




Message from the President of Golder Associates

At Golder Associates we strive to provide beneficial technical solutions to our clients practically everywhere on earth. It is not unusual for a team of Golder people to work for a client who is based in Europe, but has an oil field in South America or a mine in Africa. In order to do this effectively, we have built the Golder Associates group of companies to serve global clients through our local offices. The term we coined internally to reflect this unique capability is "glocal." While the Oxford English Dictionary doesn't recognize the word, this term is becoming well known within Golder. This issue of Technically Speaking definitely reflects our glocal capabilities. From our award-winning flood control work in China to our environmental permitting work at a mine in northern Sweden, the solutions we provide to our clients, some of which are described herein, are far afield and technically challenging.

I would like to also take a moment to introduce the readers of Technically Speaking to an initiative that we recently started – the Golder Trust for Orphans. The primary objective of the Trust is to provide support to children who have been orphaned or displaced by the AIDS epidemic in Africa, and to provide for the care and counseling of the families and dependents of persons affected with HIV/AIDS. More about this endeavor is described in the article about our team that is presently riding in the Tour d'Afrique – a grueling bicycle relay race that runs the length of the African continent.

Thank you for your continued interest in our activities and please contact us if you have any questions or would like to learn more about any of the projects described in this newsletter.


Frederick W. Firlotte

PROTECTING a Chinese river basin

THE FIVE MILLION PEOPLE IN THE SIHU BASIN IN CHINA HAVE LONG LIVED WITH THE THREAT OF FLOODING, WHICH CAUSES ECONOMIC DAMAGE, SOCIAL COSTS AND CAN SPREAD WATER-BORNE DISEASES SUCH AS SCHISTOMIASIS.

A complex flood control system manages water flow in an area of about 11,500 km². Despite having over 2,000 km of canals, many sluice gates and pump stations, and two large flood regulation lakes, the system has not always protected the region.

That danger has been reduced, thanks to Golder's work in developing a sophisticated Decision Support System (DSS) that helps local authorities manage water flow. Golder's work on the DSS was part of the larger Yangtze

Basin Water Resources Project, financed by the World Bank.

The DSS uses a database of historical and real-time information on water flows, advanced computer models, an expert system with artificial intelligence capability and user-friendly interfaces. Innovations include using "fuzzy" mathematics to simulate human behavior in operating the drainage systems.

The Hubei Water Resources Bureau, the recipient client, commented that "The economic benefits to date far exceeded



our initial expectations." The World Bank praised the project as "path-breaking work in China and one of the most successful water resource technical assistance programs funded by the World Bank in China."

Application of the Sihua DSS to date has averted flood damages of over US\$20 million.

Fast-tracked project in BRAZIL

DEVELOPING THE NATURAL RESOURCES OF THE AMAZON REGION HAS LONG BEEN A NATIONAL PRIORITY FOR BRAZIL. HOWEVER, THE REGION IS ALSO AN ENVIRONMENTAL TREASURE FOR THE WHOLE WORLD. BRAZILIANS HAVE FOUND THE WORLD WATCHING CLOSELY AS MINING AND OTHER RESOURCE EXTRACTION OPENS UP THIS HUGE AREA.



This has meant that it was particularly crucial for the country's first large copper mine, Mineração Serra do Sossego, located in Pará state, to be operated in an environmentally appropriate way. From a hydrological perspective, the area of the mine is challenging, with rainfall averaging 1,800 mm per year, almost all of it between November and March.

Yet the mine is also important to Brazil's future, with an estimated 255 million tons of ore reserves, and average grades of one percent copper and 0.3 g/t of gold.

Accordingly, Companhia Vale do Rio Doce (CVRD), Brazil's biggest mining company and one of the largest in the world, called Golder to see about ways to protect the environment.

Staff from Golder's Belo Horizonte office led the designs, conducting environmental, geotechnical, hydrogeotechnical and hydrogeologic work. Golder was involved in the preliminary studies, pre-feasibility and feasibility phases, basic and detailed designs, construction technical supervision and complementary studies.

Golder's work for CVRD, including studies, designs and technical support to the construction, started in 1999 and was completed in December 2003. Since then, Golder has been developing technical support for the CVRD operation team. The client has benefited from a fast-track process and significant cost reduction.

BUILDING PIPELINES beneath Arctic waters

THE WATER OFF SAKHALIN ISLAND, ON THE EASTERN COAST OF RUSSIA, IS A HOSTILE PLACE.

Oil production there must deal with the need to protect the environment while coping with its challenges, one of which is drifting sea-ice.

The undersea pipelines carrying oil from the production platforms and under three different bodies of water to the tankers must be protected from damage as this ice moves and sometimes gouges deep into the ocean bed.

The solution has been to bury the pipelines in undersea trenches. The question for oil companies has been – how deep a trench is deep enough? Digging too shallow risks damage from the ice and from seabed displacement, and digging too deep causes its own environmental problems, as it disturbs a wider swath of the seabed.

Traditionally, engineers have used small-scale physical models to determine the optimum depth for a trench. As well as being slow and costly, this modeling method can lose accuracy when the

findings of these 1 to 100 or so models are scaled up to "real world" size.

Accordingly, Golder has pioneered the use of computer-generated numerical modeling to estimate soil displacements below ice keels.

This technique consists of building a computerized model of the seabed, pipeline and ice, and then "moving" the ice to see the depths to which its effects are felt. This is more realistic in some cases, in part because the simulations are full-scale and more scenarios can be analyzed.

This project is another example of Golder's ability to go to the farthest ends of the earth, and to the depths of the oceans, to meet the needs of our clients.



Photo courtesy of Ken Croasdale of K.R. Croasdale and Associates

MONITORING contaminated sites – remotely

FOR MOST OWNERS OF PROPERTY WITH CONTAMINATED SOIL, THEIR OBJECTIVE IS TO FIX THE PROBLEM RELIABLY AND QUICKLY, WITH MINIMAL COST AND DISRUPTION TO THEIR OPERATIONS.

For Golder Associates Innovative Applications (GAIA) Inc., this means a need to develop a way to offer efficient remediation, with minimal disruption, and increased cost savings to the client.

Use of new communications technologies has been key. Clients at some 30 soil remediation sites across Canada get the benefit of on-site automated monitoring systems that can issue an alarm whenever there is a malfunction or problem, such as a pump shutdown. The system alerts technicians, who are equipped with pagers and laptop computers.

In many cases, the problem can be fixed remotely, so that the system gets back to work promptly, without the need for a technician to travel to the site. It also means lower costs for the clients – and fewer disruptions to operations from technician visits.

The remote aspect has another benefit in real-time information being available to technicians, so they can monitor progress and prevent problems from becoming serious. This is a significant advantage over technicians having to visit each site periodically to gather performance data.

While installation of the equipment may require some up-front client investment, the expense is often repaid in short order. Because of this remote monitoring capability, soil remediation sites virtually anywhere in the world can be monitored effectively.





Team helps Dubai cope with economic growth

DUBAI, THE BUSINESS AND COMMERCIAL CENTRE FOR THE UNITED ARAB EMIRATES, HAS A RAPIDLY GROWING ECONOMY, AND A PRESSING NEED TO EXPAND ITS TRANSPORTATION INFRASTRUCTURE. THIS INCLUDES WIDENING AND UPGRADING THE 40 KM STRETCH OF FOUR-LANE HIGHWAY THAT CONNECTS THE TOWN OF LIHBAB AND THE PORT AT JABEL ALI.

The highway sustains heavy commercial traffic, including fully loaded trucks from a rock quarry. The major challenge for the rehabilitation design is to cope with projected growth in traffic, as this area of Dubai continues to attract commercial development. The current traffic on the highway is expected to grow from 2,500 vehicles per day now, to 32,000 in 15 years. That is eighteen percent per year — in vivid contrast to average North American and European growth rates of less than two percent.

The Dubai Municipality asked Cansult Limited and Golder Associates to design this six-lane highway upgrade.

Thanks to the excellent road condition records and structural evaluation surveys conducted by the Dubai Municipality since the highway's 1977 construction, we were able to develop an accurate picture of the highway's

subsurface condition, and develop plans, with minimal use of destructive testing such as boreholes and coring.

Based on this analysis, Golder Associates' pavement engineers were able to segment the 40-km-long highway into sections of uniform condition and identify the most cost-effective rehabilitation strategies for each. One of the challenges of the project is the fact that one side of the highway had deteriorated much more than the other, as it sustained the weight of loaded gravel trucks, which were empty on their return journey. The need to do the work cost effectively, as well as to minimize the environmental impact of any waste generated, means that virtually all of the material in the existing highway will be re-used.

Cansult Limited is currently preparing the design drawings so that the project can go to tender for construction later this year.

Geophysics probes into history

UNDERSTANDING SUBSURFACE RISKS BY WAY OF EXCAVATION, DRILLING AND TRENCHING ARE EXPENSIVE, TIME CONSUMING AND POTENTIALLY RISKY ENDEAVORS. THE USE OF GEOPHYSICAL TECHNOLOGIES AND EXPERTISE CAN BE AN EFFICIENT, COST-EFFECTIVE AND NON-DESTRUCTIVE MEANS FOR GATHERING SUBSURFACE INFORMATION.

Ever since controversial Teamsters union boss Jimmy Hoffa disappeared in 1976, there has been speculation that he is buried somewhere under Giants Stadium in New Jersey.

Working under their motto, "Leave no urban legend untested", producers of the "Mythbusters" program on the Discovery Channel called in Golder to investigate. Our geophysicists conducted a test in San Francisco with ground penetrating radar (looking for two test objects buried in concrete) and, following the successful test,



traveled to New Jersey and scanned selected areas where Hoffa was supposed to have been buried. No body was found but the show on Discovery was great!

To meet increased traffic demands, planners in the Seattle area wanted to expand the capacity of the floating bridge that carries Highway 520 across Lake Washington. Golder geophysicists used sonar to map the lake bed and sediment along the proposed route.

During the investigation, three sunken vessels were found in the right-of-way for the bridge anchors. This necessitated developing an expanded investigation using underwater video and deep-water professional divers to determine if the vessels posed an environmental hazard or if they were of archeological significance. The discovery was of considerable interest to the local community and the operations were filmed for a local TV show.

History tells us that Spanish conquistador **Hernando Cortés**, on his way to plunder the Yucatan in the mid-1500s, left his sick

horse in a village along the way. The local people, who had never seen such an animal, worshipped it, and when it died from eating food prepared for gods and not for horses, made a stone carving in order to continue their worship. Upon his return to retrieve his horse, Cortés and his entourage, which included members of the clergy, were incensed at seeing the idol and threw it into a lake — which lake is unknown.

Golder's geophysicists, called in by archeologist Richard D. Hansen, used side-scan sonar and underwater video to search portions of Lake Peten (near the Tikal Ruins) to attempt to find the statue. Although the search was not successful (may have been the wrong lake!), Golder has been contracted by Dr. Hansen to use geophysics to image through the walls of Mayan Pyramids to assist in locating burial chambers. This work will continue this coming year.

Gold mine in SWEDEN balancing economic benefits with environmental commitments



Environmental, political, economic and technical issues are significant challenges when proposing and operating a mine in any part of the world today, but particularly the case in the location of the Svartlinden gold mine in northern Sweden.

As a lead consultant on this project, Golder Associates was involved in a range of tasks including environmental permitting; water management and design of the open pit, tailings storage facility and waste rock disposal.

In part, the future viability of Sweden's mining industry depended on finding an environmentally acceptable way to

be developed — even in areas with high natural values and with new and more strict environmental requirements.

One issue that we helped address was to minimize the impact of the mine's location, which is on a traditional reindeer migration route used by the indigenous Sami people. As well, the mine is adjacent to a European Protected Habitat Area, principally intended to protect a population of freshwater pearl mussels downstream.

We also evaluated the treatment of tailings water and the future decommissioning of the mine. This included the need to protect the environment from the impacts of metals such as arsenic found naturally in the ore body, cyanide from the processing of the gold ore, and from the effects that weathering would

have on the sulfide-bearing tailings if exposed to air.

Golder developed technical solutions that contained a number of elements — a tailings storage facility using Best Available Technique with disposal underwater both during operation and after decommissioning, an embankment made with hundreds of meters of waste rock support that would reduce the risk of dam failure and protect the downstream valley from being flooded, ways to deal with the possibility of a catastrophic flood and ways to treat and recycle process water to prevent the discharge of process water to the environment.

Construction work has started at the mine and production is expected to start in the summer of 2004.



mine the ore body, as it demonstrated that new mines can

Tour d'Afrique – the great cycling challenge from Cairo to Cape Town

It is 120 days of heat, rough roads, exhaustion and lack of showers –

but Golder's participation in the 2004 Tour d'Afrique bicycle race is not all about fun. The eight Golder staff participating in

the relay race from Cairo to Cape Town have the serious purpose of helping raise awareness regarding the pandemic of HIV/AIDS that is sweeping Africa.

During the ride, described as the world's longest and toughest cycling event, the Golder team will promote the need to help children affected by the loss of their parents to HIV/AIDS related illnesses.

Our participation in the Tour is the kickoff event for the Golder Trust for Orphans, which helps affected children directly, as well as encouraging Golder staff to volunteer their talents to helping them.

The Trust will also promote and fund the concept of linking orphan

support initiatives, such as farm-based child care centres, with commercial (profit generating) agricultural projects.

Golder Associates has provided initial funding for the Trust and we will continue making contributions in the future. In addition, our employees worldwide are being encouraged to contribute ideas, energy, money and time to the Trust.

We also welcome participation from our clients, partners and suppliers. For interested cyclists, you can learn more about the Tour d'Afrique challenge on their website at: www.tourdafrique.com. For further information on contributions to the Trust or Trust projects, contact Jon Rutherford (jrutherford@golder.co.za) or Jon Howcroft (jhowcroft@golder.co.za).



For more information about projects featured in this newsletter, please contact us at: solutions@golder.com. Electronic versions of the newsletter are available at www.golder.com. Just follow the links to our "Library" and "Newsletters".

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