

# Environment Canada

Water Science and  
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Direction générale des sciences  
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# Environnement Canada

Groundwater and the Internet

By:

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### **Management Perspective**

The Internet is a highly effective method of communicating research results and achieving technology transfer. This paper summarizes the progress of the Groundwater Remediation Project (GWRP) of the National Water Research Institute of Environment Canada in establishing a presence on the Internet via a suite of Internet services developed and maintained by the Project. The paper highlights the availability of groundwater-related information resources on the Internet by outlining the services that are currently provided through the GWRP's Internet server. Access statistics that describe the use of these services indicate a very favourable response and confirm the utility of the Internet relative to developing increased recognition for the research contributions of the GWRP and in achieving improved technology transfer.

## **Groundwater and the Internet**

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There is no doubt that the Internet has attracted an enormous following over the past few years and, in doing so, has become a prototype of the so-called "Information Superhighway." Newspapers now routinely report on the Internet, bookstores and libraries offer texts that describe entree to the Internet, and television and radio advertising list Internet addresses. In light of this popularity, the Groundwater Remediation Project (GWRP) of Environment Canada has been experimenting with a range of Internet services. Our experience over the past year indicates that, beyond popular appeal, the Internet is a highly effective method of communication that is consistent with our corporate objectives. As a result, the use of the Internet has become an integral element of our business practice. This discussion summarizes our experience in establishing a presence on the Internet and highlights the information that we have made available to the groundwater research community, practicing hydrogeologists, and the general public.

In essence, there are three aspects to our use of the Internet as an element of business practice. First, there are the innumerable resources (expertise, data, software, etc.) that can be recovered and used within our research activities. Second, there are the considerable operating efficiencies that can be realized. Third, there are the implications of increased recognition of our research contributions and of enhanced technology transfer. This discussion focuses on the latter of these three aspects because it is there that the greatest, long-term benefits are likely to be realized.

The first step in developing the suite of services that represent the GWRP on the Internet was the installation of communications software. This software includes anonymous FTP and HTTP servers and the MAJORDOMO electronic mailing list manager. These components operate on a single UNIX workstation, which has been appointed as the Project's Internet server. In addition, a substantial and continuing effort has been applied to assembling information resources for distribution using these services. Many of these resources have been developed using in-house expertise, others have been developed through collaborative

range of operating systems and software. Our WWW site also offers several interactive applications which allow a client to transmit data to the server for processing. In one such application, the user is able to conduct a sensitivity study of leachate migration from a landfill by specifying parameters such as hydraulic conductivity and porosity and submitting the parameters to a numerical model of leachate migration. The numerical model then runs on the server and a plot of leachate breakthrough into an underlying aquifer is transmitted back to the client for display.

### **Electronic Mailing Lists**

The MAJORDOMO software provides an interactive communication capacity based on e-mail, the most widely used Internet service. The premise of this service is that, when a user submits a subscription request for an electronic mailing list to the MAJORDOMO software, their e-mail address is automatically added to the existing list of subscribers. Subsequent messages sent to the list are then distributed to the new subscriber and to all of the previous subscribers. Thus, users are able to subscribe to a list and either follow, respond to, or initiate e-mail based communications. The advantages of this service are that the list of subscribers is a single address, the management of the list is automated, and that subscribers have immediate access to persons with related interests and expertise. Users can also unsubscribe to a mailing list by sending a message to the MAJORDOMO software. Two electronic mailing lists are supported by our MAJORDOMO installation. These are the Groundwater Modelling (GWM-L) and Canadian Hydrogeology (GWCAN-L) mailing lists. Subscription requests for these lists are sent to [majordomo@grp.cciw.ca](mailto:majordomo@grp.cciw.ca) and contain "subscribe GWM-L" or "subscribe GWCAN-L" in the body of the message. Messages for distribution across these lists are sent to [GWM-L@grp.cciw.ca](mailto:GWM-L@grp.cciw.ca) and [GWCAN-L@grp.cciw.ca](mailto:GWCAN-L@grp.cciw.ca), respectively.

### **Measuring the Effectiveness of our Internet Services**

Monitoring the response of users to our Internet services provides us with an indication of the success of these services. The most thorough source of usage information is the HTTP server access log which records the hypertext requests sent to the HTTP server. Analysis of this record indicates that approximately

500 computers submit requests to the server each week. Approximately 300 of these requests constitute the first request received from the indicated client computer; thus, approximately 300 new users and 200 repeat users are recorded each week. Requests have been received from more than half of the 80 countries that currently have access to the Internet. While usage of the anonymous FTP and MAJORDOMO services are not included in these totals, casual monitoring of these services also indicates a favourable response with an encouraging international distribution.

### **Conclusions**

The Internet is an avenue into a vast array of information that is relevant to groundwater practitioners. The scope and volume of information that is available is increasing rapidly and frequent exploration is required to keep up with the pace of change. Access to the Internet is widely available through telephone connections to commercial providers, and is relatively inexpensive. Much of the software required to navigate the Internet is either publicly available or commercially available at a nominal cost. Finally, organizations can join in the distribution of corporate products and expertise using a range of services, many of which are also available from commercial access providers. The GWRP regards the recorded usage of the Project's Internet services as a very positive response and is committed to developing these services according to the requirements of users and the evolving landscape of the Internet. We are continually adding information to our server and we welcome contributions from all interested persons. For additional information about the Internet services offered by the GWRP, please contact Andrew Piggott by postal mail at the National Water Research Institute, 867 Lakeshore Road, Burlington, Ontario L7R 4A6, Canada or by electronic mail at [Andrew.Piggott@CCIW.Ca](mailto:Andrew.Piggott@CCIW.Ca).

**Table 1 Selected Information Available via our Internet Services**

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**Items of Interest to the Groundwater Research Community**

- ▶ Descriptions of the GWRP and our research activities
- ▶ Groundwater Modelling and Canadian Hydrogeology mailing lists
- ▶ Research reports and a searchable library of abstracts

**Items of Interest to Practicing Hydrogeologists**

- ▶ Groundwater modelling and analysis software
- ▶ An on-line version of the Canadian Groundwater Directory
- ▶ National and provincial groundwater information

**Items of Interest to the General Public**

- ▶ An interactive groundwater modelling facility
  - ▶ Groundwater fact sheets and a groundwater quiz
  - ▶ Connections to other Internet servers
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**Canada Centre for Inland Waters**

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867 Lakeshore Road  
Burlington, Ontario  
L7R 4A6 Canada

**National Hydrology Research Centre**

11 Innovation Boulevard  
Saskatoon, Saskatchewan  
S7N 3H5 Canada

**St. Lawrence Centre**

105 McGill Street  
Montreal, Quebec  
H2Y 2E7 Canada

**Place Vincent Massey**

351 St. Joseph Boulevard  
Gatineau, Quebec  
K1A 0H3 Canada

**Centre canadien des eaux intérieures**

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867, chemin Lakeshore  
Burlington (Ontario)  
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**Centre national de recherche en hydrologie**

11, boul. Innovation  
Saskatoon (Saskatchewan)  
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**Centre Saint-Laurent**

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