

## Norwest Provides On-Site Technical Services to Grande Cache Coal Corporation by David Miller

Norwest is expanding its services to meet a growing need in the mining industry. Requests from our clients for on-site technical services have increased as mining companies experience a shortage of experienced senior engineering staff. Clients are finding they have a need for supplemental technical support in areas such as:

- Permitting
- Certified plan preparation
- New procedure implementation
- Ventilation design and ground control

These types of projects represent some of the requests Norwest has responded to in the past year and Norwest has risen to the call by increasing staff and associates.

One such project is with Grande Cache Coal Corporation (GCC) headquartered in Calgary, Alberta. Mining operations located north of Grande Cache, Alberta are a mix of surface mining in rugged terrain, small area underground mining, and a preparation plant working to produce high quality metallurgical coal for the export market. The client's initial request was for small rapid turnaround projects that may require a single site visit to resolve. As their service requirements have increased, GCC has asked Norwest to provide an on-site engineering presence to respond to both day to day

needs and longer range project goals. A brief summary of some of the services Norwest is currently providing to GCC is provided below.

**Permitting** – Norwest is assisting on both an underground mine application and a technical modification for the preparation plant circuit expansion and improvement. Norwest provided technical expertise in the application preparation as well as technical plans and figures for amending the current permit.

**Certified Plan Preparation** – Alberta mining regulations require the preparation of certified plans involving ground control, ventilation, and the technical evaluation of mining installations. This includes the location of refuge chambers in any area where mining will be adjacent to underground hazards and outcrops.

**New Procedure Implementation** – As part of its overall strategy to continually improve its operations, GCC is enhancing the safety of work practices in retreat mining with the implementation of newer technology. Mobile roof supports are being used to replace timbering in the current underground mine. While timbering had been in practice for a long time, Norwest, along with the equipment manufacturer, are providing the recommended design and safe work procedures necessary for the operation of this new equipment.

**Ventilation Design, Ground Control, and Mine Forecasting** – Changes in the Alberta regulations regarding ventilation have required the operation to modify current ventilation



**Future Location of the New 12 South B 2 Underground Mine**



**Grande Cache Coal Corporation 4 Seam Entry from South Side Control**

practices. Air course isolation, face ventilation, and seal installation are a few of the concerns being addressed. Ground control hazard mapping conducted by geologists and geotechnical engineers are conducted on a quarterly basis. These inspections identify ground control issues requiring rehabilitation, evaluate current practices and provide optimized installation plans for the ever changing conditions at the mine. Monthly mine forecasting provides mine management key planning information as one mine moves toward closure and another is preparing to begin production.

The project requirements have evolved to include several of the Norwest disciplines:

**(cont'd on pg5)**

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# Serving the Energy and Minerals Spectrum

**President's Message** by Jim Thomson

This edition of the Norwester covers the breadth of the energy and mineral spectrum within which Norwest provides services. Norwest supports the energy, mining, and natural resource sectors, and over our 30+ years in business, the variety of projects and commodities we have been involved in has continually grown. In fact, Norwest's employees often comment on the variety of projects as one of the main reasons they enjoy our company. Commodity markets, like national economies, tend to be cyclical, and it is prudent for Norwest to be active in many sectors to help smooth out the peaks and troughs. Some markets are more volatile than others.

After hitting a price spike in 2007, uranium prices fell precipitously, but started rebounding in 2010. While most uranium is mined underground, insitu leaching has seen renewed interest, requiring accurate hydrogeologic characterization of formation permeability and flow. Landon Beck's article describes a growing project in Wyoming

for the world's largest uranium mining company.

Gold has more than doubled in price over the last 5 years, leading to increased exploration and mining activity, from Mongolia to British Columbia (article by Calvin Boese on Eldorado Gold).

The energy world is rarely out of the news. Price increases for both thermal and metallurgical grade coal have led to new mine developments (see the article by David Miller on Grande Cache). All our field projects require a continued strong commitment to health, safety, and the environment (see article by John Pilgrim on HSE).

As energy needs grow, environmental regulations do not seem to be decreasing. Coal mining, coal-bed methane, and shale gas production all require water management, treatment, and disposal expertise, and new tighter standards for selenium pose a growing challenge.



**Jim Thomson, Senior VP, Denver**

This wide variety of projects is matched by Norwest's range of services, from geology to field services, permeability testing to geotechnical analysis, mine design to environmental permitting.

## TFF - The Future Found

By Sat Pandher



**Malawi School Children**

I recently travelled to Malawi, East Africa to visit the project site of a charity that I have been involved with. The current project revolves around building a primary and secondary school near the community of Chintheche in the Nkhata Bay district of Malawi. It is currently in the approval stage and, as such, there are community consultations and open houses (sounds a lot like getting a mining permit) being held

to ensure that the project will meet the needs of the people in the area. I was able to spend a week touring the area, checking out the project site with Diane Boles (the founder of TFF) and the Chief of the area, and even participating in a bit of soil sampling.

The project will be utilizing a Rammed Earth construction method; this is different from the "normal" brick and mortar construction that is being

used in the area right now but is a throwback to more traditional construction that was used many years ago. The construction is scheduled to begin this August and will continue for approximately 8-12 months (weather dependent). It was an amazing experience to see and meet some of the people in the community who will hopefully benefit from this project. The warmth of the Malawian people is something that I will not

soon forget.

Sat Pandher is a mining engineer based in Norwest's Vancouver office. You can e-mail or give him a call if you have any questions regarding this project, TFF or donating in Canada, as he would be happy to chat about it. Also, check out the website for more information. [www.thefuturefound.org](http://www.thefuturefound.org)



**Sat Pandher Soil Sampling with the Chief**

# Kisladag Gold Mine Rock Storage Design

by Calvin Boese

Eldorado Gold Corporation is a Vancouver-based, international gold producer with five operating mines, including the Kisladag mine in west-central Turkey. The Norwest Vancouver office has been involved in this project since 2002 when we created a conceptual rock dump design prior to the start of production.

The Kisladag gold mining project area lies on the western edge of the Anatolian Plateau at an elevation of approximately 1,000 meters, in gentle rolling topography. The closest large population center is Usak, 35 kilometers to the northeast. The ore deposit at Kisladag is typical of a porphyry gold system with mineralization forming concentric shells around a central intrusion. Eldorado has extracted approximately 45 million tonnes of ore and host rock since mining commenced in 2005 using truck-shovel methods. The ore is processed by heap leaching.



View of Kisladag Development Rock Pile and Runoff Collection Ponds, Looking South

In late 2010, Norwest completed a modified design for additional mine rock storage. The design included a mine rock placement schedule, a water management plan, geotechnical stability evaluations, and a reclamation plan for final closure. The plan was designed to manage 182.5 million tonnes of mine rock, produced from 2010 to 2015, in a manner that ensured geotechnical stability and minimized the environmental impacts of acid rock drainage.

## The Plan in Detail

Important features of the plan are a lower lift of oxide rock and sequencing that allows for progressive reclamation. Each phase is designed to minimize the exposure time of the sulfide material to the environment, while maintaining realistic haul profiles. This is achieved primarily through final contouring and covering of the surface, but also through separate management of sulfide and oxide materials for cover placement. By staging the placement of sulfide rock and stockpiling oxide rock for cover material, successful phasing of the rock pile construction will significantly decrease the amount of cover material re-handled and

reduce potential environmental impacts.

Stability evaluations were carried out to assess stability during construction and after re-sloping the final face for closure. The mine is located in a highly seismic zone and seismic displacement analysis was completed for final rock pile configurations. Experience from Western Canada was drawn upon to provide operating and construction guidelines, as well as enhance worker safety. The main issues for long term stability were cover integrity and erosion control to preserve environmental integrity.

A water management plan was advanced in coordination with the rock placement plan, and included mitigation measures for sediment and erosion control and for minimizing acid rock. A no-discharge policy was implemented at the rock pile facility where all mine affected water will be kept in a closed circuit. Mitigation measures included diversion ditches for clean water and collection ditches, ponds for mine affected water and for sediment control measures around the rock pile area.

The final re-contoured rock pile surface will be capped for reclamation with a store-and-release cover to minimize acid rock drainage at Kisladag. The cover design relies on storage of excess moisture within the soil's pore spaces during wet portions of the year and release of moisture through evapo-transpiration during the dry season, thus reducing percolation of water into the underlying mined rock. It was recommended that a progressive reclamation plan be implemented through the mine life, including the re-grading, cover placement, and re-vegetation of the rock pile surface as the platforms are completed. The final reclaimed surface over the final rock pile configuration covers an area of approximately 134 hectares.



Top: View of Kisladag Development Rock Pile Looking North  
Bottom: Reclaimed Portion of Development Rock Pile on the West Portion of the Facility

## Norwest Employees in the Spotlight

**Cathy Begej** (Denver) has recently re-elected to a second year as the Board Secretary of the Colorado Section of the Society of Mining Engineers.

**Darin Dority** (Salt Lake City) recently earned his PEng credentials in Alberta.

**Robert Evans** (Salt Lake City), Norwest Corporation and Michael McLanahan were appointed 2012 Program Co-Chairs by the Manufacturers and Services Board of Governors of National Mining Association. The Co-Chairs are responsible for the Technical Paper portion of MINExpo 2012 in Las Vegas. MINExpo is the largest mining exhibition in the world.

**Robert Evans** (Salt Lake City) completed the "Financial Literacy Program for Executives and Directors" at the Rotman School of Management at the University of Toronto in April. The program is sanctioned by the Institute of Corporate Directors. The program provides a context for the use of financial information and builds a framework for strategic thinking based on solid financial measures.

**James Faraday, Erin Golko and Theresa Lavender** (Calgary) serve on the Executive Committee of the Canadian Institute of Mining's Calgary Branch.

**Rosalyn de la Pena** (Calgary) has been appointed to serve on four separate committees for the Society for Mining, Metallurgy and Exploration (SME).

**Rick Reinke** (Denver) presented a poster for the Devils Hole 2011 Workshop May 4-6, 2011, on "Nye County Natural Gradient Tracer Testing" at the Nye County Commissioners' Chambers in Pahrump, Nevada. Pedro Vaca (Calgary) and Ryan Marsters (Denver) helped prepared the poster which describes tracer tests used to calibrate a numerical groundwater flow and transport model for the Nye County Nuclear Waste Repository Project Office.

**Michelle Surette** (Calgary) has been appointed to CSPG's Recovery 2011 Committee under the Earth Science for Society Outreach Initiative.

**Jim Thomson** (Denver) will speak at the Second International Conference on Process Engineering – Efficient Carbon Capture for Coal Power Plants in Frankfurt am Main, Germany, held June 20-22, 2011. The paper is titled "The Alberta Saline Aquifer Project" and will cover the feasibility and economics of geologic carbon sequestration.

**Tony Toney** (Evansville, IN) presented the paper, "Evaluation of a Plant Performance Upgrade using Computer Simulations" at the Society of Mining, Metallurgy, and Exploration meeting on computer simulations at coal washeries held in May 2011.

**Keith Wilson** (Calgary) has been appointed APEGGA Experience Examiner for new applicants and Chair for the Professional Practice Examination Committee. Keith also serves on the Alberta Chamber of Resources - Mining Industry Advisory Committee

## Why Is This Man Smiling?

by Kirk Weber

Does Sean Ennis (Vancouver office) realize he's at the starting line of the Adventure Xstream race, a grueling backcountry multisport torture-fest held in remote desert canyons outside Moab, Utah? He and CanAm team-mate Kirk Weber (Salt Lake City office) endured a 28-mile mountain bike ride (including a thigh-trashing 3,000 ft mountain climb), 300 ft rappel off a sheer canyon wall, 7-mile slickrock trail run, and 14 more miles on the mountain bike before finishing with a hypothermic 10-mile paddle down the frigid Colorado River in an inflatable kayak rapidly losing its air! Were they smiling after finishing with a respectable 8-hour time? We'll never know, although the pair did say at the

end they "had nothing better to do on an April Saturday morning."



PRESIDENT'S  
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AWARD



FINAL CLOSURE POND 1  
OIL SANDS

Overall Environment and Sustainability  
Team Award 2010

President's Award 2010



## Suncor President's Award

Norwest's Vancouver geotechnical group was recently recognized for its work on the Tailings Pond 1 closure project at Suncor's Oil Sands Mine, near Fort McMurray, Alberta. Sean Wells, P. Eng, Manager of Research Engineering at Suncor and team lead for the project, acknowledged the work by Norwest's Vancouver geotechnical engineers by presenting them with a plaque representing a share in his team's reception of the 2010 Suncor President's Award. The award was

presented following Suncor's completion of closure activities on their Tailings Pond 1. Norwest's part in the closure project involved the design and implementation of a geotechnically stable cap over an 11 hectare area of soft tailings. The cap now provides a trafficable surface for carrying out further reclamation activities and monitoring the tailings consolidation.

# Norwest Contributes to ISR Uranium Development

by Landon Beck



**SRHO Pumping Test Equipment Preparation**

Globally, the demand for uranium for nuclear power generation continues to increase. With this demand, both major and junior uranium producers are stepping up their exploration and production programs. Norwest has been assisting Cameco Resources with the expansion of the Smith Ranch-Highland Operation (SRHO) in Wyoming. Cameco Resources is a subsidiary of Cameco Corporation, headquartered in Saskatoon, Saskatchewan, Canada, one of the largest uranium producers in the world with major operations in Canada, Kazakhstan, and the US, and in development in Australia. Since late 2010, Cameco has undertaken a significant growth plan with a global target to double its current uranium production by 2018.

SRHO is an insitu recovery (ISR) mine site operating since 1988, whereby uranium is dissolved in a mildly oxidizing lixiviant which is injected into the ore zone and produced from groundwater pumped from sandstone aquifers at depths to 1000 feet below ground surface. ISR is a well-established method to produce low-grade uranium ore in commercial quantities for processing suitable for sale and international distribution. SRHO, the largest uranium production facility in the United States, is dedicated to responsible development and maintains an extensive Safety, Health, Environment and Quality Department (SHEQ) and culture.

As with any ISR process, full hydrogeologic characterization is critical to proper resource development. With respect to operations in Wyoming, this includes satisfying Cameco Resources' design and operations needs as well as complying with regulations set forth by the Wyoming Department of Environmental Quality and the U.S. Nuclear Regulatory Commission. Prior to issuance of a permit to mine by the regulatory agencies, hydrologic testing must be completed to satisfy numerous

requirements.

These requirements include:

- determining the hydrogeologic characteristics of the production zone aquifer,
- demonstration of hydrologic communication between the production zone aquifer and the production zone aquifer monitoring wells,
- determination of potential hydrologic boundary conditions, and
- evaluation of hydraulic communication between the production zone aquifer and the underlying and overlying aquifers, if any are documented.

Since 2009, Norwest has conducted field services for numerous extensive aquifer tests by means of conventional pumping and recovery tests with up to 74 observation wells per test. Each observation well is instrumented with data logging pressure transducers for groundwater level measurements. With

support from the Cameco Resources Maintenance Department for electric submersible test pump installation and removal, Norwest operates pumping tests up to 72 hours in duration. The production and monitoring wells are then allowed approximately one week to recover to pre-pumping water levels, with level data logging continuing through this period. In addition to field services, Norwest is tasked with test data management, analysis, interpretation, and reporting. Norwest is also supporting ongoing development with flow and transport groundwater modeling utilizing MODFLOW.

Norwest looks forward to continuing a long-term relationship with Cameco Resources and its parent company Cameco Corporation.



**ISR Uranium MDK Testing**

## Norwest Provides On-Site Technical Services to Grande Cache Coal Corporation (cont'd from pg1)

- Process and Facilities Engineering – Norwest has assisted with a preparation plant modification to increase the recovery of fine coal.
- Environmental Engineering/Hydrology – Norwest has helped with float dust mitigation, recovery planning, wells for additional water supply for the preparation plant, and with water balance and site drainage for the new underground mine.
- Construction and Project Procurement Management – Norwest has helped with preparation of AFEs, bid and contract packages for the new un-

derground mine, on-site construction management for a dust control mitigation installation, and the development of the new underground mine.

- Surface Mine Engineering – Norwest assists with annual budget preparation and training of young engineers to safely work in the field with pit coordinators.

Norwest will continue to meet the changing demands of the industries we serve by adapting our services to meet our client's needs. This project is only one example of the breadth and depth Norwest has to offer.

## CSPG Recovery Conference 2011 by Eric Swanbergson

Norwest was a featured exhibitor at this year's Canadian Society of Petroleum Geologists Conference in Calgary, Alberta. This was the first time that Norwest has organized a display for the event and our presence was well received by those that dropped by either to visit our team or to learn what Norwest has to offer.



**Employees at the Norwest Booth, Rob Moloney, Sue Carr, Trevor Keating and Rachel Sawyer.**

We used the opportunity to introduce our new software, CoreRelate, to the industry and were pleased with the positive feedback. Our programmers are continuing with further

enhancements to CoreRelate that will meet and exceed the needs of our clients.

We would like to take this opportunity to thank the Norwest employees that planned and organized for the CSPG event, as well as, those that welcomed visitors to our booth during the conference. We couldn't have done it without their efforts and commitment. Thanks.



## Health Safety & Environmental Program

Norwest prides itself on the quality of its Health, Safety and Environmental program and its ability to maintain an incident-free work environment. To this end, we maintain certification under the Certificate of Recognition (CoR) program sponsored by Alberta Occupational Health and Safety. In addition, we undertake an annual internal audit of the health and safety management system utilizing the skills and experience of a certified external auditor.

Norwest encourages a continuing emphasis on the identification of potential hazards, implementation of control measures, worker competency and training coupled with effective emergency response planning and incident investigation.

Our goal is to complete projects in a timely manner without incident, ensuring that we avoid personal injuries, property damage and/or adverse environmental impact.

## Long Standing Relationship by Eric Swanbergson

Starting in 1999, Norwest began working with UTS Energy Corporation to help with the acquisition and exploration of their oil sand properties north of Fort McMurray, Alberta. Since that time a lot has changed, not only for their land holdings but also for the personnel that work at both companies.

which is active in the exploration and development of oil sands in the Athabasca Basin. In the winter of 2011, Norwest provided technical and management support for SilverBirch's field exploration program and will help with the management and interpretation of the new data.

In 2005, Norwest was asked to participate in the exploration of their recently acquired oil sands leases and that relationship has continued through these past 6 years as we have worked together to better define the resource potential of their properties.

The long term working relationship between Norwest and the management team at UTS, now SilverBirch, is based on strong personal connections and mutual respect; a winning combination for all.

In October of 2010, UTS was acquired by a major petroleum company, but some of their assets were sold to a new company, SilverBirch Energy Corporation. Most of the UTS management team moved to SilverBirch,

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