Chapter 1 - GFLOW Installation Guide

This chapter guides the new GFLOW user through the process of installing the package and provides instructions for testing the installation using a demonstration data set.

Installation

The groundwater flow modeling system GFLOW is composed of several programs. The groundwater flow model GFLOW1 has been written in Lahey Fortran[1] and runs on IBM-PC Compatible personal computers in extended memory. The program is accompanied by three support programs[2] written in Borland C/C++[3] which run in conventional memory:

- GAEP Geographic Analytic Element Preprocessor
- TABLET A basic digitizing program
- GFPRINT A printing postprocessor for use with GFLOW

Hardware Requirements

- An 80386- or 80486 based PC
- At least 1.5 megabytes of available extended memory
- At least 3 megabytes of available hard disk space
- A Numeric Data Processor (except when using a 80486DX system)
- A Microsoft, PS/2, or compatible mouse device
- A digitizer (optional)
- A printer (optional)

Software Requirements

- PC-DOS or MS-DOS Version 5.0 or higher
- DOS extender bound with `GFLOW1.EXE` (provided)
- `ANSI.SYS` driver (supplied with DOS)

---

1 Lahey is a trademark of Lahey Computer Systems, Inc.

2 The educational version or is not accompanied by TABLET and GFPRINT.

3 Borland is a trademark of Borland International

What is on the Distribution Diskette?

In the root directory you find:

- `INSTALL.EXE` Installation program
- `DISK.ID` Disk identifier for `INSTALL.EXE`.
- `GFLOW.001` GFLOW product files (in archived form).
- `GFLOW.INF` Installation instructions for `INSTALL.EXE`.

These files can only be read by the install program INSTALL.EXE. To install the product, run the install procedure (see below).

Installing on your Hard Disk

The installation process for GFLOW is entirely automated by the `INSTALL.EXE` program on the distribution disk. The installation program will locate potential target drives on the system, install the products in a target directory specified by the user and make any necessary changes to your `CONFIG.SYS` and `AUTOEXEC.BAT` files.

- To install, place the distribution disk in drive A: or B: and switch your logged drive to the floppy drive:

  ```
  C:\> A: <CR>
  A:\>
  ```

  or, if using drive B:,

  ```
  C:\> B: <CR>
  B:\>
  ```

- Next, run the installation program:

  ```
  A:\> INSTALL <CR>
  ```

  or

  ```
  B:\> INSTALL <CR>
  ```

- The `INSTALL` program will determine which available drives can be used for the installation and request an installation directory (default is `C:\GFLOW`). Once all the product files are unpacked, you will have the opportunity to let INSTALL make changes to your `AUTOEXEC.BAT` and `CONFIG.SYS` files. The changes may be automatically performed (in which case the old versions will be backed up), or have the changes placed in a new file (for the user's inspection prior to changing `AUTOEXEC.BAT`).

  If changes are required, GFLOW will not operate properly until they are made. It is therefore recommended that the user allow `INSTALL` to make the changes. Once the installation is complete, reboot your system to make the necessary changes take effect.

- INSTALL does not attempt to configure the digitizer connected to your system. This may be performed after installation using program TABTEST (see below).

Digitizer Configuration

As mentioned above, the user will need to perform one more configuration step if using a digitizer. A utility program TABTEST is provided to simplify the process.

INSTALL places a batch file TABSETUP.BAT in the GFLOW installation directory. This file contains the DOS commands required to configure the user's digitizer and are defaulted to use the mouse after product installation. Program TABTEST allows the user to adjust the parameters for the digitizer communication driver and to see the results on his screen. Once the parameters are set properly, exit TABTEST to save to parameters to TABSETUP.BAT. In Appendix C, the supported tablet configurations are documented, including instructions for several popular digitizer models.

Let's Try

To make sure everything works properly you may try to run the demonstration problem. Go into the \GFLOW\DEMO directory and type

```
C:\GFLOW\DEMO> GFLOW <CR>
```

After a few seconds you should see the opening screen depicted in Figure 1.1. The

```
Program GFLOW1 (rev. 7/1/94)
Copyright (C) H.M. Haitjema 1991 - 1994
Haitjema Software, LLC


COMMERCIAL VERSION 1.0


The graphics cursor in this program requires a MOUSE.
The graphics screens require ANSI.SYS loaded.
The program is designed for file IO without path names,
and using fixed filename extensions. See manual for
proper program setup and disk organization.

Maximum number of equations =   500



Press <Enter> to continue.
```

Figure 1.1 - Opening Screen of GFLOW1

maximum number of equations may differ from the one reported on your screen. For the **educational version** of the program the number of equations is limited to 100. For the commercial version the number of equations is adjusted to the available extended memory. For instance, 100 equations requires about 1.5Mb of available extended memory, while 550 equations will fit in 3Mb of extended memory.

Note:

In order to prevent GFLOW1 from monopolizing all system memory resources, a maximum number of equations may be provided as part of the GFLOW1 command line. The batch file GFLOW.BAT provided with the package sets the maximum number of equations to 500. GFLOW1 can support up to 1,000 equations.

Press <CR> to enter the main program (see Figure 1.2). The commands on the main program menu are organized by function. Notice that all commands may be abbreviated to their first two letters (capital letters in the commands on the menu), except for the help command, which is given by pressing the <F1> key. Parameters between ( ) are mandatory, while parameters between [ ] are optional. Commands without parameters, in general, refer to program modules with their own command menu. In these modules the same conventions for command abbreviation and parameter use apply as for the main program. The commands SAVE and LOAD, listed in the first column under --INPUT/OUTPUT--, save groundwater

```
------------------- M A I N  P R O G R A M -----------------

--INPUT/OUTPUT--      --ANALYTIC ELEMENTS--  --MISCELLANEOUS-
SWitch (filename)     WEll                   TItle [title]
SAve   (filename)     PPwell                 AQuifer
LOad   (filename)     TWell                  MAp
DAta   (filename)     SInkdisc               DOs
VIew   (filename)     SD3d                   STop
                      LInesink               COmmand summary
                      INhomogeneity          <F1> = help

--SOLUTION--          --NUMERICAL OUTPUT--   --GRAPHICAL OUTPUT--
SOlve [GRoun] [it.]   HEad      (x,y[,z])    LAyout
SOlve BAseflow        POtential (x,y[,z])    GRid
SOlve COnjunc [it.]   OMega     (x,y)        PLot
CHeck                 DIscharge (x,y)        CUrsor
                      SPecific  (x,y[,z])    TRace
                      VElocity  (x,y[,z])
>
```

Figure 1.2 - Main Program Screen of GFLOW1

```
File DEMO.SOL         assigned to logical unit  2

Total number of bytes read:    8942

------------------- M A I N  P R O G R A M -----------------

--INPUT/OUTPUT--      --ANALYTIC ELEMENTS--  --MISCELLANEOUS-
SWitch (filename)     WEll                   TItle [title]
SAve   (filename)     PPwell                 AQuifer
LOad   (filename)     TWell                  MAp
DAta   (filename)     SInkdisc               DOs
VIew   (filename)     SD3d                   STop
                      LInesink               COmmand summary
                      INhomogeneity          <F1> = help

--SOLUTION--          --NUMERICAL OUTPUT--   --GRAPHICAL OUTPUT--
SOlve [GRoun] [it.]   HEad      (x,y[,z])    LAyout
SOlve BAseflow        POtential (x,y[,z])    GRid
SOlve COnjunc [it.]   OMega     (x,y)        PLot
CHeck                 DIscharge (x,y)        CUrsor
                      SPecific  (x,y[,z])    TRace
                      VElocity  (x,y[,z])
>
```

Figure 1.3 - Main Program Screen of GFLOW1

flow solutions to disk and load groundwater flow solutions from disk, respectively. In general, no filename extensions are needed (except for the VIEW command) as GFLOW1 assumes default extensions for the various input and output files.

To load the demonstration problem, type:

```
LOAD DEMO <CR>
```

The screen should now look as depicted in Figure 1.3.

Notice the report on the file I/O above the main menu. What you loaded in the program is a binary file `DEMO.SOL` which contains all data associated with the groundwater

flow problem, including so-called "strength parameters" of the analytic elements solved for during previous program operation. Hence, in this try out we omit the procedure of reading in an input data file and solving the groundwater flow problem. Instead, we just read back from disk a previously created solution.

Let's look at a layout of the hydrological features in the domain. Type

```
     --------- GRAPHICS module --------
<F1> = Help
WINDOW       6560.119       -1631.557       36694.988       33984.277
                          (all,cursor,select,save,delete)
DISPLAY COLOR             (monochrome)
<F2> or GO
<Esc> or QUIT
>
```

Figure 1.4 - Menu in the GRAPHICS module following the LAYOUT command

```
LAYOUT <CR>
```

to enter the GRAPHICS module (Figure 1.3). Just press <F2> to bring up the graphics. You should see a layout of streams and lakes (yellow) and some landmarks (brown, green, and magenta). The area you are looking at is defined by the WINDOW command in the GRAPHICS module, see Figure 1.4, but we will discuss its use elsewhere in this manual.

```
     ----------- GRID module ----------
<F1> = Help
WINDOW       6560.119       -1631.557       36694.988       33984.277
                          (all,cursor,select,save,delete)
HORIZONTALPOINTS   30
PLOT HEADS       (potentials, streamlines,discharge, flownet)
DOTMAP ON        (off)
MINUSGRID                 (filename)
SAVE                      (filename)
LOAD                      (filename)
SURFER                    (filename)
<F2> or GO
<Esc> or QUIT
>
```

Figure 1.5 - Menu in the GRID module

Plotting Piezometric Contours

Next we will look at a piezometric contour plot. In order to contour the piezometric heads in the aquifer, we need to calculate piezometric heads in a grid over the area of interest. Press <CR> to exit graphics mode and type

```
GR <CR>
```

to enter the GRID module. You should see the menu depicted in Figure 1.5. A complete explanation of all of the commands will be done elsewhere in this manual. Just notice that we will PLOT HEADS and that the grid resolution is set to HORIZONTALPOINTS 30, which means that 30 points will be distributed in horizontal direction, while the number of points in

```
     --------- GRAPHICS module --------
<F1> = Help
DISPLAY COLOR            (monochrome)
<F2> or GO
<Esc> or QUIT
>
```

Figure 1.6 - Menu in the GRAPHICS module following the PLOT command

the vertical direction will depend on the aspect ratio of the domain, creating an equally spaced grid. Press <F2> to start the gridding. You will see vertical columns of points plotted on the layout of streams, lakes and landmarks in the domain of interest. At each of these points the piezometric head is calculated by superimposing the contributions of all analytic elements (about 100 in this case). Once the grid is complete press <ESC> to exit graphics mode and reenter the GRID module. Press <ESC> to leave the GRID module and to return to the MAIN program. Type

```
     ----- CONTOUR PLOTTING module -------
Minimum and maximum values in the grid:  255.7606      309.9636
LEVEL (  259.2    ) [  5.400    ] [  307.8    ] {  10}
LAYOUT ON
HELP
<F2> or GO
<Esc> or QUIT
>
```

Figure 1.7 - Menu of the CONTOUR PLOTTING module

```
PLOT <CR>
```

to enter the GRAPHICS module (Figure 1.6). Accept the default parameter settings, and press <F2> to proceed. You are now in the CONTOUR PLOTTING module which menu is shown in Figure 1.7. The program has calculated 10 default contour levels to be contoured. We will accept them by pressing <F2> again. You will see the same layout as before but now blue piezometric contour lines are superimposed. Also an arrow mouse cursor appears on the screen. The text above the screen indicates that you may annotate the contour plot by positioning the cursor at points on the contour lines and pressing the L key: a contour level is printed on the contour line (See Figure 1.8).

Making Hardcopy Output Using GFPRINT[4]

The commercial version of GFLOW provides a powerful output postprocessor, GFPRINT, which allows the user to print high-quality output on literally hundreds of printers (including PostScript and color devices). To test GFPRINT, press the <F7> key while a graphic is onscreen. GFLOW will process the current graphical image and execute the GFPRINT postprocessor. Once in GFPRINT, you may position the image on the printed page by use of appropriate margin settings, preview the final hardcopy (press the View <F2> key) and print the image (press the Print <F3> key). Select an appropriate printer - see the GFPRINT manual (Chapter 6). After printing with GFPRINT, use the <ESC> key to return

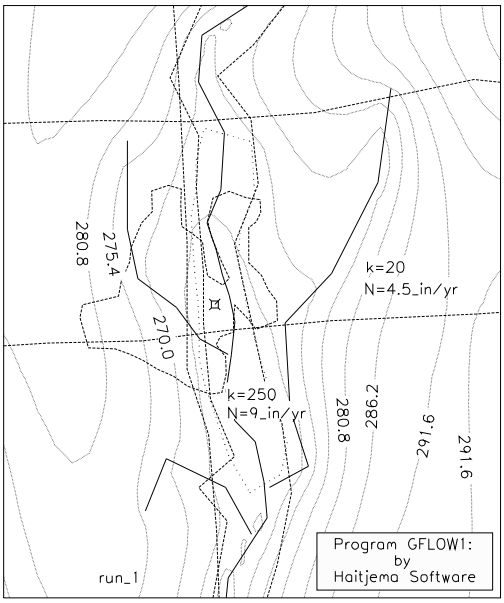

Figure 1.8 - Contour plot generated by GFLOW1

to GFLOW. The previous graphic will reappear. Press <ESC> to return to the GFLOW Main Menu.

Creating Graphics Hardcopies Using the DOS Screen Dump Facility

If you cannot use GFPRINT (for example, when using the educational version of GFLOW), you may use the DOS program GRAPHICS.COM[5] to make hardcopies. Assuming

---

4 This option is not available in the educational version of the program.

5 See your DOS manual for proper configuration of GRAPHICS.COM. GFLOW installation does not attempt to configure GRAPHICS.COM

you have a monochrome printer (no colors) we first will reset our graphics environment to monochrome. Exit graphics mode by pressing <ESC>. Return to the main program by typing

```
QUIT <CR>
```

in the CONTOUR PLOTTING module. Reenter the GRAPHICS module by typing

```
PLOT <CR>
```

and now type the command

```
DISPLAY MONOCHROME
```

Next press <F2>to get to the contour level settings menu and <F2> again to view the plot.

The same contour plot appears, but now in black and white. You may annotate your graph again if so desired. To dump a hardcopy of the screen onto the printer hold the Shift key and press the PrintScrn key (once). It may take a minute or more before your plot appears on the printer. During this time the keyboard is inactive, thus you cannot exit the graphics environment.

Problems with Shift-PrintScrn

If the printing fails, check the C:\AUTOEXEC.BAT file and the DOS manual to ensure you have been running the GRAPHICS program with the proper printer driver. It is also possible that the DOS GRAPHICS program conflicts with other utilities, such as a printer spooler or screen saver. Such conflicts may even lead to program failure. If this happens, reboot your system without installing these utilities and try again.

Leaving GFLOW

The command

```
STOP <CR>
```

stops the program and returns you to DOS.

The GFLOW.INI File

When you stopped the program an initialization file GFLOW.INI was written to disk which will be read by the program when started again. Several environment parameters are written to that file to preserve the operating state of the previous run. For instance, the command DISPLAY MONOCHROME given in the GRAPHICS module is stored in this file, so that when restarting GFLOW1 the graphics mode is still set to black and white.

This page is intentionally left blank.