

Edward Squires, R.P.G.

EDUCATION

M.S. Interdisciplinary Hydrogeology, 1992, Boise State University, Boise, Idaho.

Advisors: Dr. S.H. Wood (BSU) and Dr. J.L. Osiensky (U of I).

B.S. Geology, groundwater emphasis, cum laude, 1990, Boise State University, Boise, Idaho.

Advisor: Dr. C. M. White.

Thesis: Hydrogeologic Framework of the Boise Aquifer System, Ada County, Idaho.

REGISTRATION

Registered Professional Geologist, since 1999, Idaho Certificate No. 968

Registered Professional Geologist, since 2010, Arizona Certificate No. 51268

Professional Well Log Analyst, since 1995

Certified Water Right Examiner, Certification No. 14-125

OVERVIEW

Ed Squires is the President and Managing Hydrogeologist for Hydro Logic, Inc. of Boise, Idaho. Before starting his own consulting firm in 1999, he served for 6 years as Manager of the Geosciences Department and Company Hydrogeologist for United Water Idaho, Inc. In that capacity, Mr. Squires has consulted on a variety of water resource projects to the United Water Resources group of companies around the United States. He has been part of the adjunct graduate faculty at Boise State University's Department of Geosciences since 1995, regularly teaching a curriculum course in Field Hydrogeology and serving as a guest lecturer for other water-related coursework. Prior to his tenure at United Water Idaho, Mr. Squires worked as a hydrogeologist for S.H. Wood and Associates and has over twenty years of hands-on groundwater and geophysical experience.

Mr. Squires' professional career and current practice emphasizes all aspects of responsible groundwater development, water rights, and resource protection. He has conducted extensive research and published several reports on the groundwater and subsurface hydrogeology of the Boise River Valley since publication of his Masters Thesis, entitled "Hydrogeologic Framework of the Boise Aquifer System, Ada County, Idaho". Mr. Squires served three years on the Technical Advisory Committee of the Treasure Valley Hydrologic Project and has been a member of the Southeast Boise Groundwater Management Area Committee, formed as a result of his research in Southeast Boise, since 1994. He recently served on the Technical Advisory Committee for the Hydrogeologic Framework and Computer Modeling Project for the Boise Front Geothermal Groundwater Management Area and was been appointed by the Director to the Negotiated Rulemaking Committee to draft new administrative rules for well drilling in the State of Idaho. Ed currently is an active member of the Technical Working Group for North Ada County studies at IDWR at the request of the Director.

Mr. Squires has designed and supervised the construction of over 300 large bore, high capacity water supply wells averaging 500 feet deep in sedimentary and volcanic aquifers. He has designed, supervised the construction, developed, and tested more than 60 deep (500-to-1000 feet) exploratory test/observation wells in addition to multiple geothermal and irrigation well development projects. In addition to new well installations, Mr. Squires has run down hole camera surveys and borehole geophysical logs in hundreds of wells throughout the Western States and has been in charge of rehabilitative maintenance/reconstruction of over 100 older wells.

Mr. Squires is a registered Professional Geologist (No. 968) in Idaho and a Professional Well Log Analyst. He is a member of the National Groundwater Association, the Association of Ground Water Scientists and Engineers, and is a Certified Water Rights Examiner in the State of Idaho (14-125).

REPRESENTATIVE PROJECT EXPERIENCE

Groundwater Development

- 1) Design, construction oversight, development, and testing of over 300 large bore, high capacity production supply wells for public drinking water systems, municipalities, and private utilities.
- 2) Designed, organized, and supervised 14 regional scale, long-term aquifer tests using the wells of: the State of Idaho Department of Corrections, United Water Idaho, Inc., Water District 63-S, Mesa Water Corporation, Capital Water Corporation, Tamarack Resort, Crane Creek Country Club, J.R. Simplot, Town of Wickenburg, AZ, City of Meridian, City of Kuna, City of Caldwell, and City of Eagle.
- 3) Conducted and interpreted borehole geophysical logs in newly drilled wells and provided design information for hundreds of well projects for industrial, commercial, agricultural, domestic, and municipal wells in the western U.S.
- 4) Testing/analysis of United Water Idaho's infiltration galleries (Ranney Collectors) along the Boise River.
- 5) Pumping test analysis and pumping plant design of municipal supply wells for the Cities of Caldwell, Meridian, Kuna, and Garden City and for many irrigation and commercial clients.
- 6) Ground water quality and water geochemistry evaluations for the Cities of Meridian, Caldwell, Kuna, and Garden City, United Water Idaho, Capitol Water Corp., Tamarack Resort, Pepsico USA, SSI Food Industries, Idaho Power Company, Wickenburg Ranch, Tusayan, AZ, The Terteling Company, Inc., and numerous other agricultural, commercial, water company, and subdivision clients.
- 7) Hydrogeologic and geophysical investigations for groundwater supply projects for the Idaho cities of Boise, Meridian, Caldwell, Mountain Home, Nampa, Greenleaf, Kuna, Marsing, Buhl, Rupert, Eagle, Cascade, Donnelly, Victor, Star, Emmett, Glenns Ferry, and Notus. Also the Cities of Hawthorne NV, Mt. Vernon OR, LaGrande OR, Island City OR, and Walla Walla WA and the towns of Tusayan AZ and Wickenburg AZ.

Aquifer Recharge

- 1) Project manager for the United Water Idaho, Inc.'s Swift Aquifer Storage and Recovery project (aquifer recharge) in West Boise, Idaho, 1996-1999.
- 2) Consulting hydrogeologist to United Water Resources for various aquifer recharge projects along the east coast 1996-1999.
- 3) Geophysical and hydrogeological consultant to the State of Idaho Department of Water Resources' Managed Recharge Project including providing open-hole geophysical logs and borehole video 2000.
- 4) In-situ Aquifer Storage and Recovery project for dissolved iron concentrations in ground water in the Tamarack Resort municipal supply Well #7 ; successful elimination of iron 2004.

- 5) Attended two international ASR conferences and two recharge conferences in the US.
- 6) City of Meridian ASR Evaluation for City Well #23, 2009.
- 7) Member of the National Groundwater Association's ASR Task Force, 2009-2014

Surface Water

- 1) Five-year stream flow and surface water-geochemistry/water-quality monitoring of four mountain streams in the Tamarack Resort area of Valley County Idaho including establishment of baseline data and statistical analysis.
- 2) Three-year stream flow monitoring of three spring-fed perennial streams in the Squaw Ridge area near Ola, Idaho including an evaluation for two administrative futile water calls and associated water rights.
- 3) Monitoring and demonstration of water rights futile call and expert witness for Cold Springs Creek and Ryegrass Creek near Glenn's Ferry, ID, 2014.
- 4) Ground and Surface Water Resources Management Plan for Clagstone Meadows area of north Idaho including 3 exploratory test bores, surface water stream monitoring for flow and geochemistry. Surface water rights evaluation, adjudication claims, and new applications.

Water rights

- 1) Preparation, filing, and follow-through of numerous water right transfers and water right permit applications and transfers for public utilities, municipalities, the State of Idaho, commercial, and agricultural water users in Idaho.
- 2) Evaluation of surface water rights and filing of transfer applications in Little Salmon River Valley.
- 3) Expert witness in Basinwide Issue #5 – Conjunctive Management of Water Resources in Idaho.
- 4) Expert witness in all manner of water right disputes, protests, and well interference issues before the Idaho Department of Water Resources and in the Idaho courts including groundwater/surface water interactions.
- 5) Evaluations and filing of claims in the Snake River Basin Adjudication.
- 6) Certified Water Right Examiner in the State of Idaho regularly conducting field licensing examinations and evaluations of pumping systems including determination of historical use.
- 7) Continual involvement in the interpretation and application of the tenets of the State of Idaho Water Code with respect to groundwater resource development and management.
- 8) Project manager for United Water Idaho, Inc. concerning the implementation of the 1996 Municipal Water Rights Statute 1994-1999.
- 9) Successful "Municipal" water rights application for the Idaho Dept. of Transportation for its Issac's

Canyon Rest Area near Boise. 1st use of 1996 Municipal Water Rights Statute for the State of Idaho.

- 10) Co-author of the first successful municipal "future needs" (RAFN) water right application in Idaho and three pending subsequent future needs applications.
- 11) Water rights consultant to the Idaho Department of Corrections for several facility locations.

Groundwater Development Feasibility Studies

- 1) 2006-2011 Project Manager for \$1.5 M hydrogeologic characterization and ground water development potential studies of the Upper Hassayampa Basin for the 3,000-unit Wickenburg Ranch planned development community near the town of Wickenburg, Arizona.
- 2) 2006-2011 Project Manager for \$2M hydrogeologic characterization and ground water development potential studies for the 6,000-unit Spring Valley planned development community in the Eagle, Idaho foothills.
- 3) Design, construction oversight, development, water quality testing, and monitoring of over 50 deep (500-1000 feet) exploratory test-well and piezometer nest installations for municipal and industrial water providers in Southwest Idaho..
- 4) Groundwater Feasibility Study For Idaho Power Co.'s Pahsimeroi Fish Hatchery, Lemhi, County, Idaho.
- 5) Reconnaissance Level Groundwater Feasibility Study for the Idaho Power Company's Oxbow Fish Hatchery at the Confluence of Pine Creek With the Snake River in the Hells Canyon Reach, Baker County, Oregon.
- 6) Hydrogeologic Evaluation of Groundwater Quality and Yield Beneath the Idaho Power Company's Pahsimeroi Fish Hatchery – Upper Facility.
- 7) Analysis of the 2001 Aquifer Testing for the Municipal Water Supply of the Proposed Tamarack Resort, Donnelly, Valley County, Idaho.
- 8) Groundwater Conditions and Hydraulic Testing of the Boise Fan-Aquifer of Southeast Boise River Valley, Ada County, Idaho.
- 1) Evaluation of the Hydrogeologic Framework and Groundwater Production Potential of the Kings River Valley, Nevada.

Resource Protection

- 1) Investigation, design and oversight of the decommissioning and proper abandonment of 49 aging and unsealed large-bore production well using perforate-and-pressure grouting techniques.
- 2) Design and oversight of the pressure grout sealing and rehabilitation of four high-yield unsealed wells for the defunct United Dairymen of Idaho Creamery in downtown Meridian, Idaho prior to building a new

City Hall facility on the site.

- 3) Development and implementation of a baseline (pre-development) surface water quality monitoring plan for the proposed Tamarack Resort, Donnelly, ID.
- 4) Served two years (2008-2010) representing the City's of Meridian, Caldwell, and Kuna on the negotiated rulemaking committee for revision of Idaho's administrative rules for well drilling at request of the Director of the Department of Water Resources.
- 5) Served one year (1995-1996) representing United Water Idaho, Inc. on a negotiated rulemaking committee for revision of Idaho's administrative rules for well drilling at request of the Manager of the Western Regional office of the Department of Water Resources.

Expert Witness Testimony (entity represented underlined – all winning outcomes):

- 1) Idaho Department of Corrections versus Tyson Fine Foods
- 2) The Terteling Company, Inc. versus Edwards Greenhouses, LLC.
- 3) Naylor Farms versus Latah County et al
- 4) Ivey versus Russell
- 5) North Ada County Ground Water Users Association versus M3 Eagle, LLC.
- 6) Round Valley water users and well owners versus Ringel.
- 7) Edwards Greenhouses versus The Terteling Company, Inc.
- 8) Idaho Power Company versus group of Pahsimeroi Valley water users and well owners.
- 9) Carlock, McKenzie, and Redmon versus Mooers - Squaw Creek Idaho.
- 10) The Terteling Company versus the City of Boise.
- 11) City of Caldwell versus United Water Idaho, Inc.
- 12) City of Meridian versus United Water Idaho, Inc.
- 13) The Terteling Company, Inc. versus United Water Idaho, Inc.
- 14) Tamarack Resort versus Henry's North Forty, LLC.
- 15) Thompson versus George Bryant Drilling.
- 16) Micron Technology, Inc. versus United Water Idaho, Inc.
- 17) Jardine versus Inland Crane
- 18) Brenegar versus City of Meridian.
- 19) Double Anchor Ranches versus Casa del Norte
- 20) United Water Idaho, Inc. versus Idaho Department of Corrections
- 21) McNabb versus United Water Idaho, Inc.
- 22) General Water Works Corporation versus Intel, Corporation.
- 23) Idaho Public Utilities Commission versus Mesa Water Company.
- 24) Duspiva versus Filmore Supreme Court case over well drilling procedures.

EMPLOYMENT

1999-present	Founder, President ,and Managing Hydrogeologist; Hydro Logic, Inc.
1995-present	Adjunct graduate faculty; Boise State University Department of Geosciences.
1994-1999	Sr. Hydrogeologist (RPG) United Water Idaho, Inc.; Geosciences Department Head.

- 1992-1994 Consulting Hydrogeologist. S.H. Wood and Associates, Boise, Idaho.
- 1990-1993 Staff Technician; Geophysical Well-logging Unit, Boise State University.
- 1989 summer Idaho Geological Survey; Idaho Initiative. Albion Range field-mapping.
- 1989 Internship; Boise Water Corp.; Digital Data Acquisition for Groundwater Studies.
- 1988 summer White/Naslund National Science Foundation Research Expedition to Kangerslugsuaag region of arctic East Greenland. Team member in charge of field mapping.
- 1987 summer Research assistant at BSU on hydrogeological studies. Design, construction, and operation of Boise State University's truck-mounted geophysical well-logging unit. Thin-section and X-ray diffraction laboratory manager.

PUBLICATIONS AND REPRESENTATIVE PROFESSIONAL REPORTS

- Evaluation of Changing Ground Water Geochemistry in the Meridian Municipal Well #25, 2014, Investigation of radionuclides in groundwater and causative factors behind elevated levels of uranium in Meridian ground water.
- Aquifer Insights Gained from a Seventeen-Year Water Level Monitoring Record of a Rapidly Developing Municipal Well Field in Meridian, Idaho, 2013, Results and analysis of a long-term, designated ground water-level monitoring well network and the implications to future resource sustainability, a report prepared for the City of Meridian Public Works Department
- An Evaluation of the Pumping Plant, Ground Water geochemistry, Hydrogeology, and Current Condition of the City of Meridian Municipal Supply Well #24, a Ninth Year Check-Up, 2012, Prepared for the City of Meridian
- Understanding the Boise River Valley Aquifers: the Hydrogeology Depends on the Geology, Modeling Depends on Good Data, 2012, Abstract and presentation for Law Seminars International.
- The Artesian Wells of the City of Meridian, Idaho, March 17, 2012, municipal well data base and report to City of Meridian Public Works Department.
- Evaluation of Elevated Concentrations of Dissolved Radionuclides in Ground water from the City of Meridian Municipal Well #20-B, 2011, prepared for the City of Meridian Public Works Department
- Hydrogeologic Characterization and Demonstration of Physical Availability of Groundwater for an Assured and Adequate Water Supply Application for Wickenburg Ranch, Yavapai County, Arizona, October 11, 2010.
- Geologic Framework of the Congress Basin Groundwater Resources, Yavapai County, Central Arizona, July 4, 2010.
- City of Meridian Source Water Protection Plan Update, 2009, second edition after 2003.
- Options For Improving Groundwater Quality in the City of Meridian Well #23, May 5, 2009 Technical memorandum to Public Works Director Tom Barry including a detailed evaluation for the potential for Aquifer Storage and Recovery.
- Hydrogeologic Framework and Evaluation of the Ground Water Development Potential Beneath The City of Meridian's Test Well #28 Site, April 1, 2009.
- A Nine-Day Constant-Rate-Discharge Aquifer Test of the SVR #7 Test Well In Big Gulch, North Ada County, Idaho, Consultant's report issued January 20, 2009
- Thirteen-Day Constant-Discharge Aquifer Test of the Wickenburg Ranch Supply Well #7, January 8, 2009, a Demonstration of Assured and Adequate Water Supply for the Upper Hassayampa Basin, AZ to the Arizona Department of Water Resources.
- Ground Water Level Measurements the Northern Ada County Area Including the Proposed M3 Eagle Planned Community, to Dennis E. Owsley of the Idaho Department of Water Resources, Consultant's report issued March, 19. Hydro Logic, Inc., 2008a. Technical Memorandum.
- Modeling of Groundwater Flow in the Pierce Gulch Sand Aquifer: Five Models: History, Updates and Predictions of Impacts Caused by Pumping at the M3 Eagle Planned Residential Community, Ada County, Idaho. Consultant's report issued November 26. Hydro Logic, Inc., 2008c.
- Re-analysis of 16 Aquifer Tests in the Greater Eagle-Star Area of North Ada County, Idaho. Consultant's report issued July 4, 2008, Utting, M. and Squires, E., 2008.
- M3 Eagle Regional Hydrogeologic Characterization, North Ada, Canyon and Gem Counties, Idaho One-Year Progress Report. Consultant's report issued May 4. Squires, E., Utting, M., and Pearson, L.H., 2007.
- Baseline Surface Water Quality Estimation For Streams In the Tamarack Resort Area, Donnelly, Valley County, Idaho, March 15, 2007, Streamflow and geochemistry monitoring of four mountain streams 2002-2007.
- Movement of Dissolved Constituents From Surface to Groundwater and Analysis of Hydrochemical Trends in the Boise Aquifer, 2006, research paper in preparation with D. Glanzman.

Baseline Surface Water Quality Estimation For Streams In the Tamarack Resort Area, Donnelly, Valley County, Idaho: 2006, a four-year study to develop baseline geochemical signatures and annual flow rates/volumes for six area streams using the Probability Plot Analysis method.

Hydrogeologic Evaluation of the Feasibility for Ground Water Development Beneath the Miller Gulch Area of the Terteling Ranch in the Boise Foothills, Ada County, Idaho With Emphasis on Water Quality / Geochemistry: 2005, a report on the drilling, design, construction, and sampling of the Miller Gulch exploratory test-well bore and piezometer nest.

Options for Additional Ground Water Development and Replacement of the City of Caldwell's #7 Supply Well: 2005, a report on the drilling, design, construction, and sampling of an exploratory test-well and long-term dedicated piezometer nest/monitoring well at the City of Caldwell's existing municipal water supply well site, prepared for the City of Caldwell, Idaho Department of Public Works.

Boise Valley Groundwater Geochemistry – Origin, Infiltration Rate, and Transport Characteristics: 2005, abstract submitted to the 15th Annual Goldschmidt Meeting of international geochemists, co-author with Dick Glanzman, CH2M Hill Denver.

Treasure Valley Hydrologic Project Seismic Survey and Hydrogeologic Framework Study, 2003, research paper with Dr. S.H. Wood, and Lee Liberty of BSU.

Compilation of Drilling, Geological, Geophysical, Geochemical, and Hydraulic Testing Data for the City of Meridian, Idaho's Groundwater Supply: Including Detailed Well-Construction Information and Aquifer Pressure Measurements From a Long-Term Groundwater Monitoring Well Network, 2003, data compilation from a ten-year hydrogeologic study funded by the City of Meridian.

City of Meridian, Idaho Source Water Protection Plan: 2003, prepared for the Idaho Department of Environmental Quality and the City of Meridian Department of Public Works.

Details of Drilling, Construction, and Hydraulic Testing of the Idaho State Correctional Institution #4 Supply Well, 2002, a report prepared for the Idaho Division of Public Works.

Results and Analysis of the 2001 Aquifer Testing for the Municipal Water Supply of the Proposed WestRock Resort, Donnelly, Valley County, Idaho: 2002, A report prepared for the Idaho Department of Water Resources.

Causative Factors of Detachment of the Mountain Home #1 Municipal Supply Well Pump With Details of the Recovery Effort: 2002, A report prepared for Ringert Clark Chartered Lawyers.

Evaluation, Abandonment, and Proposed Replacement of the Capitol Water Corporation's #5 (Lubkin) Municipal Supply Well 1999-2002: 2001, A report on the history of repair, the occurrence of volatile organic compounds, and the abandonment of an aging supply well in preparation for replacement of the #5 well with a new facility.

Preliminary Evaluation of the Well Construction, Present Down Hole Conditions, and Sustainable Yield of the Garden City #5 Municipal Well: 2001, A report the Garden City Public Works Department.

Stratigraphic Studies of the Boise (Idaho) Aquifer System Using Borehole Geophysical Logs With Emphasis on Facies Identification of Sand Aquifers: 2000, Report to the Treasure Valley Hydrologic Project, Idaho Department of Water Resources, (co author with Dr. S.H. Wood).

Geophysical signatures of lacustrine facies: Experience from Hydrostratigraphic Studies of temperate Neogene Lake Idaho sediments and aquifers, U.S.A., Abstract of the General symposium, 3-1 Lacustrine Sedimentation, 31st International Geological congress, Rio de Janeiro, Brazil, August 6-11, 2000_Wood, S.H., Liberty, L., and Squires, E.

Hydrogeology, Geochemistry, and Well Construction of the Treasure Valley Hydrologic Project Monitoring Well #1, Ada County, Idaho: , 1999, Final report to the Technical Advisory Committee (co-author).

Supporting Data for the Groundwater Conditions and Aquifer Testing of the Tenmile Ridge Area of South Boise, Ada County, Idaho: 1998.

Implications of Well-Construction to Aquifer Water-Quality: Some Observations: (principal author), 1997, Southwest Idaho Subsection – Pacific Northwest Section of the American Water Works Association; in Southwest Idaho As An Example of Ground Water Development in the Northwest Intermountain Region, Speakers Expanded Abstracts City of Meridian #15 Production Well; Discovery of a New, Good-Quality Aquifer: 1994, Professional report to the City of

Meridian, Idaho.

Groundwater Conditions and Hydraulic Testing of the Boise-Fan Aquifer of Southeast Boise River Valley, Ada County, Idaho: 1993, Report to Boise Water Corporation. (principal author).

City of Meridian #14 Production Well: 1993, A new large-capacity municipal-supply well is completed in response to unprecedented 18% growth. Report to City of Meridian, Idaho.

Hydrogeologic Framework of the Boise Aquifer System, Ada County Idaho: 1992, Project Completion Technical Report, Idaho Water Resources Research Institute, University of Idaho, Moscow, Idaho, 109 pages.

An Irrigation Well for the Les Bois Invitational Soccer Tournament Incorporated, 1992, professional report to Boise Water Corporation, 42 pages. (sole author)

Hydrogeologic Investigation for the Proposed State of Idaho, Department of Transportation Blacks Creek Rest Area, Ada County, Idaho: 1992, report to Idaho Department of Transportation, 38 pages. (principal author)

Investigation of Groundwater in the Tenmile Ridge Area of South Boise, Idaho: 1989. Report to Boise Water Corporation. (principal author)

Origin of Granophyres in the Vandfalsdalen Macrodike, East Greenland: 1989, Evidence for Assimilation and Magma Mixing. GSA Abs. with Programs. (co-author)

Crustal Assimilation and Coexisting Silicic and Mafic Magmas in the Vandfaldalen Macrodike, East Greenland: Continental Magmatism Abstracts (IAVCEI): New Mexico Bureau of Mines and Mineral Resources Bulletin 131. (co-author)

Analysis of Historical and Current Water-level and Production Data from the Boise Geothermal System: 1988, Geological Society of America Abstracts. (co-author)

Preliminary Geology and Hydrogeology of the Mayfield/Orchard Area, Elmore and Ada Counties, Southwest Idaho: 1988, Program and Abstracts, 30th Annual Meeting of the Idaho Academy of Science. (sole author)

Geologic Study of Groundwater in Deep Wells, Southeast Boise Area: 1987. Report to Boise Water Corporation.

February 13, 2015

Mr. Ed Smith
P.O. Box 6015
Twin Falls, ID 83303

Re: Thomas Leno and Four Sisters Dairies Proposed Water Right Transfers

Dear Mr. Smith,
P.O. Box 6015
Twin 83303

At your request, I have looked at the proposed Thomas Leno and Four Sisters water rights transfers (Transfers) with an eye toward your group of domestic well owners' (Protestants) perceived concerns about the effects of the proposed Transfers on the Protestants wells and the local area aquifer in general from pumping of new proposed water wells and, in particular, the so-called "New Irrigation Well" subject to the Transfers. I have prepared the following synopsis with my observations, conclusions, and recommendations:

1) SCOPE OF WORK:

- a. Review of available hydrogeologic reports for the area.
- b. Review of local area Well Driller's Reports for the area.
- c. Review of the PowerPoint presentation by Brockway Engineering.
- d. Review of the "New Irrigation Well" pumping test by Brockway Eng.
- e. Review of the proposed Transfers.
- f. Discussions with local interested parties and the Protestants.

2) PUMPING TEST OF THE "NEW IRRIGATION WELL":

a. Overview.

- i. Brockway Engineering pump-tested an existing well ("New Irrigation Well") and described some aspects of the test in a PowerPoint presentation slide to IDWR. Subsequently, as part of the contested case and administrative hearing process in the matter,

Brockway provided the water level and pumping rate data for the test.

- ii. The purpose for the testing is unclear, as are the results and conclusions from the test.
- iii. The pump testing conducted by Brockway Engineering is not useful to any sort of aquifer analysis, well sustainability analysis, well interference analysis, or even a pumping plant design analysis and should not be represented as such or taken as such. In my professional opinion, with the data presented, the pumping test is nearly useless as explained below.

b. Technical Problems with the Testing Procedures and Measurements.

- i. The test was not long enough.
 - 1. In the hydrogeologic setting, as characterized by Brockway Engineering, an essentially “unconfined” aquifer is assumed. In unconfined aquifers, an aquifer test of sufficient duration to extend past the effects of “delayed yield” are often 48 hours in duration as a standard or more if necessary.
 - 2. Delayed yield occurs when the dewatering cone of depression around the pumping well “drains” from the aquifer matrix thus adding a water source to the aquifer being pumped. The delayed yield response is relatively short lived and eventually goes away as the pumped well resumes drawing down.
 - 3. Delayed yield has the effect of falsely indicating that drawdown has stabilized as this consultant has interpreted as happening in this test.
 - 4. I include a hydrograph (Figure 1), from an aquifer test I recently conducted to illustrate the effects of delayed yield. aquifer test

ii. Very few actual water level and discharge measurements were taken.

1. The water level and discharge rate were measured for the first 150 minutes and the last 8 minutes of the $17\frac{3}{4}$ -hour test or only 15% of the test period.
2. The test pumping occurred mostly over the night time hours with no measurements taken or reported for 15 hours of the $17\frac{3}{4}$ -hour test period.
3. There are no records of the pumping rate and water level (or any adjustments to the pumping rate) for 15 hours of the $17\frac{3}{4}$ -hour test (Figure 2).
4. Of the few obtained water levels, these fluctuated during the test by as much as 11 feet over the course of 3 minutes with the water level deepening while the discharge was decreasing.

iii. Pre-test water level trends were not measured in the aquifer.

1. Only one non-pumping water level was taken prior to the test even though the pump was not started until 33 minutes later.
2. Without such pre-test water level data, rising or declining trends in the aquifer, from other pumping or regional-scale causes, cannot be taken out of the test data to be able to see the actual effects of the testing or whether other pumping wells may be affecting the test.

iv. Post-test water level recovery measurements for only 9 minutes.

1. Rapid water level recovery after pumping is a common occurrence in fractured volcanic aquifers.
2. Rapid partial recovery of a pumped water level is also often interpreted by inexperienced analysts as being some sort of positive signal about the well or aquifer when it is not. While such a statement may impress the layman unfamiliar with how aquifer hydraulics actually work, this observation is more misleading than anything else.

3. What is important, is not the “90% recovery in 8 minutes” but the length of time for the remaining 10% of water level recovery to occur (if it indeed does). These measurements were not obtained in this test.
 4. Because nearly 20 feet of water level recovery remained after the 9-minute measured recovery and without at least one water level measurement at $17\frac{3}{4}$ hours following the turning off of the pump, no conclusions should (or could) be drawn from this data.
- v. Discharge not held constant.
1. The discharge was not monitored, recorded, or adjusted during 85% of the test but, during the $2\frac{1}{2}$ hours the test was attended, the discharge varied considerably; all the more reason to have measured recovering water levels that are not affected by variations in pumping rate but those measurements were not taken in this case.
- vi. No digital data-logger instruments used.
1. In the absence of an on-site presence by those conducting the pumping test (and the complete absence of water level and pumping rate for 85% of the night time test period), a calibrated (to hand measured water levels) digital water level instrument should have been installed in the well to obtain measurements when the well was unattended (see Figure 1 as an example).
 2. Similarly, even the beginning and ending totalizing flow-meter readings were not logged or explained.
- vii. Water level data not plotted or analyzed.
1. It is not possible to correctly analyze or interpret hydraulic test data without plotting the data arithmetically and semi-logarithmically.

2. This is especially true in the case of a short-term test with very few water level measurements and in an allegedly unconfined aquifer where the phenomenon of delayed yield must be taken into account.
3. By way of example, I plotted the Brockway Engineering test data from the New Irrigation Well on, both, arithmetic and semi-logarithmic scales (Figure 3) by way of comparison to a quality-controlled pumping test (Figure 1).

viii. No hydrogeological analysis presented.

1. Other than the conclusions by Brockway Engineering in the PowerPoint slide, that the water level “90% of the drawdown recovered within 8 minutes”, and that “The pumping water level remained constant after pumping for over eight hours” (response to protestant’s Interrogatory No.16) there is no scientific analysis, plotting, interpretation, or conclusions presented.
2. This is mainly because the presented data are not suitable for such analyses or helpful to any sort of aquifer characterization and perhaps were never intended as such.

ix. Discharge was to a depression less than 75 feet away from the well.

1. In the postulated unconfined (water table) conditions, discharging to the land surface so close to the well could easily have the effect of the pumped water returning (draining) back into the aquifer units open to the well thus disguising the actual drawdown (a circulating system).

x. No information presented on the well itself.

1. No details of construction for the New Irrigation Well were presented.
2. Such information is essential to the analysis of pump test data.

c. Conclusions of Brockway Engineering from the Testing.

- i. I have not seen any conclusions or technical analyses developed by Brockway in support of the Transfers except an unsupported PowerPoint presentation slide, a statement that the drawdown stabilized after 8 hours of pumping, and one statement that the water level in the New Irrigation Well recovered 90% after 8 minutes.
- ii. Nor have I seen any professionally stamped work product subject to the Transfers.

3) Water Rights priority after the Proposed Transfer Application:

- i. Although it is apparently a point of contention among some researchers, the water rights proposed for transfer are designated as being within the same ground water basin (Basin 47), are now decreed as such, and will likely be considered as such by IDWR in the Transfers. Therefore, the proposed transfer of the points of diversion (wells), place of use, etc. will be considered as a standard transfer of withdrawn ground water within a hydraulically continuous basin with the transferred water rights retaining the originally assigned priority date of when the water right was filed for.
- ii. However, in the case of a transfer of points of diversion, such as is proposed in the Transfers, that being the moving of water wells to a new location, the potential for well-to-well interference effects to existing wells at the new proposed location of the transferred rights must be considered. In other words, even though the water rights may be transferred to a new location under an existing water right priority, this does not mean that the effects of pumping the newly relocated water wells to an area of existing water wells, would retain the original priority date if injury to existing uses at the new location can be shown. The evidence presented by Brockway Engineering in its PowerPoint presentation is not useful to such an analysis.

4) CONCLUSIONS:

a. Pumping Test Conclusions:

- i. The presented pumping test is not a useful indication of aquifer conditions, sustainability, and an indication of limited possible well-to-well interference effects. In my professional opinion as a practicing and licensed Hydrogeologist in the State of Idaho, this test should not, and cannot, be used for any of these purposes.
- ii. In my professional opinion, the pumping test was not designed, carried out, or analyzed according to any defensible scientific method to allow its use to characterize aquifer conditions or even to size a future pumping plant for the well.
- iii. This test is not useful to show interference effects, the actual long-term effects to the aquifer(s) drawn upon, or as any sort of substantiation for the proposed transfer applications and should not be taken as such.
- iv. The Transfers should not be approved until such time that a responsible and well-planned aquifer test can be designed and conducted using area domestic wells as monitoring wells (including the wells of the nearby Protestants) for the production well(s) proposed by the transfer at the proposed pumping rates in the transfer.

b. Modeling Conclusions:

- i. The presented modeling uses methods for which almost none of the underlying required scientific assumptions are met so the model is not applicable to the known subsurface conditions and should not be relied upon for such purposes.
- ii. In my professional opinion, the numerical model presented by Brockway Engineering, is not calibrated to any meaningful pumping tests and should not be used to predict future aquifer conditions. Rather, it is meaningless and useless for that purpose.

c. Water Right Point of Diversion Priority Date Conclusions:

- i. The Transfers should not be allowed unless the proposed new points of diversion are designated with a water right priority date junior to existing local are domestic wells for well-to-well interference effects or until a suitable analysis of local short-term and long-term water level interference effects is accomplished via a well-planned and executed, multiple well aquifer test.
- ii. The Transfers should not be approved without accompanying condition such as

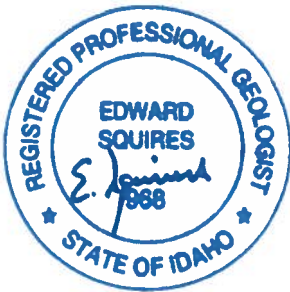
d. Long-Term Water Level Monitoring Conclusions.

- i. The water level monitoring hydrographs presented by Brockway Engineering's PowerPoint presentation are from agency measurements taken in monitoring wells located miles from the proposed post- transfer points of diversion.
- ii. Because the effects of new ground water withdrawals will take time (years) to completely manifest throughout the local area, a long-term water level monitoring and reporting plan should be implemented in the wells adjacent to the proposed new uses. The monitoring, utilizing a combination of hand-measurements and digital instruments, should be in place at least six months prior to commencement of the proposed new pumping.
- iii. Such monitoring and reporting plans are often required by IDWR in water rights approvals.

5) RECOMMENDATIONS:

- a. The Applicant should design, plan, and carry out a pumping test of several days duration that includes water level measurements in surrounding domestic well including pre-test, drawdown, and recovery periods using a combination of digital instruments and hand measurements. The pump testing plan should include input from the Protestants and approval from the IDWR.

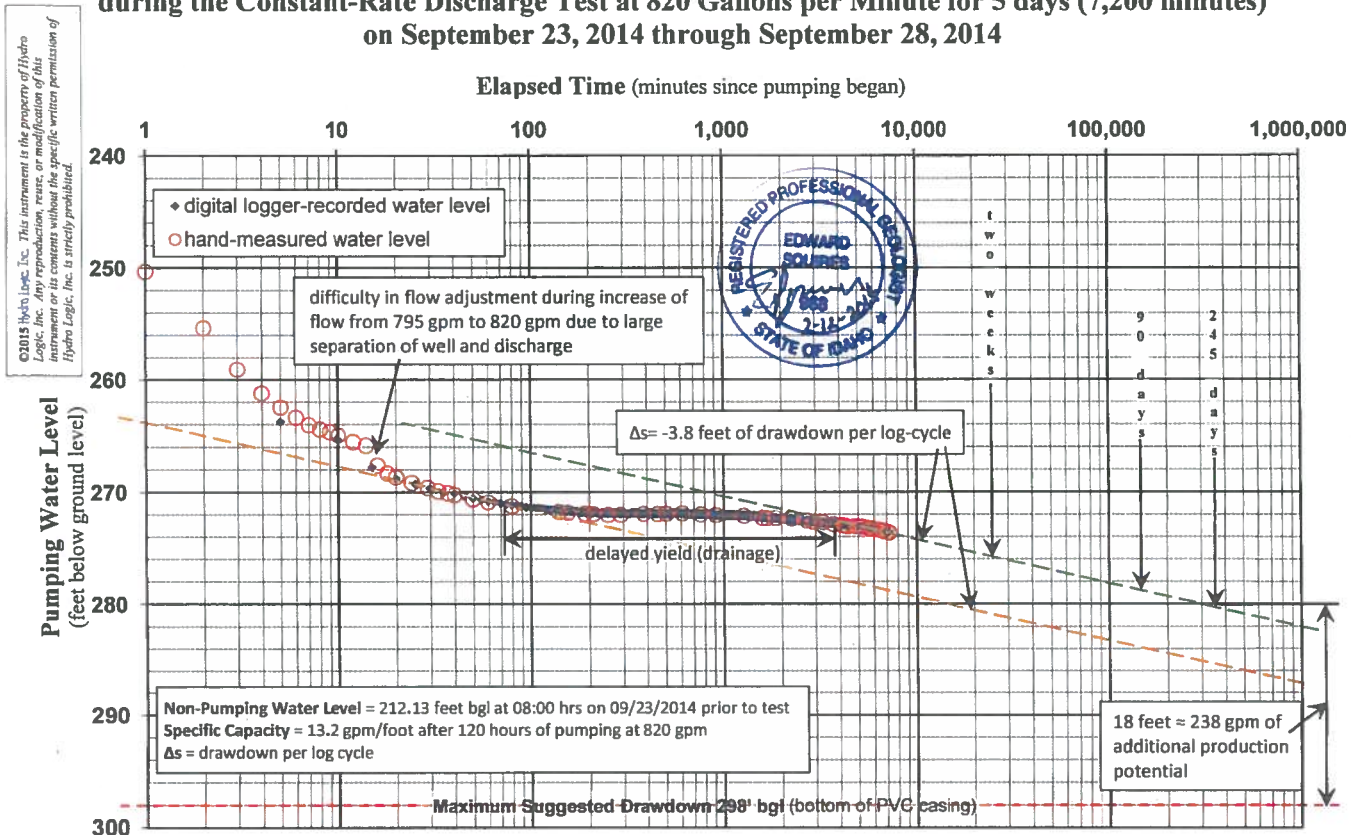
- b. The Applicant should plan, develop, and implement a long-term ground water level monitoring and reporting plan to be reviewed and approved by the Protestants and the IDWR with stipulated penalties for non-compliance.
- c. Request the IDWR to delay action on the proposed Transfers until such time the appropriate testing and monitoring programs can be put in place, carried out, and interpreted.
- d. Develop conditions of approval for any approved transfer protecting Protestant's point of diversion priority dates from any new uses after the date of the transfer approval and reserving the right to rescind the transfer approval in the event the subsequent monitoring shows injury to pre-existing uses.



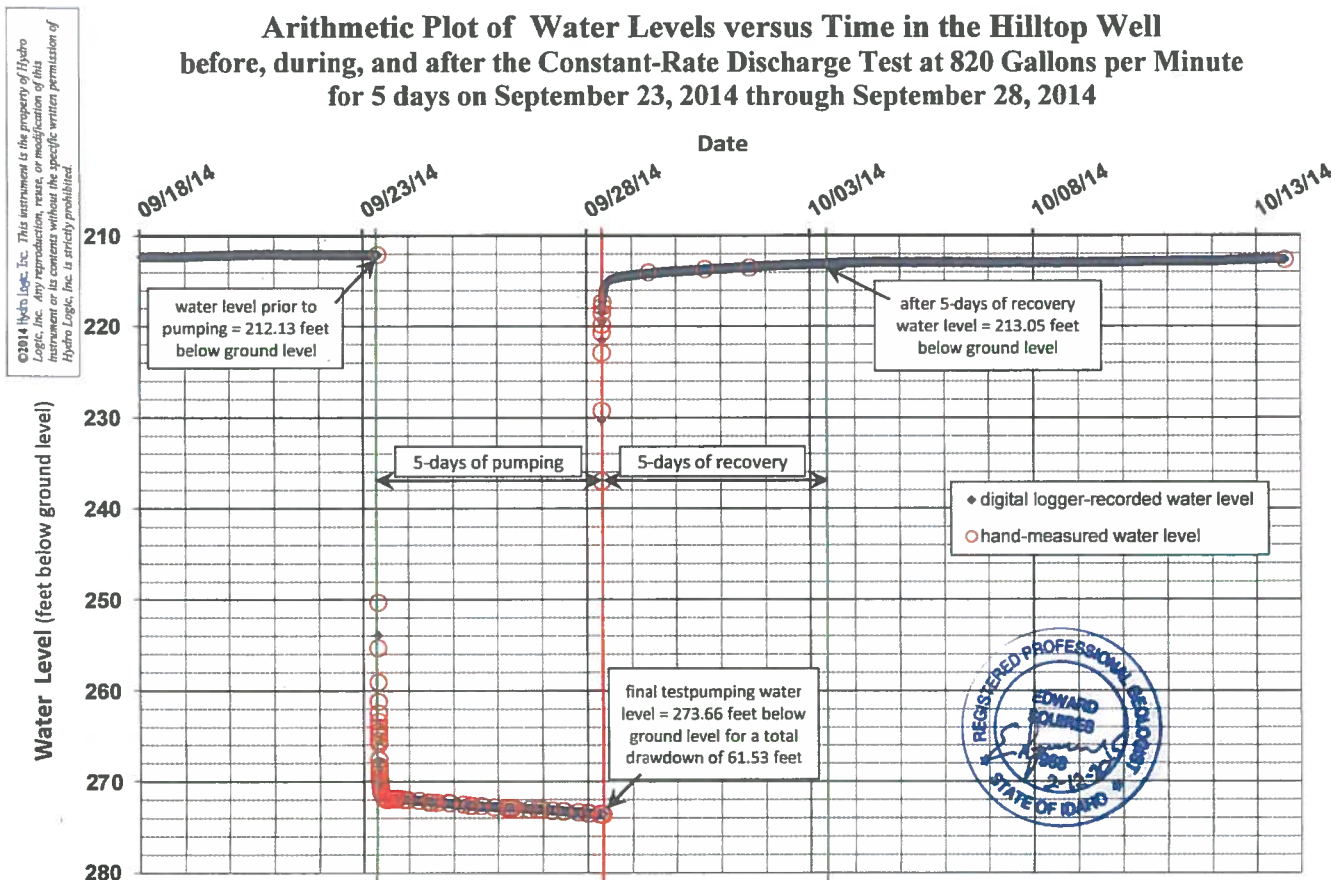
Respectfully,

Ed Squires, RPG

Semi-Logarithmic Plot of Pumping Water Level versus the Log of Time in the Hilltop Well during the Constant-Rate Discharge Test at 820 Gallons per Minute for 5 days (7,200 minutes) on September 23, 2014 through September 28, 2014



Arithmetic Plot of Water Levels versus Time in the Hilltop Well before, during, and after the Constant-Rate Discharge Test at 820 Gallons per Minute for 5 days on September 23, 2014 through September 28, 2014



Hydrographs from a recent pumping test showing the effects of “Delayed Yield” (cone of depression drainage) in a deep well completed into an unconfined aquifer. The upper plot of water level versus the logarithm of time, clearly shows the effects of delayed yield (as a temporary cessation of drawdown). Predicted drawdown resumes after the aquifer drainage is complete, in this case, requiring about 3 days.

Figure 1.

Pump Test
Hank Hafliger
Brockway Engineering
Greg Sullivan
October 7 through October 8, 2014

Ed Smith Note: 2nd Test,
7-8 OCT 14

Well Location is 11 S, 16 E, Section 8 SWSW
40 horse power submersable pump
Discharge measured with Fuji Ultrasonic Flow Meter
Water Level measured with Waterline Envirotech LTD probe and a Pressurized Air Line

Time	Discharge gpm	Water Level feet
2:23 PM		247.6
2:53 PM		
2:56 PM	160	
3:00 PM	138	404
3:05 PM	139	404
3:11 PM		409
3:14 PM	150	416
3:19 PM		420
3:24 PM	150	428
3:29 PM	148	432
3:34 PM		427
3:46 PM	177	404
3:48 PM	170	439
3:51 PM	134	450
3:55 PM	138	423
3:58 PM	140	386
4:01 PM	128	388
4:04 PM	143	397
4:13 PM	128	397
4:23 PM	116	365
4:31 PM	156	441
4:44 PM	135	423
4:57 PM	139	425
5:26 PM	134	418
8:27 AM	120	402
8:30 AM	118	
8:31 AM		
8:32 AM		370
8:35 AM	137	425
8:36 AM	128	430
8:39 AM	128	432
8:40 AM		365
8:40 AM		344
8:41 AM		328
8:41 AM		314
8:41 AM		307
8:41 AM		303
8:45 AM		270
8:46 AM		270
8:47 AM		266
8:48 AM		266

Pump On

Pump Off

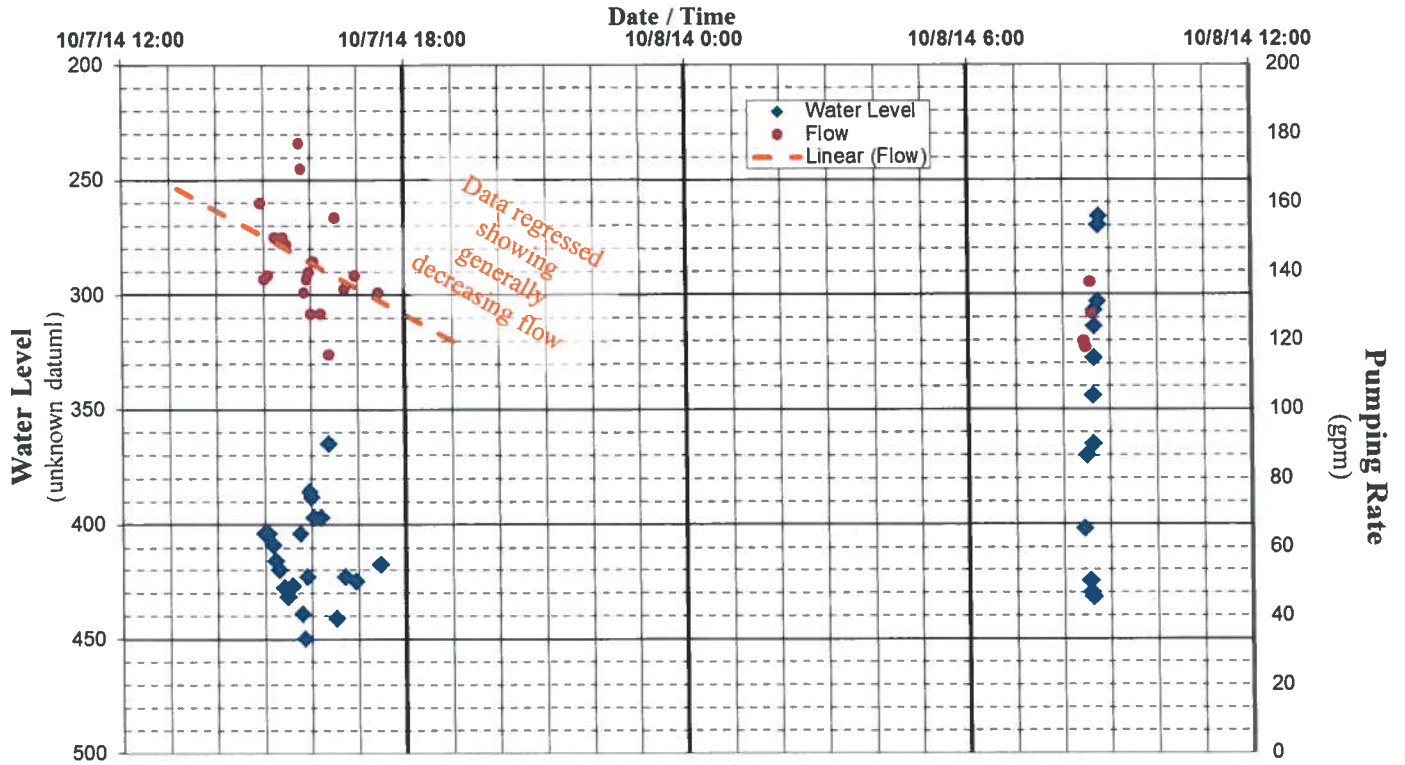
1
New
Day

Figure 2. Water level, time, and pumping rate measurements by Brockway Engineering from the pumping test of the "New Irrigation Well" in the Salmon Falls Tract of Basin 47 near Filer, ID. Measurements were taken for 2½ hours of the 17¾-hour test period with 15¼ hours of data, mostly during night time hours, not obtained. There are also no pre-test water level trend data and only 8 minutes of water level recovery data available.

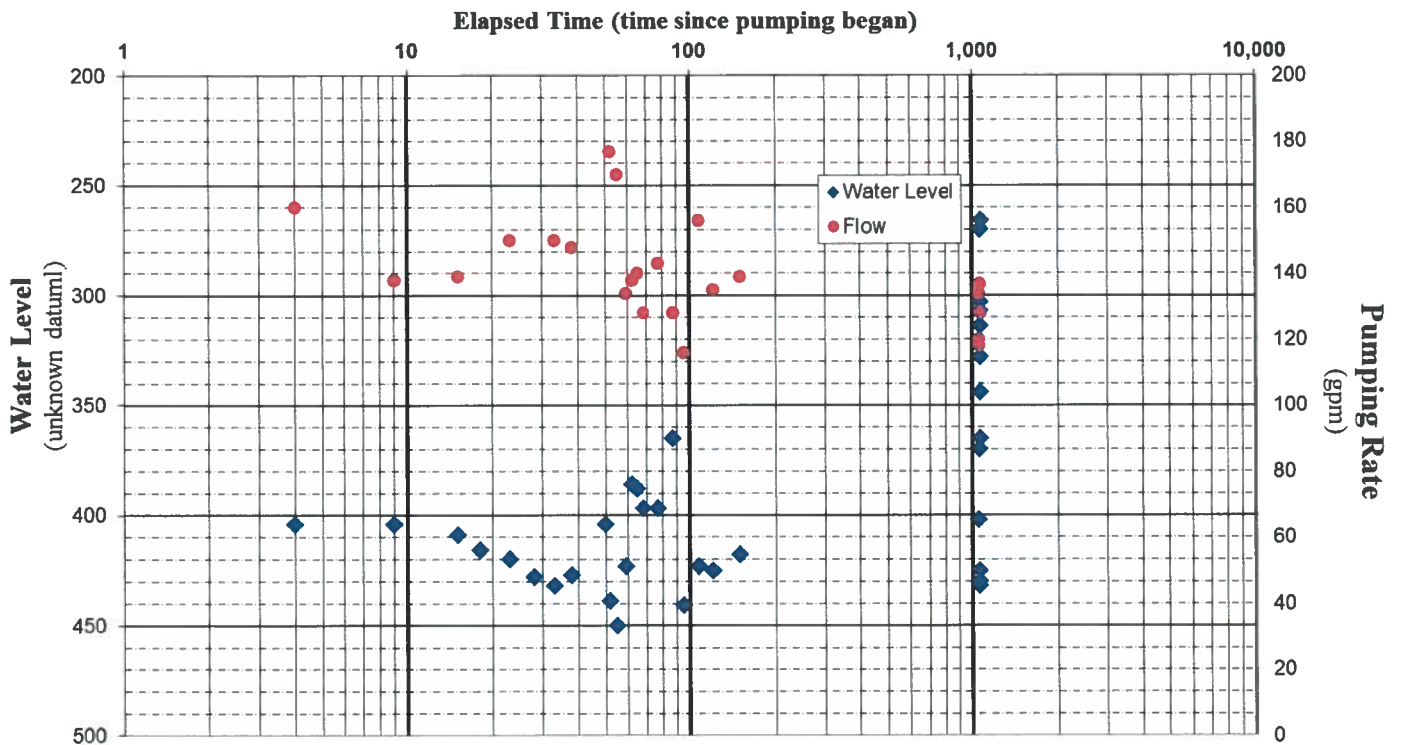
Pump Test
CRD 2

Figure 2.

**Arithmetic Plot of Pumping Water Level in Salmon Falls Tract "New Irrigation Well"
During Discharge Testing at 118 - 177 Gallons/Minute**



**Semi-Logarithmic Plot of Pumping Water Level in Salmon Falls Tract "New Irrigation Well"
During Discharge Testing at 118 - 177 Gallons/Minute on 10/7/14 thru 10/8/14**



Plotted Brockway Engineering data of Figure 2 for the test pumping of the "New Irrigation Well" proposed as a water right point of diversion for Transfer No. 79384. Owing to the wide variations in pumping rate and water levels, coupled with a lack of measurements during 15 ¼ hours of the 17 ¾-hour test, these data are not able to be scientifically analyzed or interpreted in any useful way.

Figure 3.