

Applied Hydrology International merges with Norwest Corporation

by Mike Day

Applied Hydrology International (AHI) formally joined Norwest Corporation in November of last year adding its specialized expertise to create one of the world's leading energy consulting firms. AHI's hydrology, environmental, and permitting expertise contributes to Norwest's goal of providing a complete range of services to the energy development sector. The merger is the culmination of several years of professional collaboration between Norwest and AHI.

Applied Hydrology was founded in Denver, Colorado in 1982. The founders had worked for major energy and mining corporations, and their goal was to bring an industry perspective to the consulting business, which has continued throughout the history of the company. Steady growth over the years has resulted in a 30-person group with a solid reputation for hydrologic expertise and integrity. "After collaborating with Norwest on numerous projects over the past six years, we realized their corporate culture was much like ours" commented AHI president Michael Day. "We have always recognized

the synergies that existed between the companies, and are excited about contributing to continued growth and success as a division of Norwest."

AHI has expertise in groundwater and surface water hydrology, including flow and mass transport modeling, water management, water supply, dewatering design, environmental assessment and remediation, permitting

and compliance, and field testing. AHI has an extensive client base in energy, mining, chemical, manufacturing, and property development. AHI also brings a strong history of successful environmental remediation work, including several Superfund site cleanups and numerous private sector projects.

AHI's broad experience in hydrologic issues related to mining and coal bed natural gas development complements the expertise within Norwest Corporation. The combined entities are currently working on several water supply, mining and energy development projects involving mine planning, geotechnical issues, dewatering, and water management, for coal, oil sands, oil shale, and coal bed natural gas. A recent example was the joint effort with Norwest and Questa Engineering (Norwest's reservoir engineering subsidiary) to develop the Injection/Fall-Off Test (IFOT) trailer for assessment of permeability in coal bed natural gas prospects (see separate article in this edition).

Applied Hydrology is based in Denver with offices in Calgary; Houston; southern Colorado; Gillette, Wyoming; and Yerington, Nevada. With the addition of AHI, Norwest continues its growth as an industry leader offering fully-integrated consulting services to the oil, gas, mining, oil sands, oil shale, unconventional resources, and coal bed natural gas industries worldwide.



From Left Back Row: Terry Gulliver, Konard Quast, Juliana Harris, Jamie Krezelok, Rick Reinke, Jeremy Snyder, Kevin Conley, Paul Kos, Art O'Hayre, Landon Beck
Front Row: Jake Maybach, Jim Thomson, Kevin Ritter, Paige Garduno, Mike Day, Pam Tarquin, Adam Bedard.

> Mike Day, President
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 **Applied Hydrology International**
A NORWEST Company

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Doing it right the first time:

Equipment design/build for Norwest Field Services

by Jim Thomson

In early August 2004, one of Norwest's Canadian clients asked us to perform injection/falloff tests (IFOTs) as part of a coal bed methane (CBM) exploration program. In these tests, clean water is injected under carefully controlled conditions, and downhole pressure monitoring is used to determine formation permeability and other reservoir characteristics. Test conditions, formations, and depths all vary, so injection equipment needs to be precisely matched to the site. Based on the expected geology and coal characteristics, reservoir engineers in the Questa division calculated the likely range of pressures, flow rates, and test duration. All we needed was the equipment.

A very remote site, winter conditions, and the need to tailor equipment for site conditions dictated that a new unit be

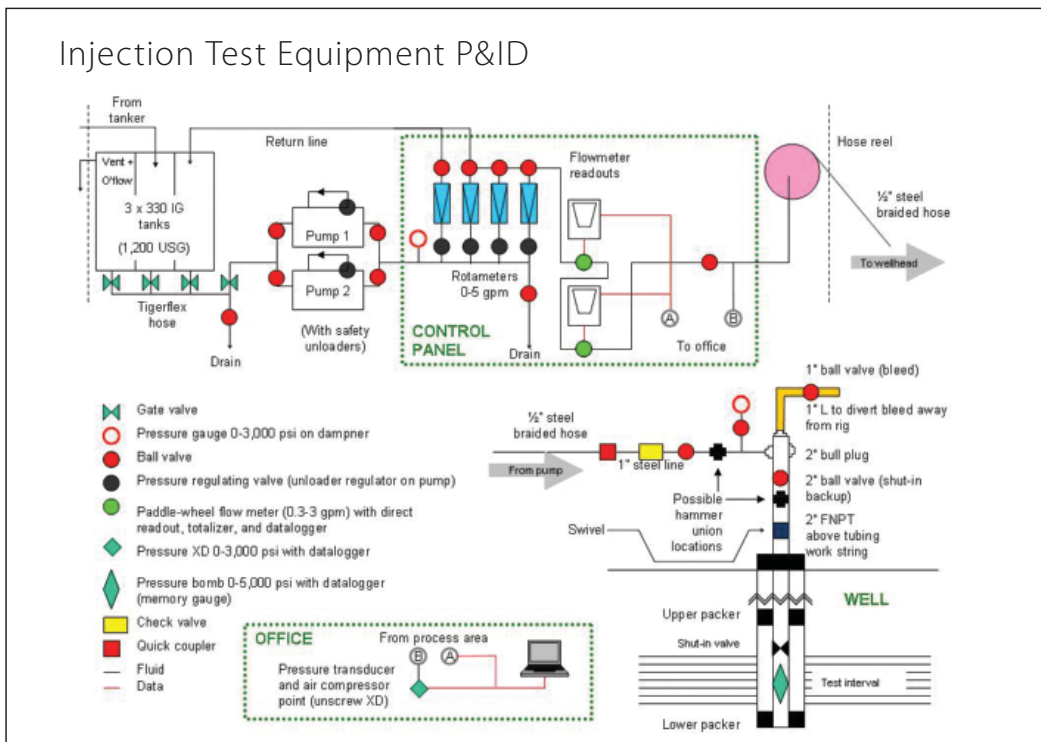
built - and it had to be done right the first time. IFOT equipment is not available off-the-shelf: a Google search on "IFOT trailer" gives zero results. However, the AHI division, with long experience in designing and building aquifer testing and water treatment equipment, stepped up to the plate.

Adding to the stress potential of this project, there were a couple of additional factors:

1. The unit had to be built, tested, calibrated, approved by the client and CSA, and mobilized, all in less than a month
2. No downtime was allowed. At this difficult-access site, any breakdown would have added greatly to project costs, so all systems had to have at least 100% redundancy, with the ability to change over on the fly.

Being centered in Denver, AHI initially considered building the equipment in Colorado and driving it north. However, the prospect of convincing Canadian Customs that "pressure bombs" are not explosive devices was a little daunting, so we quickly decided to build it in Alberta. We contacted our colleagues at Sequoia Environmental in Calgary, who we have known since 1996. From experience, we know that they are very responsive and totally competent. After explaining our needs, budget, and P&ID (see diagram below), Sequoia got to take the ball and run with it - and run they did. Within a week they had winterized a 20-foot trailer and started filling it with water tanks, catalytic heaters, 3,000-psi-rated piping, explosion-proof electrical systems, and computer data links, plus the wellhead and fittings. Not only that, they set up a project website so that we could check on daily progress. By the end of week 2, with AHI on site to make final design decisions on the ground, baby IFOT was

ready for the client's safety inspection. Final modifications, wet testing (no drips or leaks allowed), CSA inspection, and legalities took one more week - we were done ahead of time!



Process and Instrumentation Diagram of Injection Test Equipment.

When we took the unit into the field, it ran perfectly. Although the IFOT project was initially expected to last three weeks, Arctic weather, hard-as-nails drilling, and uncooperative downhole fluids tripled the duration. However, the IFOT unit ran glitch-free throughout, and as an added bonus it was also used to test the blow-out preventers. Only one gauge had to be changed, and the modular manifolded design allowed this to be done in mid-stream. Having experienced the mud of a Canadian drilling season first-hand, we are now making one major modification—adding a pressure-washing wand.



Business end of IFOT in action.

The project was a great example of smooth coordination between all of Norwest's divisions and our client. We are all proud of the Norwest family's newest addition. This unit is easily adaptable to varying conditions, and it does have wheels, so it could appear at one of your projects sometime soon.

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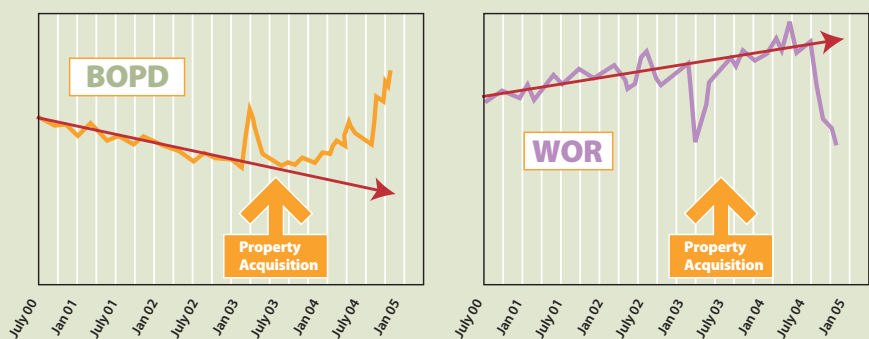
Successful reawakening of mature wells: Key factors for reversing declining oil production

A sixty-year-old oil field experienced a 30% increase in oil rate as the result of a dozen projects completed in late 2004. The increase translated into a \$28 million gain in field value.

This field had been scrutinized in 1990 with a detailed engineering and geologic evaluation conducted by a major oil company. As a result, the company felt all the big-impact projects had either been applied or at least examined. However, this belief did not account for the steady improvements in technology since that time, especially the gains in computing power. Inspired by improvements in oil price and the belief that the large companies were missing something, a small independent acquired the field in mid-2003 and began the turn-around with technical assistance led by Questa Engineering.

The first step of the technical evaluation was to transfer all the information held in boxes and boxes of paper records to an electronic database. This allowed data to be organized and sorted to define what had already been attempted and to quantify the impacts of that work. The next step was a multi-disciplinary evaluation where findings from various technical disciplines were integrated to understand what drove the responses to those previous projects. New or refined development techniques were then explored and field tested. Results from that work were then brought into the database and the evaluation process repeated to continue refining future work plans.

The wellwork projects increased revenue by increasing oil rates and they cut the largest field expense, water-handling, by reducing the water-to-oil ratio (WOR). The arrows highlighting the historical trends below indicate the current oil rate is twice what the field would have been producing without the recent wellwork. In addition, the WOR is 40% below the historical WOR trend.



These improvements and the identification of 81 more projects for this field has led to significant gains in proven reserve volumes, as certified by a major third-party evaluation company. Their reports show that between the second and third quarter of 2004 the proven-developed (PDP) reserves increased 31% while the proven non-producing (PDNP) reserves jumped 36%.

The same evaluation process is in various stages of completion for seven other mature fields. So far, 235 new potential projects have been identified for those fields and expectations are high for field testing in 2005. All indications are that the process is applicable to a wide range of mature fields, which supports the concept that new looks at old fields can yield significant gains in rate and value.

Presidents' message

Value to our Clients— Developing our Human Assets

The upturn continues and the international mining industry is reaping the dividends. Commodity prices are at record levels. Earnings are finally at levels that provide returns which justify new project developments and expansion of existing mines. While the current strength of the industry has attracted capital investment it has not yet attracted the most critical asset we need to continue this trend: more good people.

Statistics from the National Mining Association (NMA) show from 1995 to 2003 mining employment in the United States fell by 20%. NMA reported world mining employment declined from 1995 to 2000 by similar or even greater rates. China was down 34%, South Africa 30%, Canada 14% and the mining industry in the United Kingdom lost nearly half its workers. These reductions were often the result of greater efficiencies as industry responded to consumers' demands for lower prices. The indirect result, though, was the loss of skilled people, both miners and engineers.

While recent prices for production from the world's mines have almost immediately attracted investments from the capital markets, there is no such ready source of good people. It takes time to train, educate and develop people who can work in and manage the technologically advanced mining industry of the 21st Century. While there are great opportunities for our industry we are now finding ourselves unable to fully take advantage of these opportunities due to the scarcity of good people.

Norwest has seen this shortage world-wide, in all the industries we serve. We have also experienced first hand the difficulty in finding qualified engineers and technical specialists; however, we have successfully recruited new members to the Norwest team. Our senior staff is assuming a mentoring role for younger members. Senior engineers supported by technically skilled younger members form the teams we typically assign to our projects.

We have a philosophy within Norwest applied when assisting our clients. Norwest is called upon to provide support on projects where clients are also in the process of recruiting or developing staff. In these cases, we assure Norwest members assigned to projects also concentrate on helping our clients develop internal capabilities to deal with future issues without Norwest involvement. Though it may appear we are minimizing our prospects for future work, we know it is by providing value to our clients that we assure Norwest will be the consultant of choice.

Norwest and our employees are dedicated to the advancement of the international mining industry. Of all the challenges now before our industry, none is greater than the need to develop our human assets. People are what will make us successful, and the need for skilled miners and engineers has never been more acute. Norwest is committed to fulfilling this need, both within our company and with our clients.

▶ Bob Evans, President, Norwest Corporation (US);
Joe Aiello, President, Norwest Corporation (Canada)
John Wright, President, Questa Engineering (US)
Michael Day, President, Applied Hydrology International (US)

Ribbon Cutting Ceremony

MineExpo 2004

by **Donovan Symonds**

The ribbon cutting ceremony took place prior to the opening of MineExpo 2004 at the Las Vegas Convention Center on Monday September 27, 2004.

This is the largest mining convention and exhibition in the world and is held every four years. Attendance exceeded 30,000 delegates from all sectors of the mining industry throughout the globe. Donovan Symonds, Chairman of Norwest, was the co-chair of the four day technical session. A videotaped message from President George Bush was the surprise backdrop for the official opening ceremony. From his appearance on a giant screen in the LVCC lobby, the President sent his personal greetings to Nevada Governor Kenny Guinn, NMA President Jack Gerard "and everyone attending this fantastic exhibit of mining technology and know-how."



From left:

Donovan Symonds (co-chair of technical sessions)
Doug Hardman, President, J.H. Fletcher and Company (co-chair technical sessions);
Bill Tate, President and CEO, DBT and Chairman of MINExpo International 2004
Gov. Kenny Guinn, Governor of the State of Nevada
Jack Gerard, President and CEO National Mining Association
John Brinzo, Chairman and CEO Cleveland-Cliffs Inc. and Chairman National Mining Association
Brett Harvey, President and CEO Consol Inc.
Jim Roberts, President and CEO Foundation Coal Co.

Mozambique and the International Finance Corporation

by Andrew Scrymgeour

Mozambique has one of few remaining undeveloped premium deposits of low ash coal in the world. As part of an ongoing program to stimulate private sector economic development, the Government of Mozambique recently engaged the International Finance Corporation (IFC), the private sector arm of the World Bank Group, to seek a mining company to develop the Moatize Coal Deposit located in Tete Province.

To find suitable mining companies, the IFC followed their proven multi-step system consisting of first soliciting formal "Expressions of Interest" from companies and then requesting proposals from the most qualified companies. Bob McCurdy and Andrew Scrymgeour were invited by the IFC to join them in Mozambique to assist in evaluating the proposals.

The winning bidder was a consortium headed by Companhia Vale do Rio Doce (CVRD) of Brazil. It bid \$122.8 million for the rights to explore and develop the coal deposit.

CVRD's winning proposal is based on developing a mine with annual production capacity of 21 million tonnes run-of-mine per year. It is expected that about half of the mine output will be exported as high quality metallurgical coal and steam coal. Included in CVRD's proposal are feasibility studies for the development of a mine-mouth coal-fired power plant with a capacity of up to 1,500 MW, the development of adequate port facilities, and a rail link to the intended port. CVRD will also assess various other domestic industrial projects linked to the mine, including coking, steel, cement, aluminium smelting, and ferroalloy plants.

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Room at the end of the hall

In the basement of Norwest's office, there is a long hallway with a room at the end. Chris, one of our young engineers was sent into the basement to get some old files from the room in question, however he was confronted with a dilemma. At the near end of the hallway are three light switches, one of which controls the light in the file room. The door is closed and Chris cannot see if the light is on in the room from where he is standing. He needs to find out which one of the three switches controls the light in the room by making only one trip to the end of the hall. How can Chris do this with only a single trip to the room?

Be one of the next five lucky winners:

Five winners will be drawn from all those with correct responses submitted to Theresa Murphy by July 15, 2005.

Questa Spring Courses

Coalbed Methane

March 18, 2005, 8:00am - 5:00pm - Calgary, AB
8 CLE (Continuing Legal Education) Credits.

The Influence of Geology on Coalbed Methane Plays

April 13, 2005, 8:00am - 5:00pm - Denver, CO
May 19, 2005, 8:00am - 5:00pm - Calgary, AB

Coalbed Methane Reservoir Analysis

April 14, 2005, 8:00am - 5:00pm - Denver, CO
6 CPL (Certified Professional Landmen) Credits.
Sponsored by the Denver Section of The Society of Petroleum Engineers

Coalbed Methane Completions & Development

April 21-22, 2005, 8:00am - 5:00pm - Calgary, AB
12 CPL (Certified Professional Landmen) Credits.

Oil Field 101*

May 2 - 3, 2005, 8:00am - 5:00pm - Golden, CO
17 CLE (Continuing Legal Education) Credits.
12 RPL (Registered Professional Landmen) Credits.

Coming Fall 2005

Applied Oil & Gas Property Evaluation
Canadian Coalbed Methane Water Management
Maximizing Coalbed Methane Asset Value
Enhanced Oil Recovery Processes

For further details, email questa@questa.com or call 303 277 1629.

The answer to
September's 2004
Gold Bar riddle.

Marsha is pretty fleet of mind and came up with the solution on her own. She knew she needed a one-unit piece to pay Calvin on the first day. She decided to make the second (and final) cut to the bar by making a two-unit piece and a four-unit piece. At the end of day two, she gave Calvin the two-unit piece and he returned the one-unit piece.

On day three, she gave Calvin the one-unit piece, giving him a total of three for his three days of work.

On day four, she gave Calvin the four-unit piece in exchange for the

last issue's
riddle answer:

three previous units and so on until the end of the week. (day 5, four-unit piece plus one-unit piece; day 6, four-unit piece plus two-unit piece minus one-unit piece; day 7, four-unit piece plus two-unit piece plus one-unit piece).

The previous five winners from last issue's riddle were:

*Luc Savoie, Calgary, AB, CANADA
John Innis, Calgary, AB, CANADA
Harry Nagel, Houston, TX, USA
Gregory E. Lindley, Salt Lake City, UT, USA
Peter Hartwell, Bethesda, MD, USA*

Congratulations to all the participants and winners who demonstrated their abilities in problem solving and having fun with last issue's riddle. A job well done!



Sinopec and Norwest reps with Canadian Trade Minister Peterson.

Norwest Corporation in China

Since Norwest opened its Beijing office in June, 2004 the firm has focused on developing business with western resource companies interested in entering China and on Chinese corporations interested in entering North America. JiuHong (Joe) Guo is the General Manager of the Beijing office and is responsible for all the regular contacts with potential clients within China.

On January 21, 2005 in Beijing, Norwest signed a Framework Agreement on consulting services with the major Chinese petroleum corporation Sinopec. Sinopec is one of three major Petroleum corporations in China which have been active in evaluating oil sands investment opportunities in Alberta over the past year or more. Norwest's Sinopec agreement forms a basis to negotiate scopes of work and commercial terms for consulting services related to regional geology studies and resource estimation methodologies.

Norwest and Sinopec used the opportunity created by the visit to China by

Canadian Prime Minister Paul Martin and Trade Minister James Peterson to execute the Framework Agreement in Beijing as part of the Canadian Trade Mission. The signing was witnessed by several senior Canadian trade and embassy officials.

At the same ceremony Norwest signed a Memorandum of Understanding with China United Coalbed Methane Co. Ltd. on behalf of a Canadian client company, TerraWest Energy Corp. (TWE) which is pursuing coalbed methane projects in China. Norwest provides a range of professional services to TWE.

These signings illustrate both sides of the resource investment equation which Norwest is attempting to assist, foreign investment in China and Chinese investment in western countries.

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NORWEST
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