

# **CANADA-BRAZIL TECHNOLOGY TRANSFER FUND**

a proposal for:

## **NORTHEASTERN BRAZIL GROUNDWATER PROJECT**

### **Concept Paper**

Submitted to

**THE CANADIAN INTERNATIONAL DEVELOPMENT AGENCY  
(CIDA)**

and

**AGÊNCIA BRASILEIRA DE COOPERAÇÃO  
(ABC)**

by

**GEOLOGICAL SURVEY OF CANADA  
(GSC)**

**COMPANHIA DE PESQUISA DE RECURSOS MINERAIS  
(CPRM)**

**ASSOCIAÇÃO BRASILEIRA DE ÁGUAS SUBTERRÂNEAS  
(ABAS)**

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## **SUMMARY**

The Geological Survey of Canada (GSC), Companhia de Pesquisa de Recursos Minerais (CPRM) and Associação Brasileira de Águas Subterrâneas (ABAS) are joining forces in soliciting financial support from the Canadian International Development Agency (CIDA) in order to provide much needed relief to the populations of the drought stricken areas of northeastern Brazil. The proposed program will transfer Canadian technology applied to groundwater research and management. Specific areas where Canada can make a significant contribution include satellite imagery interpretation, airborne and ground geophysics, hydrogeology, hydrogeochemistry, groundwater systems modelling, groundwater pollution assessment and remediation, and more.

The principal outcome of the project will be to improve the water supply situation, in terms of both quality and quantity, in the areas of northeastern Brazil that are susceptible to severe drought conditions. This will be achieved by enhancing the capability of Brazilian institutions involved in groundwater research and management, to carry out appropriate surveys and studies using state-of-the-art technology. Long-term linkages between Canadian and Brazilian private and public institutions involved in groundwater research and management will be established to ensure that the new technologies continue to be applied beyond the duration of the project.

## **CANADA-BRAZIL TECHNOLOGY TRANSFER FUND**

### **NORTHEASTERN BRAZIL GROUNDWATER PROJECT**

#### ***CONTEXT***

Northeastern Brazil is struggling with one of the worst droughts of this century. Recent headlines have announced extraordinary measures to be taken by the federal and state governments in order to help the population cope with the disaster. Cases of civil unrest have already been reported in some areas.

Northeastern Brazil is the most populated semi-arid region on earth. Twenty eight million people in nine states live within the drought stricken area. And because the drought is cyclical rather than permanent, governments have been slow to implement large-scale projects that would effectively bring the relief needed to the region. For example, plans for the construction of pipelines to bring water from the São Francisco River and other large watersheds, have been put on hold and/or postponed indefinitely, because of the enormous costs involved.

In the meantime, the population suffers deeply for having to rely on the very inadequate supply of often-contaminated local water, or on water brought in by tank trucks. But increasingly, efforts are being directed towards improving the supply of locally derived water, mostly groundwater, by earth science sector institutions such as the federal and state geological surveys, universities, and several environmental and water management organizations based in the region.

Groundwater is a viable option for improving the plight of the population because, unlike in other drought stricken areas of the globe, underground reservoirs and aquifers in northeastern Brazil are replenished periodically, thus reducing the risk of exhausting the resource through over exploitation. But northeastern Brazil has its own set of problems when it comes to groundwater; these are geological and environmental. One of the geological challenges, for example, comes from the fact that a large proportion of the region is underlain by hard and impermeable rocks that have limited water retention capacity, except in difficult-to-detect fracture systems. From an environmental stand point, there is constant preoccupation with the quality of the groundwater supply, due mainly to the high population density.

#### ***CANADIAN TECHNOLOGY APPLIED TO THE SEARCH FOR GROUNDWATER IN NORTHEASTERN BRAZIL***

Advanced Canadian technology applied to groundwater research and management can help Brazil achieve the results it urgently needs, more quickly and more efficiently. For

example, specialised satellite imagery, such as that provided by Canada's Radarsat, will allow to rapidly map geological structures and locate underground reservoirs over large areas. Targets can further be assessed in terms of their potential for groundwater using the latest and most advanced geophysical methods, both airborne and ground-based. To date, most of the groundwater-related work done in Brazil has involved traditional geological mapping and drilling. These techniques, while very important per se, can be made much more effective when combined with remote sensing technology.

Canada can also provide much needed expertise in groundwater systems modelling and groundwater pollution and remediation. These specialties, for which Canada is among the world leaders, involve several basic disciplines including structural geology, hydrogeology, organic and inorganic geochemistry, isotopic geochemistry, borehole geophysics, and geographical information systems (GIS). Improved knowledge in these areas will not only lead to greater quantities of potable water available for public consumption, it will also help the Brazilians to properly manage this most important resource.

#### **GOAL AND OBJECTIVES**

The prime goal of the proposed project is:

***“to improve the water supply situation, in terms of both quality and quantity, in the areas of northeastern Brazil that are susceptible to severe drought conditions”***

To achieve its prime goal, the projects has the following concrete objectives:

***(a) Enhance the capability of Brazilian institutions involved in groundwater research and management, to conduct surveys and studies that will effectively lead to an improvement in the water supply in northeastern Brazil.***

This will be accomplished by transferring Canadian technologies to the Brazilian institutions by way of training sessions (workshops, seminars and short courses), in-field demonstrations both in Brazil and in Canada, technical visits, joint pilot-scale projects, etc.

***(b) Improve the water supply situation in selected areas of northeastern Brazil by applying the newly transferred Canadian technologies.***

This will be achieved by carrying out studies and surveys, and by adopting sound groundwater management practices, in selected areas, and by drilling wells as a means of testing the efficacy of the new technologies.

***(c) Establish long-term linkages between Canadian and Brazilian private and public institutions involved in applied groundwater research and management.***

This will be accomplished by maximizing the opportunities for the Canadians and the Brazilians to interact, and by developing a sense of partnership between project participants of both countries. Joint project activities and other mechanisms that will stimulate such interactions, will be fostered.

#### ***ANTICIPATED RESULTS***

(a) On the short term, i.e. during the lifetime of the project, we will observe that the staff of participating Brazilian institutions have acquired the knowledge necessary to carry out more effective applied groundwater research and management based on Canadian technologies. We also anticipate that the institutions themselves will become progressively better equipped to carry out groundwater related studies and surveys as they acquire the recommended tools to carry out such studies and surveys.

(b) On the longer term, we will witness a general improvement in the water supply situation in northeastern Brazil, first in selected areas where the newly transferred technologies will be tested and applied as part of the proposed project and, later, in other parts of the region as the technologies become progressively more widely adopted.

(c) Canadian and Brazilian groundwater experts will continue to interact much beyond the duration of the project, either by pursuing joint research activities or through consultation or other types of arrangements. This will ensure that the new technologies continue to be applied long after the proposed project has ended.

#### ***CANADIAN AND BRAZILIAN PARTNER INSTITUTIONS***

The project will be jointly coordinated by the Geological Survey of Canada (GSC) and Companhia de Pesquisa de Recursos Minerais (CPRM). A third partner, Associação Brasileira de Águas Subterrâneas–Núcleo Ceará (ABAS), based in Fortaleza in northeastern Brazil, will coordinate the activities locally. All three organizations operate on a non-profit basis and can offer the leadership required to bring together all the players and establish the links that are needed to make this project work. GSC and CPRM have a long history of successful collaboration. ABAS, on the other hand, has full cognition of the water problems in northeastern Brazil, has contacts with every private and public organization involved with the water supply of the region, and has devoted a great deal of energy towards establishing links and partnership between these groups. All the Brazilian organizations that have been informed of this project proposal are extremely enthusiastic with the prospect that Canada will participate in finding a solution to the water supply problems in northeastern Brazil. Already, ABAS and CPRM have begun to canvas support for the project, and several letters expressing interest and offers to participate and to contribute resources to the project, are attached to this document.

Canada will participate with the full strength of its private and public institutions to ensure that the results of the project are achieved. GSC, in addition to providing superior management of the program, will join forces with private sector firms to deliver parts of the program in areas of geophysics, borehole logging, hydrogeochemistry and geographical information systems. The Canada Centre for Remote Sensing (CCRS), jointly with Radarsat International and private consultants, will transfer Canadian satellite technology to Brazil, as it applies to groundwater research. Other groups of experts—faculty members of the Department of Earth Sciences at the University of Waterloo being an important one—will provide the expertise in structural geology, hydrogeology, groundwater systems modelling, pollution problems and remediation. As the project evolves, other groups—universities, private sector firms, etc.—will be called upon to participate in various aspects of the project.

The above list of partners and contributors has all the ingredients required to form strong, cordial and long-lasting institutional linkages that will benefit both countries. But above all, the project will help propel forward the relief effort to the millions of people who are currently experiencing real hardship due to the lack of potable water.

***PROJECT DURATION AND LEVEL OF FUNDING***

The proposed project could begin in April 1999 and will require three years to complete. A \$2.5 million budget, broken down approximately as follows, is proposed:

(1) CIDA contribution	\$1,000,000	To support the actual transfer of technology: Canadian personnel costs; travel costs for Canadian participants; private sector consulting charges; costs of holding seminars, workshops, etc. in Brazil; cost of hosting Brazilian trainees in Canada (excluding international air fares); other justifiable expenses
(2) GSC in-kind contribution	\$300,000	Overheads and absorbed costs and fees
(3) CPRM contribution (and contributions of other Brazilian organizations involved in the delivery of the project)	\$400,000	Costs of hosting Canadian participants in Brazil; personnel costs (Brazilian participants); transportation and field support in Brazil (air fares, vehicles, equipment, support staff, etc.); international air fares for Brazilians traveling to Canada; overheads
(4) Costs of testing and implementing recommendations derived from project; costs to be borne by municipal, state and federal organizations responsible for the water supply in the region	\$800,000	Implementation of recommended geophysical, geochemical and other surveys; private sector contracts; equipment purchase; drilling of wells to test hypotheses derived from project activities; chemical analyses, etc. (These costs are those incurred for activities beyond the demonstration and pilot-scale studies that form part of the actual technology transfer exercise.)

**EXPRESSIONS OF INTEREST FOR A CANADA-BRAZIL TECHNICAL COOPERATION  
AGREEMENT ON GROUNDWATER RESEARCH AND MANAGEMENT  
IN NORTHEASTERN BRAZIL**

- (1) Water Resource Management Company — COGERH, Fortaleza, Ceará
- (2) Department of Geology, Federal University of Ceará, Fortaleza, Ceará
- (3) Water and Sewers Company of Ceará — CAGECE, Fortaleza, Ceará
- (4) Department of the Environment — SEMACE, Ceará State Government, Fortaleza, Ceará
- (5) Brazilian Groundwater Association — ABAS, Fortaleza, Ceará
- (6) Water Resources Secretariat — SRH, Ceará State Government, Fortaleza, Ceará