DOCUMENTATION OF GEOGRAPHIC-INFORMATION-SYSTEM COVERAGES AND DATA-INPUT FILES USED FOR ANALYSIS OF THE GEOHYDROLOGY OF THE VIRGINIA COASTAL PLAIN

By Michael J. Focazio and Theodore B. Samsel, III

U.S. GEOLOGICAL SURVEY

Water-Resources Investigations Report 93-4015

Prepared in cooperation with the

HAMPTON ROADS PLANNING DISTRICT COMMISSION and the

VIRGINIA WATER CONTROL BOARD

Richmond, Virginia

1993

U.S. DEPARTMENT OF THE INTERIOR

BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information
write to:

District Chief
U.S. Geological Survey
3600 West Broad Street, Room 606
Richmond, VA 23230

Copies of this report can be
purchased from:

U.S. Geological Survey
Books and Open-File Reports Section
Box 25425, Denver Federal Center
Denver, CO 80225

CONTENTS

ILLUSTRATIONS

TABLES

TABLES--Continued

CONVERSION FACTORS, VERTICAL DATUM, ABBREVIATED HYDRAULIC UNITS, AND ACRONYMS

Multiply	By	To obtain
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
square mile (mi^2)	2.590	square kilometer
foot per day (ft/d)	0.3048	meter per day
foot squared per day (ft^2/d)	0.0929	cubic meter per second
cubic foot per second (ft^3/s)	0.02832	cubic meter per second
million gallons per day (Mgal/d)	0.04381	cubic meters per second

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929--a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

Hydraulic conductivity and transmissivity: In this report, hydraulic conductivity is reported in foot per day (ft/d), a mathematical reduction of the unit cubic foot per day per square foot $[(ft^3/d)/ft^2]$. Transmissivity is reported in foot square per day (ft^2/d), a mathematical reduction of the unit cubic foot per day per square foot times feet of aquifer thickness ($[(ft^3/d)/ft^2]ft$).

List of acronyms:

AAT: Arc attribute table. A table associated with an arc coverage that stores attribute information for that coverage.

DEM: Digital-elevation model. A data file that represents a topographic surface defined by regularly spaced Cartesian coordinates in three dimensions.

DLG: Digital-line graph. A format for digital data.

Fortran: Formula translation.

GIS: Geographic information system. A computerized system used to manipulate, analyze, and display geographic data in digital form.

PAT: Point (or polygon) attribute table. A table associated with a point (or polygon) coverage that stores attribute information for that coverage.

TIN: Triangular irregular network. A representation of a surface derived from irregularly sampled points.

UTM: Universal Transverse Mercator.

DOCUMENTATION OF GEOGRAPHIC-INFORMATION-SYSTEM COVERAGES AND DATA-INPUT FILES USED FOR ANALYSIS OF THE GEOHYDROLOGY OF THE VIRGINIA COASTAL PLAIN

By Michael J. Focazio *and* Theodore B. Samsel, III

ABSTRACT

This report documents geographic-information-system **coverages**[1] and data-input files for a ground-water-flow model, which are used for analysis of the ground-water resources of the Coastal Plain physiographic province of Virginia. The coverages include the altitude of aquifer tops, areal limits of the aquifers, confining-unit thickness and areal extent, geographic and political boundaries, ground-water use, and coverages needed for the regional ground-water-flow model of the Coastal Plain physiographic province of Virginia. Input files for the regional ground-water-flow model also are documented.

INTRODUCTION

The Coastal Plain physiographic province of Virginia is underlain by a seaward-sloping wedge of unconsolidated clastic sediments of Early Cretaceous to Holocene age that lies unconformably on consolidated bedrock. These sediments form a layered system of aquifers and confining units that supply ground water to users throughout the area. As demand for these ground-water resources increases, management tools, such as ground-water-flow models, become of crucial importance to help guide ground-water-resource-management decisions. Development and use of these management tools will be more efficient if digital information from previous studies is retained and updated. The U.S. Geological Survey (USGS), in cooperation with the Hampton Roads Planning District Commission and the Virginia Water Control Board, developed a geographic information system (GIS) to store and spatially relate information and data from previous studies. This GIS interfaces with a ground-water-flow model of the entire Coastal Plain physiographic province. Focazio (1990) described the GIS and gives examples of its applications.

Purpose and Scope

The purpose of this report is to document the GIS coverages for ground-water resources in the Coastal Plain physiographic province of Virginia. These coverages are based on data and information derived from previous studies. The coverages include **point**, **line**, and **polygon** coverages of basic geohydrologic features, such as altitudes of aquifer tops, as well as complex coverages of input and output files for a regional ground-water-flow model. The documentation describes numerous characteristics of the coverages, including the type, source, original scale, and items contained in the coverage. Many coverages can be, and were, derived from other documented coverages. Many of the derivative coverages are documented in this report; others were temporarily established for short-term use. The documentation can help ground-water resource agencies to determine which coverages are of interest by providing detailed reference information on the coverages and files. Coverage files can be requested from the

[1]Terms defined in the glossary are in bold print where first used in this report.

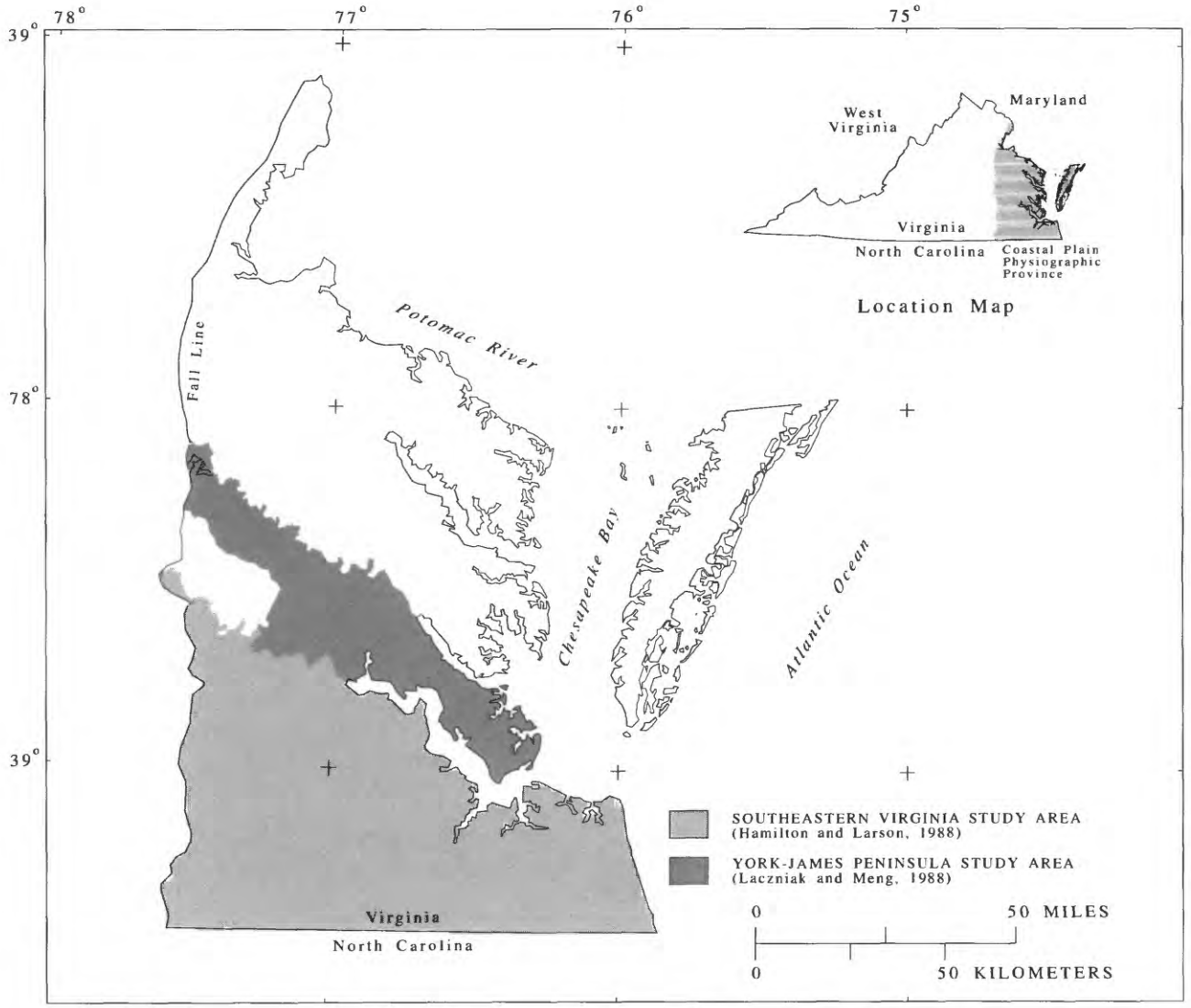

Figure 1.--Location of selected previous U.S. Geological Survey studies in the Coastal Plain physiographic province of Virginia.

Chief, Virginia District of the USGS, at the address at the front of this report. A glossary is included at the end of the report to clarify technical terminology.

Previous Studies

The ground-water resources of the Virginia Coastal Plain physiographic province have been studied by many investigators. Harsh and Laczniak (1990) summarize the work that was completed through 1980. Since then, the USGS has produced several reports, including a report that describes the geohydrologic framework of the Coastal Plain aquifer system (Meng and Harsh, 1988). This framework subsequently was used as the basis for other studies. Harsh and Laczniak (1990) analyzed the ground-water-flow system for the entire Coastal Plain physiographic province of Virginia and parts of Maryland and North Carolina by use of a ground-water-flow model. Hamilton and Larson (1988) improved the definition of the framework and developed a refined ground-water-flow model for the southeastern part of the Coastal Plain physiographic province of Virginia (fig. 1). An improved framework and ground-water-flow model also were developed for the York-James peninsula by Laczniak and Meng (1988).

DOCUMENTATION OF GEOGRAPHIC INFORMATION SYSTEM COVERAGES

The GIS coverages are stored and manipulated as points, lines, and polygons by use of an **ARC/INFO**[2]. Commonly, these different features are stored as separate **layers** for subsequent map overlays and manipulations. Most coverages were **digitized** directly from original copies of the source maps. Others were derived from software that combined previously digitized coverages and other sources of information. The point, line, and polygon coverages were assigned unique descriptive and spatial information during the digitizing and (or) software-manipulation process that became a part of the coverage. After digitizing, all data sets were geometrically **transformed** into the Universal Transverse Mercator (UTM) map **projection**. The digitized data were then **built** into a coverage that was stored in the GIS. Data for the coverages came from different sources, including **thematic** maps and input and output files for the ground-water-flow model.

Point, line, and polygon coverages also can be represented as interpolated surfaces by applying ARC/INFO's **triangular-irregular-network** (TIN) subsystem. This process was described by Focazio (1990).

Many customized ARC/INFO subsystems, Fortran programs, and other software interfaces were developed for use with the GIS. Among the software are documentation programs that describe the contents and other pertinent information on individual coverages. This information is incorporated into the data base for each coverage. The documentation programs contain a long and short form; the long form, however, contains information on individual-coverage **topology** that is not necessary for the purpose and scope of this report.

The tables at the back of this report are edited versions of the output of the short-form documentation program. The editing was necessary to create and format concise tables that include only the information needed for this publication; thus, the tables do not contain all of the information from the documentation file for each individual coverage. That information is available with the coverage. Descriptions of items associated with the coverages that were documented for this report are listed in table 1.

Geohydrologic-Framework Maps

The geohydrologic framework of the Coastal Plain aquifer system was described by Meng and Harsh (1988), and revised by Hamilton and Larson (1988) and Laczniak and Meng (1988). This framework defines the aquifers and confining units that constitute the system. Maps of the altitudes of aquifer tops, altitude of the basement, confining-unit thickness, and aquifer and confining-unit limits were combined to create new maps that incorporated the interpretations from all three studies. Each new map was then digitized as a line coverage.

The altitude of the top of the basement map (BASEMENT.UTM) represents the altitude of the base of the Coastal Plain aquifer system. The coverage is documented in table 2.

The lower Potomac aquifer is the deepest aquifer in the stratigraphic sequence and, therefore, is defined as aquifer 1 (AQ1). Successive overlying aquifers are numbered sequentially, ending with the uppermost aquifer, AQ10 (the Columbia aquifer). Coverages of altitudes of aquifer tops are documented in tables 3–10. The top of aquifer 10 is the water table and is not documented as a separate coverage, but is part of the TEMPGRID2.PLY coverage that is described in the "Input Point and Polygon Coverages" section of this report. The PeeDee aquifer (AQ5) exists in the North Carolina Coastal Plain but not in the Virginia Coastal Plain; therefore, aquifer 5 is not documented separately. The top of aquifer 5 is, however, part of FRAMEWORK.PLY and TEMPGRID2.PLY, because it is an active part of the regional ground-water-flow model where the model extends into North Carolina. The altitude of the top of the lower Potomac aquifer (AQ1TOP.UTM; fig. 2) is an example of the type of coverage stored for aquifer tops. Contours of altitudes were extended beyond the limit of the study area to establish reasonable values at and

[2]The use of trade or product names in this report is for identification purposes only, and does not constitute endorsement by the U.S. Geological Survey.

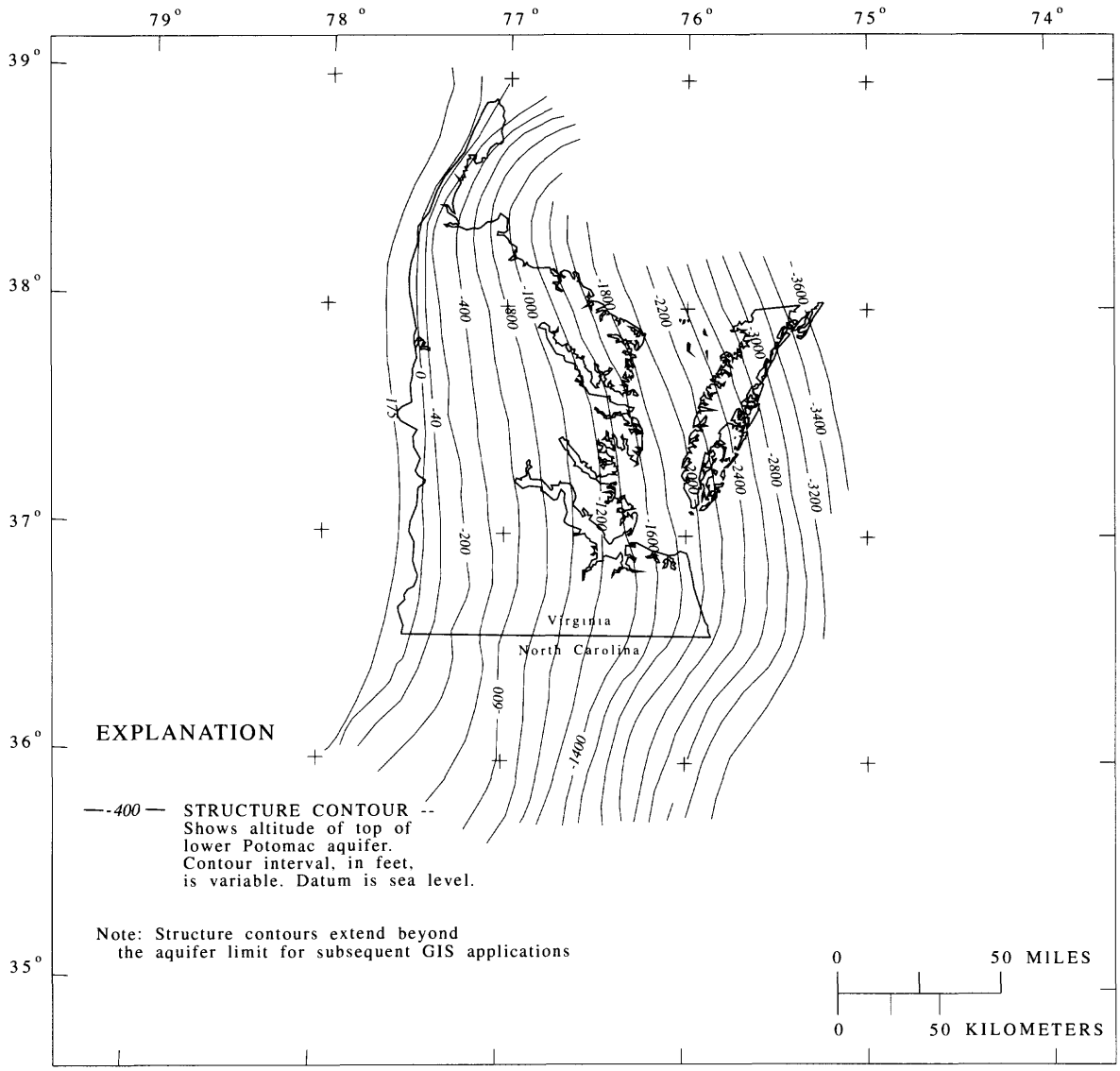

Figure 2.--Altitude of top of lower Potomac aquifer--coverage AQ1TOP.UTM.

near the limit of the unit for subsequent GIS interpolations. Interpolated TIN surfaces of the aquifer tops also were created and are described in table 11.

The aquifer limits (LIMITAQ1 for aquifer 1) are stored as line coverages and are separate from the aquifer-top coverages. This separation is necessary so that the aquifer limits can be used as a **clip** coverage, and so other types of applications can be facilitated. The coverages consist of three parts: the updip limit of the aquifer, the **flow-model boundary**, and the seaward limit of the freshwater system. The aquifer-limit coverages for an individual aquifer are further divided into two different coverages. One of these coverages only represents the areal extent of the aquifer. The other coverage represents a combination of features; including, the areal extent of the aquifer and the limits of the **finite-difference grid** for the ground-water-flow model (see "Ground-Water-Flow Model" section). These coverages are documented in tables 12–20. The limit of the lower Potomac aquifer (LIMITAQ1) is shown as an example of aquifer-limit coverages (fig. 3). Line coverages of the limits without the model boundaries are named LIMIT#.UTM ("#" represents the aquifer number) and are not documented separately.

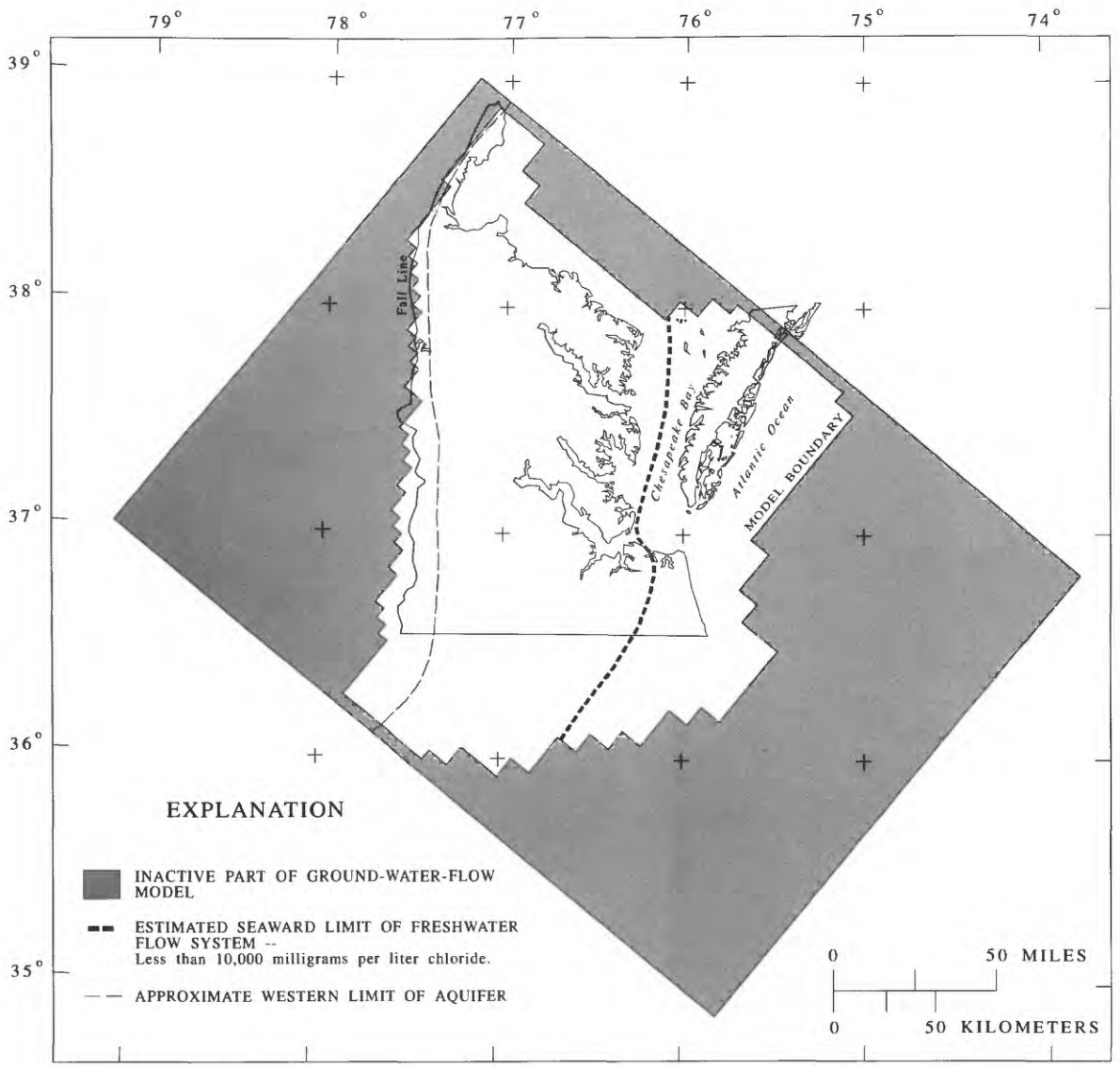

Figure 3.--Limits of lower Potomac aquifer--coverage LIMITAQ1.

Coverages of confining-unit thicknesses are documented in tables 21–29 as CU#TH ("#" represents the confining-unit number). The confining unit directly overlying the lower Potomac aquifer is the deepest in the stratigraphic sequence and is defined as confining unit 1 (CU1). Successive overlying confining units are numbered sequentially ending with the uppermost confining unit, CU9 (the Yorktown-Eastover). Coverage of thickness of confining unit 5 (table 25) was created by digitizing the altitude data of the top of CU5 directly from paper copy and subtracting the altitude of AQ5 from the top of CU5 with the GIS commands. All other confining-unit thickness coverages were digitized directly from the paper copies. A model of the altitudes of confining-unit tops (other than CU5) was generated by custom software that added the confining-unit thickness data to altitudes of the appropriate aquifer tops to calculate the altitudes of the confining units. The TIN's of the altitudes of the tops of all confining units are described in table 30.

Confining-unit-limit data also were recorded as line coverages and are separate from the confining-unit-top coverages to facilitate different types of applications. The coverages consist of the updip limit of the confining unit combined with the flow-

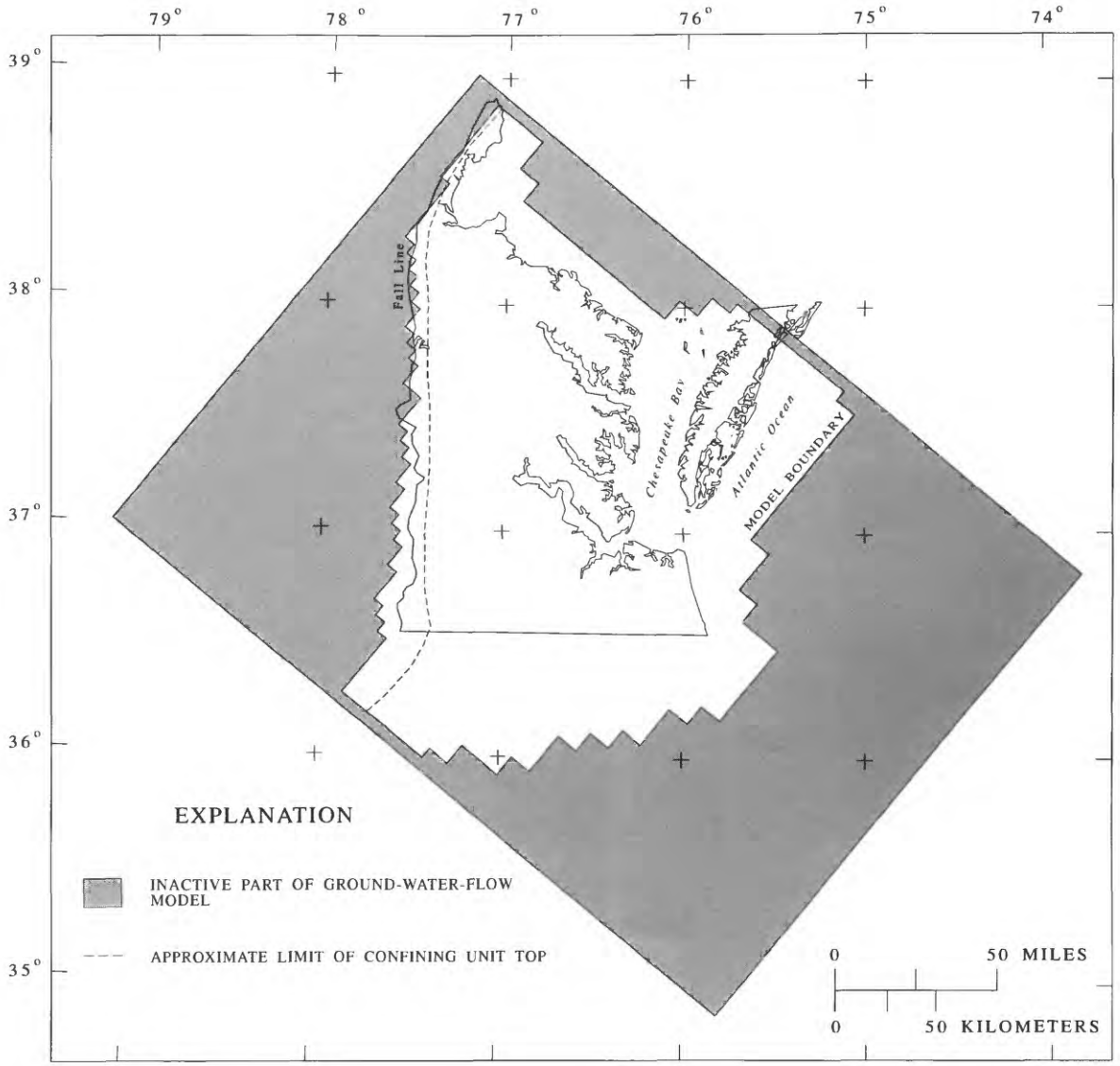

Figure 4.--Limit of lower Potomac confining unit--coverage LIMITCU1.UTM.

model boundaries. The coverages are documented in tables 31–39. An example of the confining-unit limit for the lower Potomac confining unit (LIMITCU1) is shown in figure 4. Line coverages of the limits without the model boundaries are named LIMITCU#.UTM ("#" represents the confining-unit number) and are not documented separately.

Each feature in the geohydrologic framework was incorporated into a polygon coverage (FRAMEWORK.PLY) where an individual polygon represents one block within the finite-difference grid of the flow model (Focazio, 1990). This coverage contains data for the tops of aquifer and confining units for each polygon (or finite-difference block) described below. Focazio (1990) provides further discussion of this coverage and possible applications. The documentation of this derivative coverage is listed in table 40.

Digital-Line Graphs

Several digital-line graphs (DLG) of the study area were obtained as preexisting GIS coverages and are recorded in the Coastal Plain physiographic province GIS. Digital-line graphs represent political, geographic, and physiographic features. These coverages are documented in tables 41–46.

Digital-Elevation Models

Digital-elevation-model (DEM) data from four of the 1:250,000 topographic maps in the Coastal Plain physiographic province were manipulated by ARC/INFO subsystems to create TIN's of the land-surface elevation. These TIN's represent a continuous surface of interpolated elevations and can be used with any point coverage in the Coastal Plain to determine land-surface elevation at the location of the points by the **TINSPOT** subsystem in ARC/INFO. The TIN's are documented in table 47. Each of the four topographic maps (one each for Norfolk, Chincoteague, and Richmond, Va., and Washington, D.C.) were divided into a western half and an eastern half, and each half was further divided into a left half and a right half; thus, each map was divided into four sections for data-manipulation purposes. The coverages were named to represent this division. For example, the TIN for the left half of the western Chincoteague panel is named CHIN_W.L.TIN. The panels include Norfolk, Chincoteague, and Richmond, Va., and Washington, D.C.

Values of elevation from the TIN's were extracted for each node of the ground-water-flow model by the TINSPOT subsystem and used to **populate** a point coverage. This derivative coverage (DEMGRID.PNT) is documented in table 48 and also contains the geohydrologic framework.

Water Use

Harsh and Laczniak (1990) simulated the ground-water-flow system with ground-water withdrawals (including industrial, commercial, and public-supply uses) that were divided into 10 pumping periods of variable time lengths from 1890 through 1980. Focazio (1990) updated these data to include data from 1981 through 1986. Point coverages were created for each of these pumping periods that contain information about the spatial location of each well and the amount of water pumped from each aquifer by each well. The point-coverage data contain the latitude and longitude of each well and pumpage rates (in Mgal/d) from each aquifer and are described in tables 49–58. The coverages are identified as PP#.PNT ("#" represents the pumping-period number).

Ground-Water-Flow Model

Geohydrologic data and interpretive information from the ground-water-flow models (Hamilton and Larson, 1988; Laczniak and Meng, 1988; Harsh and Laczniak, 1990) were incorporated into a refined ground-water-flow model of the entire Coastal Plain physiographic province of Virginia (Focazio, 1990). Several components of this model were stored as coverages for future applications.

Finite-Difference Grid

The orientation and geometry of the finite-difference grid was obtained from the model developed by Harsh and Laczniak (1990). The grid consists of 68 rows and 50 columns. Each grid cell is 3.5 mi on each side. A line coverage was created that represents the finite-difference grid for the entire model domain (fig. 5). The coverage (RASAGRID.LNE) is documented in table 59. There are no features in this coverage other than the lines of the finite-difference grid. Accordingly, this coverage is only used to plot the finite-difference grid quickly and efficiently.

Input Point and Polygon Coverages

The finite-difference grid described above also was generated as a point coverage and a polygon coverage. The point coverage (RASGIS.PNT) contains information describing the spatial location of each of the 3,400 **nodes** in the finite-difference grid. The polygon coverage (TEMPGRID2.PLY) contains spatial information for each of the 3,400 blocks in the grid, as well as information about the area of each block. The point coverage can be used for certain applications (such as TINSPOT) and the polygon coverage can be used for other types of applications (such as area-weighted averaging). Brief descriptions of these applications are discussed in Focazio (1990). Some of the information in these coverages duplicates the information in coverages that were described in previous sections of this report; however, it is preferable to organize the information this way for other applications. These coverages are documented in tables 60–61 and are described as follows:

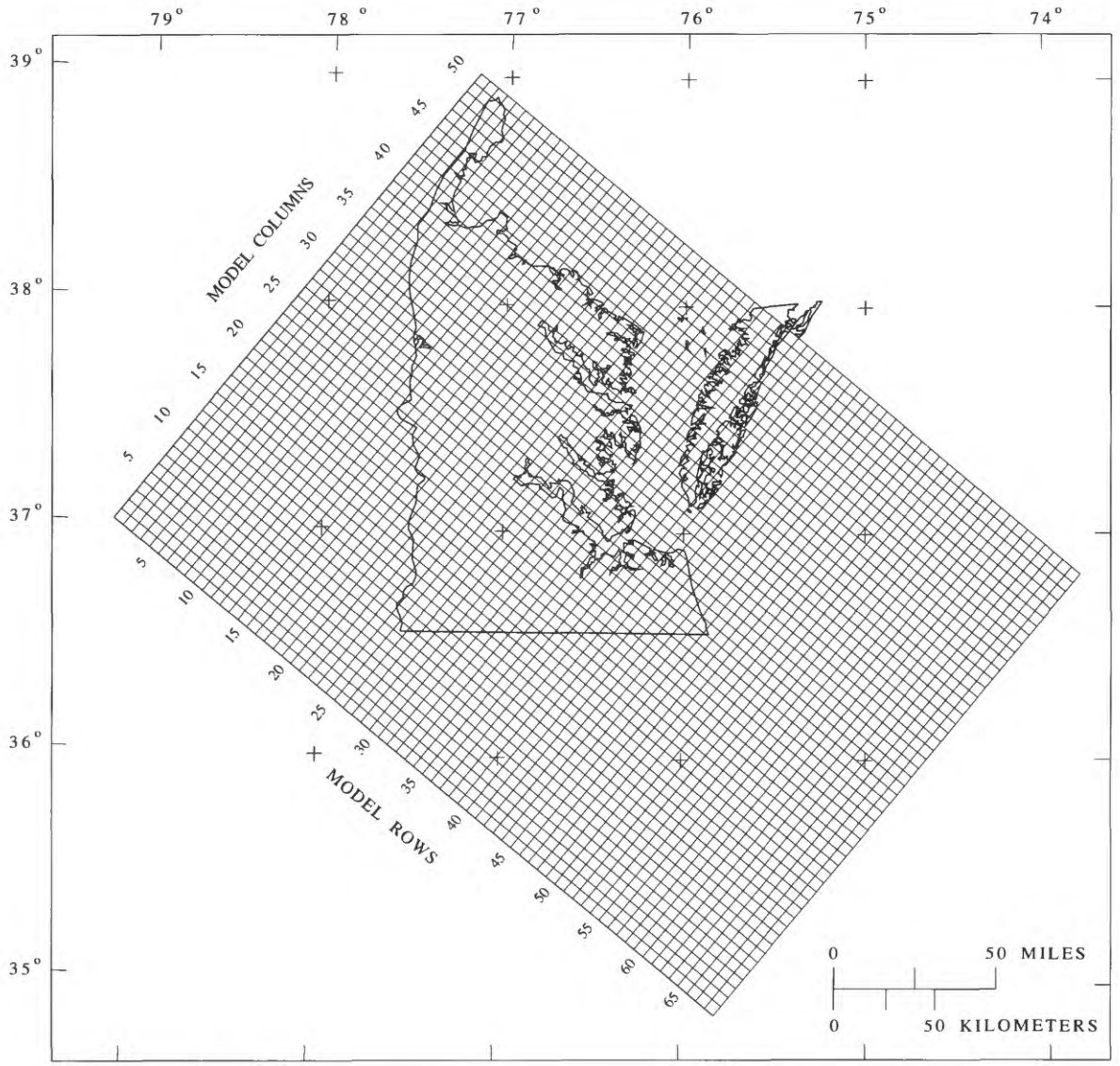

Figure 5.--Finite-difference grid for ground-water-flow model of the Virginia Coastal Plain.

Aquifer transmissivity data are recorded by row, column, and aquifer. Preprocessing programs format this information for input to the flow model. The transmissivity data are recorded in units of foot squared per day.

Confining-unit **leakance** data are recorded by row, column, and confining unit. Preprocessing programs extract this information from the coverage and format it for input to the flow model. The leakances are stored in units of foot per day.

Water-table altitudes (Harsh and Laczniak, 1990) are recorded for each row and column. A preprocessing program uses this information to develop the constant-head boundary for the top aquifer of the flow model. The heads are recorded in units of feet.

These coverages also contain data for the entire geohydrologic framework for each row column, and aquifer. These coverages also can be used to correlate such information as transmissivity, aquifer thickness, and horizontal hydraulic conductivity for input to the flow model.

Boundary Fluxes

The northern and southern boundaries of the flow model are constant-flux boundaries (Harsh and Laczniak, 1990), which are recorded for coverages for each individual aquifer of the flow model only for the last pumping period. Coverages for the other pumping periods can be created easily through software that already was developed for this purpose. These coverages are documented in tables 62–71. Coverages are identified as BND#.-FLX.PLY ("#" represents the aquifer number).

Output Polygon Coverages

Output from the flow model can be entered into the GIS by software that was developed to populate output coverages of the finite-difference grid. This coverage can be used to record and manipulate the output of the model. Simulated-head output for each row, column, and aquifer of the flow model is recorded as a polygon coverage (HEADOUT_T.PLY) for the end of each pumping period. The documentation of the coverage is listed in table 72. The simulated water levels in the lower Potomac aquifer for 1980 pumping conditions are shown in figure 6 as an example. Shade patterns can be selected to distinguish between different values of head and can be plotted with DLG's and other pertinent coverages.

DOCUMENTATION OF THE DATA-INPUT FILES

The flow-model-input information can be extracted from the previously described coverages by custom-designed software. The software will also format the data sets as required by the model computer code. The most recent version of the input information is stored on the Data General, PR1ME, and IBM-PC computers in the Virginia District of the USGS, Richmond, Va. The USGS is not responsible for, and cannot support results of simulations made by outside parties that request this information. The information was developed for a specific application, and any other applications are the responsibility of the user.

Basic-Package Input

The file for Basic-Package Input is named BPI_T. The file contains data that were described in McDonald and Harbaugh (1988) for the Basic-Package Input. This file also contains information on input-unit and output-unit numbers that will be specific to individual uses and, therefore, must be edited for application. The starting-head arrays are recorded in units of feet.

Block-Centered Flow-Package Input

The file for Block-Centered Flow-Package Input is named BCFPI_T. This file contains data as described in McDonald and Harbaugh (1988) for Block-Centered Flow-Package Input. The file is set up for transient simulations but can easily be edited for steady-state runs. The transmissivity arrays and their multipliers produce input that is in foot per second and the vertical leakance arrays and their multipliers also produce input in units of foot per second.

Well-Package Input

The file for Well-Package Input is named WELLS_T. This file contains data as described in McDonald and Harbaugh (1988) for the well package. The file is set up for 10 pumping periods from 1890 through 1986. The data are recorded in units of cubic foot per second. The fluxes for the constant-flux boundary cells also are stored in this file.

SUMMARY

This report documents the coverages that were developed to analyze the ground-water resources of the Coastal Plain physiographic province of Virginia. Coverages include the altitude of aquifer tops, limits of the aquifers, confining-unit thickness and areal limits, geographic and political boundaries, ground-water use, and coverages needed for the regional ground-water-flow model. The input files for the refined Coastal Plain ground-water-flow-model also are documented.

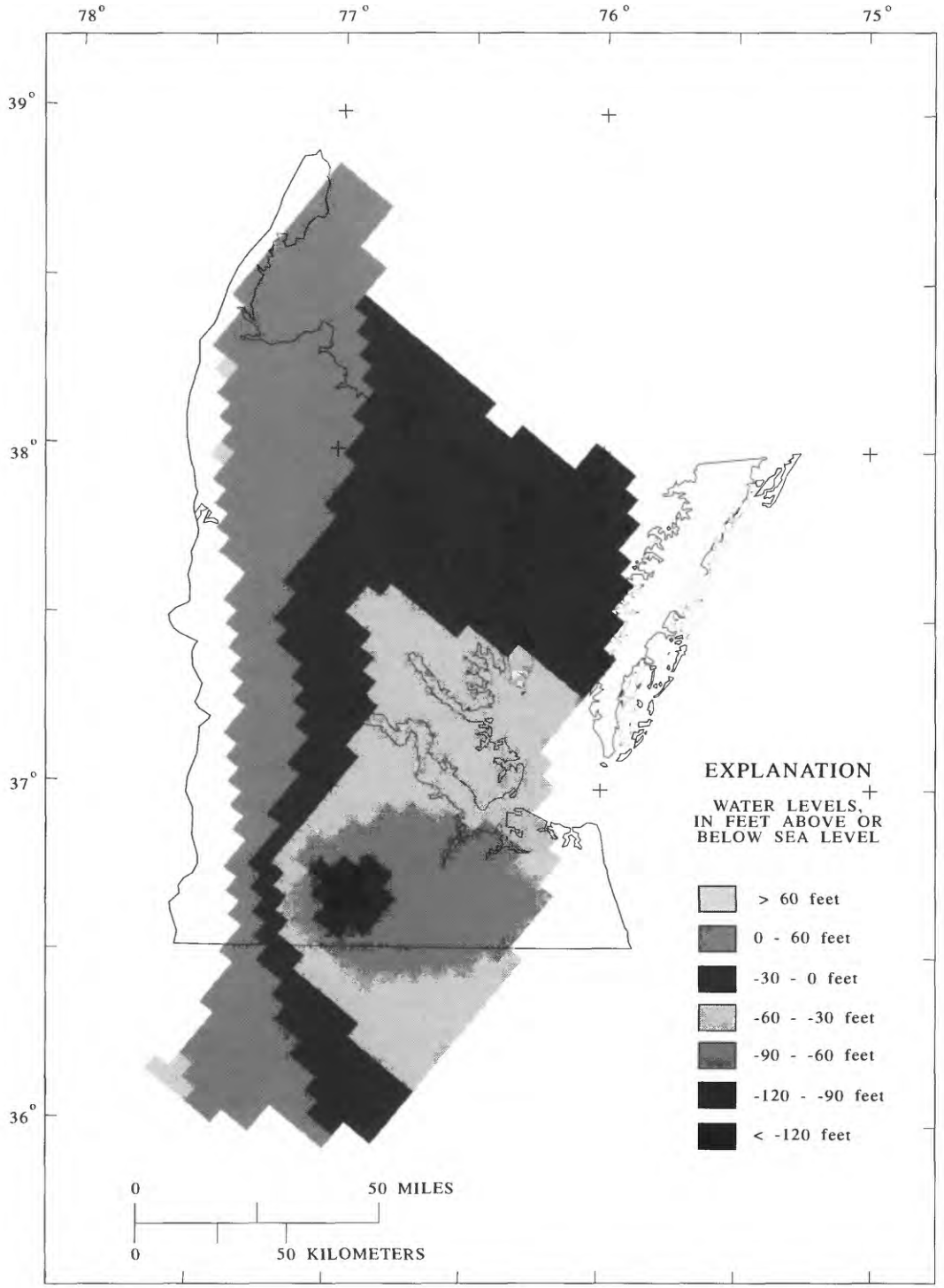

Figure 6.--Simulated altitude of water levels in lower Potomac aquifer (1980).

SELECTED REFERENCES

Environmental Systems Research Institute, Inc., 1987a, Users guide, ARC/INFO, Volume 1--The geographic-information system software: Redlands, Calif., various pagination (periodic updates by inserts).

_____1989, Users guide, ARC/INFO, Volume 2--Command references: Redlands, Calif. various pagination (periodic updates by inserts).

_____1987, Users guide, TIN, ARC/INFO, Surface modeling and display: Redlands, Calif., various pagination (periodic updates by inserts).

Focazio, M.J., 1990, Application of a geographic-information system to the analysis of groundwater resources in the Coastal Plain of Virginia, in International conference on application of geographic-information systems, simulation models, and knowledge-based systems for landuse management, November 12-14, 1990, Proceedings: Blacksburg, Va., Virginia Polytechnic Institute and State University, p. 351-359.

Hamilton, P.A., and Larson, J.D., 1988, Hydrogeology and analysis of ground-water-flow system in the Coastal Plain of southeastern Virginia: U.S. Geological Survey Water-Resources Investigations Report 87-4240, 175 p.

Harsh, J.F., and Laczniak, R.J., 1990, Conceptualization and analysis of ground-water-flow system in the Coastal Plain of Virginia and adjacent parts of Maryland and North Carolina: U.S. Geological Survey Professional Paper 1404-F, 100 p.

Laczniak, R.J., and Meng, A.A., 1988, Groundwater resources of the York-James Peninsula of Virginia: U.S. Geological Survey Water-Resources Investigations Report 88-4059, 178 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, chap. A1, 578 p.

Meng, A.A, and Harsh, J.F., 1988, Hydrogeologic framework of the Virginia Coastal Plain: U.S. Geological Survey Professional Paper 1404-C, 81 p.

Moore, G.K., Batten, L.G., Allord, G.J., and Robinove, C.J., 1983, Application of digital mapping technology to the display of hydrologic information--A proof-of-concept test in the Fox-Wolf River Basin, Wisconsin: U.S. Geological Survey Water-Resources Investigations Report 83-4142, 118 p.

Tom, Henry, 1991, Proposed federal information-processing standards for spatial data transfer standard: Federal Register, Thursday, April 11, 1991, v. 56, no. 70, p. 14,686.

GLOSSARY

ARC/INFO.–Product name for the geographic-information system used in this report (Environmental Systems Research Institute, Inc., 1987a).

Arc.–A primary coverage feature that represents linear features, the borders of polygons, or both. The location and shape of an arc are defined as a series of X,Y coordinates.

Arc Attribute Table.–An ARC/INFO data file that contains descriptive data about arcs.

Attribute.–A defined characteristic of an entity type.

Build.–An ARC/INFO command that creates or updates features for a coverage.

Clip.–An ARC/INFO command that extracts features from one coverage that overlap features from another coverage, like a "cookie cutter."

Coverage.–The basic unit of data that can be recorded in ARC/INFO. A coverage is analogous to a single map layer and generally describes one type of map feature, such as streams, roads, or geology. A coverage contains the locational data and the thematic attributes for map features in a given geographic area.

Dangle tolerance.–A digitizing error in which the end (terminal point) of an arc overshoots its target.

Digitize.–To convert continuous analog data to discrete digital–data values.

Entity instance.–A single spatial phenomenon of a defined type that is embedded in one or more phenomena of a different type, or that has at least one key attribute value that is different from the corresponding attribute values of the surrounding phenomena.

Entity type.–A general description and/or definition of a group of entity instances with similar characteristics.

Finite-difference grid.–A system of nodal points that is superimposed onto the study area for the ground-water-flow model computations.

Finite-difference block.–The smallest subdivision of the finite-difference grid.

Flow-model boundary.–The limit of the computational borders of the ground-water-flow model.

Fuzzy tolerance.–The minimum distance that separates data in a coverage.

Hull.–A polygon defined by the boundaries of a TIN.

Label point.–A primary coverage feature that represents a point feature that is used to assign user identifiers to polygons. The location of a label point is described by a single X,Y coordinate. Descriptive data about a label point are stored in a Point or Polygon Attribute Table (PAT), which is an ARC/INFO data file.

Layer.–An integrated, areally distributed set of spatial data, usually representing entity instances with a single theme, or with one common attribute or attribute value in an association of spatial objects.

Leakance.–A characteristic of the ground-water-flow system that controls the vertical flow of ground water through confining units.

Line coverage.–A coverage consisting of spatial objects, which consists of line segments or arcs.

Node.–A primary coverage feature that represents endpoints of an arc and the location where line features connect. Node coordinate data are recorded as the beginning and end points of each arc. Also, the center each finite-difference block within a finite-difference grid.

Point coverage.–A coverage composed of one-dimensional spatial objects, which can be either nodes or points.

Polygon coverage.–A coverage composed of two-dimensional spatial objects.

Populate.–To associate a data set with a grid structure.

Projection.–An ARC/INFO command that projects coordinates between two projections for a coverage or file.

Thematic.–Generalized classes of geographic phenomena (for example, hydrography or geology).

TINSPOT.–A command in ARC/INFO that computes surface values for each point of a point coverage by interpolating from a TIN.

Topology.–A mathematical procedure that explicitly defines spatial relations of map features. Topology is used to define areas and to represent connectivity and contiguity.

Transform.–An ARC/INFO command that changes coverage coordinates, using a mathematical function based on control points.

Triangular irregular network (TIN).–A set of adjacent, nonoverlapping triangles developed from irregularly spaced points having x, y coordinates and z values.

TABLES 1—72

Table 1.--List of coverage items

[The numbers in parenthesis indicate the range of aquifers or confining units that exist for that item; ft, foot; ft^3/s, cubic foot per second; ft/d, foot per day; ft^2/d, foot squared per day; Mgal/d, million gallons per day]

AQ(1-10)	Top altitude of aquifers 1-10 (ft)
AQ(1-9)TH	Thickness of aquifers 1-9 (ft)
BASE	Top altitude of basement (ft)
CHECKAQ(1-10)	Dummy aquifer item for testing
CHECKHEAD	Dummy hydraulic head item for testing
CHECKCU(1-9)	Dummy confining unit item for testing
COL	Finite-difference column number
CWL	Elevation extracted from CHIN_W.L.TIN (ft)
CWR	Elevation extracted from CHIN_W.L.TIN (ft)
CU(1-9)	Top altitude of confining units (ft)
CU(1-9)TH	Thickness of confining units (ft)
DEM	Land-surface elevation from DEM (ft)
DEMF	Land-surface elevation from DEM (ft)
DIFF	Dummy item used for drawdown calculation
DIFF2	Dummy item used for drawdown calculation
DIFF3	Dummy item used for drawdown calculation
ELEV	Dummy elevation item for testing
FIPS: (*)	Federal Information Processing Standards code
FLOW	Volumetric flow for constant flow boundary (ft^3/s)
GWSIALT	Land-surface elevation from GWSI (ft)
HEAD(1-10)	Hydraulic head in aquifers 1-10 (ft)
HEAD(1-10)LAZ	Dummy head item for testing
ICU(1-9)	Dummy integer for vertical leakance plotting purposes
K(1-10)	Horizontal hydraulic conductivity (ft/d)
LAYER	Aquifer layer number (for example, lower Potomac = 1)
LN	Lines of finite-difference grid network
MAJOR	ARC/INFO proprietary arc attribute item
MINOR	ARC/INFO proprietary arc attribute item
NEL	Elevation extracted from NORF_E.L.TIN (ft)
NER	Elevation extracted from NORF_E.R.TIN (ft)
NNODE	Finite-difference node number
NODE	Finite-difference node number
NWL	Elevation extracted from NORF_W.L.TIN (ft)
PUMPAGE	Pumpage from water wells (Mgal/d)
REL	Elevation extracted from RICH_E.L.TIN (ft)
RER	Elevation extracted from RICH_E.R.TIN (ft)
ROW	Finite-difference row number
RWL	Elevation extracted from RICH_W.L.TIN (ft)
RWR	Elevation extracted from RICH_W.R.TIN (ft)
T(1-10)	Transmissivity (ft^2/d)
TRANS	Transmissivity (ft^2/d)
UNCAQ	The unconfined aquifer number
VC(1-9)	Vertical conductance (ft/d)
WEL	Elevation extracted from WASH_E.L.TIN (ft)
WWR	Elevation extracted from WASH_W.R.TIN (ft)
XALT	Dummy item for land-surface testing
XLAZ	Dummy item for land-surface testing

Table 2.--Documentation of BASEMENT.UTM

Cover Name: BASEMENT.UTM
Cover Content: Basement (bedrock surface)
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990). Altitudes are in feet above sea level.

Table 3.--Documentation of AQ1TOP.UTM

Cover Name: AQ1TOP.UTM
Cover Content: Top of lower Potomac aquifer
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990). Altitudes are in feet above sea level.

Table 4.--Documentation of AQ2TOP.UTM

Cover Name: AQ2TOP.UTM
Cover Content: Top of middle Potomac aquifer
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990). Altitudes are in feet above sea level.

Table 5.--Documentation of AQ3TOP.UTM

Cover Name: AQ3TOP.UTM
Cover Content: Top of Brightseat-upper Potomac aquifer
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990). Altitudes are in feet above sea level.

Table 6.--Documentation of AQ4TOP.UTM

Cover Name: AQ4TOP.UTM
Cover Content: Top of Virginia Beach aquifer
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990). Altitudes are in feet above sea level.

Table 7.--Documentation of AQ6TOP.UTM

Cover Name: AQ6TOP.UTM
Cover Content: Top of Aquia aquifer
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990). Altitudes are in feet above sea level.

Table 8.--Documentation of AQ7TOP.UTM

Cover Name: AQ7TOP.UTM
Cover Content: Top of Chickahominy-Piney Point aquifer
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990). Altitudes are in feet above sea level.

Table 9.--Documentation of AQ8TOP.UTM

Cover Name: AQ8TOP.UTM
Cover Content: Top of St. Mary's-Choptank aquifer
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990). Altitudes are in feet above sea level.

Table 10.--Documentation of AQ9TOP.UTM

Cover Name: AQ9TOP.UTM
Cover Content: Top of Yorktown-Eastover aquifer
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990). Altitudes are in feet above sea level.

Table 11.--Triangular-irregular-network descriptions for altitudes of aquifer tops

[TIN, triangular irregular network; min, minimum; max, maximum]

TIN description	TIN topology		Surface value range	
AQ1.TIN	Nodes	892	Min Z	-2,216.247
	Triangles	1,761	Max Z	-47.503
	Hull nodes	21		
AQ2.TIN	Nodes	1,025	Min Z	-1,396.273
	Triangles	2,026	Max Z	167.070
	Hull nodes	22		
AQ3.TIN	Nodes	1,025	Min Z	-1,039.840
	Triangles	2,026	Max Z	197.613
	Hull nodes	22		
AQ4.TIN	Nodes	333	Min Z	-1,447.467
	Triangles	647	Max Z	-13.383
	Hull nodes	17		
AQ5.TIN	Nodes	86	Min Z	-1,290.220
	Triangles	158	Max Z	-290.514
	Hull nodes	124		
AQ6.TIN	Nodes	878	Min Z	-954.99
	Triangles	1,576	Max Z	171.360
	Hull nodes	16		
AQ7.TIN	Nodes	1,081	Min Z	-1,029.096
	Triangles	2,144	Max Z	161.976
	Hull nodes	16		
AQ8.TIN	Nodes	220	Min Z	-877.081
	Triangles	422	Max Z	-193.803
	Hull nodes	16		
AQ9.TIN	Nodes	1,151	Min Z	-188.401
	Triangles	2,280	Max Z	226.189
	Hull nodes	20		

Table 12.--Documentation of LIMITAQ1

Cover Name: LIMITAQ1
Cover Content: Limit of lower Potomac aquifer (including model boundary)
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990).

Table 13.--Documentation of LIMITAQ2

Cover Name: LIMITAQ2
Cover Content: Limit of middle Potomac aquifer (including model boundary)
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990).

Table 14.--Documentation of LIMITAQ3

Cover Name: LIMITAQ3
Cover Content: Limit of Brightseat-upper Potomac aquifer (including model boundary)
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990).

Table 15.--Documentation of LIMITAQ4

Cover Name: LIMITAQ4
Cover Content: Limit of the Virginia Beach aquifer (including model boundary)
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990).

Table 16.--Documentation of LIMITAQ5

Cover Name: LIMITAQ5
Cover Content: Limit of the PeeDee aquifer (including model boundary)
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990).

Table 17.--Documentation of LIMITAQ6

Cover Name: LIMITAQ6
Cover Content: Limit of the Aquia aquifer (including model boundary)
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990).

Table 18.--Documentation of LIMITAQ7

Cover Name: LIMITAQ7
Cover Content: Limit of the Chickahominy-Piney Point aquifer (including model boundary)
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990).

Table 19.--Documentation of LIMITAQ8

Cover Name: LIMITAQ8
Cover Content: Limit of St. Marys-Choptank aquifer (including model boundary)
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990).

Table 20.--Documentation of LIMITAQ9

Cover Name: LIMITAQ9
Cover Content: Limit of Yorktown-Eastover aquifer (including model boundary)
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990).

Table 21.--Documentation of CU1THICK.UTM

Cover Name: CU1THICK.UTM
Cover Content: Thickness of lower Potomac confining unit
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1988
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990). Thicknesses are in feet.

Table 22.--Documentation of CU2THICK.UTM

Cover Name: CU2THICK.UTM
Cover Content: Thickness of middle Potomac confining unit
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1988
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990). Thicknesses are in feet.

Table 23.--Documentation of CU3THICK.UTM

Cover Name: CU3THICK.UTM
Cover Content: Thickness of Brightseat-upper Potomac confining unit
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: August 1988
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990). Thicknesses are in feet.

Table 24.--Documentation of CU4THICK.UTM

Cover Name: CU4THICK.UTM
Cover Content: Thickness of Virginia Beach confining unit
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: February 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990). Thicknesses are in feet.

Table 25.--Documentation of CU5THICK.UTM

Cover Name: CU5THICK.UTM
Cover Content: Thickness of PeeDee confining unit
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990). Thicknesses are in feet.

Table 26.--Documentation of CU6THICK.UTM

Cover Name: CU6THICK.UTM
Cover Content: Thickness of Nanjemoy-Marlboro confining unit
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: February 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990). Thicknesses are in feet.

Table 27.--Documentation of CU7THICK.UTM

Cover Name: CU7THICK.UTM
Cover Content: Thickness of Calvert confining unit
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: March 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990). Thicknesses are in feet.

Table 28.--Documentation of CU8THICK.UTM

Cover Name: CU8THICK.UTM
Cover Content: Thickness of St. Marys confining unit
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: March 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990). Thicknesses are in feet.

Table 29.--Documentation of CU9THICK.UTM

Cover Name: CU9THICK.UTM
Cover Content: Thickness of Yorktown-Eastover confining unit
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: April 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990). Thicknesses are in feet.

Table 30.--Triangular-irregular-network descriptions for altitudes of confining-unit tops
[TIN, triangular irregular network; min, minimum; max, maximum]

TIN description	TIN topology		Surface value range	
CU1.TIN	Nodes	1,358	Min Z	-9,999.000
	Triangles	2,689	Max Z	-29.375
	Hull nodes	25		
CU2.TIN	Nodes	1,340	Min Z	-9,999.000
	Triangles	2,657	Max Z	75.769
	Hull nodes	21		
CU3.TIN	Nodes	1,149	Min Z	-9,999.000
	Triangles	2,277	Max Z	10.371
	Hull nodes	19		
CU4.TIN	Nodes	354	Min Z	-9,999.000
	Triangles	692	Max Z	-20.290
	Hull nodes	14		
CU5.TIN	Nodes	88	Min Z	-9,999.000
	Triangles	158	Max Z	-272.673
	Hull nodes	16		
CU6.TIN	Nodes	785	Min Z	-9,999.000
	Triangles	1,548	Max Z	217.074
	Hull nodes	20		
CU7.TIN	Nodes	1,144	Min Z	-9,999.000
	Triangles	2,267	Max Z	191.701
	Hull nodes	19		
CU8.TIN	Nodes	563	Min Z	-9,999.000
	Triangles	1,101	Max Z	153.539
	Hull nodes	23		
CU9.TIN	Nodes	973	Min Z	-9,999.000
	Triangles	1,921	Max Z	142.716
	Hull nodes	23		

Table 31.--Documentation of LIMITCU1

Cover Name: LIMITCU1
Cover Content: Limit of lower Potomac confining unit (including model boundary)
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990).

Table 32.--Documentation of LIMITCU2

Cover Name: LIMITCU2
Cover Content: Limit of middle Potomac confining unit (including model boundary)
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990).

Table 33.--Documentation of LIMITCU3

Cover Name: LIMITCU3
Cover Content: Limit of Brightseat-upper Potomac confining unit (including model boundary)
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990).

Table 34.--Documentation of LIMITCU4

Cover Name: LIMITCU4
Cover Content: Limit of Virginia Beach confining unit (including model boundary)
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990).

Table 35.--Documentation of LIMITCU5

Cover Name: LIMITCU5
Cover Content: Limit of PeeDee confining unit (including model boundary)
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990).

Table 36.--Documentation of LIMITCU6

Cover Name: LIMITCU6
Cover Content: Limit of Nanjemoy-Marlboro confining unit (including model boundary)
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990).

Table 37.--Documentation of LIMITCU7

Cover Name: LIMITCU7
Cover Content: Limit of Calvert confining unit (including model boundary)
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990).

Table 38.--Documentation of LIMITCU8

Cover Name: LIMITCU8
Cover Content: Limit of St. Marys confining unit (including model boundary)
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990).

Table 39.--Documentation of LIMITCU9

Cover Name: LIMITCU9
Cover Content: Limit of Yorktown-Eastover confining unit (including model boundary)
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990).

Table 40.--Documentation of FRAMEWORK.PLY

Cover Name: FRAMEWORK.PLY
Cover Content: Geohydrologic framework
Source Map Title: N/A
Source Map Scale: N/A
Source Map Media: N/A
Source Map Accuracy: N/A
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Software derived
Date Finished: August 1990
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: This is a polygon coverage of the Coastal Plain model finite-difference grid with the aquifer and confining-unit tops assigned to each grid cell. Units of aquifer and confining-unit tops are in feet above sea level. From Hamilton and Larson (1988), Meng and Harsh (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990).

Table 41.--Documentation of NCCOUNTY.UTM

Cover Name: COUNTY.UTM
Cover Content: Digital-line graph of all county boundaries in the State of North Carolina
Source Map Title: N/A
Source Map Scale: 1:2,000,000
Source Map Media: Digital-line graph
Source Map Accuracy: N/A
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Software derived
Date Finished: July 1989
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From U.S. Geological Survey digital-line graphs.

Table 42.--Documentation of OUTLINE.UTM (NC)

Cover Name: OUTLINE.UTM
Cover Content: Digital-line graph of North Carolina State outline
Source Map Title: N/A
Source Map Scale: N/A
Source Map Media: N/A
Source Map Accuracy: N/A
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digital line graph
Date Finished: July 1989
Cover Accuracy: N/A
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From U.S. Geological Survey digital-line graphs.

Table 43.--Documentation of COUNTY.UTM (VA)

Cover Name: COUNTY.UTM
Cover Content: Digital-line graph of all county boundaries in the State of Virginia
Source Map Title: N/A
Source Map Scale: 1:2,000,000
Source Map Media: Digital line graph
Source Map Accuracy: N/A
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digital-line graph
Date Finished: July 1989
Cover Accuracy: N/A
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From U.S. Geological Survey digital-line graphs.

Table 44.--Documentation of OUTLINE.UTM (VA)

Cover Name: OUTLINE.UTM
Cover Content: Digital-line graph of Virginia State outline
Source Map Title: N/A
Source Map Scale: 1:2,000,000
Source Map Media: Digital-line graph
Source Map Accuracy: N/A
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digital-line graph
Date Finished: July 1989
Cover Accuracy: N/A
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From U.S. Geological Survey digital-line graphs.

Table 45.--Documentation of CP.OUT

Cover Name: CP.OUT
Cover Content: Outline of the Coastal Plain physiographic province
Source Map Title: N/A
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: N/A
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: June 1988
Cover Accuracy: N/A
Cover Projection: UTM
Projection Parameters: Zone 18
Notes:

Table 46.--Documentation of CP

Cover Name: CP
Cover Content: Digital-line graph of county boundaries of the Coastal Plain physiographic province
Source Map Title:
Source Map Scale: 1:250,000
Source Map Media: Paper
Source Map Accuracy: N/A
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Digitized
Date Finished: July 1989
Cover Accuracy: N/A
Cover Projection: UTM
Projection Parameters: Zone 18

Table 47.--Triangular irregular network descriptions for digital-elevation models
[TIN, triangular irregular network; min, minimum; max, maximum]

TIN description	TIN topology		Surface value range	
chin_w.1.TIN	Nodes	21,888	Min Z	0.000
	Triangles	43,759	Max Z	20.000
	Hull nodes	15		
chin_w.r.TIN	Nodes	8,013	Min Z	.000
	Triangles	16,015	Max Z	15.000
	Hull nodes	9		
norf_w.r.TIN	Nodes	40,591	Min Z	3.000
	Triangles	81,118	Max Z	47.000
	Hull nodes	62		
norf_w.l.TIN	Nodes	37,258	Min Z	10.000
	Triangles	74,455	Max Z	137.000
	Hull nodes	59		
norf_e.l.TIN	Nodes	22,547	Min Z	.000
	Triangles	45,026	Max Z	35.000
	Hull nodes	66		
norf_e.r.TIN	Nodes	20,229	Min Z	.000
	Triangles	40,434	Max Z	15.000
	Hull nodes	22		
rich_e.r.TIN	Nodes	23,548	Min Z	.000
	Triangles	47,054	Max Z	30.000
	Hull nodes	40		
rich_e.l.TIN	Nodes	36,070	Min Z	.000
	Triangles	72,049	Max Z	46.000
	Hull nodes	89		
rich_w.r.TIN	Nodes	31,326	Min Z	.000
	Triangles	62,566	Max Z	74.000
	Hull nodes	84		
wash_w.r.TIN	Nodes	21,815	Min Z	.000
	Triangles	43,606	Max Z	152.000
	Hull nodes	22		
wash_e.l.TIN	Nodes	22,608	Min Z	.000
	Triangles	45,190	Max Z	91.000
	Hull nodes	24		

Table 48.--Documentation of DEMGRID.PNT

Cover Name: DEMGRID.PNT
Cover Content: Point coverage used for digital-elevation models (DEM's)
Source Map Title: DEM grid
Source Map Scale: 1:25,000
Source Map Media: N/A
Source Map Accuracy: N/A
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: DEM
Date Finished: September 1989
Cover Accuracy: N/A
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: This coverage can be used to obtain land-surface elevations for each node in the Coastal Plain physiographic province ground-water-flow model.

Table 49.--Documentation of PP1.PNT

Cover Name: PP1.PNT
Cover Content: Point coverage containing pumpage data for pumping period 1 (1891-20)
Source Map Title: Pumping period 1
Source Map Scale: N/A
Source Map Media: Software derived
Source Map Accuracy: N/A
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Software derived
Date Finished: March 1991
Cover Accuracy: N/A
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: Points represent well locations, pumpage is in million gallons per day.

Table 50.--Documentation of PP2.PNT

Cover Name: PP2.PNT
Cover Content: Point coverage containing pumpage data for pumping period 2 (1921-39)
Source Map Title: Pumping period 2
Source Map Scale: N/A
Source Map Media: N/A
Source Map Accuracy: N/A
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Software derived
Date Finished: March 1991
Cover Accuracy: N/A
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: Points represent well locations, pumpage is in million gallons per day.

Table 51.--Documentation of PP3.PNT

Cover Name: PP3.PNT
Cover Content: Point coverage containing pumpage data for pumping period 3 (1940-45)
Source Map Title: Pumping period 3
Source Map Scale: N/A
Source Map Media: Software derived
Source Map Accuracy: N/A
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Software derived
Date Finished: March 1991
Cover Accuracy: N/A
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: Points represent well locations, pumpage is in million gallons per day.

Table 52.--Documentation of PP4.PNT

Cover Name: PP4.PNT
Cover Content: Point coverage containing pumpage data for pumping period 4 (1946-52)
Source Map Title: Pumping period 4
Source Map Scale: N/A
Source Map Media: N/A
Source Map Accuracy: N/A
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Software derived
Date Finished: March 1991
Cover Accuracy: N/A
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: Points represent well locations, pumpage is in million gallons per day.

Table 53.--Documentation of PP5.PNT

Cover Name: PP5.PNT
Cover Content: Point coverage containing pumpage data for pumping period 5 (1953-57)
Source Map Title: Pumping period 5
Source Map Scale: N/A
Source Map Media: N/A
Source Map Accuracy: N/A
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Software derived
Date Finished: March 1991
Cover Accuracy: N/A
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: Points represent well locations, pumpage is in million gallons per day.

Table 54.--Documentation of PP6.PNT

Cover Name: PP6.PNT
Cover Content: Point coverage containing pumpage data for pumping period 6 (1958-64)
Source Map Title: Pumping period 6
Source Map Scale: N/A
Source Map Media: N/A
Source Map Accuracy: N/A
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Software derived
Date Finished: March 1991
Cover Accuracy: N/A
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: Points represent well locations, pumpage is in million gallons per day.

Table 55.--Documentation of PP7.PNT

Cover Name: PP7.PNT
Cover Content: Point coverage containing pumpage data for pumping period 7 (1965-67)
Source Map Title: Pumping period 7
Source Map Scale: N/A
Source Map Media: N/A
Source Map Accuracy: N/A
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Software derived
Date Finished: March 1991
Cover Accuracy: N/A
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: Points represent well locations, pumpage is in million gallons per day.

Table 56.--Documentation of PP8.PNT

Cover Name: PP8.PNT
Cover Content: Point coverage containing pumpage data for pumping period 8 (1968-72)
Source Map Title: Pumping period 8
Source Map Scale: N/A
Source Map Media: N/A
Source Map Accuracy: N/A
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Software derived
Date Finished: March 1991
Cover Accuracy: N/A
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: Points represent well locations, pumpage is in million gallons per day.

Table 57.--Documentation of PP9.PNT

Cover Name: PP9.PNT
Cover Content: Point coverage containing pumpage data for pumping period 9 (1973-77)
Source Map Title: Pumping period 9
Source Map Scale: N/A
Source Map Media: N/A
Source Map Accuracy: N/A
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Software derived
Date Finished: March 1991
Cover Accuracy: N/A
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: Points represent well locations, pumpage is in million gallons per day.

Table 58.--Documentation of PP10.PNT

Cover Name: PP10.PNT
Cover Content: Point coverage containing pumpage data for pumping period 10 (1978-86)
Source Map Title: Pumping period 10
Source Map Scale: N/A
Source Map Media: N/A
Source Map Accuracy: N/A
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Software derived
Date Finished: March 1991
Cover Accuracy: N/A
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: Points represent well locations, pumpage is in million gallons per day.

Table 59.--Documentation of RASAGRID.LNE

Cover Name: RASAGRID.LNE
Cover Content: Finite-difference grid for the Coastal Plain physiographic province ground-water-flow model
Source Map Title: N/A (software derived)
Source Map Scale: 1:250,000
Source Map Media: N/A (software derived)
Source Map Accuracy: N/A
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Software derived
Date Finished: July 1989
Cover Accuracy: N/A
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: This is a line coverage that can be used for plotting.

Table 60.--Documentation of RASGIS.PNT

Cover Name: RASGIS.PNT
Cover Content: Input data for Coastal Plain physiographic province flow model
Source Map Title: N/A
Source Map Scale: N/A
Source Map Media: N/A
Source Map Accuracy: N/A
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Software derived
Date Finished: March 1991
Cover Accuracy: N/A
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: This is a point coverage of the Coastal Plain physiographic province flow-model finite-difference grid. Each point represents a node in the grid. Model-input parameters, geohydrologic framework, and other different items are assigned to each node. From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990).

Table 61.--Documentation of TEMPGRID2.PLY

Cover Name: TEMPGRID2.PLY
Cover Content: Input data for Coastal Plain physiographic province flow model
Source Map Title: N/A
Source Map Scale: N/A
Source Map Media: N/A
Source Map Accuracy: N/A
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Software derived
Date Finished: April 1990
Cover Accuracy: N/A
Cover Projection: N/A
Projection Parameters: N/A
Notes: This is a polygon coverage of the Coastal Plain physiographic province flow-model finite-difference grid. Each polygon represents one-grid cell. Model-input parameters, geohydrologic framework, and other different items are assigned to each grid cell. From Hamilton and Larson (1988), Laczniak and Meng (1988), and Harsh and Laczniak (1990).

Table 62.--Documentation of BND1.FLX.PLY

Cover Name: BND1.FLX.PLY
Cover Content: Constant-flow boundary for Coastal Plain physiographic province low model for pumping period 1
Source Map Title: flow boundary for pumping period 1
Source Map Scale: N/A (software derived)
Source Map Media: N/A
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Software derived
Date Finished: April 1991
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Harsh and Laczniak (1990). Units of flow are cubic foot per second.

Table 63.--Documentation of BND2.FLX.PLY

Cover Name: BND2.FLX.PLY
Cover Content: Constant-flow boundary for Coastal Plain physiographic province flow model for pumping period 2
Source Map Title: flow boundary for pumping period 2
Source Map Scale: N/A (software derived)
Source Map Media: N/A
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Software derived
Date Finished: April 1991
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone
Notes: From Harsh and Laczniak (1990). Units of flow are cubic foot per second.

Table 64.--Documentation of BND3.FLX.PLY

Cover Name: BND3.FLX.PLY
Cover Content: Constant-flow boundary for Coastal Plain physiographic province flow model for pumping period 3
Source Map Title: flow boundary for pumping period 3
Source Map Scale: N/A (software derived)
Source Map Media: N/A
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Software derived
Date Finished: April 1991
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Harsh and Laczniak (1990). Units of flow are cubic foot per second.

Table 65.--Documentation of BND4.FLX.PLY

Cover Name: BND4.FLX.PLY
Cover Content: Constant-flow boundary for Coastal Plain physiographic province flow model for pumping period 4
Source Map Title: flow boundary for pumping period 4
Source Map Scale: N/A (software derived)
Source Map Media: N/A
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Software derived
Date Finished: April 1991
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Harsh and Laczniak (1990). Units of flow are cubic foot per second.

Table 66.--Documentation of BND5.FLX.PLY

Cover Name: BND5.FLX.PLY
Cover Content: Constant-flow boundary for Coastal Plain physiographic province flow model for pumping period 5
Source Map Title: flow boundary for pumping period 5
Source Map Scale: N/A (software derived)
Source Map Media: N/A
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Software derived
Date Finished: April 1991
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Harsh and Laczniak (1990). Units of flow are cubic foot per second.

Table 67.--Documentation of BND6.FLX.PLY

Cover Name: BND6.FLX.PLY
Cover Content: Constant-flow boundary for Coastal Plain physiographic province flow model for pumping period 6
Source Map Title: flow boundary for pumping period 6
Source Map Scale: N/A (software derived)
Source Map Media: N/A
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Software derived
Date Finished: April 1991
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Harsh and Laczniak (1990). Units of flow are cubic foot per second.

Table 68.--Documentation of BND7.FLX.PLY

Cover Name: BND7.FLX.PLY
Cover Content: Constant-flow boundary for Coastal Plain physiographic province flow model for pumping period 7
Source Map Title: flow boundary for pumping period 7
Source Map Scale: N/A (software derived)
Source Map Media: N/A
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Software derived
Date Finished: April 1991
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Harsh and Laczniak (1990). Units of flow are cubic foot per second.

Table 69.--Documentation of BND8.FLX.PLY

Cover Name: BND8.FLX.PLY
Cover Content: Constant-flow boundary for Coastal Plain physiographic province flow model for pumping period 8
Source Map Title: flow boundary for pumping period 8
Source Map Scale: N/A (software derived)
Source Map Media: N/A
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Software derived
Date Finished: April 1991
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Harsh and Laczniak (1990). Units of flow are cubic foot per second.

Table 70.--Documentation of BND9.FLX.PLY

Cover Name: BND9.FLX.PLY
Cover Content: Constant-flow boundary for Coastal Plain physiographic province flow model for pumping period 9
Source Map Title: flow boundary for pumping period 9
Source Map Scale: N/A (software derived)
Source Map Media: N/A
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Software derived
Date Finished: April 1991
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Harsh and Laczniak (1990). Units of flow are cubic foot per second.

Table 71.--Documentation of BND10.FLX.PLY

Cover Name: BND10.FLX.PLY
Cover Content: Constant-flow boundary for Coastal Plain physiographic province flow model, pumping period 10
Source Map Title: flow boundary for pumping period 10
Source Map Scale: N/A (software derived)
Source Map Media: N/A
Source Map Accuracy: Interpreted data, therefore no quantitative value of accuracy possible
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Software derived
Date Finished: April 1991
Cover Accuracy: Not quantifiable
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: From Harsh and Laczniak (1990). Units of flow are cubic foot per second.

Table 72.--Documentation of HEADOUT_T.PLY

Cover Name: HEADOUT_T.PLY
Cover Content: Polygon coverage used to store and manipulate simulated heads from the ground-water-flow model
Source Map Title: Head output
Source Map Scale: N/A
Source Map Media: Software derived
Source Map Accuracy: N/A
Source Map Projection: Universal transverse mercator (UTM)
Projection Parameters: Zone 18
Source Contact Person: Michael J. Focazio
Source Contact Phone: (804) 771-2427
Source Organization: U.S. Geological Survey, Water Resources Division
Source Address: 3600 West Broad Street, Room 606, Richmond, VA 23230
Input Method: Software derived
Date Finished: April 1990
Cover Accuracy: N/A
Cover Projection: UTM
Projection Parameters: Zone 18
Notes: This coverage can be populated by software with simulated heads that are originally recorded as unformatted output from the Coastal Plain physiographic province ground-water-flow model.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1993 — 351-759