ALASKA POWER AUTHORITY

SUSITNA HYDROELECTRIC PROJECT

PLAN OF STUDY

PART B
IMPLEMENTATION OF
THE PLAN OF STUDY

SEPTEMBER 1979

ACRES

ACRES AMERICAN INCORPORATED

In Association with:

COOK INLET REGION INC. / HOLMES & NARVER INC.
R&M CONSULTANTS INC.
TERRESTRIAL ENVIRONMENTAL SPECIALISTS INC.
FRANK MOOLIN & ASSOCIATES INC.
SALOMON BROTHERS
WOODWARD-CLYDE CONSULTANTS

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PART B - IMPLEMENTATION OF THE PLAN OF STUDY

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SECTION B1 - ORGANIZATIONAL STRUCTURE OF THE STUDY TEAM

B.1.1 - Introduction

The proposed organization for the Susitna Hydroelectric Project Study is presented in Plates B1.1 through B1.8. The principal project management organization is presented in Plate 1, with succeeding plates expanding the Acres/subcontractor relationship and the five major project areas of licensing and public participation, Alaska engineering studies, feasibility studies, environmental studies and financial studies.

This section is organized in a manner to explain the key elements of the project team, as the team is displayed on the organizational plates. Detailed curriculum vitae are included in Section C4 for each key member of the proposed project team.

B.1.2 - Principal Project Management Organization

The project management workload will be divided generally as follows:

Project Manager: Mr. J. D. Lawrence will hold overall responsibility for the project. Three principal efforts will be undertaken under his direction. These include the conduct of the study itself, early and continuing financial planning, and coordination of the activities of an external engineering board. He will be responsive to the designated representative of the Alaska Power Authority. Mr. Lawrence currently holds the position of Manager of Hydroelectric Projects in Acres American Incorporated. His extensive worldwide experience spans the spectrum from planning through direction of construction management on hydroelectric projects.

External Environmental Board: An impartial board of prominent environmental specialists will be formed for the purpose of providing objective professional review and advice. This group, to be nominated by Acres and agreed to by the Alaska Power Authority, will be afforded broad latitude in its deliberations. At the same time, we regard it as a particularly necessary element in efforts to increase public and regulatory agency confidence and reduce environmental concerns.

External Engineering Board: An impartial board of eminent engineers will be formed for the purpose of providing objective professional review and advice. This group, to be nominated by Acres and agreed to by the Alaska Power Authority, will be afforded broad latitude in its deliberations. At the same time, we regard it as a particularly necessary element in efforts to insure investor confidence and reduce safety concerns.

Study Director*: Col.(Ret.) C. A. Debelius will be responsible to the Project Manager for the preparation of the Plan of Study and for conduct of the study itself. Col. Debelius was the Alaska District Engineer from 1973 until 1976 when his organization prepared the initial Corps of Engineers studies of the Susitna project. He personally conducted all public meetings on the subject during his tour of duty in Alaska and presented the findings and recommendations of the initial studies to the Board of Engineers for Rivers and Harbors.

In-House Review Panel: An in-house panel of experts will be formed from senior members of the Acres organization, each of whom is regarded internationally as an expert in his particular area of expertise. This team will be an an in-house counterpart to the expert engineering board previously described. This group has had extensive collective experience in hydroelectric work in subarctic climates and in seismically active areas. Their involvement in the Churchill Falls Project is recounted in curriculum vitae in Section C4. Members include Messrs. J. G. Thomson, D. C. Willett, J. G. Warnock, D. H. MacDonald (Ph.D.), D. E. Hepburn and M. R. Vanderburgh.

* Functions as Deputy Project Manager.

Licensing and Public Participation: Mr. P. H. Tucker will be responsible for the public participation program and the identification and compilation of data needed for the application of the FERC license, as well as all other licenses and permits needed for the study and implementation of the Susitna Project. His organization is discussed in paragraph B.1.3.

Alaska Engineering Studies: Mr. J. D. Gill will direct the Acres and subcontractor team responsible for all field work and site and regional studies. The organization for that effort is discussed in paragraph B.1.4.

Feasibility Studies: Mr. J. P. Sinclair will manage the feasibility study team composed of four subgroups of dam construction, conceptual design, hydrology and hydraulics and mechanical/electrical aspects. The feasibility study team elements are detailed in paragraph B.1.5.

Environmental Studies: Dr. J. W. Hayden of Acres American Incorporated and Mr. J. O. Barnes of Terrestrial Environmental Specialists Incorporated will be responsible for all environmental studies as well as preparation of those exhibits in the FERC license application dealing with environmental matters. The environmental organization is discussed in paragraph B.1.6 below.

Financial Studies: Mr. J. G. Warnock will be responsible for preparation of necessary plans and comprehensive documentation for public financing of the Susitna Project. No stranger to such work, he served in this role for the Churchill Falls power development and has been intimately involved as well in the Bay of Fundy Tidal Power Study, yet another giant project still in planning.

B.1.3 - Licensing and Public Participation

The licensing work and the public participation program will be accomplished primarily by Acres. The organizational structure for this effort is on Plate B.1.6. Duties and principal personnel involved are as follows:

Project Manager: P. H. Tucker will oversee this portion of the study as well as conduct the data compilation and preparation of the FERC license application and other applicable federal, state and local licenses and permits. His effort will include identification of all necessary permits, scheduling, preparation and submission of applications, and direction of all coordination necessary for successful acquisition of the license. Mr. Tucker has had extensive experience in the field of FERC licensing and permitting for hydroelectric projects, having directed those efforts for a utility with many hydroelectric projects in New York State.

Public Participation: P. M. Hoover will coordinate the assembly, review, public notice and public information programs for the feasibility study. He will also insure all statutory and regulatory requirements for providing opportunity for public involvement are fulfilled. Mr Hoover's experience in the field includes conducting public participation programs for Corps of Engineers feasibility studies. These programs consisted of formal and informal public meetings and workshops, inter-agency and citizens standing advisory groups and public notice development and distribution.

Permits: F. Klett of CIRI will direct the effort for obtaining necessary state and local permits for the study and project implementation. His extensive experience in dealing with state and local governments in major project development will assure that these permits are pursued in the most cost effective and time saving manner.

B.1.4 - Alaska Engineering Studies

These studies will be conducted primarily through the efforts and resources of R & M Consultants, Inc., Woodward-Clyde and CIRI, and with assistance in planning and scheduling by Frank Moolin & Associates. Acres American Incorporated will direct and coordinate the efforts of the subcontractors. The organization chart for the Alaska team is on Plate B.1.4.

Project Manager: J. D. Gill will be responsible for the planning, scheduling and coordination of a large number of Alaska-based activities which must be conducted concurrently to maximize opportunities available during the short season favorable to certain investigations. He will provide the interface as well for field activities of the environmental team, which will also operate in the same general area as the field work teams. Mr. Gill is the Chief Engineer, Power and Heavy Civil, of Acres American Incorporated and he offers a strong background in the conduct and management of engineering activities for hydroelectric work.

Geotechnical Design/Inspection Support: R. Henschel of Acres will direct the Acres staff efforts in support of the Alaska Engineering Studies. He will provide the interface between Acres staff and the subcontractor's staffs involved in the field work. Mr. Henschel's previous experience in site geotechnical investigations qualifies him well for this position.

Geotechnical Investigations and Surveys: R. Migliaccio will direct the efforts and resources of R&M Consultants in conducting the site exploration and testing, survey, and geologic and hydrologic studies. Mr. Migliaccio, as President of R&M Consultants, is thoroughly familiar with all aspects of Alaskan geotechnology, having acted as a special consultant to Alyeska Company and other gas pipeline groups. Mr. Migliaccio will be assisted by an R&M Review Board consisting of J. W. Rooney, R. L. Shraeder, and M. A Menzies, each having specialized knowledge of geological conditions prevalent in the Railbelt. Directors of specific study areas within the geotechnic team are:

Survey:	Mr. B. Dortch
Geology:	Dr. J. M. Brown
Hydrology:	Mr. B. Drage
Site Exploration and Testing:	Mr. G. Smith

The team organization is on Plate B.1.8.

Seismic Investigations: The seismic study will be primarily an effort by Woodward-Clyde under the general direction of project manager G. E. Brogan. Mr. Brogan has worldwide experience in engineering geology and seismic geology on projects including nuclear and conventional power plants, dams, tunnels, and pipelines. Mr. Brogan will have the assistance of a WCC panel of experts and will have the general guidance of Mr. U. Luscher, WCC principalin-charge. The WCC seismic team organization is on Plate B.1.7.

Camps and Land Use: F. Klett of CIRI will be repsonsible for acquiring, establishing, maintaining, and ultimately removing all facilities necessary for access and project team support. He will secure permits and ensure regulatory compliance as well. During Mr. Klett's vast Alaska project experience, he has gained extensive management experience in Alaska and has acquired a thorough understanding of the need for proper project planning and direction. Mr. Klett will oversee the team of H&N and CIRI personnel involved in dealing with real estate and native interests, camp design, and camp operation.

Administration, Cost Control and Support: Mr. F. P. Moolin of FMA will provide support to Mr. Gill in the areas of administration, cost control, and general support of Alaska study activies. FMA's experience in Alaskan project accomplishment will assure that the entire organizational effort will proceed in a cost effective manner.

Mr. Moolin is intimately familiar with the planning management of giant projects, and his herculean efforts in Alaska as senior project manager on the pipeline earned him recognition as ENR's "Construction Man of the Year" in 1976.

B.1.5 - Feasibility Studies

While all of the firms on the project team will participate in the feasibility study effort, the primary role will be played by Acres, wherein extensive hydroelectric experience under arctic conditions is found. Because of the magnitude and the nature of the work, virtually the entire resources of the Acres Group (including our International and Canadian companies) will from time-to-time be called upon for contribution to successful accomplishment of the study, assistance as the license application is considered by FERC, and for involvement in detailed design and construction management if Acres is selected for such efforts. Key members of the team are shown on Plate B.1.33 with duties as follows:

Project Manager: J. P. Sinclair will lead the major project engineering effort in performing technical and economic feasibility assessments. He is charged with orchestrating the concurrent efforts of small teams generally broken down by discipline. He will ensure frequent coordination of these diverse activities and will identify data gaps to be filled through coordination with field and environmental groups. In this latter regard, his responsibilities extend as well into the acquisition of special skills on inputs for which requirements were not foreseen initially. It is likely that he will call upon authorities in other project organizations (e.g., Mr. Milo Bell, with the environmental team, is well known for his ability to design effective fish passages) whenever developing study efforts indicate a need exists. Mr. Sinclair is a Project Manager in the Hydroelectric Division of Acres American Incorporated, with extensive experience in feasibility assessments, and is a recognized authority on hydroelectric machinery. His subordinate teams will each be headed up by an engineer thoroughly experienced in hydroelectric work.

Dam Construction: D. W. Lamb will direct dam construction studies. He will provide the interface between the feasibility study team and the field investigators and will be responsible for analysis and interpretation of field investigation data and material test results. Mr. Lamb's background in soils and foundations engineering and management and supervision for civil works large projects qualifies him well for his lead position on the feasibility study team. Specific areas of this portion of the team will be directed by the following personnel:

Climatic Conditions:	J. MacPherson
Construction Methods:	G. Tappay
Cost Estimates and Schedules:	J. Minstrell

Conceptual Design: S. S. Ahmad will direct concept designs for the feasibility team. His background in planning, engineering and design of hydroelectric and other water resource developments qualifies him well for this lead engineering position. He will have a staff consisting of four subteams directed by the following personnel:

Project Layout:	T. Gwozdek
Civil Structural:	P. Pal
Geology:	S. Thompson
Geotechnical:	S. Bahadur

Hydrology/Hydraulics

Dr. I. Hutchison will direct the hydrology/hydraulics team for the feasibility study. He will oversee and coordinate the efforts between the hydraulics and hydrologic subteams and will become directly involved in selection and design of various hydraulic features. Dr. Hutchison will also provide the necessary interface between the information needs of the project engineering team and the data collection efforts of the field team. His background in managing hydrologic and hydraulic modeling studies in different regions of the world qualify him for this lead role. His staff of subteam directors is as follows:

Hydraulics:	R. Shields
Ice Engineering:	R. Carson
Hydrology:	R. Mayer
Economic Studies:	A. Vircol

Mechanical/Electrical: E. N. Shadeed will direct the electrical and mechanical concept and design aspects of the project. He will also direct staff performing the power and transmission studies and engineering the generating machinery for the project. Mr. Shadeed has 30 years experience in planning, design and estimation of technical aspects for hydroelectric projects. His senior subteam staff will be as follows:

Power Studies:	S. Omkar
Mechanical:	P. Rodrigue
Electrical:	D. Kaushal
Transmission:	R. Stuchbury
Generating Machinery:	A. Ali

B.1.6 - Environmental Studies

In recognition of the importance of thorough and expert environmental studies urged to date by public and private conservation interests, we recognize the necessity to field a team whose content includes a broad variety of special qualifications pertinent to the Alaskan environment as well as a management structure which has acquired special experience in environmental investigations for hydroelectric projects. Thus, we have chosen to seek the assistance of Terrestrial Environmental Specialists, Inc. (TES). TES has agreed to provide the framework, management, and a number of investigators for environmental studies. In addition, TES has also secured the agreement of leading experts to serve on the investigatory team. The proposed organization for environmental studies appears in Plate B.1.5. Duties are described below:

Environmental Study Managers: Dr. J. W. Hayden (Acres) and J. O. Barnes (TES) will provide the overall administration and coordination of the environmental work on the project. Dr. J. W. Hayden will represent Acres on the environmental team, and in the interfacing with ongoing engineering work. Mr. Barnes is an environmental scientist experienced in particular in the environmental aspects of transmisison line corridor selection. Dr. Hayden heads the Environmental Division of Acres American Incorporated. He has had extensive diverse experience in the conduct of environmental assessments. He is currently involved as the Manager of the Chesapeake Bay Hydraulic Model, where Acres has been engaged by the Corps of Engineers to conduct a variety of studies to determine the impact of changes, both man-made and naturally occurring, in the Bay's regime.

Environmental Study Directors: Dr. V. J. Lucid (TES) will provide the day-to-day direction of the environmental work, both during data collection and subsequent interpretation. He will be responsible for the content of the final environmental reports. He is currently the Director of Environmental Studies at TES, and he has had extensive experience in support of powerhouse siting and operation. He will be assisted in this capacity by C. A. Baumgartner (TES) whose specific assignment will be to coordinate studies in ecological fields and will also serve in a quality assurance role as data and samples are conducted and evaluated. Ms. Baumgartner is an environmental scientist with a Bachelor's degree in Biology and a Master's in Zoology. She has frequently been involved in the conduct of studies for power plant sites and is particularly adept at planning and organizing field data collection activities.

Socioeconomic Resources: Dr. R. Gerard (TES) will coordinate socioeconomic resource studies. The principal investigator for this portion of the work will be Dr. F. I. Orth whose work on economic impact and financial feasibility studies in Alaska has been extensive. He has had particular experience in developing and implementing methodologies for studies in support of the Alaskan fishery industry. His memberships have included the Alaska Fisheries Council (1977-78), Steering Committee for Bering Sea Clam Development (1977), Executive Advisory Committee for Alaska Power Survey

(1974) and Faculty Fellow at the Pacific Coast Banking School, University of Washington (1973). The resources of the firm, Frank Orth & Associates, Economic and Business Consultants, will be available as appropriate in the environmental studies as well as for consultation in other studies conducted by the project engineering team (e.g., market analysis, economic evaluation).

Recreational and Cultural Resources: M. P. Killeen (TES) will coordinate activities in these two study areas. Dr. E. J. Dixon will be the principal investigator for cultural resources. Dr. Dixon is a respected archaeologist with knowledge of known and suspected earlier evidence of human settlements in Alaska. Dr. A. Jubenville will be the principal investigator for recreation resources. He holds his Ph.D. in Wildland Recreation and is currently Associate Professor of Resources Management at the University of Alaska. He has developed and conducted a number of recreation management, evaluation, and policy courses at the university level, has written texts on these subjects and has widely published other related materials.

Ecological Studies: C. A. Baumgartner (TES) will coordinate studies in ecological fields and will also serve in a quality assurance role as data and samples are evaluated. Ms. Baumgartner is an environmental scientist with a Bachelor's degree in Biology and a Master's in Zoology. She has frequently been involved in the conduct of studies for power plant sites and is particularly adept at planning and organizing field data collection activities.

Fisheries Ecology: R. W. Williams (TES) will coordinate these studies. C. E. Atkinson will be the principal investigator for anadromous fisheries. His extensive work in government, industry and academe in the study of Pacific Salmon is well known. He was involved in early Susitna River studies in the mid-1950's when, as a Director of Biological Research with the Bureau of Commercial Fisheries, he did research on salmon fisheries in Cook Inlet. He has been Fisheries Advisor to the President of the University of Alaska, has chaired the Alaska Interagency Fisheries Committee, and has been a member of the Board of Directors, Whitney-Fidalgo Seafoods, Inc. Milo C. Bell will be the principal investigator for resident fisheries. He is internationally known for his investigations of fish facilities at hydroelectric power sites, and he is perhaps the foremost authority on effective design of fish passage facilities.

Wildlife Ecology: E. T. Reed (TES) will coordinate wildlife ecology studies. Dr. B. Kessel will be principal investigator for Avian Ecology. With long experience and in-depth knowledge of Alaskan ornithology, Dr. Kessel served as Head of the Department of Biological Sciences at the University of Alaska from 1957-1966 and is currently Curator of Terrestrial Vertebrate Collections at the University Museum. S. O. MacDonald will be principal investigator for small mammal ecology. A University of Alaska graduate, he has had twenty-four years of experience in furbearing animal trapping in Minnesota and Alaska. He currently serves as a principal investigator for small mammal and bird population as a museum technician at the University of Alaska Museum.

Dr. P. S. Gibson will be principal investigator for Furbearer Ecology. He is currently an Assistant Leader of the Alaska Cooperative Wildlife Research Unit of the University of Alaska. He has extensive research experience and is a recognized authority on predator-prey relationships.

Plant Ecology: J. W. McMullen (TES) will coordinate this activity. Dr. J. D. McKendrick will serve as the Principal Investigator. Dr. McKendrick has expertise in plant ecological studies, range management and forage qualities of habitats, plant succession, rehabilitation and revegetation, remote sensing, and assessing disturbances in sensitive areas. Much of his experience in these areas of expertise has been obtained from projects in Alaska. As a result of his experience in Alaska and in conjunction with the staff of the Alaska Agricultural Experiment Station, he is quite familiar with the vegetation types in the Susitna River Basin.

Water Quality: T. L. Smith (R&M) will provide the R&M contact on the environmental team. In addition to furnishing his own expertise in evaluation and enhancement of water quality, he will coordinate the use of R&M facilities, laboratories, and environmental staff members as required to support the effort. He holds twin Masters' degrees in Sanitary Engineering and Geology-Mineralogy and has conducted numerous water supply, erosion control and environmental impact studies in Alaska.

B.1.7 - Financial Studies:

J. G. Warnock, Vice President and Manager of the Power and Heavy Civil Group of Acres American Incorporated will be responsible for preparation of necessary plans and comprehensive documentation for public financing of the Susitna project. Mr. Warnock has previously filled this role in development of Churchill Falls and in the planning for the Bay of Fundy Tidal Power Project. He will also oversee the studies done of project risk analysis and direct the study of financibility issues by Salomon Brothers.

Financibility Issues:

The investment banking firm of Salomon Brothers, which is described in their memorandum in Section C, will be involved in the identification and resolution of financibility issues of the Susitna project. Their professional skills, experience and judgment as a major investment banker will assist in all areas of financial study at a level of effort equal to that of Acres. Salomon Brothers currently serves 237 public power clients, nationwide, in financing power producing projects.

Risk Analysis:

Dr. Chris B. Chapman of Acres International Management Services, Ltd., will direct the risk analysis of the Susitna project. Dr. Chapman is an expert in the risk analysis field having performed and directed such studies on many large projects. He acted as an advisor on the Lower Chruchill Falls study and has done studies of seismic risks relating to power plant development.

B.1.8 - External Review Function

(i) Introduction

The need for external review of preliminary task outputs and proposed FERC licensing exhibits is pointed out at various places throughout this POS. We propose that the Power Authority appoint a Board composed of eminent engineers and environmental scientists to perform the important review function. Such a Board would include two task forces for each of the two major areas of concern.

(ii) Selection and Operation

In order to maintain a necessary degree of objectivity and independence, we propose that selection, direction, termination, and similar matters be placed entirely in the hands of APA. Acres will provide coordination, liaison, and administrative support as appropriate. While the Board will provide an extraordinary measure of confidence in the validity of the recommended optimal development plan, it will also be tasked and funded specifically for the purpose of ensuring that important seismicity studies are properly carried out. In this latter regard, the sum of $1 million (directed by APA for an independent seismicity study) would be provided directly to the external Board for use at the Board's discretion for performance of such confirmatory and supplementary studies as they may deem appropriate to provide the highest possible degree of confidence in the results of work performed by the Acres' team.

(iii) Recommended Composition

Preliminary contacts have been made with a number of professional engineers whose credentials for the purpose are impeccable. Each of these men has agreed to act as a consultant to the Power Authority in the event he is selected. The persons with whom we have made contact provide important special knowledge in certain key areas of engineering design and construction. A similar group should be recommended to review environmental matters. A list of environmental candidates, as well as additional specialists in other disciplines for consideration by APA will be provided at the time that oral presentations are made on September 27, 1979. The following persons have thus far agreed to serve if called upon:

HOMER B. WILLIS - Mr. Willis has 39 years of experience in general civil engineering practice, primarily in the field of water resource development. Until his retirement in January 1979, he was the Chief, Engineering Division, Civil Works Directorate, Office of the Chief of Engineers, U.S. Army Corps of Engineers. He has served on international commissions, is currently the Vice President of the U.S. Committee on Large Dams, has been a member of the Board of Directors, U.S. National Committee, World Energy Conference, and served as a member of the Department of Interior Review Group investigating the failure of Teton Dam in Idaho.

JACOB H. DOUMA - Mr. Douma is particularly skilled as a hydraulic engineer. Until his retirement in 1979, he was the Chief of Hydraulic and Hydrology Branch, Civil Works Directorate, Office of the Chief of Engineers, U.S. Army Corps of Engineers. He has been a member of the U.S. Committee, International Commission on Large Dams since 1948; has served on numerous committees for the American Society of Civil Engineers (a member since 1935); has served as a consultant for hydraulic dams worldwide and has had particular consulting experience for hydraulic design of large dams in subarctic regions.

STANLEY D. WILSON - Mr. Wilson is an internationally recognized authority on earth and rockfill dams and serves as a consultant on major hydroelectric projects worldwide. He is also an expert in laboratory and field instrumentation used in geotechnical engineering and has developed techniques and special equipment for measurement of earth and rock movements. A former Chairman of the ASCE Committee on Performance of Earth Supported Structures, he has received numerous awards and prizes during his long career.

MERLIN D. COPEN - Mr. Copen has had 40 years of professional experience and is an international authority on arch dams. Prior to his retirement from the Bureau of Reclamation in 1973, he headed the Concrete Dams Section of that organization. His numerous awards over the years were capped at the time by presentation in 1974 of the Distinguished Service Award, the highest honor of the Department of the Interior. He has consulted internationally on concrete arch and gravity dam problems and is a member of the U.S. Committee on Large Dams as well as a Fellow, ASCE.

DR. DON U. DEERE - Dr. Deere has more than 36 years of experience in engineering geology, soil and rock mechanics associated with underground excavation and heavy civil works for power plants. He has been Chairman of Commission on Standardization of Laboratory and Field Tests on International Society for Rock Mechanics; Committee on Underground Works of U.S. Committee on Large Dams; previously chairman of Committee on Tunnel Geology of Engineering Geology Division of GSA; Committee on Rapid Excavation of National Academy of Science.

DR. ANDREW H. MERRITT - Dr. Merritt is an expert on the geotechnical aspects of underground works. He has consulted internationally on numerous tunnels, dams, underground power facilities and nuclear power plants. He is a principal in the firm of Don U. Deere and Andrew H. Merritt, Inc., Consultants in engineering geology and applied rock mechanics.

DR. ALFRED J. HENDRON, JR. - Dr. Hendron is an internationally acclaimed expert on foundation engineering and earthquake engineering. He has consulted for numerous firms and government agencies on seismic aspects of large dams, slope stability problems encountered worldwide (including those for the TransAlaska Pipeline), and on rock mechanics problems for the design of large underground chambers. He was selected by the National Science Foundation as a U.S. Member to an exchange meeting with Japanese engineers on the topic of Ground Motions Produced by Earthquakes and has chaired or served on panels addressing various aspects of foundation stability for ASCE and ASTM.

B.1.9 - In-Depth Capability for Follow-On Work

Preceding paragraphs have already noted the importance of introducing construction management expertise into the planning team. As the project proceeds and a strong construction management organization evolves, Acres is prepared to offer the services of a team of skilled managers whose past involvement in large projects has seasoned them well. In particular, the following individuals will be available for in-house consultation throughout the study phase and, assuming Acres is selected to design and manage this important project, will be a part of the project management team as it evolves for construction:

John L. Owen - Project Services Manager: 20 years experience in project management and engineering primarily for power generating stations.

James E. Partridge - Planner & Scheduler: 9 years experience in planning and scheduling contract administration and cost engineering for power generating stations.

George F. Lipsett - Manager, Materials Handling: 39 years experience in manpower economics, manpower planning, material management and labor relations related to large power generating stations and heavy industrial installations.

Robert C. Hunter - Contract Administrator: 5 years experience in contract negotiations, procurement, coordination and expediting related to large power generating stations.

Ernest J. Durocher - Senior Buyer: 12 years experience in procurement, expediting and scheduling related to power generating stations and heavy industrial installations.

W. A. Slatcher - Procurement Coordinator: 5 years experience in procurement and expediting.

Kenneth J. Owen - Engineering Coordinator: 32 years experience in project management and engineering related to large power generating stations and heavy industrial projects.

A. E. Williams - Senior Cost Engineer: 33 years experience in cost engineering, estimating, financial forecasts and analysis of power generating stations and heavy industrial installations.

John H. Saldat - Project Manager: 32 years experience in project management and engineering related to large power station development.

Terry W. Waters - Manager, Project Planning & Services: 14 years experience in engineering, contracts administration, coordination of planning and scheduling, cost control and procurement.

Keith H. Marriott - Project Contracts Administrator: 23 years experience in project management, coordination and contracts administration related to power generating stations and heavy industrial installations.

John W. McCreight - Planner/Scheduler: 11 years experience in engineering, project planning and scheduling and procurement.

Edward A. F. Welter - Project Cost Engineer: 32 years experience in multidiscipline project coordination, cost engineering, and contract administration related to power generating stations and heavy industrial installations.

J. Trevor Minstrell - Project Estimator: 28 years experience in engineering, estimating and cost engineering related to large power developments and heavy industrial installations.

Roy Oakely - Project Administration: 28 years experience in engineering, cost administration, materials management, and procurement related to power generating stations.

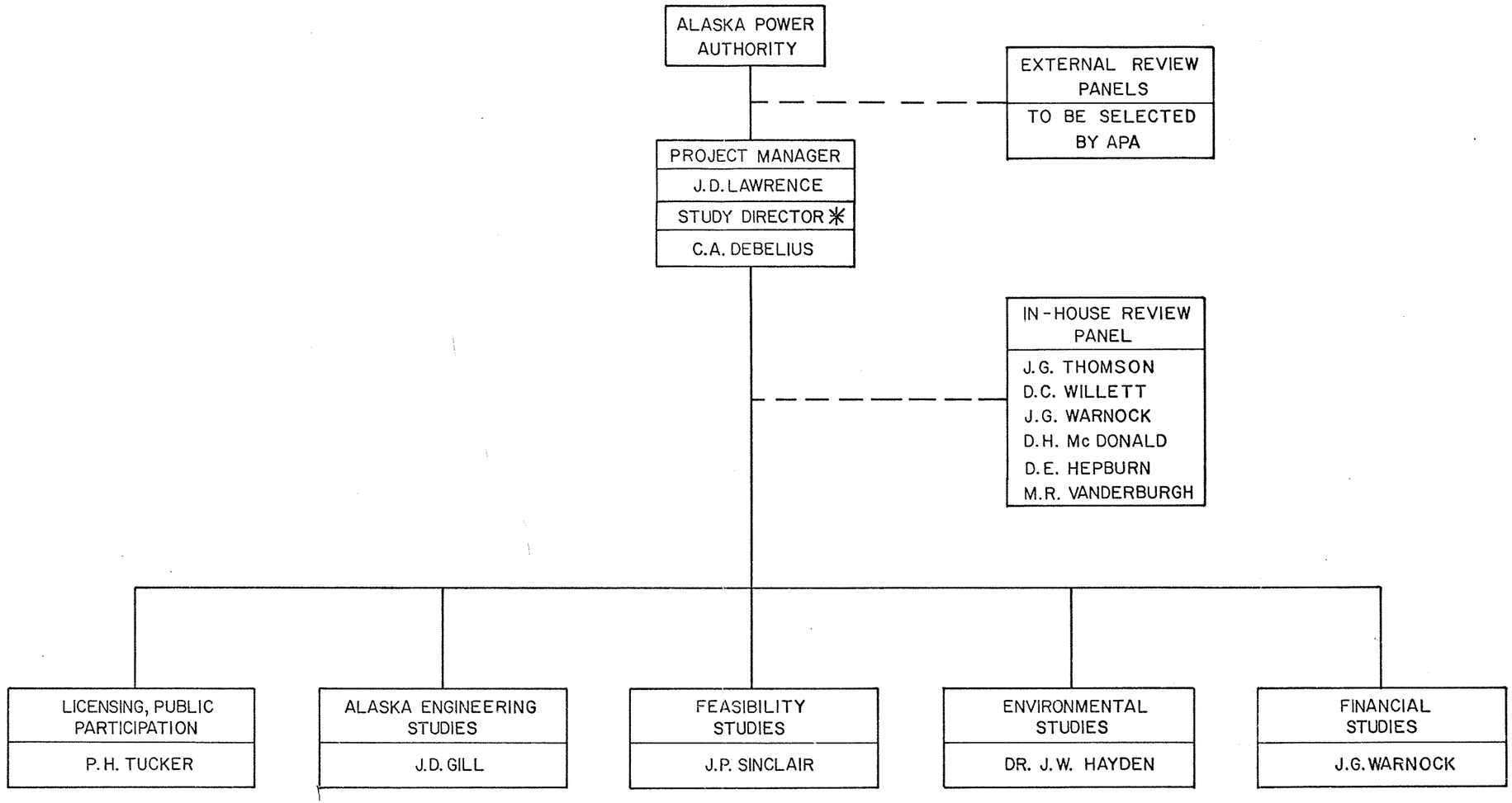
Albert J. Haverty - Construction Manager: 24 years experience in project management, construction management, contracts administration and engineering related to large power generating stations.

Howard R. Simon - Electrical Construction Supervisor: 32 years experience in electrical engineering and construction supervision of power stations and heavy industrial projects.

William N. Verlaan - Construction Cost Engineer: 21 years experience in engineering, scheduling, cost engineering, estimating and project management related to power generating stations and heavy industrial installations.

Robert H. Morris - Field Design Supervisor: 36 years experience in design engineering related to large power developments and heavy industrial installations.

Philip L. Luby - Manager, Materials Handling: 38 years experience in project management and engineering related to power generating stations and heavy industrial installations.



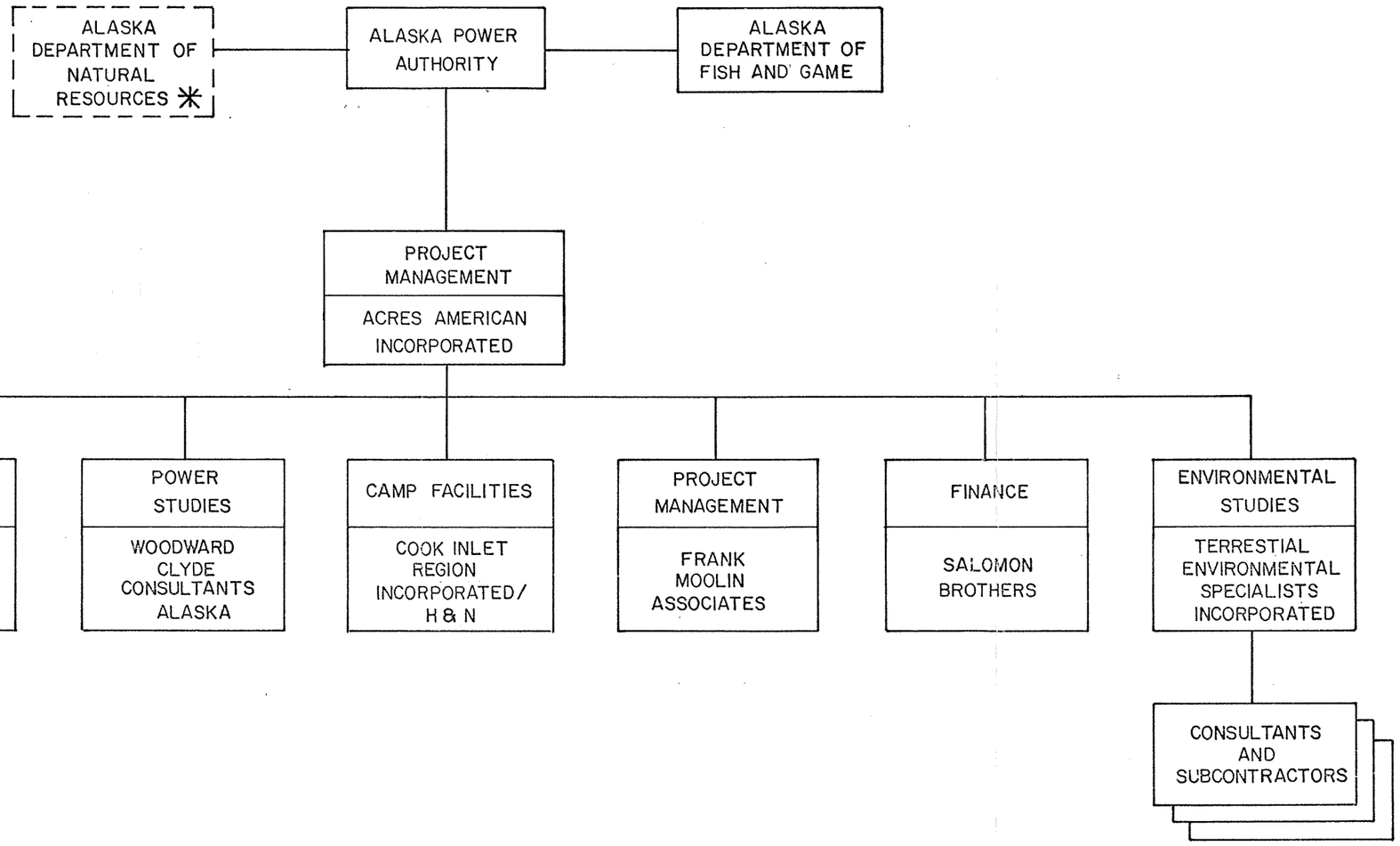
✳ FUNCTIONS AS DEPUTY PROJECT MANAGER

SUSITNA HYDROELECTRIC PROJECT

PLAN OF STUDY

PLATE B1.1 : PROJECT MANAGEMENT ORGANIZATION

ACRES



✳ DNR WILL BE ASKED TO CONDUCT IN-STREAM FLOW STUDIES IF ECONOMY CAN BE EFFECTED THEREBY

SUSITNA HYDROELECTRIC PROJECT

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PLATE B1.2: ACRES SUB-CONTRACTOR RELATIONSHIPS

ACRES

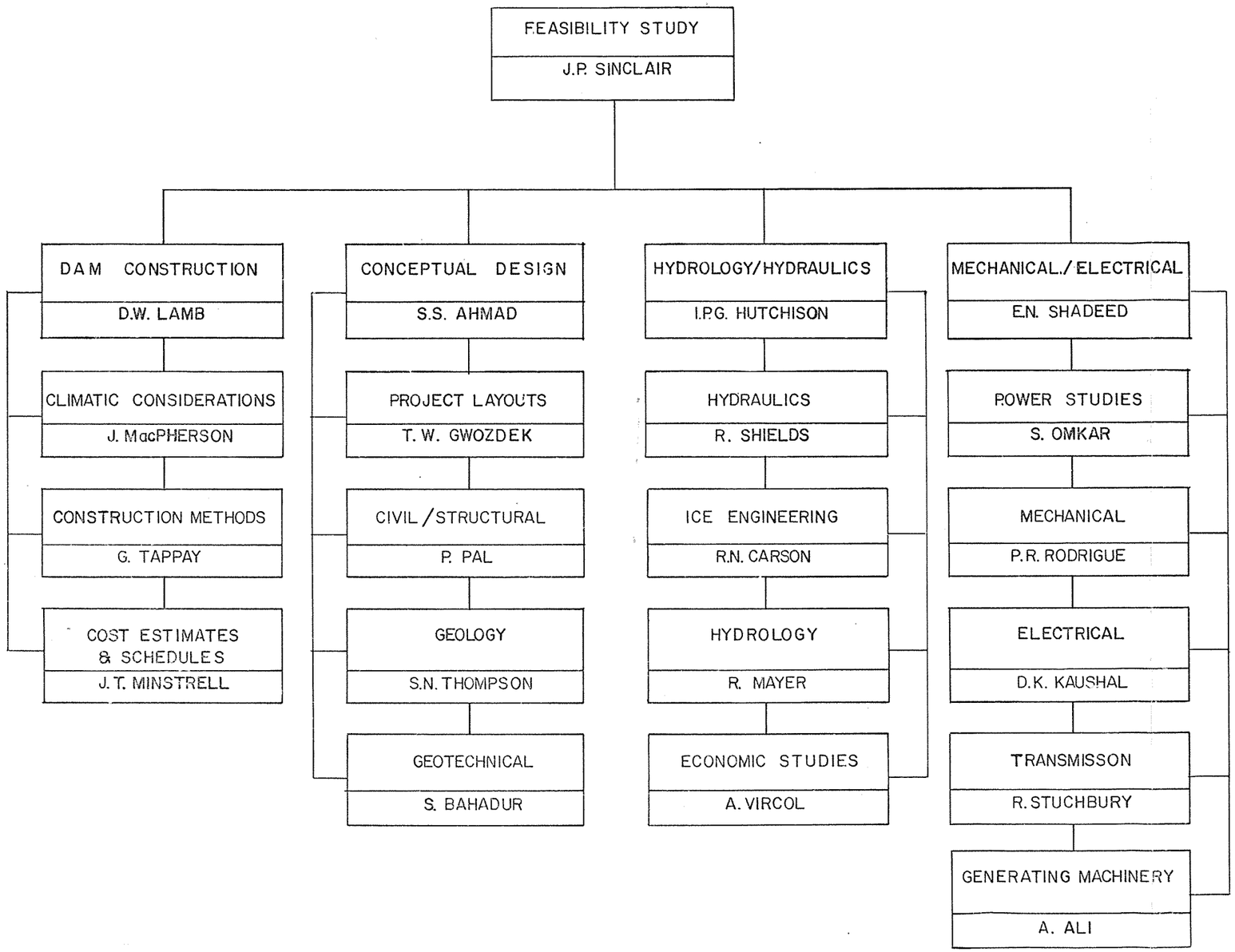

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PLATE B.I.3: ORGANIZATION FOR FEASIBILITY STUDIES

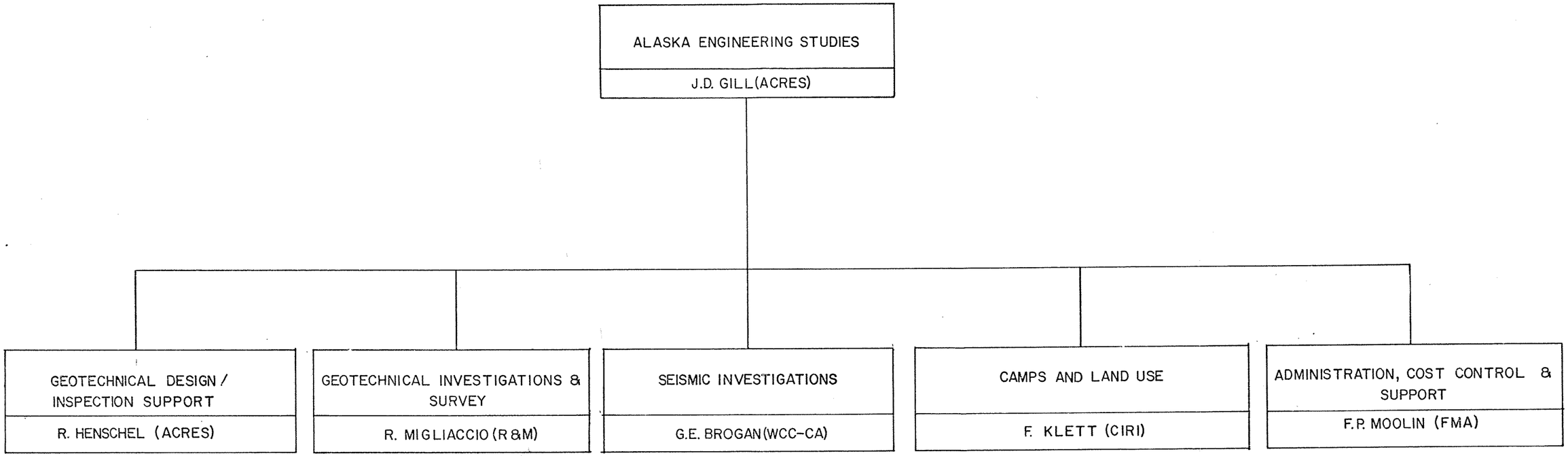

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PLATE B1.4: ORGANIZATION FOR ALASKA ENGINEERING STUDIES

ACRES

APA

ADF&G

ACRES PROJECT MANAGER

ENVIRONMENTAL STUDY MANAGERS

DR. J.W. HAYDEN - ACRES

J.O. BARNES - TES

TECHNICAL INPUT TO ENVIRONMENTAL STUDIES FROM:

TASK 1 - POWER STUDIES
TASK 2 - SURVEY
TASK 3 - HYDROLOGY
TASK 5 - GEOTECHNICAL EXPLORATION
TASK 6 - DESIGN DEVELOPMENT
TASK 8 - TRANSMISSION
TASK 12 - PUBLIC PARTICIPATION

ENVIRONMENTAL STUDY DIRECTORS

DR. V.J. LUCID - TES

C. A. BAUMGARTNER - TES

FISH ECOLOGY

TEAM LEADER
R.W. WILLIAMS - TES
ANADROMOUS FISH
C.E. ATKINSON - CONSULTANT
RESIDENT FISH
M.C. BELL - CONSULTANT
PLUS INPUT FROM ADF & G

WILDLIFE ECOLOGY

TEAM LEADER
E.T. REED - TES
FURBEARERS
DR. P.S. GIPSON - U of A
SMALL MAMMALS
S.O. MacDONALD - U of A MUSEUM
AVIAN ECOLOGY
DR. B. KESSEL - U of A
LARGE ANIMALS
ADF & G

PLANT ECOLOGY

J.M. McMULLEN - TES

DR. J.D. McKENDRICK - U of A

LAND USE RECREATION & CULTURAL RESOURCES

M.P. KILLEEN - TES

DR. E.J. DIXON - U of A MUSEUM

DR. A. JUBENVILLE - U of A

SOCIO - ECONOMIC STUDY

DR. R. GERARD - TES

DR. F.L. ORTH - ORTH & ASSOCIATES

——— DIRECT CONTROL

— — — LAISON & COORDINATION

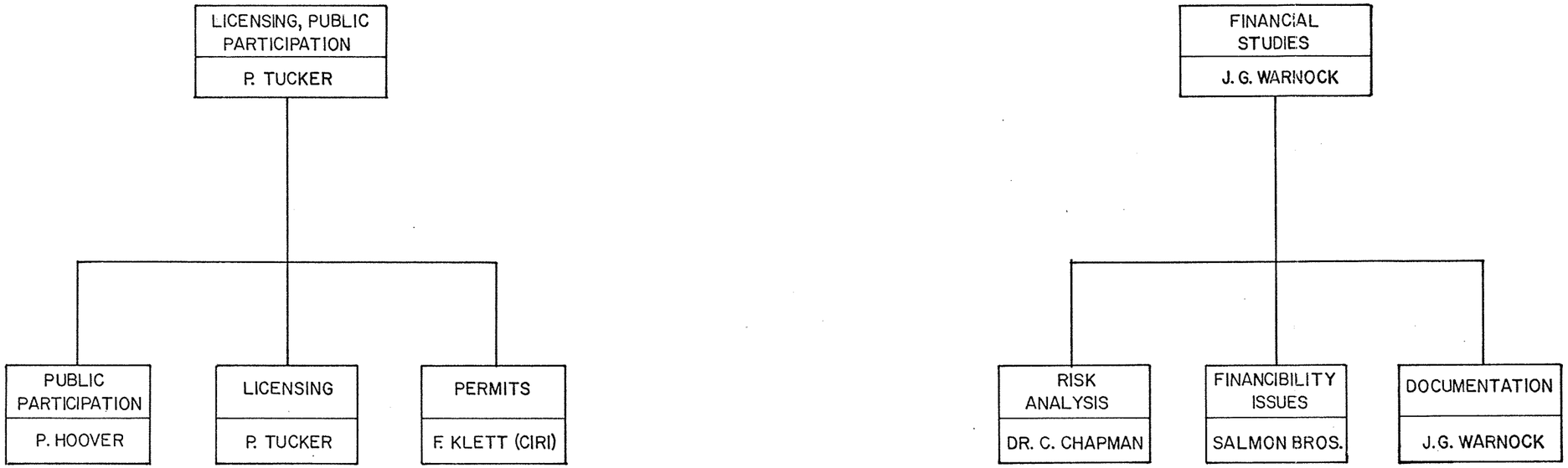
– – – – DATA EXCHANGE & INTERACTION OF STUDY PERSONNEL

ACRES

SUSITNA HYDROELECTRIC PROJECT

PLAN OF STUDY

PLATE B1.5: ORGANIZATION FOR ENVIRONMENTAL STUDIES

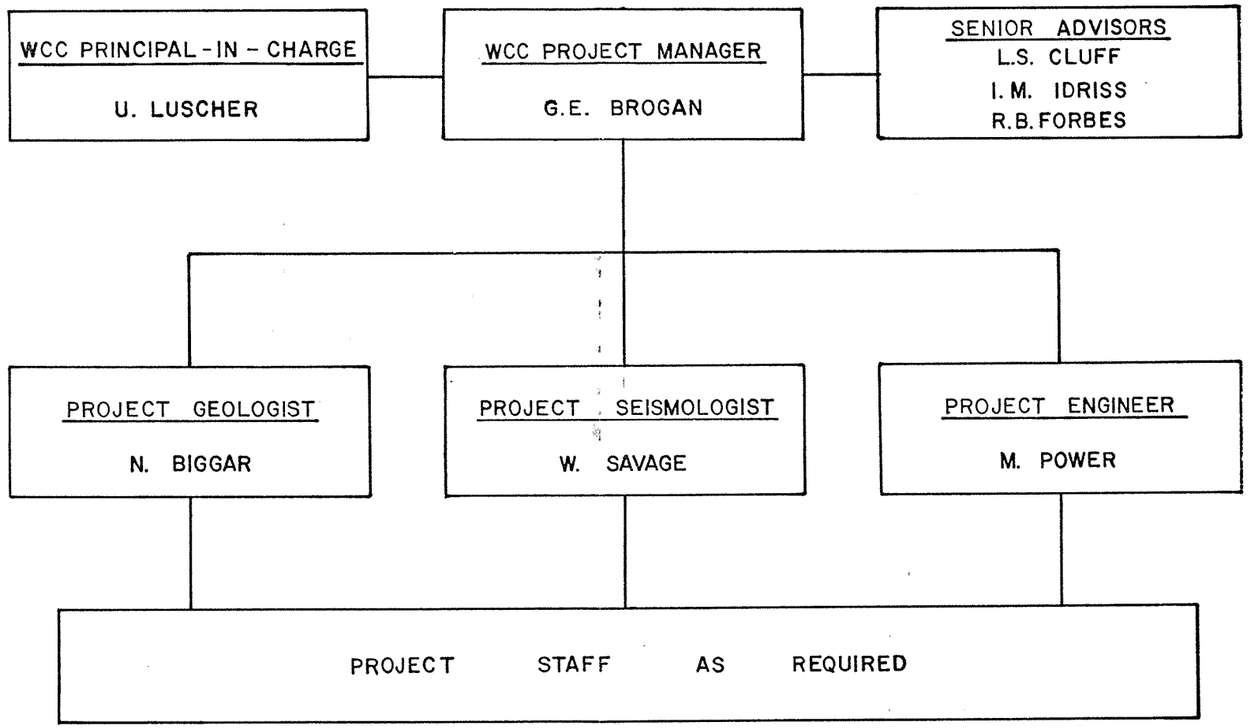


SUSITNA HYDROELECTRIC PROJECT

PLAN OF STUDY

PLATE BI.6: ORGANIZATIONS FOR FINANCIAL AND LICENSING, PUBLIC PARTICIPATION

ACRES

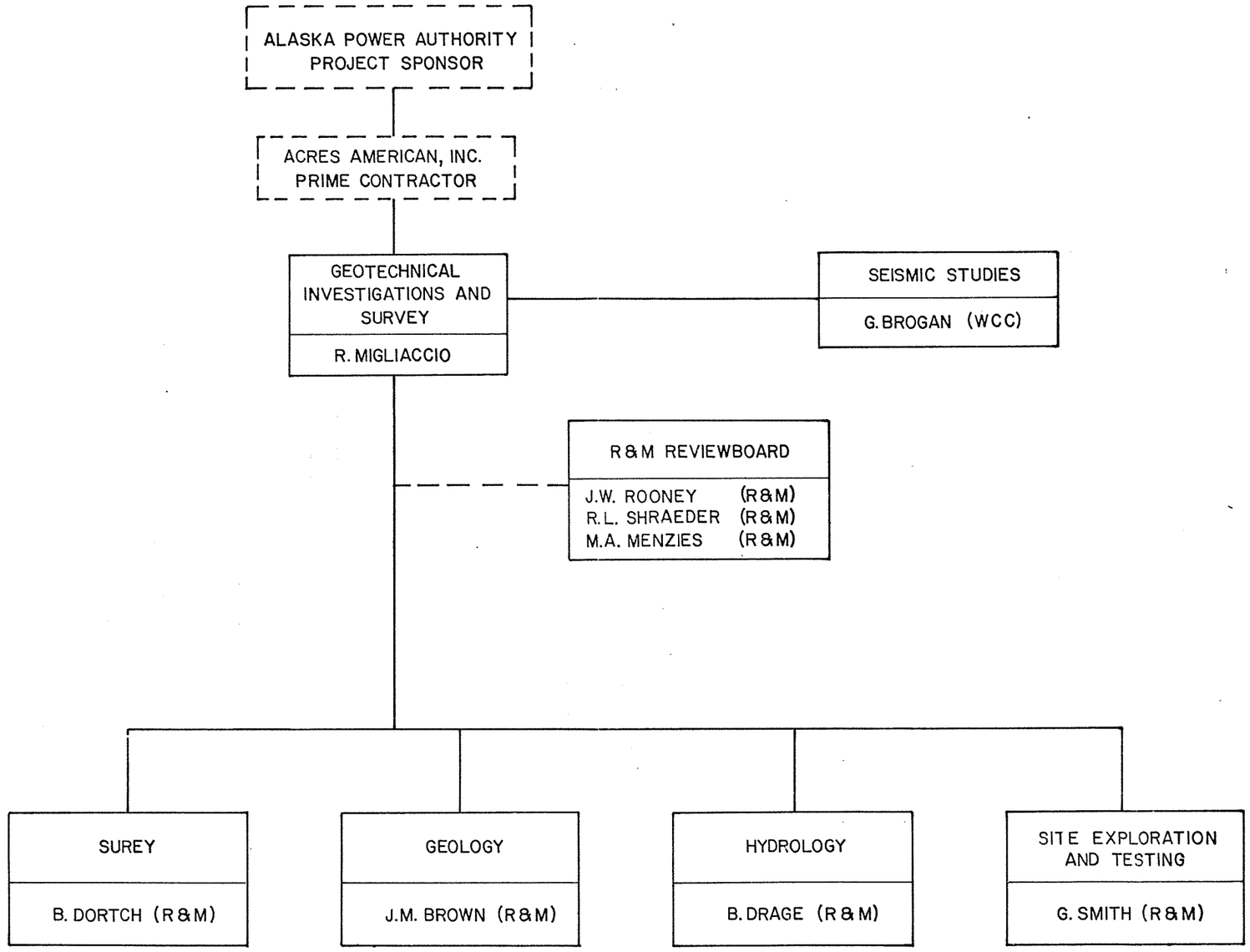


SUSITNA HYDROELECTRIC PROJECT

PLAN OF STUDY

PLATE BI.7: WOODWARD-CLYDE CONSULTANTS PROJECT ORGANIZATION FOR SEISMIC STUDIES

ACRES



SUSITNA HYDROELECTRIC PROJECT

PLAN OF STUDY

PLATE B1.8: R&M PROJECT ORGANIZATION FOR GEOTECHNICAL INVESTIGATIONS AND SURVEYS

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B2: KEY PERSONNEL ASSIGNMENTS

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SECTION B2 - KEY PERSONNEL ASSIGNMENTS

B.2.1 - Introduction

Summary resumes contained in this section are provided in an attempt to capsulize highly relevant and generally long term experience in various important project areas. The task of summarizing has been an especially difficult one simply because it requires that so much remains unsaid. To the extent that we have understated the eminent qualifications of colleagues in other firms within the Acres team, it is hoped that forgiveness will be extended to us.

More detailed resumes are provided elsewhere in our initial statement of qualifications as well as in an Appendix to this Plan of Study. It is recommended that the reviewer who wishes to focus on a particular area of expertise use the detailed resumes as a more complete information source.

We believe it is important to recognize that most key engineering personnel mentioned in succeeding pages have been officially registered, licensed, or chartered in their profession. As a matter of convention, we have chosen to use the abbreviation "P.E." after a name to indicate the individual is a professional engineer licensed in one or more of the several states or the District of Columbia. The symbol "P.Eng." indicates certification or registration in Canada. "L.S." indicates registered Land Surveyor. "R.G." indicates registered or certified geologist.

JOHN D. LAWRENCE, P.E. — Acres American Incorporated

Manager of Hydroelectric Projects

Discipline/Year of Graduation: Civil Engineering/1956/B.S.
Hydropower Engineering/1963
Water Resources/1972/M.S.

Study Assignment: Project Manager

Relevant Area of Expertise:

Technical direction and administration of hydro power and heavy civil projects. Feasibility studies of two pumped storage plants involving underground powerhouses, hydraulic structures, steel and concrete lined tunnels. Preliminary and detail design, scheduling, costing, evaluations, preparation of contract documents for large hydroelectric projects in sub-arctic environments. Site supervision of hydroelectric plants with extensive underground facilities.

Previous Project Responsibilities:

Executive Engineer:
Management and direction of:
- Comprehensive siting and engineering studies and field exploration for a proposed 1,000 MW underground pumped hydroelectric power energy storage project.
- Power alternatives and energy study for Dickey-Lincoln School Lakes hydroelectric project.
- Numerous low head hydroelectric feasibility studies.

Chief Design Engineer:
Public Power Corporation, Athens, Greece - Responsible for civil, mechanical and electrical design and engineering of 300 MW hydroelectric plant.

Project Civil Engineer (Acres):
250 MW Lower Notch Generating Station, Ontario; 1,800 MW station at Gull Island, Labrador; 340 MW station at Alto Anchicaya, Colombia.

J. GAVIN WARNOCK, P.Eng. — Acres American Incorporated

Vice President

Discipline/Year of Graduation: Mechanical Engineering/1945
Hydropower/1947

Study Assignment: Manager of Financial Studies, In-House Review Panel

Relevant Area of Expertise:

Financial planning and preparation of bond support documentation for giant hydroelectric projects in sub-arctic environments.
Development of advanced designs for reversible pump turbines and large hydroelectric generating equipment.
Contract negotiation, formation and operation of international consortia for execution of major projects.

Previous Project Responsibilities:

Manager of Power and Heavy Civil Engineering Group directing the activities of hydroelectric, thermal power, electrical services, transportation, and special services (including hydraulic modeling and environmental) divisions.

Manager for preparation of complete financial package leading to successful financing of the nearly billion dollar Churchill Falls project.

Manager of design, development and production of hydroelectric equipment for a major turbine manufacturer.

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CHARLES A. DEBELIUS, P.E. — Acres American Incorporated
Regional Manager and
Manager of Engineering, Columbia

Discipline/Year of Graduation: Military Engineering/1954/B.S.
Physics/1963/M.S.
Operations Research/1968/MMAS
Management/1972/Diploma

Study Assignment: Deputy Project Manager

Relevant Area of Expertise:

Management of planning, design and construction of civil and military engineering projects in Alaska.
Economic analysis and cost risk studies for major organizations and equipment items.
Project management of power studies, hydroelectric feasibility studies.
Planning and conducting public participation programs in Alaska.

Previous Project Responsibilities

Manager of Engineering:

Responsible for overall management of engineering efforts devoted to alternatives and power studies, major thermal power studies and thermal energy storage studies, hydroelectric feasibility studies including low head.

District Engineer, Alaska:

Management of 400 person organization involved in planning, design, and construction of hydroelectric projects in Alaska, including :

- Pre-authorization feasibility study for the Susitna Hydroelectric Project.
- Design of transmission line rerouting for Snettisham Hydroelectric Project.
- Direction of public participation programs throughout Alaska.
- Design and construction management of the Chena River Lakes Flood Control Project near Fairbanks.

J. GRAY S. THOMSON, P.Eng. — Acres American Incorporated
Vice President

Discipline/Year of Graduation: Civil Engineer/1950

Study Assignment: In-House Review Panel

Relevant Area of Expertise:

Management of engineering design for major hydroelectric projects in sub-arctic environments.
Consultation as principal provincial and Canadian representative on international committees dealing with cold environments.
Feasibility studies for large water resources projects.

Previous Project Responsibilities:

Vice President:
Elected Ontario representative on CANCOLD Executive Committee (1977). Canadian representative on ICOLD Committee for Bibliography and Documentation (1978).
Responsible for the March 1971 formative report on James Bay development (5 rivers).

Manager of Engineering:
Responsible for all engineering design, including permanent and temporary site facilities and transmission lines, for the 5,225-MW Churchill Falls power development, Labrador, Newfoundland.

Head, Civil Department:
- Grand Rapids H.E. Development
- Los Esclavos hydroelectric development, Guatemala, 14 MW
- Manicouagan 2 hydroelectric development, Quebec, 1,010 MW
- Feasibility studies, Mactaquac hydroelectric development, 630 MW

DAVID C. WILLETT, P. Eng. — Acres American Incorporated

Vice President

Discipline/Year of Graduation: Civil Engineering/1955

Study Assignment: In-House Review Panel

Relevant Area of Expertise:

Project management in hydro and heavy civil and underground engineering projects. Supervison of design studies for underground storage of crude oil for strategic reserve program. Preparation of reports on underground pumped storage, conventional pumped storage, cooling water discharges.

Previous Project Responsibilities:

Project Manager:

- Six UPH and conventional pumped hydro studies
- Cardinal Dam (AEP)
- Amos Dam (AEP)
- FEA strategic petroleum storage program

Executive Engineer:

- Churchill Falls Underground Power Plant
- Mactaquac Hydroelectric Project
- Ffestiniog Pumped Storage Project

DONALD H. MACDONALD, Ph.D., P. Eng. — Acres American Incorporated

Director

Discipline/Year of Graduation: Civil Engineering/1945/B.Sc.
Regional Planning/1947/M.R.P.
Soil Mechanics, Foundations/1955/Ph.D.

Study Assignment: In-House Review Panel

Relevant Area of Expertise:

Technical involvement in heavy civil engineering and geotechnical fields, including all phases such as explorations, studies, laboratory investigations, preliminary and final designs, and field supervision. Particular fields include excavations, foundations, cofferdams, dams and dikes (earth fill, rock fill and concrete), tunnels, shafts and underground openings, channels, unwatering and seepage problems, groundwater studies, and river regulation works.

Previous Project Responsibilities:

In his association with Acres, Dr. MacDonald has been involved in the following projects in technical, administrative or policymaking capacities.

Canada: Churchill Falls power project; Gull Island power project; Mica project; Kettle Rapids generating station; Long Spruce generating station; Limestone generating station; Lower Notch generating station; Amprior generating station; Mactaquac development; Manicouagan 2 development; Grand Rapids generating station and at least two dozen more major power and tunneling projects.

U.S.A.: Amos Dam, Cardinal Dam

Pakistan: Warsak project; Shadiwal

Colombia: Alto Anchicaya development

Ghana: Kpong hydroelectric project

DAVID E. HEPBURN, P. Eng. — Acres American Incorporated

Manager of Engineering

Discipline/Year of Graduation: Electrical Engineer/1952

Study Assignment: In-House Review Panel

Relevant Area of Expertise:

Design and management of electrical portions of major hydroelectric projects.
High voltage long distance transmission line design and management.
Power systems studies and development of computerized load dispatch systems.

Previous Project Responsibilities:

Divisional Chief Electrical Engineer:

- Quality assurance duties on balance of plant for Wolsung-1, a 600-MWe CANDU nuclear station in Korea.
- Addition of four 185-MW hydroelectric generators and associated 500-kV substation, Tarbela, Pakistan.
- Preparation of fully detailed purchase specification for computerized load dispatch system for 400-kV Iraq Supergrid.
- Team member on power system studies in Tanzania, Iraq, Pakistan, and Indonesia.

Head, Electrical Department:
Responsible for production of all electrical construction drawings, schematics and cable schedules for Churchill Falls hydro project.

System Planning Engineer:
Advisor on technical, financial and administrative matters relating to the planning and financial policy of a major power system, and assistance in negotiations with international agencies for loans in excess of $25,000,000.

JAMES D. GILL, P.E. — Acres American Incorporated

Chief Engineer, Power and Heavy Civil

Discipline/Year of Graduation: Civil Engineering/1966/B.Sc.
Soil Mechanics, Foundations/1970/M.Sc.

Study Assignment: Director of Alaska Engineering Studies

Relevant Area of Expertise:

Formulation of investigation programs and staff coordination for geotechnical investigations; soils mechanics, hydrology, geological design and construction supervision of tunnels, excavations, grouting mapping and drainage works; monitoring of dam and powerhouse instrumentation foundation designs.

Previous Project Responsibilities:

Geotechnical Coordinator: AMOS Fly Ash Dam (AEP)

Geotechnical Specialist:
Responsible for design and construction supervision of large drainage tunnels; large scale excavation works.

Senior Engineer:
Construction supervision of overseas power tunnels, surge chambers and excavation work for hydroelectic installations; stability analysis of powerhouse structures; tunnel and shaft designs.

JAMES P. SINCLAIR, P.E. — Acres American Incorporated

Executive Engineer

Discipline/Year of Graduation: Mechanical Engineer/1951

Study Assignment: Director of Feasibility Studies

Relevant Area of Expertise:

Preparation of hydroelectric feasibility studies for large hydroelectric projects in northern climates as well as small and low head hydroelectric projects.
Mechanical engineering design of turbines, governors, gates and the like, particularly for projects having severe icing conditions.
Consultation on cavitation avoidance.

Previous Project Responsibilities:

Executive Engineer:
- Manage feasibility studies for three small hydroelectric projects under the DOE program.
- Direct and coordinate mechanical aspects of feasibility studies for 1000 MW underground pumped hydroelectric scheme.
- Coordinate design for 10 MW Granby hydroelectric redevelopment.

Head, Mechanical Department, Crippen Acres Engineering:

Responsible for mechanical engineering designs and feasibility studies for:
- 1224 MW Kettle Project
- 1000 MW Long Spruce Station
- 1070 MW Limestone Station
- river control structures in Manitoba for the Churchill River diversion project
- extension of boiler house and modifications to central steam heating system for Brandon University
- domestic water, fire protection water and sewerage systems for various construction camps

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PETER H. TUCKER, P.E. — Acres American Incorporated

Project Engineer

Discipline/Year of Graduation: Civil Engineering/1966

Study Assignment: Director of Licensing, and Public Participation

Relevant Area of Expertise:

Regulatory reporting and preparation of license applications for hydroelectric projects.
Preparation of hydroelectric feasibility studies.

Previous Project Responsibilities:

Project Engineer:
Principal investigator for two feasibility studies for low head hydroelectric plants.

Hydro Engineer, Niagara Mohawk Power Corporation:
Staff and project engineering functions in hydroelectric plant design and study jobs, environmental reports, regulatory reporting and licensing. Responsibilities included acting as Project Engineer on a 10-MW new hydro facility through its preliminary design and licensing stage; undertaking a statewide review of hydro development potentials which resulted in a 15-plant hydro expansion program; studies involving hydro purchases, rehabilitation or other capacity related matters; liaison, review and correspondence with agencies and groups associated with water resources in upstate New York, including preparation and presentation of testimony; and other staff functions incorporating impacts on corporate hydro facilities or involving licenses or permit applications.

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DR. JOHN W. HAYDEN, P.E. — Acres American Incorporated

Manager, Special Services Division

Discipline/Year of Graduation: Civil Engineering/1958/B.Sc.
Civil Engineering/1963/Ph.D.

Study Assignment: Director of Environmental Studies

Relevant Area of Expertise:

Technical direction of Hydraulic Research Laboratory including physical and mathematical modeling. Responsible for optimizing designs of spillway, intake and discharge structures and other hydraulic facilities. Director of environmental studies including preparation of EIA and EIS for EPA, Corps of Engineers.

Previous Project Responsibilities:

As Assistant Professor, Dr. Hayden undertook research projects and lectured in Hydraulic Engineering courses at University of Arizona from 1961-62. After Military Service (U.S. Army Corps of Engineers) he was Professor and Associate Department Head, Civil and Mineral Engineering, University of Minnesota (1964-1972), lecturing in Water Resources, Fluid Mechanics and Hydrology. As Manager, Special Services, he has directed numerous environmental studies associated with power plants and water resources.

DR. IAN HUTCHISON — Acres American Incorporated

Senior Hydraulic Engineer

Discipline/Year of Graduation: Civil Engineering/1967 B.Sc.
Civil Engineering/1976 Ph.D.

Study Assignment: Director of Hydrology/Hydraulics Studies, Feasibility Studies Team

Relevant Area of Expertise:

Detailed hydraulic/hydrological studies: Development and application of mathematical modeling to water resources investigations. Environmental assessment and remedial measures for surface water clean-up. Groundwater contamination.

Previous Project Responsibilities:

Research Officer:

Mathematical models to simulate water level variations and salinity regime to devise remedial measures for improving environmental conditions at St. Lucia Lake, South Africa.

Hydraulic and hydrological studies for devising measures to reduce polluted run-off and industrial effluent entering natural streams in Ashtabula, Ohio and Hot Springs, Arkansas.

MALCOLM R. VANDERBURGH, P. Eng. Acres American Incorporated

Executive Engineer

Discipline/Year of Graduation: Civil Engineering/1957

Study Assignment: In-house Review Panel

Relevant Area of Expertise:

Design and site supervision - earth fill dams and dikes.
Civil design - concrete structures for hydroelectric and water resource projects.
Underground pumped storage studies.
Erosion and flood control projects and studies.

Previous Project Responsibilities:

Project Manager:
Design of 1000 MW Long Spruce Generating Station in Manitoba - Manitoba Hydro.

Project Engineer:
Two major earth fill dams for retention of fly ash slurry in West Virginia (Amos) and Ohio (Cardinal) - American Electric Power.
Flood control development - Metro Toronto Conservation Authority.

Coordinating Engineer:
Technical responsibility for civil engineering design for 340 MW Hydroelectric Peaking Station.
Various hydroelectric, erosion control and water supply studies.

ROBERT R. HENSCHEL Acres American Incorporated

Geotechnical Design Engineer

Discipline/Year of Graduation: Geology/1971/B.A.

Study Assignment: Director of Geotechnical Design/Inspection Support

Relevant Area of Expertise:

Field supervision for geotechnical investigation of industrial, energy producing, and water resource projects.

Previous Project Responsibilities:

Responsible for field supervision of:
- shallow drilling investigation for PEPCO UPH/CAES project near Washington, D.C.
- geotechnical investigation to assess the suitability of Weeks Island Salt Mine, Weeks Island, Louisiana, for storage of crude oil, Federal Energy Administration.

Respsonsible for research and development of deep drilling methods and techniques currently in use and preparation of contract documents for the drilling of a 5,000-ft deep hole for PEPCO UPH/CAES project near Washington, D.C.

RICHARD W. CARSON, P.Eng. — Acres American Incorporated

Project Coordinating Engineer

Discipline/Year of Graduation: Civil Engineer/1970/B.S.
Water Resources/1973/M.S.

Study Assignment: Director of Ice Engineering, Feasibility Study Team

Relevant Area of Expertise:

Study of and appropriate designs for the effects of icing conditions on major civil engineering projects.

Previous Project Responsibilities:

Project Coordinating Engineer:

- Involved in a study of alternative methods of ice management in the Arctic harbor of Bridport Inlet, Melville Island.
- Principal investigator in a study of the effects of extended winter navigation on the ice and flow regimes of the international section of the St. Lawrence River.
- Principal investigator in a study of hydraulic improvements and rehabilitation of 2 hydroelectric plants (total capacity 15 MW) on the Winnipeg River.
- Conceptual studies for the comparison of a conventional spillway and powerhouse versus an integrated powerhouse using low-level sluiceways for a 1,100-MW hydroelectric power development.
- Participation in the hydraulic design of an 1,100-MW hydroelectric power development on the Nelson River.
- Principal investigator in a study of hydraulic effects of diking to preserve waterfowl habitat on the upper Columbia River.

ROBERT O. SHIELDS — Acres American Incorporated

Lead Civil Engineer

Discipline/Year of Graduation: Economics/1975/B.Sc.
Water Resources/1977/M.Sc.

Study Assignment: Director of Hydraulic Structures Studies, Feasibility Study

Relevant Area of Expertise:

More than 26 years of experience in the construction and engineering industry. Thorough knowledge of the practical aspects of reservoir regulation, hydraulic structure design and function, and hydrologic studies.

Previous Project Responsibilities:

Lead Civil Engineer:

Design hydraulic features and prepare cost estimates for low head as well as larger hydroelectric projects.

Lake Control Engineer:

- Supervision and operational control of a 2700 acre lake and care of 300 square mile watershed. Maintenance and operation of gaging stations. Selection of location, establishment of elevations, calibration, computation of velocity and discharge curves.
- Development of rainfall/runoff model for watershed.

Construction Engineer:

Served as project engineer for underground facilities design and construction.

S. SHARIF AHMAD, P.E. — Acres American Incorporated

Senior Project Engineer

Discipline/Year of Graduation: Civil Engineer/1952/B.Sc.
Civil Hydraulic Engineer/1956/M.Sc.

Study Assignment: Director of Conceptual Design

Relevant Area of Expertise:

Twenty-six years of experience in Consulting Engineering in water resources management as Project Engineer, and Project Manager in planning, design, engineering of hydro, thermal and nuclear power plants, and water supply and irrigation projects in the United States and abroad.

Previous Project Responsibilities:

Project Engineer, Bechtel:

Direction of engineering and economic studies including:

- Prefeasibility studies for water resources and power pool study (WRAPPS) in Colorado for 10 hydropower, 6 pumped storage sites, 2 water supply projects.
- Prefeasibility report on the 2,000 MW Brown's Canyon Pumped Storage Project with 2,400 feet head, using single stage reversible units in an underground power plant.
- Development of technical data on hydromechanical aspects of machines for various types of reversible and ternary machines and investigations of special problems and its application in seawater and bulb turbines.

Principal Engineer, C. T. Main:

- 1,620 MW Salto Grande project

Prior experience with Stone and Webster and with HARZA.

STEWART N. THOMPSON — Acres American Incorporated

Senior Geologist

Discipline/Year of Graduation: Geology/1968/B.S.
Geology/1973/M.S.

Study Assignment: Geologic Aspects of Conceptual Design, Feasibility Study Team

Relevant Area of Expertise:

Geotechnical aspects of site studies for large projects.

Previous Project Responsibilities:

Responsible for geotechnic investigation for
- Department of Energy Strategic Oil Storage Project, Louisiana
- feasibility of hydrofracture and injection, West Valley, New York
- site selection and exploration for the DOE/EPRI Energy Storage Study

Lead Geotechnical Engineer, Stone & Webster

Responsible for all aspects of geotechnical studies and licensing for the Greene County nuclear plant, Power Authority of the State of New York, (PASNY) and for several fossil-fueled plants.

D. WILLIAM LAMB — Acres American Incorporated

Executive Engineer

Discipline/Year of Graduation: Civil Engineer/1953/B.S.

Study Assignment: Director of Dam Construction Studies

Relevant Area of Expertise:

Extensive experience in soils and foundations engineering, management and supervision for large projects civil works, site investigations, site development.

Previous Project Responsibilities:

Responsible for pavement design for Tribhuvan Airport, Kathmandu, Nepal, pavement and airport lighting projects for Niagara Falls, New York Airport.
Chief engineer for master plan study for new international airport, Jakarta, Indonesia, responsible for all civil engineering works, site investigations, aircraft pavements and lighting, site development, and drainage.

Manager of Engineering:
Administration and job assignments for the engineering and technical personnel of the company and quality control of engineering and drafting work.

Senior Soil Mechanics and Foundation Engineer:
- Supervision of construction of a 200-ft high earth dam for fly-ash retention at Brilliant, Ohio.
- Foundation and structural design for electrical substations, facilities and pollution control equipment at thermal power stations, a multistory rotating hotel in New York State, and various industrial installations and transmission line towers.
- Planning, supervision and assessment of geotechnical investigations; preliminary designs involving excavation slopes, dewatering, piling, backfilling and groundwater control for marine facilities in South Korea, Newfoundland, Taiwan and Puerto Rico.

EDWARD N. SHADEED, P.E. — Acres American Incorporated

Executive Engineer

Discipline/Year of Graduation: Electrical Engineer/1950

Study Assignment: Director of Electrical Engineering, Feasibility Study

Relevant Area of Expertise:

Planning, design, and estimation of electrical engineering aspects for hydroelectric projects.

Previous Project Responsibilities:

Executive Engineer:
Supervising the engineering of the Iraq National Despatch Centre. Supervision and design of automating a hydro plant for Peterborough Utilities Commission. Consultant on Warsak Hydro Development and Larona Project in Indonesia.

Engineering Specialist:
Feasibility and electrical preliminary engineering proposals for underground pumped storage plants. Electrical engineering estimate for 1,620-MW Salto Grande Development, Uruguay, Argentina. Consultant for various projects, including Long Spruce, Manitoba, Sirikit, Thailand and Arnprior Hydroelectric Generating Station, Ontario. Feasibility study for increasing Nam Ngum Project capacity in Laos.

Management and direction of engineering for Rochester Gas and Electric Substation 23, an urban type enclosed substation.

Commissioning Coordinator at the Lower Notch Generating Station.

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JOHN G. MACPHERSON — Acres American Incorporated

Executive Engineer

Discipline/Year of Graduation: Civil Engineering/1953/B.S.

Study Assignment: Director, Climatic Considerations, Feasibility Study Team

Relevant Area of Expertise:

Management of concept and design studies for hydroelectric projects in cold regions.

Previous Project Responsibilities:

Project management of concept study and design for the powerhouse, intake, spillway earth dams for a 1140-MW, 10-unit, 90-ft head hydroelectric power development, Limestone generating station, Manitoba Hydro.

Manager for hydrologic studies of Hay-Zama lakes area of northern Alberta, Ducks Unlimited.

Executive Engineer, Crippen Acres:
- Project Manager for design of a 1000-MW, 10-unit, 80-ft head hydroelectric power development including dikes on permafrost and camp facilities, Long Spruce generating station, Manitoba Hydro.
- Manager for evaluation of a 40-year old single-unit hydroelectric station, Kanuchuan hydroelectric station, Province of Manitoba.
- Manager for design of marinas at Hecla Island, Winnipeg Beach and Falcon Lake, Manitoba Parks Branch.

GARRY W. TAPPAY — Acres American Incorporated

Project Engineer

Discipline/Year of Graduation: Civil Engineering/1961/B.S.
Soil Mechanics/1966/M.S.

Study Assignment: Director of Construction Methods, Feasibility Study Team

Relevant Area of Expertise:

Geotechnical field investigations for international projects.

Previous Project Responsibilities:

Geotechnical field investigations and feasibility studies for hydroelectric dam projects in Iran and Ontario.

Inital supervision and coordination of field investigation program and geotechnical design work for Atikokan thermal generating station, consisting of coal supply, storage and processing facilities, cooling-water system, and multiple reservoir control dams.

Project Engineer on Muskrat Falls development study comprising preliminary layout and cost estimate for hydroelectric scheme on Lower Churchill River, Labrador. Project included stabilization and erosion protection of marine clay slopes.

J. T. MINSTRELL — Acres American Incorporated

Senior Project Engineer

Discipline/Year of Graduation: Mechanical Engineering/1962

Study Assignment: Manager, Cost Estimates and Schedules, Construction Aspects

Relevant Area of Expertise:

Design and application of cost and progress control systems for major mining, nuclear and hydro power projects.
Supervision of estimating and cost control functions.
Coordination of field construction including quality control and responsibility for field labor costs.

Previous Project Responsibilities:

Senior Project Engineer:
Responsible for preparation and schedules, estimates and control of progress and costs for power generation plants, water resources and other major projects.

Cost Engineering Specialist (Bechtel):
Responsible for the design and application of project control systems for nuclear hydro and major mining projects.
Supervisor of project office cost engineering - Bourgainville Copper Project.
Preparation of budgets and estimates for mechanical and electrical portions of Churchill Falls.

SONGTHARA OMKAR, P.E. — Acres American Incorporated

Hydroelectric Planning Engineer

Discipline/Year of Graduation: Civil Engineer/1965/B.Sc.
Civil Engineer/1967/M.Sc.

Study Assignment: Manager of Power Studies, Feasibility Study Team

Relevant Area of Expertise:

Direction of hydroelectric planning and feasibility studies. Directs and prepares system studies for utility clients.

Previous Project Responsibilities:

Hydroelectric Planning Engineer, Harza Engineering Company:
Conducted economic, market, and hydraulic studies for water resource projects. Group leader for the project investigating "The Magnitude and Regional Distribution of Needs for Hydropower", as a part of the Corps of Engineers' National Hydropower Study. Prepared major systems studies. Involved in not less than twelve other studies concerned with water resources, hydroelectric power, irrigation and energy storage projects.

Planning Engineer, United Nations Economic and Social Commission for Asia and the Pacific, Bangkok, Thailand:
Conducted economic and technical analyses of water resources projects in the Lower Mekong River Basin in Cambodia, Laos, Thailand, and Vietnam. Developed an inventory of hydroelectric power potential for Cambodia, Laos, Thailand, and Vietnam, including preliminary designs of dams and powerplants and project costs.

RICHARD MAYER, P.E. — Acres American Incorporated

Senior Civil Engineer

Discipline/Year of Graduation: Agricultural Engineering/1967/B.S.

Study Assignment: Hydrologic Studies, Feasibility Study Team

Relevant Area of Expertise:

Studies and computer applications of hydrology and hydraulics.

Previous Project Responsibilities:

Project Engineer responsible for directing:
- hydrologic investigations and hydraulic design of wastewater settling ponds for industrial and mine sites.
- feasibility studies and design for various hydroelectric facilities
- numerous analytical and physical hydraulic model studies
- HUD flood insurance studies

Formerly with U.S. Soil Conservation Service, conducted numerous hydrologic and hydraulic studies for flood control projects and also acted as field inspector on several flood control dam projects.

DARSHAN K. KAUSHAL — Acres American Incorporated

Engineering Specialist, Power Systems

Discipline/Year of Graduation: Mathematics/1958/B.A.
Electrial Engineer/1967/B.Tech.

Study Assignment: Director of Electrical Design Aspects, Feasibility Study Team

Relevant Area of Expertise:

Coordination and direction of electrical engineering and design of power utility related projects.

Previous Project Responsibilities:

Responsible for preparation of protective relaying schemes for high-voltage power systems, including a 400 kV supergrid in Iraq. 500 kV Tarbela hydroelectric generation project scheme in Pakistan.

Design of control, metering, protective relaying systems and the bid documents preparation for 4x44 MVA Kpong hydroelectric project in Ghana.

Responsible for the supervision of general layout and design of EHV substations, selection and rating of transformers and circuit breakers, preparation of design transmittal, purchase specifications and review of tender documents.

ALEXIS C. VIRCOL, P.E. Acres American Incorporated

Hydroelectric Planning Engineer

Discipline/Year of Graduation: Hydroelectric Engineering/1958

Study Assignment: Director of Economic Analysis, Feasibility Study

Relevant Area of Expertise:

Direction of hydroelectric planning, feasibility and design studies. Direction and preparation of hydraulic, hydrologic and economic studies for water resource development studies.

Previous Project Responsibilities:

Planning Engineer, Harza Engineering Company:
- Design and cost estimate of a diffuser structure at D. H. Mitchell Station in Indiana; water supply analyses for the Guri Dam Project, Venezuela.
- Design of spillway and outlet works for the multi-purpose (irrigation, water supply, flood control) Kajakai Project in Afghanistan.
- Determination of water supply available for irrigation and estimated drainage design discharges for the Black River Upper Morass Project, Jamaica.
- Hydraulic and economic analyses for the surface water-control plan in the North Rawhide-Caballo surface coal mine areas, Carter Mining Company Project, Wyoming.
- Economic evaluations of additional developments at various existing multi-purpose dams in the Kanawha River Basin, West Virginia (both normalized cost and life-cycle cost analyses). Design and cost estimates of spillways and lower level outlets for new damsites in Virginia.

WILLIAM C. TERVO Acres American Incorporated

Chief of Hydroelectric Drafting

Discipline/Year of Graduation: Civil Engineering/1947

Study Assignment: Director of Drafting

Relevant Area of Expertise:

Responsible for development of conceptual layouts for several large hydroelectric generating stations, and water resource projection.

Previous Project Responsibilities:

Technologist, Crippen Acres, site liaison at Long Spruce Generating Station, Nelson River, Manitoba.

Participation in the preparation of conceptual designs and feasibility studies, or preliminary report drawings for Limestone Generating Station, Churchill River Diversion, James Bay, Lower Churchill River and others.

ACRES

SHER BAHADUR, PH.D., P.E. — Acres American Incorporated

Project Coordinating Engineer, Geotechnical

Discipline/Year of Graduation: Geology/1959/B.S.
Engineering Geology/1960/M.Sc.
Geotechnology/1972/Ph.D.

Study Assignment: Director of Geotechnical Studies, Feasibility Study Team

Relevant Area of Expertise:

Preparation of studies and reports on geotechnical aspects of power and industrial projects.

Previous Project Responsibilities:

Project Coordinating Engineer, Geotechnical:

Responsible for geotechnical aspects of

- field exploration program, foundation design and structural stability for the 10-MW Granby hydro redevelopment for Niagara Mohawk Power Corporation.
- preliminary design of surface reservoir embankments and structures and underground excavations for 1000 MW underground pumped/compressed air energy storage complex.
- design memorandum for embankments and instrumentation systems associated with tailings disposal dam for Union Carbide at Hot Springs, Arkansas.
- feasibility study of small hydroelectric projects in the States of Maine, Massachusetts, and Vermont.

PARIMAL C. PAL, P.Eng. — Acres American Incorporated

Senior Civil Engineer

Discipline/Year of Graduation: Civil Engineering/1959/B.E.
Civil Engineering/1964/M.Sc.

Study Assignment: Civil/Structural Aspects of Conceptual Design Studies

Relevant Area of Expertise:

Preliminary and detailed design of reinforced concrete and structural steel structures for hydroelectric projects, ore refining facilities, grain handling facilities and other heavy civil projects.

Previous Project Responsibilities:

Senior Engineer/Group Leader:
Responsible for design of surge tank and spillway piers for Outardes 2 project (Hydro Quebec) and design of spillway, service bridge, diversion structures for various projects, design of low head powerhouse for 1000 MW James Bay LG-2 project.

Design Engineer:
Design of grain handling facilities, ore crusher buildings, ore concentrate handling facilities, heavy industrial building, structures for large steam generators.

ACRES

THOMAS W. GWOZDEK, P.E. — Acres American Incorporated

Project Engineer

Discipline/Year of Graduation: Civil Engineering/1971

Study Assignment: Director of Project Layouts, Feasibility Study Team

Relevant Area of Expertise:

Design of foundations and structural support systems and coordination with mechanical and electrical aspects of projects involving heavy reciprocating and rotating equipment. Conceptual and preliminary design engineering and construction cost estimates for UPH and large underground storage facilities. Structural designs of high pressure pipework and large cross-section duct work.

Previous Project Responsibilities:

Project Engineer:

Responsible for civil and structural engineering for industrial process facility for Union Carbide. Civil Project Engineer for U.S. Corps of Engineers Watervliet Arsenal Rotary Forge. Conceptual and preliminary engineering, cost estimates for UPH - PEPCO underground oil storage facility for FEA.

Structural Design Engineer:

Responsible for design of foundations for compressors and other heavy industrial equipment.

M. ASGHER ALI — Acres American Incorporated

Project Electrical Engineer

Discipline/Year of Graduation: Electrical and Mechanical Engineer/1962

Study Assignment: Manager of Generating Machinery Studies, Feasibility Study Team

Relevant Area of Expertise:

Design, installation, testing and commissioning of control and distribution systems, hydroelectric generators and auxiliaries for generating systems.

Previous Project Responsibilities:

Senior Electrical Engineer, Manitoba Hydro
Responsible for installation and commissioning of 30 MVA horizontal bulb type hydrogenerators, all auxiliaries and ancillary systems.

Senior Electrical Enginerr, Crippen Acres Engineering
Design of electrical systems for 7000-man construction camp; design of motor controls for a river control structure; design of motor controls and powerhouse ancillary systems for a hydroelectric generating station.

PETER RODRIGUE, P.Eng. Acres American Incorporated

Lead Mechanical Engineer

Discipline/Year of Graduation: Mechanical Engineer/1971

Study Assignment: Manager of Mechanical Design, Feasibility Study

Relevant Area of Expertise:

Design and selection of mechanical equipment for hydroelectric projects.

Previous Project Responsibilities:

Lead Mechanical Engineer:

Responsible for mechanical designs, equipment selection, and cost estimates for turbines, gates, cranes, elevators, large valves, and similar equipment for numerous hydroelectric projects and dams.

Mechanical Coordinator, Crippen Acres Engineering:

Coordination of preliminary mechanical engineering for Limestone Generating Station, Manitoba Hydro.

Preliminary mechanical design, for tender purposes, of gates and associated hoist and crane equipment, for Wreck Cove Power Project, Nova Scotia, Canron Ltd.

Coordination of mechanical design for two control structures associated with the diversion of the Churchill River into the Nelson River.

RICHARD C. STUTCHBURY Acres American Incorporated

Executive Engineer

Discipline/Year of Graduation: Civil Engineering/1955/B.S.

Study Assignment: Director of Transmission Planning and Design, Feasibility Study Team

Relevant Area of Expertise:

Responsible for overseeing transmission projects. Director of planning, engineering and construction for numerous transmission projects.

Previous Project Responsibilities:

Responsible Manager for contracts, purchasing, inspection, expediting, scheduling and planning, estimating, budgeting, forecasting and cost control for Gull Island Hydroelectric Project, Lower Churchill Consultants, an 1800-MW development in Labrador. Organization and direction of a division as part of project management team to carry out the above functions.

Responsible for engineering, planning and coordination of construction management for 360 miles of single-circuit 735-kV line from Churchill Falls Power Project to Quebec border and 50 miles of single-circuit 230-kV line from Churchill Falls to Twin Falls power project.

Coordination of engineering studies on the economics of alternative designs for the crossing, including studies of geotechnical and structural design factors and wave and ice action on proposed structures.

PHILIP M. HOOVER — Acres American Incorporated

Civil Engineer

Discipline/Year of Graduation: Civil Engineering/1974

Study Assignment: Coordinator of Public Participation Program

Relevant Area of Expertise:

Hydroelectric power studies including feasibility analysis, alternatives evaluation, and licensing and regulatory applications. Public involvement program for Corps of Engineers planning studies.

Previous Project Responsibilities:

Civil Engineer, FERC:
Responsible for preparation of water resource appraisal reports for the hydroelectric development of river basins; review of reports of other agencies pertaining to water resource development; participation in various joint water resource investigations with other governmental agencies; and served on President's Water Policy Implementation Task Force.

Civil Engineer, U.S. Army Corps of Engineers, Baltimore District:
Study manager for water resource development studies in hydropower water quality, navigation, and flood control. Study team member responsible for planning, economics, and for interagency coordination and public involvement programs. Contract negotiation and management.

CHRIS B. CHAPMAN, Ph.D. — Acres American Incorporated

Director

Discipline/Year of Graduation: Industrial Engineer/1962/B.Sc.
Operational Research/1964/M.S.
Economics/1974/Ph.D

Study Assignment: Planning and review of risk analysis

Relevant Area of Expertise:

Risk analysis of large engineering projects

Previous Project Responsibilities:

Responsible for risk analysis methodology and analysis execution of Acres risk studies as follows:

- McKenzie River Valley Pipeline	1975
- Hartha (Thermal Power Plant, Iraq)	1975
- Ninian Methodology Development Exercise	1976-77
- Magnus	1978-79

Also acted as advisor on Lower Churchill Falls study and several other risk analysis studies, including related work on seismic risk to nuclear power plant.

RALPH R. MIGLIACCIO, R.G. — R & M Consultants, Incorporated

President

Discipline/Year of Graduation: Geology/1958/B.S.

Study Assignment: Director of Geotechnical Investigations and Survey

Relevant Area of Expertise:

Engineering Geologist, with broad experience in geotechnical disciplines including soil mechanics, foundations, geology, aerial photographic interpretation and earthquake effects; work has encompassed every physiographic province of Alaska, including permafrost regions and areas possessing more normal conditions.

Previous Project Responsibilities:

Special Consultant to Alyeska Pipeline Service Company and gas pipeline groups. Includes participation on unique earth science engineering geology projects.

Geologist, experienced in route soils studies, foundation investigations, site evaluation, and selection studies. In charge of geological route review and drilling studies, Trans Alaska Pipeline Project.

Materials Foundation Engineering Geologist, Alaska Department of Highways. Directed many complex subsurface foundation investigations throughout the State for major bridge and embankment structures.

JAMES W. ROONEY, P.E., L.S. — R & M Consultants, Incorporated

Vice President and Principal-in-Charge, Special Projects

Discipline/Year of Graduation: Civil Engineer/1962/B.S.
Civil Engineer/1967/B.S.

Study Assignment: R & M Review Board

Relevant Area of Expertise:

Direction of geotechnical investigations for major engineering projects in Alaska.
Slope stability investigations.

Previous Project Responsibilities:

Lead Geotechnical Engineer for the Northwest Alaskan Natural Gas Transmission System. Coordination and supervision of geotechnical studies for the chilled gas pipeline alignment.

Special Consultant to Trans Alaska Pipeline System (TAPS) and gas pipeline study groups.

Assisted in the evaluation of pipeline alignment, general soil conditions, and preliminary review of slope performance of critical segments along the TAPS route.

Geotechnical Engineer, selected as special task group member by Dr. R. B. Peck for detailed review and identification of slope stability problems along the TAPS route.

Evaluation and design recommendations for cut slopes of up to 30' in height in soils and rock containing both frozen and thawed conditions.

MALCOLM A. MENZIES, P.E., L.S. R & M Consultants, Incorporated

Principal and General Manager, Juneau Office

Discipline/Year of Graduation: Geology/1958/B.S.
Engineering Management/Continuing
Glaciology, /Continuing
Soil Mechanics/Continuing

Study Assignment: R & M Review Board

Relevant Area of Expertise:

Direction of survey activities and aerial photogrammetric programs throughout Alaska. Planning and coordination of field investigations in remote arctic and sub-arctic regions.

Previous Project Responsibilities:

Supervised site reconnaissance, evaluation, location surveys, and soils investigation Loran 'C' Sites at Shoal Cove, Tok, and Narrow Cape, Alaska.

Responsible for locating 55 miles of secondary road from Livengood to the Yukon River for the Trans Alaska Pipeline.

Project Right-of-Way Engineer, Alaska Department of Highways, Juneau District.

Supervised 155 mile Native Land Selection Cadastral Engineering project at Unalakleet, Alaska and in the Craig-Klawock area in Southeast.

ROBERT L. SCHRAEDER, R.G. R & M Consultants, Incorporated

Head, Earth Sciences Department, R & M
Vice President, Resource Exploration Corporation

Discipline/Year of Graduation: Geology/ /M.S.

Study Assignment: R & M Review Board

Relevant Area of Expertise:

Supervision and direction of soils investigations and drilling programs throughout the State of Alaska.

Previous Project Responsibilities:

Supervisory Geologist, supervision of the centerline soils investigation for the Trans Alaska Pipeline. Products included preparation of published borehole logs, drilling location maps and supporting information in a format suitable for presentation to government review agencies.

Supervisory Geologist, supervision of the preliminary centerline soils investigation for the proposed Northwest Alaskan Gas Pipeline between Delta Junction and the Canadian Border.

Geotechnical Consultant, supervised the development of numerous reports such as slush flow avalanche studies, solifluction studies, slope stability studies and bedrock mapping projects.

Geologist, Member of the Site Study Task Force, North Slope Haul Road Maintenance Camp Study for the Alaska Department of Transportation and Public Facilities.

JIM M. BROWN, PH.D., R.G. — R & M Consultants, Incorporated

Senior Engineering Geologist

Discipline/Year of Graduation: Geology/1960/B.S.
Geology/1963/M.S.
Geology/1968/Ph.D.

Study Assignment: Director of Geological Studies

Relevant Area of Expertise:

Specializes in projects requiring expertise in rock mechanics, structural geology, groundwater monitoring and control, bedrock mapping, and airphoto interpretation.

Previous Project Responsibilities:

- Resident Geologist during construction of the Valdez Terminal of the Trans Alaska Pipeline, primarily responsible for subsurface exploration, documenting bedrock formations, geotechnical investigation and design of rock slopes, design and field modification of rock slope reinforcement, design and field modification of groundwater control measures.
- Project Geologist, responsible for the 1977 Terrain and Geotechnics Investigation of the South Willow Capital Site.
- Project Manager, rock slope stability consultant to the Alaska Department of Highways on the Keystone Tunnel Bypass Project.

GARY A. SMITH, R.G. — R & M Consultants, Incorporated

Senior Geologist

Discipline/Year of Graduation: Geology/1968

Study Assignment: Director of Site Exploration and Testing

Relevant Area of Expertise:

Project Manager for scheduling and coordination of multidisciplined projects.

Geologist, specializing in engineering and environmental geology.

Previous Project Responsibilities:

- In charge of subsurface investigation for ARCO's proposed Kuparuk River Pipeline Crossing.
- Directed a complete geotechnical study for a Cattle Research Center, Kalsin Bay, Kodiak Island.
- Project Manager, responsible for a project to drill 300 foot deep holes and install cathodic protection apparatus at the Trans Alaska Pipeline Terminal, Valdez, and four pump stations.
- Editor-in-Chief in charge of preparation of school site investigation reports for sixteen villages in the Lower Kuskokwim School District.

BOB A. DORTCH, L.S. R&M Consultants, Incorporated

Chief of Surveys and Survey Coordinator, Anchorage

Discipline/Year of Graduation: Surveying/1959

Study Assignment: Manager of Surveys

Relevant Area of Expertise:

Extensive experience in boundary and topographic surveys and mapping in remote regions in Alaska.

Previous Project Responsibilities:

- Project Manager, Alaska Divisions of Lands Cadastral Survey at Glennallen, Alaska. Boundary survey involving 14 Sections of land including aerial topography and tentative subdivision.
- Chief of Surveys, responsible for the field surveying, computing and mapping of 16 remote village high school sites within the Lower Kuskowkwim School District.
- Project Manager, Southwest Region Schools Boundary surveys at Togiak, Koliganek, Portage Creek, Ekwok and Alegnagik.
- Consulting Surveyor to Bureau of Land Management.
- Consultant to Pacific Power and Light Co., monitoring lateral movement and subsidence of John Boyle Dam.
- Project Supervisor, Alaska Division of Lands Cadastral Survey G.S.C.-131, Glennallen, Alaska.

WILLIAM A. ROBERTSON, P.E. R&M Consultants, Incorporated

Senior Civil Engineer

Discipline/Year of Graduation: Civil Engineer/1972/B.S.E.
Civil Engineer/1976/M.S.

Study Assignment: R&M Coordinator for Camps

Relevant Area of Expertise:

Specializes in planning, design, and construction management of marine facilities, warehouses, water and sewer systems, roads, solid waste disposal systems, remote site construction and fish rearing facilities.

Previous Project Responsibilities:

- Project Manager for preliminary site planning and boundary surveys for sixteen proposed high schools in the Lower Kuskokwim River Delta.
- Project Manager for developmental planning of a 4,600 acre subdivision in Glennallen, Alaska.
- Survey Field Supervisor, responsible for directing all predesign and preconstruction surveys for nineteen proposed airport improvement and new projects throughout Alaska.
- Design Engineer, involved in land use planning and utility layout and design at Anchorage International Airport.
- Project Manager, responsible for the design of a new water supply system and dam for Saxman, Alaska.
- Engineer/Surveyor in charge of site selection and field surveys for twelve secondary and trunk airstrips throughout Alaska.

BRENT T. DRAGE, P.E. — R & M Consultants, Incorporated

Hydrologist/Senior Engineer

Discipline/Year of Graduation: Civil Engineer/1969/B.S.
Civil Engineer/1977/M.S.

Study Assignment: Director of Field Hydrology Studies

Relevant Area of Expertise:

Hydrologist, specializing in hydraulic design, river mechanics, ice engineering, sedimentology, riverine regime analysis, and northern hydrological evaluation and assessment.

Previous Project Responsibilities:

- Hydrologist, conducted an extensive hydrological study of the Kuparuk River and Coastal Plain watershed on the North Slope.
- Permit application specialist, prepared permit applications for bridges, waterway encroachments and marine facilities for presentation to the U.S. Army Corps of Engineers.
- Investigated the current methods of peak flood determination in northern sparse data regions.
- Developed and implemented a hydrology program to determine guidelines for mining gravel from rivers and floodplains in Alaska.
- Prepared a hydrological assessment of the National Petroleum Reserve.
- Hydraulic Engineer for the Trans Alaska Pipeline System.
- Conducted an extensive river ice research program on the Mackenzie River to determine the effects of spring break-up on proposed wharf structures and pipeline crossings.

ULRICH LUSCHER, SC.D., P.E. — Woodward-Clyde Consultants

Principal

Discipline/Year of Graduation: Civil Engineer/1956/B.S.
Structures/1959/M.S.
Civil Engineer/1963/Sc.D.

Study Assignment: WCC Principal-in-Charge, Director of Seismic Investigations

Relevant Area of Expertise:

Project management, geotechnical engineering, frozen soil engineering, performance and instrumentation engineering.

Previous Project Responsibilities:

- In charge of a Projects Group which conducts or manages large, often interdisciplinary projects for major industrial and governmental clients.
- Managed several studies for the proposed chilled gas pipeline across Alaska. The work was related to trench blasting tests and a review of the existing data base for the project.
- Involved nearly full-time in the Trans Alaska Oil Pipeline project, leading a group of Woodward-Clyde Consultants' personnel engaged in evaluating geotechnical aspects of the pipeline system.
- Research on the interaction of soil and underground structures and the failure conditions of foundations under static and dynamic loads.

GEORGE E. BROGAN, R.G. — Woodward-Clyde Consultants

Deputy Director of Geology

Discipline/Year of Graduation: Geology/1966/B.A.
Geology/1969/M.S.

Study Assignment: Project Seismic Engineer

Relevant Area of Expertise:

Engineering, geology, seismic geology, structural geology, and geomorphology.

Previous Project Responsibilities:

- World-wide experience in engineering geology and seismic geology on projects including nuclear and conventional power plants, dams, tunnels, pipelines.

- In charge of the evaluation of active faults for the Trans-Alaska Pipeline System, the evaluation of the Bocono fault in Venezuela for the Yacumbu tunnel, the mapping and evaluation of the Wasatch fault in Utah, the evaluation of seismic activity and faults for several power plants in Italy, studies for nuclear power plant siting in Iran, evaluations of dams and dam sites in North and South America, and mapping active faults for land-use planning in Managua, Nicaragua.

- Completed studies of seismic and geologic hazards in offshore areas of California, Alaska, and the Caribbean.

NORMA E. BIGGAR, R.G. — Woodward-Clyde Consultants

Staff Geologist to Project Geologist

Discipline/Year of Graduation: Geology/1974/M.S.
Geology/1974/M.S.

Study Assignment: Project Geologist

Relevant Area of Expertise:

Particular knowledge and experience in Alaskan geology. Has served as research assistant in the Geophysical Institute, University of Alaska.

Previous Project Responsibilities:

- Ms. Biggar has served as the project geologist for the active fault identification study for the proposed Alcan gas pipeline in Alaska; and for the geological and seismological investigations of the New Melones Dam site in California.

- She has also been involved in regional geologic studies for the siting of a proposed LNG plant Yakutat, Alaska, nuclear reactors in the Persian Gulf of Iran, Italy, and the Central Valley of California, and the detection of active faults for the Trans Alaska pipeline project.

- An overall geologic study of the Chena Hot Springs area near Fairbanks, Alaska was the topic of Ms. Biggar's Master's Thesis.

WILLIAM U. SAVAGE, Ph.D. — Woodward-Clyde Consultants

Senior Project Seismologist

Discipline/Year of Graduation: Physics/1966/B.S.
Seismology/1971/M.S.
Seismology/1976/Ph.D.

Study Assignment: Project Seismologist

Relevant Area of Expertise:

Seismology, geophysics, and seismic geology. Specific experience in and strong knowledge of Alaskan seismicity.

Previous Project Responsibilities:

- Recently completed a study of the seismicity of the Alaskan Interior for the proposed Alcan gas pipeline. In this study, detailed analyses of the microearthquake data along and east of the Denali fault were carried out to assess the location, level of activity, and sense of movement of potentially active faults.
- Conducted historical seismicity evaluations, seismotectonic interpretations, and seismic safety analyses for high-rise buildings, thermal and nuclear power plant sites, offshore oil developments, and other critical engineering projects, both in the United States and overseas.
- Dr. Savage is leading the Woodward-Clyde Consultants program in developing additional capabilities in microearthquake instrumentation and applications.

F.P. MOOLIN, JR. — Frank Moolin and Associates, Inc.

President

Discipline/Year of Graduation: Civil Engineer/1955/M.B.A.(partial)

Study Assignment: Administration, Cost Control, Construction Process Consultant

Relevant Area of Expertise:

Eighteen years of Project Management experience (five in Alaska) on large and involved construction projects. Has provided the total project leadership and control for worldwide projects and is familiar with the requirements of projects occurring in remote areas such as the Susitna Hydropower Project. Intimately familiar with the Alaskan "scene" after serving as Senior Project Manager during construction of the Trans-Alaska Pipeline. Earned the construction industry's highest award, the Engineering News Record "Construction Man of the Year", in 1976 during pipeline construction.

Previous Project Responsibilities:

- Senior Project Manager, heading Alyeska Pipeline Construction
- Project Manager, DuPont Atomic Energy Commission Bedrock Waste Storage Project
- Project Engineer, Resident Engineer, and Project Manager on major refinery projects in the Far East
- Project Engineer coordinating civil and structural work on the Bay Area Rapid Transit System

Jeffrey O. Barnes
President

Terrestrial Environmental Specialists, Inc.

Discipline/Year of Graduation — B.S. Zoology/1971

Study Assignment: Environmental Study Manager

Relevant Area of Expertise:

Mr. Barnes has experience in the coordination of environmental studies in regards to the electric utility industry. He has served in this capacity as both a private consultant and also as a representative of a major utility company.

Previous Project Responsibilities:

Mr. Barnes has been involved in several environmental studies including the siting of hydro facilities, nuclear and fossil-fueled generating stations, and transmission line routings. He has prepared exhibits to fulfill regulations governing the licensing and relicensing of hydroelectric generating facilities. He has also presented testimony at public hearings regarding proposed electric generating plant siting studies.

Dr. Vincent J. Lucid
Director of Environmental Studies

Terrestrial Environmental Specialists, Inc.

Discipline/Year of Graduation — B.S. Zoology/1968
M.S. Wildlife Management/1971
Ph.D. Wildlife Biology/1974

Study Assignment: Environmental Study Director

Relevant Area of Expertise:

Dr. Lucid is an experienced terrestrial ecologist who has worked closely with specialists in the various disciplines of the environmental sciences in conducting comprehensive environmental studies. Dr. Lucid has supervised or coordinated studies involving: air quality, aquatic ecology, geology and soils, historical and archaeological resources, land-use and aesthetic impacts, noise considerations, recreational factors, socio-economic impacts, terrestrial ecology and water quality.

Previous Project Responsibilities:

Dr. Lucid has coordinated and/or participated in environmental studies at a total of 11 proposed generating station sites, five operating stations, and one under construction. His responsibilities in these studies included the following: coordinating terrestrial ecology, recreation, and cultural resource studies as part of a siting effort; coordinating a terrestrial ecology monitoring program of construction activities; coordinating quality assurance programs for terrestrial ecology, aquatic ecology and water quality studies; participating in terrestrial ecology sampling programs; designing and implementing statistical data analysis; compiling and editing comprehensive reports; and preparing responses to interrogatories.

Cathie A. Baumgartner
Vice President

Terrestrial Environmental Specialists, Inc.

Discipline/Year of Graduation

B.A. Biology/1969
M.S. Zoology/1973

Study Assignment: Environmental Study Director

Relevant Area of Expertise:

In addition to being an experienced field biologist, Ms. Baumgartner is an excellent project coordinator and is experienced in the editorial review of reports, logistics of field sampling, project accounting and budgetary control procedures, and interdiscipline coordination.

Previous Project Responsibilities:

Ms. Baumgartner has applied her project coordination expertise to several large-scale studies. Such studies have included environmental assessments for hydro projects, transmission lines, nuclear and fossil-fueled generation site studies, and several smaller projects.

Dr. Roy Gerard
Socioeconomic Consultant

Terrestrial Environmental Specialists, Inc.

Discipline/Year of Graduation

B.A. Economics/1940
M.A. Economics/1949
Ph.D. Economics/1957

Study Assignment: Socio-economic Analysis

Relevant Area of Expertise:

Dr. Gerard specializes in assessments of proposed developments on socioeconomic resources. Dr. Gerard has lectured in many aspects of economics at Niagara University, New York State University College at Buffalo, and Syracuse University. He also served as Chairman, Department of Economics, LeMoyne College as well as Director of Research for the Syracuse Department of City Planning, Syracuse, New York.

Previous Project Responsibilities:

Dr. Gerard has prepared or assisted in preparation of studies of: housing, economic base-industrial development, population, finances, capital budget, growth management, governmental unification, economic impact of bridges, roads, colleges, and management analysis of social agencies. These studies have included socio-economic analysis for several major hydroelectric developments.

Dr. Frank Orth
President

Frank Orth and Associates

Discipline/Year of Graduation

B.A. Economics/1966
Ph.D. Economics/1970

Study Assignment: Socioeconomic Analysis

Relevant Area of Expertise:

Dr. Orth brings to the Susitna project extensive expertise in economic analysis as it pertains to natural resources. He is considered an expert in dealing with Alaskan resources, particularly fisheries resources.

Previous Project Responsibilities:

Dr. Orth has participated in numerous projects concerning the economics of Alaskan resources. Over fifteen projects have been directed by Dr. Orth in regards to Alaska fisheries. Dr. Orth also supervised an analysis of the economic impact of a proposed civic, recreation, and convention center on the economy of Cordova, Alaska.

Matthew P. Killeen
Associate Environmental Scientist

Terrestrial Environmental Specialists, Inc.

Discipline/Year of Graduation

B.S. Environmental and Resource Management/1974
M.S. Resource Management and Policy/1978

Study Assignment: Recreation and Cultural Resources Analysis

Relevant Area of Expertise:

Mr. Killeen has participated in the coordination of recreational and cultural resource studies in regards to several hydro development projects. He has developed a sound understanding of the recreational aspects associated with hydro projects and is thoroughly familiar with FERC regulations as they pertain to recreational and cultural resources.

Previous Project Responsibilities:

Mr. Killeen has coordinated the cultural and recreational aspects of hydro studies in both New York and West Virginia. He designed and implemented a management plan for a county-wide winter recreational system in New York. He also participated in a research project aimed at classifying the users of forest research materials.

Dr. James Dixon
Curator of Archaeology

University of Alaska Museum
Fairbanks, Alaska

Discipline/Year of Graduation

B.S. Anthropology/1970
M.A. Anthropology/1972
Ph.D. Anthropology/1979

Study Assignment: Cultural Resources

Relevant Area of Expertise:

Dr. Dixon is a recognized authority on the cultural resources of Alaska. He has been involved in archaeological studies in all regions of Alaska and has published over twenty papers dealing with archaeological investigations in Alaska.

Previous Project Responsibilities:

Dr. Dixon has participated in and supervised numerous archaeological studies in all portions of Alaska. One of his most relevant efforts was an analysis of the archaeological potential in regards to the Upper Susitna River. He is currently director of an archaeological survey of the Porcupine River caves, Eastern Interior Alaska.

Dr. Alan Jubenville
Associate Professor of Resource Management

University of Alaska, Fairbanks

Discipline/Year of Graduation

B.S. Forest Management/1962
M.S. Forest Ecology/1964
Ph.D. Wildland Recreation/1970

Study Assignment: Recreational Resources

Relevant Area of Expertise:

Dr. Jubenville is considered an expert on recreational resource management. He has been involved in recreation planning on both an academic and consulting basis and specializes in wilderness-oriented recreation. He has published two text books dealing with outdoor recreation and management. These texts are used widely in universities throughout the nation.

Previous Project Responsibilities:

Dr. Jubenville has participated in numerous recreational projects including an evaluation of wilderness potential of the roadless areas in the Medicine Bow National Forest, Albany County recreation plan, and snowmobiler preferences in the Snowy Range. He has also published numerous research-related papers dealing with wilderness recreation.

Robert W. Williams
Fisheries Consultant

Terrestrial Environmental Specialists, Inc.

Discipline/Year of Graduation

B.S. Biology/1966
M.S. Vertebrate Zoology/1969

Study Assignment: Team Leader - Fisheries Analysis

Relevant Area of Expertise:

Mr. Williams has been involved in siting and operational studies for power stations since 1970. He has conducted studies at locations along estuaries and the Great Lakes.

Previous Project Responsibilities:

Mr. Williams has been the project biologist, project manager or director on many large biological (aquatic) studies, including those for nuclear generating stations on the Great Lakes and Hudson River. In addition, Mr. Williams was the project biologist and primary researcher in the Supreme Court of the United States case---The State of Vermont vs. The International Paper Co. and the State of New York.

Clinton E. Atkinson

Private Consultant

Discipline/Year of Graduation

B.S. Fisheries/1937
M.S. Fisheries/1964

Study Assignment: Anadromous Fisheries

Relevant Area of Expertise:

Mr. Atkinson is a world-recognized expert in salmon fishery science. He has conducted research and studies in all areas of the salmon fishery.

Previous Project Responsibilities:

Mr. Atkinson has had project responsibilities for anadromous fish in many locations. However, he has specific experience in Alaska as the Director of Biological Research for the United States Bureau of Commercial Fisheries. At that time, research projects were carried out in the Cook Inlet area and the staff was involved in a cooperative study of the proposed development of the Susitna River for hydroelectric power (1952-56/57). He was also chairman of the Alaska Interagency Fishery Committee from 1974-1977. He has been involved with the salmon fishery since 1937.

Milo C. Bell — **Private Consultant**

Discipline/Year of Graduation — M.E./1930

Study Assignment: Resident Fisheries

Relevant Area of Expertise:

Mr. Bell is a recognized expert in hydroelectric dam fishery studies. He has done research on fish passage, dissolved atmospheric gases and virtually every other facet related to high dams.

Previous Project Responsibilities:

Mr. Bell has had project and research responsibilities since 1930. In 1933 he was a consultant on the Bonneville Dam Project. From 1941-53 he was the Chief Engineer and Associate Director of the International Pacific Salmon Fisheries Commission. In 1971 he was involved in the Bonneville Environmental study: Impacts of Fish and Wildlife.

Edward T. Reed
Vice President

Terrestrial Environmental Specialists, Inc.

Discipline/Year of Graduation — B.S. Science Education/1967
M.S. Wildlife Management/1974

Study Assignment: Team Leader - Wildlife Ecology Analysis

Relevant Area of Expertise:

Mr. Reed has extensive experience in mammalian and avian ecology and has participated in several impact-related studies, including hydro-electric projects. Mr. Reed's primary area of expertise includes ecology of avian and mammalian game species, habitat requirements, and the prediction of impacts upon game species in regards to large-scale projects. Mr. Reed's familiarity with game management procedures will be valuable in developing mitigation programs in order to reduce the impacts of the Susitna project on game species.

Previous Project Responsibilities:

Mr. Reed has been responsible for the organization, data collection, and report preparation of mammalian studies in regards to 11 electric generation projects. This included designing sampling programs, supervision of data collection, and impact assessment.

Dr. Philip S. Gipson
Assistant Unit Leader

Alaska Cooperative Wildlife Research Unit, University of Alaska, Fairbanks

Discipline/Year of Graduation

B.S. Biology/1964
M.S. Zoology/1967
Ph.D. Zoology/1971

Study Assignment: Furbearer Ecology

Relevant Area of Expertise:

Dr. Gipson is considered an expert on the biology of furbearer species. He has conducted several research projects on furbearers, particularly coyotes, foxes, and wolves. He is currently engaged in several studies of these species in Alaska.

Previous Project Responsibilities:

Dr. Gipson's project responsibilities have been primarily of a scientific research nature and have dealt with many aspects of furbearer ecology, including reproduction, food habits, activity patterns, ecological relationships with other animals, dealing with canid interactions along a transportation and utility corridor.

Dr. Brina Kessel
Professor of Zoology

University of Alaska, Fairbanks

Discipline/Year of Graduation

B.S. Biology/1947
M.S. Zoology/1949
Ph.D. Ornithology/1951

Study Assignment: Avian Ecology

Relevant Area of Expertise:

Dr. Kessel is a recognized authority on Alaskan avian ecology. She has conducted numerous surveys and investigations of birds in all regions of Alaska and has published numerous papers concerning Alaskan birds. Dr. Kessel is a member of the Governing Council of the American Ornithologist's Union and served as Vice President of that organization from 1976 to 1977.

Previous Project Responsibilities:

Dr. Kessel has participated in several avian field studies in Alaska, including Sheenjek River (summer 1956), Chukchi Seacoast (summer 1976), entire Seward Peninsula (summers 1966-1977), Yukon-Kuskokwim Delta (June 1963); also, North Slope (several sites), Cape Thompson, Kivalina, Selawik, Tokotna, Fairwell, Iguigig, Shemya, Cold Bay, Kenai Peninsula, Minto Lakes, and the entire Alaska highway system, including Alyeska Haul Road. She was also Project Director, University of Alaska Ecological Investigations for AEC Project Chariot, Northwestern Alaska, 1959-1963. More recently, Dr. Kessel has been involved in avian surveys conducted in the upper Tanana River Valley for the Northwest Alaskan Pipeline Company.

Stephen O. MacDonald
Museum Technician

University of Alaska, Museum
Fairbanks, Alaska

Discipline/Year of Graduation — B.S. Biology/1975

Study Assignment: Small Mammal Ecology

Relevant Area of Expertise:

Mr. MacDonald has served on numerous avian and mammalian surveys in Alaska and has become an expert in the small mammals of Alaska. Since most of the small mammal research in Alaska has been restricted to a few local project sites, Mr. MacDonald is one of the few people qualified to conduct a survey of the small mammals in the Upper Susitna River Basin.

Previous Project Responsibilities:

Mr. MacDonald was principal investigator for small mammal and bird population studies for the baseline studies for the Delta Barley Project, interior Alaska, and mammalogist for a reconnaissance of the mammals of the Skagway-Haines area of Alaska. Mr. MacDonald has also developed and published a checklist of Alaskan mammals. As a result of this experience he has become familiar with the species and habitat preference of small mammals in the interior regions of Alaska.

Joseph M. McMullen
Plant Ecologist

Terrestrial Environmental
Specialists, Inc.

Discipline/Year of Graduation — B.S. Biology/1971
M.S. Biology (Botany/Ecology)/1974

Study Assignment: Plant Ecology Analysis

Relevant Area of Expertise:

Mr. McMullen has experience in the following areas of study: endangered plant species surveys, plant community structure and dynamics (plant succession), impact predictions, vegetation mapping, remote sensing, and transmission line routing analysis.

Previous Project Responsibilities:

Mr. McMullen has designed and implemented a number of plant ecological studies. These studies included literature reviews, the preparation of vegetation cover maps, quantitative sampling, detailed descriptions of vegetation cover types, endangered species surveys, and impact predictions. As the senior plant ecologist on these studies, he was responsible for all aspects of the programs, including supervision of personnel. In addition to detailed plant ecological studies, Mr. McMullen has also been involved with transmission line routing studies.

Dr. Jay D. McKendrick
Associate Professor of Agronomy

University of Alaska
Agricultural Experiment Station, Palmer

Discipline/Year of Graduation

B.S. Soils/1963
M.S. Range Management/1966
Ph.D. Plant Ecology, Range Management/1971

Study Assignment: Plant Ecology

Relevant Areas of Expertise:

Dr. McKendrick has expertise in plant ecological studies, range management and forage qualities of habitats, plant succession, rehabilitation and revegetation, remote sensing, and assessing disturbances in sensitive areas. Much of his experience in these areas of expertise has been obtained from projects in Alaska. As a result of his experience in Alaska and in conjunction with the staff of the Alaska Agricultural Experiment Station, he is quite familiar with the vegetation types present in the Susitna River Basin.

Previous Project Responsibilities:

Dr. McKendrick has been involved in range research in Alaska since 1972. He has been involved in a number of descriptive plant ecology studies in Alaska. He has also performed studies concerning succession, reclamation, and revegetation on sand dunes, mine spoils, and tundra ecotypes in Alaska.

B3: COORDINATION PROCEDURES

ACRES

SECTION B3 - COORDINATION PROCEDURES

This portion of the POS deals with the details of the methods that will be used to control and coordinate the myriad of tasks and subtasks that comprise the entire POS. A full description of the cost and schedule control methods, outlined in Task 13 - Administration, will be presented along with appropriate examples of the reports and tabulations that support these methods. These coordination procedures will be used to control the activities occurring in the three major areas of investigation: Alaska Engineering Studies, Feasibility Studies and Environmental Studies, and in the two remaining areas of study dealing with licensing and public participation and financing of the project. Minor modifications will be required to suit each area; however, the basic concepts will apply to all.

B.3.1 - Cost Control Procedures

The first step in establishing realistic cost control procedures is to assign that responsibility to those best able to exert controls. Each of the project managers for the major areas of study will have the bottom line responsibility to control costs. Review and approval of these efforts will be overseen by the Project Manager with the assistance of the Study Director.

The three major areas of responsibility will each be established as a Cost Control Center, and all costs incurred as a result of activities performed in these areas will be borne by the respective cost center. As shown in Section A2 - Study Approach, each discreet element of work has been described and a cost estimate and schedule has been prepared. These individual cost estimates will be consolidated to form the budget for each of the three cost centers and will be the baseline to which all incurred project costs will be compared. Any changes to the final cost center estimate will be made only in accordance with the budgetary change procedures as established under Task 13.

A number of reports will be generated, beginning at the lowest level of responsibility, to display and summarize all incurred costs as the project progresses. Data will be gathered from various sources, including expenditure and commitment data from accounting, corporate overhead, manhour and equipment hour data from field supervisors and quantity data from the field.

A reporting format, compatible with the Project Code of Accounts and APA requirements, will be developed to display the data. The format will include the following information:

- Manhour reports
  - -- Activity code
    - . Number
    - . Description
  - -- Manhours and quantities
    - . Current control estimate
    - . This period
    - . To date
    - . To complete
    - . Forecast at completion
    - . Percent complete

  -- Control estimate
     . Overrun
     . Underrun
  -- Productivity
- Dollar reports
  -- Cost center
  -- Activity code
  -- Description
  -- Current control estimate
  -- Incurred cost
  -- Estimated amount to complete
  -- Forecast final cost
  -- Control estimate variance

Typical examples of this type of report are shown at the end of this section. These reports will be prepared on a monthly basis and distributed to the appropriate personnel. Electronic data processing will be utilized as much as possible to ensure a timely preparation of the reports and to allow sufficient time for management correction. A description of a typical cost control system is included in Part C of this POS.

Monthly meetings of the Project Manager, the cost center managers and other personnel, as appropriate, will be held to review the cost center reports. Each area of cost overrun wil be analyzed in depth, and corrective actions will be recommended to eliminate or minimize overruns. In addition, input from project managers and field personnel will be used to forecast total costs and potential scope of overruns. Risk analysis procedures will be applied to each cost forecast in order to indicate the degree of confidence, probability, range and likelihood of each line item.

B.3.2 - Schedule Control Procedures

Schedule control procedures will be conducted in much the same manner as the cost control procedures. The division of the work effort and the respective responsibilities will be identical to those in the cost control program. In other words, the project managers for each of the three major areas will have bottom line responsibility for both cost and schedule.

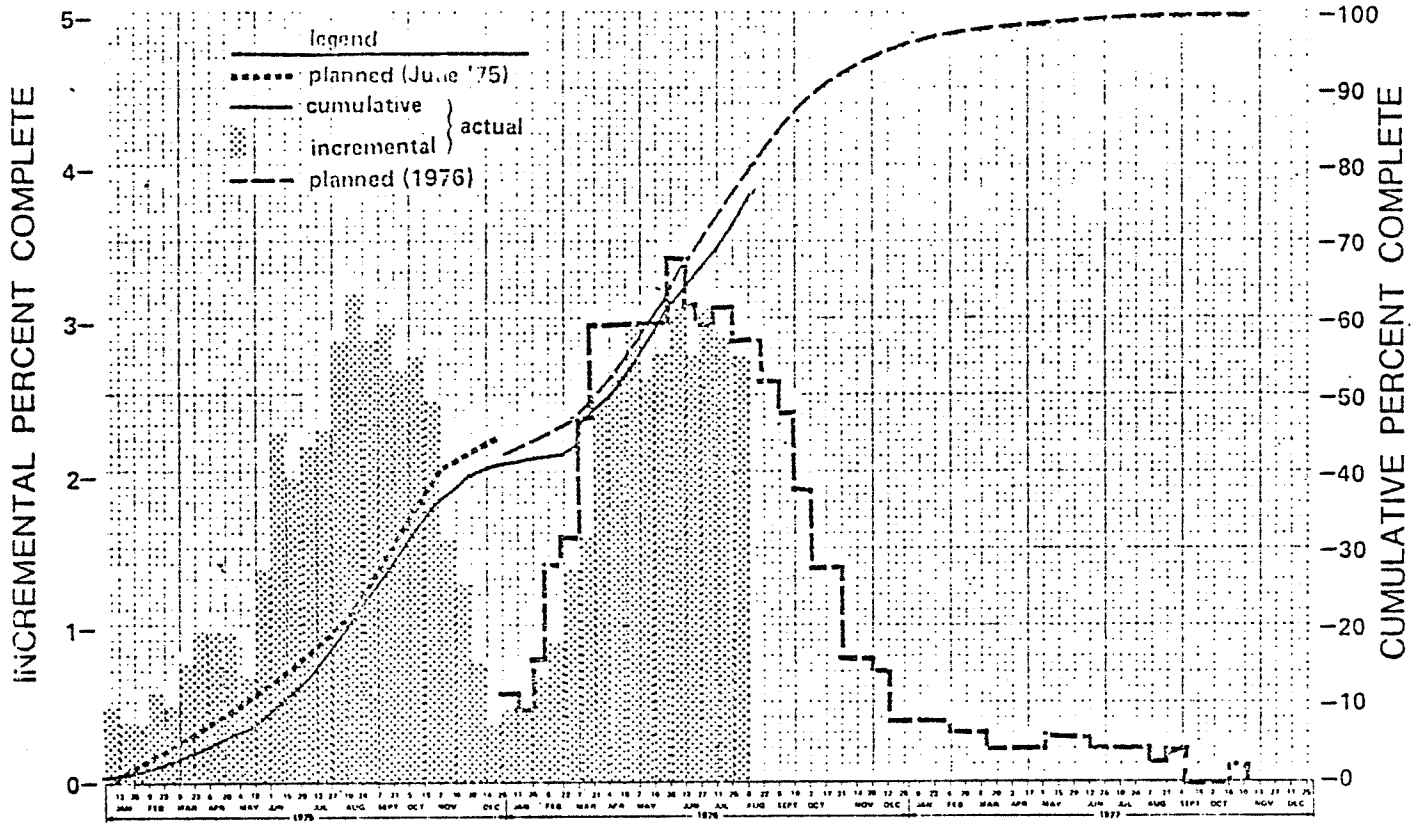
Again, monitoring of the schedules will be accomplished through the generation of periodic reports. Data will be gathered at the field level and other sources as appropriate. For each of the tasks and subtasks, a weighted, percent complete reporting system will be established. Schedules have already been developed for each of these items, as shown in Section A7. These schedules will be used to establish a baseline schedule showing percent complete versus time for each element of work.

A reporting format consistent with internal, APA and government requirements will be developed to display the schedule information. The format will include the following information:

- Comparison of scheduled progress to actual progress
- Schedule updates
- Periodic progress reports
- Percent-complete reports

These reports will be published and distributed in a timely manner to allow management sufficient time to initiate appropriate corrective actions. Monthly review sessions will be held with the Project Manager, cost center managers and others to pinpoint and analyze all schedule slippages, determine potential impacts to the project, recommend corrective action and to forecast anticipated completion dates. The cost control system description included in Part C of this POS also includes a schedule control function approximate for use for this study.

TOTAL PROJECT
PHYSICAL PERCENT COMPLETE SUMMARY



PHYSICAL PERCENT COMPLETE

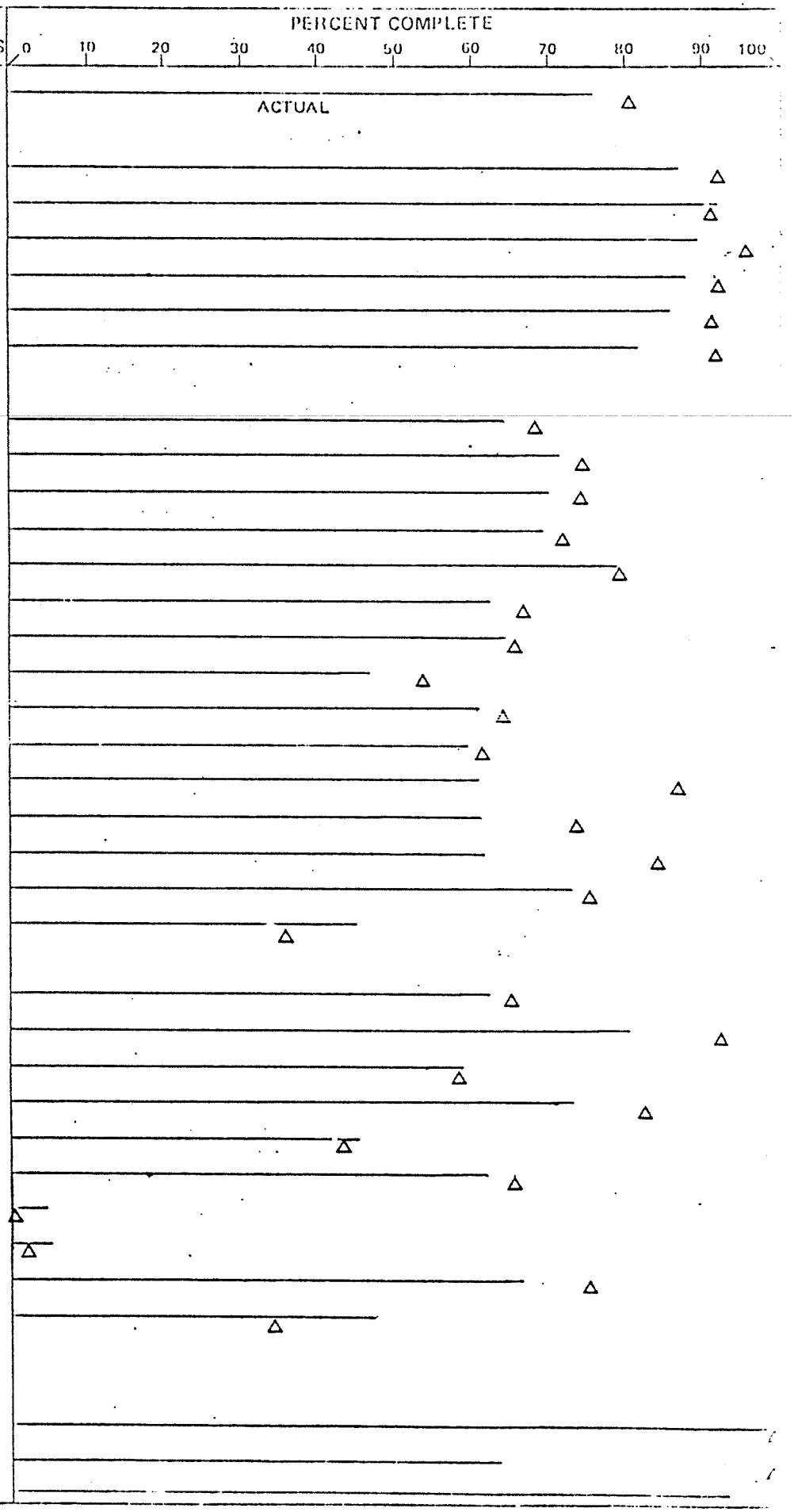
BY MAJOR DIVISION	7/11 TO 7/25	7/25 TO 8/8	CUMULATIVE TO 8/8/76	PLANNED TO 8/8/76
PIPELINE	2.5	2.0	87.3	92.6
STATIONS	3.8	4.7	64.3	68.4
TERMINAL	3.0	2.9	62.2	65.2
TOTAL	2.9	2.7	76.1	80.5

Note: Cumulative progress reflects all field adjustments, i. e., adjustments for changes in scope, quantity audits, forecast updates, etc. Two week incremental progress represents actual progress for the period.

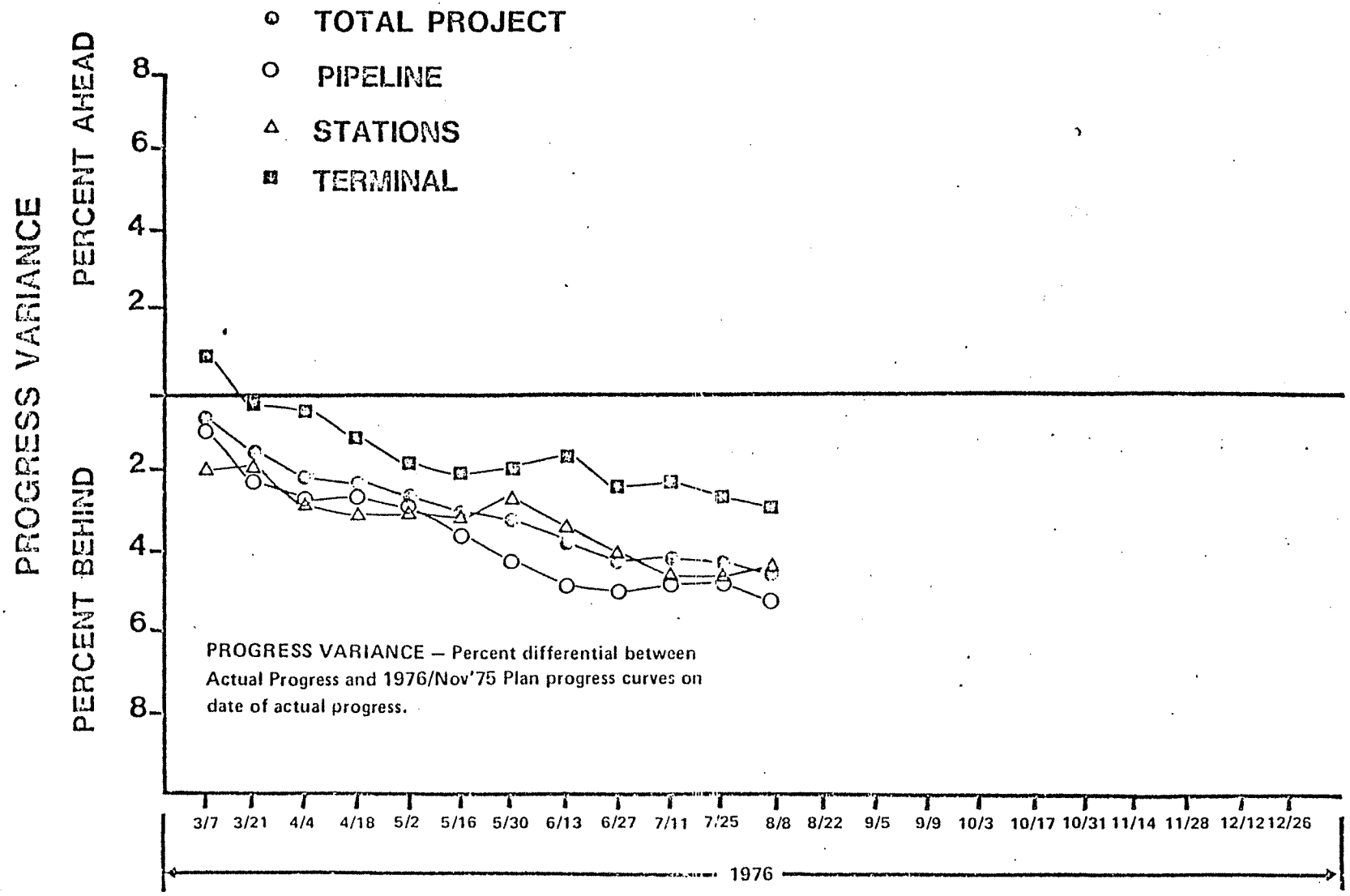
TOTAL PROJECT

AREA % COMPLETE AS OF AUGUST 8, 1976

AREA	WT. FACTORS	WT. FACTORS
TOTAL PROJECT		1.000
PIPELINE	1.000	.540
SECTION 1	.217	
SECTION 2	.183	
SECTION 3	.174	
SECTION 4	.146	
SECTION 5	.280	
PUMP STATIONS	1.000	.165
PHASE I/PS 1	.149	
PS 3	.087	
PS 4	.079	
PS 5	.073	
PS 8	.114	
PS 10	.112	
PHASE II/ PS 6	.138	
PS 9	.079	
PS 12	.082	
PHASE III/PS 2	.015	
PS 7	.011	
PS 11	.011	
RGV	.044	
MLR	.006	
TERMINAL	1.000	.295
BALLAST WATER	.098	
POWER/VAPOR	.140	
EAST TANKAGE	.260	
WEST TANKAGE	.131	
OFFSITES	.295	
BERTH 1	.015	
BERTH 3	.016	
BERTH 4	.023	
BERTH 5	.022	
COMMUNICATIONS	N/A	N/A
BACKBONE SYSTEM	N/A	
GATE VALVE SYSTEM	N/A	
ALTERNATE ROUTE SYS	N/A	

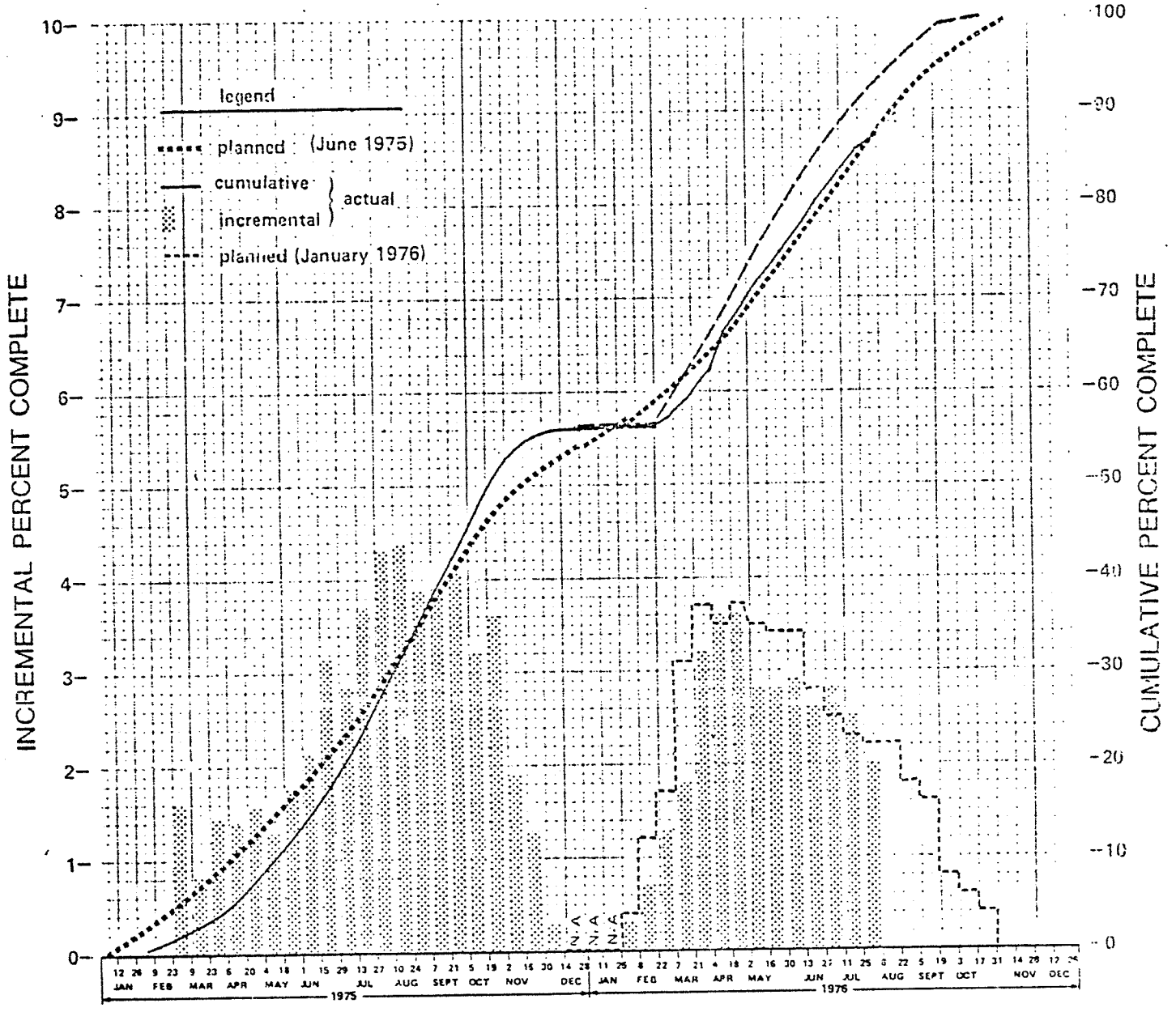


TAPS
PHYSICAL PROGRESS VARIANCE



PROGRESS VARIANCE — Percent differential between Actual Progress and 1976/Nov'75 Plan progress curves on date of actual progress.

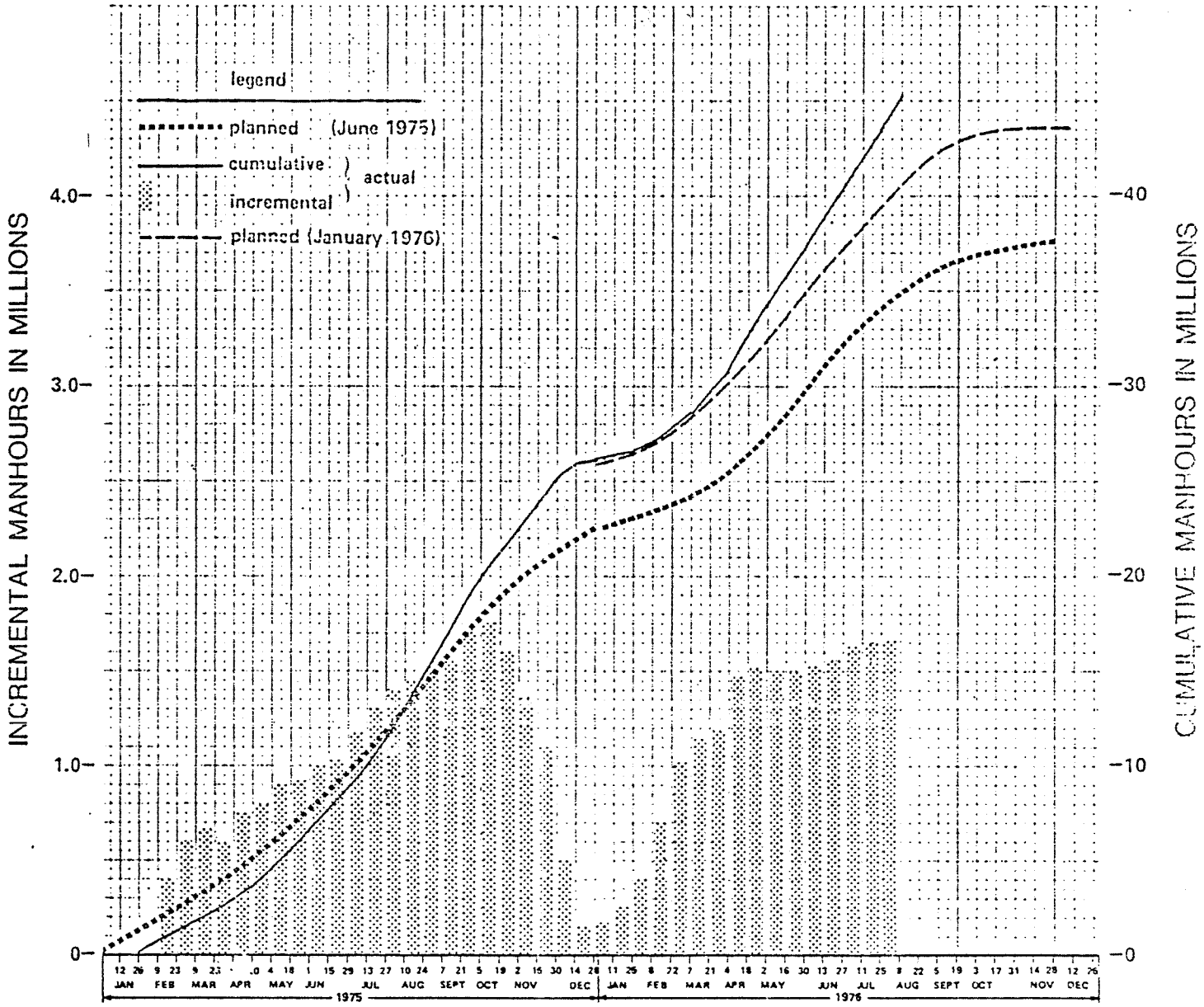
PIPELINE DEPARTMENT
PHYSICAL PERCENT COMPLETE SUMMARY



PHYSICAL PERCENT COMPLETE

SECTION	7/11 TO 7/25	7/25 TO 8/8	CUMULATIVE TO 8/8/76	PLANNED TO 8/8/76
SECTION 1	2.7	2.3	92.2	91.4
SECTION 2	2.8	2.1	89.6	95.9
SECTION 3	2.5	1.6	88.3	92.5
SECTION 4	3.0	2.8	86.2	91.1
SECTION 5	1.9	1.3	81.8	92.0
TOTAL	2.5	2.0	87.3	92.6

PIPELINE EXECUTION CONTRACTOR
TOTAL MANHOUR SUMMARY



TOTAL LABOR MANHOURS EXPENDED IN THOUSAND

SECTION	7/11 TO 7/25	7/25 TO 8/8	CUMULATIVE TO 8/8/76	CONTROL ESTIMATE	PERCENT EXPENDED
SECTION 1	369.5	369.8	9,543.8	8,665.0	110.1
SECTION 2	343.8	325.8	8,580.7	7,770.0	110.4
SECTION 3	250.8	256.5	7,085.6	7,159.0	99.0
SECTION 4	238.2	234.3	6,955.0	6,797.0	102.3
SECTION 5	452.6	480.5	13,205.6	13,115.0	100.7
TOTAL	1,654.9	1,666.9	45,370.7	43,506.0	104.3

PIPELINE MAJOR CONSTRUCTION ACTIVITIES

PROGRESS DATA
As of July 25, 1978

SECTION	QUANTITIES	MILES of PIPE INSTALLED (mi)	INSTALL VSMVS (EA.)	THERMAL DEVICES (PNS)	ELEVATED SUPP (SEARS'S)	LINE UP & WELD (A/G & BG) (mi)	A/G PIPE INSTALL (mi)	DITCHING (mi)	B/G PIPE INSTALL (mi)	RIVER X – INGS (mi)	VALVE INSTALL (EA.)	INSULATION (mi)	HYDRO TEST (mi)	FUEL GAS LINE (mi)	ACTUAL PHYSICAL % COMPLETE	PLANNED PHYSICAL % COMPLETE	SECTION
1	TOTAL REQUIRED	154.5	13,008	12,000	6,202	154.5	72.0	74.4	74.4	8.1	37	72.0	154.5				
	PLANNED	130.8	13,008	6,464	6,202	140.3	70.3	61.7	61.3	8.1	29	70.3	17.9			90.3	1
	ACTUAL	132.9	13,008	5,984	6,024	146.4	66.4	71.0	58.9	7.6	20	53.2	35.3		93.0		
2	TOTAL REQUIRED	143.9	14,464	12,835	7,214	143.8	77.4	63.5	63.5	8.0	23	77.4	150.2				
	PLANNED	139.1	14,464	7,927	6,423	143.7	69.4	61.6	61.6	8.0	20	45.5	34.7			94.0	2
	ACTUAL	90.3	14,464	5,516	5,438	146.4	42.6	62.9	47.5	8.0	13	36.7	51.9		87.6		
3	TOTAL REQUIRED	143.6	13,429	12,250	6,402	143.6	73.4	68.3	68.3	1.9	32	73.4	142.3				
	PLANNED	123.5	13,429	8,583	5,578	126.5	53.3	60.3	64.3	1.9	23	37.2	12.6			83.3	3
	ACTUAL	93.3	13,429	7,703	6,259	122.4	41.1	60.6	56.3	1.9	23	33.4	57.9		86.7		
4	** TOTAL REQUIRED	142.7	16,112	18,724	8,117	142.7	101.8	39.0	53.2	1.7	26	101.8	144.5				
	PLANNED	118.6	16,112	8,356	7,000	127.8	77.6	38.0	39.8	1.7	23	64.6	39.3			80.0	4
	ACTUAL	92.6	16,112	11,567	7,765	124.4	52.8	3	31.5	1.7	12	35.3	37.9		83.7		
5	** TOTAL REQUIRED	210.6	21,028	4,013	9,963	211.6	100.6	91.1	91.5	12.1	12	100.6	208.7	146.6			
	PLANNED	185.9	21,028	3,740	8,956	181.5	90.3	89.4	81.9	10.8	27	58.3	22.6	146.6		89.2	5
	ACTUAL	150.9	21,028	0	9,810	187.3	53.3	95.2	86.1	11.5	4	3.3	0	70.5	81.1		
TOTAL	TOTAL REQUIRED	800.3	78,038	60,742	37,833	800.3	425.2	343.3	343.3	31.6	175	425.2	800.3	146.6			
	PLANNED	706.9	78,038	34,069	31,759	719.8	361.1	320.0	312.1	39.5	127	276.9	213.9	146.6		90.4	TOTAL
	ACTUAL	574.0	78,038	30,820	35,296	726.9	256.4	334.6	237.3	30.7	87	161.9	183.3	70.5	85.6		

** TOTAL QUANTITIES REQUIRED & PLANNED SECTIONS MAY REFLECT IN MILE OVERAGE

Alyeska Pipeline Service Company

CONTROL CENTER COST REPORT

PM #6 CONSTRUCTION SURVEY

REPORT DATE September 10, 1976

($ IN THOUSANDS)

PAID COST THRU August 29, 1976

LINE ITEM	TAPS NO.	DESCRIPTION	CURRENT CONTROL BUDGET	INCURRED COST	ESTIMATED AMOUNT TO COMPLETE	FORECAST FINAL COST	PAID COST	VARIANCE INCREASE (DECREASE)	OVERRUN (UNDERRUN)	VAR NO.
	139	Ocean Tech.	11,007	11,002*	0	11,002	11,002	-	(5)	
	841	Michael Baker, Jr.	8,000	8,449	1,860	10,309	6,414	-	2,309	
	1006	LHD	2,787	2,787*	0	2,787	2,787	-	-	
	1007	Bomhoff	2,996	2,996*	0	2,996	2,996	-	-	
	1123	Construction Survey	1,613	1,613*	0	1,613	1,613	-	-	
	1136	Cardinal	542	542*	0	542	542	-	-	
	1143	Wakon Redbird	139	139*	0	139	139	-	-	
	1317	Cardinal	1,462	965	171	1,136	859	-	(326)	
	1318	LHD	3,175	2,153	503	2,656	1,576	100	(519)	6
	1319	Arctic	3,775	2,472	501	2,973	2,001	141	(802)	6
	1320	Construction Survey	2,888	2,579	590	3,169	2,321	-	281	
	1328	Ocean Tech	1,937	207	693	900	169	(241)	(1,037)	6
		Subtotal	40,321	35,904	4,318	40,222	32,419	0	(99)	
	COST CODE	MATERIALS:								
	1010	Engineering Surveys	70	70	0	70	70	-	-	
	5230	Survey Contracts	1	1	0	1	1	-	-	
		Subtotal	71	71	0	71	71	-	-	
		TOTAL	40,392	35,975	4,318	40,293	32,490	-	(99)	

FORM 2031 (REV. 3-76)