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Technical Proposal

Assessment of the Permit Application Package for the Rilda Canyon Mine

Submitted to

Utah Department of Energy and Natural Resources
Division of Oil, Gas and Mining
4241 State Office Building
Salt Lake City, Utah 84111

Submitted by

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Technical Proposal
to
Division of Oil, Gas and Mining

Submitted by

BIO/WEST, Inc.
Logan, Utah

Title of Proposed Project

Assessment of the Permit Application Package
for the Rilda Canyon Mine

Desired Starting Date

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Completion Date

June 29, 1984

Thomas M. Twedt, Principal

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INTRODUCTION

The Request for Proposal (Req. No. 580322) from the State of Utah involves technical assistance in the assessment of a Permit Application Package for the Rilda Canyon Mine. To provide this assistance, BIO/WEST, Inc., of Logan, Utah, and Richardson Associates, of Denver, Colorado, are submitting this proposal which defines their unique qualifications to accomplish the statement of work. This proposal is divided into several sections which discuss the technical approach, personnel qualifications, management, and cost. BIO/WEST and Richardson Associates provide a team of highly qualified individuals who have extensive experience in mine plan reviews. Most of the staff have reviewed over 25 mining and reclamation plans for the Office of Surface Mining (OSM) in the states of Utah, Colorado, Arizona, New Mexico, Wyoming, Kentucky, and Georgia. BIO/WEST and Richardson Associates recently completed the Technical Analysis of the Emery Deep Mine under contract to the Division of Oil, Gas and Mining. In addition to mining and reclamation plan review for the Emery Deep Mine in Utah, the staff of Richardson Associates prepared an Apparent Completeness Review for the Price River Mine in Carbon County, Utah. This required a meeting in the offices of DOGM to discuss deficiencies in the mine plan with the applicant.

BIO/WEST has been involved in permitting, reclamation planning, and revegetation of U.S. Fuel Company's mines in Carbon County, Utah. This has given them the added perspective of industry's problems in preparation of a mining and reclamation plan. This effort also included

meeting with DOGM personnel to discuss deficiencies in the mine plan and regulatory compliance. Neither BIO/WEST nor Richardson Associates has worked for West Appa Coal Company, nor will they accept work from West Appa Coal Company for one year following completion of the contract (if awarded).

The proposed team offers extensive experience in mine plan reviews, familiarity with underground mining in Carbon and Emery Counties, understanding of the Utah Permanent Program, and an established working relationship with DOGM. We feel that the proposed team is uniquely qualified to provide DOGM with the expertise which they require. The team is fully capable of meeting all associated deadlines.

TECHNICAL APPROACH

The assessment of a Permit Application Package (PAP) for compliance with the State of Utah Permanent Regulatory Program requires technical expertise from several disciplines. Specialists must be brought together for analysis of impacts to water, air, fish and wildlife, and public welfare. To accomplish this task efficiently; that is, to obtain a high quality product at a reasonable cost; an approach must be utilized which optimizes the use of each specialist's time. This requires a very effective management system and development of a sound technical approach prior to initiating the review process. This section discusses the approach which BIO/WEST, Inc., and Richardson Associates intends to utilize for the proposed scope of work. The management approach is discussed in a following section of this proposal.

Phase I - Preparation of an Initial Review Document

An Initial Review (IR) requires a thorough review of the mining and reclamation plan to determine if the applicant has provided information sufficient to determine compliance with the regulatory program. It is not sufficient to find that there is or is not information in the application pertaining to each regulation; instead, the reviewer must quickly evaluate the quality of that information to insure that it will be possible to later proceed with preparation of a Findings and Supporting Documentation Report. Thus, the initial review must: 1) detail both the adequacy and deficiency of information contained in the PAP; 2) identify all deficiencies in the PAP and recommend the types of studies

and/or data necessary to render the PAP complete; and 3) be sufficiently thorough with regard to the technical adequacy of the PAP. The team of BIO/WEST, Inc., and the staff of Richardson Associates will review DOGM files and conduct an on-site inspection of the mine to acquaint personnel with the project. Familiarity with IR (Apparent Completeness Review, ACR) preparation and underground mining in Carbon and Emery Counties will enable this phase to be completed in an efficient manner. In addition, to reduce the level of effort in Phase II, information in the mine plan required by the regulations will be noted on a master copy of the regulations. This was done for the Emery Deep Mine ACR completed in 1983 by BIO/WEST and Richardson Associates on a large copy of the regulations which left room for notations on the right hand column of the page (Figure 1). Information in the mine plan could thus be readily accessed. During Phase II then, it will be only necessary to fill in areas where deficiencies occurred, and a Determination of Completeness (DOC) will be readily made.

It is extremely important in this phase to prepare an ACR which will facilitate the applicant's efforts to respond to the questions which are prepared. Often, it is useful to indicate why information is required and to suggest an approach for responding to the question. In this way, delays during Phase II can be minimized. The better the applicant understands the question, the better the response will be, and the technical analysis will be made much easier.

Phase II - Determination of Completeness

After the applicant has responded to the questions in the IR, a Determination of Completeness (DOC) can be made. This phase is the

(2) The geology for those surface lands within the proposed mine plan area which are underlain by the coal seam to be extracted and the geology of the coal seam itself, including-

(i) Location of subsurface water, if encountered;

(ii) The depth, classification, and geologic structure of the overburden;

(iii) Pyritic content and potential alkalinity of the stratum immediately above and below the coal seam to be mined and the clay content of the stratum immediately below the coal seam to be mined; and

(iv) Pyrite, marcasite, and sulfur content of the coal seam.

(b) An applicant may request that the requirements of Paragraph (a)(1) of this Section be waived by the Division. The waiver may be granted only if the Division makes a written determination that the statement required is unnecessary because other equivalent information is accessible to it in a satisfactory form.

UMC 783.15 Ground Water Information

(a) The application shall contain a description of the ground water hydrology for the proposed mine plan and adjacent area, including, at a minimum-

(1) The depth below the surface and the horizontal extent of the water table and aquifers;

(2) The lithology and thickness of the aquifers;

(3) The uses of the water in the aquifers and water table; and

(4) The quality of subsurface water, if encountered.

(b) The application shall contain additional information which describes the recharge, storage, and discharge characteristics of aquifers and the quality and quantity of ground water, according to the parameters and in the detail required by the Division.

UMC 783.16 Surface Water Information

(a) Surface water information shall be described, including the name of the watershed which will receive water discharges, the location of all surface water bodies such as streams, lakes, ponds, and springs, the locations of any water discharge into any surface body of water, and descriptions of surface drainage systems sufficient to identify, in detail, the seasonal variations in water quantity and quality within the proposed mine plan and adjacent areas.

(b) Surface water information shall include:

(1) Minimum, maximum, and average discharge conditions, which identify critical low flows and peak discharge rates of streams sufficient to identify seasonal variations; and

Figure 1. An example of the master copy of the regulations used for reviewing the Emery Deep Min (ACR).

precursor to the Findings and Supporting Documentation (FSD) phase. As such, it is important that the applicant's responses to the IR are complete. The completeness of the responses hinges upon the quality of the IR and the effectiveness of the meeting which is held during this phase. Both BIO/WEST and Richardson Associates have held meetings with applicants including recent meetings with DOGM and Consolidation Coal Company. It is important during these meetings to not only understand what the regulatory requirements are, but also understand that the applicant is often under budgetary constraints and may not be thoroughly familiar with the need for the information that is required. More often than not, these meetings require a great deal of patience and perseverance.

The completion of this phase, the DOC, can be easily made by completing the previously discussed copy of the regulations. Once a response for each regulatory requirement is identified and is found to be reasonably adequate (technically), a DOC can be made, and the FSD phase can begin.

Phase III - Findings and Supporting Documentation Report

The outcome of this phase is to determine whether or not the applicant's proposal actually complies with the regulatory requirements. Calculations must be checked, impacts to the environment from the operation are evaluated, and a recommendation made as to whether or not to approve the mine plan. If the previous phases were done well, minimal problems should arise at this point. However, there is always the possibility that the FSD phase will uncover more concerns and, thus, more questions.

The detailed TA portion of the FSD will be written in accordance with the outline and format of the technical analysis part of Introduction to OSM Technical and Environmental Assessment of Mine Plan, items A-G. The remainder of the FSD will be written in accordance with the procedures outlined in Draft Federal Procedures for Processing Permit Application Packages, particulary Chapter 2 and Appendix C.

In summary, BIO/WEST and the staff of Richardson Associates are very familiar with the regulatory requirements and will be able to prepare a quality product for DOGM most efficiently. We have reviewed over 25 mine plans in seven states using federal and state regulations. We are extremely familiar with the review process and will be able to assist DOGM to a great extent.

PERSONNEL QUALIFICATIONS

The state of Utah Coal Mining and Reclamation Permanent Program requires that a mining operator submit a detailed mine plan showing how he intends to comply with all aspects of that program. This includes analyses in the areas of ground and surface water, soil science, agronomy, fish and wildlife, blasting, subsidence, slope stability, road construction, cost estimation and coal refuse disposal. To review a mine plan, the regulatory authority must have technical experts in all of these areas to make a determination of compliance. To provide these personnel, which covers a wide spectrum of disciplines, BIO/WEST and Richardson Associates have developed a team of qualified specialists which are very familiar with the regulatory processes involved in assessing a permit application package. The personnel proposed for the project are immediately available for the duration of the project. Should any substitution become necessary, the contractor will notify DOGM reasonably in advance and shall submit justification (including proposed substitutions) in sufficient detail to allow evaluation of the impact on the program. No substitution shall be made without the written consent of DOGM. The qualifications of the proposed team are discussed below. Management of this team is discussed in the following section of this proposal.

Figure 2 summarizes the qualifications of the technical experts which will be working on this project. The list of the areas of technical expertise was developed by reviewing "Introduction to OSM Technical and Environmental Analyses of Mine Plans." For each major compliance determination that had to be made for the Analysis, an area

	Rice	Albee	Richardson	Kimball	Jewett	Standwood
Soil Stability	x					
Soil Handling			x			
Soil Amendments	x					
Surface Water Control				x		
Pond Design				x		
Ditch Design				x		
Channel Reconstruction				x		
Stream Impacts				x		
Groundwater Impacts					x	
Groundwater Monitoring				x	x	
Toxic Overburden			x		x	
Explosives Handling			x			
Flyrock Control			x			
Control of Ground Vibration			x			
Control of Air Blast			x			
Waste Disposal			x			
Fish and Wildlife Surveys		x				
Fish and Wildlife Protection		x				
Approximate Original Contours			x			
Slope Stability			x			
Overburden Handling			x			
Excess Spoil Handling			x			
Vegetation Surveys	x					
Revegetation Success	x					
Planting Requirements	x					
Road Construction			x			
Protection of the Hydrologic Function of AVF's					x	
Prime Farmland Investigation	x					
Prime Farmland Protection	x					
Land Use Evaluation	x					
Air Resources Protection			x			
Cost Estimation for Reclamation						x

Figure 2. Areas of technical expertise of the project team.

of technical expertise was defined. As can be seen, the staffs of BIO/WEST and Richardson Associates have the necessary qualifications to make the required determinations. It is important to note that the staffs of BIO/WEST and Richardson Associates have worked together before on mine plan assessments, including the work which was done on assessment of the Emery Deep Mine in Utah.

BIO/WEST and Richardson Associates have recently established computerized telecommunication. This allows almost instantaneous transfer of written reports between Denver and Logan, and enables corrections and modifications to be made in a timely manner. Telecommunication capability effectively removes the distance barrier between BIO/WEST and Richarson Associates and allows the office in Denver (near OSM) and Logan (near DOGM) to operate almost as a single unit.

Bio/West, Inc.

BIO/WEST was incorporated in the state of Utah in March 1976. During the last two years, BIO/WEST has worked with the staff of Richardson Associates reviewing seven different mining and reclamation plans for the Denver Regional Office of Surface Mining and Utah Division of Oil, Gas and Mining. These reviews were for mines in Utah and Colorado, and include the Emery Deep Mine (for DOGM), along with the modification for the preparation plant and disposal area (for OSM). In addition to mining and reclamation plan review, BIO/WEST's staff has been involved in permitting, reclamation planning, and revegetation of U.S. Fuel Company's mines near Price, Utah. BIO/WEST's staff is quite familiar with mine plan review and the regulatory requirements of Utah's

Coal Mining and Reclamation Permanent Program. The related qualifications of each staff member are discussed below.

Dr. John Rice, Vegetation/Soils Section Manager

Dr. John Rice manages BIO/WEST's Vegetation/Soils Section. Dr. Rice received his Ph.D. in Range Science (1981) from Colorado State University. His graduate research focused on energy flow in rangeland ecosystems, emphasizing plant-animal interactions. In 1978, Dr. Rice was an Instructor for the Ecosystem Management Short Course sponsored by the College of Natural Resources, Colorado State University. While a graduate student at Colorado State University, Dr. Rice was employed by Uniscale Corporation to conduct baseline vegetation inventories of the Alton Coal Field, Utah, and the Kemmerer Coal property in southwestern Wyoming.

Dr. Rice joined BIO/WEST in 1981. As Vegetation/Soils Section Manager, he has been involved in numerous studies for mining; oil and natural gas production and transmission; power generation and transmission; and facility siting projects. Dr. Rice was the Reclamation/Vegetation Specialist for a project to assist the Denver Regional Office of Surface Mining (OSM) in reviewing and evaluating mining permit applications. Dr. Rice is currently Project Manager for the review (ACR, DOC, and TA) of the Emery Deep Mine under contract to the Division of Oil, Gas, and Mining. He has reviewed the following mine plans: ACR for Pittsburg and Midway's Edna Mine, Routt County, Colorado; ACR, DOC, and TA for Consolidation Coal's Emery Deep Mine, Emery County, Utah; and TA for Wyoming Fuel's Canadian Strip Mine,

Jackson County, Colorado. A summary of related experience follows; however, for more complete detail, see the attached resume.

Summary of Related Experience

1981 Reclamation Specialist for review and evaluation of mining permit applications for the Denver Regional Office of Surface Mining. Fred C. Hart Associates.

1981 Vegetation/Soils Specialist for an Environmental Impact Statement for Western Area Power Authority's Liberty to Coolidge, Arizona transmission line upgrade. Willdan Associates.

1981 Project Manager for an inventory and population study of threatened, endangered, and rare plant species on approximately 290,000 acres of federal land in Uintah County, Utah. Bureau of Land Management.

1982 Project Manager and Reclamation Specialist for the Revegetation and Topsoil sections of the King VI Coal Mine permit. U.S. Fuel Company.

1982 Project Manager and Reclamation Specialist for interim revegetation of the King VI Coal Mine. U.S. Fuel Company.

1983 Project Manager and Reclamation Specialist for correction of vegetation information deficinecies in the King VI Mining and Reclamation Plan. U.S. Fuel Company.

1983 Project Manager for an inventory and population study of threatened, endangered, and rare plant species for the LOFRECO and Seep Ridge Projects. Geokinetics, Inc.

1983 Project Manager and Reclamation Specialist for review (ACR, DOC, and TA) of the Emery Deep Mining and Reclamation Plan. Utah Division of Oil, Gas, and Mining.

Mr. Michael H. Albee, Wildlife Section Manager

Mr. Michael H. Albee manages BIO/WEST's Wildlife Section. Mr. Albee received his B.S. in Wildlife Biology (1972) from Utah State University. From 1972-1974, Mr. Albee was a Research Assistant in the Department of Wildlife, Utah State University. His research focused on the estimation of populations of mule deer on winter range. The study was designed to obtain the lowest sampling variance with a minimum of observation.

In 1974, Mr. Albee joined the Bureau of Land Management, Platte River Resource Area, Casper, Wyoming. Mr. Albee was responsible for wildlife habitat management on approximately 1.5 million acres of public land. In addition, he participated in inventories of terrestrial and aquatic wildlife, the writing of eight environmental analysis reports, and assessment of natural gas lease applications. In 1976, Mr. Albee moved to the Rock Springs District where he served as a team member on the Southwest Wyoming Coal Environmental Impact Statement. He also was responsible for reviewing mine plans for technical adequacy in terrestrial and aquatic wildlife.

Mr. Albee joined BIO/WEST in 1980. As Wildlife Section Manager, he has been involved in numerous wildlife studies for mining; oil and natural gas production and transmission; power generation and transmission; and facility siting projects. Mr. Albee was the Wildlife Specialist for a project to assist the Denver Regional Office of Surface Mining (OSM) in reviewing and evaluating the mining permit application (ACR/TEA) for Colorado Westmoreland's Orchard Valley Mine, Delta County, Colorado. Mr. Albee is currently the Wildlife Specialist for review (ACR, DOC, and TA) of the Emery Deep Mine under contract to the Utah Division of Oil, Gas, and Mining. A summary of related experience follows; however, for more complete detail, see the attached resume.

Summary of Related Experience

1980 Wildlife Specialist for the Draft Environmental Impact Statement for the proposed White River Dam, Utah. Bureau of Land Management.

1980 Wildlife Specialist for a study of large and small mammal populations in western Utah and south-central Nevada and analysis of potential impacts related to the proposed MX Missile System. HDR Sciences.

1980-Present Wildlife Specialist for several environmental assessments of oil and gas exploration by: Mobil, Sohio, Chevron, Dome Oil, and Amarada Hess. Land Management Services and Rio Verde Engineering.

1980 Wildlife Specialist for a baseline wildlife inventory of the Chaco Strippable Coal Area, New Mexico. Bureau of Land Management.

1980 Project Manager for a vegetation baseline inventory of the U.S. Fuel Company property near Price, Utah. U.S. Fuel Company.

1981 Wildlife Specialist for the Environmental Assessment for correction of safety problems with Jackson Lake Dam. Water and Power Resources Service.

1981-82 Wildlife Specialist for an Environmental Impact Statement for Western Area Power Authority's Liberty to Coolidge transmission line upgrade. Willdan Associates.

1981-82 Wildlife Specialist for a study to classify and evaluate the wetlands of the Malad Valley, Idaho, and assessment of potential impacts of irrigation projects. Soil Conservation Service.

1981-82 Wildlife Specialist for review and evaluation of mining permit applications for the Denver Regional Office of Surface Mining. Fred C. Hart Associates.

1983 Wildlife Specialist for a wildlife survey of coal mining properties in Carbon County, Utah with emphasis on migratory species of high federal interest. U.S. Fuel Company.

1983 Wildlife Specialist for review (ACR, DOC, and TA) of the Emery Deep Mining and Reclamation Plan. Utah Division of Oil, Gas, and Mining.

Richardson Associates

Although Richardson Associates is a newly-formed business, the staff of Richardson Associates has been working together for over two years reviewing mining and reclamation plans for the Office of Surface Mining. These reviews were for mines in the states of Utah, Colorado, New Mexico, Arizona, Wyoming, Kentucky, and Georgia. The mines that the staff of Richardson Associates worked on in Utah are the Emery Deep Mine, along with the modification for the preparation plant and disposal area, the Price River Mine, and Kaiser's Sunnyside Mine. For the Price River Mine plan review, the staff of Richardson Associates developed an Apparent Completeness Review (ACR), and met with the applicant at DOGM's offices to discuss the ACR. The staff of Richardson Associates is extremely familiar with mine plan reviews and the regulatory requirements of Utah's Coal Mining and Reclamation Permanent Program. The related qualifications of each staff member are discussed below.

Deborah L. Richardson, Mining Engineer

Ms. Richardson is a mining engineer with a strong background in geology and environmental sciences. She has worked on many projects involving the review of mining and reclamation plans, and has worked on many other projects related to mining environmental issues. Projects that she has worked on related to the scope of work on this proposed project are:

- Technical Analysis for the Emery Deep Mine. This evaluation required a determination of the completeness of the Emery Deep Mine permit application and a detailed assessment of the technical information presented in the application. The areas which were reviewed were mining operations, subsidence, backfilling and grading, and evaluation of the suitability of the proposed postmining contours. Of particular concern at this mine was the effect of the subsidence on the Upper Ferron aquifer, alluvial valley floors, and farmlands located above the mine.
- Apparent Completeness Review for the Emery Deep Mine and Preparation Plant Modification for the Office of Surface Mining. This review involved determination of deficiencies in the application and preparation of an ACR. Issues of concern centered on stability of the proposed waste pile and impoundment structure for coal waste, subsidence impacts on the waste structures and irrigation structures above the underground workings, bonding, and road construction. The review required working knowledge the use of the state of Utah regulations.

- Technical Analysis for the Price River Coal Mine in Helper, Utah. This review required an assessment of deficiencies in the applicant's response to a previous ACR and development of additional questions concerning portions of the mine plan that were still deficient. A meeting was held with the applicant in the Utah State Offices of the DOGM to discuss the deficiencies and suggest how the applicant could best respond to the questions. The review was conducted using the state of Utah regulations. Areas which were reviewed included stability of the coal waste pile, subsidence impacts, bonding concerns, and road construc tion.

- Project Manager and technical expert for the review and preparation of over 25 additional ACR's and technical analys mining and reclamation plans in the western U.S. These reviews involved the analysis of backfilling and grading issues, approximate original contour assessments, stability analyses for spoil material and refuse, determination of special handling needs for toxic materials, control of flyrock and ground vibrations from blasting, and bonding requirements.

- Development of a manual for estimating bonding costs for mining operations. Unit costs were developed to facilitate in the development of bonding requirements for rough and smooth grading, topsoil handling, revegetation, and removal of structures.

Ms.Richardson has the following experience related to the technical requirements of the scope of work:

- Evaluation of underground mining techniques
- Evaluation of stability of coal refuse and spoil material
- Determination of bond amounts
- Assessment of road construction requirements
- Evaluation of backfilling and grading requirements for reclamation
- Evaluation of overburden characteristics and the formation of toxic mine drainage
- Familiarity with the Utah State regulations pertaining to surface effects of underground coal mining activities

Ms. Richardson has a B.S. in Geology and a M.S. in Mining Engineering from the Pennsylvania State University. For more complete detail, see the attached resume.

Connie R. Kimball, Engineering Geologist

Ms. Kimball is an engineering geologist specializing in the areas of surface water hydrology and water control plans. She has reviewed many mining and reclamation plans to determine the adequacy of the design and construction of surface water control structures to assess surface water impacts. Projects she has worked on related to the scope of work include:

- Technical Analysis for the Emery Deep Mine. This evaluation required a determination of the completeness of the Emery Deep

technical information presented in the application. The structures, collection of baseline surface water data, and the effect of mine discharges on the surface water system. There was concern that the high TDS discharge from the mine would degrade the streams in the area. High TDS discharges from irrigation return flows made evaluation of the overall effect of the mine discharge difficult to identify.

- Technical Analysis for the Price River Coal Mine in Helper, Utah. This review required an assessment of deficiencies in the mine plan and development of questions for an ACR explaining to the applicant what the additional information requirements were. In addition, a meeting was held with the applicant at the offices of DOGM to discuss the application. Issues of concern centered on the design capacity of the surface water control structures, plans for mitigation of impacts to surface waters, and adequate design of outlet structures.

  The review was conducted using the state of Utah Permanent Program.

- Project Manager and technical expert for the review and preparation of over 25 additional ACR's and technical analyses for mining and reclamation plans in the western U.S. These reviews required the analysis of surface water control structures, assessment of surface water impacts, meetings with the applicant to discuss deficiencies in the mine plans and coordination of review efforts with the regulatory authority.

- Evaluation of permit applications for construction in floodways in the state of Indiana. The review of the applications entailed calculation of drainage areas and peak runoffs for flood events to delineate floodplains and floodways, sizing drainage structures, and evaluating the adequacy of runoff and stream channel diversions for mining operations.

- Technical assistance for surface water availability studies in Indiana. Surface water resources for the state were evaluated using historic precipitation and flow data for hydrograph separation and flow duration curves.

Ms. Kimball has the following expertise related to the technical requirements of the scope of work:

- Determination of peak flow calculations
- Floodplain and terrace mapping
- Evaluation of sediment pond adequacy
- Channel construction, capacity and reclamation
- Evaluation of water control plans for protecting surface water quality
- Familiarity with the state of Utah Permanent Program.

Ms. Kimball has a B.A. in Geology from Hanover College in Indiana and has completed the majority of requirements for a M.A. in Geology from Indiana State University. For more complete detail, see the attached resume.

Mark A. Jewett, Hydrologist

Mr. Jewett is a hydrologist with a strong background in water chemistry and environmental impact evaluation. Projects which he has worked on related to the scope of work include:

- Technical Analysis for the Emery Deep Mine. This evaluation required a determination of the completeness of the Emery Deep Mine permit application and a detailed assessment of the technical information presented in the application. The areas which were reviewed were AVF's in the completeness phase, and ground water impact evaluation in the completeness and technical assessment phase. The ground water impacts were very difficult to evaluate due to the complexity of the system and the probable effects of subsidence on the aquifer. Significant caving of the mine roof through the aquifer was expected and possible caving into the overlying strata. This caving had the potential to combine the high quality water in the Upper Ferron with the low quality water in the Bluegate Shale. In addition, water degradation was occurring in the mine where the water mixed with the coal fines and with the rock dust material. Drawdown in the aquifer had the potential to effect several wells and springs in the area.

- Apparent Completeness Review for the Emery Deep Mine and Preparation Plant Modification for the Office of Surface Mining. This review involved determination of deficiencies in the application and preparation of an ACR. Issues of concern centered on

the impacts of subsidence on a significant aquifer above the mine, high TDS discharges from the mine, and evaluation of potential alluvial valley floors in the area which could be affected by mining. This review was done using the state of Utah Regulatory Program.

- Technical Analysis for the Price River Coal Mine in Helper, Utah. This review required the determination of deficiencies which existed in the mine plan related to groundwater studies. This section of the mine plan was particularly deficient and extensive suggestions were made on how to complete the application. The evaluation was particularly complex due to the number of seams being mined and the discontinuity of the strata. This review was conducted using the state of Utah Permanent Program.
- Project Manager and technical expert for the review and preparation of over 25 additional ACR's and technical analyses for mining and reclamation plans in the western U.S. These reviews involved the analysis of premining groundwater conditions, impacts to the hydrologic system from mining, and the evaluation of alluvial valley floors.
- Evaluation of methods available to evaluate impacts to groundwater systems subsequent to mining in the western U.S. Over ten mine plans and procedures utilized for the evaluation of groundwater impacts were evaluated for their adequacy to predict postmining conditions.

- Technical review and evaluation of uranium mill tailings disposal plans in Colorado. The impact of the proposed disposal plan was evaluated for impacts to the hydrologic system. Permeability of the confining strata was assessed and transport of contaminents to aquifers evaluated.

Mr. Jewett has the following expertise related to the technical requirements of the scope of work:

- Development of hydrologic monitoring requirements and installations
- Assessment of toxic overburden characteristics and the potential for groundwater contamination
- Evaluation of aquifer characteristics
- Determination of alluvial valley floor characteristics and assessment of impacts to designated AVF's
- Familiarity with the state of Utah Permanent Program.

Mr. Jewett has a B.S. in Hydrology from the University of Montana and a M.S. in Water Resources Management from the University of New Hampshire. For more complete detail, see the attached resume.

R. Michael Stanwood, Mineral Economist

Mr. Stanwood is a mineral economist with a strong background in feasibility studies, compliance analysis, and resource economics. He has worked on many projects involving the review of mining and reclamation plans, and has also worked on several projects dealing with

socioeconomic issues surrounding energy projects. Projects that he has worked on related to the scope of work on this proposed project include:

- Technical Analysis for the Emery Deep Mine. The review involved the determination of completeness of the permit application and a technical assessment of the information presented. The area which was evaluated was the amount of the proposed bond for the underground operation. Of concern was the amount of costs which should have been added concerning the topsoil operation and the mitigation of subsidence impacts. Since the subsidence impacts were anticipated to be severe, the cost was expected to be significant.
- Evaluation of Bond Amounts for Five Mines in Kentucky. The bond estimates prepared by operators for five operations in Kentucky were evaluated. In general, the estimates were very low and through negotiations with the operatiors were adjusted to reflect the cost for reclamation should the regulatory authority be required to reclaim the sites.

Mr. Stanwood has the following experience related to the techical requirements of the scope of work:

- Evaluation of equipment capacities
- Assessment of equipment costs
- Determination of project associated costs

Mr. Stanwood has an M.S. in Mineral Economics from the Colorado School of Mines. For more complete detail, see the attached resume.

BIO/WEST AND RICHARDSON ASSOCIATES

CORPORATE EXPERIENCE AND REPUTATION

BIO/WEST, INC.

Qualifications

BIO/WEST was established in 1976 to conduct research, inventories, and assessments of natural resource systems in the western United States. BIO/WEST operates with a permanent core of senior scientists and supporting staff, and is organized to bring together additional support personnel that are geared to individual project requirements.

The corporation takes an interdisciplinary, service oriented approach to problem solving, and thus affords organizations a broad range of creative solutions to problems in resource management. BIO/WEST is flexibly structured to provide an individual scientist or a team of resource specialists for short or long-term projects. The corporation provides expertise in all phases of environmental assessment, including biological, physical, and human resources. It is especially qualified in the assessment of impacts due to environmental manipulation of western resources. BIO/WEST has the capability and expertise to research and/or assess any resource system in the western United States.

Capabilities

BIO/WEST structures projects around key scientists with extensive experience in applied research and management of all components of resource systems. BIO/WEST has available a broad, multidisciplinary corporate experience by virtue of its core professionals, supporting

technical staff, and top level support personnel. This experience has diversified and expanded as different corporate projects are staffed specifically around their needs, i.e., each project determines the staffing, rather than immediately available staff dictating key personnel. Thus, a number of experienced professionals, at both the senior and junior level, have been/are involved in BIO/WEST's past and on-going projects. This degree of participation is especially significant to resource development industries and their mandated compliance to environmental regulations. The depth and continuity of relevant professional experience that is held by BIO/WEST's environmental analysts provides corporate clients a cost effective approach to problem solving.

In regard to environmental impact analysis and regulation compliance programs, BIO/WEST can offer expertise in most of the resources to be investigated, as well as the management structure to integrate these individual areas of expertise into an interdisciplinary environmental task force. Our areas of expertise and experience are centered in the firm's seven technical sections: Aquatics, Engineering, Recreation/Visual, Socio-economics, Vegetation/Soils, Water Resources, and Wildlife. We also provide support personnel in the areas of Cultural Resources, Paleontology, Air Quality and Meteorology, and Land Use. In addition to offering comprehensive discipline-specific expertise in the major areas of resource analysis through our technical sections, BIO/WEST has considerable experience in utilizing the sections to form interdisciplinary teams. These interdisciplinary teams have been used to conduct major environmental analyses, including complete Environmental Impact Statements and Environmental Assessments, for a variety of private industries

and governmental agencies. Our interdisciplinary capabilities are best emphasized by the projects we have conducted which are summarized later in this statement.

Support Facilities and Equipment

BIO/WEST's offices and laboratory facilities are located in Logan, Utah, a geographical nucleus for much of the ecological research and energy development in the western United States. The firm's location is centralized in terms of travel distance and accessibility, allowing for highly cost-effective operations.

BIO/WEST maintains an extensive inventory of field equipment for terrestrial and aquatic research, including: physical characterization of aquatic environments; basic water quality and quantity assessments; fish and macroinvertebrate sampling and taxonomic analysis; mammalian and avian assessments; and vegetative and soil surveys. In addition, the company has large river rafts, Jon boats, outboard motors, 4-wheel drive vehicles, and a Cessna 182 fixed-wing aircraft.

Our in-house cartographic expertise includes the normal black and white and color separation techniques for maps, charts, figures, etc. required of scientific reports, as well as aerial photography interpretation for resource analysis.

Utah State University, located in Logan, is utilized for various support facilities, including: Merrill Library, the Intermountain Herbarium, the Intermountain Regional Depository Library for Federal Documents, the Utah Water Research Laboratory (with a certified water quality laboratory), and the Utah State Computer Center (with complete computer capability). BIO/WEST has an in-house terminal with linkage to the University Computer Center and various other computer systems, providing on-location computer services. Recent additions include the development of telecommunications which was used in the TA Phase of the Emery Deep MRP review.

Summary of Selected Projects

Liberty-Coolidge Transmission Line Environmental Impact Statement, Arizona - Served as subcontractor to Willdan Associates of Phoenix with responsibility for all biological and physical analysis, portions of project management, and public involvement program. Project involves the selection of preferred alternative line corridors and the evaluation of impacts resulting from each. Western Area Power Administration, Boulder City, Nevada.

Malad Valley Wetlands Assessment - Determination of the effects of irrigation efficiency changes upon natural wetland area via water budget modeling and quantitative habitat evaluation techniques. Includes historical and field habitat analyses, water quality and quantity monitoring, hydrologic modeling, irrigation analyses, and geologic surveys. Soil Conservation Service, Boise, Idaho.

Draft Environmental Impact Statement on White River Dam Project - Served as prime contractor for a multi-discipine environmental impact analysis of a proposed dam on the White River in eastern Utah. Approximately 12 specialized support personnel and a large in-house staff were utilized on the project. Bureau of Land Management, Richfield, Utah.

Jackson Lake Dam Environmental Assessment - Preparation of an Environmental Assessment relative to correcting safety problems with

Jackson Lake Dam near Jackson, Wyoming. The study involves using an interdisciplinary team of 12 resource specialists, and integrating their analysis into a comprehensive environmental statement. Bureau of Reclamation, Boise, Idaho.

Schell Resource Area Grazing Environmental Impact Statement, Nevada -Preparation of a major environmental study of alternative grazing management systems for the 4,000,000 acre Schell Resource Area in eastern Nevada. The study involves the use of in-house as well as supporting resource specialists in 14 separate disciplines. It requires the interpretation and analysis of considerable data, as well as the integration of that material into a concise Environmental Impact Statement. Bureau of Land Management, Ely, Nevada.

Baseline Fishery Data for Cache Creek EIS, Wyoming - Collection of fishery data from both the field and the literature on several streams near Jackson, Wyoming. The information was provided to the U.S. Forest Service for use in an EIS.

Evaluation of Alternative Access Roads and Drill Sites to Exploratory Oil and Gas Wells, Wasatch National Forest and BForest, Wyoming - An assessment of impacts to aquatic and terrestrial ecosystems associated with oil and gas exploration and possible methods for mitigation of those impacts. A number of well sites have been examined for a variety of oil and gas firms.

Wildlife Resource Inventory of the Chaco Strippable Coal Area, New Mexico - A long-term inventory and habitat analysis on 500,000 acres of land underlain by strippable coal. The study included sampling of avian, mammalian, herpetological, and vegetative resources during each season of the year, as well as an in-depth evaluation of pronghorn and scaled quail habitat. The data will be used to assess the impacts of coal stripmining, set a baseline for future monitoring studies and develop plans for reclamation and mitigation of the wildlife resources. Bureau of Land Management, Farmington, New Mexico.

Large Mammal Population Studies - Wildlife studies to establish numbers, densities, distribution, and behavioral responses of the larger, more conspicuous mammals in valleys of western Utah and southcentral Nevada. Methods of data gathering included intensive aerial surveys, pellet group counts, and ground observations to record behavioral responses to human activities. The study also included extensive small mammal trapping and lagomorph population estimates using flushing transects. The purpose of the study was to help predict the impacts of construction of the MX missile system upon the native and exotic fauna within disturbed and undisturbed valleys of Nevada and Utah. HDR Sciences, Santa Barbara, CA.

N.E. Wyoming Wildlife Inventory - This project involved extensive collection and analysis of background ecological data on aquatic and terrestrial wildlife as part of a preoperational inventory. Data will be used for impact assessment, long-term monitoring programs, and

reclamation and mitigation planning. This program was an in-depth evaluation of existing wildlife and habitat on 500 square miles of uranium lands in eastern Wyoming, involving both quantitative and qualitative sampling. Close association with federal and state monitoring agencies was required. Threatened or endangered species and economically significant species were emphasized in the program. Cleveland Cliffs Iron Company, Casper, Wyoming.

Impact of Coal Mine Operation On Stream Biology - An ongoing, biannual survey of the biological condition of two streams in northeast Wyoming relative to coal mine development and operation. This is a long-term study of instream (vertebrate and invertebrate fauna) and riparian biology that includes monitoring, impact assessment, reclamation, and mitigation strategies. The monitoring process includes natural, bypass, and reconstructed channels. AMAX Coal Company, Gillette, Wyoming.

Utah Oil Shale Wildlife Monitoring Program - A long-term predevelopment environmental baseline data collection and monitoring program of terrestrial vertebrates on the Utah oil shale tracts along the White River. This study involved extensive seasonal sampling of terrestrial wildlife species over a potential resource development area. Should development take place, data accumulated will be used to determine potential impact, reclamation procedures and mitigation strategies. White River Shale Project, Vernal, Utah.

Investigation of Physical and Certain Biological Components of a Large River - A detailed field and laboratory study involving the collection and analysis of seasonal samples from the San Juan River, New Mexico and Utah. The study required definition of the current condition of the river system in terms of its physical and biological components and projection of its response to varied flow regimes resulting from further water resource development. Analysis involves the extensive use of hydraulic and ecological computer models in conjunction with various statistical techniques. U.S. Bureau of Reclamation, Amarillo, Texas.

Assessment of Impacts of Intake Modification of Flaming Gorge Dam on Downsteam Fishes and Macroinvertebrates - An assessment of changes in distribution, abundance, and reproductive success of native and introduced fishes and macroinvertebrates in the Green River following warming of tailwater summer releases. This is a three-year study, designed primarily for evaluating effects on the endangered Colorado squawfish. Field samples are taken four times per year. The data will be used to evaluate similar intake modifications on other dams. U.S. Bureau of Reclamation and U.S. Fish and Wildlife Service, Salt Lake City, Utah.

Utah and Colorado Baseline Aquatic Survey for a Proposed Power Plant and Coal Mine - A one-year survey of the Green River of eastern Utah and the White River of western Colorado. Fish, macroinvertebrates and periphyton were sampled and analyzed. Endangered fishes were of special concern. The study evaluated the species present and the potential impact of the proposed project on them. Also included are appearances at

public meetings to answer questions of both governmental authorities and private individuals. Burns and McDonnell, Inc., Kansas City, Missouri, and Western Fuels, Inc., Cheyenne, Wyoming.

Mine Plan Permit Review - Under subcontract to the Office of Surface Mining through Fred C. Hart and Associates, we reviewed and performed technical analyses on mine plan permit applications in the fishery, wildlife, vegetation and soils areas. Fred C. Hart and Associates, Denver, Colorado.

Vegetation Survey of U.S. Fuel Company Property near Hiawatha, Utah -Baseline survey to determine the species composition, density, cover, productivity, and diversity of vegetation for an underground coal mine in central Utah. U.S. Fuel Company, Salt Lake City, Utah.

Riley Ridge Project Soil Survey - A third order soil survey of approximately 70,000 acres and geomorphological survey of potential pipeline and rail routes. Northwest Pipeline Company, Salt Lake City, Utah.

Threatened and Endangered Plant Inventory, Utah - An inventory of threatened, endangered, and rare plant species on approximately 290,000 acres of federal land in Uinta County, Utah. U.S. Bureau of Land Management, Vernal, Utah.

Snow Surveys for the State of Utah - Collection of monthly snow survey data by helicopter at 112 sites throughout Utah. Data to be utilized for developing water supply forecasts. Soil Conservation Service, Salt Lake City, Utah.

Collection of Substrate and Flow Data on Yakima River - Collection of all necessary physical data on the Yakima River for operation of the US FWS Instream Flow Incremental Methodology models. Involved sampling 30 stations at three different flow levels over a wide range of stream types. Results of analysis to be used in Indian water rights litigation. U.S. Fish and Wildlife Service, Portland, Oregon.

Navajo Surface Water Hydrology - An investigation to determine surface water availability on the Eastern Navajo Trust lands in New Mexico. Involves river system modeling, drainage analysis, water quality sampling and analysis, recharge basin evaluation, water rights analysis, diversion mapping, and litigation coordination. Bureau of Indian Affairs, Gallup, New Mexico.

Upper Gila River Water Quality - Collection of water quality and benthic invertebrate data from four potential reservoir sites on the Gila and San Francisco Rivers, New Mexico and Arizona. Correlation of field and a variety of existing comparable data to predict water quality and effects upon invertebrate communities of reservoir operations. Involves reservoir trophic modeling and prediction techniques. Bureau of Reclamation, Boulder City, Nevada.

Review of the Emery Deep Mining and Reclamation Plan - Preparation of Apparent Completeness Review, Determination of Completeness, and Technical Analysis reports. Involved a number of meetings with the Applicant and the Division of Oil, Gas and Mining. Areas of particular

concern for this project include ground and surface water hydrology, subsidence, soils, vegetation, wildlife, land use, reclamation, mining engineering, and civil engineering. To date, all budget and schedule requirements have been met.

Baseline Aquatic Biology and Water Quality for a Utah Coal Mine -Sampled and mapped a small stream adjacent to a proposed coal mine for information needed for a mine permit application. The stream is an important rainbow and cutthroat trout spawning stream, and flows into a heavily used recreational reservoir. Stations were intensively mapped to show habitat features and their changes in the future. Aquatic macroinvertebrates were sampled as well as water quality.

CLIENTS

Alcan Pipeline Company
AMAX Coal Company
Battelle Memorial Institute
Burns and McDonnell
Cleveland Cliffs Iron Company
Don Chapman Consultants
Ecology Consultants, Inc.
Fred C. Hart Associates
Geokinetics, Inc.
Gulf Interstate Engineering Company
HDR Sciences
Klohn Leonoff Engineering
Land Management Services
National Park Service
Northern Coal Company
Northwest Pipeline Company
Sanders Exploration Company
Soil Conservation Service
U.S. Bureau of Land Management
U.S. Bureau of Reclamation
U.S. Fish and Wildlife Service
U.S. Forest Service
U.S. Fuel Company
U.S. Geological Survey
Utah Division of Oil, Gas, and Mining
Western Area Power Administration (DOE)
Western Energy and Land Use Team (FWS)
Western Fuels Association, Inc.
White River Shale Oil Corporation

RICHARDSON ASSOCIATES

Richardson Associates of Denver provides consulting services in the areas of mining engineering, resource development feasibility studies, hydrology, economic and market analysis, regulatory compliance and project permitting, socioeconomic assessment, and environmental impact analysis. The firm has been in existence since January, 1983.

Our clients primarily consist of engineering and consulting firms which require specific expertise and experience in the above areas. Our associates have also worked directly for resource development firms and governmental agencies in the areas of mining, energy, and solid and hazardous waste management.

The Firm's Principals

Our principals include Deborah Richardson, a mining engineer (Pennsylvania State University, M.S.), Connie Kimball, a geological engineer and hydrologist (Indiana University, B.S.), and Michael Stanwood, an economist and strategic planner (Colorado School of Mines, M.S.). All principals have at least three years prior consulting experience as project managers with national consulting firms.

Facilities and Resources

We are headquartered in Denver, Colorado, a regional and national center for resource development. The firm has operated on projects in four western states and three eastern states from our Denver facilities. We have complete word processing capabilities, and have three inter-related microcomputers capable of communication with mainframe computers and several data bases. In addition, link-up with the word-processor at Bio/West has been established providing instant communication between the two firms.

Mine Plan Review Experience

The staff of Richardson Associates has been involved in permit reviews for several years. During that time they have prepared documentation evaluating the adequacy of mining and reclamation plans to meet the requirements of the regulations. They have prepared several Technical and Environmental Analyses (TEA), Technical Analyses/Environmental Assessements (TA/EA) and Findings of Supporting Documentation (FSD), all of which are similar in that they evaluate the adequacy of a proposed mining and reclamation plan to comply with the regulations. The FSD however, deletes many of the sections of a TEA dealing with NEPA compliance, i.e. the EA.

A list of the operations for which the staff of Richardson Associates was directly responsible for the completion of TEA's or EA/TA's all of which include an FSD, are shown below.

In addition to being responsible for the preparation of these documents, the staff of Richardson Associates had technical responsibility for preparation of the following sections: 1) topsoil handling, 2) surface water hydrology, 3) ground water hydrology, 4) cumulative hydrologic impacts, 5) backfilling and grading, 6) roads, 7) explosives handling, 8) coal recovery on mines with non-Federal coal, 9) coal refuse disposal, 10) excess spoil disposal, 11) alluvial valley floors, 12) socioeconomics, 13) bonding, and 14) subsidence.

The following is the list of mine plan reviews that the staff of Richardson Associates has completed:

Price River Mine, Utah, underground mine

Marr Strip Mine, Colorado, open pit operation

Edna Mine, Colorado, area strip mine

Canadian Strip, Colorado, area strip mine

Deserado Mine, Colorado, underground mine

Black Mesa - Kayenta, Arizona, area strip mine

Feds Hollow of Grape Vine Creek, Kentucky, surface disturbance

Cain Branch Mine, Kentucky, underground mine

Camp Complex, Kentucky, surface disturbance

Jackson County Mine, Georgia, area strip mine

In addition, Richardson Associates is currently in the process of completing 11 other FSD's for operations in Kentucky and Georgia. Also Richardson Associates is working on

the mining engineering and geotechnical portions of FSD's for five operations in Utah, three in New Mexico and three in Washington. The operations that they are working on in the State of Utah are:

Deer Creek, underground operation, operated by Utah Power & Light

Wilberg, underground operation, operated by Utah Power & Light

Des-Bee-Dove, underground operation, operated by Utah Power & Light

Trail Mountain Mine, underground operation, operated by Natomas Coal Company

Emery Deep Mine, operatated by Consolidation Coal Company.

For the Emery Deep Mine, Richardson Associates is completing not only the mining engineering and geotechnical portions of the FSD, but also the hydrology sections. Familiarity with the Deer Creek operation which is near the Deer Creek operation, provides Richardson Associates familiarity with the geologic setting of the West Appa Mine. This familiarity provides an up front understanding of the issues affecting subsidence in this region. In addition, with our work on the Emery Deep Mine and the Price River Mine Complex, we have an understanding of the hydrologic issues of the region. Currently OSM is completing a CHIA for the Huntington Drainage. To prepare the CHIA for the West Appa Mine, Richardson Associates is proposing to utilize this CHIA which should soon be available from OSM. This will save a

great deal of time and effort in the completion of the CHIA.

Other Project Experience

Richardson Associates of Denver provides consulting services in the areas of mining engineering, economic analysis, cost estimation, hydrologic analysis, strategic planning, and environmental and socioeconomic analysis. Project experience of the staff of Richardson Associates includes:

Completeness reviews for over 40 mining and reclamation plans to ensure the adequacy of the plans to show compliance with the applicable state and federal regulations. This work required the evaluation of areas of the mining and reclamation plan dealing with hydrology, surface and underground mining, bonding calculations, excess spoil and refuse disposal, and socioeconomic evaluations. Plans were reviewed to determine if the submitted designs were adequate to show compliance with the regulatory requirements. Meetings with some of the mine operators were held to discuss deficiences and to identify additional information requirements. Mines were evaluated in the states of Arizona, New Mexico, Colorado, Utah, Wyoming, Georgia, and Kentucky.

Technical and environmental assessments of mining and reclamation plans for operations in the states of Colorado, Arizona, Utah, Kentucky and Georgia. These assessments included the evaluation of the portions of the operations dealing with surface and ground water hydrology, topsoil handling, backfilling and grading, excess spoil and refuse disposal, explosives handling, bonding calculations, socioeconomic evaluations, subsidence impacts, and road construction. The designs and plans submitted by the applicant were checked in detail for adequacy.

Evaluation of methods available to evaluate impacts to ground water systems subsequent to mining in the western U.S. Over ten mine plans and procedures utilized for the evaluation of ground water impacts were evaluated for their adequacy to predict postmining conditions. Methods utilized by several major researchers in the western U.S. were reviewed and their applicability to the particular environmental setting assessed. The usefulness of each of the techniques to the prediction of groundwater impacts was determined and

limitations studied. Methods utilized in sampling overburden strata and laboratory procedures in determining the potential for groundwater contamination were also assessed.

Evaluation of the economic impact of the surface mining regulations on mine operators within eleven regions of the U.S. Eleven mining operations were designed in compliance with the federal surface mining program, and the cost of environmental compliance determined. The eleven operations provided the basis for further analysis of the proposed surface mining regulations published in 1982. The operations included area strip mines, contour strip, open pit, mountaintop removal, and surface facilities associated with underground operations.

Preliminary feasibility studies of two potential synfuels plants in the western U.S. The projects involved and examination of the physical, economic, technical, policy, and environmental variables of development. The goal was to determine the potential for each of these factors to become a major constraint to development. Alternative approaches were formulated where necessary to reduce the risks of development.

Regulatory compliance strategies for several energy development and waste disposal facilities. This process involved the identification of all applicable permits, clearances and other types of approvals, determination of likely time frames to obtain these regulatory approvals, the scheduling of activites and determination of a critical path, and the formulation of a strategy to accomplish specific goals in the most efficient manner.

Management and business strategies to consider and incorporate emerging issues and factors into future development plans. This effort included regulatory and policy analysis, analysis of long-range plans, and projections of capital and product markets. A position paper was then prepared suggesting changes to existing planning processes and topics.

Market and research analysis of coal in the Rocky Mountain and Midwest coal-supply regions. This effort involved extensive data collection on existing and potential coal supply sources in five states. Information analysed included quality, heat content, geological information, and mining costs. The information and data collected was used to idnetify potential coal buyers and competitive coal supply sources.

Socioeconomic studies of proposed activities in six western states. Analyses included housing, public service and infrastructure, labor supply, and population projections. Categories of proposed projects have included coal mines, oil shale facilities, ski areas, and urban developments. Studies conducted have also included recommendations to reduce time delays and lessen the potential for adversary relationships.

Preparation of a study plan for a site in Montana that was suspected of contaminating the local groundwater supply with substances used in wood-treating processes. Involved planning the steps needed to verify the source of contamination, basing the plan on available information from local well data, history of industry in the area, chemical characteristics of the contaminants and known characteristics of groundwater flow.

Prepared a closure plan for a hazardous waste disposal site in Maryland. Required familiarity with EPA-RCRA regulations for closure of such sites and expertise necessary for projecting needs for a clay liner and cap, diversion of surface water flow away from the area, protection against intruders and familiarity with the potential for migration of groundwater contaminants.

Conducted the engineering review of proposals for construction along streams in Indiana. Projects included commercial buildings, residential developments, dams, levees, diversions, fills and excavations. Required expertise to perform hydraulic studies using HEC-II computer modeling to identify constuction of the floodway, as well as hydrograph development and research of historical flow data for input into these studies. Additionally required the use of reservoir routing, geotechnical evaluation of embankments and levees, field inspections of structures and meeting with the public to discuss violations or project specifications.

Review of methods available to treat mine drainage in the eastern U.S., and methods to abate the formation of poor quality mine drainage. Treatment of acid mine drainage and drainage with a high suspended solids content was evaluated and available options reviewed. In addition, emphasis was placed on the benefits of preplanning in mining operations to minimize the formation of poor quality drainage. These included minimizing the contact of in-pit water with pyritic material and the need for efficient collection of in-pit water to a sump area.

MANAGEMENT

Dr. John Rice will serve as Project Manager and Life Science Team Leader. Dr. Rice is BIO/WEST's Vegetation/Soils Section Manager and Coordinator of Mining Services. Dr. Rice has served in both management and technical capacities for numerous projects. In his role as Project Manager, Dr. Rice will have overall responsibility for completion of the project, including coordination and monitoring of the budget, and quality control. He will also have responsibility for Lead Reviewer contacts.

Ms. Deborah Richardson will serve as Assistant Project Manager and Earth Sciences Team Leader. Ms. Richardson is a principal of Richardson Associates and provides considerable experience in review of mining and reclamation plans. She has reviewed over 25 mining and reclamation plans and has worked on many projects related to mining environmental issues. Ms. Richardson will work closely with the Earth Sciences Team, insuring that management procedures are followed and that problems are solved as soon as they are evident.

Figure 3 shows the level of effort (man-hours) proposed for each discipline during each phase of the project. Figure 4 summarizes each team member's effort during each phase of the project.

At the onset of Phase I, a briefing will be held in the DOGM office in Salt Lake City. A site visit at the mine will be conducted in conjunction with this meeting. During Phase II, a meeting will be held in Salt Lake City to discuss and clarify deficiencies in the mining and reclamation plan with the applicant and DOGM personnel. A third meeting

Figure 3. Level of effort (man-hours) for each discipline during each phase.

PHASE I (approximately 35% of the effort)

Discipline	Hours
Mining and Civil Engineering (D. Richardson)	48
Bonding (M. Standwood)	8
Geology (M. Jewett)	8
Surface Water Hydrology (C. Kimball)	24
Groundwater Hydrology (M. Jewett)	32
Soil Science (J. Rice)	24
Fish and Wildlife Biology (M. Albee)	40
Plant Ecology/Reclamation (J. Rice)	32
Management (J. Rice, D. Richardson)	16
Clerical (C. Braegger)	24
Total	256

PHASE II (approximately 10% of the effort)

Discipline	
Mining and Civil Engineering (D. Richardson)	8
Bonding (M. Stanwood)	2
Geology (M. Jewett)	4
Surface Water Hydrology (C. Kimball)	8
Groundwater Hydrology (M. Jewett)	12
Soil Science (J. Rice)	10
Fish and Wildlife Biology (M. Albee)	12
Plant Ecology/Reclamation (J. Rice)	12
Management (J. Rice, D. Richardson)	8
Clerical (C. Braegger)	8
Total	84

Figure 3. Continued

PHASE III (approximately 55% of the effort)

Discipline	Hours
Mining and Civil Engineering (D. Richardson)	64
Bonding (M. Standwood)	10
Geology (M. Jewett)	8
Surface Water Hydrology (C. Kimball)	32
Groundwater Hydrology (M. Jewett)	32
Soil Science (J. Rice)	40
Fish and Wildlife Biology (M. Albee)	48
Plant Ecology/Reclamation (J. Rice)	48
Management (J. Rice, D. Richardson)	24
Clerical (C. Braegger)	52
Total	358

Figure 4. Manning chart; level of effort (man-hours) during each phase.

	Phase I	Phase II	Phase III	Total
J. Rice	64	26	104	194
M. Albee	40	12	48	100
D. Richardson	56	12	72	140
M. Stanwood	8	2	10	20
C. Kimball	24	8	32	64
M. Jewett	40	16	40	96
C. Braegger	24	8	52	84
Total	256	84	358	698

will be held in Salt Lake City during Phase III to discuss any necessary ammendments or changes to the FSD report, and to provide direction from DOGM for the final FSD report. For each of these meetings, the contractor will be represented by Dr. John Rice, Project Manager and Life Sciences Team Leader, Ms. Deborah Richardson, Assistant Project Manager and Earth Sciences Team Leader, and appropriate staff.

Throughout the course of the project, the Project Manager, Dr. John Rice, will contact the DOGM Lead Reviewer, Ms. Mary Boucek, on a weekly basis to review progress and discuss problems encountered. Copies of the telephone logs will be forwarded to the Lead Reviewer at the end of each week.

A projected schedule for the review process is given in Figure 5. Eight copies of each report will be submitted to DOGM with one of the copies unbound and not on corporate letterhead.

Figure 5. Projected schedule for the assessment process.

Task	Anticipated Date
PHASE I - Initital Review (ACR)	
A. *Meeting with OSM, DOGM, Contractor	January 6, 1984
B. *Contractor prepares and submits Initial Review to DOGM	January, 31, 1984
C. DOGM reviews and transmits Initial Review to Applicant and OSM, if it is acceptable[1]	February 10, 1984
PHASE II - Determination of Completeness (DOC)	
A. *Applicant reviews Initial Review and attends meeting with DOGM and Contractor	February 17, 1984
B. Applicant responds in writing to Initial Review; response submitted to DOGM	March 9, 1984
C. *Contractor reviews response, prepares DOC, and submits DOC to DOGM	March 30, 1984
D. DOGM reviews DOC and transmits it to Applicant and OSM, if it is acceptable[1]	April 9, 1984
PHASE III - Findings and Supporting Documentation (FSD) (encompasses Technical Analysis Phase)	
A. *Contractor prepares draft FSD	April 30, 1984
B. DOGM reviews draft FSD and transmits it to Applicant and OSM, if it is acceptable[1]	May 10, 1984
C. *Applicant reviews draft FSD and attends meeting	May 17, 1984
D. Applicant responds to draft FSD	May 31, 1984
E. *Contractor prepares final FSD	June 21, 1984
F. DOGM reviews final FSD and transmits it to OSM, if it is acceptable[1]	June 29, 1984

Figure 5. Continued.

Task	Anticipated Date
Final Review and Approval	
OSM reviews final FSD, prepares final decision document with NEPA	July 13, 1984
Secretarial Decision and Notices	July 31, 1984
DOGM issues permit	July 31, 1984

*Indicates steps where Contractor is involved.

[1]NOTE: This schedule does not account for time required by Contractor to correct reports or documents found unacceptable by DOGM.

RESUMES OF KEY PERSONNEL

JOHN A. RICE

VEGETATION/SOILS SECTION MANAGER

Education

1975-81 Colorado State University, Ft. Collins, Ph.D. Range Science

1970-74 University of Texas, El Paso, B.S. Biology

Professional Experience

1981-Present - Vegetation/Soils Section Manager, BIO/WEST, Inc., Logan, Utah.

- o Project Manager. Correction of Vegetation Information Deficiencies in the King Mines Mining and Reclamation Plan. U.S. Fuel Company.
- o Project Manager. King VI Mine Reclamation Plan. Responsible for Revegetation and Topsoil sections of the permit, and regulatory compliance. U.S. Fuel Company.
- o Project Manager. Interim revegetation of the King VI Mine. U.S. Fuel Company.
- o Project Manager. Review of the Emery Deep Mining and Reclamation Plan. Utah Division of Oil, Gas, and Mining.
- o Project Manager. Threatened and Endangered Plant Inventory: Seep Ridge Project. Geokinetics Inc.
- o Project Manager. Threatened and Endangered Plant Inventory: Utah. An inventory and population study of threatened, endangered and rare plant species on approximately 290,000 acres of federal land in Uintah County, Utah. Bureau of and Management.
- o Project Manager. Riley Ridge Project Soil Survey. A third order soil survey of approximately 70,000 acres and geomorphological survey of potential pipeline and rail routes. Northwest Pipeline Company.
- o Assistant Project Manager. Preparation of a grazing Environmental Impact Statement for the Schell Resource Area, Ely District, Nevada. Bureau of Land Management.

- o Prepared Apparent Completeness Review and Technical Environmental Analysis for mine plans. Responsible for Vegetation, Soils, Land Use, Prime Farmland, and Reclamation reports. Fred C. Hart Associates, for the Office of Surface Mining.

- o Vegetation-Soils Team Leader. Preparation of an Environmental Impact Statement for the Liberty to Coolidge, Arizona Transmission Line Upgrade. Willdan Associates, for Western Area Power Administration.

- o Vegetation-Soils Team Leader. Preparation of an Environmental Impact Statement for the proposed modification of Jackson Lake Dam. Water and Power Resources Service.

1980-81 Research Associate, Animal Science Division, University of Wyoming. Conducted research to evaluate the utilization of important forage plants and the nutritional status of wild horses and cattle grazing rangeland in southwestern Wyoming. Responsibilities included coordinating research, directing collection of data, supervising field crews and hiring personnel. The study included range site mapping and baseline vegetation inventory of the study area.

1979-80 Worked as a ranch hand for a cow-calf operation in northern Nebraska.

1979 Participated in a baseline vegetation inventory of the Alton Coal Field, Utah. Uniscale Corporation.

1978 Participated in a study to determine utilization of a crested wheatgrass seeding by cattle under different grazing systems. Colorado State University.

1978 Participated in a baseline vegetation inventory and evaluation of reclaimed areas on a coal mine near Kemmerer, Wyoming. Uniscale Corporation for Kemmerer Coal Company.

1976-79 Research Assistant, Department of Range Science, Colorado State University. Conducted research to evaluate energy partitioning for the cow-calf unit and the energetic efficiency of three cow biological types. The study included evaluation of the standing crop of herbage available for cattle grazing, the amount of forage consumed by cattle and the quality of the cattle diets.

1975-76 Teaching Assistant, Department of Range Science, Colorado State University.

Publications and Reports

1983 Vegetation of the U.S. Fuel Company property, Hiawatha, Utah. BIO/WEST PR 41-83-4.

1983 Threatened and endangered plant inventory: LOFRECO Site and the Seep Ridge Project. BIO/WEST PR 82-83-1. (with F. Smith)

1982 Topsoil plan for the King VI coal mine. U.S. Fuel Company. BIO/WEST PR 69-82-2. (with W. Glenn)

1982 Revegetation plan for the King VI coal mine. U.S. Fuel Company. BIO/WEST PR 69-82-1.

1981 Energetic efficiency of three range cattle biological types. Ph.D. Dissertation, Colorado State University, 84 pp.

1979 Energetic efficiency of three range cattle biotypes. Page 59 in 32nd Annual Meeting of the Society for Range Management, Casper, Wyoming (Abstract). (with P. L. Sims).

Reports Contributed To

1983 Environmental Impact Report for the Jackson Lake Dam Modification Program. BIO/WEST PR 80-83-1.

1982 Draft and Final Schell Resource Area Grazing EIS, BLM, Nevada. BIO/WEST PR 52-81-1.

1982 Preliminary Draft EIS for the Liberty-Coolidge Transmission Line, Arizona. BIO/WEST PR 67-82-1.

Teaching

1978 Instructor, Ecosystem Management Short Course, Colorado State University, Fort Collins.

1975-76 Teaching Assistant, Department of Range Science, Colorado State University, Fort Collins.

Activities

1982-83 Chairman of the Information and Education Committee, Utah Section, Society for Range Management.

1978-79 Graduate Student Representative, Department of Range Science and Graduate Student Council, Colorado State University, Fort Collins.

MICHAEL H. ALBEE

Wildlife Biologist/Section Manager

EDUCATION

1972-74 Graduate Research, Utah State University

1972 B.S. Wildlife Biology, Utah State University

PROFESSIONAL EXPERIENCE

1979-Present - Wildlife Section Manager, BIO/WEST, Inc., Logan, Utah.

- Wildlife Biologist for review (ACR, DOC, and TA) of the Emery Deep Mining and Reclamation Plan. Utah Division of Oil, Gas, Mining.

- Wildlife Biologist on the Jackson Lake Dam Modification Environmental Impact Statement. Responsible for assessing the impacts of dam modification and alternative action, plus the use of several possible borrow material sites located throughout the Jackson Hole area. Included in the impact analysis is potential disturbance to peregrine falcon feeding areas, bald eagle nesting and wintering sites, and grizzly bear habitat.

- Principal Investigator and Field Biologist on a wildlife survey of coal mining properties in central Utah with emphasis on migratory species of high federal interest. U.S. Fuel Company

- Terrestrial Wildlife Consultant for the Teton County Planning Commission. Responsible for identifying critical wildlife habitats in the South Park area of Jackson Hole and insuring that those habitats are protected and maintained when planning for new housing developments.

- Terrestrial Wildlife Consultant on an interdisciplinary team to assess the impacts of alternative exploratory oil and gas drill sites and access roads in the Pruess Creek drainage of the Caribou National Forest.

- Wildlife Biologist, on the Malad Valley Wetlands Assessment. Responsible for classifying and evaluating 12,000 acres of wetlands in southern Idaho and assessing potential impacts of irrigation projects.

PROFESSIONAL EXPERIENCE - Continued

- Wildlife Biologist, on the Liberty-Coolidge Transmission Line Environmental Impact Statement. Responsible for analyzing impacts of various alternate routes on the existing wildlife.

- Terrestrial Wildlife Consultant on an interdisciplinary team to assess the impacts of alternate exploratory oil and gas drill sites and access roads in the Rock Creek area of the Bridger-Teton and Caribou National Forests.

- Terrestrial Wildlife Consultant on an interdisciplinary team to assess the impacts of alternate exploratory oil and gas drill sites and access roads in the Gannett Hills area of the Greys River Ranger District, Bridger Teton National Forest.

- Terrestrial Wildlife Consultant on an interdisciplinary team to assess the impacts of alternative exploratory oil and gas drill sites on the Poker Hollow Creek area of the Kemmerer Ranger District, Bridger Teton National Forest.

- Wildlife Biologist on the Schell Grazing Environmental Impact Statement. Responsible for analyzing the impacts of livestock grazing and several land use alternatives upon wildlife resources of eastern Nevada.

- Wildlife Biologist for on the Jackson Lake Dam Modification Environmental Analysis. Responsible for assessing the impacts of modification of the Jackson Lake Dam which includes the possible use of several alternative construction material borrow areas near critical wildlife habitat.

- Terrestrial Wildlife Consultant on an interdisciplinary team to assess the impacts of an exploratory drill site in the Fall Creek area of the Hoback Ranger District, Bridger-Teton National Forest.

- Terrestrial Wildlife Consultant on an interdisciplinary team to assess the impacts of alternative exploratory drill sites in the Quaking Aspen Hollow area of the Grey Rivers Ranger District, Bridger-Teton National Forest.

- Project Manager on a vegetation study of U.S. Fuel Company Mining property, Hiawatha, Utah.

- Terrestrial Wildlife Consultant on an interdisciplinary team to assess the impacts of proposed access roads and exploratory drilling in the Gros Ventre and Hoback Ranger Districts, Bridger-Teton National Forest.

PROFESSIONAL EXPERIENCE - Continued

- Project Manager and Principal Investigator on a baseline wildlife inventory of the Chaco Stripable Coal Area, New Mexico.

- Terrestrial Wildlife Consultant on an interdisciplinary team to assess the impacts of proposed access roads and exploratory drilling in the Mountain View Ranger District, Wasatch National Forest.

- Principal Investigator for on a study of large and small mammal populations in western Utah and southcentral Nevada.

- Assistant Project Manager for on the preparation of an Environmental Impact Statement on the proposed White River Dam in Utah.

1974-76 Field Biologist, Platte River Resource Area, Bureau of Land Management, Casper, Wyoming. Responsible for wildlife habitat management on approximately 1.5 million acres of public land. Participated in inventories of all terrestrial and aquatic wildlife, writing of eight environmental analysis reports, assessment of natural gas lease applications, and analyzing various potential impacts on public lands.

1972-74 Research Assistant, Utah State University. Completed a population study of mule deer winter range using pellet group transects. The study was designed to obtain the lowest sampling variance with a minimum of observations.

1976-78 Biologist, Bureau of Land Management, Rock Springs, Wyoming. Served as a team member on Southwest Wyoming Coal Environmental Statement. Was responsible for all terrestrial and aquatic sections. Primarily reviewed information supplied by contract and incorporated it into the EIS. Reviewed mine plans for technical adequacy in terrestrial and aquatic wildlife.

1978-79 Field Biologist, Salt Wells Resource Area, Bureau of Land Management, Rock Springs, Wyoming. Responsible for habitat monitoring, maintenance and improvement of all terrestrial and aquatic wildlife on 1.5 million acres of public land. Developed annual work plans, conducted photo trend studies of elk and deer habitat, conducted antelope and endangered species surveys.

1980 Assistant Project Manager on the preparation of an Environmental Impact Statement on the proposed White River Dam in Utah.

PUBLICATIONS AND REPORTS

1983 Terrestrial Wildlife and Aquatic Biology Survey of Mohrland Canyon, Carbon County, Utah (with L. Crist) BIO/WEST PR-78-1

1983 Wildlife Values of South Park - Can They Be Perserved? Report to Teton County Planning Commission, Jackson Wyoming (with P. Holden) BIO/WEST PR-74-1

1980-82 Eleven environmental analysis reports concerning exploratory oil and gas drilling in western Wyoming.

1981 Wildlife Resource Inventory of the Chaco Strippable Coal Area, New Mexico. Final Report to Bureau of Land Management, Farmington, New Mexico. BIO/WEST PR-40-1.

1980 Large mammal population studies. Final Report to HDR Sciences, Santa Barbara, CA. BIO/WEST PR-35-1.

1975 Habitat Management Plans, Goldeneye Wildlife and Recreation Area, Railroad Grade Reservoir, 33-mile Reservoir, Teal Marsh Reservoir, Casper District. U.S. Bureau of Land Management.

1974-79 A large number of environmental analysis reports, environmental statements, habitat management plans and other reports while employed with BLM.

REPORTS CONTRIBUTED TO:

1983 Environmental Impact Report for the Jackson Lake Dam Modification Program, Bureau of Reclamation. BIO/WEST PR 80-83-1.

1983 Biological Assessment for the Parachute Shale Oil Project, Mobil Oil. BIO/WEST PR 85-83-1.

1982 Malad Valley Wetlands Assessment, Final Report. Soil Conservation Service, Boise, ID. BIO/WEST PR 65-82-1.

1982 Draft and Final Schell Grazing Environmental Impact Statement. Bureau of Land Management, Ely, Nevada. BIO/WEST PR 52-81-1.

1982 Draft Environmental Impact Statement, Liberty to Coolidge Power Transmission Line. Western Area Power Administration, Golden, CO. BIO/WEST PR 67-82-1.

1981 Draft Environmental Assessment, Jackson Lake Dam Modification. Bureau of Reclamation, Boise, ID. BIO/WEST PR 51-81-1.

1980 Draft Environmental Impact Statement, White River Dam Project. Bureau of Land Management, Richfield, UT. BIO/WEST PR 33-80-1

1978 Final Environmental Statement, Development of Coal Resources in Southwestern Wyoming. U.S. Department of the Interior.

1976 Unit Resource Analysis. Platte River Resource Area, Casper District. Bureau of Land Management.

1976 Management Framework Plan. Platte River Resource Area, Casper District. Bureau of Land Management.

DEBORAH L. RICHARDSON

EXPERIENCE

January, 1983 to Present

Currently employed as a partner in Richardson Assoc., Mining/Environmental Consultants. Responsibilities include marketing for the partnership, technical and administrative management of projects, and technical responsibilities in areas dealing with mining engineering. Experience includes:

- Evaluation of subsidence impacts from six underground operations in Utah. Several of the operations were experiencing fracturing at the surface due to miningadjacent to steep slopes. Another operation was planning a partial extraction operation under a major river.

- Assessment of bonding estimates for several mines in the eastern and western U.S. Equipment utilization and productivity were evaluated to determine cost requirements.

- Review of stability evaluations on several major fill constructions, coarse and fine coal refuse disposal sites, and a development waste disposal site for an underground mine.

- Assessment of backfilling and grading operations for three mines in New Mexico. Operations were evaluated to determine if it was feasible to achieve the proposed postmining topography. The mines utilized a combination of dragline and truck and shovel operations.

August, 1979 to January, 1983

Project manager/mining engineer for Fred C. Hart Associates, Inc., a consulting firm. Responsibilities included the technical and administrative management of many projects in the energy and environmental fields and coordination of marketing efforts. Experience included:

- Analysis of the economic impact of regulations promulgated under the Surface Mining Control and Reclamation Act and revised regulations proposed in 1982. This analysis included mine design and cost estimation for backfilling, drilling and blasting, and topsoil handling operations.

- Technical review of over 30 mining and reclamation plans for compliance with the surface mining regulations in eastern and western U.S. These reviews required the evaluation of the overall mining operation, along with the assessment of the geologic setting and coal recovery.

- Development of a manual evaluating techniques for the analysis of groundwater impacts resulting from mining operations in the Western U.S.

- Feasibility analysis of techniques for the disposal of spent oil shale and oil shale fines at the Anvil Points surface retort facility.

- Assessment of several abandoned hazardous waste disposal sites for possible environmental impacts and development of impact mitigation plans. These studies required the evaluation of the geologic formations at the sites, development of alternative disposal techniques, and risk assessments.

- Review of state permit requirements for opening and operating a coal mine in several states in the U.S., and development of a permit acquisition strategy.

- Evaluation of uranium tailings disposal sites for potential groundwater impacts.

March, 1976 to August, 1979

Worked as a research and teaching assistant for the Mineral Engineering Department of the Pennsylvania State University. Responsibilities included:

- o Assessment of coal preparation techniques for the removal of pyrite and the concentration of coal materals.
- o Comparison of overburden characteristics with the quality of mine drainage in several mines.
- o Analysis of pyrite characteristics affecting the formation of acid mine drainage.
- o Development of a manual for planning considerations for control of mine drainage.
- o Review of basic electrical engineering principles for students in a Mine Plant Design course.

EDUCATION

Master of Science in Mining Engineering from the Pennsylvania State University; August, 1979.

Bachelor of Science in Geology from the Pennsylvania State University; March, 1975.

Awarded National Science Foundation Fellowship; September, 1978.

PUBLICATIONS

Richardson, Deborah L., A Study of the Occurrence of Pyrite in Coal and Its Relationship to Liberation in Coal Preparation and Acid Mine Drainage Formation, M.S. Thesis, Pennsylvania State University, 126 pages, 1979.

Richardson, D.L., and H.L. Lovell, "Pyrite Liberation in Coal - Key to Sulfur Reduction During Beneficiation", Coal Conference and Expo V, Louisville, Kentucky, October, 1979.

Richardson, D.L., "Assessment of Impacts to Surface Coal Mine Operators Due to Changes in Surface Mining Regulations", 1982 Symposium on Surface Mining Hydrology, Sedimentology, and Reclamation", Lexington Kentucky, December, 1982.

CERTIFICATIONS

Received Engineering-in-Training Certificate from the State of Pennsylvania; September, 1978.

R. MICHAEL STANWOOD

EXPERIENCE

January, 1983 to Present

Currently employed as a partner in Richardson Associates, Mining/Environmental Consultants. Responsiblities include marketing for the partnership, technical and administrative management of projects, and technical responsibilites in areas dealing with resource economics, cost estimation, and socioeconomics. Experience includes:

- o Assessment of bonding estimates for several mines in the eastern and western U.S. Equipment utilization and productivity were evaluated to detemine cost requirements.
- o Socioeconomic analyses in accordance with CEQ guidelines in three western states.
- o Market studies of proposed coal development in Colorado, Utah, Virginia and Tennesse.
- o Program evaluations of permit acquisition and requlatory compliance, primarily in coal development projects.

May, 1979 to January, 1983

Group Manager/Senior Economist for a national consulting firm. Responsibilities included feasibility studies, compliance analyses, resource economics, and project management/personnel management involving energy development. Experience included:

- o Analysis of economic and other impacts associated with the promulation of Surface Mining Control and Reclamation Act revised regulations.

- o Feasibility and economic evaluations of proposed coal gasification complex in Wyoming.

- o Preparation of a programmatic EIS on Federal growth in the Denver area.

- o Regulatory compliance and permit acquistion strategies for energy development, solid waste and hazardous waste facilities.

- o Socioeconomic analyses of major proposed energy and mining facilities in six western States.

- o Development of a socioeconomic analysis state-of-the-art manual describing techniques, assumptions, mitigation methods and developing issues.

January, 1978 to May, 1979

Research Economist/Fellow for the Colorado Energy Research Institure, an advisory and research group. Projects included:

- o Principal research and collaborator on Energy Resources in Colorado. Analysis of issues associated with a proposed Federal coal leasing and management program.

- o Feasibility study of proposed coal gasification project in Colorado

EDUCATION

Master of Science in Mineral Economics from the Colorado School of Mines; May, 1979

Bachelor of Arts from the University of Colorado; May 1975.

Awarded Colorado Energy Institute Fellowship and Industrial Ecology Institute Scholarship; 1980

PUBLICATIONS

Practical and Environmental Considerations of Oil Shale Development, Water Pollution Control Association, 1982

Oil Shale and the Environment: Still Clouded in Uncertainties, Mining Engineering, 1981.

The Impact of RCRA on Oil Shale Development, Oil Shale Symposium, Colorado School of Mines, 1980.

The Requirements of SMCRA: Its Relevance for Planners, American Planning Association, 1980.

CONNIE R. KIMBALL

EXPERIENCE

January, 1983 to Present

Currently employed as a partner in Richardson Assoc., Mining/Environmental Consultants. Responsibilities include marketing for the partnership, technical and administrative management of projects, and technical responsibilites in areas dealing with surface water hydrology. Experience includes:

- Evaluation of surface water control structures for over 12 operations in the eastern and western U.S. Several of the operations were located in mountainous regions, complicating the design of the sediment structures.
- Assessment of road construction in the eastern U.S. Roads were already existing and located on steep terrain. As such, evaluation of erosion control procedures was required taking into consideration the performance history of the roads and actions to be taken to upgrade their performance.
- Review of diversion structures around coal refuse disposal sites. The diversions had to be designed to handle the 100-yr, 24-hour storm event and be constructed using the best technology available to ensure their stability.
- Review of the structural integrity of high hazard dams in Colorado for the State Engineer, Department of Natural Resourses. In some instances these dams were inspected in the field for integrity.

August, 1981 to January, 1983

Project manager/engineering geologist for Fred C. Hart Associates, Inc., a consulting firm. Responsibilities included the technical and administrative management of many projects in the energy and environmental fields. Experience included:

- Technical review of over 30 mining and reclamation plans for compliance with the surface mining regulations in eastern and western U.S. These reviews required an evaluation of the design of surface water control structures and surface water impacts.
- Analysis of the cost of compliance with the surface mining regulations dealing with surface water control. Operations in eleven areas of the U.S. were designed in compliance with the federal program and costs of construction of the structures determined.
- Prepared study plan for a site in Montana that was suspected of contaminating the local groundwater supply with substances used in wood-treating.
- Evaluated and proposed alternatives to the Environmental Protection Agency for immobilization and dispoal of radioactive sludge generated from treatment of a town's drinking water supply contaminated with naturally-occuring radium.
- Prepared a closure plan for a hazardous waste disposal site in Maryland.

May, 1978 to January, 1981

Worked as an Engineering Geologist for the State of Indiana Department of Natural Resources, Division of Water. Responsibilities included:

- Approving floodway planning under the 1945 Indiana Flood Control Act.
- Review of commercial construction and mining operations along streams.

- o Design of dams and levees.
- o Performed hydraulic studies using HEC II model.
- o Coordinated Federal Coastal Zone Management Program Studies, researching and documenting industrial and governmental records and making field inspections of the Lake Michigan shoreline. Determined the extent of shoreline erosion and identified and documented hazard areas.

January, 1976 to May, 1977

Indiana University, Associate Instructor, Geology Laboratory Section. 1977 recipient of William Post Rawles award for Outstanding Associate Instructor

EDUCATION

B.S. Degree in Geology from Hanover College, Madison, Indiana; 1976

M.A. Candidate in Geology from Indiana University, Bloomington, Indiana; All course work completed.

PUBLICATIONS

Bottjer, David J.; Roberts, Connie, and Hattin, Donald E.; November, 1978. Stratigraphic and Ecologic Significance of Pycnodonte Kansasense, a new Lower Turonian Oyster from the Greenhorn Limestone of Kansas. Journal of Paleontology, Volume 52, Number 6, pages 1208 - 1218.

Indiana Department of Natural Resources Bulletins: An Inventory of Manmade Land Along the Indiana Shoreline of Lake Michigan.

Shoreline Erosion Along the Indiana Coast of Lake Michigan.

Kimball, Connie and Orzinski, Stephen, 1983. Disposal of Radium-Barium Sulfate Sludge from a Water Treatment Plant in Midland, South Dakota: A Technical Assistance Program Report EPA/NTIS Publication.

MARC A. JEWETT

EXPERIENCE

January, 1983 to Present

Currently working as an independent consultant in the field of groundwater hydrology. Experience includes:

- Evaluation of groundwater impacts from underground mining operations in two mines in Utah. In one of the operations, a significant aquifer is located directly above the proposed operation. Potential impacts include dewatering of the aquifer and degradation of water quality.

- Assessment of buried hazardous wastes discovered during the construction of a runway extension at the Phoenix, Arizona airport. The project, performed under contract to the City of Phoenix, involved the installation of a groundwater monitoring network, delineation of the site hydrogeologic regime, sampling and analysis for the EPA Priority Pollutants, and an evaluation of remedial measures which may be necessary at the site.

- Investigation of hazardous wastes disposed of at an abandoned site in Indianapolis, Indiana. The project involved an evaluation of the probable migration of contaminants from the site and installation of a groundwater monitoring program.

September, 1979 to January, 1983

Project manager/hydrologist for Fred C. Hart Associates, Inc., a consulting firm. Responsible for the management of hydrogeologic investigations within the firm's hazardous waste management and energy resource development programs.

Served as a Senior Hydrologist in the firm's Abandoned Sites Program. Experience included:

- o Evaluation of the impacts of energy and minerals development on water resources in the Western U.S. Principle activities included the technical review of 26 mining and reclamation plans submitted under the Federal Office of Surface Mining SMCRA program and state programs. Provided experience in the technical areas of alluvial valley floor analysis, evaluation of mining impacts on groundwater resources, and the development of initial baseline and long-term operational hydrogeologic monitoring programs.

- o Assisted in the preparation of technical guidelines for the OSM in the areas of Probable Hydrologic Consequences (PHC) and Cumulative Hydrologic Impacts (CHI)

- o Directed the development of groundwater monitoring programs at hazardous waste disposal sites in Colorado, Arizona, Missouri, and Maryland. Performed risk assessments, and contaminant transport evaluations at a number of superfund sites across the nation. Responsible for the preparation of initial site hydrogeologic study plans, well network design, coordination of laboratory activites, data interpretation and expert testimony.

1978 to September, 1979

Research assistant at the University of New Hampshire. Responsibilities included:

- o Analysis of chlorinated organic compounds in ground and surface waters using electron-capture gas chromatography. Duties included the development of analytical procedures and presentation of research results.

- o Assisted in monitoring of ground-water quality beneath a landfill operation. Duties involved sampling of both ground and surface water, lab analysis of ten chemical parameters, and computer assisted analysis of data.

EDUCATION

Master of Science in Hydrology with an emphasis in Hydrochemistry from the University of New Hampshire, June 1979.

Bachelor of Science in Hydrology from the University of Montana, June 1976.

Miami University, Chemical Engineering Program, 1972 to 1973

Academic Scholarship, Miami University, 1972 to 1973

Water Resources Research Institute Assistantship, University of New Hampshire, 1978

PRESENTATIONS

Masters Thesis work was one of eight projects selected nationally for presentation at the American Water Works Association Universities Forum in San Francisco, June, 1979. The project examined the formation of toxic chorinated organic compounds in drinking water during the water treatment process.

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Art
by
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