

DOE/ER/75931--T/Pt. 2

CERT Tribal Internship Program

FINAL INTERN REPORTS

U.S. Department of Energy Grant # FG03-93ER75931

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COUNCIL OF ENERGY RESOURCE TRIBES

AND

WRIGHT WATER ENGINEERS, INC.

1994 SUMMER INTERNSHIP REPORT

DUANE M. GOPHER, Intern

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INTERN PROFILE

My name is Duane Michael Gopher, [REDACTED]. I am Chippewa-Cree [REDACTED]. I come from a family of seven: [REDACTED] Natalie Big Knife, my older sister; Timothy Gopher, my younger brother; and Rachel Big Knife, my younger sister. I also have two nephews, John Ross and Jerome Lane Big Knife.

I am very proud to say that the internship at CERT has been a great experience and I hope to use the knowledge I have gained further down the road. Also, this experience has given me drive to pursue a Master's Degree -- and maybe even a Doctorate. Someday I would like to return to my reservation to help my people as much as possible.

Other than my family, I feel education is the most important thing I have going for me. I have demonstrated this by trying my best not to quit, even when times got very trying.

My internship at Wright Water Engineers, Inc. (WWE) has opened an excellent road of opportunity for me. The enthusiasm and patience the staff of WWE sparked my interest in the subject of groundwater. I am honored that I got the chance to work with such fine professionals.

I would like to thank everybody at CERT for giving me the chance to expand my horizons.

Duane Michael Gopher
P.O. Box 257
Box Elder, Montana 59521
(406) 395-4536

Objective: To obtain a permanent position in water/wastewater treatment or other environmental health-related fields.

Education: Northern Montana College, Havre, Montana
Major: Interdisciplinary Studies, Water Concentration
Dates Attended: September 1991 to Present
Relevant Coursework: Wastewater I & II, Chemistry, Microbiology, Water Processes, Ecology, Electronics, Hydrology, and Environmental Analytical Techniques.

Employment History:

June to August 1994 CERT Intern
Wright Water Engineers, Inc. Denver, Colorado

- Conducted research for BAT's for the removal of radionuclides in drinking water, BMP's for sediment and erosion control, and how groundwater behaves in karst terrain.
- Analyzed Pauma Indian water quality data for purposes of potential irrigation uses.
- Field work to perform actual flow gaging, piezometer reading, and water quality sampling.
- Learned how to properly read and planimeter 7.5 minute USGS topographic maps.
- Completed a preliminary groundwater resources report for the Rocky Boy Reservation.

August 1992 to May 1993 Peer Counselor
Northern Montana College, Havre, Montana

- Provided academic, career, and personal guidance to freshman Native American students.

Additional Work Experience:

**May to
August 1993**

**Tertiary Wastewater Treatment Plant Operator
Flathead Lake Biological Station, Polson, Montana**

- Performed daily laboratory tests such as: ATC, RSC, WSC, Ph, chlorine residual, microscope exam, and settlometer tests.
- Weekly and monthly tests included BOD and MLSS.
- Daily tasks accomplished: calculation of proper sludge to be wasted for smooth process control, keeping plant sanitary, inspection of pumps and lift stations, and recording important data for future reference.

**May to
August 1992**

**Laboratory Assistant
Meadow Gold Dairy, Great Falls, Montana**

- Performed daily laboratory tests on both raw and finished milk. Monitored Ph values twice a day. Made buttermilk on weekends. Cleaned lab work area.

**June to
August 1990**

**Janitorial Assistant
Rocky Boy High School, Box Elder, Montana**

- Cleaned and painted gymnasium. Cut and maintained lawn. Vacuumed all classrooms daily.

Certifications:

Wastewater Operator-In-Training, Class 1A
Received Certification: June 30, 1992

Other Training:

Technology of Participation, Group Facilitation Methods Training, Council of Energy Resource Tribes, Albuquerque, New Mexico, June 13-14, 1994.

Technology of Participation, Applications for Tribal Managers, Council of Energy Resource Tribes, Denver, Colorado, June 23-24, 1994.

Awards:

Salutatorian for the Class of 1991
Student of the Year, Auto Mechanics - 1991
Science Student of the Year, 1987-1991
Chemistry Student of the Year - 1990
English Student of the Year - 1990
Most Improved Basketball Player - 1990

References:

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Senior Hydrogeologist
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2490 West 26th Avenue
Denver, Colorado 80211
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Mark Potter
Maintenance Supervisor
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Melissa Stilger
Director
Cultural & Gender Equity
Northern Montana College
Havre, MT 59501
(406) 453-4336

Jack Stanford
Director
Flathead Lake Biological Station
311 Bio Station Lane
Polson, MT 59860
(406) 982-3301

PERSONAL/PROFESSIONAL DEVELOPMENT

The skills I derived from this internship will definitely help me further down the road. I learned to be a much better reader because of all the literature-searching and data-collecting involved. Also, I have become a better people-person by being exposed to the professionalism that was continuously displayed at the workplace. Most importantly, I am now aware that I need to learn more about Groundwater. Now, I definitely want to pursue a Master's Degree and possibly, a Doctorate.

I believe the opportunities my host company (Wright Water Engineers, Inc.) gained from the internship are numerous. For example, I saved them a lot of time by collecting data and conducting literature searches for employees at Wright Water Engineers. It would have been more time-consuming if they had done some of these tasks themselves, especially when deadlines approached. I also familiarized some of the employees of my own cultural beliefs and background. I feel this was very important because many of them were interested in my opinions.

I know I will succeed this fall at school because of the infused drive to learn more about groundwater. Also, my sharpened reading skills will contribute to my learning abilities. I will also go back to school with a much higher confidence level. This is due to the fact that I have worked well with some of Colorado's premier water experts and from this experience I know I have what it takes to make it. Before, I was always doubting myself; but now I feel good about my own capabilities.

The experience that Wright Water Engineers has provided me will definitely look good on a resume; it will also help me find a job in the field of water.

With all of my new-found knowledge and desires, I want to someday return home and do good for my people. I also hope that I influence some of the younger students to get educated.

This experience has allowed me to see the many different disciplines of water quality, and most importantly, it has helped me choose the career I ultimately want to attain. This field is Groundwater Hydrology.

I definitely will have to work harder, because in order to be a hydrologist, a person needs to be familiar with computers and all forms of math and chemistry. All of these different subjects can prove to be difficult if one is lazy.

HOST ORGANIZATION PROFILE
WRIGHT WATER ENGINEERS, INC.

Wright Water Engineers, Inc. a private company, was formed in 1961 to provide water resources planning and engineering services for clients throughout the Rocky Mountain region. Growing and diversified client needs have led to the development of a diverse, full-service firm with a history of successful planning, engineering and construction projects throughout the United States.

Wright Water Engineers consists of engineers, scientists, planners and technicians that represent a broad spectrum of disciplines ranging from civil engineering to advanced groundwater computer modeling to biology. A combination of high-level education, professional development and practical experience allows the professional staff at Wright Water Engineers to provide effective and efficient solutions to engineering problems.

MENTOR PROFILE

ERIC A. BIKIS

Eric A. Bikis is the Senior Hydrogeologist at Wright Water Engineers, Inc. He comes from a Spanish, Italian, Hungarian and Romanian descent. His family consists of his wife, two children and another on the way.

Eric feels that the 1994 CERT Summer Internship Program has provided the intern (Duane Gopher) with good exposure to a variety of technical disciplines that could help him choose a profession among the many water-related fields.

Mr. Bikis feels that it is important for the intern to have a meaningful experience during his summer visit. He has demonstrated that by exposing the intern to a variety of different projects and providing him with technical stimulation during his visit at Wright Water Engineers, Inc.

Overall, Eric has related that Wright Water Engineers, Inc. looks forward to the summer CERT Internship each year and the mutual benefits received by each party!

**ERIC A. BIKIS
SENIOR HYDROGEOLOGIST
WRIGHT WATER ENGINEERS, INC.**

Education:

Hazardous Material Management Program, 1990
Environmental Engineering Department
Colorado School of Mines

M.S., Hydrogeology, 1978
Ohio University

B.S., Mathematics, 1976
Ohio University

Current:

Consultation on hydrogeology problems, hazardous material contamination, basin analysis, and water rights.

Summary of Experience:

A master degreed hydrogeologist with 16 years of hydrogeological, geological, and geophysical experience, over 6 years of which focused on aquifer characterization through pumping tests and groundwater basin wide studies to determine sustainability. Applied aquifer modeling techniques to predict future potentiometric surfaces and the useful life of well fields. Managed multidisciplinary technical teams and annual budgets of up to \$5 million.

Experience:

Mountain Village Metropolitan District. Design and development of water supply to meet the current and future needs of a rapidly-expanding resort project located on the Telluride Ski Mountain. Two high-yielding (700-1,000 gpm) alluvial wells with excellent water quality constructed in 1991 and four on-mountain bedrock will meet projected water demand for years to come.

Pauma Indian Reservation. Development of water resources on the reservation will include an initial sitewide geophysical investigation, drilling of two new 750 foot wells, and rehabilitation of three existing wells. Findings of the study regarding groundwater resources underlying the reservation and safe yield of the wells will be used as evidence for settlement for an upcoming water rights court case and to design a citrus irrigation system on the reservation.

Aldasoro Ranch Development. Sited, designed, and tested numerous wells in a 165-home development to provide water for the residents.

Town of Minturn. Design and construction monitoring of municipal wells that replaced existing wells located immediately downgradient of the consolidated tailings pile of the Eagle mine.

Rocky Flats Weapons Plant. Groundwater hydrogeologist representing EG&G and DOE for water quality standards hearing on the subject property. Investigations include groundwater flow, quality and remediation, and the effect on health and the environment. Presented expert testimony to the Colorado Water Quality Control Commission on behalf of Rocky Flats. Reviewed selected portions of shallow, high-resolution seismic reflection data work at Rocky Flats which resulted in an improved understanding of the surface water geology and hydrogeology at Operable Unit 2 and a better definition of potential pathways for containment migration.

City of Glendale. Designed alluvial well capable of producing 500 gpm of high quality water to be used for irrigating a city park.

Boy Scouts of America, Denver Area Council. Designed and tested one unconfined well to fulfill the water needs of a camp expansion project. Also performed a seven-day pumping test on a confined Denver aquifer well to specify a pump and determine its long-term safe yield.

Colorado Water Quality Control Commission. Attend monthly meetings of the Commission, a Governor-appointed group, which sets surface water and ground water quality regulations within the State of Colorado.

ASARCO. Investigations of flow regime and characterization of contamination in the South Platte River alluvial groundwater for a state groundwater classification and standards hearing. Evidence presented from this study was instrumental in the ultimate hearing outcome.

National Hog Farm. Characterization of the groundwater flow regimes and evaluation of the impact of land application of effluent on the local groundwater quality.

Sandstone Ranch. Evaluation of the effects of aerial spraying of Crossbow, a defoliant, on the local water quality. Investigations included sampling and analysis of streams, ponds, and municipal water supply well.

Other Experience:

Hygronics. Projects dealt with both surface and groundwater problems. Most notable was the design and development of the Sarir water well field in the Libyan Sahara. Job duties included analysis of field data from existing test wells to determine aquifer parameters, programming a modified Hantush leaky equation which best matched the geologic setting, and simulating various models to obtain the ideal field design. The Sarir field has 157 production wells, each fitted with a self-propelled sprinkler that irrigates 80 hectares. Expected field life is more than 50 years.

Fiberglass Resource Corp (FRC). Evaluated the performance of fiberglass water well screens manufactured with a preformed gravel pack by FRC and continuous-slot stainless steel screens made by the Johnson Company. Research included step-drawdown and continuous pumping tests in both the laboratory and the field.

Conoco, Inc. Rapidly promoted up the technical ladder as a geophysicist and through various managerial positions before resigning as Project Director to start an oil and gas partnership. Had personal success at discovering hydrocarbons, managing budgets and investor packages, and directing multidisciplinary teams.

Publications:

Bikis, Eric A., Brent R. Lewis, "Integration of Shallow, High-Resolution Seismic Reflection Data and Subsurface Geological Information to Characterize the Hydrogeology at the Rocky Flats Plant, Golden, Colorado." Sixth National Outdoor Action Conference, National Ground Water Association, May 1992.

Bikis, Eric A., Patrick A. Jackson, Moid U. Ahmad, "Laboratory and Field Studies of Well Designed and Efficiency." International Conference on Groundwater Technology, Johannesburg, South Africa, November 1994.

Bikis, Eric A., Tom D. Anderson, "South Elk Basin Field -- A Case History." Montana Geological Society -- Yellowstone Big Horn Research Association Field Conference, 1986.

Professional Societies, Registrations, and Certifications:

Registered Professional Geologist, State of Wyoming
National Water Well Association
Colorado Groundwater Association
Society of Exploration Geophysicists
Denver Geophysical Society
American Association of Petroleum Geologists
Rocky Mountain Association of Geologists
Certified by OSHA, 29CFR Part 1910.120 Training

INTERN ACTIVITY OUTLINE

I. Project Purpose

- Initiate groundwater study

II. Project Objectives

- Groundwater study at Rocky Boy, Montana

III. Project Approach

- Research and phone calls

IV. Project Results

- Rocky Boy Preliminary Groundwater Report completed

V. Project Assessment

- Outcome dependent upon Tribal Council review

INTERN ACTIVITY SUMMARY

I. Project Purpose

The purpose of this internship was to initiate a groundwater investigation on the Rocky Boy Reservation in north-central Montana by writing a report and submitting it to the Tribe. I am doing all of this because I feel there is no need for an expensive pipeline. Logically, it makes no sense to build an entire pipeline of 53 miles where, from familiarity with the Reservation, a dependable supply of drinking water may already exist right beneath their very feet. It is important to keep in mind that they could not release any information to me because of water-rights negotiations with the State of Montana.

II. Project Objectives

Instead of building an expensive pipeline, I want to get the Rocky Boy Water Resources Committee to initiate a comprehensive groundwater study.

III. Project Approach

I got several topographic maps from USGS in Denver. I also requested well logs from the IHS Environmental Health Technician at Rocky Boy, Montana. I conducted research by reading and collecting data from necessary literature. I made a phone call to the Montana Bureau of Mines and requested planimetric maps as well as related literature. Last of all, I kept in contact with a member of the Rocky Boy Water Resources Committee.

IV. Project Results

The Rocky Boy Preliminary Groundwater Report was completed. However, the report has still not been read by the intended audience located in Rocky Boy, Montana. Therefore, the final results are dependent upon the review by the Rocky Boy Tribal Council.

V. Project Assessment

Hopefully, the completed report will convince the Rocky Boy Water Resources Committee to initiate a comprehensive groundwater study. However, at the present time, the actual outcome is not available.

COUNCIL OF ENERGY RESOURCE TRIBES

AND

WRIGHT WATER ENGINEERS, INC.

1994 SUMMER INTERNSHIP TECHNICAL REPORT

Prepared by

DUANE M. GOPHER, Intern

August 1994

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TECHNICAL REPORT

INTRODUCTION

The Rocky Boy Indian Reservation in north-central Montana has had difficulty in establishing a dependable source of drinking water. In 1993, due to a water shortage on the Rocky Boy Reservation, the Chippewa-Cree Council began negotiating water rights with the State of Montana in order to construct a pipeline that would pump water from an off-reservation source to reservation homes. The proposed plan is to pipe water from the Tiber Dam, located approximately 53 miles west, to the Rocky Boy Indian Reservation for treatment and distribution (Russette, 1994).

Instead of building an expensive and perhaps unneeded pipeline, an investigation needs to be conducted of the groundwater of Rocky Boy Indian Reservation. It is estimated that the entire pipeline would cost about \$7.6 million. This figure was determined by calculating the average 12 inch PVC pipe costs, an estimated \$20 per foot including installation, plus 35% for drilling, siting and logistics. The cost of \$7.6 million is a very expensive one. For this reason the Rocky Boy Reservation needs to seriously look at their groundwater resources before they implement any stage of construction.

This report suggests that there may be enough existing groundwater on the reservation to support its estimated 5,000 people. What Rocky Boy needs is a well(s) that yields 500 gpm instantaneous discharge that assumes a peaking factor of 1.5 [100 gpd/person X 5,000 people X 1.5 p.f.]. Otherwise, without proper research, the estimated \$7.6 million might be spent on something unneeded. This money could be spent on other necessary issues, like education, health care and jobs for Indian people.

SOURCES OF DATA

It is important to keep in mind that this entire report is based on personal research from maps and books on hydrology, groundwater and wells. Most critically, it became politically impossible to acquire data from the Rocky Boy Tribe engineering consultants, HKM in Billings. The information was withheld because the Tribe was still negotiating its water rights with the State of Montana.

GEOGRAPHY

Rocky Boy Indian Reservation lies on the Bear's Paw Mountains in north-central Montana. It occupies the Larado NE, Rocky Boy, Bear Paw Lake, Bowery Peak, Centennial Mountain, Cowan Reservoir and Box Elder USGS quadrangle maps. Elevation ranges from a low level of 2,650 feet to the highest point of 6,916 feet above sea level (Mount Baldy). Precipitation varies from 8 to 18 inches since the 1880s. Rocky Boy's hills are covered with vegetation that varies from simple range grasses to the ever-present pine trees. The total reservation area totals 121,757.175 acres or 190.55 square miles (Rocky Boy Forestry, 1994).

GEOLOGY

After examination of USGS Geologic maps of Shambo, Centennial Mountain, Laredo, and Warrick quadrangles, Rocky Boy seems to consist of the following rock types: mafic volcanic rocks, felsic volcanic rocks, extrusive mafic phonolite and latite porphyry. The behavior of these rocks types with groundwater will be included into the hydrology section of this report.

HYDROLOGY

There are many annual and ephemeral streams located on the Rocky Boy Reservation. These streams are located in areas where rainfall runs off higher elevations onto lower grounds.

There are also known areas of saline seep. One area is located on the southern base of Haystack Mountain and the other is about 1/2 mile east of Bonneau Reservoir. Saline seep is caused by a high water table that actually rises to the level of the ground and, upon evaporation, deposits its salt onto the ground's surface as well as the underlying soils. Usually, areas of saline seep are indicated by white-colored soils. If it becomes extreme, it will kill surrounding plant life.

There are many springs present. They are numerous along surface traces of faults and along contacts of volcanic rock. The rock types of the Rocky Boy Reservation fall directly under the volcanic rock types. Although, volcanic rocks generally are not very permeable; volcanic aquifers can yield high amounts of water if they are drilled near areas of faulting.

There are basically two types of aquifers present on the Rocky Boy Reservation -- shallow alluvial and the deeper volcanic type.

Well logs from the IHS Environmental Health Technician were plotted onto a 7.5 minute topographic map and were compared to their location on geological maps. It appears that the majority of the wells were drilled into the shallow alluvial aquifers and in the deeper volcanic aquifers. However, in the deeper volcanic aquifer, wells were not drilled near heavy fault areas. This may be the reason many wells have low yields and why it seems that Rocky Boy has a water shortage.

CONCLUSION, DISCUSSION AND RECOMMENDATIONS

Rocky Boy needs to have a groundwater study conducted on their reservation. Groundwater exploration will help determine whether the Rocky Boy Reservation has sufficient water or whether there might be a shortage. A comprehensive groundwater investigation would be beneficial in making this determination and would avoid risk of spending money on an alternative that may not be necessary. It would also provide information concerning the necessity of the proposed pipeline. Most importantly, \$250,000 would be well spent before investing \$7.6 million.

The methods that could be used for groundwater exploration are satellite imagery photography (infrared), well drilling/pumping tests, dye flow tests, spring hydrograph analysis, water-balance estimation, and isotope characterization. A combination of any of these tests could show that the planned pipeline is unnecessary.

OVERVIEW OF ALTERNATIVES

Alternatives

A. Pipeline

Cost: \$7.6 million (estimated)
Keep in mind, this is the least it will cost because the prices of pumps and the power needed have been left out

Dependability: If created, can deliver water even in drought years

Risk: Low because of secure water supply

Treatment: Will have to treat because raw water usually contains high amounts of turbidity, dissolved solids and coliform bacteria (which is an indicator of pathogens)

B. Groundwater Exploration

Cost: \$250,000 (estimated) (very dependent on what type of test would be conducted and the findings of the earlier tests)

Dependability: If a good yielding aquifer or aquifers are found they can prove to be very dependent

Risk: Unknown until exploration completed

Treatment: Because Rocky Boy volcanic rocks are considered young on the geologic time scale, they should yield water with good quality. Therefore, no treatment should be necessary.

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