

Computer Programs for Obtaining and Analyzing Daily Mean Streamflow Data from the U.S. Geological Survey National Water Information System Web Site

Appendix 1. Get National Water Information System Streamflow (Q) files GNWISQ (Version 1.0)—A program for downloading streamflow-gaging-station information and daily mean streamflow files from the U.S. Geological Survey National Water Information System Web Site

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Prepared in cooperation with the
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Conversion Factors and Abbreviations

Multiply	By	To obtain
Area		
square mile (mi ²)	259.0	hectare (ha)
square mile (mi ²)	2.590	square kilometer (km ²)
Volume		
cubic foot (ft ³)	0.02832	cubic meter (m ³)
Flow rate		
cubic foot per second (ft ³ /s)	0.02832	cubic meter per second (m ³ /s)
cubic foot per second per square mile [(ft ³ /s)/mi ²]	0.01093	cubic meter per second per square kilometer [(m ³ /s)/km ²]

Abbreviations

1B3	1-day 3-year biological low flow
4B3	4-day 3-year biological low flow
7Q10	7-day 10-year low flow
ADAPS	USGS Automated Data Processing System
BCF	bias correction factor
BMP(s)	best management practice(s)
CD-ROM	computer disk-read only memory
dv	daily value
dd	data descriptor
EMC	event mean concentration
FHWA	Federal Highway Administration
GNWISQ	Get National Water Information System Streamflow (Q)
KTRLLine	Kendall-Theil robust line
log10	common logarithm
MkDF	Make U.S. Environmental Protection Agency DFLOW3 batch input Files
MkPP	Make plotting position file
MOVE	maintenance of variance
NWIS	National Water Information System
NWISWeb	National Water Information System Web
PC	Personal Computer
Q	Streamflow
QSTATS	Streamflow (Q) Statistics
RDB	relational database
ROS	regression-on-order statistics
SELDM	stochastic empirical loading and dilution model
SQL	structured query language
SREF	Streamflow Record Extension Facilitator
TMDL(s)	Total Maximum Daily Load(s)
USGS	U.S. Geological Survey

Appendix 1. Get National Water Information System Streamflow (Q) files GNWISQ (Version 1.0)—A program for downloading streamflow-gaging-station information and daily mean streamflow files from the U.S. Geological Survey National Water Information System Web Site

By Gregory E. Granato

Abstract

The Get National Water Information System Streamflow (Q) files (GNWISQ Version 1.0) program was developed by the U.S. Geological Survey (USGS) in cooperation with the Federal Highway Administration to facilitate the process for downloading streamflow-gaging-station information and daily mean streamflow data files from the USGS National Water Information System Web (NWISWeb) site. The GNWISQ program has an individual-file mode to retrieve information and data for one streamflow-gaging-station. The GNWISQ program also has a batch-file mode to retrieve information and data for multiple streamflow-gaging-stations. The program also has the capability to reformat the current (2006) NWISWeb text-file format to an earlier, more consistent, NWISWeb text-file format. The program provides error files to document any problems that may occur. The output from the GNWISQ program can be used to facilitate hydrologic data analysis with multiple programs in individual or batch mode. This computer program has a graphical user interface that follows standard Microsoft Windows interface conventions.

Introduction

Streamflow information is important for many planning and design activities including water-supply analysis, habitat protection, bridge and culvert design, calibration of surface and ground-water models, and water-quality assessments. Streamflow information is especially critical for water-quality assessments (Warn and Brew, 1980; Di Toro, 1984; Driscoll and others, 1989; Driscoll and others, 1990a, b). Calculation of streamflow statistics for receiving waters is necessary to estimate the potential effects of point sources such

as wastewater-treatment plants and nonpoint sources such as highway and urban-runoff discharges on receiving water. Streamflow statistics indicate the amount of flow that may be available for dilution and transport of contaminants (U.S. Environmental Protection Agency, 1986; Driscoll and others, 1990a, b). Streamflow statistics also may be used to indicate receiving-water quality because concentrations of water-quality constituents commonly vary naturally with streamflow. For example, concentrations of suspended sediment and sediment-associated constituents (such as nutrients, trace elements, and many organic compounds) commonly increase with increasing flows, and concentrations of many dissolved constituents commonly decrease with increasing flows in streams and rivers (O'Connor, 1976; Glysson, 1987; Vogel and others, 2003, 2005).

Reliable, efficient and repeatable methods are needed to access and process streamflow information and data. For example, the Nation's highway infrastructure includes an innumerable number of stream crossings and stormwater-outfall points for which estimates of stream-discharge statistics may be needed. The U.S. Geological Survey (USGS) streamflow data-collection program is designed to provide streamflow data at gaged sites and to provide information that can be used to estimate streamflows at almost any point along any stream in the United States (Benson and Carter, 1973; Wahl and others, 1995; National Research Council, 2004). The USGS maintains the National Water Information System (NWIS), a distributed network of computers and file servers used to store and retrieve hydrologic data (Mathey, 1998; U.S. Geological Survey, 2008). NWISWeb is an on-line version of this database that includes water data from more than 24,000 streamflow-gaging stations throughout the United States (U.S. Geological Survey, 2002, 2008). Information from NWISWeb is commonly used to characterize streamflows at gaged sites and to help predict streamflows at ungaged sites.

Automated NWISWeb Data Retrieval and Processing

The NWISWeb database is designed to accommodate a variety of automated data-retrieval methods. The standard NWISWeb interface, however, does not facilitate retrievals of streamflow data for multiple stations into separate output files by station. Users must do one query to obtain station information and a second query to obtain daily streamflow data for each station. Automated retrievals also are limited to 20,000 records for each data request to maintain service for other data queries. Thus a method was needed to enable batch retrievals within NWISWeb operational criteria.

The current (2006) NWISWeb relational database (RDB) daily streamflow file format is relatively new (initiated in the spring of 2006). This format provides more information than the older daily-value format, but the new format has several features that make automated data processing difficult. For example, this new format may include daily peak flows and daily minimum flows in addition to the daily mean streamflow values in the daily value files. These extra data columns, which may be placed to the left of the daily mean streamflow column, may not be consistently included either spatially for stations in the United States or temporally in the record for a single station. The 2006 daily streamflow format uses a data-descriptor (dd) code as a prefix to the column name for the daily mean streamflow. This prefix is not used consistently for different stations within a state or between states. The 2006 daily mean streamflow format also may include text in the value field for the daily mean streamflow. For example, the record for station 01121000 has the comment “_ICE” appended to some winter streamflow values. In the 2006 daily mean streamflow format, gaps in data (periods during which the station is not in active service) are represented by a date with a blank data field. These lines in the file have the potential to be misrepresented when imported into other applications. This format also allows the user to retrieve provisional data that have not been reviewed and approved and so are subject to revision. Provisional data are helpful for examining recent conditions, but may not be representative for statistical analysis. Files retrieved from NWISWeb with the tab-separated data output option are saved in UNIX format rather than personal computer (PC) format. The UNIX format can cause problems with applications designed to be used with PC-format files.

The 2006 daily streamflow format is useful for manual examination of the data from a few stations, but the new format makes automated data processing more difficult. For example, this new NWISWeb daily value format is not completely compatible with a number of streamflow-statistics programs such as the EPA DFLOW3 program (U.S. Environmental Protection Agency, 2004; Rossman, 1990). The MkPP (Appendix 2), SREF (Appendix 3), QSTATS (Appendix 4), and MkDF (Appendix 3) programs also were written for the previous NWISWeb format. Programs that use NWIS Web data could be rewritten to decode new file formats while

processing the data, but this effort could reduce the efficiency of these computer programs. GNWISQ was written to download and reformat NWISWeb data because it is more efficient to reformat new NWISWeb formats as they evolve with updated versions of GNWISQ than to rewrite multiple program packages that may utilize NWISWeb daily mean streamflow data.

Purpose and Scope

This manual describes the implementation, use, and interpretation of results from the GNWISQ (Version 1.0) program. The GNWISQ program was developed by the USGS in cooperation with the Federal Highway Administration for use in the analysis of local, regional, and national hydrologic data sets. This program was developed as part of a suite of tools to download and process streamflow information in support of a stochastic empirical loading and dilution model for planning-level estimates of the effects of highway runoff on receiving water. The process for automatically downloading NWISWeb files containing station information and streamflow is described. The formats of the input- and output-data files are described. Step-by-step use of the program’s graphical user interface is illustrated. The program code written in Microsoft Visual Basic 6.0 is documented in a Visual Basic project directory on the computer disk containing this manual.

Use of the GNWISQ Program

The GNWISQ program is a Visual Basic program that provides several choices for obtaining and formatting NWISWeb data. The program is used to retrieve NWISWeb station information and streamflow files of a specific format by translating user input into the appropriate structured-query-language (SQL) commands that are transmitted over the Internet to retrieve data. The user interface consists of one interactive form identifying the program and providing the graphical user interface controls necessary to specify user input and provide feedback on the NWIS streamflow-data-collection operations. The GNWISQ program can be run to download files for an individual station or in batch mode to download files from multiple stations. The program outputs tab-delimited text files that can be used with many computer applications including text editors, spreadsheets, graphing software, and statistical software. The GNWISQ program, if installed properly, should be compatible with commonly used Microsoft Windows operating systems.

Installation and Removal

The GNWISQ program depends on a number of software drivers and dynamic-link libraries that may not be installed and available on the user’s computer. This program must be

installed by someone who has administrative rights on the program user's computer. The administrator must test the installation with the user's profile to ensure that all permissions are set properly. A readme.txt file with installation instructions and three installation files are in the folder GNWISQInstall on the CD-ROM containing this manual. Three files—setup.exe, setup.LST, and GNWISQ.CAB—are needed to install the program. The file setup.exe is the installation program. The setup.LST file is a text file that provides the necessary installation specifications. The file GNWISQ.CAB is the file containing the program and support files. The setup program is a standard Microsoft installation wizard that should be familiar to the user or system administrator. These three files must be located in the same directory on the CD-ROM or in a directory on the user's computer. The person installing the program should follow all the standard choices for installation. The installation program creates the directory C:\Program Files\FHWA\HEP\GNWISQ\ and includes the GNWISQ program in the computer's registry. If desired, a shortcut to the program can be added to the desktop manually after installation. Sample files are saved on the CD-ROM containing this manual and should be copied to a directory in which the user has read, write, and execute rights. The user may uninstall the GNWISQ program and its support files by use of the standard Microsoft Windows Add or Remove Programs wizard on the control panel of the user's computer.

Input- and Output-File Formats

The GNWISQ program uses two input files and creates two output files in different formats (table 1-1). Data from the NWISWeb database is transmitted in RDB format (Manis and others, 1988). RDB files are tab-delimited ASCII text files that can be imported into many software packages. The USGS RDB file format begins with comment lines that are intended to describe the source of the data and the content of the file. These comment lines are denoted by a pound symbol (#) in the first character location of each line. The comments are followed by a line of NWIS variable names for each type of information in the file. The variable-name line is followed by a data-format line which indicates the maximum character length for each variable and the type of variable (d for date, n for number, and s for string). All remaining lines in the RDB files contain the daily mean streamflow data. If data are qualified, such as being estimated, being less than a listed value, or being greater than a listed value, a numerical value will appear in a data field with an additional character code; alternatively, if the measurement cannot be quantified, the data field may contain just the character code (U.S. Geological Survey, 2006). The documentation and format lines in these files and the qualification codes in the data are essential for transmitting meaningful data in an efficient format but are not amenable for batch-processing data from many stations. Example station

Table 1-1. Summary of input and output files for the Get National Water Information System Streamflow (Q) files (GNWISQ Version 1.0) program.

[GNWISQ, Get NWIS streamflow (Q) software version 1; NWIS, National Water Information System; RDB, relational database]

File type	Example files on the CD-ROM directory: CDROM:\Applications\GNWISQEX\	Comments
Input files		
Initialization input file	GetNWISQ.ini	Provides flexibility in the NWIS Web queries used to retrieve data
Station-list input file	IndexStations.txt	Lists long-term index-station numbers
Output files		
Station-information file	01117500H.txt	NWISWeb RDB file for selected streamflow-gaging-station information
Streamflow-data file	01117500Q.txt	NWISWeb RDB streamflow data in new format (unprocessed) or reformatted to the NWISWeb daily value RDB streamflow data file (2005 format)
	01117500Q.txt.orig	Original streamflow file in the new NWIS Web RDB format
Error output file	GNWISQErrFile.txt	File containing errors or warnings generated during the file downloading and reformatting process

and daily mean streamflow files are provided in the example-data directory for the GNWISQ program on the CD-ROM containing this manual.

Program-Initialization Input File Format

The program GNWISQ uses an initialization file (GNWISQ.ini) to set initial conditions for NWISWeb queries. The initialization file will be installed in the NWISQ program-file folder on the user's computer. The initialization file provides flexibility for change in the Web address and changes in the syntax of the NWISWeb query language. If the initialization file is absent or is not in the proper format, the program will use hard-coded default values. The NWISWeb internet address has changed in the past and may change in the future. The Internet address also may change because of server problems, system upgrades, or maintenance. NWISWeb has redundant servers and it may redirect the (human) user to a new server address. It is difficult to redirect automated programs to a different server because this event appears as a server error. The syntax of the NWISWeb query language for daily mean streamflow files changed during the GNWISQ development effort, and the query syntax may change again at any time (U.S. Geological Survey, 2006). Initially, the user should try an individual-site query, and if a problem arises, try to manually download stream information and daily mean discharge data. The query that is created in the web-browser Internet-address window will provide the information necessary for modifying the initialization file.

The GNWISQ initialization file is an annotated text file (fig. 1-1). The initialization file can be edited by the user to update the operation of GNWISQ in response to changes in NWISWeb. The initialization file may be modified with any text-editing program that does not add additional formatting to this ASCII text file. The annotation lines in the initialization file begin with the pound symbol (#); the content of these lines is not stored or used by GNWISQ.

The GNWISQ initialization file allows the user to change the default streamflow-gaging station number and the NWISWeb Internet address, the query syntax for the streamflow-gaging-station information file and the query syntax for the streamflow-data file (fig. 1-1). The first line that is read by GNWISQ is the default station number. This value is the default value selection for downloading information and data for an individual streamflow-gaging station. The default station number is currently set as "0117500." The next line that is read by GNWISQ is the default NWISWeb address, which is currently *http://waterdata.usgs.gov/nwis/*. The user can change the default NWISWeb address in the initialization file. The current NWISWeb address will appear on the GNWISQ user interface once the user initiates a web query. The next line, which is preceded by a dollar sign (\$), is the default discharge code (01_00060_00003), which is used for program output. A data prefix (A00) and seven NWISWeb query lines (A01–A07) are used to build the NWISWeb query for streamflow. The line with the asterisk character (*) indicates

the end of the data-query information. This convention allows the user to specify more or less than seven lines to define future NWISWeb data queries. The initialization file also provides a method for defining the site-information queries. The site-information query lines have a data prefix (B00) and six NWISWeb query lines (B01–B06). Each NWISWeb query line is preceded by comment lines beginning with the pound character. The initial lines identify the site number, and the remaining lines are concatenated after the site number. Any number of comment lines starting with the pound symbol may be included anywhere in this initialization file. It is hoped that this method will provide sufficient flexibility to adjust for future syntax changes in the NWISWeb query language.

Station-List Input File Format

Streamflow data for multiple stations can be retrieved in batch mode to facilitate the analysis of local, regional, and national hydrologic data sets. In batch mode, the program reads a station-list file. This list file does not contain any header lines. The list file consists of 8- to 12-character streamflow-gaging-station numbers on separate lines without leading or following spaces. The station-list file should not include any text except the station numbers of interest and should not end in a blank line.

Station-Information Output File Format

The station-information file provides information about the streamflow-gaging station that can be used for analysis of streamflow data. Station-information filenames include the station number followed by the letter "H" and the suffix ".txt" (for example, 01022500H.txt). The default station information includes the site-identification number, site name, decimal latitude, decimal longitude, latitude-longitude accuracy, latitude-longitude datum, state code, altitude of gaging station or land surface, altitude accuracy, altitude datum, hydrologic unit code, drainage area, contributing drainage area, daily mean streamflow-data begin date, daily mean streamflow-data end date, and daily mean streamflow-data count. Not all of these station-information parameters are available for every station. The user may expand or reduce the list of station-information parameters by editing the initialization file.

Streamflow-Data Output File Format

The streamflow-data output file provides the daily mean streamflow values for the requested period of record. The streamflow-data filenames include the station number followed by the letter "Q" (a common abbreviation for streamflow in the hydrologic literature) and the suffix ".txt" (for example, 01022500Q.txt). The GNWISQ program is designed to download an NWISWeb daily value table with columns for the agency code (typically the USGS), the 8- to 12-digit USGS


```

# This file is an initialization file for the GetNWISData Program
# It includes web site, and query-string text, comments are after #, which won't be read
# Default Station Number
01117500
# Default NWIS Web Address
http://waterdata.usgs.gov/nwis/
# Default NWIS Code for Discharge, cubic feet per second (Mean)
$ 01_00060_00003
# Data Prefix A00
dv?referred_module=sw&search_site_no=
# Next A01
&search_site_no_match_type=exact&station_type_cd=___Y_&station_type_cd=__Y___
# Next A02
&station_type_cd=_Y___&station_type_cd=Y___&index_pmcode_00060=1
# Next A03
&sort_key=site_no&group_key=NONE&sitefile_output_format=html_table
# Next A04
&column_name=agency_cd&column_name=site_no&
# Next A05
column_name=station_nm&period=&range_selection=date_range&begin_date=
# Next A06
&end_date=
# Next A07
&format=rdb&date_format=YYYY-MM-DD&rdb_compression=value&list_of_search_criteria=search_site_no%2Cstation_type_
cd%2Crealtime_parameter_selection
# end of A
*
# Site Info Prefix B00
inventory?search_site_no=
# Next B01
&search_site_no_match_type=exact&sort_key=site_no&group_key=NONE&format=sitefile_output&sitefile_output_format=rdb
# Next B02
&column_name=site_no&column_name=station_nm&column_name=dec_lat_va&column_name=dec_long_va&column_
name=coord_acy_cd
# Next B02
&column_name=dec_coord_datum_cd&column_name=state_cd&column_name=alt_va&column_name=alt_acy_va
# Next B04
&column_name=alt_datum_cd&column_name=huc_cd&column_name=drain_area_va&column_name=contrib_drain_area_va
# Next B05
&column_name=discharge_begin_date&column_name=discharge_end_date&column_name=discharge_count_nu
# Next B06
&list_of_search_criteria=search_site_no

```

Figure 1-1. GNWISQ program initialization-file format.

streamflow-gaging-station number, the measurement date of the daily mean streamflow (in a YYYY-MM-DD format), the daily mean streamflow (in cubic feet per second), and data-value qualification codes (for example, “A” for approved, “e” for estimated, “>” for greater than a listed value, “<” for less than a listed value, and “P” for provisional data). If data are qualified, such as being estimated, being less than a listed value, or being greater than a listed value, a numerical value will appear in the data field with an additional character code (U.S. Geological Survey, 2006). Qualification codes in the NWISWeb output files are listed in the comment lines preceding the data. The output will include a row for each day between the specified beginning and end dates. If the station was discontinued during the period of record, the dates will be included without a daily mean flow or a qualification code.

The GNWISQ program downloads data in the 2006 NWISWeb RDB format for daily mean streamflow values. The previous NWISWeb RDB format had three columns for each daily mean streamflow value with headers: “dv_dt,” the daily value date (in a YYYY-MM-DD date format); “dv_va,” the daily value daily mean streamflow (in a decimal number format); and “dv_cd,” the data-value qualification code (in a text format). The current (2006) NWISWeb RDB format for daily mean streamflow values may have three to seven columns with headers: “datetime,” the date, “02_00060_00001” and “02_00060_00001_cd,” the daily peak flow and associated data-qualification code (optional); “02_00060_00002” and “02_00060_00002_cd,” the daily minimum flow and associated data-qualification code (optional); and “02_00060_00003” and “02_00060_00003_cd,” the daily minimum flow and associated data-qualification codes. The first two characters of the preceding heading values are the data descriptors (shown with a value of 02 here). The data-descriptor values for a given parameter may differ from station to station, state to state, and region to region, depending on the other parameters being measured at a given site and the streamflow-gaging-station operator’s initial selection. Because the data-descriptor code for streamflow differs from site to site, programs that may use the full column name to identify the daily mean streamflow column may be confounded by these variations in the data descriptor. The current (2006) NWISWeb output format uses a text format for the streamflow values, which may also include comment codes such as “_ICE” with the numeric streamflow value to qualify data.

Because NWISWeb is on a UNIX operating system, it may produce RDB files with the UNIX end-of-line convention. The UNIX file format uses linefeed character to denote the end of a line of data, whereas PC files use a carriage return and a linefeed character to denote the end of a line of data. If the RDB file is in Unix format, some PC programs may read the entire file as one long, wrapping line rather than a series of individual data lines.

The GNWISQ program has an option named “Convert Format” to reformat 2006 NWISWeb RDB format to the previous NWISWeb RDB format with the PC end-of-line convention. This format-conversion feature is included to facilitate

any subsequent data-processing efforts. Use of this feature with the proper initialization-file options will help users import RDB data into other applications even if NWISWeb RDB formats are different in the future. The user has the option to replace the downloaded streamflow file during the reformat process. If the user does not choose to replace the downloaded streamflow file, it is saved with an .orig extension (for example, 01117500Q.txt.orig). When a file is reformatted, the text string “dv format” is added after the pound symbol (#) on the first line of the reformatted file so that GNWISQ will not try to reformat a previously reformatted streamflow file.

Error Output File Format

The GNWISQ program produces an error file to help the user troubleshoot potential problems in the processes for downloading and reformatting NWISWeb streamflow data. If an error occurs, the user will be advised to examine the error file GNWISErrFile.txt. The error file consists of one line for each error. If a problem occurs for a station-information file, the line “Header download problem station: {StationNumber} Data not retrieved” will be printed, in which {StationNumber} is the 8- to 12-digit USGS streamflow-gaging-station identification number. If a problem occurs for a data file, then the line “Streamflow download problem station: {StationNumber} Data not retrieved” will be printed. If an error occurs the user may want to check the station number, internet connection, and NWISWeb address before trying the query again. The user also may want to retry the query at a later time; a valid query may occasionally fail because of internet or server traffic. The reformat option may produce a variety of error lines to indicate potential problems in the reformatting process. The error file GNWISErrFile.txt will be overwritten or deleted with each run, so the user may wish to manually rename this file to keep a record of any download errors that have occurred. The error file is automatically deleted at the end of each program run if a station-download error has not occurred.

Graphical User Interface

The graphical user interface consists of one interactive form and a file-specification dialog form. The program is initiated by double clicking on the program file or a Microsoft Windows shortcut to the executable program-file location. Initially, the user is presented with two command buttons, an individual NWIS RDB file or a batch file (fig. 1-2). The user can download and reformat files for one station or for multiple stations by selecting the associated command button. In both individual-file and batch mode, the user specifies the output-file directory in a Microsoft Windows common-dialog form, also known as the file-specification dialog box (fig. 1-3). In both individual NWIS RDB file mode (fig. 1-4) and batch-file mode (fig. 1-5), the user may specify the current USGS NWISWeb site address, as well as the beginning and end dates of the period of record of interest. The default address

(<http://waterdata.usgs.gov/nwis/>) is current as of May 2008 but may change periodically. Users can copy this address into a web-browser address bar to test the connection. Once the “Download Data” or “Convert Format” command buttons are selected, text boxes appear to indicate the target directory and the program status (fig. 1-6). The “Convert Format” command button may be used if there are existing NWISWeb streamflow files available for processing. (The user may download files in one GNWISQ session and reformat files in a subsequent session.) At any time in the data-specification process, the user may click the close button to terminate the program, but this button will not be active while the program is downloading or reformatting NWIS files.

If the user selects the individual-file option, the program requires that the user enter a valid 8- to 12-digit USGS streamflow-gaging-station identification number (fig. 1-4). Once a valid station number is accepted, a file-specification dialog box (fig. 1-3) will appear that allows the user to specify the output directory. The Microsoft Windows file-specification dialog box will allow the user to retype the default filename, but the GNWISQ program will ignore the change and use the default filenames in the selected directory to help prevent

accidental file corruption. Once the station number and the output directory have been specified, the user can proceed through the file download and reformatting process.

If the user selects the batch-file option, a file-specification dialog box appears so that the user may select the name of a station-list file for downloading data and information for multiple stations (fig. 1-3). Once the station file is selected, the path and file are displayed in the input-file-name text box (fig. 1-5), and the user can proceed through the file download and reformatting process.

The GNWISQ program was conceived and written to retrieve and reformat all necessary files in one session but the user may do these actions separately in different sessions. This flexibility allows the user to reformat manually downloaded NWISWeb files or to review the results of a download session before proceeding with the reformatting process. To reformat one file, the user must select the individual NWIS RDB file option, enter the appropriate station number, and select the target directory in the file-specification dialog box. To reformat a group of files, the user must select the batch-file option and select the station file in the target directory with the streamflow-data files by using the file-specification dialog box.

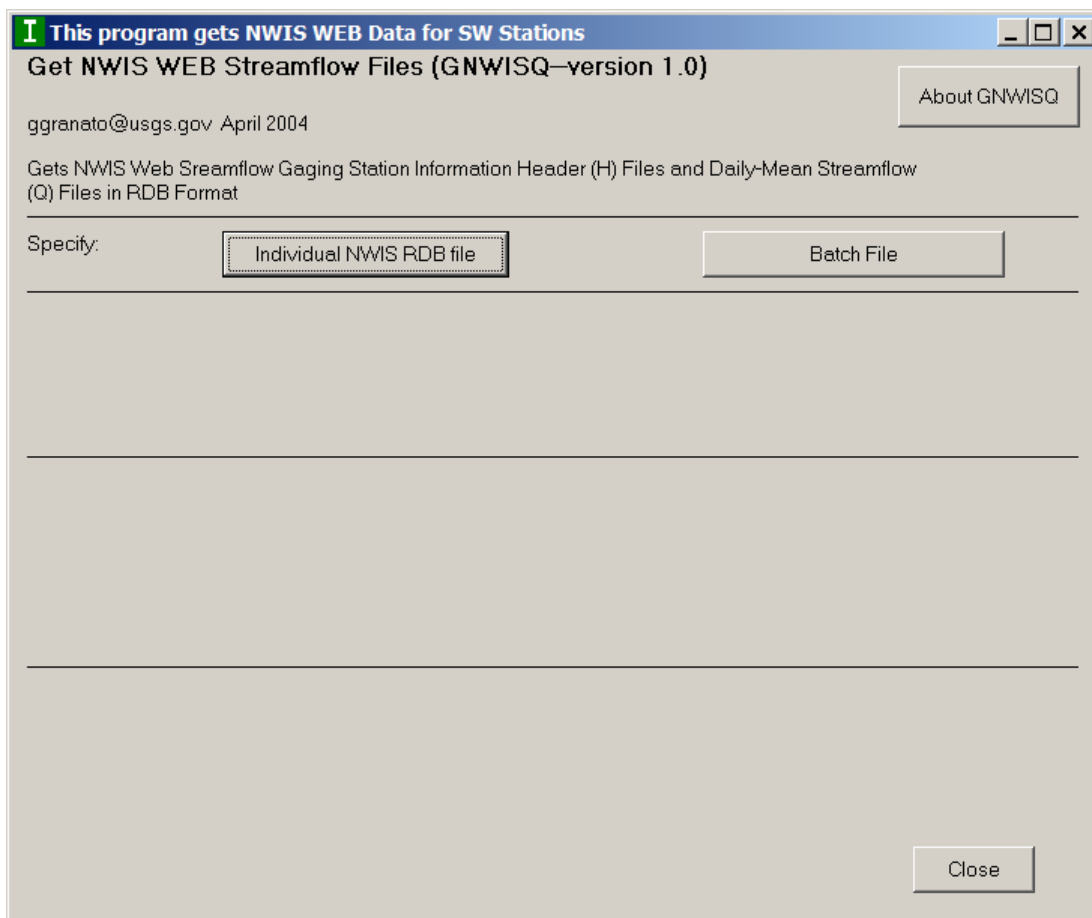


Figure 1-2. Initial appearance of the GNWISQ input form when the program opens.

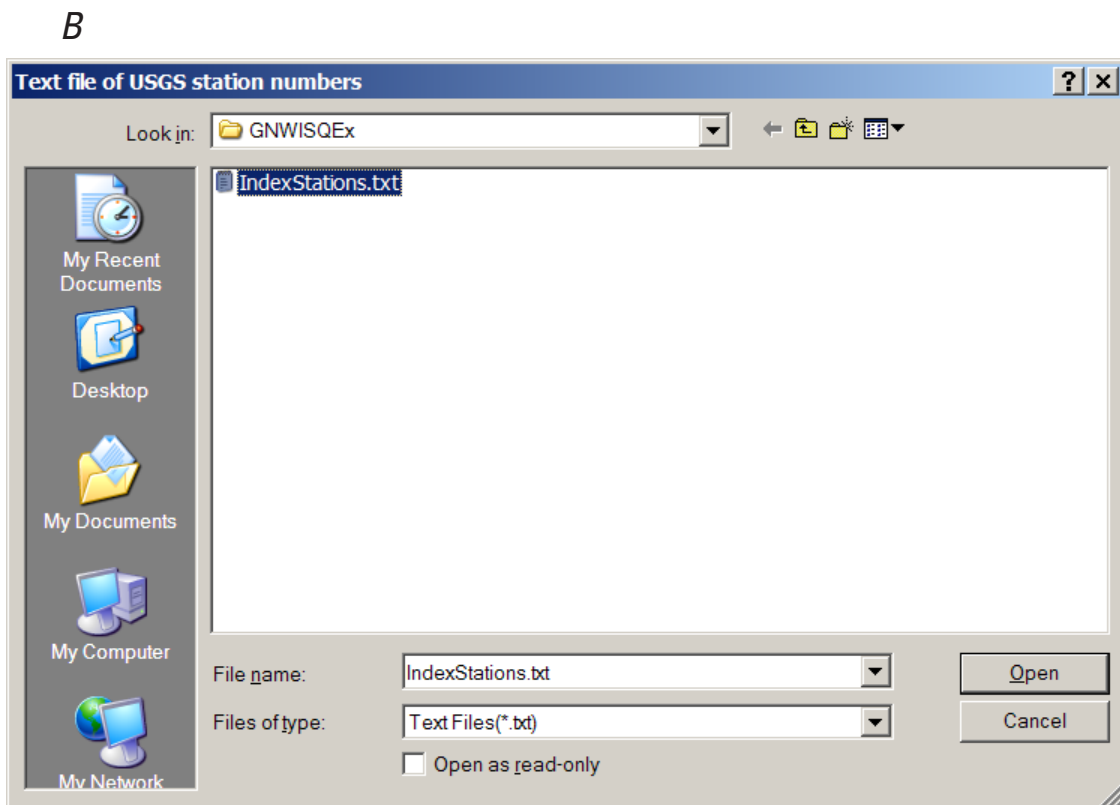
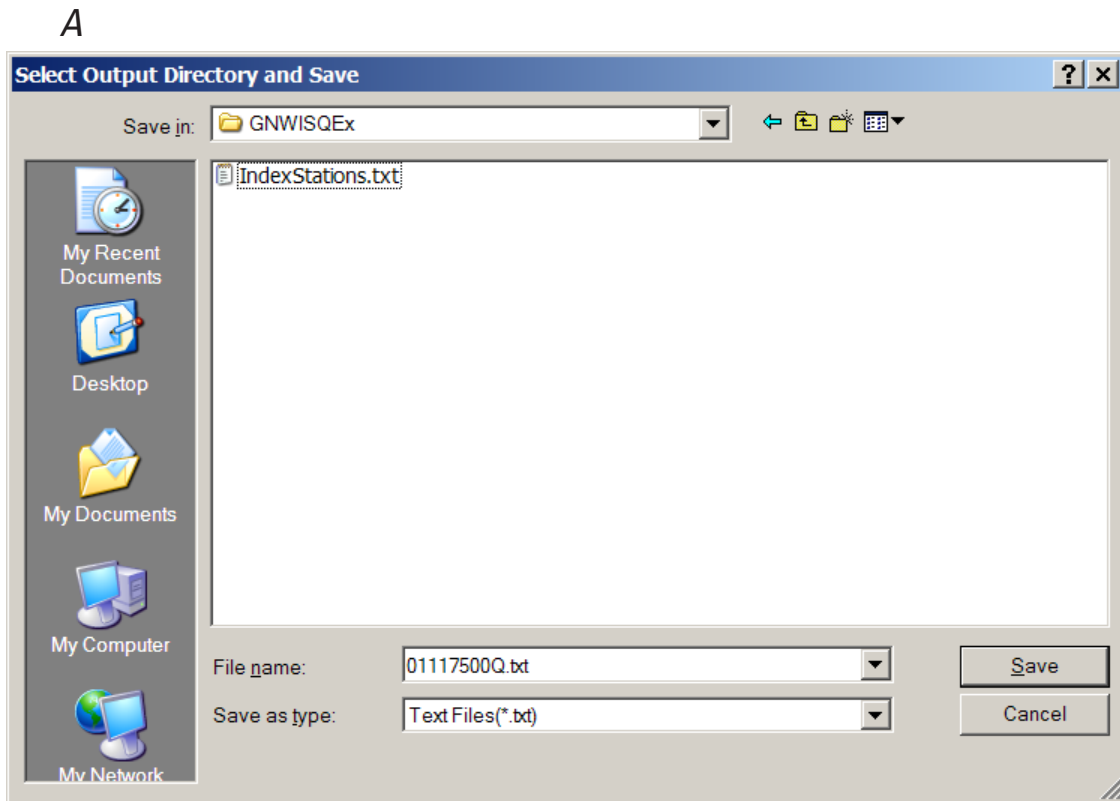


Figure 1-3. Example of the GNWISQ file-specification dialog box used to (A) specify the output directory in individual-file mode and (B) select the station input file in batch mode.

I This program gets NWIS WEB Data for SW Stations _ □ ×

Get NWIS WEB Streamflow Files (GNWISQ—version 1.0) About GNWISQ

ggranato@usgs.gov April 2004

Gets NWIS Web Streamflow Gaging Station Information Header (H) Files and Daily-Mean Streamflow (Q) Files in RDB Format

Specify: Individual NWIS RDB file Batch File

Enter Station Number (Must be valid 8-12 digit number)

USGS NWIS Web Site:

Specify Period of Record:	Four-Digit Year	Two-Digit Month	Two-Digit Day	Note: NWIS web will return any available data between specified beginning and end dates.
Begin Date:	<input style="width: 40px;" type="text" value="1960"/>	<input style="width: 40px;" type="text" value="01"/>	<input style="width: 40px;" type="text" value="01"/>	
End Date:	<input style="width: 40px;" type="text" value="2005"/>	<input style="width: 40px;" type="text" value="09"/>	<input style="width: 40px;" type="text" value="30"/>	Number of Files: <input style="width: 50px;" type="text" value="1"/>

Keep: Approved Data All Data
Replace Q Files? Yes No

Figure 1-4. Example of the GNWISQ input form as configured for specification of data retrieval options for an individual streamflow-gaging station.

This program gets NWIS WEB Data for SW Stations

Get NWIS WEB Streamflow Files (GNWISQ—version 1.0)

ggranato@usgs.gov April 2004

Gets NWIS Web Streamflow Gaging Station Information Header (H) Files and Daily-Mean Streamflow (Q) Files in RDB Format

Specify:

Input File Name: (All output files will be saved to this directory)

USGS NWIS Web Site:

Specify Period of Record:

	Four-Digit Year	Two-Digit Month	Two-Digit Day
Begin Date:	<input type="text" value="1961"/>	<input type="text" value="01"/>	<input type="text" value="01"/>
End Date:	<input type="text" value="2007"/>	<input type="text" value="09"/>	<input type="text" value="30"/>

Note: NWIS web will return any available data between specified beginning and end dates.

Number of Files:

Keep: Approved Data All Data

Replace Q Files? Yes No

Figure 1-5. Example of the GNWISQ input form as configured for specification of data retrieval options for a batch of streamflow-gaging stations specified in the station-input file.

I This program gets NWIS WEB Data for SW Stations [-] [□] [X]

Get NWIS WEB Streamflow Files (GNWISQ-version 1.0) [About GNWISQ]

ggranato@usgs.gov April 2004

Gets NWIS Web Streamflow Gaging Station Information Header (H) Files and Daily-Mean Streamflow (Q) Files in RDB Format

Specify:

Input File Name: (All output files will be saved to this directory)

USGS NWIS Web Site:

Specify Period of Record:	Four-Digit Year	Two-Digit Month	Two-Digit Day	Note: NWIS web will return any available data between specified beginning and end dates.
Begin Date:	<input type="text" value="1961"/>	<input type="text" value="01"/>	<input type="text" value="01"/>	
End Date:	<input type="text" value="2007"/>	<input type="text" value="09"/>	<input type="text" value="30"/>	Number of Files: <input type="text" value="7"/>

Keep: Approved Data All Data

 Yes No

DIR:

Current Status:

Figure 1-6. Example of the GNWISQ input form (in batch mode) showing the directory (DIR) textbox and the current-status textbox.

Summary

The Get National Water Information System Streamflow (Q) files (GNWISQ Version 1.0) program was developed by the U.S. Geological Survey (USGS) in cooperation with the Federal Highway Administration to facilitate the process of downloading streamflow-gaging-station information and daily mean streamflow data files from the U.S. Geological Survey (USGS) National Water Information System Web (NWISWeb) site. Streamflow information is important for many planning and design activities including water-supply, habitat protection, bridge and culvert design, calibration of surface and ground-water models, and water-quality assessments. The GNWISQ program was developed for use in the analysis of local, regional, and national hydrologic data sets. This manual describes the implementation, use, and interpretation of results from the GNWISQ program.

The user may download information and data from one station or from multiple streamflow-gaging stations. To download data, the user must specify a streamflow-gaging-station number (in individual NWIS relational database (RDB) file mode) or an input file with a series of streamflow-gaging-station numbers (in batch-file mode). The GNWISQ program downloads information and data to a user specified directory by initiating internet queries to NWISWeb. Once the user selects the "Download Data" command button, the program checks the internet connection and, if the connection works and the Web address for NWISWeb is correct, proceeds to download station information and data. Station information is saved in header files designated by the station number followed by the suffix "H.txt" (for example, 01117500H.txt). Streamflow data are saved in a file designated by the station number followed by the suffix "Q.txt" (for example, 01117500Q.txt).

The output files provide information and data necessary to analyze streamflow records for the selected site(s). Station-header information includes the site-identification number, site name, decimal latitude, decimal longitude, latitude-longitude accuracy, decimal latitude-longitude datum, state code, altitude of station or land surface, altitude accuracy, altitude datum, hydrologic unit code, drainage area, contributing drainage area, begin date for daily streamflow data, end date for daily streamflow data, count of the daily streamflow data. The daily mean streamflow data file includes the agency code; USGS station number; date of daily mean streamflow; value of daily mean streamflow, in cubic feet per second; and any qualification codes for daily mean streamflow values. The program saves the information and data to the user-specified output-file directory in the tab-delimited RDB format.

The program can be used to reformat the new (2006) NWISWeb streamflow files to the original, more consistent, daily value format. The user may reformat the daily mean streamflow data files to facilitate use with other software applications. The user also may reformat data from one streamflow-gaging station or from multiple streamflow-gaging

stations. This process facilitates post processing with other programs by providing a consistent format with the agency code, site number, date, daily mean streamflow values, and the associated data-qualification codes in separate tab-delimited columns. This process also ensures that the reformatted files follow the personal computer line-feed format.

This manual describes the implementation, use, and interpretation of results from the GNWISQ program. GNWISQ was written in Microsoft Visual Basic 6.0 and has a graphical user interface that follows standard Microsoft Windows interface conventions. The one-form user interface provides text boxes for entry of the current USGS NWISWeb site address and the calendar year, month, and day for the beginning and end date of the desired record. In individual-file mode, the program retrieves station information and daily mean streamflow data files for the station associated with the USGS streamflow-gaging station identification number that the user enters into the text box. In batch mode, the program reads a series of station numbers from a user-specified input file and downloads the information and data sequentially. The program outputs tab-delimited text files that can be used with many computer applications including text editors, spreadsheets, graphing software, and statistical software. An executable version of the program, example files, and the Visual Basic source code are documented in the GNWISQ directory on the computer disk containing this manual.

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The author thanks Elizabeth Ahearn and Julie Kiang of the USGS for providing thoughtful and thorough technical reviews that helped the author improve the GNWISQ program and the associated documentation. Gardner Bent and Ken Eng of the USGS did additional tests of the program and recommended several improvements included in the current version of GNWISQ.

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