U.S. Geological Survey Water Information on the Internet

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Introduction

Hydrologists at the U.S. Geological Survey (USGS) are finding that their distributed network of workstations and minicomputers is an excellent vehicle for providing water information to their customers. Several major applications already are on-line and more are in the pilot stages. This report reviews what is available from USGS over the Internet and discusses some of the implications of this technology to water resources.

USGS Water Resources Information "home page"

All World Wide Web (WWW) pages are equal in the sense that any page can connect to, or reference, any other page. In practice, each application or local site tends to form a logical hierarchy of pages branching out from a "home page." Connections among applications, though, tend to be somewhat haphazard. The USGS Water Resources Information "home page" is the top of a backbone navigation path that ultimately connects all USGS pages serving information about water resources, regardless of location.

The USGS Water Resources Information "home page," shown in figure 1, and several supporting pages are maintained on a server in Reston, Virginia. It can be found at <URL:http://h2o.usgs.gov/>.

This is a good starting point for users interested in water information. Supporting pages lead users to national programs, such as the National Water Quality Assessment Program (NAWQA), the Water Use Program, and to all local and regional USGS offices serving data on Internet. The USGS Water Resources Information "home page" itself connects to the USGS "home page," which leads the user to other pages serving information about geology and mapping.

All USGS pages with water information must conform to a set of design guidelines. The guidelines -- a collection of common-sense techniques along with some agreed-upon styles -- help establish a "corporate image." As it is not uncommon for a WWW user to "visit" several USGS sites, a common "look and feel" -- a USGS banner, commonly used buttons in the same place, familiar links to other USGS pages -- among sites is important. USGS Director's approval authority for pages that follow the guidelines is delegated to the local level, so that pages can be prepared and released quickly.

Early Successes

The National Water Conditions Report

Dissemination of the monthly National Water Conditions report through the Internet began in October, 1994. Circulation of the new electronic format exceeds that of the former paper version, and continues to rise. Readers can view maps of monthly streamflow conditions figure 2, ground-water levels, and charts of monthly streamflow at more than 200 stations.

The National Water Conditions report, produced by USGS in cooperation with Environment Canada, had been published monthly since 1944 and mailed free to a list of 5,000 subscribers. Postage and printing costs, however, continued to rise, and its readers wanted to see the information more quickly. A key decision was to discontinue the paper version of the report and to focus on producing the electronic version.

Producing an all-electronic report opened several new opportunities. Page limits of the paper report restricted streamflow charts to only 6 to 8 carefully-selected stations. The new format lets users customize their own reports by selecting stations either from a scrolling list of more than 200 station names or by pointing to a map of the stations. With printing and mailing steps eliminated, sections of the report can be released as soon as they are prepared (like the "early" and "late" editions of a newspaper) so that a delay in one section does not delay the whole report. The result is that more information gets to more users faster and at less cost.

The new National Water Conditions report is very popular. Readers have accessed it from over 5000 sites from all over the world. A new (and instantaneous) "feedback" page included with the report has returned many positive comments and indicated great interest in more such publications. Aside from the immediate publication value, the knowledge gained through this effort has had a great impact on other Internet applications.

Daily Flow Values

Daily flow values for all USGS stations through Water Year 1993 are available on the Web. Users can select a station by name or number from a scrolling list organized
by county. The flow values and dates are returned in a simple tab-delimited format along with header information about the station. The file may be viewed on the screen or saved on the users local computer. Alternatively, the user can see a graph of the streamflow values figure 3.

This application was made possible by the rapidly declining cost of disk storage and the ease with which users can find and retrieve files through the Web. It is proving more convenient to serve popular data sets on the Web than to make custom retrievals from main data bases.

Water-Use Data

The National Water-Use Information Program has placed its report, "Estimated Use of Water in the United States in 1990," U.S. Geological Survey Circular 1081, on the World Wide Web. Users can find data on water use in a variety of different categories (e.g. public, domestic, commercial) for all counties and hydrologic units. Many interesting tables, charts and maps, such as figure 4, are included. This new application is expected to increase awareness of water use and the USGS Federal-State Cooperative Water-Use Data Program.

National Geospatial Data Clearinghouse

The USGS node of the National Geospatial Data Clearinghouse opened with an electronic ribbon-cutting ceremony on January 23, 1995. This node is the gateway to a vast collection of USGS digital spatial data, including all digital elevation models (DEM's), digital line graphs (DLG's), and Landsat images. Water data sets of interest include basins and streams as well as more specialized data sets developed as part of hydrologic investigations.

The Clearinghouse offers both browse and search capability. Users can browse through descriptions of the data categories to see what is available, or they may use a WAIS gateway to search the metadata (data about data) by keyword and spatial extent. For each available data set, the metadata includes instructions on how to order the data and, in some cases, direct links to retrieve the data on line. The USGS node of the National Geospatial Data Clearinghouse can be accessed at <URL:http://nsdi.usgs.gov/nsdi/>.

Implications for Future Data Distribution

Distribution of water-resources information over World Wide Web is proving to be economical from the production side and popular with the customers. Increased pressure on Federal agencies to "do more with less" will lead to more network services replacing paper reports. Internet access may become the key to citizens receiving Federal information in the future. Although this runs the risk of dividing the public into those who have Internet access and those who don't, the increasing availability of computers in libraries and schools and the declining costs of personal computers and network connections may make universal availability a reality.

Log records indicate that many of the "visits" to USGS World Wide Web pages are by users who are not among the traditional users of USGS data. Users at more than 12,000 sites accessed USGS water pages through February, 1995, and this number is increasing by 1,300 sites each week. This is significant in comparison to the approximately 1,100 agencies with established cooperative agreements. User sites are from educational institutions (26%), Federal agencies (17%), commercial organizations (17%), and foreign countries (9%); 31% of the sites have no identified affiliation. Nobody knows how many more people the Web will ultimately bring in contact with USGS, or how many of these will become regular users of USGS data, but the potential clearly is there for creating a vast new class of USGS "customers."

If access to water information is the foundation for rational debate on water-resources issues, then we may be seeing the start of a great democratization in setting water policies. The Internet can give all parties involved with an issue instant and equal access to information. Scientific reports will be exposed to much wider scrutiny by a broader readership. Electronic mail and bulletin boards will shorten the time period between proposals and comments, and allow participants to learn about those with similar or opposing views. Nobody knows if this will make consensus easier to achieve, but we do know that the process will be very different than it has been in the past.

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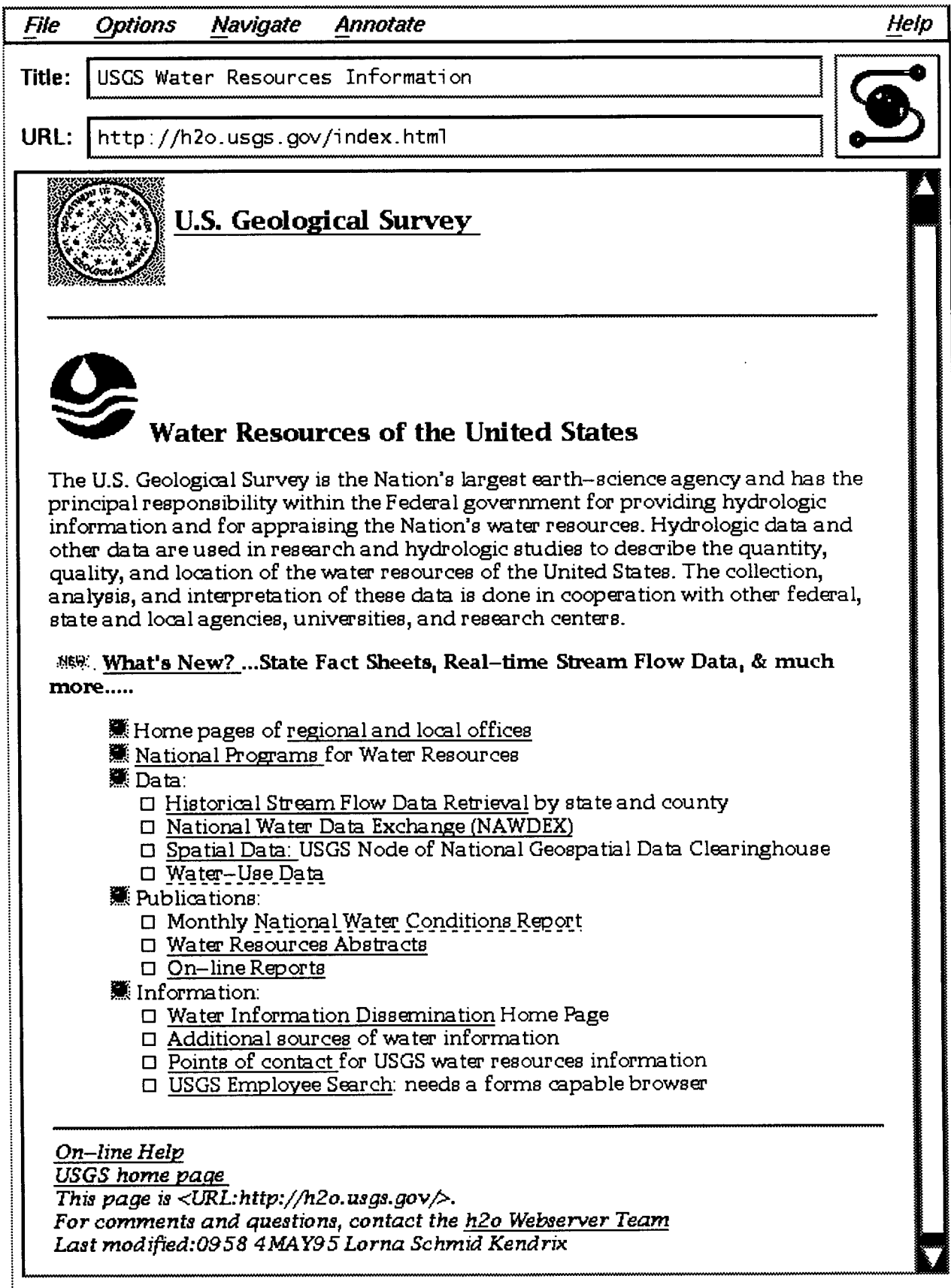

Figure 1. Image of the USGS Water Resources Information "home page."

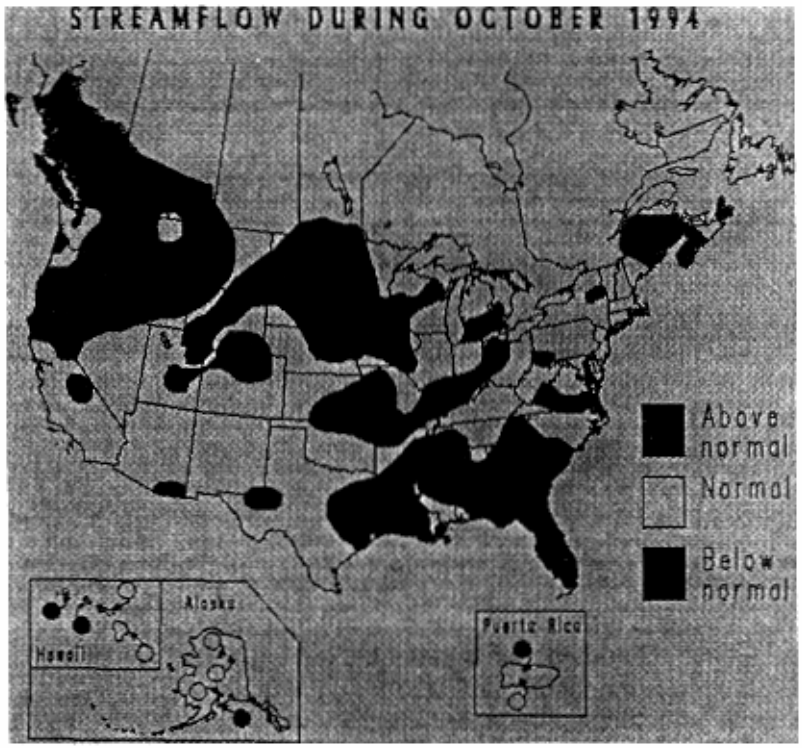

Figure 2. Example of the map of monthly stream conditions shown in the National Water Conditions report.

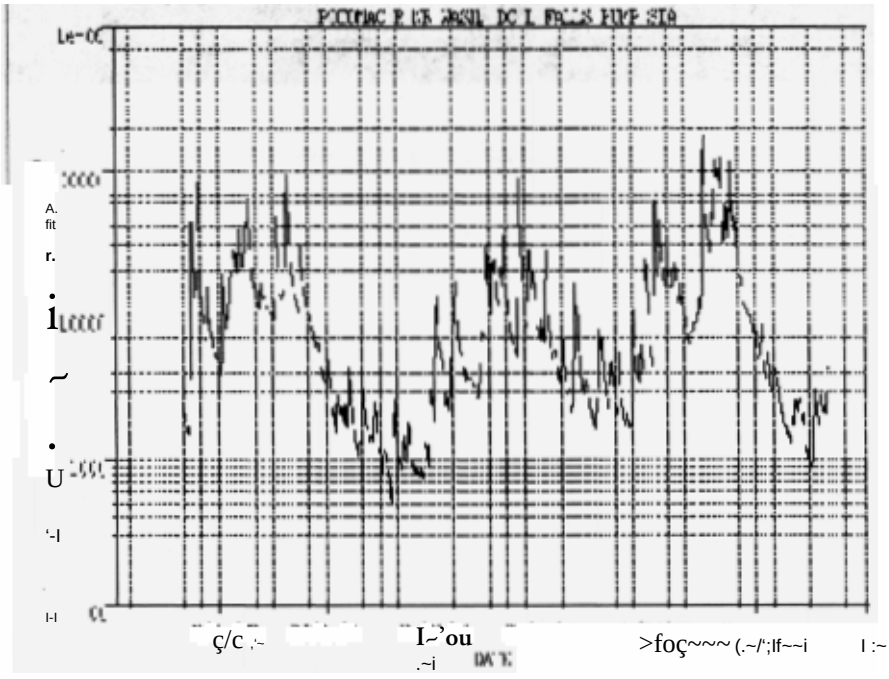

Figure 3. Example of a graph of daily streamfiow values.

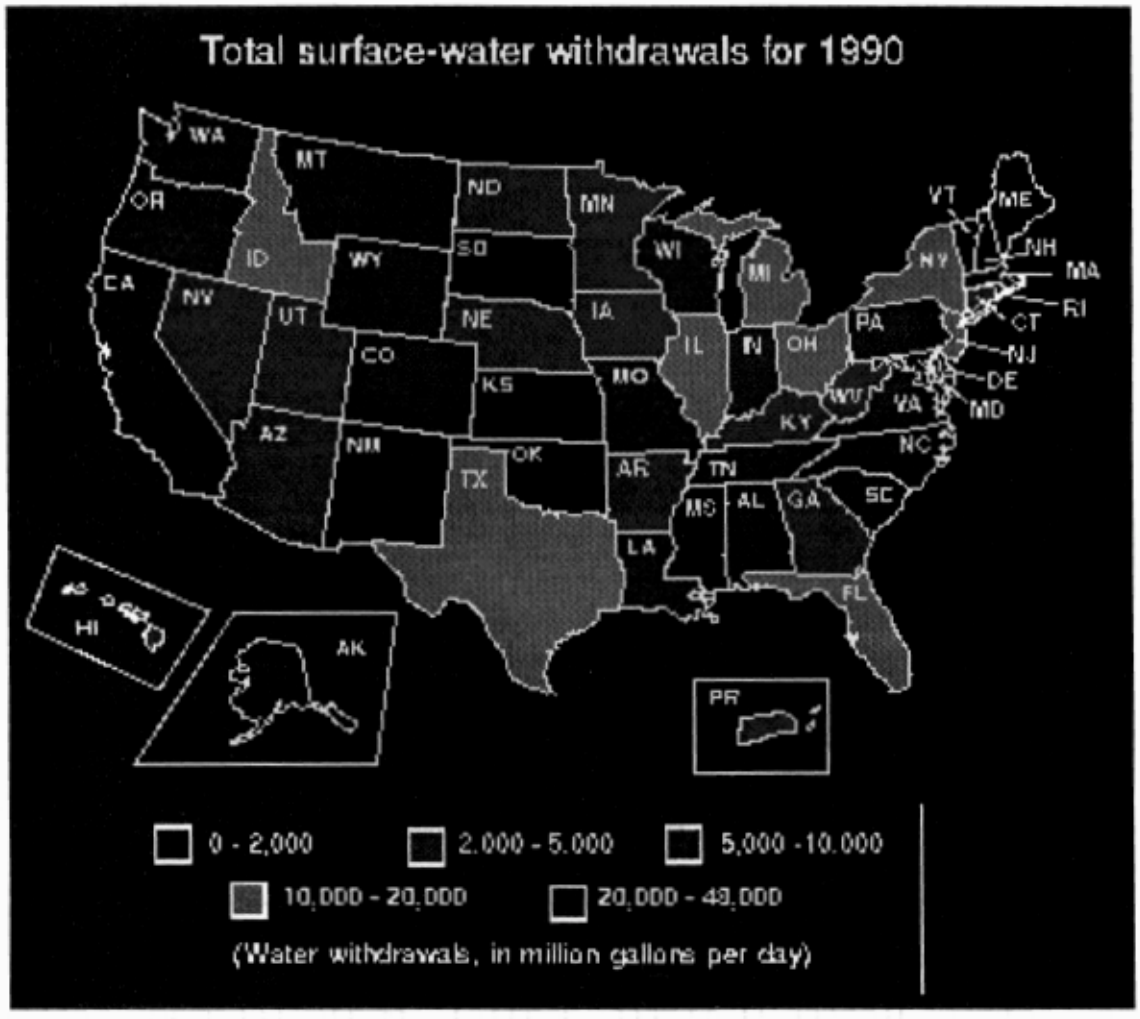

Figure 4. Example of a map of water use.