Documentation of Model Input and Output Values for Simulation of Pumping Effects in Paradise Valley, A Basin Tributary to the Humboldt River, Humboldt County, Nevada

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ABSTRACT

Documentation is provided of model input and sample output used in a previous report for analysis of ground-water flow and simulated pumping scenarios in Paradise Valley, Humboldt County, Nevada. Documentation includes files containing input values and listings of sample output. The files, in American International Standard Code for Information Interchange (ASCII) or binary format, are compressed and put on a 3-1/2-inch diskette. The decompressed files require approximately 8.4 megabytes of disk space on an International Business Machine (IBM)-compatible microcomputer using the MicroSoft Disk Operating System (MS-DOS) operating system version 5.0 or greater.

INTRODUCTION

Paradise Valley, Nev., is a narrow valley approximately 40 miles long that extends north-northeastward from the Humboldt River near Winnemucca. Ground-water flow and response to hypothetical development of ground water in this basin were simulated as part of the U.S. Geological Survey Great Basin Regional Aquifer-System Analysis (RASA) project (Harrill and others, 1983). A three-layer digital model was developed for Paradise Valley using a computer program written by McDonald and Harbaugh (1988). Results of the model are given by Prudic and Herman (1995).

Although the report by Prudic and Herman (1995) summarizes the data input to the model, a detailed description of grid location, a listing of model input values, and sample output have not been published previously. The purpose of this report, which is a supplement to the report by Prudic and Herman (1996), is to provide more detailed documentation of the model.

MODEL GRID

The basin-fill aquifer of Paradise Valley was represented by a three-layer finite-difference model of 33 columns and 89 rows, with nodes 2,500 feet apart at the centers of the cells. The model has 1,691 active cells in the top layer (layer 1), 1,440 active cells in the middle layer (layer 2), and 1,195 active cells in the bottom layer (layer 3). The model is surrounded by inactive cells through which there is no flow. The model grid is oriented along the major axis of the valley and is rotated approximately 13 degrees east of a north-south line. Latitude and longitude of the four corners of the grid (beginning at the origin of the grid at the northwesternmost corner and continuing in a clockwise direction) are as follows.

Corner	North latitude	West longitude
Northwest	41° 37′ 07″	117° 37′ 51″
Northeast	41° 35′ 01″	117° 19′ 58″
Southeast	40° 58′ 49″	117° 27′ 32″
Southwest	41° 00′ 54″	117° 45′ 16″

Recharge to the basin-fill aquifer is primarily from streams that become ephemeral during summer and fall. A computer program (Prudic, 1989), designed specifically for use with the ground-water flow model of McDonald and Harbaugh (1988), was used to route variable streamflows through the modeled area and to compute leakage to and from the streams.

The program divides streams into reaches and segments. A reach is the part of a stream that corresponds to a model cell; segments are groups of reaches in which no tributary flow from other streams is added and from which no water is diverted to ditches or canals. In the model for Paradise Valley, 274 reaches and 27 segments were used to simulate varying leakage to and from streams. Included with the stream package is a section of the Humboldt River used as the southern boundary of the modeled area.

The model simulated predevelopment and pumping conditions, with a steady-state simulation for predevelopment conditions and transient simulations for three pumping periods (1948-68, 1969-78, 1979-82). The pumping period 1948 to 1968 was divided into four stress periods: 1948-53, 1954-58, 1959-65, and 1966-68. The period from 1969-78 was divided into 10 stress periods, each of 1-year duration. The period 1979-82 was divided into 16 stress periods, each of 3-month duration.

INPUT AND OUTPUT FILES

Original input and output files for the Paradise Valley model were developed on a Prime computer, transferred to microcomputer, and compressed so they would fit on a single diskette. The compressed files were collected into two self-extracting files, or libraries, named INPUT.EXE and OUTPUT.EXE. A diskette (included in this report) contains a copy of this text (README.TXT) and the compressed files. The 3-1/2-inch diskette has a capacity of 1.2 megabytes. Files compressed on the diskette were created on an IBM compatible microcomputer using MS-DOS version 5.0. The file compression was performed using LHarc version 1.13c (copyright Haruyasu Yoshizaki). The decompressed files require approximately 8.4 megabytes of disk space. To decompress the files, copy the self-extracting libraries (INPUT.EXE and OUTPUT.EXE) to the desired directory on a hard disk. Type INPUT (or OUTPUT) and press the enter key. Computer instructions contained within INPUT.EXE and OUTPUT.EXE will decompress the files into that directory. Decompression of INPUT.EXE creates 54 model-input files (table 1); decompression of OUTPUT.EXE creates 4 model-output files (table 2). The decompressed files are identical to the original input and output files and are in the American International Standard Code for Information Interchange (ASCII) format.

Data contained in the files are in units of feet and seconds, except as noted. The model program, written in Fortran 77, can be used on a variety of computers; the input files might require reorganization depending on the specific computer and compiler used, and the computed output might differ slightly from that presented here.

REFERENCES CITED

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Prudic, D.E., 1989, Documentation of a computer program to simulate stream-aquifer relations using a modular, finite-difference, ground-water flow model: U.S. Geological Survey Open-File Report 88-729, 113 p.

Prudic, D.E., and Herman, M.E., 1996, Ground-water hydrology and simulated effects of development in Paradise Valley, a basin tributary to the Humboldt River in Humboldt County, Nevada: U.S. Geological Survey Professional Paper 1409-F, 92 p.

McDonald, M.G., and Harbaugh, A.W., 1988, A modular three-dimensional finite-difference ground-water flow model: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 6, Chapter A1, 586 p.

Table 1. Model-input files, Fortran units, sizes, maximum record lengths, and descriptions

File	Fortran unit	Size (bytes)	Maximum record length (characters)	Description
BAS.DTA	5	455	72	Steady-state model, basic information
BCF.DTA	7	298	39	Steady-state model, block centered flow information
BOT1.DTA	30	21, 271	76	Altitude at bottom of layer 1
ELEV.DTA	54	18,156	78	Land-surface altitude
EVT.DTA	11	139	46	Steady-state model, evapotranspiration information
HYCOND1.DTA	29	6,052	72	Hydraulic conductivity, layer 1
IBOUND1.DTA	42	6,052	72	Boundary, layer 1
IBOUND2.DTA	44	6,052	72	Boundary, layer 2
IBOUND3.DTA	46	6,052	72	Boundary, layer 3
OC.DTA	17	210	46	Steady-state model, output control information
RCH.DTA	14	24,344	86	Steady-state model, recharge package information
SHEAD1.DTA	48	12,104	78	Steady-state model, starting heads, layer 1
SHEAD2.DTA	50	12,104	78	Steady-state model, starting heads, layer 2
SHEAD3.DTA	52	12,104	78	Steady-state model, starting heads, layer 3
SIP.DTA	15	74	56	Steady-state model, Strongly Implicit Procedure information
STR.DTA	18	21,536	86	Steady-state model, streamflow data
SY1.DTA	31	9,168	85	Primary storage coefficient, layer 1
THICK2.DTA	33	21,271	76	Primary storage coefficient, layer 2
THICK3.DTA	37	21,271	76	Primary storage coefficient, layer 3
TRANS2.DTA	34	30,260	76	Transmissivity, layer 2
TRANS3.DTA	40	30,260	76	Transmissivity, layer 3
VC12.DTA	32	30,260	76	Vertical conductivity between layers 1 and 2
VC23.DTA	36	30,260	76	Vertical conductivity between layers 2 and 3
T48HEAD1.DTA	48	12,104	78	Transient model, initial heads, layer 1 (1948-68)
T48HEAD2.DTA	50	12,104	78	Transient model, initial heads, layer 2 (1948-68)
T48HEAD3.DTA	52	12,104	78	Transient model, initial heads, layer 3 (1948-68)
T69HEAD1.DTA	48	21,093	83	Transient model, initial heads, layer 1 (1969-78)
T69HEAD2.DTA	50	21,093	83	Transient model, initial heads, layer 2 (1969-78)
T69HEAD3.DTA	52	21,093	83	Transient model, initial heads, layer 3 (1969-78)
T78HEAD1.DTA	48	21,093	83	Transient model, initial heads, layer 1 (1979-82)
T78HEAD2.DTA	50	21,093	83	Transient model, initial heads, layer 2 (1979-82)
T78HEAD3.DTA	52	21,093	83	Transient model, initial heads, layer 3 (1979-82)
T69HEAD.OUT	56	141, 552	--	Transient model, calculated heads, end of 1969-78 (binary file). File used to produce heads for 1979-82 pumping periods
TBAS48.DTA	5	547	71	Transient model, basic information (1948-68)
TBAS69.DTA	5	729	74	Transient model, basic information (1969-78)
TBAS79.DTA	5	940	74	Transient model, basic information (1979-82)
TBCF.DTA	7	391	39	Transient model, block-centered flow information
TEVT48.DTA	11	265	46	Transient model, evapotranspiration data (1948-68)
TEVT69.DTA	11	517	46	Transient model, evapotranspiration data (1969-78)
TEVT79.DTA	11	1,099	46	Transient model, evapotranspiration data (1979-82)
TOC48.DTA	17	2,115	80	Transient model, output control information (1948-68)
TOC69.DTA	17	3,125	82	Transient model, output control information (1969-78)
TOC79.DTA	17	5,101	90	Transient model, output control information (1979-82)

Table 1. Model-input files, Fortran units, sizes, maximum record lengths, and descriptions --Continued

File	Fortran unit	Size (bytes)	Maximum record length (characters)	Description
TRCH48.DTA	14	262	57	Transient model, recharge data (1948-68)
TRCH69.DTA	14	804	63	Transient model, recharge data (1969-78)
TRCH79.DTA	14	1,374	72	Transient model, recharge data (1979-82)
TRECHARG.DTA	16	387,328	86	Transient model, recharge location array
TSIP.DTA	15	74	56	Transient model, Strongly Implicit Procedure information
TSTR48.DTA	18	87,228	86	Transient model, streamflow data (1948-68)
TSTR69.DTA	18	215,792	86	Transient model, streamflow data (1969-78)
TSTR79.DTA	18	343,026	86	Transient model, streamflow data (1979-82)
TWELL48.DTA	8	11,620	46	Transient model, well data (1948-68)
TWELL69.DTA	8	56,640	66	Transient model, well data (1969-78)
TWELL79.DTA	8	88,748	84	Transient model, well data (1979-82)
	Total	1,831,720 bytes		

Table 2. Model-output files, Fortran units, sizes, and descriptions

File	Fortran unit	Size (bytes)	Description
PVRUN.LST	6	675,365	Output for steady-state simulation
PVT48RUN.LST	6	1,294, 018	Output for transient simulation (1948-68)
PVT69RUN.LST	6	1,952,085	Output for transient simulation (1969-78)
PVT79RUN.LST	6	2,687,047	Output for transient simulation (1979-82)
	Total	6,608,515 bytes	