbating a severe drought in the northern part of the country. The environmental and health costs of China's energy production, particularly with so much of it driven by coal, are placing a mounting burden on the Chinese people—and on the world.

The Efficiency Revolution

Raising energy efficiency is something China can't afford *not* to do, especially if it hopes to continue boosting living standards for its citizens. That may be true of other countries too, but it is particularly true in China. It takes far more energy—and pollution—to produce goods or services in China than elsewhere. A concerted move toward efficiency would not only reduce exorbitant costs but would lead to greater employment—a major benefit in an economy that is labor-rich and capital-poor. And of course, an efficient energy system would slow the increase in carbon emissions.

More than two-thirds of China's commercial energy consumption goes to industry. Yet for each ton of steel or cement produced, the typical factory in China uses from 7 to 75 percent more energy than its Western counterpart (see table). China's 300,000 small industrial boilers operate at only 55 to 60 percent efficiency, as compared to an 80-percent average for the 24 member countries of the Organization for Economic Cooperation and Development, according to the World Bank.

Table 1. Additional Energy Requirements of Energy-Intensive Products in China

Product	Difference[1] (%)
Steel	70
Electrolytic aluminum	7
Synthetic ammonia	75
Caustic soda	39
Cement	63
Plate glass	46
Paper	21

[1]Additional amount of energy Chinese industry uses to produce the same amount of product as industrialized countries.

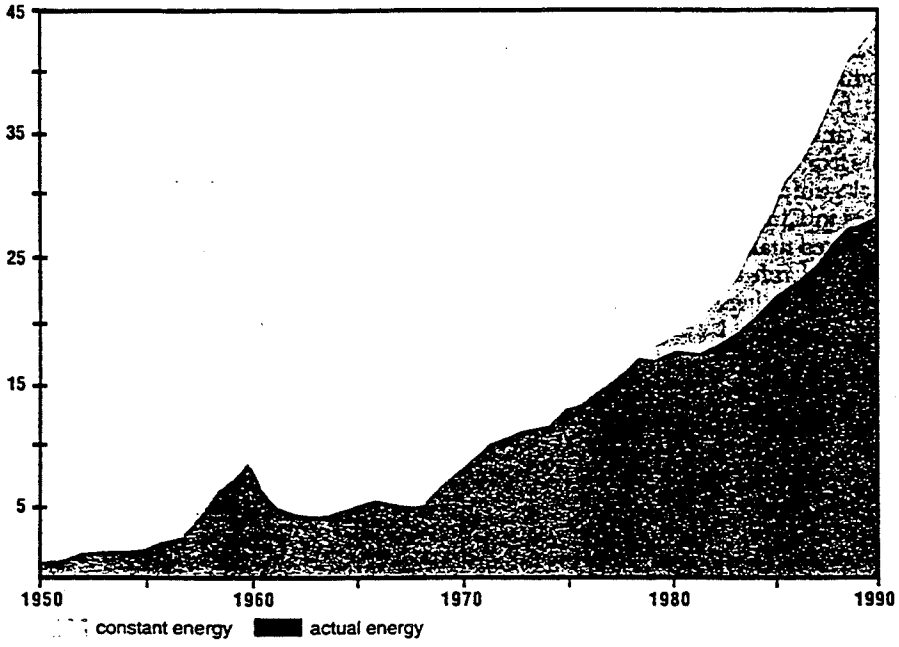
Source: Wu Zongxin and Wei Zhihong, "Policies to Promote Energy Conservation in China," Energy Policy, December 1991.

The lower efficiency of the Chinese plants, which results partly from poor maintenance and operating procedures, can be readily improved given sufficient information and incentives—including market prices for energy. Efficiency is further impaired by reliance on old or obsolete industrial processes—often purchased at bargain prices from industrial countries.

China has the opportunity to base future economic growth not only on more efficient industrial processes, but on more efficient products as well. Building a $7.5-million compact fluorescent light bulb factory, for example, would eliminate the need to build $4.9 *billion* worth of coal-fired power plants and transmission facilities, if the bulbs (which need 75 percent less power than incandescent ones) were used domestically. Each dollar invested in efficiency would save $650 in capital expenditures—before the savings on energy use even begin. China's factories already have the capacity to produce 10 million compact fluorescent bulbs a year, but this is still only a small portion of the 2.8 billion light bulbs it produced in 1991.

Likewise, Chinese buildings use three

Figure 1. Energy Consumption in China, Actual and with Constant Energy Intensity, 1950-1990[1]



[1]Assumes energy use rose at the same rate as economic output from 1978 onward.Sources: Lawrence Berkeley Laboratory, United Nations

times as much energy for heating as U.S. buildings, even though their buildings are still colder. By making boiler improvements and using insulation and double-glazed windows, the Chinese could raise average winter building temperatures in the northern part of the country from 52 degrees to 64 degrees Fahrenheit—and consume 40 percent less coal. In Harbin, for example, such improvements could pay for themselves in six and a half years even with energy costs artificially low because of subsidized coal, according to Yu Joe Huang, a scientist at the U.S. government's Lawrence Berkeley Laboratory in Berkeley, California. With unsubsidized coal, the payback period would be quicker—around four years.

In combination, the efficiency potential now within reach for industry, buildings, agriculture, and transportation could provide an enormous boost to China's economy. By investing $3 billion a year, the country could cut future growth of its energy demand by nearly half, eliminating the need for $16 billion worth of new power plants, oil refineries, and other energy infrastructure each year, according to a study prepared by the U.S. Working Group on Energy Efficiency. And instead of pumping 1.4 billion tons of carbon into the atmosphere in 2025, it would emit less than 1 billion tons.

Wide-scale savings are not simply paper prophecies—nor are they entirely unknown to Chinese planners. In 1980, the government launched an ambitious efficiency program to improve energy use in major industries. By directing about 10 percent of its energy investment to efficiency, the nation cut its annual growth in overall energy use from 7 percent to 4 percent by 1985, without slowing growth in industrial production, according to energy analyst Mark Levine and his colleagues at Lawrence Berkeley Laboratory.

Levine discovered that efficiency improvements accounted for more than 70 percent of the energy savings during the 1980-1985 period, with shifts toward less energy-intensive industries yielding the remainder. And efficiency gains were found to be one-third less expensive than comparable investments in coal supplies. One result was that China's energy consumption expanded at less than half the rate of economic growth from 1980 through 1988. Had the nation failed to make such progress, either energy consumption in 1990 would have been 50 percent higher than it actually was or—more likely—economic output would have grown far more slowly, as China would have been unable to import the $80 billion of energy the difference represented (see figure).

Unfortunately, since the mid-1980s, China has poured money into expanding its energy supply, thereby *reducing* its spending on efficiency from 10 percent to just 6 percent of total investment in the energy sector. That could soon change, however, since China's energy and economic planners are

beginning to recognize efficiency's past success in facilitating strong economic development. There may be, too, a growing recognition among these planners that exacerbating global warming in the interests of short-term economic gains would not be in the country's long-term interests.

Alternatives to Coal

If China proceeds to maximize its efficient use of energy, it will greatly reduce—but not eliminate—the need for increased energy supplies as its overall demand more than doubles over the next 35 years. Unfortunately, government planners and international lending institutions still assume that China has to follow the energy path the West blazed a century ago—a strategy that relies primarily on expanding supplies of coal and oil to meet people's needs.

Over the long haul, though, China will need to develop its own alternatives to polluting coal and costly oil, partly to alleviate supply problems, but also to reduce air pollution. The country evidently has extensive, unexploited reserves of natural gas, which could supplant oil and coal use in buildings, transport, industry, and power generation, while emitting about 60 percent less carbon dioxide. And renewable resources, other than large hydroelectric dams, are increasingly viable today, even before factoring in what they save by not polluting.

Natural gas accounts for only 2 percent of China's current energy use, though the country has started to reconsider gas as part of its effort to slow the growth in oil and coal use. In 1986, the government formed a gas research institute, and in early 1992 it decided to build a pipeline from a large offshore gas field that had been discovered in the South China Sea during an unsuccessful search for oil years earlier.

Gas commonly accompanies not only oil but also coal, suggesting that China, with its almost limitless coal reserves, is well endowed with natural gas too. One multiagency Chinese group estimates the country's gas resource to be about half as big as its enormous proven coal reserves (more than 100 years' supply). In one region in north-central China, every well drilled in the first five months of 1991 struck natural gas.

China could also look to import natural gas, even swapping gas for pipeline rights-of-way being planned by its neighbors. Russia and South Korea signed an agreement last November to study the possibility of building a gas pipeline from Siberia to the Korean peninsula—a project that could cut across northern China. And Japanese engineers have drawn up plans for pipelines criss-crossing China to move gas from Turkmenistan, Indonesia, and Australia to Japan.

Beyond the increased use of natural gas, China has an enormous potential to draw on solar, wind, biomass, and geothermal energy resources. Western countries are increasingly pursuing these options as technological advances, and cost reductions make them more attractive. The opportunities are even greater in China, because so much of its energy infrastructure has yet to be built. Decisions the country makes today will determine how readily it can tap these resources in the future.

The country has already tapped many renewable sources in rural parts of the country. For example, small hydroelectric generators supply roughly half of the electricity used in rural areas. Electrical output from these small dams nearly doubled between 1979 and 1988. Also, more than 110,000 small wind turbines churn away, mainly in Inner Mongolia.

China also appears poised to electrify at least a portion of its rural households with photovoltaic technologies. More than 60,000 households in other developing nations receive their electricity this way. The government of Gansu Province plans to electrify 1,500 homes with domestically manufactured systems in a project being organized by the Washington, D.C.-based Solar Electric Light Fund.

During the past decade, the cost of solar and wind electricity systems has fallen 66 and 90 percent respectively, and these renewables are emerging as the least expensive route to electricity in some developing countries. China recently announced a program to install 200 megawatts of wind turbines over the next three years, and 1,000 megawatts by the turn of the century.

The final step for China would be to use wind and solar power plants to produce hy-

drogen in the generally sunny and windy areas of the vast central and northwestern desert regions, then pipe it to the populated eastern coast. Larger investments in renewables in the next few years would stimulate development of the technology and business infrastructure—and the in-country expertise—needed to replace fossil fuels on a large scale.

Policies for Clean Energy

China has relied on market-based reforms for much of the boost in its economy since 1978. Unfortunately, the energy sector has been lagging. In getting its energy industry up to speed, it will need to adopt some of the innovative policies that other countries have used to encourage both more efficient energy use and more serious reliance on non-polluting renewables. The logical starting point for these policies is the adoption of real market prices.

Energy prices are critical because if they are too low, there is little incentive for the consumer to use energy efficiently or for industry to invest in alternative supplies. China has already made a promising move on this front, having planned to triple the price of oil sold domestically in January. The key now is to raise prices on coal and electricity as well.

Experience in industrial countries, however, shows that higher energy prices eliminate only one of the many obstacles to reducing wasteful energy use. To work, substantial price hikes may need to be accompanied by investments in end-use efficiency. That way the final cost of the energy service—whether manufacturing cement or lighting a home—remains unchanged or declines. For example, subsidizing the use of efficient lighting technologies would cost less than providing below-cost electricity to households and building new power plants.

As China learned in the 1980s, investing in energy efficiency can yield rewards that the country can hardly afford to miss. The first challenge is to once again boost efficiency's share of the total energy investment to levels above the 10 percent that brought the earlier gains. And such investments should no longer be limited just to major industries, but expanded to transportation, buildings, and consumer products as well.

Likewise, the country could profitably begin to shift the money it now spends obtaining coal and oil to the pursuit of natural gas and renewables. As part of a new environmental policy announced in 1992, the government said it plans to encourage renewable energy resources, including solar, wind, geothermal, tidal, and biomass—though it left its plans unclear.

The Twain Shall Meet

China is likely to find that building a sustainable energy system won't be possible without international support. China already receives a good sum of aid for energy development, only that money is probably doing as much harm as good, not just for the global climate but for China's long-term economic health. The World Bank, for example, loaned China nearly $1 billion for energy projects in 1992, yet nearly all of that money went to coal or large hydroelectric projects. That's not surprising, in view of the fact that 80 percent of the bank's energy loans around the world since 1948 have been aimed at supplying electric power. But now, for China to make the changes it needs, the lending agencies will need to shift their focus as well.

There are promising signs that this will happen. In Manila, the Asian Development Bank (ADB) has started to invest directly in efficiency. Last September, the ADB approved a $107 million loan for improving energy efficiency in Chinese fertilizer, cement, and steel industries. The ADB also has started to incorporate into its energy planning a novel technique—known as integrated resource management—that compares efficiency investments to expansion of energy supplies in determining the least expensive, and least environmentally destructive, energy option.

Investment in education is another neglected area that aid programs can bolster. One successful program, run by the Lawrence Berkeley Laboratory, has trained a cadre of energy specialists in critical efficiency and environmental issues. More than a dozen Chinese scientists, engineers, and other specialists have conducted research at Berkeley over the past four years, while scores more, including the director of China's Global Climate Change program, have participated in study tours and joint conferences.

Taken one step further, establishing an energy efficiency center in China would allow even more Chinese citizens to tap into the country's expanding expertise and knowledge. Based on past success in launching three such centers in the former Czechoslovakia, Poland, and Russia, William Chandler of Battelle Pacific Northwest Laboratories has now set his sights on China. "Such a center could help cut carbon emissions by half a billion tons a year over 20 years," says Chandler.

It is critical, too, that support from the wealthier industrial nations include not only the hundreds of millions of dollars annually provided as foreign assistance, but the power of example as well. That has already occurred to some degree in the development of more energy-efficient industrial processes and consumer products, but it will become far more persuasive when it includes more substantial shifts to renewable, non-polluting energy sources, compliance with stringent targets to reduce carbon emissions, and the pursuit of less energy-intensive lifestyles. ●

Nicholas Lenssen is a senior researcher and the author of Worldwatch Paper 111, Empowering Development: The New Energy Equation.

To: Mr. Richard Emerman
Alaska Energy Authority
P.O. Box 190869
Anchorage, AK

Date: March 15, 1993

From: Mark H. Clark
P.O. Box 242
Sutton, AK 99674

Concerning: Proposed Copper Valley Intertie Project

Dear Sir:

I would like to make a few brief comments concerning the proposed Copper Valley Intertie Project. In 1984, I built my home approximately two miles northeast of Sutton in the southeast quarter of section 13, T.19N., R.3E. on the Little Granite Creek Bench (see attached map). There are currently four families that reside here year-round. Eight 10-acre parcels and four 40-acre parcels are located on the Bench, all of which would be crossed by the proposed intertie.

I chose the site because of the unrivaled view of the Talkeetna and Chugach Mountains and the fact that the land is bound on the north and east by the Matanuska State Moose Range. The value that I derive in terms of quality of life is impossible to measure in terms of dollars and cents. I assumed the risk that coal development was possible, but I was aware and I made the choice to buy and build here. I was surprised to see the resurrection of the intertie project especially after the overwhelming opposition that it received from upper Matanuska Valley residents two years ago.

I am not convinced that all alternatives have been given adequate concideration especially when so little appears to be known about the corridor. The following information seems critical for making an initial estimate of intertie feasability before any alternative can be discounted.

1. Land status along the proposed corridore has not been established.

2. Engineering and continuing maintenance problems associated with constructing a powerline through mountainous terrain and over approximately 65 miles of permafrost. Conventional pole installation suited for nonpermafrost terrain are not adequate for permafrost areas where frost temperatures approach 32 degrees F. I suggest you take a drive to Glennallen and observe Copper Valley's power poles along the highway. I also suggest you talk to the department of transportation in regards to continuing maintenance of the Glenn Highway at the crossing of the Little Nelchina or the Richardson Highway at Simpson Hill south of Glennallen. Please speak with the Trans-Alaska Pipeline Service in regards to thermokarst

subsidence problems at the pipeline crossing at the Klutina River.

3. Wetland mitigation costs for crossing approximately 65 miles of land currently mapped as wetland by the National Wetland Inventory.

Without this fundamental information, I have a difficult time envisioning how any alternative could be adequately compared or negated.

A commodity that is more difficult to assess than price per kilowatt hour is the value that local residents place on living qualities. Why should Mat Valley residents be expected to compromise these values so that Copper Basin residents can enjoy lower cost power without any personal sacrifice? We all have the opportunity to chose where we live and the conditions under which we live. Glennallen residents do not pay property taxes yet receive road service, schools, and emergency medical service courtesy of the state of Alaska. I have chosen to live in the Mat-Su Borough and pay Borough property taxes. At parity, I pay a total tax and power bill that is approximately 28 percent more than a comparable home owner in the Copper Basin.

Many upper Valley residents derive their living directly or indirectly from tourism. Most businesses survive on a thread due to the brief summer tourist season. Any activities in the valley such as the installation of the intertie that would deter even a fraction of the tourists from the Valley would bankrupt tourist based businesses.

The intertie makes no sense economically, environmentally, and from the perspective of living qualities that would be lost.

Mark H Clark

Sincerely,
Mark H. Clark

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MAR 23 1993

ALASKA ENERGY AUTHORITY

DOCUMENTATION OF PUBLIC COMMENTS
ALASKA ENERGY AUTHORITY
COPPER VALLEY INTERTIE FEASIBILITY STUDY

You are invited to comment on the proposed Copper Valley Intertie Project which would consist of a 138-kV electric transmission line from Sutton to Glennallen. The Alaska Energy Authority is conducting the first Phase of a planned two-phase feasibility study of the Intertie. Two sets of public meetings will be held in Phase 1 at which comments may be voiced. Phase 2 of the feasibility study will follow in the second half of 1993, if funding permits, and would include one additional set of public meetings.

The comments of all parties who may be affected by the construction and operation of the Intertie are important to the study. Verbal comments will be recorded at each public meeting. In addition, this comment sheet is provided as a convenience to any party wishing to comment. However, use of this comment sheet is not necessary in order for your comments to be considered. We request that any comments be as specific and detailed as possible. Do not feel limited by the space provided; attach additional sheets as necessary. Attached for your reference are seven maps showing two preliminary route alternatives identified as a starting point for the feasibility study.

Please submit your comments as soon as practical to the following:

Mr. Richard Emerman
Alaska Energy Authority
P.O. Box 190869
Anchorage, AK 99519-0869

Comments will be included in the reports provided they are received at least two weeks prior to the publication of the reports. Tentative dates are June 15, 1993 for the Phase I report and October 1, 1993 for the draft Phase 2 report.

Name of Person Commenting: Michelle [illegible]

Mailing Address: [illegible] Box 809
Sutton AK 99674

TRACT E
NE1/4 SE1/4, Sec 13
T19N, R3E, Seward Merid.

COMMENTS:

This proposed intertie would severely impact the quality of life Alaska values itself in having. The short term affects, much less the long term affects, are equated as profits for Copper Valley, the oil industry in Valdez, and possibly, not as costly electrical costs for the residents in Copper Valley. As a resident of the Mat-Su Valley, I am being forced to give up my quality of life, my values, for savings + profit of the Matsu Copper Valley. My concerns are with

Continued on Back

COMMENTS: (Continued)

health of our resources, children, wildlife, water, and air; wildlife impacts, tourism, and my property. I see only negative impacts from this development:

1. Proven - facts proven that powerlines cause leukemia especially in children & other forms of cancer (New England J. of Med. 2 months)
2. Proven - powerlines have caused cancerous tumors in livestock grazing near them (W.Sh.)
3. Visual / Scenic - No matter which alternative this interties is placed it will have neg results on tourism: air traffic, whitewater rafting, Kayaking, snow machining, hiking trails, cross country skiing, etc. People rely on tourism in the Valley. Tourists come to Alaska for its' Natural Quality! The loss of revenue from this would make 18¢/Kwhr look minute.
4. Wetlands - this interties would impact over 100 miles of permafrost wetlands! All you need to do is see the current maintenance problems this would cause!
5. Wildlife. In addition waterfowl are abundant in the areas this line wants to impact. The effects on the health of Caribou, moose, bear and Sheep would be disasterous! In my area alone, goshawks, great gray Owl, ptarmigan, bald eagles, ruffed grouse, grizzly bear would be severely, if not completely, damaged.

I have given up many professional opportunities for my choice to live in this pristine area. It also costs us more than it does for people in Glennallen - We, Mat-Su Valley pay property taxes - This equates to 28¢/Kwhr in comparison to Copper Valley 19¢/Kwhr! But, it was my choice to live here & W/ that choice I accepted to live without the amenities that people in the city have. I feel there are better alternatives like keeping Fairview in Valdez! This alternative currently proposed is asking too many, and Alaskans, to give up the beauty, integrity, & quality of Alaska's scenic communities! Michelle Schumacher

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MAR 23 1993

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Name of Person Commenting: HANS STRICKER

Mailing Address: HC03 Box 8364-X
PALMER, ALASKA
99645

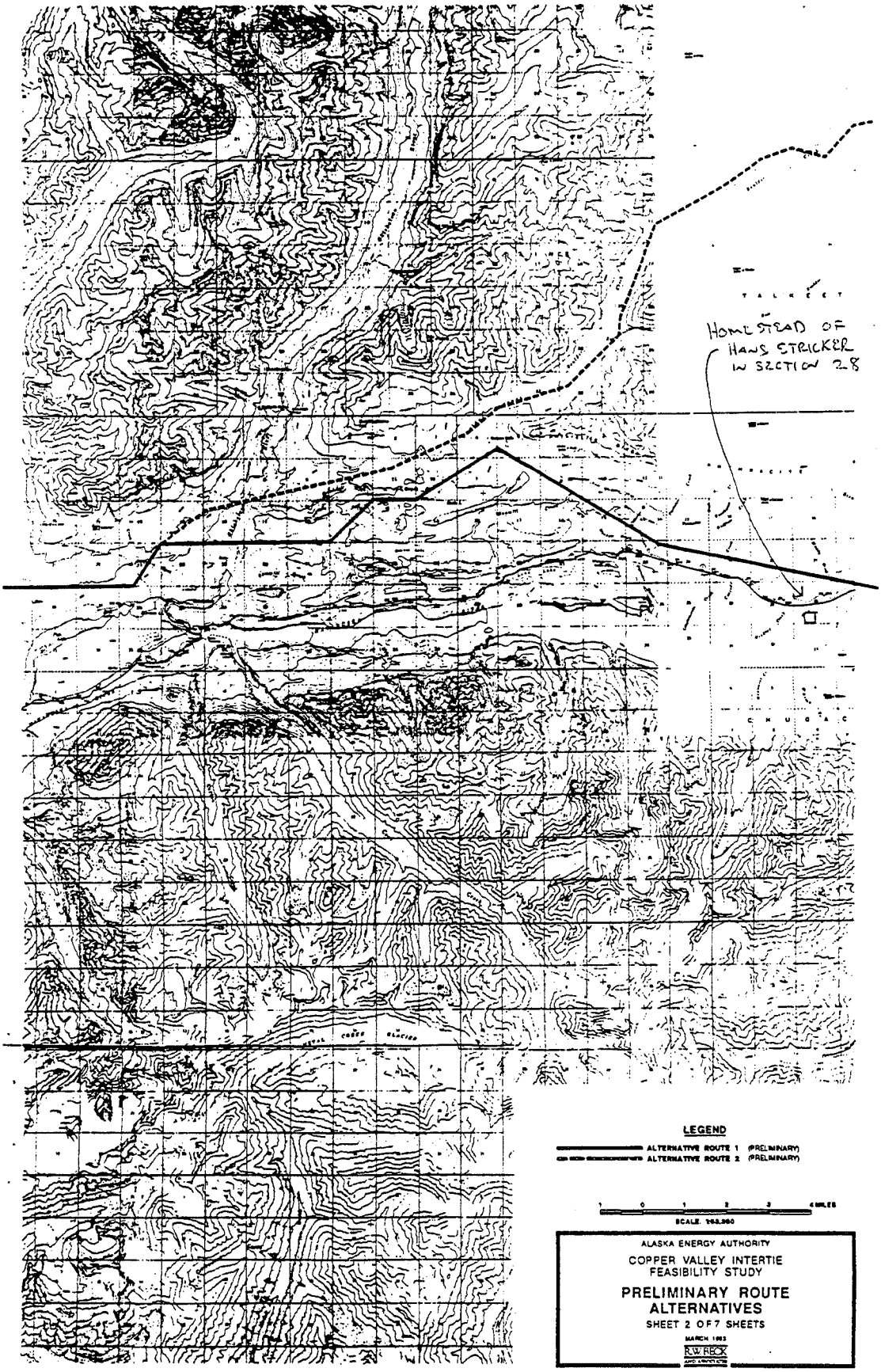
COMMENTS: MR. RICHARD EMERMAN! SECTION 2.8 IS WHERE MY HOMESTEAD IS. WHERE I CALL HOME. I DREW IT IN FOR YOUR CONVENIENCE ON THE ACCOMPANYING MAP. EVEN THOUGH I KNOW THIS INFORMATION IS AVAILABLE TO YOU THROUGH THE STATE AND MAT SU BOROUGH. I COULD LIVE WITH THE POWER LINE WHERE YOU DREContinued on Back ON THE RED SOLID LINE. PROVIDING YOU MOVE IT NO CLOSER. HOWEVER BECAUSE IT RUNS THROUGH VICTORY BIBLE CAMP I SHALL CONTINUE THIS →

COMMENTS: (Continued)

DOTTED LINE THAT TAKES THE BACK COUNTRY THROUGH BOULDER CREEK. THIS IS HOW I STAND ON THIS ISSUE. THANK YOU HANS STRICKER

Hans Stricker

P.S HOW WOULD THE LOCALS GO ABOUT GETTING A JOB ON THIS PROJECT


HOMESTEAD OF
HANS STRICKER
IN SECTION 28
LEGEND
ALTERNATIVE ROUTE 1 (PRELIMINARY)
ALTERNATIVE ROUTE 2 (PRELIMINARY)
SCALE 1:63,360
ALASKA ENERGY AUTHORITY
COPPER VALLEY INTERTIE
FEASIBILITY STUDY
PRELIMINARY ROUTE
ALTERNATIVES
SHEET 2 OF 7 SHEETS
MARCH 1983
R.W. BECK

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Name of Person Commenting: Dianne + Milo Milic

Mailing Address: P.O. Box 22
SUTTON
AK 99674

COMMENTS: WE STRONGLY OPPOSE ANY HIGH POWER ELECTRIC LINES ANYWHERE NEAR THE TOWN IN WHICH WE RESIDE. THAT KIND OF POWER LINES SHOULD BE AT LEAST 5-10 MILES FROM RESIDENTIAL AREAS. CONSIDER THE AMOUNT OF SNOW WE GET, Continued on Back
THEY EMIT TOO MANY MICROWAVES, AND WHEN THEY COME DOWN THEY WILL ELECTROCUTE ANYBODY NEAR THERE

OFFICE OF THE GOVERNOR
3601 C STREET, STE. 758
ANCHORAGE, AK 99503
(907) 561-4228

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APR 01 1993
ALASKA ENERGY AUTHORITY

PUBLIC OPINION MESSAGE

May send 25 words or less, directed to Governor Hickel, Lt. Governor Coghill, or Commissioners.

cc: Comm. Fahs

Date: 3/16/93

From: Patricia Grinzell-Lee **Phone:** 279-7175

Address: 3604 Fairbanks
Anchorage

Zip Code: 99503

Subject: Proposed Electrical line / Sutton - Glenallen

Message: Because of the natural scenic beauty, and also the health risk to humans and animals, I am totally opposed to this line being put in.

Operator: Wanda

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APR 01 1993

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Mr. Richard Emerman
Alaska Energy Authority
P.O. Box 190869
Anchorage, AK 99519-0869

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Name of Person Commenting: Donna Brendel

Mailing Address: PO Box 1138
Chickaloon, AK 99674

COMMENTS: I can see no real advantage and very definate disadvantages to the intertie proposal and I am against it. Not only will it be unsightly in the extreme, I believe the many will be unfair to wildlife and people alike. The same

Continued on Back

COMMENTS: (Continued)

to this area originally, as many people did. Because it is an extreme rural setting with a minimal amount of man made eyesores - and nothing is more visually objectionable than huge towers and electric lines -

Give us a break - surely you can do better than this in this day and age! A resounding NO! on this one folks!

Donna Brandel

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APR 0 2 1993
ALASKA ENERGY AUTHORITY

DOCUMENTATION OF PUBLIC COMMENTS
ALASKA ENERGY AUTHORITY
COPPER VALLEY INTERTIE FEASIBILITY STUDY

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Name of Person Commenting: [redacted]

Mailing Address: [redacted]
P.O. Box [redacted]
Sutton AK
99674

COMMENTS: I am against The Construction of ~~The~~ The Electric Transmission Lines from Sutton to Glennallen as I feel That it would greatly effect The quality of life for all of us That live in The Sutton AREA. I feel This would also be an Unnessecery Health hazard for The Children of The Sutton School area.

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APR 0 5 1993

ALASKA ENERGY AUTHORITY

April 1, 1993

Richard Emerman
Alaska Power Authority
P.O. Box 190869
Anchorage, AK 99519-0869

Dear Mr. Emerman:

This letter is in response to the proposed Copper Valley Intertie Project which would consist of a 138-kv electric transmission line from Sutton to Glennallen.

During the public meeting held in Sutton on March 15, 1993, some serious questions were raised on the feasibility and impact of such an impending proposal. This project is more than just a transmission line from Sutton to Glennallen, this is an energy corridor that requires a 150' cleared easement and condemns a 900' wide space for homes and other daily human activities. The plan for this corridor is to cross residential areas in the communities of Sutton, Chickaloon and other private properties along the Glenn Highway.

So what are the implications of this proposal? Well, first and foremost is, or should be, a concern for health. In 1990 the Environmental Protection Agency issued a warning linking electromagnetic fields with leukemia, lymphoma and brain cancer. Two studies done in Sweden by Stockholm's Karolinska Institute and Sweden's National Institute of Occupational Health linked a higher risk of leukemia in children living near high tension lines and leukemia in working men exposed to electromagnetic fields. How much of the Copper Valley Intertie Feasibility Study included health risks and who involved with this project is willing to take responsibility for the health of our children?

Another very important consideration is the overall impact on the environment including fish and game. Besides the negative visual impact of such a gross slash through one of the most scenic valleys of Alaska, what about the sudden impact on wildlife from off-road traffic accessed by the corridor easement. The study also needs to address the impact on critical habitat areas, wetlands, tourism, and the possibility of a bark beetle epidemic caused by cutting spruce trees.

Why are we even considering such a proposal when Copper Valley Electric Association already produces its own power with a surplus? According to MEA and Copper Valley Electric Association we are asked to sacrifice to provide Copper Valley with lower electrical rates, from approximately .20 per kilowatt hour to .11 per kilowatt hour. But is this the most feasible approach to this problem? It could be if you are only concerned with the cheapest costs. Usually though the cheapest is the most intrusive and the least safe. It could also be very feasible to those trying to justify a $40,000,000 handout from the State; i.e. the Railbelt Energy Fund to fund this ramrod approach at the expense of a more viable solution.

During the public meetings a number of alternative proposals were identified that need to be studied. They include:

- A coal generating plant in Glennallen utilizing Alaska's coal reserves.
- The utilization of identified natural gas reserves in Copper Valley for a generating plant.
- Determining the feasibility of a potential natural gas pipeline from the North Slope or McKenzie gas fields which could be used as fuel for a generating plant.
- Producing electricity from a hydroelectric facility in the Copper Valley. This would be the cleanest and most renewable resource.
- An intertie from Delta to Glennallen.
- Burying the transmission line.

MEA, CVEA and AEA need to re-evaluate this project and be more receptive to the alternative options previously discussed before they damage the health and lifestyle of our community. So, let's burn those lightbulbs a little brighter and come up with something more conducive to a modern frontier. Our quality of life depends on everyone.

Mark Bertels

Mark Bertels
Sutton

My name is Lee McEntee I'm 11 years old and I am writing to say I hope they dont put that big powerline in. I hope that when I grow up there is someplace left on earth were there is mountains, trees, and rivers and not powerlines, pipelines and roeds. My family drives along the Glenn Highway for camping and berry picking. it's the most beatiful road in the world. Please don't ruin it.

Sincerly,
Lee McEntee

Shawn McEntee
P.O. Box 4
Sutton, AK 99674

Dear Sir,

I am a 30 year resident of Alaska. I deeply oppose the construction of the intertie beginning in Sutton. I still remember my disappointment and sense of loss the first time I drove the Richardson Hwy. after construction of the pipeline. It seemed to obstruct and destroy every beautiful scenic spot I had always stopped to admire.

Then the powerline along much of the Parks Hwy. scenery appeared, doing as much scenic damage, and impacting local residents with dangerous high voltage.

Please don't destroy the remaining scenic hwy. with the scars and ugliness of the powerline to Glennallen. Skin in the tourist business. This stretch of highway is my favorite for visitors from out of state. It's main appeal is the absolute beauty of being surrounded by such an abundance of nature.

Can't there be an area relatively untouched by man? Will these areas become non-existent, so my children can only imagine what mother nature created so many millions of years ago?

I don't want to live with this powerline, and I don't want to look at it. I think 99% of the tourists enjoying that scenic world class dive into, out of, or around this area would agree.

Sincerely.

Sharon McCabe

Please count me as one of the local residents affected by the proposed power line who is totally opposed to the plan.

Why would you want to build an unsightly health hazard through our back yards. I'm sure you would not want this to happen To you.

If the power line is is absolutly necessary then why not follow the existing highway.

Why must more land and lives be ruined so some one up the highway can also begin paying a monthly electric bill.

If the potential subscribers are along the highway, then let the new line also follow the highway, especially through Sutton.

PAT McENTEE
BOX 4 SUTTON AK 99674

HC04 Box 9625
Palmer, Ak. 99645

April 5, 1993

Dear Mr. Emerman,

The proposed intertie project of the Copper Valley Electric Association, Inc., between Sutton and Glennallen would pass through a landscape viewed from the Glenn Highway that has a very great scenic value. The character of the landscape is one of wilderness and a large power transmission line would forever mar the land, detracting from the experience of residents and tourists traveling the Glenn Highway. The visual impact is just too great to allow construction of the line.

Construction and right-of-way clearing would also increase access for off-road vehicles in the area between Sutton and Bronsight Mt. This area is already heavily used and impacted by motorized use.

Though I do sympathize with the members of the Copper Valley Electric Association for less expensive electrical rates, I urge the Alaska Energy Authority and the Copper Valley Electric Association to seek other alternatives.

Yours truly,
Allen R. Mansfield

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APR 0 8 1993

ALASKA ENERGY AUTHORITY

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COPPER VALLEY INTERTIE FEASIBILITY STUDY

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Name of Person Commenting: Craig Baer

Mailing Address: P.O. Box 245
Sutton, AK 99674

COMMENTS: see attached sheet

Continued on Back

I have been a resident of Alaska for fifteen years, having lived near Fish Lake, in Chickaloon for the past ten years. I have hiked, hunted, and skied in the country the proposed Intertie would pass through, an area of exceptional scenery. Through the years, I have observed the recreational usage for hunting, hiking, skiing, snowmachining of this area of the Talkeetnas increase, by not only residents, but many more from the Mat-Su Valley and Anchorage. It is an area of wilderness accessible by vehicle to a large proportion of Alaska's population.

Building an intertie would forever change the character of the country used by many, being an eyesore and a health hazard. There must be other alternatives for Copper Valley Electric, even if more costly, because the cost of forever altering this beautiful country is beyond measure. I find the proposed Intertie totally unacceptable, not only as a resident, but for the many who use the area for recreational use.

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Name of Person Commenting: Deborah Walker

Mailing Address: PO Box 246
Sutton Ak 99674

COMMENTS:

Jim opposed to the intertie to Glennallen. It'd be alot more viable if they built a generatorsytem up there.

It's been proven outside that these highlines are dangerous to a persons health, and it'd be an investment hazard.

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Name of Person Commenting: George Coon

Mailing Address: 223
Sutton Ak 99674

COMMENTS: Highline too expensive & be too much of an environmental hazard. As a Coop we receive dividends, our rates would be cut because we'd be paying for it.

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APR 0 8 1993

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Name of Person Commenting: PETER E OLIVA II

Mailing Address: MILE 93 GLENN HWY
HC03 BOX 8364
PALMER AK 99645-9404

2-APR-93

COMMENTS: I AM OPPOSED TO THE ROUTING WHICH WOULD BE ADJACENT TO THE GLENN HWY IN THE GLACIER VIEW AREA. THE BOULDER CREEK ROUTE WOULD NOT IMPACT THIS AREA, SO I SUGGEST

Continued on Back

THAT ROUTE.
MY WIFE ROSEMARY, SON DANIEL, AND MYSELF RESIDE HERE AT MILE 93 ON THE

GLENN HWY.

I CAN THINK OF NO REASON TO PUT THE INTERESTS OF THE INTERTIE OVER AND ABOVE THE RESIDENTS MENTAL & PHYSICAL WELL BEING, PERIOD!

I WILL DO ALL I CAN TO CONVINCE MY REPRESENTATIVES, AND YOURSELF THAT THE GLENN HWY ROUTING IS TOTALLY UNACCEPTABLE.

THANK YOU,

Sincerely

Robert Eakin

COPIES: REP HARLEY OIBERG
SEN GEORGANNA LINCOLN

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APR 21 1993

ALASKA ENERGY AUTHORITY

April 8, 1993

Dear Mr. Emerman,

We are writing to express our concerns over the proposed 138 Kv intertie between Sutton and Glennallen. We are very much opposed to it for the following reasons:

1. The intertie corridor will have an extremely detrimental impact on the surrounding area. The inevitable access roads will provide easy entry for all forms of off road vehicles. This in turn will forever change the pristine quality of the area, as more noise, pollution, and scarring of the forest and the fragile tundra ensues. It will also increase hunting pressure in an area that is already at capacity. In Chickaloon, the intertie will cross a drainage that has provided drinking water for as long as there have been people in the area.

2. The intertie will have a negative impact on several local businesses. Groups like National Outdoor Leadership School and Nova River Runners are dependent for a good part of their business in the very areas the intertie will cross. Significantly, quite a number of their customers are from the Lower 48. They have come to Alaska for a pristine experience, and have put their dollars into the local and Alaskan economy to have this experience. Collectively, the amount they contribute is far more than any savings (if there really is any) to be gained from an intertie. They will not pay to hike and raft across an area degraded by an intertie.

3. The proposed route closely follows the historic Chickaloon - Nelchina-Knik trail system. This collection of trails not only has historic value, but provides rare road access to a wide variety of backcountry experiences, including hiking, horseback riding, ATV use, snowmachining, and skiing. The character of these trails would be destroyed.

4. We question why people along the Glenn Highway should be negatively impacted so that people in essentially a different part of Alaska can have cheaper power. Presumably they knew the cost of power when they moved to the Copper Valley. We also question why we should suffer so Petro Star Refinery (who has already demonstrated a willingness to cut corners on such things as environmental impact statements) can buy the copious amounts of power they use a little cheaper. Presumably, they too knew what they were getting into when they built the refinery. We forsee our electricity bills rising to support and maintain an expensive infrastructure we never asked for.

These are just a few of the many reasons why we and almost all of the people between Sutton and Glennallen are opposed to this proposed intertie.

Thank you,

Jeff Arndt and Mary Barrett
P. O. Box 124
Sutton, Alaska 99674

April 8, 1993

Laurie Dilley
P.O. Box 3247
Palmer, AK 99645

Mr. Richard Emerman
Alaska Energy Authority
P.O. Box 190869
Anchorage, AK 99519-0869

Dear Richard,

It has recently come to my attention that there is a plan being reviewed by your office to construct an electrical intertie from around the Palmer area to Glennallen.

I am opposed to construction of this intertie for several reasons. The first being the recent scientific findings and public concern about electro-magnetic fields and their impact on the human body. Though this concern is still under study does it make sense to move forward with large above ground powerlines at this time? If studies or pending lawsuits are settled against the utility companies they had better be prepared to purchase any property within the possible range of harm. The number of homeowners to be impacted may not be large by your standards, the communities of Sutton and Chickaloon for example, but to every parent with childern who live in these areas any risk is too high.

The visual, and possible health impacts, to tourists and Alaska residents alike who travel, hunt, fish, hike, snowmachine or sightsee in the vicinity of the Glenn Highway will be negatively impacted. The Anchorage-Fairbanks intertie on the Parks Highway has downgraded the beauty of this drive to feel like Anyplace USA, and who enjoys driving under the lines to hear their radio crackling while knowing that the family is being needlessly exposed to electro-magnetic fields.

The driveable roads in Alaska are limited for residents and tourists alike, the Parks Highway has the Anchorage-Fairbanks Intertie, the Richardson Highway has the pipeline. Must we degrade the value of the stunning beauty of the Glenn Highway with giant powerlines?

No this powerline won't be in my backyard per se, but isn't the wilderness of Alaska everyones backyard?

Thank you for the opportunity to express my views on this subject.

Sincerely,

Laurie Dilley

Laurie Dilley

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APR 15 1993

ALASKA ENERGY AUTHORITY

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Name of Person Commenting: Tom Wells

Mailing Address: Bx. 46
Sutton AK 99674

COMMENTS:

The proposed intertie would lower the quality of life for me personally and my family. We use the ridge for hiking and would not want a power line so close to our home. Real Estate values are also a consideration.

The intertie is to expensive at 60 million. Continued on Back

There are alternatives for the people of Glenallen and the Copper Valley area.

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APR 12 1993

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Name of Person Commenting: Gorrie Gardner

Mailing Address: PO BOX 204
Sutton AK 99674

COMMENTS:

I am opposed to the Proposed Intertie proposal because I feel it is a health hazard and would be a severe damage to the environment in the surrounding Communities. I also feel that copper center has adequate facilities which could better serve Glennallen & area. with the building of a new refinery in Valdez there will be an added need for more power which will be accomodated by the Copper Basin power co. by Gas or power produced by the [illegible] Intertie System!

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Name of Person Commenting: Lynne Woods

Mailing Address: PO Box 37
Sutton, AK 99674

COMMENTS: I am very concerned about the proposed Intertie Project. Alternative routes do not mitigate my concerns on residential and commercial current use of environment impacts of the transmission line. Most future growth in the Glenn Highway corridor will also be on the north side of corridor.

In addition, I feel alternative sources to supply power would have less impact and are more cost effective to the state.

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APR 1 / 1993

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Name of Person Commenting: LINDA KETCHUM

Mailing Address: P.O. BOX 1132
CHICKALOON, AK 99674

COMMENTS:

A resident of Chickaloon since 1986, I attended the informational meetings at Glacier View and Chickaloon and listened to the presentations and all comments with interest. My instinctive reaction to the proposed intertie is total opposition, no matter how many reasoned arguments are presented in its favor. When is society - in this case the utility companies - going to stop basing its development decisions on the dollar cost instead of giving equal weight to the social and environmental costs? For the money invested thus far in cost analyses and feasibility studies, CVEA could have solicited sound proposals from the private sector, including alternative energy sources such as natural gas, wind and solar power.

Continued on Back

COMMENTS: (Continued)

We bought 80 acres on the Chickaloon River in 1989 which we intend to make our home for life. Last fall our first son was born; we finally felt comfortable we had found a suitable environment in which to raise a child. We would never have chosen to locate anywhere near a transmission line, yet may unwillingly have one thrust upon us only a mile from our home. We are not MEA members, having chosen to be energy self-sufficient. At present we use solar panels, which will eventually be supplemented by a wind generator instead of diesel generation.

I have several objections to this intertie, which are listed below:

- This 80' line will be an eyesore whether or not it is located on the highway
  - on the highway it will have a negative impact on the natural beauty of the area, in my mind the most scenic corridor in the Matanuska-Susitna Borough
  - in the backcountry it will desecrate a popular and accessible recreational area of the state.

  If CVEA switches to a different (cheaper?) energy source, we're stuck with this monstrosity in our backyard for perpetuity.

- The line follows or traverses the historic Knik-Chickaloon-Nelchina Trail for the greater part of its length. The Matanuska-Susitna Borough Cultural Resources Division has received a federal preservation grant to survey the trail in order to identify and evaluate historically significant sites along its route to help local communities document and preserve their history and culture. It's an understatement to note that such a transmission line would considerably detract from the historic value of this famous trail.

- The proposed route cuts a relentless swathe through the Matanuska Moose Range. Opening up access to this would irrevocably affect the nature of hunting for local residents. Game is scarce as it is, but even if construction brings increased moose browse it will also bring unceasing droves of hunters from Anchorage and the Valley with their accompanying all-terrain vehicles. This will impact all wildlife in the area.

- The Chickaloon community was sufficiently concerned about potential siting of transmission lines to include them in the "conditional use" category in the Matanuska-Susitna Borough ordinance implementing the 1991 Chickaloon Comprehensive Plan.

- Last, but not least, the controversy generated by epidemiological studies linking exposure to ELF EMF's with a variety of cancers, whether or not the scientific establishment discounts these as "not proven", has prompted the EPA to demand closer examination and policymakers to recommend "prudent avoidance". Personally, I prefer to avoid all exposure to a risk for which no "safe" level of exposure has been established.

Since utilities are chartered to serve in the public interest, with the responsibility of putting public welfare first, I question whether CVEA has the right to compromise the welfare of my family and neighbors in the interest of stabilizing its members' electric bills. We chose to live here in full knowledge that electricity, should we opt to hook up to MEA, would be expensive. I cannot imagine Copper Valley residents deluded themselves into thinking utilities would ever come cheap in their area of the state.

Linda Ketchum 4-13-93

DOCUMENTATION OF PUBLIC COMMENTS
ALASKA ENERGY AUTHORITY
COPPER VALLEY INTERTIE FEASIBILITY STUDY

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APR 1[illegible] 1993

ALASKA ENERGY AUTHORITY

You are invited to comment on the proposed Copper Valley Intertie Project which would consist of a 138-kV electric transmission line from Sutton to Glennallen. The Alaska Energy Authority is conducting the first Phase of a planned two-phase feasibility study of the Intertie. Two sets of public meetings will be held in Phase 1 at which comments may be voiced. Phase 2 of the feasibility study will follow in the second half of 1993, if funding permits, and would include one additional set of public meetings.

The comments of all parties who may be affected by the construction and operation of the Intertie are important to the study. Verbal comments will be recorded at each public meeting. In addition, this comment sheet is provided as a convenience to any party wishing to comment. However, use of this comment sheet is not necessary in order for your comments to be considered. We request that any comments be as specific and detailed as possible. Do not feel limited by the space provided; attach additional sheets as necessary. Attached for your reference are seven maps showing two preliminary route alternatives identified as a starting point for the feasibility study.

Please submit your comments as soon as practical to the following:

Mr. Richard Emerman
Alaska Energy Authority
P.O. Box 190869
Anchorage, AK 99519-0869

Comments will be included in the reports provided they are received at least two weeks prior to the publication of the reports. Tentative dates are June 15, 1993 for the Phase I report and October 1, 1993 for the draft Phase 2 report.

Name of Persons Commenting: John & Catherine Greiling

Mailing Address: P.O. Box - 363
Sutton - AK
99674

COMMENTS: I [illegible] everyone is more concerned with health hazards associated with high tension lines. [illegible] [illegible] always [illegible] [illegible] [illegible] expect to [illegible]

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APR 15 1993

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Name of Person Commenting: Shirley V. Buchholz

Mailing Address: P. O. Box 254
SUTTON, AK 99674

COMMENTS: Regarding the Proposed MEA-COPPER VALLEY INTERTIE: Why is the Feasability study being done and the lobying for the $40 million Appropriation before any Public review Process has been done. There should be feasability studies done on other alternatives as coal, natural gas & hydro electric - all available in the Copper Valley area, or what about the Pipeline burn off in Valdez that Alyeska would Prefer

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the Copper Valley Association can't or wont Tell us where the propose to put this line which would necessitate a 150 foot line cut through & condemn a 900' wide electro magnetic field area. I am totaly against this intertie.

To date (7 years now) MEA hasn't seem fit to even put electricity in to my home 1/2 mile from the existing lines. but they seem to expect me to sit and watch while they run this huge monster by where I have to look at it all the Time and maybe even condemn my home in the process.

Sheila Buckley

Paul F. Twardock
Box 544 4101 University Dr.
Anchorage AK 99508
907-279-0409

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APR 21 1993
ALASKA ENERGY AUTHORITY

4-19-93

Richard Emerman

AEA
PO Box 190860
Anchorage AK 99519-0869

Dear Mr. Emerman.

I am concerned about recent news of a new intertie powerline between Sutton and Glenallen. Could you please put me on your mailing list for any information you have on this project.

I have heard that a couple of the proposed routes have the line going away from the Glen Hwy and in to the Talkeetna Mountains. My primary concern is that the area is one of superb wilderness recreational values. My next concern is that the Glen Hwy is my favorite 'scenic' drive and I would hate to see that scenery interrupted by another bunch of metal 'rabbit ears.'

Sincerely.

Paul Twardock

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APR 19 1993

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Anchorage, AK 99519-0869

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Name of Person Commenting: Joyce Mays-Rabbit

Mailing Address: 1829 Laurel Avenue
Manhattan Beach, Ca. 90266

COMMENTS: There have been recent studies showing a relationship between power lines and cancer - Nothing should be built within 2 miles of homes or schools. Plus the area you are going through is rife with wild life that will be disturbed/ unnecessa

Continued on Back

DEAR Mr. Emerman

I have been a Sutton land owner since 1985. I Am Angry About The proposed Intertie between Sutton and Glennallen because I understand There ARE other Alternatives That can supply Copper Valley with Their needed power without Affecting The property values, Lifestyle, environmeaeTheTics and even possible health of The MAT-Su. Valley ResidenTS. I recently Attended A meeting in Sutton which supplied inGormaTion on This proJecT. At This Time, I would like To express my views So ThaT They may Support The oTHers who ARE ageinST This proJecT.

I Am concerned About The health RisKS To my family and The community. There has been nothing in writing To Prove ThaT The health RiSKS ARE NOT 100% questionab I Am especially concerned for The affecTs on my 14 monTh old Son. I Am not willing To Gamble ThaT There ARE not any negative Consequences For being exposed To The cable Area.

I resenT having To pay moneTaril as well As with land depreciaTion VALUE for Those in The Copper Valley when

expensive electric bills and we are expected to sacrifice much more. If Copper Valley promised petro STAR electric power, then let Copper Valley find a way to provide that power without having the Mat. Su. residents suffer not only health risks and land devaluati but also flipping some of the bill.

This has greatly affected my lifestyle because I can not improve on my property until this matter is settled. Even after it is, I do not feel secure in the fact that the matter will be permanently settled and Am considering selling my property as a result of this matter. I enjoy my cabin in Sutton and take guests year round to the Mat. Su. valley to enjoy the recreation it provides for my friend and family. This intertie would put an end to that, and I am sure alot of commerce that comes into the Valley from people like ourselves and friends.

In conclusion, I would encourag this Intertie not be built and other Alternatives explored. Thank you for your time.

Sincerely,
Sutton Resident Si
1985

DEAR MR. EMERSON,

I AM RESPONDING TO THE INFORMATION I HAVE RECENTLY RECEIVED REGARDING THE PROPOSED COPPER VALLEY INTERTIE PROJECT BETWEEN SUTTON AND GLENNALLEN. I HAVE SEVERAL VIEWS ON THIS SUBJECT THAT I WOULD LIKE TO EXPRESS AT THIS TIME. MUCH OF MY OPINION COMES FROM A SUTTON COMMUNITY MEETING I ATTENDED LAST WEEK.

FIRST, I HAVE NOT READ NOR HEARD OF ANY EVIDENCE THAT SUGGESTS SUCH AN EXTREME MEASURE AT THIS TIME IS NECESSARY. I UNDERSTAND THAT THERE ARE MANY OTHER ALTERNATIVES, SUCH AS COAL, HYDRO ELECTRIC OR NATURAL GAS, TO NAME A FEW, THAT SHOULD BE EXPLORED. THESE MAY BE MORE COST EFFECTIVE AND/OR LESS OBSTRUCTIVE TO THE NATURAL SURROUNDINGS IN THE MAT. VALLEY. I DO NOT SEE WHY, AT THIS TIME, RESIDENTS OF THE MAT. VALLEY MUST PAY AND SACRIFICE FOR NOT ONLY 2600 RESIDENTS OF COPPER VALLEY, BUT MORE SPECIFICALLY FOR ELECTRIC SERVICE FOR PETRO STAR. COPPER VALLEY PROMISED THEM SERVICE, THEN LET COPPER VALLEY PROVIDE THE SERVICE. I DO NOT SEE WHY PRIVATE CITIZENS IN THE MAT. SU. VA

corporations. If Copper Valley promised Petro STAR Adequate service, Then let Copper Valley Residence SACRIFICE Their property values, lifestyles, environment and possibly health. We did not invite industry And progress to our community and we should not have to pay for it.

I Am Also concerned About The Health factor. I do not WANT my Family subjected to something That may be harmful. What About plants And wildlife? If we cannot get 100% Accurate information on This, I do not want my family to be guinea pigs for such unknown Factors.

I Am not able to improve on my property AT This time because of The fact That This INTERTIE may be built; And if so, probably depreciate The value of my property. Although it has been verbally promised That no private land will be Affected either physically or by view obstruc I have nevertheless not seen anything in writing That promises our property in Sutton will not suffer consequences of This projecte 80 ft. high pole--cable project. I will not invest more money in our Mat-Su property with This up in The

in Sutton my compromise Their Lifestyle and AeThetics of The Mat-Su Valley, when There Are other viable Alternatives.

In conclusion, I Am Against The construction of The Intertie between Sutton and Glennallen. I Think other Alternatives should be more seriously considered and explored. I do not Think That The Mat-Su. Valley Residents should have to pay for or sacrifice Their lifestyles for Those (unnecessarily) in The Copper Valley. I do not want my family exposed to The Health Risks This project may bring. Although I bought my property because I love The environment, wildlife and pure quiet and beauty and peaceful Nature I hate to see The land value depreciate because of an 80 FT. pole monstrosity That can be Avoided.

Thank you for your time. I have chosen not to Reveal my identity, I only wanted to voice my opinion so That it may be considered in The strong voice Against This project.

Sincerely,

Sutton Resident for 7 yrs.

April 15, 1993

Richard Emmerman
Alaska Energy Authority
P.O. Box 190869
Anchorage, AK 99519-0869

Dear Mr. Emmerman

I strongly appose the Copper River intertie being built from Sutton to Glennallen. I feel there has not been enough study done for alternative ways to assure that this is the only alternative for electricity.

It is my belief that there are better, more ecologically and economically feasible ways for electric to be brought to the people of Copper Center, Glennallen and Valdez.

It seems that this intertie is a short term, short sighted approach to the problem. I personally feel natural gas or hydro-electric to be a better alternative.

I moved to the Sutton area to be away from the un-healthy life style of Anchorage and other large populated areas. I want my son to be raised in as healthy environment as possible. Having a high voltage electric line going through my community is not my idea of a healthy environment.

This area is a beautiful place to live and I would hate to see the beauty ruined by a intertie running through the country side. The only thing to "gain" would be a "freeway" for 4-wheelers for all the inconsiderate people coming out from Anchorage. It would open the moose country and ruin the beauty of the country side.

Sincerely

Shirley Twitchell

Shirley Twitchell
Box 356
Sutton AK 99674

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APR 22 1993

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Name of Person Commenting: Tim Lengerich

Mailing Address: Box 4037
PALMER, AK 99645

COMMENTS:

Please add my sentiments to those adamantly opposed to the Intertie. This project would destroy the aesthetic beauty of one of the most beautiful highways in america I know. I've been on most of them.

additionally the project adds nothing for those who are most effected by its existence in their backyards.

Continued on Back

(over)