Claimant/Objector's Name: A & B Irrigation District

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IN THE DISTRICT COURT OF THE FIFTH JUDICIAL DISTRICT OF THE STATE OF IDAHO, IN AND FOR THE COUNTY OF TWIN FALLS

In Re: SRBA	Subcase Nos. 36-15127A, 36-15127B, 36-15193A, 36-15193B, 36-15194A, 36-15194B, 36-15195A, 36-15195B, 36-15196A and 36-15196B
Case No. 39576	

NOTICE OF SERVICE

COMES NOW the Claimant/Objector A & B Irrigation District by and through its attorney of record, Roger D. Ling of the firm of Ling, Nielsen & Robinson, and pursuant to the Idaho Rules of Civil Procedure, hereby notifies the Court and all parties that on the date below stated copies of the ***Preliminary Report of C.E. Brockway*** and the ***Bureau of Reclamation Supplement to Preliminary Report by Mark Croghan, R.D. Schmidt, Joe Spinazola, and Dave Zimmer*** were forwarded to the Dirctor of IDWR, Peter J. Ampe, Jeffrey C. Fereday, and the U. S. Department of Justice at the respective addresses more fully set forth hereinbelow.

DATED this 4th day of August. 2000.

LING, NIELSEN & ROBINSON

By: _____
Roger D. Ling, attorney for
A & B Irrigation District

LING, NIELSEN & ROBINSON
ATTORNEYS AT LAW
RUPERT, IDAHO 83350-0396

CERTIFICATE OF MAILING

I hereby certify that on the 4th day of August, 2000 I served copies of the foregoing **NOTICE OF SERVICE** upon:

Director of IDWR
P. O. Box 83720
Boise, ID 83720-0098

Peter J. Ampe
Office of the Attorney General
State of Idaho
P. O. Box 83720
Boise, ID 83720-0010

Jeffrey C. Fereday, Esq.
GIVENS PURSLEY, LLP
P. O. Box 2720
Boise, ID 83701

United States Department of Justice
Environment & Natural Resource Division
550 West Fort Street, MSC 033
Boise, ID 83724

by depositing copies thereof in the United States mail, postage prepaid, in envelopes addressed to said parties at the foregoing addresses.

Roger D. Ling

Preliminary Report

A & B Irrigation District-Use of Drain Water

In RE: SRBA Case No 39576

C.E. Brockway P.E. Ph.D., Brockway Engineering P.L.L.C. *

August 2, 2000

Introduction

The A & B Irrigation District utilizes both ground-water and Snake River water for irrigation of lands within the District service area. The service area, lying within Jerome and Minidoka Counties, overlies the regional Eastern Snake River Plain aquifer and the ground water supplies were developed from the basalt sequences within the aquifer. The service area includes approximately 81,300-irrigated acres of which over 16,000 acres are irrigated with Snake River water, all developed by the U.S. Bureau of Reclamation as the North Side Pumping Division of the Minidoka Project. Private development estimated to be in excess of 60,000 acres has occurred north of the project with water supplies from the underlying aquifer. The project was designed as a gravity surface irrigation system; however, approximately 78 percent of the project acres are now sprinkler irrigated. The surface drainage within the service area is not well defined and closed basins prevent surface return flows to live streams. Soils within the area are primarily deep silt-loam overlying sediments or basalt. Because of the poorly defined drainage and closed basins, the drainage design by the Bureau of Reclamation included the use of agricultural drain wells at strategic locations.

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* The Bureau of Reclamation staff will supply an amendment supplement to this report.

The District has over the past few years abandoned some 39 of the 78 injection wells originally installed and capped an additional 5 leaving 34 active injection wells. Because of the potential for aquifer contamination from these injection wells, the plan is to abandon all of the wells in lieu of alternate drainage plans and water use. In addition to the original relift pumps used to provide a live water source to specific areas, some drainage water is pumped from closed basins to various main drains. Pursuant to drain water permits issued by the District, farmer-owned pumps are allowed for pump back systems to irrigate lands within the District.

This report addresses the hydrologic impact of alternatives to drainage wells for the A & B Irrigation District.

Geology

The A & B Irrigation District lands are underlain by windblown deposits and older alluvium consisting of lake deposits of clay, silt sand and gravel. This quaternary alluvium is underlain by basalt of the Snake River Group with depths to the basalt of 10 to 50 feet. Toward the northern part of the area, the alluvium and windblown soils are thinner with depths to basalt of 10 feet or less. These basalts are typical of the Eastern Snake River Plain and are generally highly transmissive with water movement chiefly in the inter-bed materials and fracture zones.

Hydrogeology

The Eastern Snake River Plain Aquifer covers over 10,000 square miles and consists chiefly of the younger basalts with fine grained interbedded materials and significant alluvium along the Snake River. Some shallow perched ground water occurs along the Snake River, specifically in the

American Falls area and in the lower areas of the Minidoka Irrigation District.

Transmissivity of the basalt aquifer is variable, but generally high with estimated values as high as 1,000,000 ft2/day. Well yields are generally high but not uniform with some reported yields as high as 10 cfs with less than 10 feet of drawdown. Hydraulic conductivity decreases with depth and increasing yield by deepening existing wells is not always possible.

Inflow to the Eastern Snake Plain aquifer consists of deep percolation from irrigation, excess precipitation on the plain, underflow and surface flow from tributary valleys and leakage from the Snake River and tributaries. Outflow consists of spring flow from major spring systems such as in the Kimberly-Hagerman reach (Thousand Springs) and the Blackfoot-Neeley reach, and pumping for irrigation and domestic, commercial, municipal, and industrial (DCMI) uses. Minor evaporative depletion occurs from vegetation in high water table areas. It has been estimated that recharge from importation of Snake River and tributary water for irrigation accounts for more than 50 percent of the total annual input to the aquifer. Major spring outflow in the Thousand Springs reach has historically reached over 4.5 million-acre feet (MAF) annually or an average annual flow of 6,200 cfs. This is over 56 percent of the average annual flow through the aquifer of approximately 8 MAF. Spring flows from the Thousand Springs reach have declined since the 1950s and are now averaging about 5,600 cfs.

Ground water movement is generally west to southwest beneath the project. On the southern edges of the project some shallow ground water movement occurs to the northwest from the perched system underlying the Minidoka

Irrigation District. Wells in this part of the project exhibit reduced yields, primarily because of the increased sediments in the profile.

Use of Injection Wells

Utilization of wells to return agricultural runoff and/or municipal runoff has been practiced since the 1950s. Because of poorly defined drainage and/or closed drainage basins, ponds and wells drilled into the basalt have been used effectively to dispose of runoff. Ponding on the A & B Irrigation District has been significant with large areas such as Cap Hawley retaining water with much of the retention being evaporated. Drainage wells were common in Jerome and Gooding Counties and more prevalent in Minidoka County and in particular in the A & B Irrigation District.

The contribution to the aquifer from the 78 drain wells utilized historically on the A & B Irrigation District has not been documented. Including some expanded acres, the District currently irrigates some 81,300 acres from wells and the Snake River with some reuse or pump back of return flows. Total water use on both the A & B Divisions has been measured by District personnel and averages 3.08-acre feet per year per acre. Surface runoff from almost all of the total irrigated acreage is collected in ponds and drainage wells are utilized to dispose of the excess volume. The estimated annual return to the aquifer, including deep percolation and pond seepage may be in excess of 55,000 acre feet of which 20,500 is estimated to be returned through injection or drainage wells. Since most of the wells are associated with retention basins for sediment removal and water quality improvement, additional evaporation occurs and significant volumes of irrigation runoff do not enter the aquifer. These ponds are natural depressions or are constructed in the deep silt-loam soils of the project. Seepage rates from operational

ponds are generally low. Sediment, microbial action, and build-up of biological mats in the benthic areas of ponds reduce seepage significantly. Studies by the University of Idaho on operating canals in the A & B District showed operational seepage rates of less than 0.4 ft/day. Seepage tests conducted by Brockway Engineering on silt loam soils in operating ponds suggest long term seepage rates of less than 0.1 ft/day. Since the large ponds on the A & B District would likely not be cleaned frequently in order to retain wetland vegetation and habitat, the long term operational seepage rates are likely to be near 0.05 ft/day. Bureau of Reclamation personnel from the Burley Project Office indicate that ponds on the project generally retain water for about seven (7) months of the year.

Use of drainage wells, although hydraulically efficient and functional for drainage purposes, raises concerns for aquifer water quality. As a result, the District and the U.S. Bureau of Reclamation have a stated plan and policy to reduce or eliminate the use of drainage wells wherever possible. To date 39 drainage wells have been abandoned, 5 capped and 34 continue to be active.

Net Effects of Drainage Wells on Aquifer

Because of the ill defined drainage patterns, ponding of irrigation return flow is necessary on nearly all of the 81,300 irrigated acres on the A & B Irrigation District. Evaporation from open water surfaces occurs at rates approximately equal to actively growing alfalfa. In the Rupert area, this results in an estimated annual consumptive use of 39 inches (3.25 ft) on open water. NOAA publications indicate May-October evaporation in this region to be near this value. Initial estimates by Dan Temple, Manager of the District, indicate that there are currently in excess of 150 acres of open water associated with the poor drainage system.

Elimination of the majority of this open water associated with drainage wells reduces evaporation from open water surfaces. Pump back of water to existing lands that was formerly injected into the aquifer can be managed to increase project irrigation efficiency on existing lands or provide a water supply for new lands.

If pumping systems with small ponds are utilized to pump water back to presently irrigated lands, this can result in improved irrigation application and improved yields because of better uniformity and coverage. In addition, because of reduced or eliminated pond evaporation and enhanced water supply to the farms, the annual volume pumped from the aquifer can be reduced and the net depletion from the aquifer reduced from historical levels.

Elimination of drainage wells therefore can increase project irrigation efficiency and can result in the reduction of volume pumped and net depletion of the aquifer.

Alternatives for Containment and/or Removal of Return Flow

Drainage Wells

The most hydraulically efficient method of removal of irrigation return flow is through the use of drainage wells into the aquifer. This has historically been the practice and, although records of the volume of return flow entering the aquifer from the District are not available, it is estimated that the annual volume of return to the aquifer may have been over 55,000 acre feet including deep percolation, pond seepage, and drainage well injection. Approximately 20,500 acre-feet of the total return to the aquifer are estimated to be through drainage wells. Utilization of drainage wells obviated the need for large storage ponds and minimized evaporation from

open waters. The drainage wells will be eliminated based on stated U.S. Bureau of Reclamation policy and intent. Elimination of all drainage wells will require that all return flow be retained on the project, pumped out of the basin or used on other lands in the District service area.

A preliminary water balance for the A & B District including water supplies from the Snake River and ground water shows that the net depletion to the aquifer for the current irrigated acreage is approximately 141,000 acre feet per year as per the attached spreadsheet, Scenario 1.

Complete Containment

Complete containment of return flow from the project would require extremely large ponds. With an estimated annual evaporation from open water of 3.25 af/acre and an estimated operational seepage rate of 0.05 ft/day operating for 7 months, the annual water loss from an acre of pond would be approximately 13.9 feet per year. Assuming an annual volume of surface return flow of 22,600 af, the pond area required to balance the inflow volume with outflow would be 1628 acres. Dedication of this amount of acreage to return flow detention would encroach on existing farmland and result in a loss to the total water supply through evaporation of 5289-acre feet of water per year. The net depletion of the aquifer under the complete containment scenario is 145,800-acre feet per year or an increase of 4800-acre feet over the historical depletion (Scenario 2)

Pump Back to Existing Irrigated Lands

Elimination of all drainage wells and pumping back surface runoff to existing irrigated lands allows reduction of pumped ground water, reduction in retention pond size, and increased project irrigation efficiency. The net benefit is a reduction in net aquifer depletion over historical use of injection

wells. The attached water balance spreadsheet Scenario 3 indicates that, for the current irrigated acreage, the amount of water pumped from the aquifer can be reduced by 21,920 acre feet per year and the net depletion from the aquifer can be reduced by 325 acre feet per year. In addition, the number of acres of ponds required for runoff retention and resulting evaporation loss can be reduced significantly.

Out of Basin Pumping

Pumping of all return flow from closed basins to live streams would require numerous pumping plants with high lifts and long pipelines. No analysis of the location, number or size of facilities has been performed for this report. The closed basins are not located within economical pumping distance of major drains to the Snake River although a small number of facilities do pump from the A & B area to Minidoka Irrigation District lands. Pumping of all return flow, even if economically feasible, would result in large reductions of recharge to the aquifer in deference to enhancement of flows to the Snake River or maintenance of a more firm water supply in lands through which the pumped water might pass. Assuming no increase in irrigated acreage over the current irrigated acreage, the potential increase in depletion of the aquifer if all return flow is pumped to the Snake River is estimated at over 22,100 acre feet per year, attached spreadsheet, Scenario 4.

Regional Hydrologic Impacts

The Eastern Snake Plain Aquifer exhibits high hydraulic conductivity so the effects of pumping or recharge in the A & B Irrigation District area are propagated throughout a large part of the aquifer. Recent studies by the University of Idaho, IDWR and USBR developed response zones within the aquifer to determine relative impacts from aquifer stress on the Thousand Springs and the springs entering the Snake River in the reach from Shelley to Neeley. The most recent version of these response zones indicates that for a unit change in aquifer depletion due to continuous pumping or recharge in the A & B project, 14 to 45 percent of the depletion would affect the Thousand Springs after 100 years. Similarly, the same unit change in depletion would cause a change of 10 to 62 percent in the Shelly-Neeley springs after 100 years. The actual value of the response depends on the location of the stress, particularly the relative location with respect to the Snake River. The A & B Irrigation District covers parts of three different response zones. The largest impact on the springs would occur if all of the return flows from the project were pumped to drains entering the Snake River. This could result in a net increase in aquifer depletion of 22,200 acre feet per year of which between 3,100 and 9,990 acre feet is manifested in a reduction in Thousand Springs discharge after 100 years. This is 0.07 to 0.22 percent of the estimated average annual spring flow of 4.5 MAF

Water Quality Considerations

Elimination of recharge to the aquifer from drainage or injection wells reduces the potential for aquifer contamination from agricultural chemicals or accidental spills of other toxic materials. Sediment from irrigation runoff

is the primary polluting constituent of injected water but, by itself, is not toxic. However, fine sediment absorbs chemicals, particularly phosphate, and can be the carrier for other toxic elements. Fortunately, the discharge and pore velocity in the fractured basalts of the Eastern Snake Plain aquifer is high and dispersion of pollutants is rapid so that aquifer water quality degradation has not been significant. However, because of the non-homogeneity of the aquifer, the potential for rapid travel of pollutants is present and the decision to eliminate the injection of untreated agricultural waste is justified.

Treatment of agricultural runoff to meet water quality criteria for injection into the aquifer is not feasible. Sediment concentrations from irrigation return flows can be reduced by detention basins; however, high discharges from non-irrigation season runoff events carry large quantities of sediment and cannot be detained for long enough periods to significantly reduce sediment concentrations.

Conclusions

Elimination of drainage wells on the A & B Irrigation District requires implementation of alternative means to utilize or dispose of irrigation return flow and non-irrigation runoff. Proper utilization of runoff on existing irrigated lands can reduce pumping from the aquifer and minimize the net depletion of the aquifer compared to other alternatives.

Ponding of all runoff in lieu of drainage wells would require extensive acreage of open water, which would encroach on irrigated land and result in excessive evaporation losses. This alternative would result in a larger net depletion to the aquifer than utilization of runoff on irrigated lands.

Pumping of irrigation return flow from the closed basins to live streams would cause an increase in net aquifer depletion in excess of 22,000 af/year, by far the largest aquifer impact compared to all alternatives. High pumping lifts and excessively long pipelines would be required which would be cost-prohibitive for the District.

Utilization of pump back systems to existing lands with the resultant reduction in retention pond area results in a decrease in net aquifer depletion over current practices and reduced evaporation from pond surfaces. This scenario is the preferred alternative to eliminate drainage wells and provides both local and regional hydrologic benefits within the Eastern Snake Plain aquifer.

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June 2000

Present title:

Senior Member – Brockway Engineering P.L.L.C
Formerly-Research Professor – Civil and Agricultural Engineering: Supervision of research conducted by the University Water Resources Research Institute and the College of Engineering at Kimberly, Idaho. Graduate student supervision and directed studies instruction in Water Management and Water Resources related subjects.
Associate Director – Idaho Water Resources Research Institute

Summary of education beyond high school:

Institution, Degree, Year
University of Idaho 1955-1959, B.S.-Civil Engineering, 1959
California Institute of Technology 1959-1960, M.S. – Civil Engineering, 1960
University of Colorado, Denver, Colorado, Management, 1963
University of Denver; Denver, Colorado, Civil Engineering, 1964
Utah State University, Ph.D.-Water Resources Engineering, 1977

Number of years service on faculty: 32
Date of original appointment: 1965
Dates of advancement in rank:
Associate Research Professor: 1974
Professor – 50% Agricultural Engineering, 50% Civil Engineering: 1978

Subjects and courses taught:
CE 500, CE 600, CE 502

Summary of academic experience:
University of Idaho – Research Professor–Civil and Agricultural Engineering, 1978
University of Idaho – Associate Research Professor, Civil Engineering, 1974-1978
University of Idaho – Assistant Research Professor, Civil Engineering, 1965-1974
Boise College – Instructor in Engineering, 1961-1963

Summary of other experience:
University of Idaho – USAID Pakistan Project on Irrigation Systems Management Research, 1984
U.S. Bureau of Reclamation – Hydraulic Research Laboratory, Denver, Colorado – Hydraulic Research Engineer, 1963-1965
U.S. Bureau of Reclamation – Boise, Idaho – Hydraulic Engineer, 1961-1963

Converse Foundation Engineering, Inc. – Pasadena, California – Foundation Engineer, 1960-1961
California Institute of Technology – Pasadena, California – Assistant Project Engineer, U.S. Public Health Services Research Project, 1959-1960

Consultant:

Twin Falls Canal Company – Twin Falls, Idaho – Hydrology and water use
North Side Canal Company – Jerome, Idaho – Hydrology and water use
Micron Technology – Ground water and water supply
J.R. Simplot Company – Land disposal of processing waste, water supply, water rights
City of Twin Falls – Water supply and hydrology
Idaho Trout Processors – Hydraulics and water supply
Cedar Mesa Reservoir and Canal Co., Redding, California – Water Management Consultant
Clear Springs Trout Company, Buhl, Idaho – Water supply and distribution systems
Idaho Power Company, Boise, Idaho – Relationships of groundwater and surface water – Upper Snake River Basin – water right adjudication
Idaho Department of Fish and Game – Evaluation of groundwater stream relationship for litigation – Parma vicinity
Blaine County, Idaho – Waste disposal systems for high density rural subdivisions
Reynolds and West Reynolds Irrigation Districts – Irrigation water requirements systems analysis
U.S. Bureau of Reclamation (was Maricopa County Water District) – Arizona Flood Study
Office of Technology Assessment – U.S. Congress – Irrigation Distribution Systems
U.S. Department of Justice – Indian Water Rights
Montgomery Engineers – Ground water quality evaluations
J.U.B. Engineers, Twin Falls, Idaho – Ground-water and hydraulics
Amalgamated Sugar Company, Idaho – Hydrology and waste disposal
Pioneer Irrigation District, Idaho Water rights and hydrology

Registered Professional Engineer:

Idaho and Colorado

Special Awards or Honors:

Recipient of Bausch & Lomb Science Award
Member Phi Beta Sigma, Freshman honorary, University of Idaho
Outstanding Freshmen Engineer Award – University of Idaho, 1955
Member of secretary of Sigma Tau, National Engineering Honorary
Member and Vice-President of ASCE student chapter, University of Idaho University of Idaho undergraduate scholarship 1957-1958, 1958-1959
Honorary Membership ASTM, 1959
U.S. Army National Defense Transportation Award, 1958
Distinguished Military Graduate – University of Idaho Top Ten Graduating Senior – University of Idaho, 1959
No. 2 in graduating class of 889, University of Idaho, 1959
Representative of USBR Division of Research at 1963 Intergovernmental Training Program, Denver, 1964
Scholarship – University of Denver, Graduate School of Management, 1964

National Science Foundation Fellowship – Utah State University, 1967-1968
Outstanding Young Engineer Award for Idaho, National Society of Professional Engineers, 1968
Engineer of the Year, 1997 American Society of Agricultural Engineers
Idaho Water Users Hall of Fame - 1998

Membership in professional and scholarly organizations:

National Society of Professional Engineers, 1967- present
Idaho Society of Professional Engineers, 1967- present: President 1978
American Society of Civil Engineers – Irrigation & Drainage Division Committee Chairman:

1.) Operation and Maintenance of Irrigation and Drainage Systems, 1975-1981
2.) Water Quality Committee, 1980-1984, Chairman
3.) Task Committee on Guidelines for Erosion and Sediment Control in Irrigated Agriculture, 1980-1983, Chairman
4.) Publications Committee, 1985-1992

Research Society of America
National Council of Examiners for Engineering and Surveying, 1981-1991
Idaho Board of Professional Engineers and Professional Land Surveyors, 1981-1991, Chairman
American Water Resources Association

Offices held in such organizations:

National Society of Professional Engineers
- Member – Young Engineers Committee, 1973-1974
- Chairman – Young Engineers Committee, 1975-1977
- Member – President's Committee on Board of Directors Organization, 1977
- Member – Registration and Qualification for Practice Committee, 1979-1981
- Chairman – Registration and Qualification for Practice Committee, 1982-1984
- Member – Participating Organizations Liaison Committee to NCEE, 1982-1984

Idaho Society of Professional Engineers, President 1978
- President - Magic Valley Chapter, 1970-1971
- Member – State Ethical Practices Committee, 1966-1977
- Member – State Intersociety Relations Committee, 1968
- Member – State Nominating Committee, 1975-1976
- Member – Board of Directors, 1972-1973
- Member – Board of Directors, Past President Chairman – Nominating Committee 1979
- State Director – Representative for Idaho NSPE, 1982-1983
- Nominating Committee for Idaho Board of Professional Engineers & Land Surveyors Member

American Society of Civil Engineers
- Member – Operation and Maintenance of Distribution Systems Committee Irrigation and Drainage Division, 1975-1981
- Chairman – Irrigation and Drainage Division, Operations and Maintenance Committee, 1977-1979
- Member – Water Quality Committee, Irrigation and Drainage Division, 1980-1984
- Chairman – Water Quality Committee, Irrigation and Drainage Division, 1982-1984

Member – Task Committee on Water Measurement, 1980-1983
Chairman – Task Committee on Guidelines for Erosion and Sediment Control in Irrigated Agriculture, 1984 – Present
Member – Publications Committee, 1985 – Present
Corresponding Member – ASCE irrigation and Drainage Division Committee on Operation and Maintenance of Irrigation Systems
Reviewer – ASCE Irrigation and Drainage Division Committee on Publications

Idaho Board of Professional Engineers and Land Surveyors Member, 1981
Vice Chairman, 1983-1984
Chairman, 1984-1986, 11990-1992

National Council of Engineering Examiners
Assistant Vice President, Western Zone
Member, Professional Examinations Advisory Committee
Member, Committee on Uniform Procedure and Legislative Guidelines, 1984
Member, Communications and Publications Committee, 1983
Member, Uniform Examinations and Qualifications Committee, 1984 – Present
Member, Committee on Examination Policies and Procedures, 1987 – Present
Member, Advisory Committee on Council Activities, 1986-1987
Assistant Vice President – Western Zone, 1986-1987
Member, Fundamentals Examination Review Committee, 1986 – Present

Scholarly and creative activity:

Research:

Development of systems analysis procedures for optimization of irrigation system designs with environmental, physical, and social constrains.
Evaluation of crop consumptive use, irrigation requirements, and methods of determining basin depletion from agricultural development.
Systems analysis of water use to develop mathematical methods for studying complex ground water-surface water systems – mathematical modeling of aquifers.
Ground water quality and river system water quality evaluations for nutrient load determination and river system modeling.
Development of guidelines for design of sediment removal facilities for on-farm and irrigation distribution system waste ways.
Evaluation of attainable impacts on water quality of irrigation return flows due to implementation of best management practices for sediment and nutrient control.
Evaluation of alternate energy sources for irrigation and municipal needs in Idaho.
Analysis of operation and maintenance cost of water distribution systems and determination of the relationship of costs to known physical and organizational parameters and water use efficiency.
Evaluation of the economic potential for use of geothermal hot water and steam in Idaho.
Study of the movement of water from canals to local water tables under saturated and partially saturated conditions.
Studies of the mechanisms of microbial action, sedimentation and soil-water-chemical interactions involved in natural sealing phenomenon in canals and reservoirs.
Evaluation of irrigation management practices for sustained land disposal of geothermal fluids.

Evaluation of practices and systems for controlling sediment and other pollutant losses from irrigated lands.
Investigation of the response of aquifer systems to changes in recharge or withdrawal due to change in land use.
Evaluation of procedures for estimating crop water requirements.
Development of cost effective procedures and equipment for measurement of irrigation diversions and power use in open and closed systems.

Community services and other relevant activities:

Member – Intermountain District Church of the Nazarene; Camps Board – 1976-1984, Board of Church Properties – 1976-1979
Member – Twin Falls City Planning and Zoning Commission 12/1978-9/1979
Member – College of Southern Idaho Geothermal Energy Commission
Member – Governor's Committee on Energy Use – 1980-1981
Member – Idaho Technical Advisory Committee for Sediment in Surface Water
Chairman – Snake River Technical Advisory Committee – Idaho Legislative Council, 1983-1985
Advisor – Governor's Snake River Advisory Committee – 1985
Member – Water Resources Foundation Board of Directors – 1985
Chairman – Idaho Technical Committee of Hydrology
Member – Idaho Department of Health & Welfare Sediment Citeria Committee
Member – Snake Plain Advisory Committee of Idaho Department of Health & Welfare
Member – Idaho Water Users Water Quality Committee – 1980
Member – INEL Dose Evaluation and Risk Assessment Committee
Member – Columbia River System Operations Review
Member – Mid Snake River Nutrient Management Advisory Committee
Member - Mid Snake River Irrigation Water Quality Coordination Committee
Technical Advisor – Middle Snake River Committee
Member – Liaison Committee, U.S. Geological Survey National Water Quality Assessment Program, Snake River Basin
Member – Snake River Studies Committee, Idaho Department of Water Resources
Member – City of Twin Falls Wellhead Protection Committee

Publications:

Brockway, C.E. 1964. Progress Report – Investigation of a Seepage Meter Designed by the Agricultural Research Service – Lower Cost Canal Lining Program. Bureau of Reclamation Hydraulic Branch HYD-529.

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Hamilton, B. and C.E. Brockway. 1991. Effects of Non-Continuous Turnout Operation on the Aberdeen-Springfield Canal System. Research Technical Completion Report. University of Idaho, Idaho Water Resources Research Institute, Moscow, ID.

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Brockway, C.E. et al. 1993. Proposed Nutrient Management Plan for Middle Snake Irrigated Agriculture. Submitted to Idaho Department of Health and Welfare Division of Environmental Quality by the Mid Snake Irrigation Water Quality Coordination Committee.

Carter, D.L., C.E. Brockway, and K.K. Tanji. 1994. Controlling Erosion and Sediment Loss from Furrow-Irrigated Cropland. Journal of Irrigation and Drainage Engineering, American Society of Civil Engineers. 119(6):975-988.

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Oral and/or Written Testimony
On Water-related Cases , 1995-2000
C.E. Brockway P.E. PhD.

Idaho Department of Water Resources Administrative Hearings

Baker Heinz and Huf & Puff Trust, Water Right Transfer Hearing
Blaine County 1999

Luis Bettencourt, Water Right Transfer Hearing
Gooding County 1999

T. Visser , Water Right Transfer Hearing
Gooding County 1999

James Whittaker ,Water Right Transfer Hearing
Lemhi County 1999

Sagewillow Ranch, Ed Dumke, Water Right Transfer Hearing
Butte County 1998

Gates,Water Right Transfer Hearing
Butte County 1998

Four Brothers Dairy,Water Right Transfer Hearing
Gooding County 1998

H & H Dairy ,Water Right Transfer Hearing
Twin Falls County 1997

Koompin Brothers,Water Right Transfer Hearing
Power County 1997

Birch Creek Power,Water Right Transfer Hearing
Butte County 1998

Other

Martins, G,Water Right Transfer Hearing
Twin Falls County 1997

Jensen v Sorenson District Court Butte County
1997

River Hills Resort Teton County Planning and Zoning
Hearing re Subdivision Water Supply
1997

Big Sky Dairy Water Right Transfer Hearing
Gooding County, 1999

K & W Dairy Water Right Transfer Hearing
Jerome County 2000

Jerome Cheese Co. Water Right Transfer Hearing
Jerome County 2000

Eagle View Farms Water Right Transfer Hearing
Twin Falls County 2000

Verbree Dairy Water Right Transfer Hearing
Jerome County 2000

Compensation for Consulting Services C.E. Brockway P.E. PhD

Compensation for consulting services is $95 per hour

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Bureau of Reclamation
Supplement to Preliminary Report of
A&B Irrigation District-Use of Drain Water
by C.E. Brockway P.E. Ph.D.

The undersigned U.S. Bureau of Reclamation employees reviewed the Preliminary Report "A & B Irrigation District- Use of Drain Water" on August 3, 2000.

We agree with the methodology used in the analysis of the different scenarios that were used to reach the conclusions cited in the report. Furthermore, we agree with the preferred alternative to reuse drainage water on the existing irrigated area. As stated in the report, this alternative eliminates drainage wells and provides both local and regional benefits within the eastern Snake River Plain aquifer.

Signed,

Mark Croghan
Hydraulic Engineer
Snake River Area Office - East

R.D. Schmidt
Hydrologist

Joe Spinazola
Activity Manager - Snake River Area Office

Dave Zimmer
Regional Water Quality Coordinator

Disclosure of Expert Witness
Pursuant to Rule 26(a)(2)(A), FRCP

R.D. Schmidt

Education
B.S., Mathematics 1970, University of Minnesota
M.S. Geoengineering/Hydrology 1985, University of Minnesota

Work History
1997-2000 Hydrologist/Team Leader Aquifer Recharge Program, Bureau of Reclamation PN Region. Direct hydrologic investigation of managed aquifer recharge in the Eastern Snake River basin, in conjunction with the Idaho Department of Water Resources, the University of Idaho, and engineering consultants. Use hydrologic models (Modflow) to identify potential recharge sites and determine impacts on groundwater level and discharge.

Participate in informational exchanges with Idaho Technical Committee on Hydrology, other state and federal hydrologists, canal company and irrigation district managers, and watershed advisory groups. Coordinate managed recharge investigations with SR3 Needs Assessment Work Group. Evaluate impacts of managed aquifer recharge on Salmon flow augmentation, hydropower rights, rental pool water availability, winter water savings, instream habitat for fish and wildlife, and water rights damage mitigation. Work with IDEQ and IDWR to establish groundwater monitoring requirements for pilot recharge projects.

1995-1997 Hydrologist, Continuing Projects, Twin Cities Research Center , Bureau of Reclamation TSC. Perform groundwater hydrologic investigations in support of experimental in-situ copper leaching test in northern Arizona. Conduct pumping tests and develop analytical groundwater models.

1992-1995 Supervisor, Hydrologic Applications Group, Twin Cities Research Center, Bureau of Mines, Direct multidisciplinary group of scientists, engineers, and technicians in hydrologic and geochemical evaluation of water resources impacted by mining activity.

1975- 1992 Hydrologist, Bureau of Mines, Twin Cities Research Center, Bureau of Mines. Conduct well tests and develop hydrologic data acquisition system for well testing Develop analytical and numerical models of groundwater flow and contaminant transport. Prepare and publish investigative reports.

Selected Reports and Publications (1990- present)

Idaho Dept of Water Resources Investigative Report, Feasibility of Large-Scale Managed Recharge of the Eastern Snake Plain Aquifer System, (coauthored with Paul Castelin, Jeffery Lefkoff, and Rex Harding), December, 1999, 233 pp.

Schmidt RD and D. Earley, New Facilities Investigations: Hydrologic Impact of In Situ Leaching at Cyprus Mineral Park Mine, Aquifer Protection Permit Application submitted to Arizona Dept. of Environmental Quality, July 1 1995.

Schmidt RD, Salovich M.J, Sodhi P, and J. Oswald, Reference Guide and User Manual for MFLOW, an Analytic Element Hydrology Model , USBM Open File Reprort ,1995.

Schmidt RD, Dahl L., Kim K., Paillet, F. and D. Earley, Hydrologic Characterization of a Chalcocite Copper Ore Deposit for In Situ Leach Mining, SME/AIME Annual Meeting, Denver, Co. preprint 95-252, March 6-9, 1995, 21 pp. (accepted by International Journal of Surface Mining, Reclamation, and Environment for publication in 1996)

Earley D., Schmidt RD, Y.C. Kim , Mitigation of Acid Rock Drainage through Application of In Situ Mining Technology to Fracture Hosted, Supergene Copper Sulfide Ore Deposits, Engineering Foundations Conf. on Technical Solutions for Pollution Prevention in the Mining and Mineral Processing Industries, Palm Coast Fl, Jan. 22-27, 1995.

Schmidt, RD, Earley D., and M. Friedel, Dynamic Influences on Hydraulic Conductivity during In Situ Copper Leaching, in In situ Recovery of Minerals II Proceedings of Engineering Foundations Conf. on in situ recovery of minerals, ed. S Swan and K. Coyne p 259-287, 1994.

Friedel M. , Schmidt RD, Jones P., and Y.C Kim, Geostatistical Analysis of Dynamic Transmissivity Conditions during In situ Copper Leaching, Proceedings: APCOM 92, 23rd International Symposium Computer Applications in the Mineral Industries, Tucson Az., April 7-11, 1992, pp 49-59.

Schmidt RD, Factors Affecting Residential Water Well Yield in Vicinity of Underground Coal Mines, Proceedings; 3rd Workshop on Surface Subsidence Due to Underground Mining, Morgantown W. Va., June 1-4, 1992, p 244-252.

Schmidt, RD and M. Friedel, Application of Computers in the Analysis of In Situ Leach Mining Hydrology, Proceedings: Indo-American Seminar on Computers in the Mineral Industry - Current State of the Art and Emerging Needs, Dhanbad, India, Nov 10-13, 1991, 21 pp..

Friedel M. and RD Schmidt, Effect of an Unsaturated Setting on the Hydrology of In Situ Copper Leaching Proceedings of SME annual meeting Denver Colo. 91-192 Feb. 25-28, 1991, 12 pp

Kim Y.C., Zhao, Y., Schmidt, RD and K. Behnke, Determination of dynamic permeability changes during In situ Leaching at Cyprus Casa Grande Operation ,Proceedings of SME annual meeting Denver Colo. Feb. 25-28, 91-144,1991,m 16 pp.

Schmidt RD, Behnke, K., and M.. Friedel, Hydrologic Considerations of Underground In Situ Copper Leaching, Proceedings of SME annual meeting, Feb 26-Mar 1, 1990, 12 pp.

Level, E., Murphy, B., Schmidt, RD and M. Salovich, A Hydrologic Data Acquisition System for In Situ Leaching, Proceedings of GEOTECH 90 Oct. 7-9, Dallas, Tx. 1990, 21 pp.

Lectureships and symposia (1990- present)
University of Idaho, by request of Prof. Gary Johnson, seminar entitled, Analytic Element Hydrologic Modeling Methods applied to Eastern Snake Plain Aquifer, May, 2000.

Idaho Water Resources Research Institute, by request of Prof. Christian Petrich, seminar entitled, Hydrologic Modeling of Managed Aquifer Recharge in the ESPA , April , 1999.

National Groundwater Association, PNW Regional Symposium, presentation entitled, Hydrologic Modeling of Managed Aquifer Recharge in the ESPA , February , 1998.

Columbia University, by request of Prof. Kunsoo Kim, Krumb School of Mines, Presentation entitled, Bureau of Mines In Situ Leaching Experiment at Cyprus, Casa Grande Mine. November, 1994.

University of West Virginia, by request of Dr. Syd Peng, Chairman, Mining Engineering Dept. Presentation entitled, Factors affecting Residential Water Well Yield in Vicinity of Underground Mines, at 3rd Workshop on Surface Subsidence Due to Underground Mining, June, 1992.

University of California, Lawrence Berkeley Laboratories, by request of Dr. Jane C.S. Long. Presentation of seminar entitled; In Situ Leaching Hydrology Research at BOM, March, 1992.

University of Kentucky, Institute of Mining and Minerals Research, by request of Dr. Lyle Sendlein. Presentation of seminar entitled; Coal Hydrology Research at Bureau of Mines TCRC, Feb. 1992.

Penn. State University, presentation of half day segment of two day short course on In Situ Leach Mining hydrology, by request of Dr. R. V. Ramani, Chairman, Dept of Mining Engineering, January, 1992.
Indian School of Mines, Dhanbad, India, by request of Prof. Roger Ramani of Penn State University. Presentation entitled, Computer Applications to Mining Hydrology, at Indo-American Conference on Computer Applications in Mining, Nov. 6-20, 1991.

Michigan Technological University, by request of Prof. Al Johnson. Presentation of seminar entitled; Hydrologic Concerns of In Situ Leaching Operations in Fractured Crystalline Ore Deposits, May 1991.

Los Alamos National Laboratory, by request of Dr. Edward Van Eckhout. Presentation of seminar entitled; Fluid Distribution and Control during In Situ Leaching at Cyprus Casa Grande Mine, Sept. 1990.

Minnesota Section of AIME, by request of James Briedel, Chairman. Presentation of seminar entitled; Bureau of Mines In Situ Leaching Hydrologic Investigations at Magma San Manuel Mine, Feb. 1990.

Committee Participation (1990-present)
Eastern Snake Plain Hydrologic Modeling Committee, Interagency Committee to provide guidance in development of groundwater hydrologic models for use by state and federal agencies in Idaho. 1997-present.

Arizona Dept. of Enviromental Quality, Shallow Bedrock Hydrologic Investigations at Mineral Park, provide scientific and technical support to Az DEQ for evaluation of Aquifer Protection Permit Application from Cyprus Mineral Park Mine. Oct . 1994 - 1997.

National Academy of Sciences, Committee to Study Fracture Characterization and Fluid Flow, participated as liaison member of the committee presenting mining hydrologic concerns relative to fracture flow, July 1991-March 1992.

State of Pennsylvania, Longwall Mining Hydrology Advisory Workshop, with OSM, Pennsylvania DER, Penn State University, eastern coal mining companies, and concerned citizens groups, to establish policy guidelines for control and remediation of hydrologic impacts due to longwall mining in Pennsylvania and W. Virginia, Oct. 1991-Oct. 1992.

Nuclear Regulatory Commission, Committee for hydrologic assessment of exploratory shaft development at Hanford site, as part of high level nuclear waste repository site evaluation. Hanford Wash. June 1988.

Other cases where I have testified as an expert or in which I been deposed within the last fours. None

Compensation for Testimony

None - federal government employee and testifying pursuant to permission given by the government.

Disclosure of Expert Witness
Pursuant to Rule 26(a)(2)(A), FRCP

David Zimmer

Education
B.S., Fish and Wildlife Biology, Iowa State University, 1968
M.S., Zoology (Limnology), Iowa State University, 1972
Ph.D., Zoology (Limnology), Iowa State University, 1976

Work History

1972-73	Aquatic Ecologist, Ichthyological Associates, Berwick, Pennsylvania - Developing Baseline Information for Pennsylvania Power & Light Susquehanna River Nuclear Powerplant
1976-77	Research Fisheries Biologist, U.S. Fish and Wildlife Service, Yankton, South Dakota - Investigations of Impacts of Great Plains Coal Development on Mainstem Missouri River Water Quality
1977-2000	Water Quality Specialist, U.S. Bureau of Reclamation, Boise Idaho - Planning and Coordination of Regional Water Quality Activities for the Bureau of Reclamation

Publications Authored within the last ten years
None

Other cases where I have testified as an expert or in which I been deposed within the last four years. None

Compensation for Testimony
None - federal government employee and testifying pursuant to permission given by the government.

Disclosure of Expert Witness
Pursuant to Rule 26(a)(2)(A), FRCP

Joe Spinazola

Education
B.S. in Forest Management from the University of Minnesota, St. Paul

Work History
Hydrologist and supervisory hydrologist with U.S. Geological Survey in Kansas and Idaho for 19 years. Conducted groundwater studies including bibliographic searches; data collection, compilation, and analysis; numerical modeling, and report writing. Authored or co-authored over 20 technical reports. Delivered several papers at professional conferences. Supervised hydrology, computer services, and publication staff in the Idaho District Office.

Hydrologist for Bureau of Reclamation for 2.5 years. Conducted groundwater studies as groundwater specialist in the Pacific Northwest Region for the Snake River basin.

Activity manager in the Snake River Area Office for the Bureau of Reclamation for one year. Develop plans of study and coordinate study team efforts to implement water management and environmental activities in the Snake River basin.

Publications Authored within the last ten years

Wolf, R.J., McGovern, H.E., and Spinazola, J.M., 1992, Physical framework of the Western Interior Plains confining system, Kansas: U.S. Geological Survey Hydrologic Investigations Atlas, HA-722-C, 2 sheets.

Hansen, C.V., Spinazola, J.M., and Wolf, R.J., 1992, Physical framework of the lower aquifer unit in the Western Interior Plains aquifer system, Kansas: U.S. Geological Survey Hydrologic Investigations Atlas, HA-722-F, 2 sheets.

Hansen, C.V., Wolf, R.J., and Spinazola, J.M., 1992, Physical framework of the confining unit in the Western Interior Plains aquifer system, Kansas: U.S. Geological Survey Hydrologic Investigations Atlas, HA-722-E, 2 sheets.

Hansen, C.B., Underwood, E.J., Wolf, R.J., and Spinazola, J.M., 1992, Physical framework of the upper aquifer unit in the Western Interior Plains aquifer system, Kansas: U.S. Geological Survey Hydrologic Investigations Atlas, HA-722-D, 2 sheets.

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Spinazola, J.M., Tungate, A.M., and Rogers, T.L., 1992, Geohydrologic and chemical data from wells in the Mud Lake area, eastern Idaho, 1988-91: U.S. Geological Survey Open File Report 92-133, 92 p.

Spinazola, J. M., 1994, Geohydrology and simulation of flow and water levels in the aquifer system in the Mud Lake area of the eastern Snake River Plain, eastern Idaho: U.S. Geological Survey Water-Resources Investigations Report 94-4227, 78 p.

Spinazola, J. M., 1994, Simulation of changes in water levels and ground-water flow in response to water-use alternatives in the Mud lake area, eastern Snake River Plain, eastern Idaho: U.S. Geological Survey Water-Resources Investigations Report 94-4228, 29 p.

Spinazola, J. M., 1995, Numerical model of the eastern Snake River Plain aquifer system in the Mud Lake area, eastern Idaho: Abstract, 1 p.

Spinazola, J.M., and Higgs, B.D., 1998, Water Resources of Bannock Creek Basin, southeastern Idaho: U.S. Geological Survey Water-Resources Investigations Report 97-4231, 45 p.

Spinazola, J.M., 1998, A spreadsheet notebook method to calculate rate and volume of stream depletion by wells in the Lemhi River valley upstream from Lemhi, Idaho: Bureau of Reclamation, Pacific Northwest Region, March, 1998, 23 p.

Other cases where I have testified as an expert or in which I been deposed within the last four years. NA

Compensation for Testimony

None - federal government employee and testifying pursuant to permission given by the government.

Disclosure of Expert Witness
Pursuant to Rule 26(a)(2)(A), FRCP

Mark Croghan

Education
B.S. Agricultural Engineering, Oregon State University

Work History
Three years as Hydraulic Engineer, USBR Denver, Colorado in water resources division on water resources investigations including planning studies involving water budgets and crop consumptive use.

Seven years as Hydraulic Engineer, USBR Burley, Idaho in water operations and water conservation. Perform day to day operation of the Upper Snake River and Reservoir System for flood control and irrigation storage and delivery. Provide assistance to local irrigation entities in designing and implementing water management and conservation improvements.

Publications Authored within the last ten years
None

Other cases where I have testified as an expert or in which I been deposed within the last four years.
None

Compensation for Testimony
None - federal government employee and testifying pursuant to permission given by the government.