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Hydrogeological and Groundwater Flow Model for C, K, L, and P Reactor Areas, Savannah River Site, Aiken, South Carolina

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ABSTRACT

A regional groundwater flow model encompassing approximately 100 mi^2 surrounding the C, K, L, and P reactor areas has been developed. The reactor flow model is designed to meet the planning objectives outlined in the *General Groundwater Strategy for Reactor Area Projects* by providing a common framework for analyzing groundwater flow, contaminant migration and remedial alternatives within the Reactor Projects team of the Environmental Restoration Department. The model provides a quantitative understanding of groundwater flow on a regional scale within the near surface aquifers and deeper semi-confined to confined aquifers. The model incorporates historical and current field characterization data up through Spring 1998. Model preprocessing is automated so that future updates and modifications can be performed quickly and efficiently. The CKLP regional reactor model can be used to guide characterization, perform scoping analyses of contaminant transport, and serve as a common base for subsequent finer-scale transport and remedial/feasibility models for each reactor area.

MODEL SUMMARY

The current groundwater flow model for C, K, L, and P reactor areas simulates groundwater flow within the area bounded to the north by Upper Three Runs, to the west by the Savannah River, to the south by Steel Creek and Meyers Branch, and to the east by a line between McQueen Branch and Par Pond. Vertically the model extends from ground surface to the top of the Meyers Branch confining system. The model confirms that groundwater flow in upper aquifers at the Savannah River Site is recharge driven, with streams intercepting flow from higher elevations. The underlying Gordon aquifer is strongly influenced by and discharges to the Savannah River and Upper Three Runs. Nearly all recharge within the CKLP reactor region discharges to streams within or bounding the same area, usually the nearest stream, with the balance entering the Gordon aquifer. Simulated flow directions agree with the conceptual model of groundwater flow. Model calibration targets include groundwater recharge estimates, stream baseflow data and estimates, and water level measurements from more than 1000 wells. Model conductivity values in the Gordon aquifer and confining units are set directly to prior estimates based on field data. For the Upper Three Runs aquifer unit, conductivity values are defined through calibration to the groundwater flow and hydraulic head targets.

The chosen areal grid is 70,000 feet on a side, with a horizontal resolution of 500 square feet. The grid consists of 140 elements along each horizontal axis. The vertical resolution varies depending on hydrogeologic unit and terrain/hydrostratigraphic surface variations. The top surface of the mesh conforms to the ground surface. The bottom surface of the mesh coincides with the bottom of the Gordon aquifer unit. Interior node layers conform to the other stratigraphic surfaces. The "upper" aquifer zone of the Upper Three Runs aquifer includes the vadose zone and is represented by 3 finite-elements in the vertical direction. The "lower" aquifer zone of the Upper Three Runs aquifer contains 2 finite-elements, while the "tan clay" confining zone of the Upper Three Runs aquifer is represented by a single model element. The Gordon confining unit and Gordon aquifer unit are each assigned to one element, for a total of 8 vertical elements from ground surface to the bottom of the Gordon aquifer. The three-dimensional mesh is therefore 140×140×8 with 156,800 elements or 141×141×9 with 178,929 nodes. The finer vertical resolution in the "upper" zone of the Upper Three Runs aquifer is designed to support subsequent, finer-scale contaminant transport analyses.

Horizontal conductivity in the Gordon aquifer is set to 35 ft/day based on the extensive field data from wells at the SRS and in the region surrounding the site. The vertical conductivity of the Gordon confining unit is set to 10^{-4} ft/day in accordance with field measurements. Conductivity values within Upper Three Runs aquifer zones are set through model calibration to measured water levels. Horizontal conductivity in the "lower" and "upper" aquifer zones is nominally 5.6 ft/day, and varies from 1.6 to 9.6 ft/day. Vertical conductivity for the "tan clay" confining zone is nominally 4×10^{-3} ft/day, and varies between 4×10^{-4} and 4×10^{-2} ft/day. The ratio of horizontal to vertical conductivity is assumed to be 100 to 1. Approximate soil characteristic curves are adopted for the vadose zone in the numerical model. An effective porosity value of 25% is assumed when computing the pore velocity field.

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1.0 INTRODUCTION

1.1 Background

The Savannah River Site (SRS) is a U.S. Department of Energy (DOE) facility occupying 300 square miles within Aiken, Barnwell, and Allendale counties in southwestern South Carolina (Figure 1-1). The SRS was set aside in 1950 as a controlled area to produce nuclear materials for national defense. The DOE and its contractors are responsible for the operation of the SRS. Westinghouse Savannah River Company (WSRC) is currently contracted to manage and operate the site.

The SRS operated five reactors to produce special radioactive materials during the Cold War period. R Reactor was the first production reactor to go on-line, achieving criticality in December 1953. P Reactor achieved criticality in February of 1954, followed by L Reactor in August 1954, K Reactor in October 1954, and C Reactor in March 1955. The reactors produced primarily plutonium-238, plutonium-239, and tritium for uses related to national defense, but also generated special isotopes for non-defense research, medical uses, and space programs. These special isotopes included cobalt-60, polonium-210, uranium-233, curium-244, and californium-252.

The past disposal practices associated with SRS reactor operations created waste units within and adjacent to the five reactor areas. Reactor area waste units include seepage basins, Bingham pump outage pits, burning/rubble pits, rubble piles, acid/caustic basins, coal pile runoff basins, and coal ash basins. WSRC (1997) provides a detailed discussion of these waste units.

The reactor areas lie within five major drainage systems (groundwater basins). These include the Fourmile Branch, Pen Branch, Steel Creek, Lower Three Runs and Upper Three Runs groundwater basins (Figure 1-2). SRS facilities are normally situated on well-drained, topographically high areas (divides) which separate the groundwater basins. This arrangement commonly places the waste units associated with a reactor within both of the adjacent groundwater basins. For example, L-Reactor waste units lie within the Pen Branch and Steel Creek groundwater basins and P-Reactor waste units lie within the Steel Creek and Lower Three Runs groundwater basins.

1.2 Modeling Objective and Approach

The primary objective of this modeling effort is to establish a regional groundwater flow model to encompass the waste units associated with C, K, L, and P reactor areas. The R-Reactor waste units are addressed in previous modeling efforts (HydroGeoLogic, 1997, 1998) and are not included in this report.

This model will provide a basic understanding of the groundwater flow behavior for these areas on a regional scale. This capability is important because of the various groundwater flow directions in the near surface aquifers and deeper semi-confined to confined aquifers, and enables tracking of contaminant plumes from the source to surface discharge potentially as far as the Savannah River and Upper Three Runs. The reactor areas model has been constructed to assist in scoping characterization and remedial activities by providing a common base for the subsequent smaller scale transport and remedial/feasibility models for each of these areas. In addition, waste units that are in close proximity to one another can be addressed comprehensively to look at the possibility of commingled plumes and the effects of one waste unit on the other.

The model is designed to meet the planning objectives described in Section 4.2 of the *General Groundwater Strategy for Reactor Area Projects* (WSRC, 1997). The model incorporates all available data from geological and hydrological field characterizations into a project database that can be easily updated as additional field measurements are taken. This is consistent with the interactive approach described in WSRC (1997). The model will be able to incorporate new data as it is collected, providing quick and cost-effective updates. The model can be evaluated to determine whether the available information is adequate to address a remediation issue. If not, the model can assist in determining what types of data are needed and from where they should be collected.

The reactors groundwater flow model uses EarthVision® proprietary software to calculate two-dimensional grids, maps, and cross-sections of hydrostratigraphic surfaces. The groundwater flow modeling is performed using the Flow And Contaminant Transport (FACT) code. The FACT code is a finite-element code developed by the Savannah River Technology Center (SRTC) (Hamm and others, 1997).

1.3 Description of the Study Area

The SRS is centered 22.5 miles southeast of Augusta, Georgia, approximately 100 miles from the Atlantic Coast within the Upper Atlantic Coastal Plain Physiographic Province. The Savannah River forms the southwest boundary of the SRS (Figure 1-1). The SRS is situated on the Aiken Plateau of the Atlantic Coastal Plain at an approximate elevation of 300 feet above mean sea level (ft msl). Overall, the plateau has a highly dissected surface and is characterized by broad inter-fluvial areas with narrow, steep-sided valleys. Local relief can attain 280 feet (Siple, 1967). The Aiken plateau is generally well-drained, although many poorly drained sinks and depressions exist.

The model area, herein referred to as the C, K, L, and P Groundwater Model Area (CKLP GWMA) comprises approximately 100 square miles within the central and southern portions of the Savannah River Site. The CKLP GWMA has low to moderate topographic relief and is drained by perennial and intermittent streams (Figure 1-3). The CKLP GWMA is bounded to the north by Upper Three Runs, to the west by the Savannah River, to the south by Steel Creek and Meyers Branch, and to the east by a line between McQueen Branch and Par Pond (Figure 1-3). Upper Three Runs forms the northern boundary of the study area with an average elevation of 150 ft msl., the Savannah River forms the western boundary with an average elevation of 85-90 feet msl., and Steel Creek and Meyers Branch forms the south-southeastern boundary with elevations ranging from 100 to 105 ft msl. Beyond the headwaters of Meyers Branch, the southern boundary extends southeast to Par Pond south of P Area. There is no single natural drainage at the eastern margin of the area. A line running southeast from McQueen Branch, through the headwaters of Fourmile Branch, to Par Pond (Figure 1-3) defines an eastern boundary.

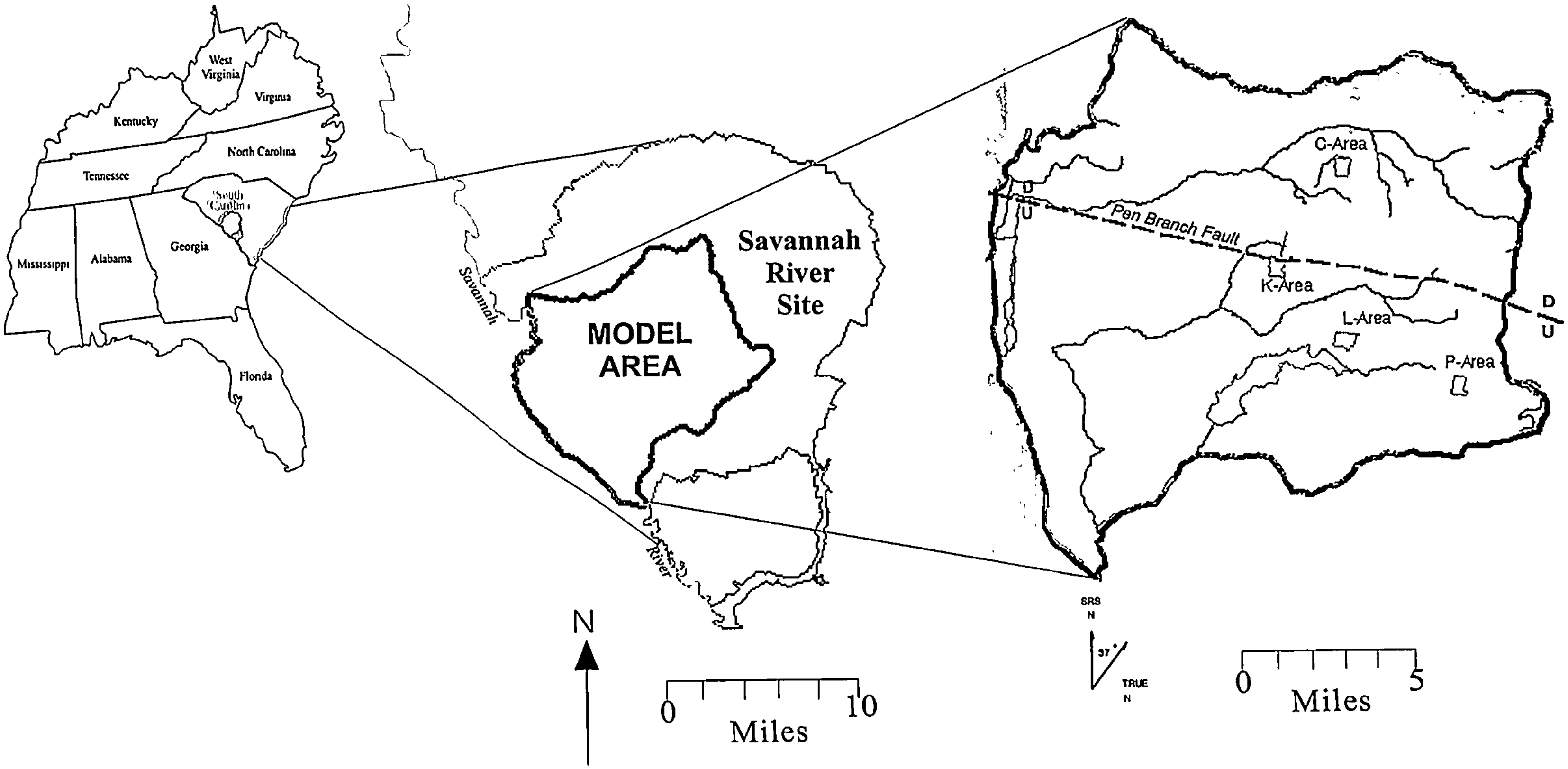


Figure 1-1. Location of the Savannah River Site and Model Area.

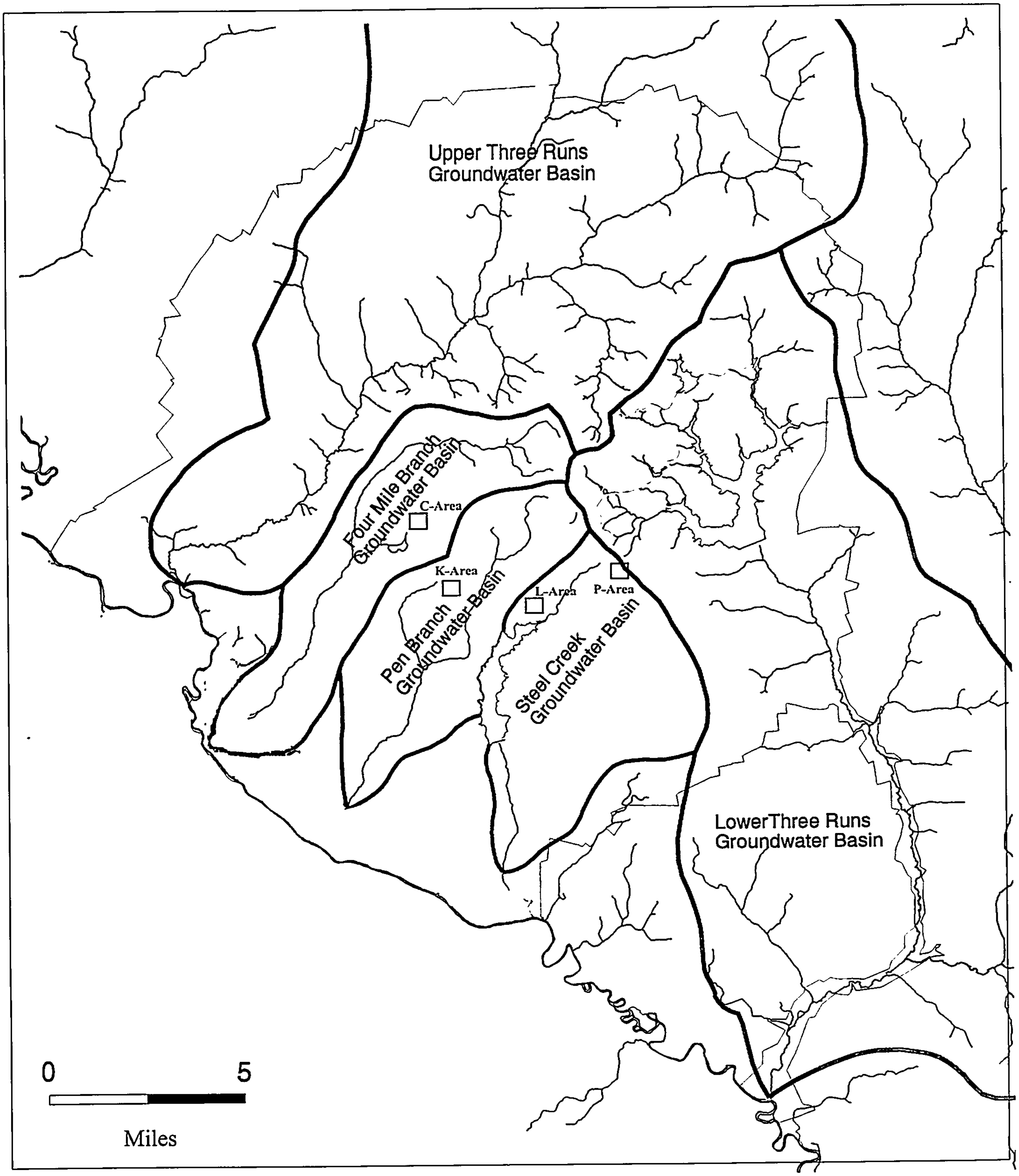


Figure 1-2. Location of Groundwater Basins at the Savannah River Site

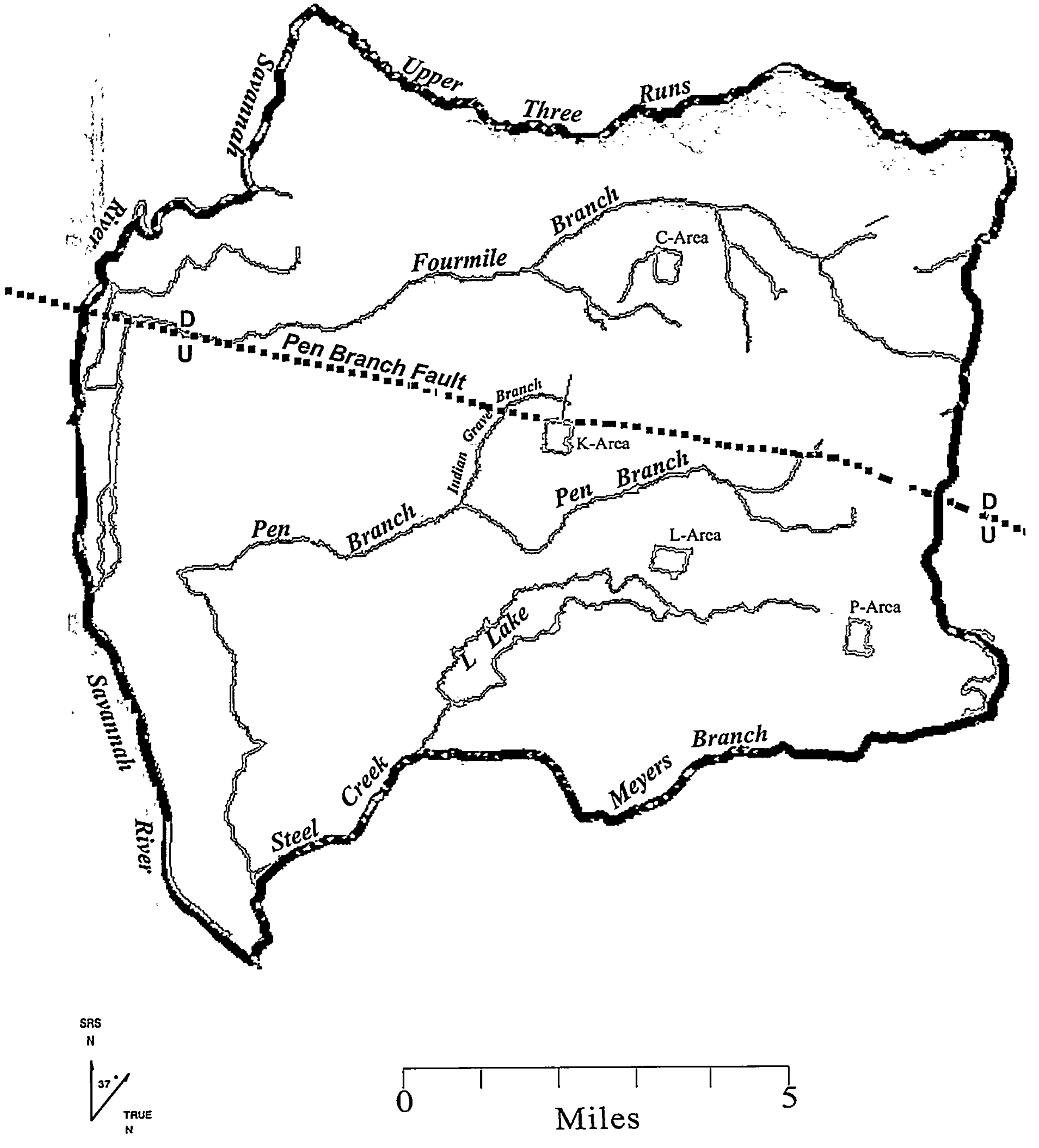


Figure 1-3. **Location of Major Streams and Rivers in Model Area. Model Boundary Shown in Red.**

2.0 Hydrogeologic Data and Conceptual Model

2.1 SRS Geology

The SRS lies within the Atlantic Coastal Plain, a southeast-dipping wedge of unconsolidated and semi-consolidated sediment that extends from its contact with the Piedmont Province at the Fall Line to the edge of the continental shelf. The sediment ranges from Late Cretaceous to Miocene in age and comprises layers of sand, muddy sand, and mud with minor amounts of calcareous sediment (Fallaw and Price, 1995). The Coastal Plain sediment rests unconformably on Triassic-aged sedimentary rock of the Dunbarton Basin and Paleozoic-aged crystalline rock of the Appalachian orogen.

The Pen Branch Fault (PBF) offsets basement rock and Late Cretaceous to Tertiary-aged sediment beneath the CKLP GWMA (Figure 1-1). Seismic studies and stratigraphic correlation indicate that the Pen Branch Fault is a sub-vertical growth fault with down-to-the-northwest movement sense. The PBF probably represents reactivation of a border fault in the basement rock along the north margin of the Dunbarton Basin (Snipes and others, 1993; Stieve and Stephenson, 1995).

2.2 SRS Hydrostratigraphic Units and Properties

The hydrostratigraphy of the SRS has been the subject of several different classification schemes. This report incorporates the hydrostratigraphic nomenclature currently established for the SRS region by Aadland and others (1995), who present a thorough review and description of the units. Figure 2-1 correlates the hydrostratigraphic nomenclature with the local lithostratigraphy as defined by Fallaw and Price (1995). This report addresses the up-dip part of the Floridan aquifer system and the top of the Meyers Branch confining system as defined by Aadland and others (1995).

The conceptual hydrostratigraphic model depicted on Figure 2-2 and the cross-sections in Figure 2-3 illustrate the relationship between the hydrostratigraphic units, the topography, and the recent alluvial material deposited in the Savannah River valley. The lateral and vertical extent of the hydrostratigraphic units and the recent alluvium are very important hydrologically. The topography is a major factor in controlling the distribution of surface water and the configuration of the water table. Major tributaries of the Savannah River incise the hydrostratigraphic units down to the "tan clay" confining zone and, to a lesser extent, to the "lower" aquifer zone of the Upper Three Runs aquifer. The Savannah River and Upper Three Runs cut down into the Gordon aquifer. The depth to which the streams and river incise underlying hydrostratigraphic units is an important factor in the localized and regional flow systems in the study area. Leeth and Nagle (1996) performed a series of borings along the Savannah River in the vicinity of SRS to determine the shallow subsurface geology of the Savannah River. Their results were used as a guide in determining the lateral and vertical extent of the alluvium in the CKLP GWMA. The thickness of the recent alluvial material in the river valley varies, and attains a maximum thickness of approximately 50 ft (Leeth and Nagle, 1996). Figures 2-2 and 2-3 depict the conceptual hydrostratigraphic model used for the CKLP GWMA and illustrate the extent to which the Savannah River has incised the hydrostratigraphic units. The Savannah River has cut down to the Gordon aquifer at the northern and southern ends of the valley but does not incise the Meyers Branch Confining System within the model area. This relationship of the alluvial valley to the hydrostratigraphic units is also illustrated in Figure 2-1.

The following sections describe the lithologic characteristics along with the configuration of the tops and thickness of the hydrostratigraphic units mapped for this study . It should be noted that the tops of the hydrostratigraphic units correspond closely with recognized unconformities in the SRS region (Fallaw and Price, 1995). All of the altitude contour maps have patterns that are consistent with the south-southeast dip of the Coastal Plain strata in this region (Fallaw and Price, 1995). Isopach contours indicate variability in thickness, which is related to the varying degrees of erosion at the unconformable surfaces and structural relations with the Pen Branch Fault. Both the altitude contour maps and isopach maps have been constructed to depict down cutting and deposition of recent alluvial material by the Savannah River. All of the maps exhibit contour patterns that reflect the variability in data density across the area.

The project database includes permeability data from aquifer pumping tests, borehole permeability tests (slug tests), and laboratory tests of core samples from locations within the CKLP GWMA. Table 2-1 presents a summary of the permeability data collected for this study. The summary incorporates only data from locations that have hydrostratigraphic boundaries established as part of this study. Statistical calculations were made using averaged values from multi-well pumping tests and the average values from wells with results from both rising and falling-head slug tests.

Appendix A presents a summary of the data collection and modeling methods that were utilized for this investigation. Appendix B presents locations of data points, hydrostratigraphic boundaries, and a summary of the two-dimensional grids calculated from the boundaries. Appendix C presents permeability data from locations within the model area. Appendix D lists source documents for the data presented in Appendices B and C and summarized in Table 2-1.

2.2.1 Meyers Branch Confining System

The Meyers Branch confining system (MBCS) defines the base of the Floridan aquifer system in the study area. In the CKLP GWMA, the top of the MBCS is delineated by the laterally continuous, dense, gray to black, clay and sandy clay of the Lang Syne Formation of the Black Mingo Group (Figure 2-1) (Aadland and others, 1991 and 1995).

The configuration of the top of the MBCS is illustrated with altitude contours in Figure 2-4. The MBCS exhibits a relatively gentle dip in a south-southeast direction. Vertical offset along this unit is approximately 40 feet along the PBF. The Savannah River has not incised the MBCS.

Laboratory tests of 38 undisturbed samples taken from the MBCS indicate vertical permeability ranges from 4.26E-06 to 3.40E-01 feet per day (ft/day)(Table 2-1). Tests of 27 undisturbed samples yield horizontal permeability values that range from 1.1E-05 to 1.5E+00 ft/day within this unit. These data show an arithmetic mean of 1.39E-02 ft/day for vertical permeability and 8.63E-02 ft/day for horizontal permeability, and a geometric mean of 2.47E-04 ft/day for vertical permeability and 5.52E-04 ft/day for horizontal permeability. The standard deviation is 5.65E-02 for vertical permeability and 3.12E-01 for horizontal permeability.

2.2.2 Floridan Aquifer System

The Floridan Aquifer System overlies the MBCS and includes the Gordon aquifer, Gordon confining unit, and Upper Three Runs aquifer within the CKLP GWMA (Figure 2-1). Groundwater maintains a downward component of flow from the Upper Three Runs aquifer into the Gordon aquifer. The Upper Three Runs aquifer is recharged primarily by precipitation (Hiergesell, 1998a).

2.2.2.1 Gordon Aquifer

The Gordon aquifer constitutes the basal unit of the Floridan aquifer system beneath the CKLP GWMA and is the lowermost unit characterized in this report (Figure 2-1). Within the study area, the Gordon aquifer includes loose sand and clayey sand of the Congaree Formation and, where present, the sandy parts of the underlying Fourmile Branch and Snapp Formations (Figure 2-1), (Harris and others, 1990; Aadland and others, 1991 and 1995). The sand within the Gordon aquifer is yellowish to grayish orange and is sub- to well-rounded, moderately to poorly sorted, and medium- to coarse-grained. Pebbly layers and zones of iron and silica cemented sand are common. Interbeds of light tan to gray clay up to three feet in thickness are rare. The Gordon aquifer contains a small amount of sporadically distributed calcareous sediment. Stringers of clay less than 6 inches in thickness are common near the base of this unit.

The configuration of the top of the Gordon aquifer is illustrated in Figure 2-5. An isopach map is presented in Figure 2-6. The Gordon aquifer exhibits the same structural pattern as the MBCS with a regional dip to the south-southeast. Vertical offset along this unit is approximately 40 feet along the PBF. The thickness of this unit is variable, ranging from approximately 60 feet to 160 feet. This variability is believed to be related to structural relations with overlying and underlying units and the presence of unconformities above and below the unit. In addition, the Gordon aquifer is incised along the Savannah River primarily in the vicinity of the PBF and along Upper Three Runs (Figure 2-5).

Laboratory tests of 23 undisturbed samples taken from the Gordon aquifer indicate vertical permeability ranges from 3.12E-06 to 3.62E+01 ft/day (Table 2-1). Tests of 24 undisturbed samples yield horizontal permeability values that range from 2.06E-05 to 3.26E+01 ft/day within this unit. These data show an arithmetic mean of 1.66E+00 ft/day for vertical permeability and 5.25E+00 ft/day for horizontal permeability and a geometric mean of 7.73E-04 ft/day for vertical permeability and 1.05E-02 ft/day for horizontal permeability. The standard deviation calculated from these data is 7.54E+00 ft/day for vertical permeability and 1.12E+01 ft/day for horizontal permeability.

Results from 47 slug tests conducted on wells screened within the Gordon aquifer indicate permeability ranges from 5.00E-03 to 3.32E+01 ft/day (Table 2-1). The arithmetic mean from these data is 3.78E+00 ft/day and the geometric mean is 9.81E-01 ft/day. The standard deviation calculated from these results is 6.15E+00 ft/day. The permeability results were averaged for wells with both rising and falling-head tests.

Thirteen pumping tests performed on wells screened within the Gordon aquifer indicate permeability ranges from 8.20E-01 to 1.43E+02 ft/day (Table 2-1). The arithmetic mean is 2.92E+01 ft/day and the geometric mean is 1.04E+01 ft/day. The standard deviation calculated from these results is 3.92E+01 ft/day. Aadland and others (1995) present additional information on pumping tests conducted within the Gordon aquifer.

2.2.2.2 Gordon Confining Unit

The Gordon confining unit (GCU) separates the Gordon aquifer from the Upper Three Runs aquifer. This unit is commonly referred to as the "green clay" in previous SRS literature and includes sediment of the Warley Hill Formation (Figure 2-1). The unit comprises interbedded silty and clayey sand, sandy clay and clay. The clay is stiff to hard and is commonly fissile. Glauconite is a common constituent and imparts a distinctive greenish cast to the sediment, hence the informal name of "green clay" given to this unit. Zones of silica-cemented sand and clay are present within the GCU in some cores taken from the GSA. In the vicinity of the CKLP GWMA, the GCU includes some calcareous sediment and limestone, primarily calcarenaceous sand and clayey sand with subordinate calcarenaceous clay, micritic clay, and sandy micrite and limestone.

The GCU dips toward the south-southeast, increasing from approximately 10 feet to 80 feet in thickness (Figures 2-7 and 2-8). The southeastward thickening is primarily due to an increase in the quantity of fine-grained calcareous material within this unit beneath the southern half of the study area. The GCU is incised along the Savannah River to the north and south of the PBF and also incised along the southern boundary of Upper Three Runs (Figure 2-7).

Laboratory tests of 41 undisturbed samples taken from the GCU indicate vertical permeability ranges from 1.14E-06 to 4.27E-01 ft/day (Table 2-1). Tests of 25 undisturbed samples yield horizontal permeability values that range from 5.40E-06 to 1.22E-01 ft/day within this unit. These data show an arithmetic mean of 1.20E-02 ft/day for vertical permeability and 1.06E-02 ft/day for horizontal permeability and a geometric mean of 1.15E-04 ft/day for vertical permeability and 1.62E-04 ft/day for horizontal permeability. The standard deviation calculated from these data is 6.68E-02 ft/day for vertical permeability and 3.09E-02 ft/day for horizontal permeability. Aadland and others (1995) discuss leakance estimates derived from multiple well pumping tests.

2.2.2.3 Upper Three Runs Aquifer

The Upper Three Runs aquifer (UTRA), as defined in this report, includes all strata from the ground surface to the top of the Gordon confining unit. The UTRA includes the informally named "upland" unit, Tobacco Road Sand, Dry Branch Formation, Clinchfield Formation, and Santee Limestone (Figure 2-1). For the purposes of hydrostratigraphic analysis, the UTRA aquifer is often locally divided into informal "lower" and "upper" aquifer zones separated by the "tan clay" confining zone (Figure 2-1).

"Lower" Aquifer Zone. The "lower" aquifer zone (LAZ) of the UTRA beneath the CKLP GWMA consists of the dominantly fine-grained, well-sorted sand and clayey sand of the Santee Formation and parts of the Dry Branch Formation beneath the "tan clay" confining zone (Figure 2-1). The bulk of the carbonate sediment beneath the CKLP GWMA is contained within the Santee and lower part of the Dry Branch and is included in the LAZ. Descriptions of drill core indicate that the carbonate sediment in this vicinity has a siliciclastic component, and consists of calcarenaceous sand, micritic sand, shelly sand, and minor amounts of sandy calcarenite and shelly limestone.

The altitude-contour map and isopach for the LAZ are presented in Figures 2-9 and 2-10. The configuration of the top of the LAZ is similar to the GCU. The thickness of the LAZ ranges from approximately 30 feet to 110 feet. The variability is attributed primarily to erosion on the overlying and underlying unconformities. The LAZ is deeply incised by the Savannah River and Upper Three Runs within the model area (Figure 2-9).

Laboratory tests of 33 undisturbed samples taken from the LAZ indicate vertical permeability ranges from 4.54E-06 to 3.42E+00 ft/day (Table 2-1). Tests of 31 undisturbed samples yield horizontal permeability values that range from 1.59E-05 to 1.11E+01 ft/day within this unit. These data show an arithmetic mean of 1.77E-01 ft/day for vertical permeability and 6.45E-01 ft/day for horizontal permeability and a geometric mean of 2.82E-03 ft/day for vertical permeability and 1.02E-02 ft/day for horizontal. The standard deviation calculated from these data is 6.19E-01 ft/day for vertical permeability and 2.03E+00 ft/day for horizontal permeability.

Results from 25 slug tests conducted within the LAZ indicate permeability ranges from 1.30E-01 to 2.44E+01 ft/day (Table 2-1). The arithmetic mean from these data is 3.90E+00 ft/day and the geometric mean is 1.67E+00 ft/day. The standard deviation calculated from these results is 6.09E+00 ft/day.

Three pumping tests of wells screened within the LAZ indicate permeability ranges from 1.23E+00 to 2.10E+00 ft/day (Table 1). The arithmetic mean is 1.67E+00 ft/day and the geometric mean is 1.63E+00 ft/day (Table 1). The standard deviation calculated from these results is 4.35E-01 ft/day.

"Tan Clay" Confining Zone. The "tan clay" confining zone (TCCZ) of the UTRA is equivalent to the "tan clay" zone referred to in previous SRS reports. The "tan clay" confining zone includes sediment of the Dry Branch Formation (Figure 2-1). The zone contains light-yellowish tan to orange clay and sandy clay interbedded with clayey sand and sand. Clay layers are dispersed vertically and horizontally throughout the confining zone and are probably not laterally continuous over distances greater than 100 to 200 feet (Harris and others, 1990; Aadland and others, 1991).

The configuration of the top of the TCCZ is illustrated in Figure 2-11 and an isopach map of the unit is presented in Figure 2-12. The configuration of the top of the TCCZ is very similar to that of the underlying LAZ. The thickness of the TCCZ ranges from approximately 10 feet to 20 feet. The TCCZ is deeply incised by the Savannah River, Upper Three Runs, Fourmile Branch, and Steel Creek and Meyers Branch within the model area (Figure 2-11).

Laboratory tests of 37 undisturbed samples taken from the TCCZ indicate vertical permeability ranges from 3.70E-08 to 9.66E-02 ft/day (Table 2-1). Tests of 24 undisturbed samples yield horizontal permeability values that range from 1.45E-05 to 1.70E-01 ft/day within this unit. These data show an arithmetic mean of 4.62E-03 ft/day for vertical permeability and 8.49E-03 ft/day for horizontal permeability and a geometric mean of 5.93E-05 ft/day for vertical permeability and 2.60E-04 ft/day for horizontal permeability. The standard deviation calculated from these data is 1.91E-02 ft/day for vertical permeability and 3.47E-02 ft/day for horizontal permeability.

"Upper" Aquifer Zone. The "upper" aquifer zone (UAZ) of the UTRA includes all strata from the ground surface to the top of the "tan clay" confining zone. The UAZ includes the "upland" unit, Tobacco Road Sand, and part of the Dry Branch Formation (Figure 2-1). The UAZ characterized by sand and clayey sand with minor interbeds of clay. The sediment within the "upland" unit is commonly very dense and clayey and often contains gravely sand.

The top of the UAZ is represented by the present-day topographic surface (Figure 2-13). As with the underlying units, the UAZ has been heavily influenced by the incision of the Savannah River, Upper Three Runs, and other major tributaries within the model area.

Permeability results from eleven laboratory tests taken from undisturbed samples in the UAZ indicate vertical permeability ranges from 9.20E-05 to 2.77E+01 ft/day (Table 2-1). Tests of twelve undisturbed samples yield horizontal permeability values that range from 2.24E-04 to 6.04E+00 ft/day within this unit. These data show an arithmetic mean of 2.68E+00 ft/day for vertical permeability and 1.21E+00 ft/day for horizontal permeability and a geometric mean of 1.04E-02 ft/day for vertical permeability and 6.19E-02 ft/day for horizontal permeability. The standard deviation calculated from these data is 8.31E+00 ft/day for vertical permeability and 2.24E+00 ft/day for horizontal permeability.

Results from twelve slug tests conducted within the UAZ indicate permeability ranges from 1.40E-01 to 1.22E+01 ft/day (Table 2-1). The arithmetic mean from these data is 1.88E+00 ft/day and the geometric mean is 7.36E-01 ft/day. The standard deviation calculated from these results is 3.46E+00 ft/day.

Results from one multi-well pumping test performed on a well screened within the UAZ indicate permeability is at least 5.16E+01 ft/day (Table 1). The test included 4 observation wells with permeability results. These results were averaged to obtain one permeability value.

2.3 Hydrogeology

2.3.1 Water Table

The water table aquifer is contained within the UTRA and includes all saturated material from the water table to the top of the GCU. The water table aquifer is commonly divided into the informal UAZ and LAZ, separated by the TCCZ. For this report, no distinction is made for the upper and lower zones because the majority of well data is from the upper zone as there are very few wells screened in the lower part of the water table aquifer within the model area at this time. A water table map of the reactor areas model domain is shown in Figure 2-14.

The configuration of the water table is tightly controlled by the local topography and drainage system. Wells are scarce in the reactors area with the majority of the wells located around the reactor facilities. Therefore, for this project a study was conducted to characterize stream baseflow and supplement water table configuration along Indian Grave Branch and the upper part of Pen Branch within the model domain (Figure 2-15; Appendix E), (Hiergesell, 1998b,c). Water level measurements were obtained from selected wells along with careful examination of flowing reaches of the headwater segments of the streams. The water table map (Figure 2-14) was further refined with this data.

In addition to the regional water table map for the area, Figures 2-16 through 2-19 illustrate the water table configuration in C, K, L, and P reactor areas. For further discussion of the water table in the reactor areas the reader is referred to (Hiergesell, 1988a).

2.3.2 Gordon Aquifer Potentiometric Surface

The Gordon aquifer is the lowermost aquifer of interest in this study and represents the basal unit of the Floridan aquifer system in the CKLP GWMA (Figure 2-1). Figure 2-20 illustrates the Gordon aquifer potentiometric surface in the model domain. Data is limited for the Gordon aquifer in the CKLP GWMA. The Gordon aquifer discharges to the Upper Three Runs valley to the north-northwest and to the Savannah River valley to the west-southwest.

2.3.3 Hydraulic Head Targets

In addition to constructing potentiometric maps for conceptual understanding of groundwater flow and boundary condition specification (e.g. Figures 2-14 and 2-20), hydraulic head data are valuable model calibration targets. Because steady-state groundwater flow is the focus of this effort, long-term, time-averaged head data are of most interest as model calibration targets. The primary source of uncertainty in mean water level is transient fluctuation in individual readings that are on the order of a few feet. Surveying errors, measurement errors, etc. are generally very small in comparison.

Water level data for most wells at the SRS are available from the Geochemical Information Management System (GIMS), which can be accessed through the Savannah River Information Network Environment (ShRINE). The data are also published in periodic well inventory and monitoring reports; see Environmental Protection Department and Exploration Resources, Inc. (1996a, b) for example. GIMS archives data obtained through a groundwater monitoring program administered by the Environmental Monitoring Section (EMS) of the Environmental Protection Department (EPD). The GIMS database is known to contain erroneous entries. Outliers were identified as single readings that deviated from the average value by more than 20 ft and eliminated. With the remaining data, the sample standard deviation of the mean value was computed as (Walpole and Myers, 1978, section 5.5)

$$s_m = \frac{s}{\sqrt{n}} = \frac{1}{\sqrt{n}} \times \left[\frac{1}{n-1} \sum_{i=1}^{n} \left(h_i - \bar{h} \right)^2 \right]^{1/2}$$

Mean values with an uncertainty exceeding 3 ft at 95% confidence ($2s_m > 3$ ft) were eliminated, with the idea that uncertainty in a hydraulic head target should not exceed the calibration goal. Previous models covering relatively small areas of the SRS have generally achieved a root-mean-square residual of 3 ft (e.g. Camp Dresser & McKee, 1989; GeoTrans, 1992; Flach and Harris, 1997). Given the large scale and coarse resolution anticipated for CKLP model, a calibration goal of 3 ft may be too low. Sample standard deviations could not be computed for wells with a single reading, and the single reading was accepted as the target for steady-state flow calibration.

Valuable data from wells not included in the EMS monitoring program are also available. The Environmental Science and Technology Department (ES&TD) has monitored the P-series wells and other SRS wells for several years (Hiergesell, 1998). Water level data are also available from Environmental Restoration Department (ERD) documents, such as the RFI/RI/BRA for the CMP Pits (WSRC, 1996). These data supplement the head targets derived from the GIMS database.

Appendix F includes the resulting list of hydraulic head targets. Each well was assigned to the appropriate hydrostratigraphic unit as defined by the grids presented in section 2.2. Category 1 includes wells screened within the Gordon aquifer, category 2 includes those within the "lower" UTRA, and category 3 includes those within the "upper" UTRA. Wells screened into or across the Gordon confining unit or across the "tan clay" confining zone are assigned to category 4 (other). Within the model domain, there are 124 Gordon aquifer targets, 356 "lower" UTRA targets, 658 "upper" UTRA targets, and 65 indeterminate targets.

2.4 Groundwater Recharge and Discharge

Groundwater flow in upper aquifers at the Savannah River Site is driven by recharge, with streams intercepting flow from areas of higher groundwater elevations (Figures 2-14 and 2-20). Nearly all recharge within the CKLP model area discharges to streams within or bounding the same area, usually the nearest stream. For this type of groundwater flow system, recharge and discharge estimates, coupled with head measurements and confining unit leakance estimates, define the overall horizontal conductivity values of upper aquifers required to calibrate a numerical flow model. Because conductivity data at the model scale are typically non-existent, groundwater flow estimates are important model calibration targets.

At least three independent investigations of surface groundwater recharge have been performed in or near the SRS. Parizek and Root (1986) conducted a detailed hydrologic budget study of the McQueen Branch basin. They estimated average recharge for the basin at 15.6 in/yr. Parizek and Root (1986) computed this value by dividing the total volumetric rate of recharge by the total basin area. The average recharge rate excluding seepage/wetland areas would therefore be somewhat larger. Hubbard (1984, 1986) conducted a multi-year lysimeter study at the SRS burial grounds in the General Separations Area and measured an average recharge of about 16 in/yr for grass cover. Based on lysimeters with small pine trees growing within them, Hubbard (1986) estimated recharge to be 6 in/yr for forested areas. Hubbard (1986) also reported that Denehy and McMahon (1985) measured 15 in/yr of recharge at the Chem-Nuclear site in Barnwell, South Carolina. Parizek and Root (1986) and Looney and others (1987) report that Cahill (1982) estimated recharge to be about 15 in/yr at the Low Level Radioactive Solid Waste Burial Site near Barnwell, South Carolina (Chem-Nuclear). It is unclear from the literature cited here whether the Denehy and McMahon (1985), and Cahill (1982) studies are related, apart from being conducted at the same location.

From these studies, the average recharge over the Savannah River Site is estimated to be about 15 in/yr. The average rate excluding groundwater discharge areas would be somewhat higher. This estimate may be high due to a bias toward analysis of developed areas that tend to be less forested and flatter. The data for forested conditions are difficult to reconcile. Hubbard (1985) estimated recharge at 6 in/yr for forested areas. On the other hand, the vegetation of McQueen Branch basin studied by Parizek and Root (1986) study was 85% evergreen and deciduous forest, and produced an estimate of nearly 16 in/yr. The average of these two estimates is 10 in/yr. Considering that the area of interest in this study is relatively undeveloped and heavily forested, perhaps a reasonable range to consider for groundwater flow modeling sensitivity studies is 10 to 16 in/yr.

To support this and subsequent modeling efforts in the C, K, L and P areas, stream base flow was estimated by analyzing U. S. Geological Survey (USGS) stream gauging station data (Cooney and others, 1998, for example) and measuring stream flow rate under low flow conditions (Hiergesell, 1998b, 1998c). The USGS data provide large-scale estimates of base flow. Complementing these estimates, Hiergesell (1998b, 1998c) measured base flow for small streams. Appendix E-1 presents the data of Hiergesell (1998). Appendix E-2 describes the simple hydrograph separation techniques that were used to estimate the long-term average rate of groundwater discharge to large-scale stream reaches within the CKLP reactor area.

The results are summarized in Table 2-1. Hiergesell (1998b, 1998c) also estimated the point of effluence along small streams and refined an ARC/INFO USGS coverage of live stream reaches, as illustrated by Figure 2-21.

The Steel Creek, Pen Branch and Fourmile Branch base flow estimates may be the most reliable calibration targets. For Meyers Branch and Upper Three Runs, there is added uncertainty in the fraction of base flow that can be attributed to the modeled area. Overall, the base flow calibration targets may have an uncertainty of 15 to 25% (Appendix E). The Steel Creek base flow estimate is negative and indicates a losing reach, reflecting artificial flow to L-Lake to maintain a historic level of 190 ft msl.

2.5 Conceptual Model of Groundwater Flow

From Figure 2-14, groundwater flow in the Upper Three Runs aquifer is seen to be driven by recharge, with nearby streams intercepting flow from higher elevations. The underlying Gordon aquifer is strongly influenced by the Savannah River and Upper Three Runs, which appear to completely drain the aquifer and function as no-flow lines (Figure 2-20). Except for reactor area outfalls and the lower portion of L Lake, surface water bodies gain from groundwater discharge. Aadland and others (1995, Plate 17) gives the leakance of the Crouch Branch confining unit (of the Meyers Branch confining system) as roughly 3×10^{-6} day^{-1}, which corresponds to 0.13 in/yr for every 10 ft of head difference. The head difference across the Crouch Branch confining unit is centered near zero (Aadland and others, 1995, Figure 30). Flow across the unit is therefore a small fraction of total recharge, and could probably be neglected. A representative leakance coefficient for the Gordon confining unit in the study area appears to be roughly 10^{-5} day^{-1} (Aadland and others, 1995, Plate 13). The head difference across the Gordon confining is highly variable due to large variation in the water table. Supposing a head difference of 50 ft for example, the Darcy velocity through the unit would be 2.2 in/yr or 15% of surface recharge. Therefore, groundwater flow in the Gordon aquifer appears to be influenced significantly by recharge from the overlying UTR aquifer, and lateral flow into the model domain, mainly from the east. L-Lake and Par Pond are major lakes that have an important influence on nearby groundwater flow (Figure 2-14). The Site Utilities Department well database on ShRINE indicates that no more than three producing wells are screened in the Gordon aquifer (905-136G, 905-126G, and 905-103G). These wells serve small facilities and have a maximum capacity of 25 gpm or less. Considering that actual usage would be much lower, the impact of these wells is insignificant at the regional scale. The impact of the Pen Branch fault on confining unit leakance is uncertain.

Solute groundwater contamination originating in the C, K. L or P areas is expected to be confined to the Upper Three Runs and Gordon aquifers. Most surface recharge discharges to the nearest stream, with the balance entering the Gordon aquifer. As groundwater in the Gordon aquifer flows toward the Savannah River or Upper Three Runs, the gradient between the Crouch Branch and Gordon aquifers becomes upward ensuring ultimate discharge to the Savannah River or Upper Three Runs. Contamination is not expected to enter the Crouch Branch aquifer.

2.6 Hydrologic Properties

In addition to the unit-specific hydraulic conductivity data discussed above. soil characteristic curves, effective porosity, and specific storage data are needed for model development. The steady-state hydraulic head and Darcy velocity fields in the saturated zone are affected only by horizontal and vertical hydraulic conductivity, making these remaining properties less critical to model development. Soil characteristic curves (capillary suction and relative permeability as a function of water saturation) affect the flow solution in unsaturated regions. Effective porosity affects groundwater "particle" tracing results, which rely on the pore velocity field. Specific storage affects transient flow only, and then only in confined aquifer systems for practical purposes. Characterization data available for defining these hydraulic properties in the model are identified below. Given the general scarcity and uncertainty in the data, generic estimates to be applied model-wide are appropriate.

2.6.1 Soil Characteristic Curves

Relative permeability and capillary suction head as a function of water saturation are referred to as soil characteristic curves. These relationships are difficult to measure accurately, and testing is expensive. Very little data are available for SRS unconsolidated sediments. O'Brien & Gere (1991) obtained a small set of water retention (capillary suction versus saturation) data for M-Area sediment samples. The data have been plotted by Flach and others (1996, Figures 11 and 12). Yu and others (1993) obtained both relative permeability and water retention data for remolded GSA sediments to be used for Environmental Restoration construction projects. Recently, Amidon (1996) obtained water retention data from 3 undisturbed soil samples collected from the vadose zone around the Burial Grounds Complex. According to Looney and others (1987), Gruber (1981, 1983) and Parizek and Root (1986) measured soil water content in the vadose zone and suggested the average water content is approximately 30% (water volume/total volume). Given the scarcity of the data and lacking a specific need for accurate vadose zone modeling in a regional scale model, a simplified approach for defining soil characteristic curves is taken as shown in Figure 2-22. The curves are chosen to align with data for sandy sediments as opposed to clayey sediments (see Flach and others (1996), Figures 11 and 12). These "pseudo-soil" characteristic curves are adequate for transporting water and contaminants through the vadose zone to the water table, provided detailed, accurate information about the unsaturated zone is not needed. The most important aspect of these curves is the assumed residual saturation value (40%), which has the strongest effect on average vadose zone saturation. Groundwater travel times through the vadose zone are affected by saturation through pore velocity.

2.6.2 Effective (Kinematic) Porosity

Aadland and others (1995, p. 44) analyzed laboratory data from 83 selected sediment samples taken from various low permeability beds within the Upper Three Runs aquifer. For 28 "clayey to very clayey, often silty, sand" samples the total porosity averaged 40%. For 55 "sandy, often silty clay, and clay" samples, the average total porosity is 41%. Aadland and others (1995, Table 3) also calculated the total porosity of the sandy portions of the Upper Three Runs aquifer using the Beard and Weyl (1973) method, and arrived at an average total porosity of 35%. For the Gordon aquifer, the result is 34% (Aadland and others, 1995, Table 7). More recently, Smits and others (1997) compiled a database of porosity measurements for the General Separations Area. The arithmetic average of these values, mostly from low permeability samples, is 45%. From these data and analyses, total porosity in aquifer zones appears to average about 40%.

An "effective" porosity value, smaller than the total porosity, is commonly used for transport simulations and particle tracing related to contaminant migration. As discussed by De Marsily (1986, Chapter 2), two types of porosity are commonly and unfortunately referred to as "effective porosity". The first is specific yield or drainage porosity of an unsaturated soil, ω_d, and the second is kinematic porosity of a saturated medium, ω_c. Section 2.3.3 of De Marsily (1986) summarizes which porosity (total included) to use for which application. For saturated-zone particle tracing and transport simulations, the kinematic porosity is appropriate and the focus of effective porosity discussions in this report.

An effective porosity can be used to account for regions of relatively immobile water, ranging from grain-sized "dead-end" pores to macro-scale clay intervals, which do not effectively participate in contaminant transport. The presence of immobile water does not necessarily dictate the use of an effective porosity (De Marsily, 1986, p. 259). If the solute contaminant perfectly penetrates the immobile water ($K'=1$, $C'=C$ in De Marsily (1986)) (or there is no immobile water), then total porosity is appropriate (ω). On the other hand, if a model block contains sub-regions of immobile water that a solute will not penetrate (K'=0, C'=0), then a lower, "effective" porosity is appropriate (kinematic, ω_C).

Effective porosity can be estimated by assuming that only the largest scale regions of relatively immobile water are not effectively penetrated by contaminant. At smaller scales, contaminant is able to effectively diffuse into regions of immobile water. Macro-scale regions of immobile water can reasonably be defined as sediment intervals with more than 25% mud. For the General Separations Area, 32% of the nearly 40,000 ft of sediment core contains greater than 25% mud, based on analysis of the lithologic data compiled by Smits and others (1997). This suggests that as low as 68% of a typical aquifer is effectively available for contaminant transport, and that effective porosity is approximately 25% (68% of 40% total porosity). This estimate may be a conservative (low) estimate for effective conductivity, because in reality some contamination would penetrate the lower conductivity intervals. This value is consistent with the recommendations of Looney and others (1987, p. 39), who recommend assuming an effective porosity of 0.2 for risk calculations. Transport sensitivity studies should consider an effective porosity range of approximately 25% to 40%.

2.6.3 Specific Storage

Specific storage is relevant only to transient flow simulations, and therefore has no effect on the steady-state results presented in later sections. Specific storage is defined by (Freeze and Cherry, 1979, p. 59)

$$S_s = \rho g(\alpha + \eta\beta)$$

where

S_s	specific storage
ρ	density of water (~1000 kg/m^3)
g	gravitational acceleration (9.8 m/s^2)
α	compressibility of porous medium
η	total porosity
β	compressibility of water (4.4x10^{-10} m^2/N)

Compressibility ranges from 10^{-6} to 10^{-8} m^2/N for clay and from 10^{-7} to 10^{-9} m^2/N for sand (Freeze and Cherry, 1979, Table 2.5). Assuming a nominal compressibility value of 5 x 10^{-8} m^2/N and a total porosity of 40% yields 1.5x10^{-4} ft^{-1} for specific storage.

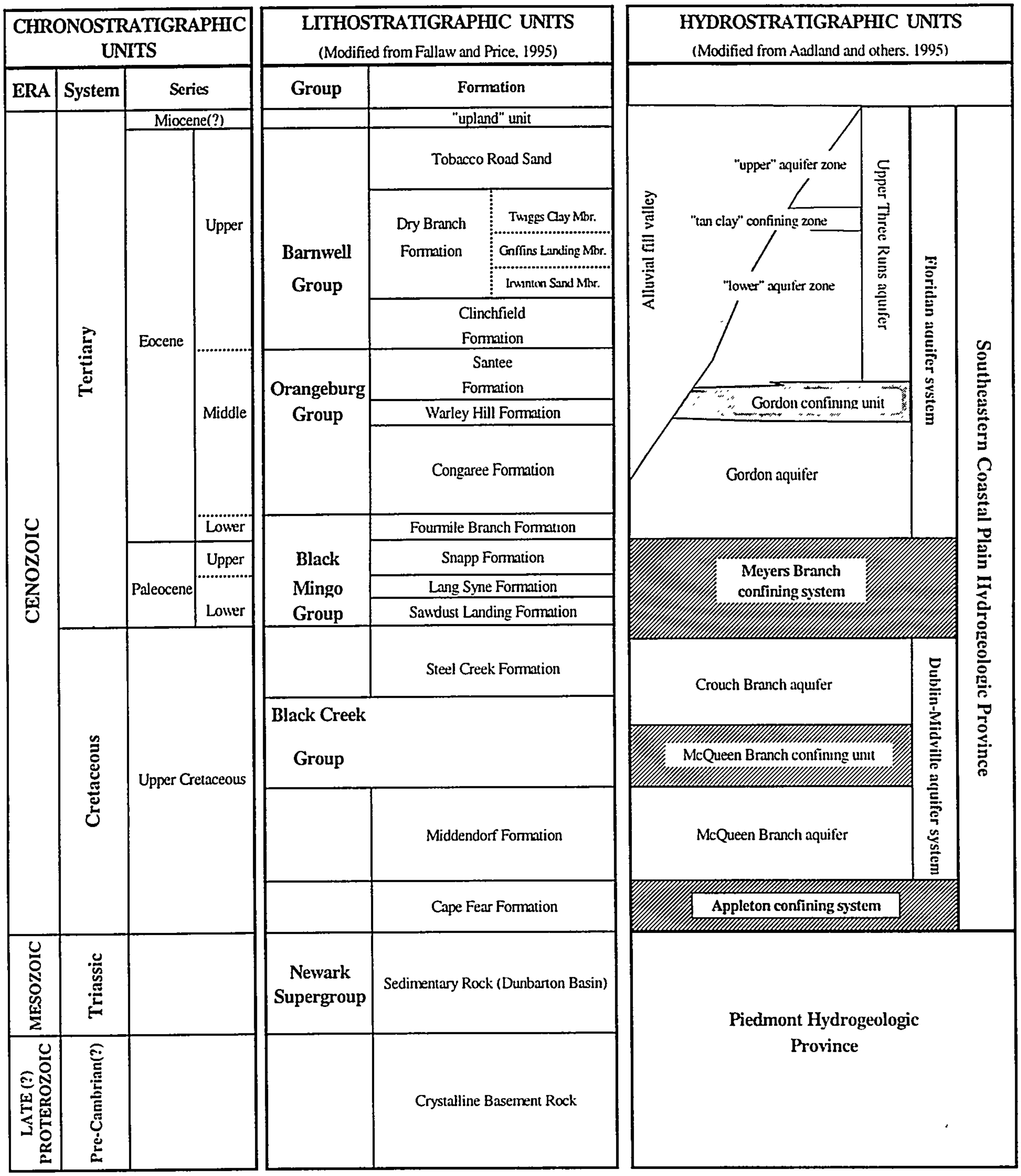


Figure 2-1. Comparison of Lithostratigraphic and Hydrostratigraphic Units at SRS

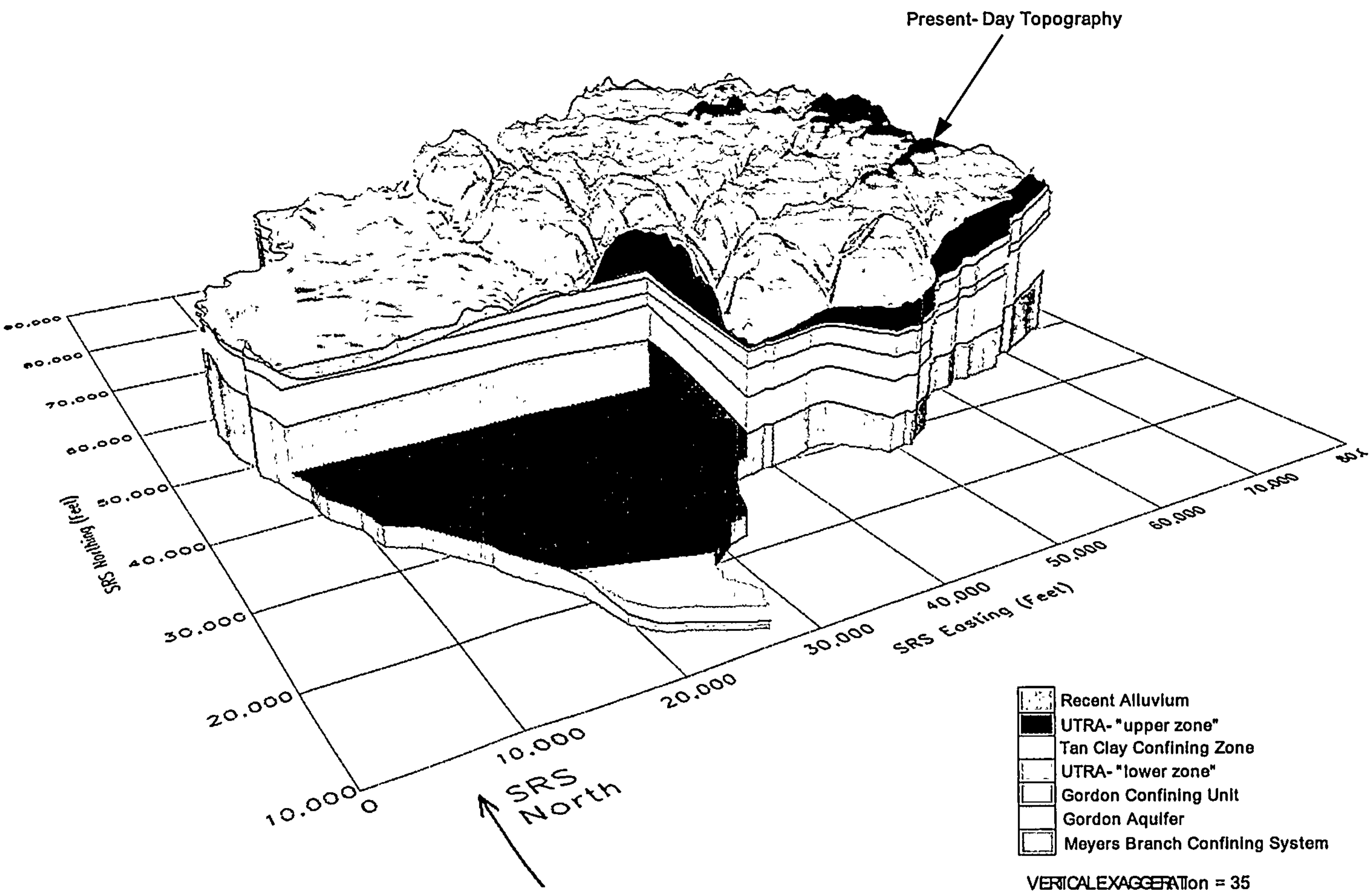


Figure 2-2. Conceptual Hydrostratigraphic Model

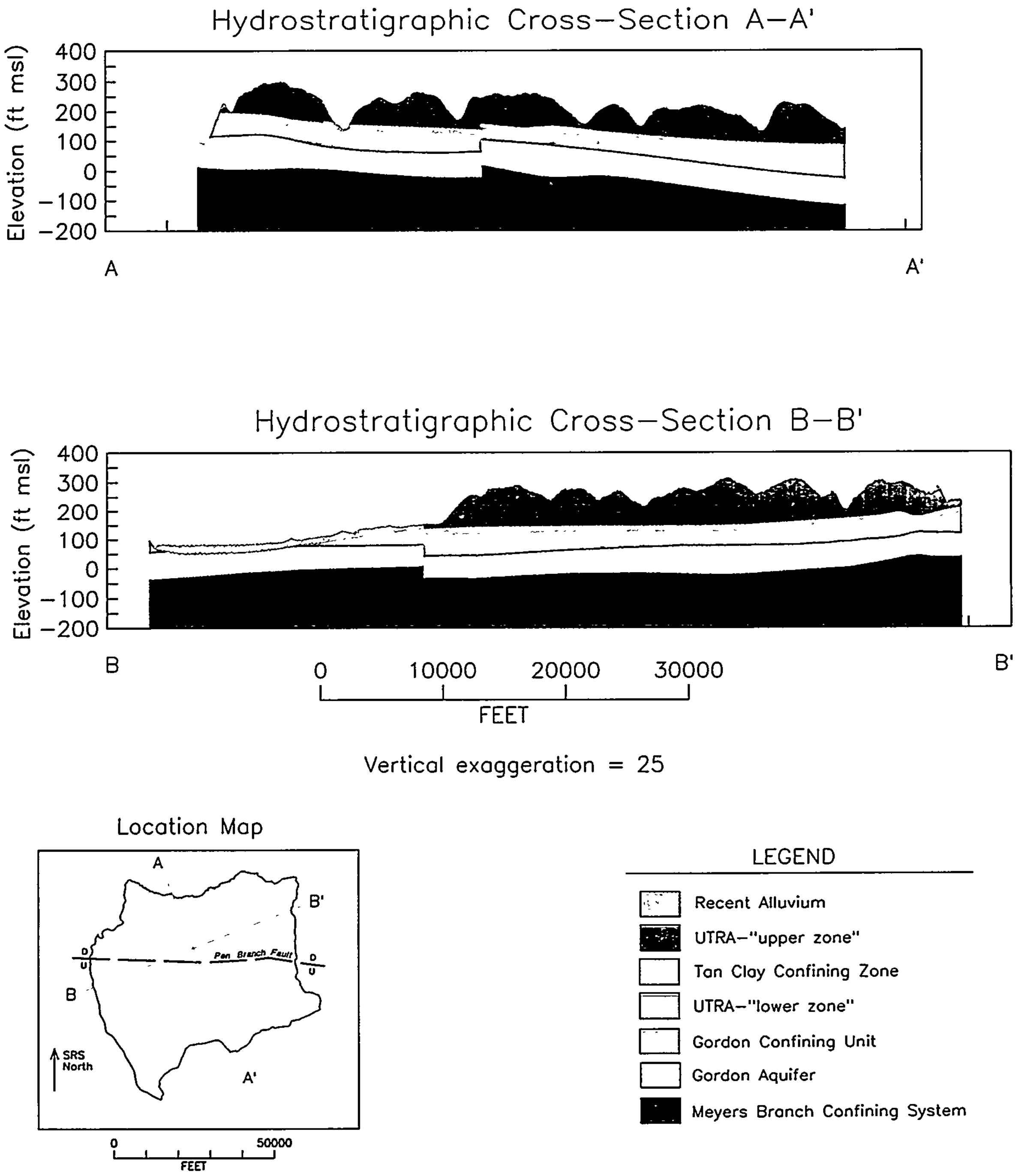


Figure 2-3. **Hydrostratigraphic Cross-Sections**

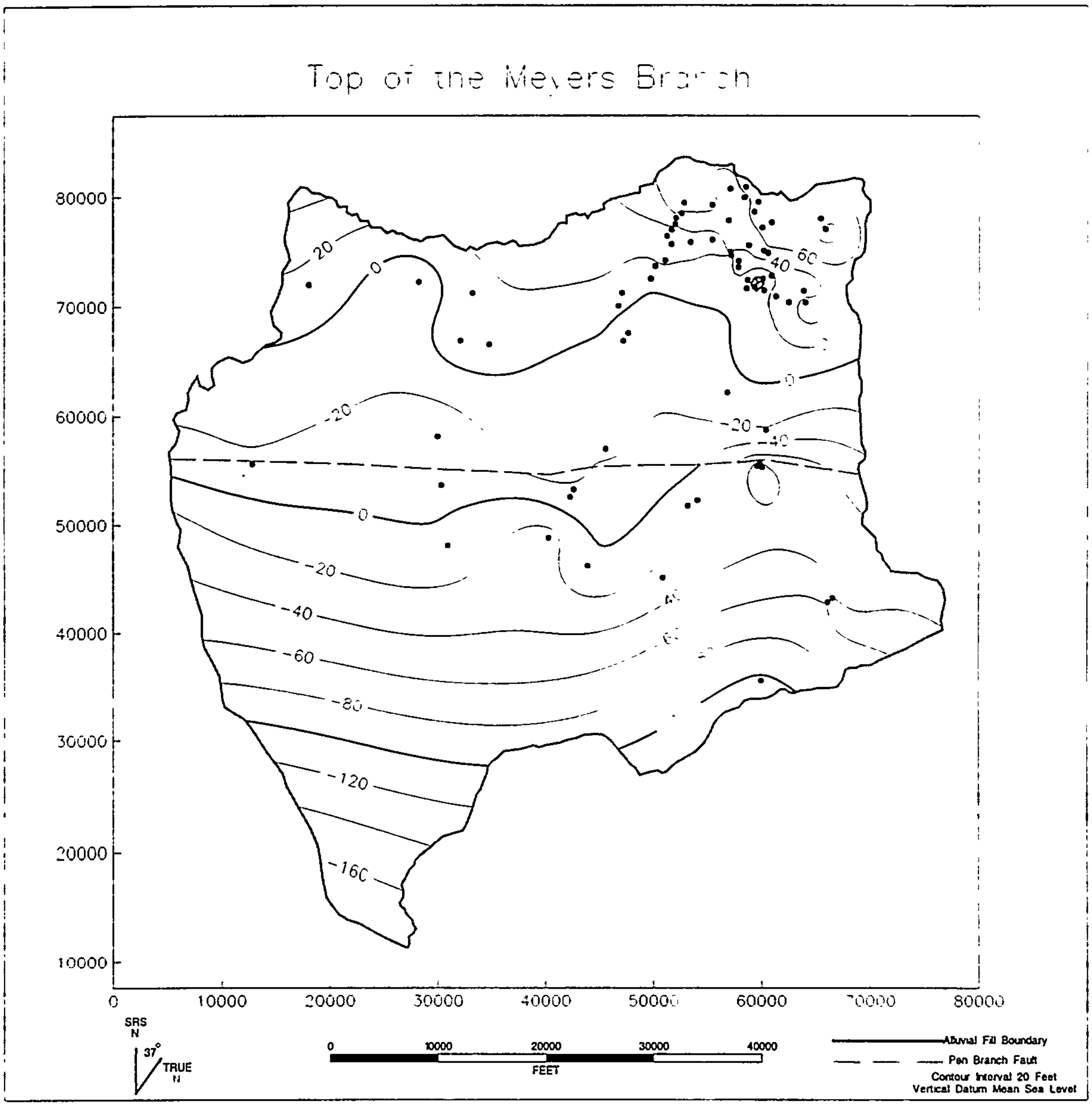


Figure 2-4. Altitude-Contour Map of the Top of the Meyers Branch Confining System

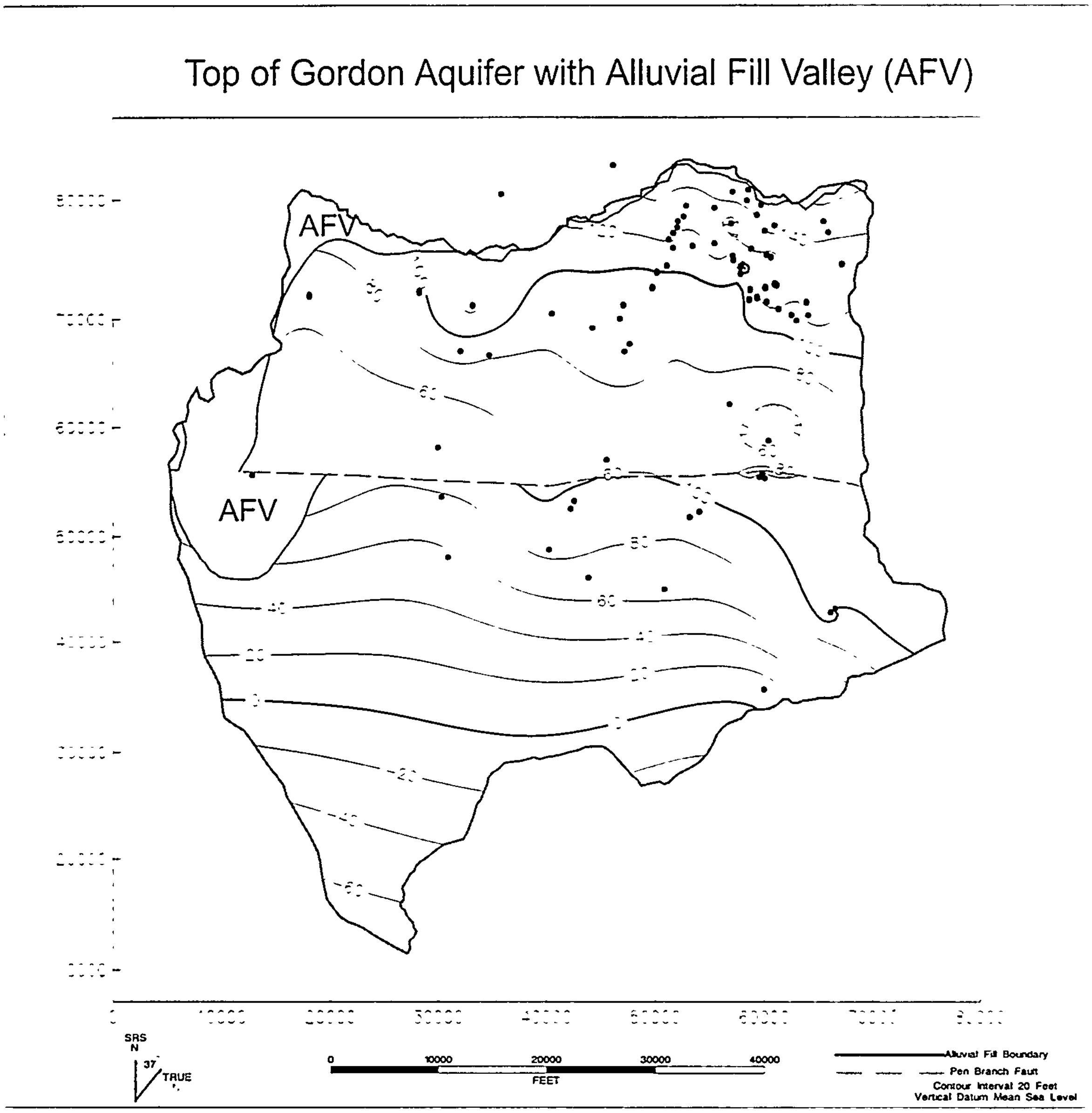


Figure 2-5. Altitude-Contour Map of the Top of the Gordon Aquifer

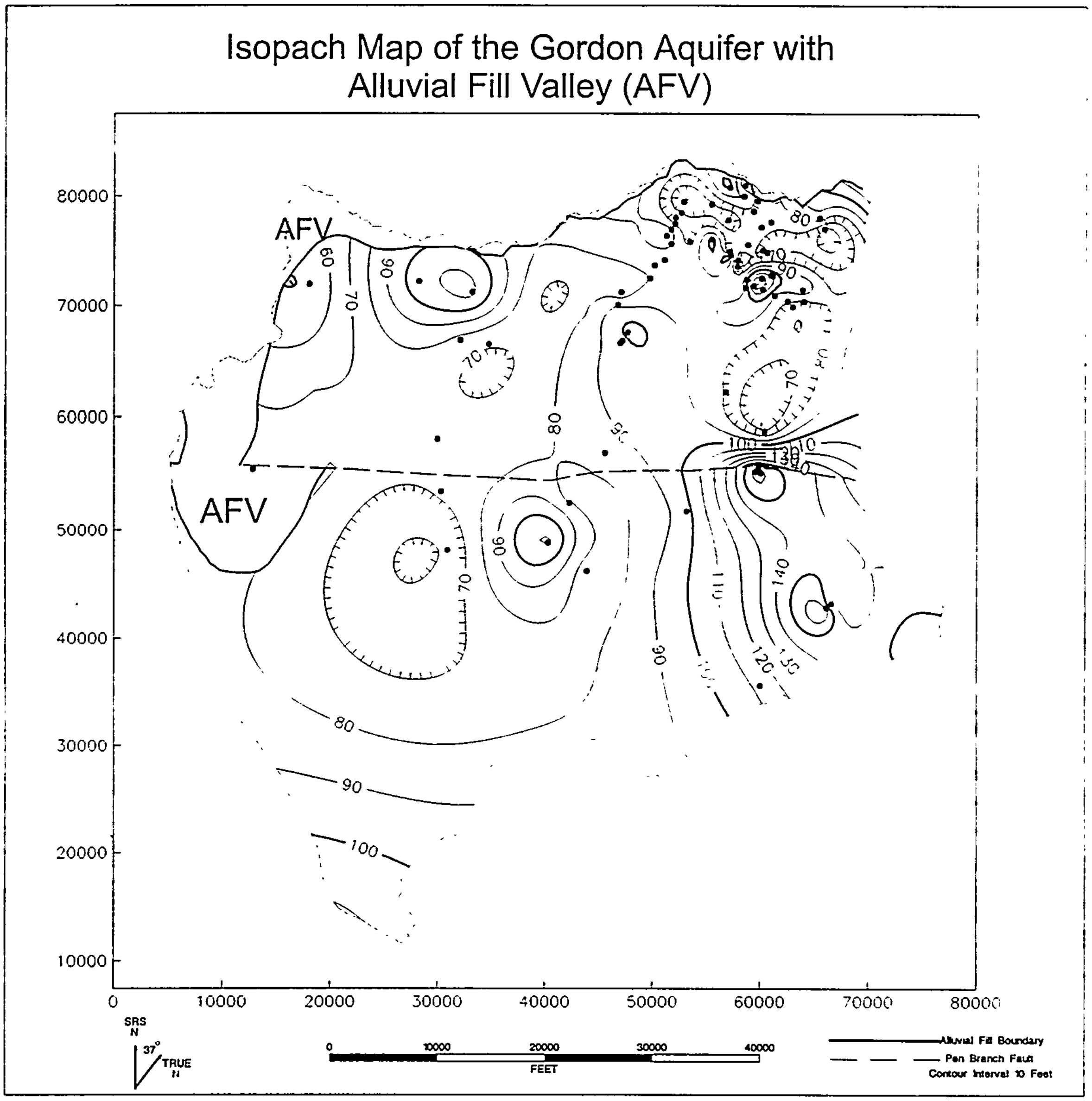

Isopach Map of the Gordon Aquifer with Alluvial Fill Valley (AFV)

Figure 2-6. Isopach Map of the Gordon Aquifer

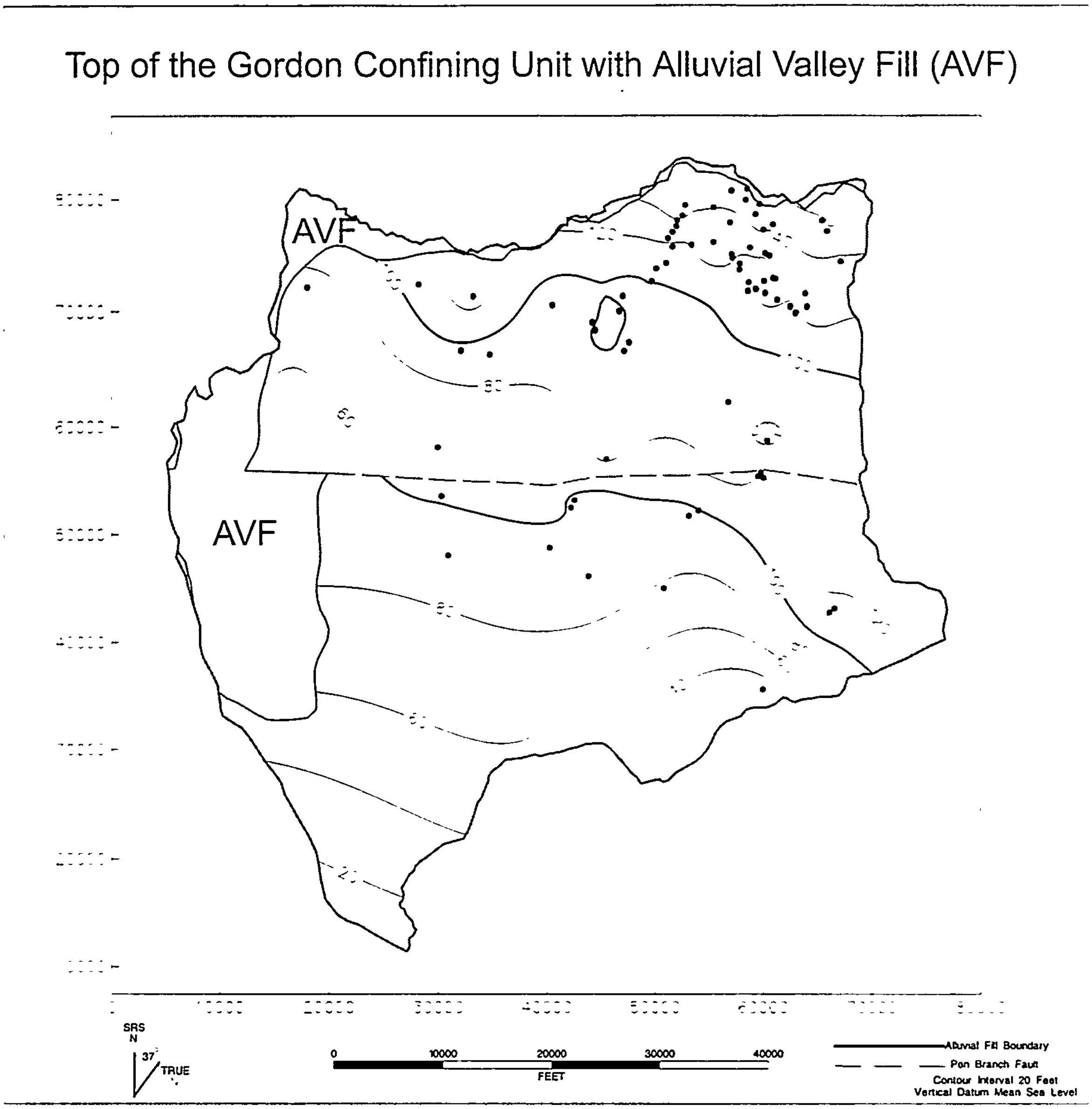
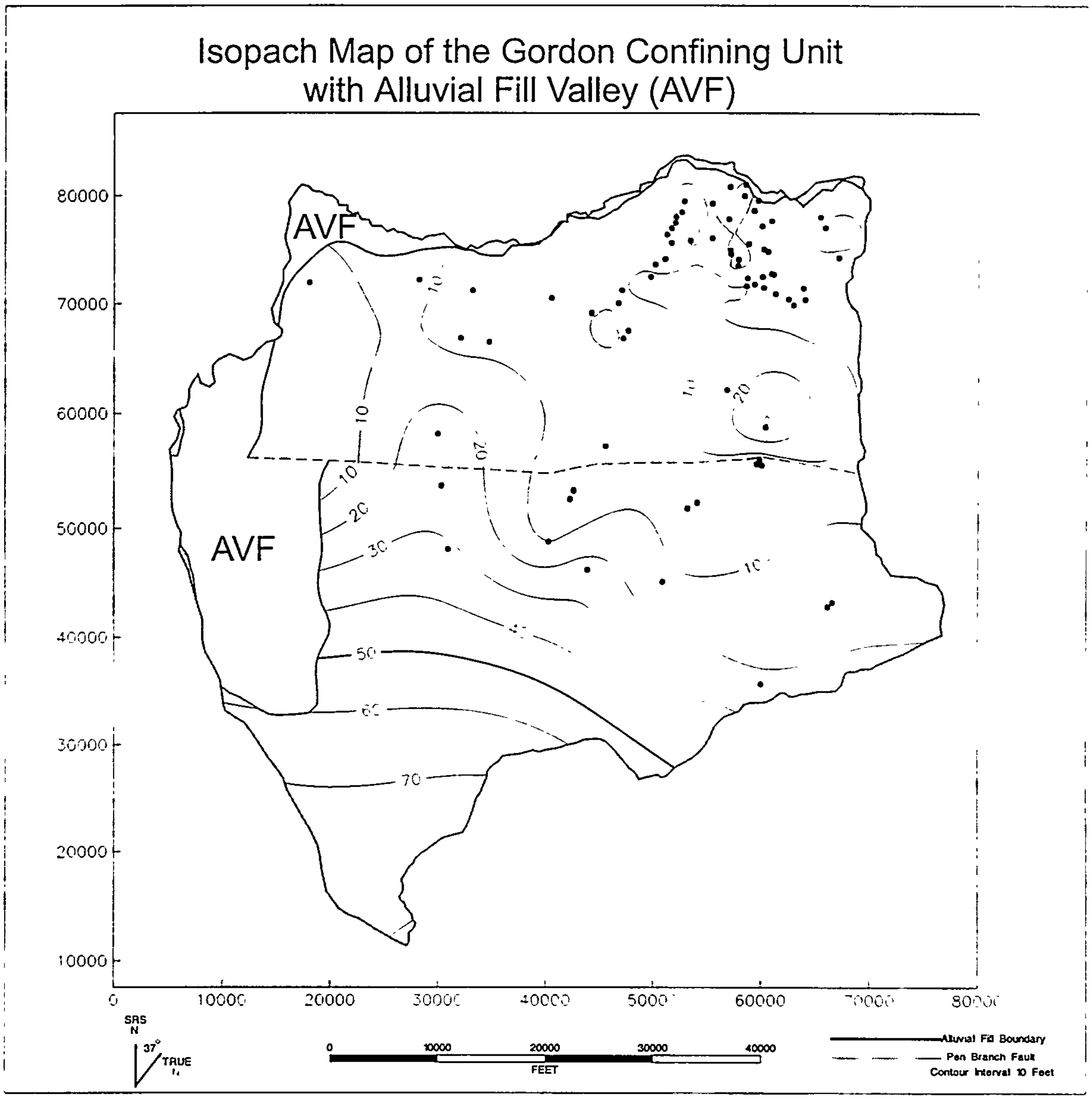
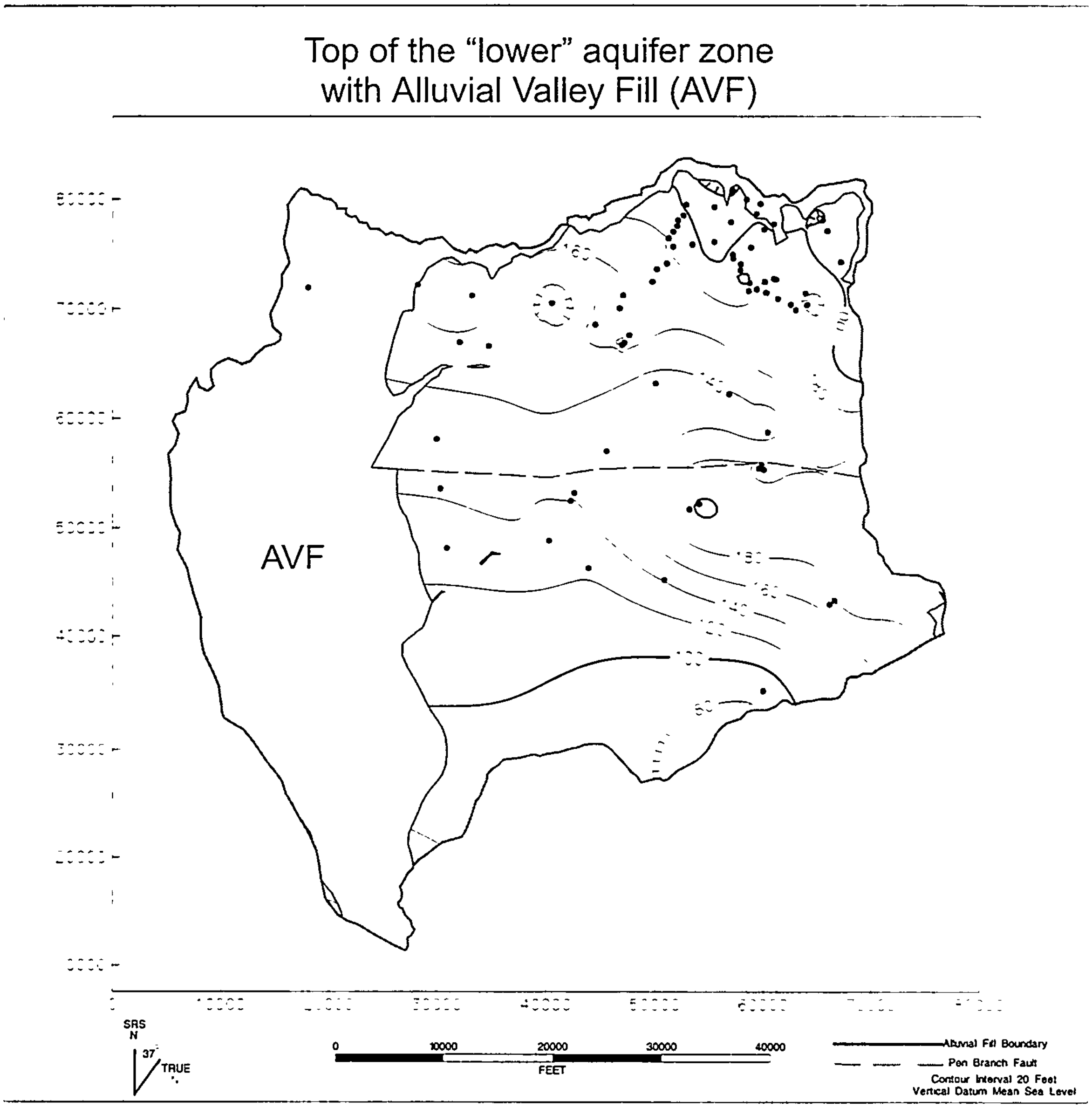


Figure 2-7. Altitude-Contour Map of the Top of the Gordon Confining Unit



Isopach Map of the Gordon Confining Unit with Alluvial Fill Valley (AVF)

Figure 2-8. Isopach Map of the Gordon Confining Unit



Top of the "lower" aquifer zone with Alluvial Valley Fill (AVF)

Figure 2-9. Altitude-Contour Map of the Top of the "Lower" Aquifer Zone

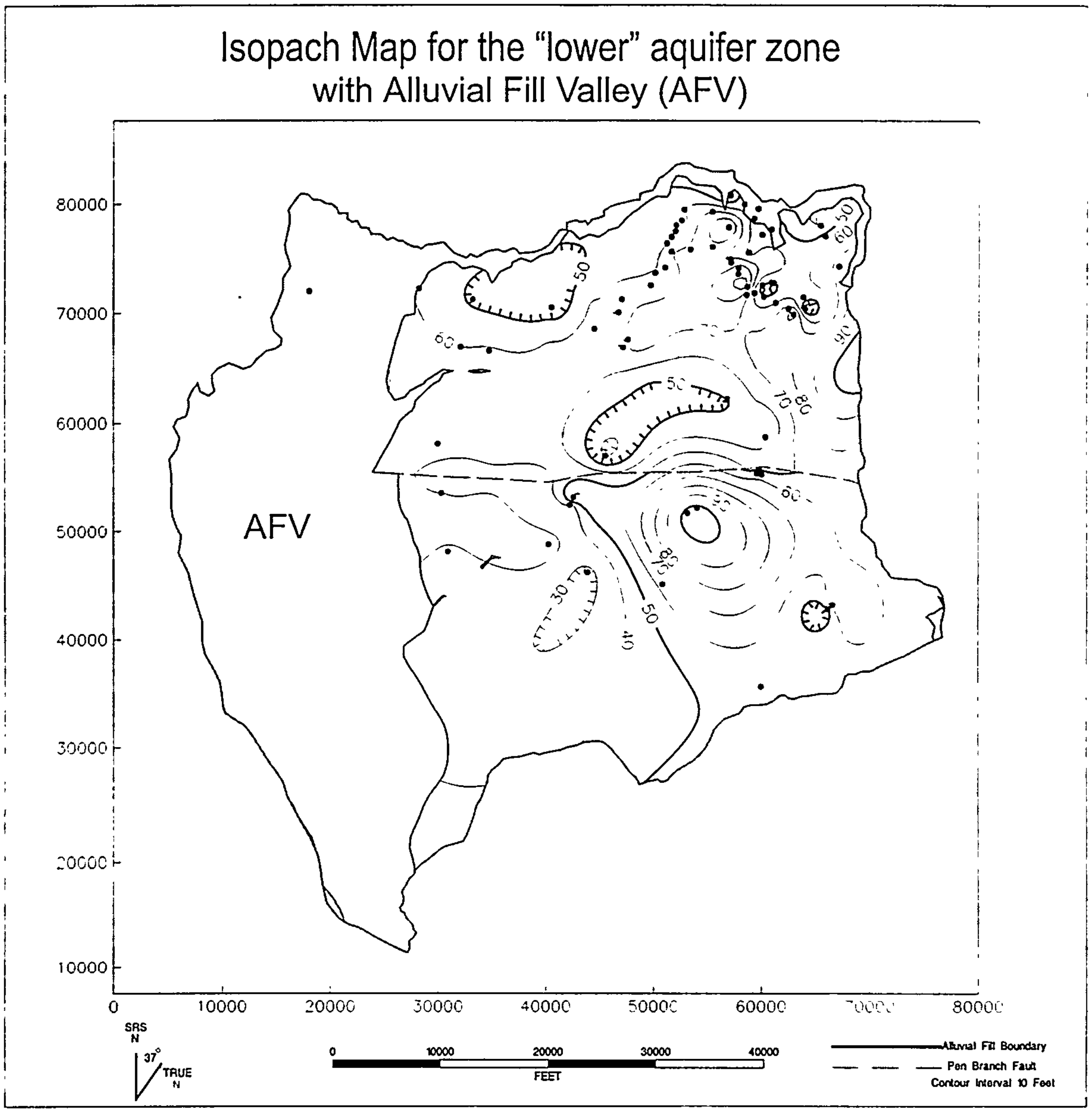


Figure 2-10. Isopach Map of the "Lower" Aquifer Zone

Top of the "Tan Clay" Confining Zone with Allluvial Valley Fill (AVF)

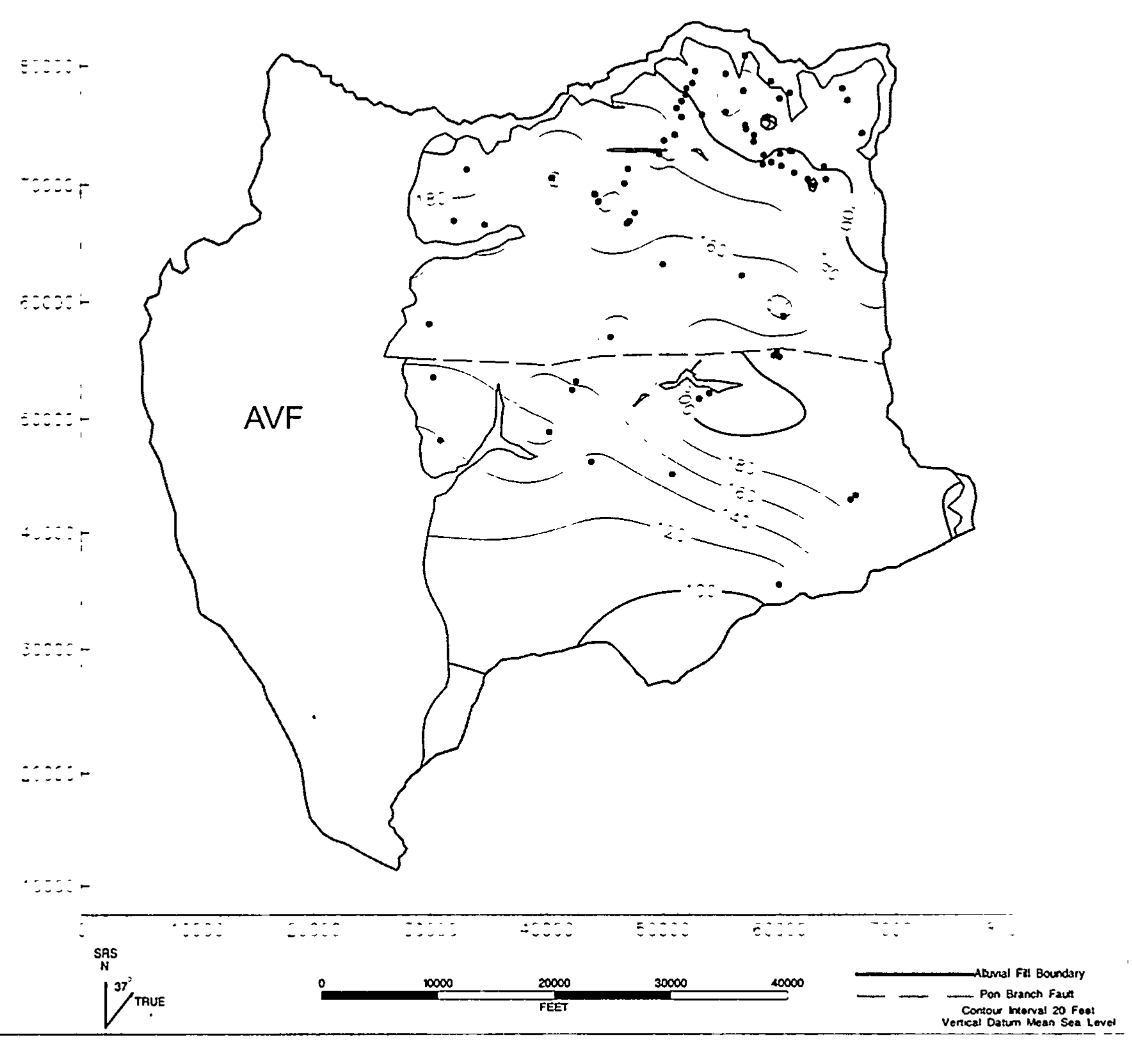
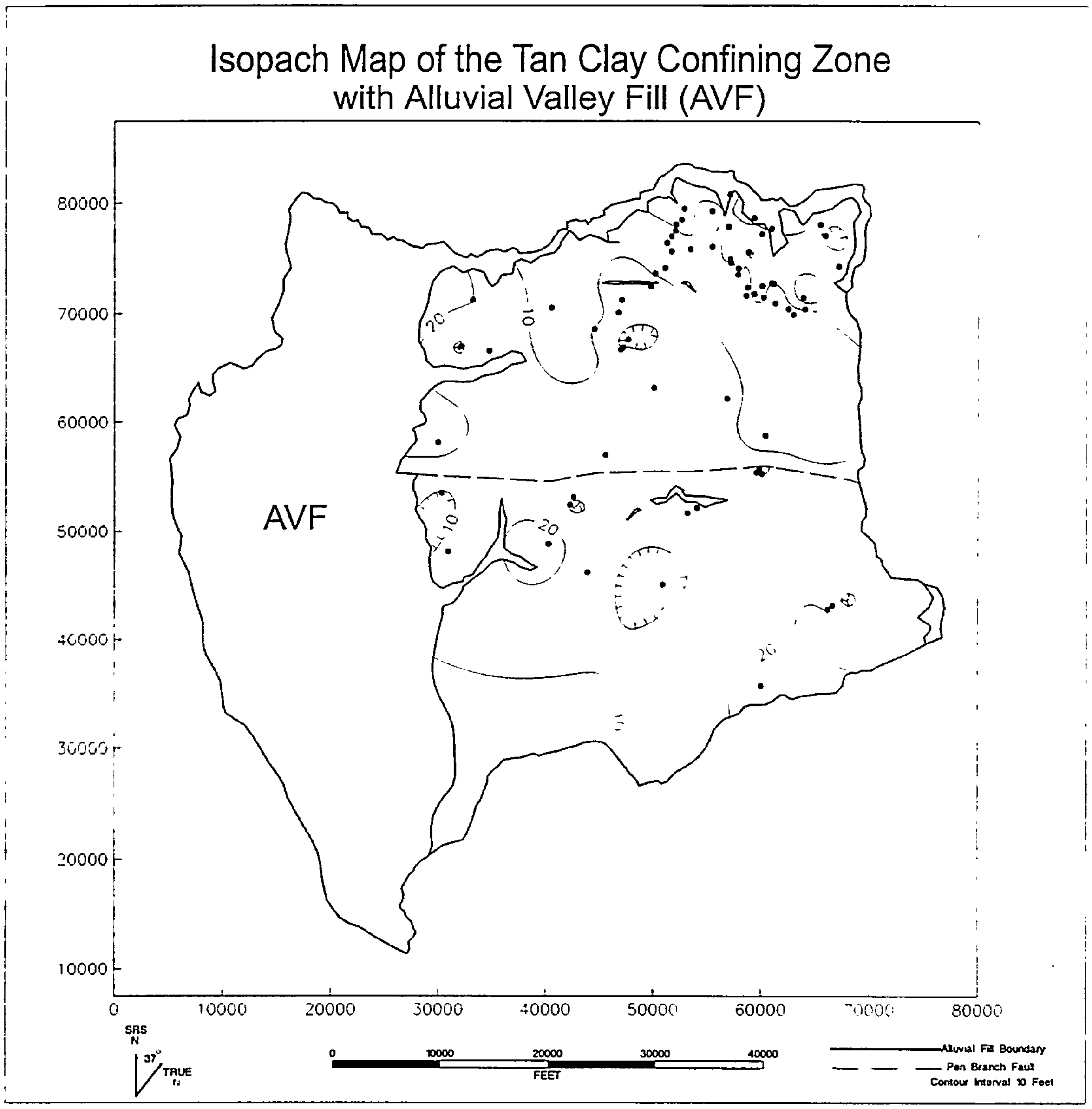


Figure 2-11. Altitude-Contour Map of the Top of the "Tan Clay" Confining Zone



Isopach Map of the Tan Clay Confining Zone
with Alluvial Valley Fill (AVF)

Figure 2-12. Isopach Map of the "Tan Clay" Confining Zone

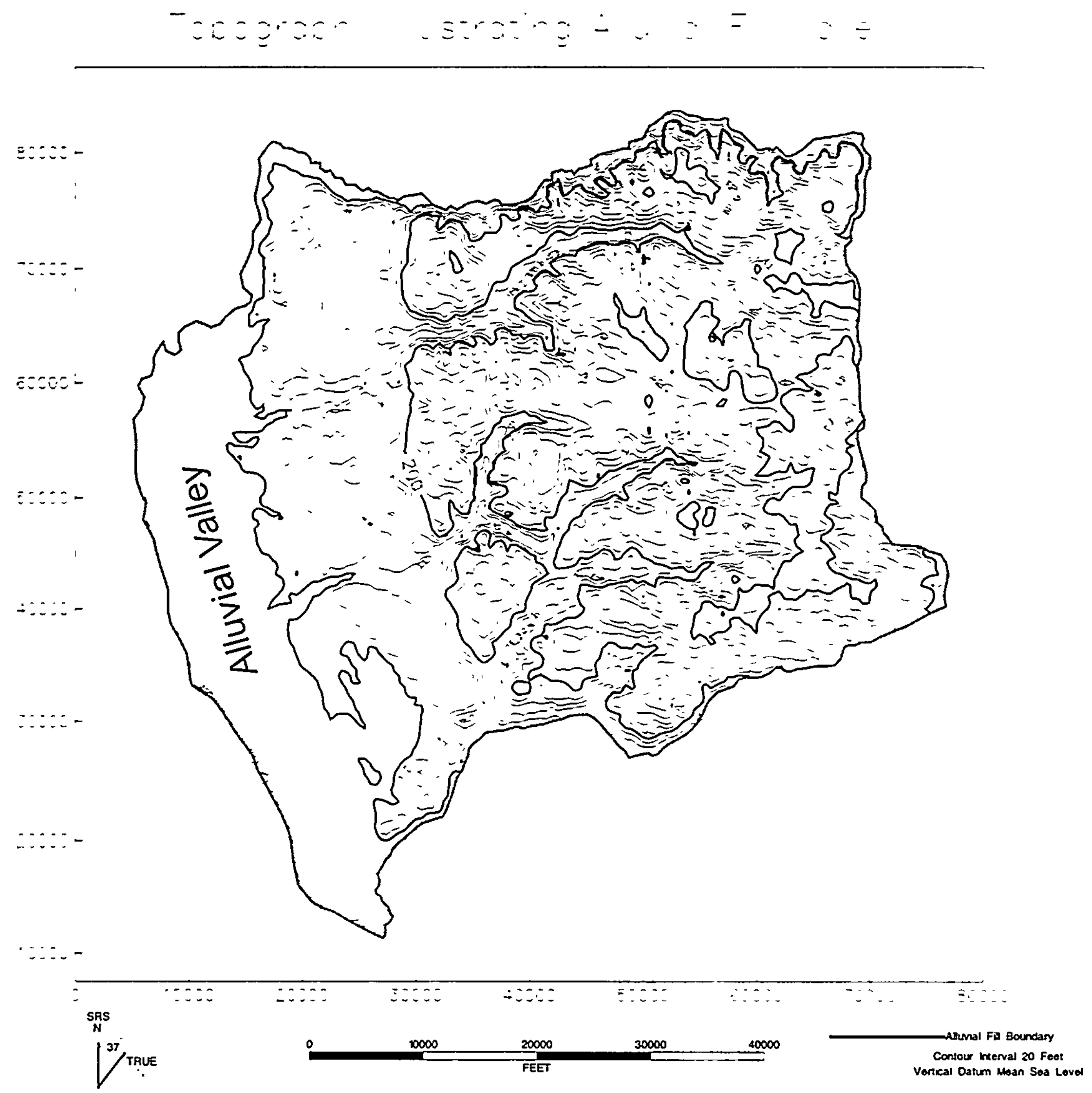


Figure 2-13. Topographic Surface of the "Upper" Aquifer Zone

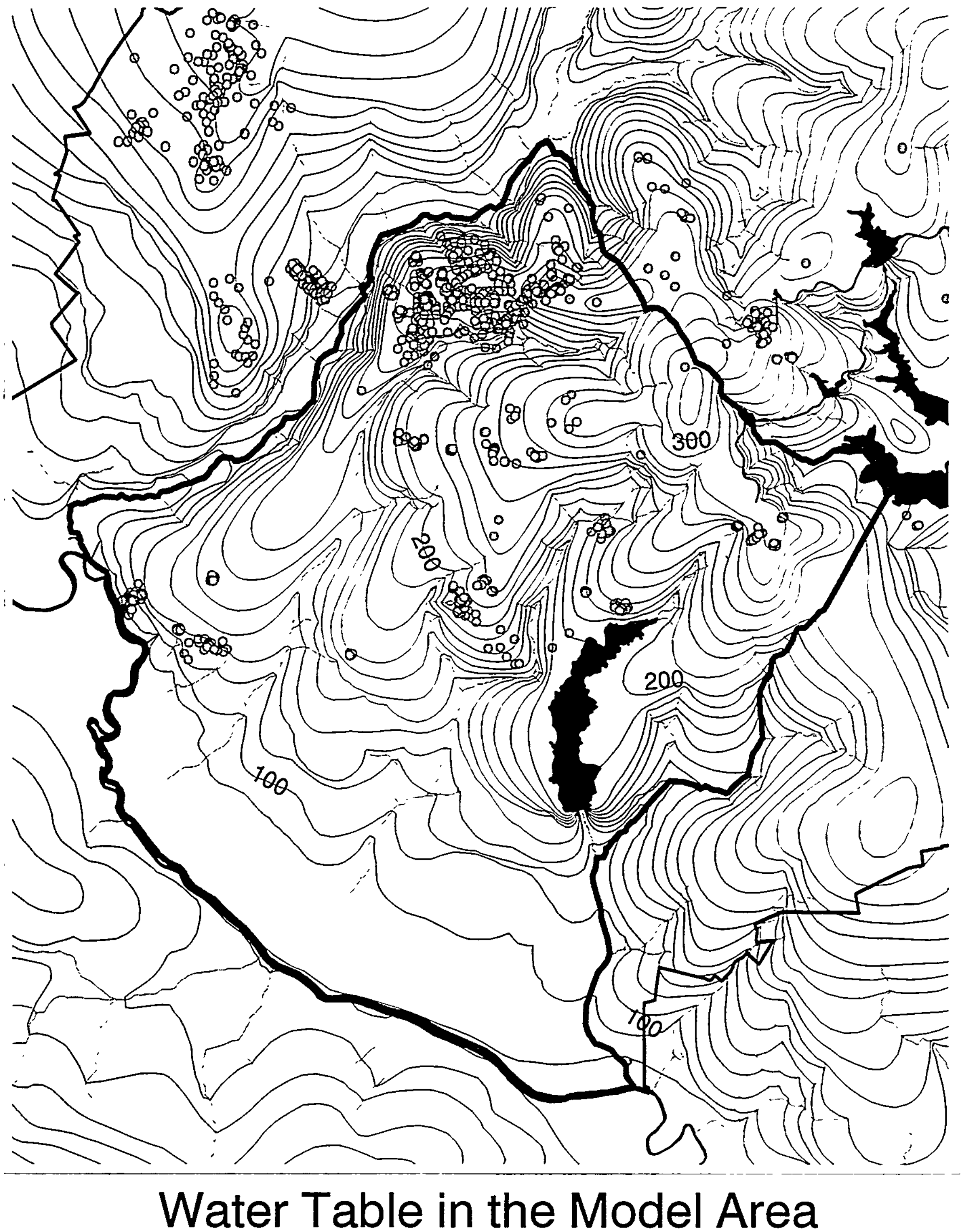


Figure 2-14. Water Table Map of CKLP Model Area

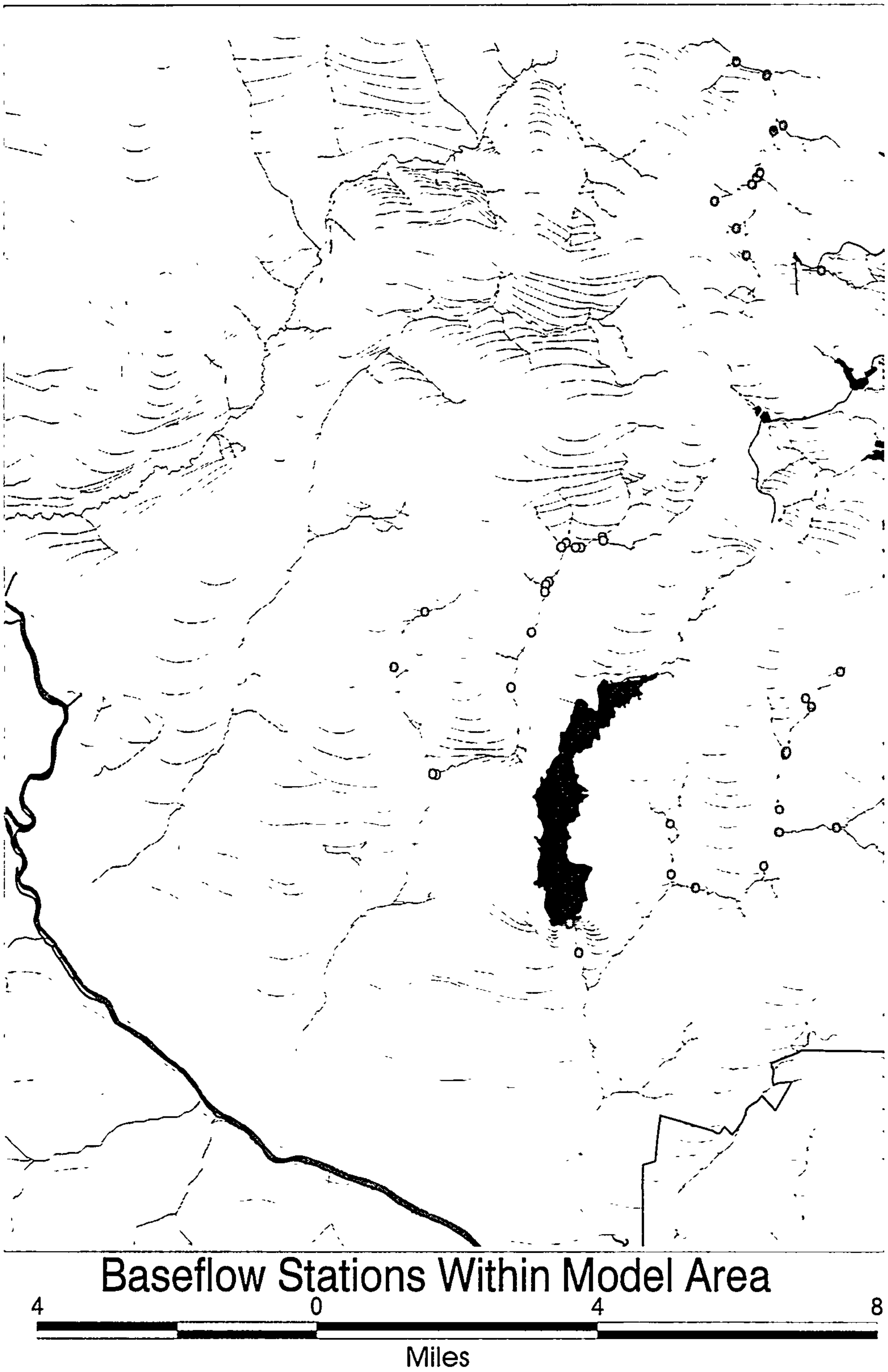


Figure 2-15. Location of Stream Baseflow Measurements for 1998 Field Study

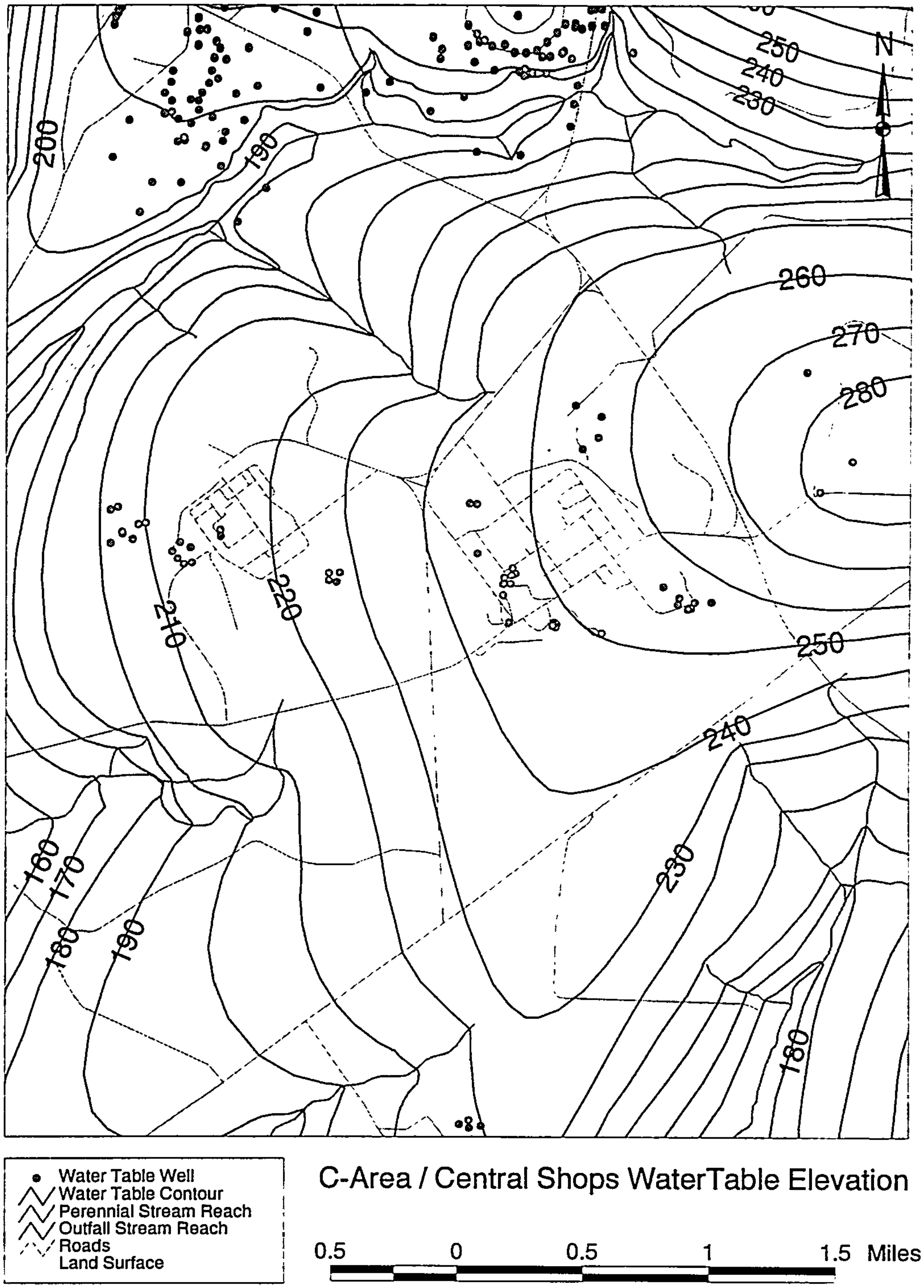


Figure 2-16. Water Table Map for C Reactor Area

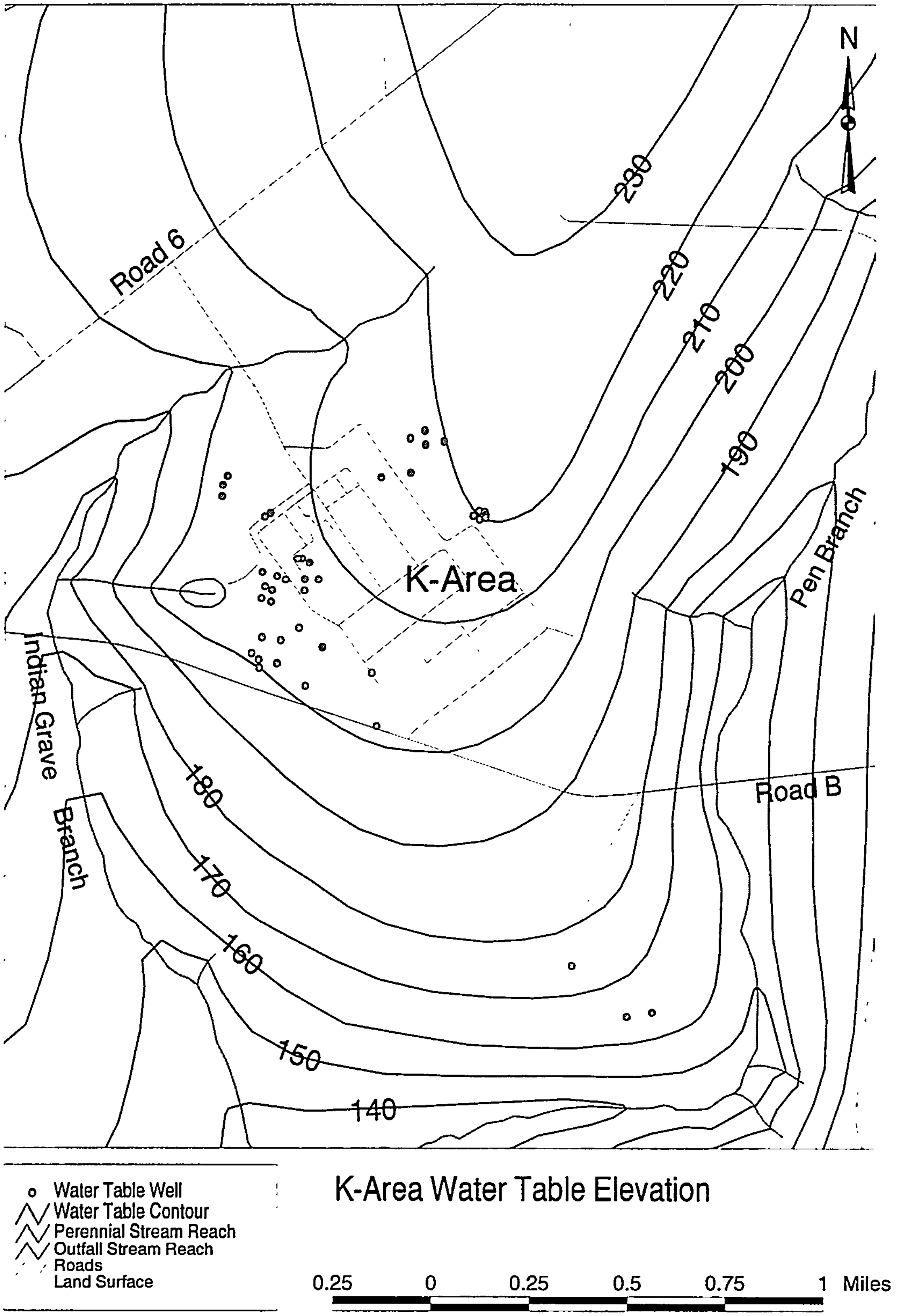


Figure 2-17. Water Table Map for K Reactor Area

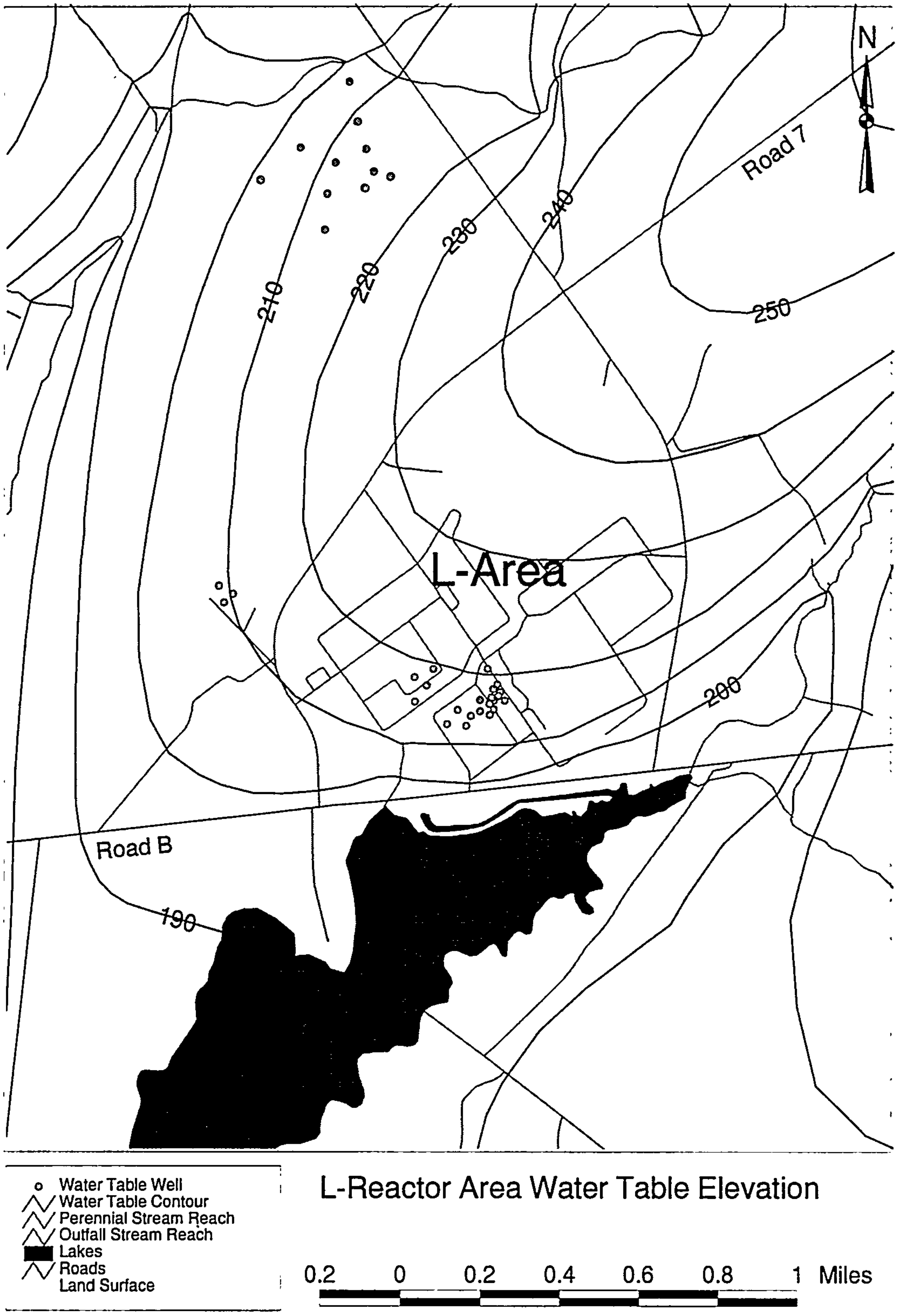


Figure 2-18. Water Table Map for L Reactor Area

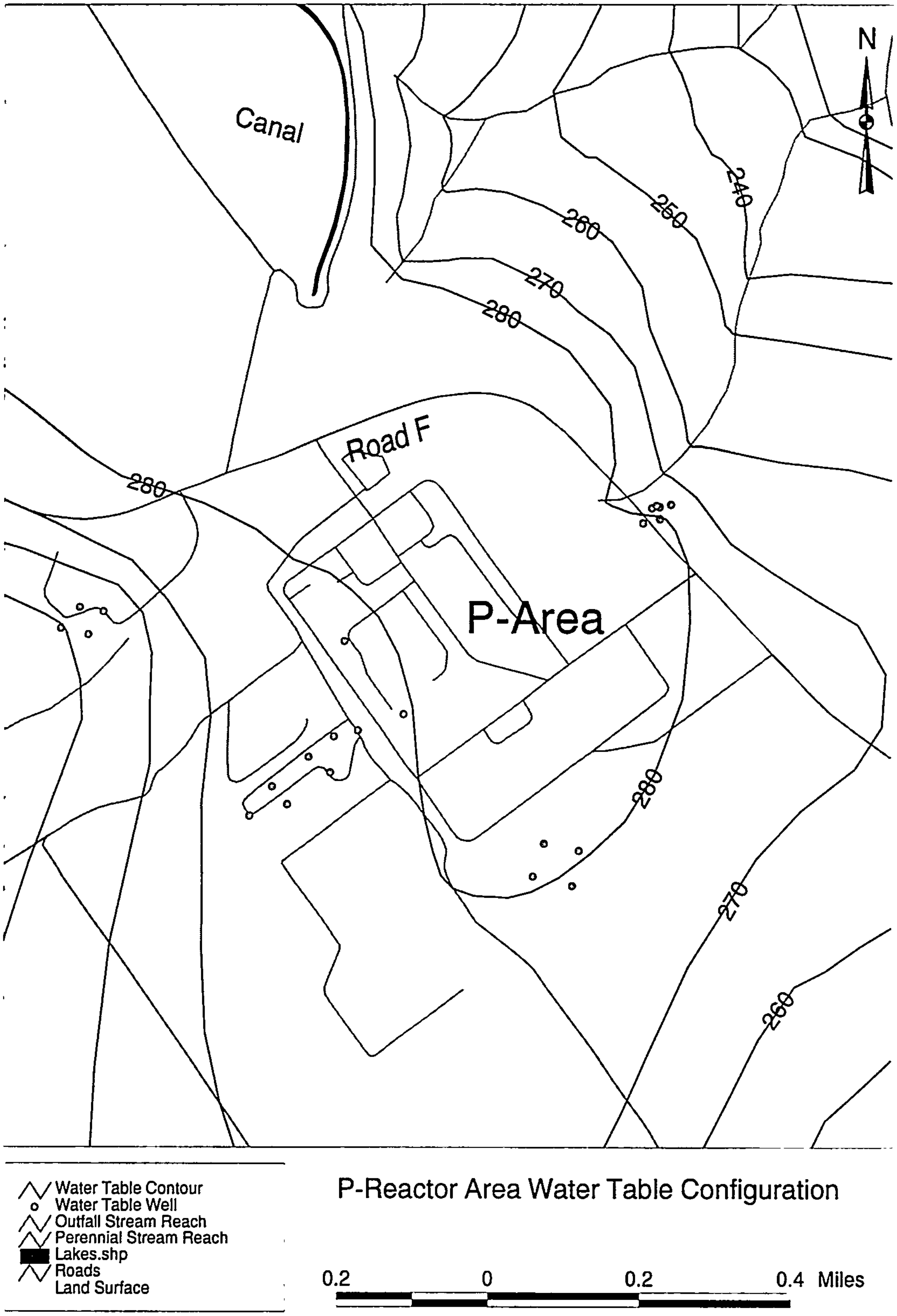


Figure 2-19. Water Table Map for P Reactor Area

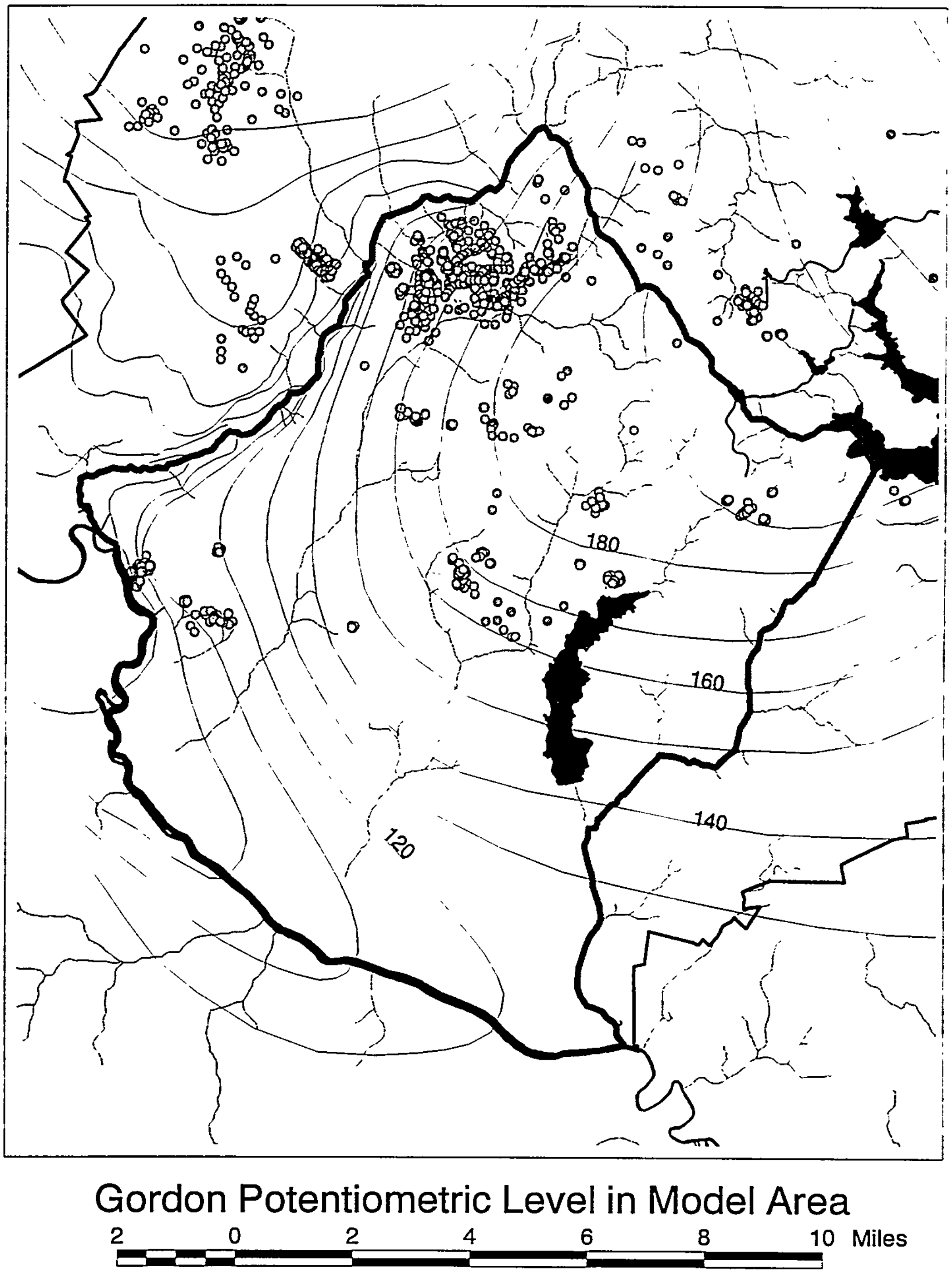


Figure 2-20. Gordon Potentiometric Surface in the CKLP Model Area

Figure 2-21. Map of Live (Perennial) Stream Reaches as Determined by Field Observations

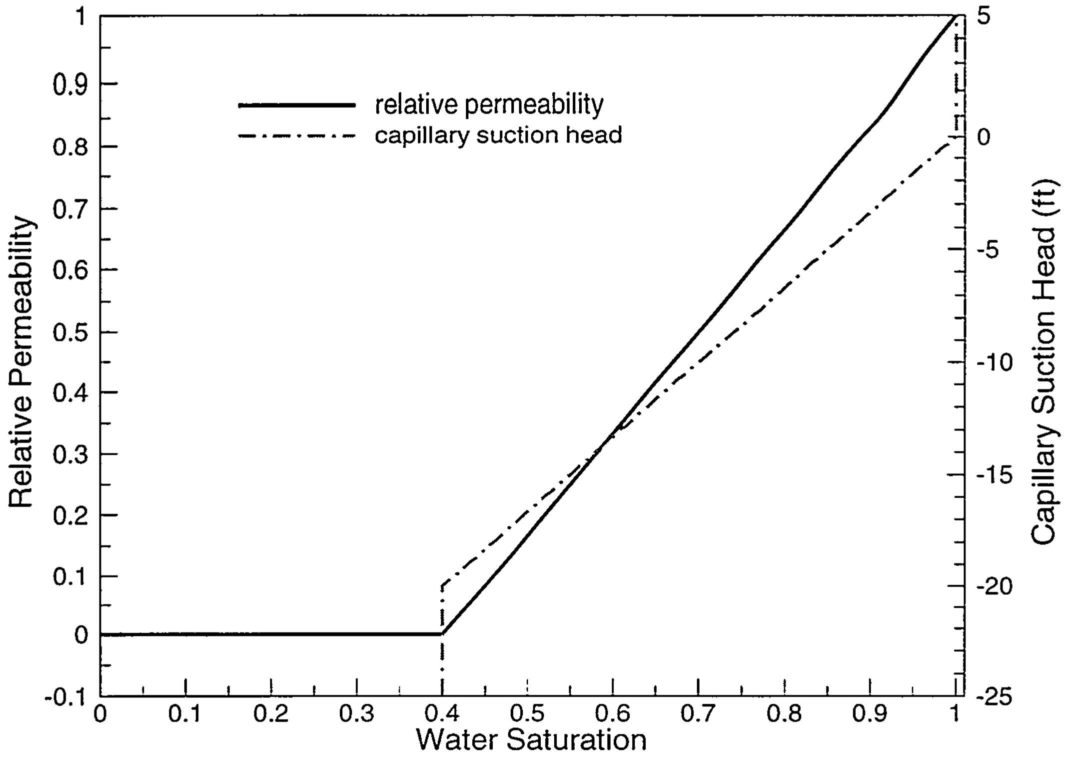


Figure 2-22. Approximate Soil Characteristic Curves

Table 2-1. Summary of Permeability Measurements

	Laboratory Tests (ft/day)		**Slug**	**Pumping**
Hydrostratigraphic Unit	Vertical	Horizontal	**Tests (ft/day)**	**Tests (ft/day)**
"upper" aquifer zone				
Number of Results	11	12	12	1
Minimum	9.20E-05	2.24E-04	1.40E-01	5.16E+01
Maximum	2.77E+01	6.04E+00	1.22E+01	-
Arithmetic Mean	2.68E+00	1.21E+00	1.88E+00	-
Geometric Mean	1.04E-02	6.19E-02	7.36E-01	-
Standard Deviation	8.31E+00	2.24E+00	3.46E+00	-
"tan clay" confining zone				
Number of Results	37	24	0	0
Minimum	3.70E-08	1.45E-05	-	-
Maximum	9.66E-02	1.70E-01	-	-
Arithmetic Mean	4.62E-03	8.49E-03	-	-
Geometric Mean	5.94E-05	2.60E-04	-	-
Standard Deviation	1.91E-02	3.47E-02	-	-
"lower" aquifer zone				
Number of Results	33	31	25	3
Minimum	4.54E-06	1.59E-05	1.30E-01	1.23E+00
Maximum	3.42E+00	1.11E+01	2.44E+01	2.10E+00
Arithmetic Mean	1.77E-01	6.45E-01	3.90E+00	1.67E+00
Geometric Mean	2.82E-03	1.02E-02	1.67E+00	1.63E+00
Standard Deviation	6.19E-01	2.03E+00	6.09E+00	4.35E-01
Gordon Confining Unit				
Number of Results	41	25	0	0
Minimum	1.14E-06	5.40E-06	-	-
Maximum	4.27E-01	1.22E-01	-	-
Arithmetic Mean	1.20E-02	1.06E-02	-	-
Geometric Mean	1.15E-04	1.62E-04	-	-
Standard Deviation	6.68E-02	3.09E-02	-	-

Table 2-1. Summary of Permeability Measurements (Continued)

	Laboratory Tests (ft/day)		**Slug**	**Pumping**
Hydrostratigraphic Unit	Vertical	Horizontal	**Tests (ft/day)**	**Tests (ft/day)**
Gordon Aquifer				
Number of Results	23	24	47	13
Minimum	3.12E-06	2.06E-05	5.00E-03	8.20E-01
Maximum	3.62E+01	3.26E+01	3.32E+01	1.43E+02
Arithmetic Mean	1.66E+00	5.25E+00	3.78E+00	2.92E+01
Geometric Mean	7.73E-04	1.05E-02	9.81E-01	1.04E+01
Standard Deviation	7.54E+00	1.12E+01	6.15E+00	3.92E+01
Meyers Branch Confining System				
Number of Results	38	27	1	0
Minimum	4.26E-06	1.11E-05	3.55E+01	-
Maximum	3.40E-01	1.50E+00	-	-
Arithmetic Mean	1.39E-02	8.63E-02	-	-
Geometric Mean	2.47E-04	5.52E-04	-	-
Standard Deviation	5.65E-02	3.12E-01	-	-

Table 2-2. Base Flow Estimates Based on Hydrograph Separation of USGS Gauging Station Data

Stream reach	**Estimated base flow (cfs)**	**Estimated fraction of reach within CKLP model**	**Base flow target (cfs)**
Meyers Branch (headwaters to Road 9)	9.5	1/3	3.2
Steel Creek (above Road B to Road A; includes L-Lake)	-2.2	1	-2.2
Pen Branch (headwaters to Road A13; includes Indian Grave Branch)	13.3	1	13.3
Fourmile Branch (headwaters to Road A12)	14.1	1	14.1
Upper Three Runs (Road C to Road A)	8.9	1/2	4.5

3.0 Groundwater Flow Model Development

The process used to transform the hydrogeologic data and conceptual model into a numerical groundwater flow is presented in this section.

3.1 Code Selection and Description

The Subsurface Flow and Contaminant Transport (FACT) code was selected for numerical flow simulations. FACT is a variably saturated, three-dimensional, finite-element groundwater flow and solute contaminant transport code developed by the Savannah River Technology Center (SRTC) (Hamm and others, 1997). FACT version 1.0 is an outgrowth of the SAFT3D code developed jointly by HydroGeoLogic, Inc. and SRTC (Huyakorn and others, 1991). Other distinguishing features of FACT include efficient memory management and numerical algorithms that make large grids feasible, and user-friendly boundary conditions. For example, the combination recharge/drain boundary condition automatically determines whether a surface node should receive recharge or be discharging groundwater, based on the head solution. The software has been extensively verification and validation (V&V) tested, and successfully used to model other areas of the SRS. The reader is referred to the FACT User's Manual for a more thorough description of the code (Hamm and others, 1997). FACT was selected primarily because

1) the variably saturated formulation enables explicit modeling of the vadose zone, which may be important for subsequent modeling of contaminant transport or remedial actions using the present model or a derivative

2) the code meets the software Quality Assurance requirements of 1Q, 20-1 and E7, 2.32 (discontinued)

3) the authors have a strong working knowledge of the code

4) the source code is available.

3.2 Model Configuration and Mesh

As described in section 2.5, groundwater recharge over the greater CKLP GWMA is thought to potentially travel as deep as the Gordon aquifer before discharging to the Savannah River, Upper Three Runs, or tributary. Therefore contamination originating from C, K, L and P reactor facilities is expected to be confined to the Upper Three Runs and Gordon aquifer units between Upper Three Runs on the north, Steel Creek/Meyers Branch on the south, the

Savannah River on the west, and an eastern line running from McQueen Branch to Par Pond. As shown in Figures 3-1 and 3-2, these are the boundaries chosen for the CKLP model. The rivers and streams bordering the selected domain also provide natural no-flow boundary conditions according to the conceptual model, and further motivation for choosing model boundaries as shown in Figure 3-1.

The chosen areal grid is 70,000 ft on each side, with a resolution of 500 square feet(Figure 3-1). The mesh resolution is a compromise between the need to resolve topographic features that drive groundwater flow in the UTR aquifer, and computer memory, run-time, and storage limitations. There are 140 elements along the east-west and north-south model coordinate axes. The vertical resolution varies depending on hydrogeologic unit and stratigraphic variations (Figure 3-2). The top surface of the mesh conforms to the ground surface. The bottom surface of the mesh coincides with the bottom of the Gordon aquifer unit. Interior node layers conform to the other stratigraphic surfaces. The "upper" aquifer zone of the UTR aquifer unit is represented with 3 finite-elements in the vertical direction. The vadose zone is included in the model. The "lower" aquifer zone contains 2 finite-elements while the "tan clay" confining zone separating the aquifer zones is modeled with a single element. The Gordon confining and aquifer units each contain one element, for a total of 8 vertical elements from ground surface to the bottom of the Gordon aquifer. The three-dimensional mesh size is therefore 140×140×8=156,800 elements or 141×141×9=178,929 nodes. The finer vertical resolution in the "upper" UTR aquifer zone is designed to support subsequent contaminant transport analyses. Within K area, the 3 element layers in the "upper" UTR aquifer zone also conform to the transmissive zone, AA horizon, and A horizon/vadose zone, in a manner consistent with a recent model for the K Burning/Rubble Pit (KBRP) facility (HSI GeoTrans, 1998).

3.3 Boundary Conditions

The entire top surface of the mesh is assigned a combination recharge/drain boundary condition, except for the area covered by L Lake and Par Pond (Figure 3-3). This FACT code option automatically specifies a recharge boundary condition for nodes with a computed head below ground elevation, and a drain boundary condition for nodes with a computed head above ground surface, which is physically correct. The reader is referred to the FACT code manual for detailed information on how this boundary condition is numerically implemented in FACT (Hamm and others, 1997). Surface drain coefficients are set to 1.0 day^{-1} model wide. The selected drain coefficient is sufficiently large to ensure that computed head will be only slightly greater than ground elevation in discharge areas. Streams and rivers can be represented with the FACT recharge/drain boundary condition, instead of general head or river boundary condition, because they are gaining according to the conceptual model. For gaining surface bodies, the FACT recharge/drain, general head, river, and drain boundaries all function as drains and are equivalent. The maximum local recharge rate is generally specified as 12.5 in/yr based on model calibration (to be discussed), which is consistent with the estimated range of 10 to 16 in/yr for recharge developed in section 2.4. Over the General Separations Area, recharge is set to 15 in/yr to reflect site-specific estimates of 15 in/yr recharge, less than average forest cover, and to be consistent with Flach and Harris (1997). However, recharge is set to 1.5 in/yr for capped areas within the Burial Ground Complex (E area).

The entire bottom surface of the mesh is assigned a general head boundary condition to account for flow into or out of the model domain across the Crouch Branch confining unit (Meyers Branch confining system). A leakance coefficient of 3×10^{-6} d^{-1} is assumed based on Aadland and others (1995, plate 17). This value is supported by a scoping SRTC regional flow model for which model calibration indicates the leakance should be about 5×10^{-6} d^{-1} (Hiergesell, 1997). Head distribution in the Crouch Branch aquifer is also taken from Aadland and others (1995, plate 45). General head boundary conditions are also specified for L Lake and Par Pond. L Lake is assumed to have a constant pool of 190 ft and a drain coefficient of 1000 d^{-1}. The drain coefficient is large enough that the lake and underlying aquifer have the same head along their boundary. Par Pond is similarly modeled as having a constant pool of 200 ft and drain coefficient of 1000 d^{-1}. Process water outfalls are not modeled because these features are too small to effectively resolve with a 500-ft finite-element size.

Boundary nodes between the top and bottom surfaces of the mesh are assigned either a no-flow or prescribed head boundary condition. Consistent with the conceptual model, boundary nodes underlying major streams and rivers are assigned no-flow boundary conditions because no groundwater is assumed to cross beneath these features. No-flow boundary conditions are also specified in the vadose zone. Where no-flow boundary conditions are inappropriate in the saturated zone, head is prescribed consistent with the potentiometric maps presented in Figures 2-14 and 2-20. For the Gordon aquifer, the result is no flow conditions along the west (Savannah River) and north (Upper Three Runs) boundaries, and prescribed head along the east and south boundaries as shown in Figure 3-4. For the Upper Three Runs aquifer, head is prescribed from the headwaters of McQueen Branch south to Par Pond, and from the headwaters of Meyers Branch east to Par Pond (Figure 3-5). Elsewhere, no flow boundary conditions are specified for this unit.

3.4 Material Properties

Horizontal conductivity in the Gordon aquifer is set to 35 ft/day based on the extensive field data from both on and off the Savannah River Site reviewed in section 2.2.2.1 and by Aadland and others (1995). The vertical conductivity of the Gordon confining unit is set to 10^{-4} ft/day in accordance with the field data summarized in section 2.2.2.2 and by Aadland and others (1995). Conductivity values in the Upper Three Runs aquifer unit are set through model calibration to well water level data, according to the procedure described in the next section. The ratio of horizontal to vertical conductivity is assumed to be 100:1 model wide. The approximate soil characteristic curves shown in Figure 2-22 are adopted for the numerical model. An effective porosity value of 25% is assumed for the purpose of computing a pore velocity field that may be used later for particle tracing. The assumed porosity value is consistent with the general recommendation of Looney and others (1987, p. 39). However, the value does not affect the steady-state head and Darcy velocity solutions, or set precedence for subsequent transport simulations. For specific storage a nominal value of 10^{-4} ft^{-1} is input to the FACT code, and would only be important for transient flow simulations within a confined aquifer.

3.5 Calibration Process

Groundwater recharge and discharge estimates, monitoring well water level data, large-scale measurements of hydraulic conductivity, previous modeling efforts, and a general knowledge of groundwater flow directions and timing were used as targets for calibrating the CKLP flow model. The main parameters selected for calibration adjustment are recharge, horizontal conductivity in UTR aquifer zones and vertical conductivity in confining zones, because the model is sensitive to these parameters, and each has significant uncertainty. Other input parameters have less impact on the steady-state flow results and/or lower uncertainty, and were set to their initial best-estimate value throughout calibration. For example, horizontal conductivity in the Gordon aquifer is relatively well known from extensive field-scale tests conducted both on and off the Savannah River Site. Therefore, the horizontal conductivity of the Gordon aquifer can be set to 35 ft/day, and essentially held fixed during model calibration. The overall calibration procedure involves 4 sequential, steps:

1) Set model recharge to a value consistent with the prior estimate, and such that simulated discharge agrees with prior baseflow estimates.
2) Adjust Gordon confining unit vertical conductivity to achieve agreement with measured head in the Gordon aquifer, while still agreeing with prior estimates.
3) Simultaneously adjust horizontal conductivity in the "lower" and "upper" UTR aquifer zones (assumed equal) and "tan clay" vertical conductivity to achieve agreement with head data in these zones.
4) Add zonal variation to UTR aquifer unit conductivity values as needed to achieve better agreement with head targets.

In practice, the above procedure is iterated during calibration. The model is most sensitive to recharge, as this parameter drives groundwater flow according to the conceptual model (section 2.5). As discussed in section 2.4, average recharge is thought to lie within the range of 10 to 16 in/yr. Taking the best-estimate value as the mid-point of the range, 13 in/yr, the uncertainty would be plus or minus 25%. The uncertainty of stream base-flow targets ranges from ±15% to 25% (Appendix E). In step 1, equal weight is given to satisfying recharge and discharge targets because these data have similar reliability.

Next in importance is leakance through the Gordon confining unit, which is adjusted in step 2. Groundwater flow in the Gordon aquifer is controlled by recharge through the Gordon confining unit, flow across the east and south model boundaries, and horizontal conductivity. Because the head boundary conditions and horizontal conductivity are relatively well known for this unit, Gordon confining unit vertical conductivity is adjusted to achieve agreement with head targets.

With recharge and Gordon confining unit vertical conductivity fixed through steps 1 and 2, horizontal conductivity in UTR aquifer zones and "tan clay" vertical conductivity become the next calibration parameters. The model is sensitive to these parameters, which are highly uncertain relative to other factors (e.g. boundary conditions). Zonal variation is invoked as a last resort to achieving adequate agreement with head targets. Zonal variation in recharge is not considered because uncertainty is greater in the prior conductivity estimates.

The goal of the calibration process is to achieve as good of agreement with prior targets as possible, without resorting to unjustifiable zonal variation in conductivity or other parameters. A lower estimate for achievable calibration accuracy is the uncertainty level in the target data. That is, one should not expect to match calibration targets better than the "noise" level in the data. As discussed in section 2.3.3, head targets that are a result of time averaging have a "2-sigma" uncertainty less than or equal to 3 ft, with most being well below 3 ft (Appendix F). However, there are also a significant number of one-time head readings that have much larger uncertainty, typically ±5 ft, that inflate average uncertainty. The recharge and stream base flow targets have an uncertainty of roughly ±25% (section 2.4; Appendix E). Previous models covering portions of the SRS have generally achieved a root-mean-square head residual of 3 ft or so (e.g. Camp Dresser & McKee, 1989; GeoTrans, 1992; Flach and Harris, 1997). Given the large scale, coarse mesh resolution, and relative uniformity of the conductivity field desired in the present model, a calibration goal of 3 ft may be too low, especially for the more heterogeneous aquifer zones. A reasonable calibration goal for the largest head residual is sometimes defined as 5-10% of the total head variation in the modeled system. For the Gordon aquifer, the total variation is about 120 ft (Figure 2-20) suggesting a calibration goal of 6 to 12 ft for the maximum residual. For the Upper Three Runs aquifer, the total variation is about 330 ft (Figure 2-14) for a calibration goal of 16 to 33 ft.

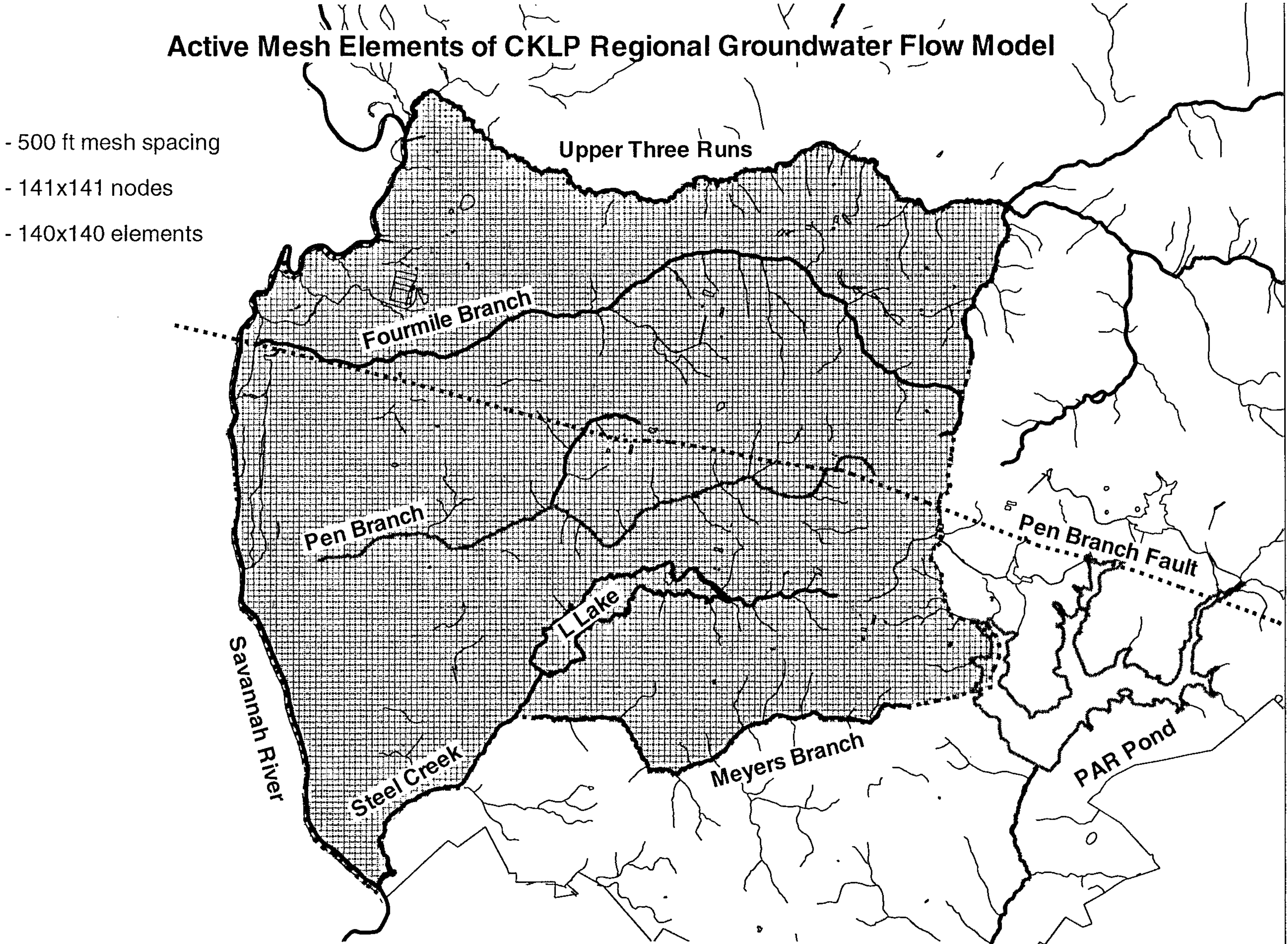


Figure 3-1. Plan View of Model Domain and Finite-Element Mesh

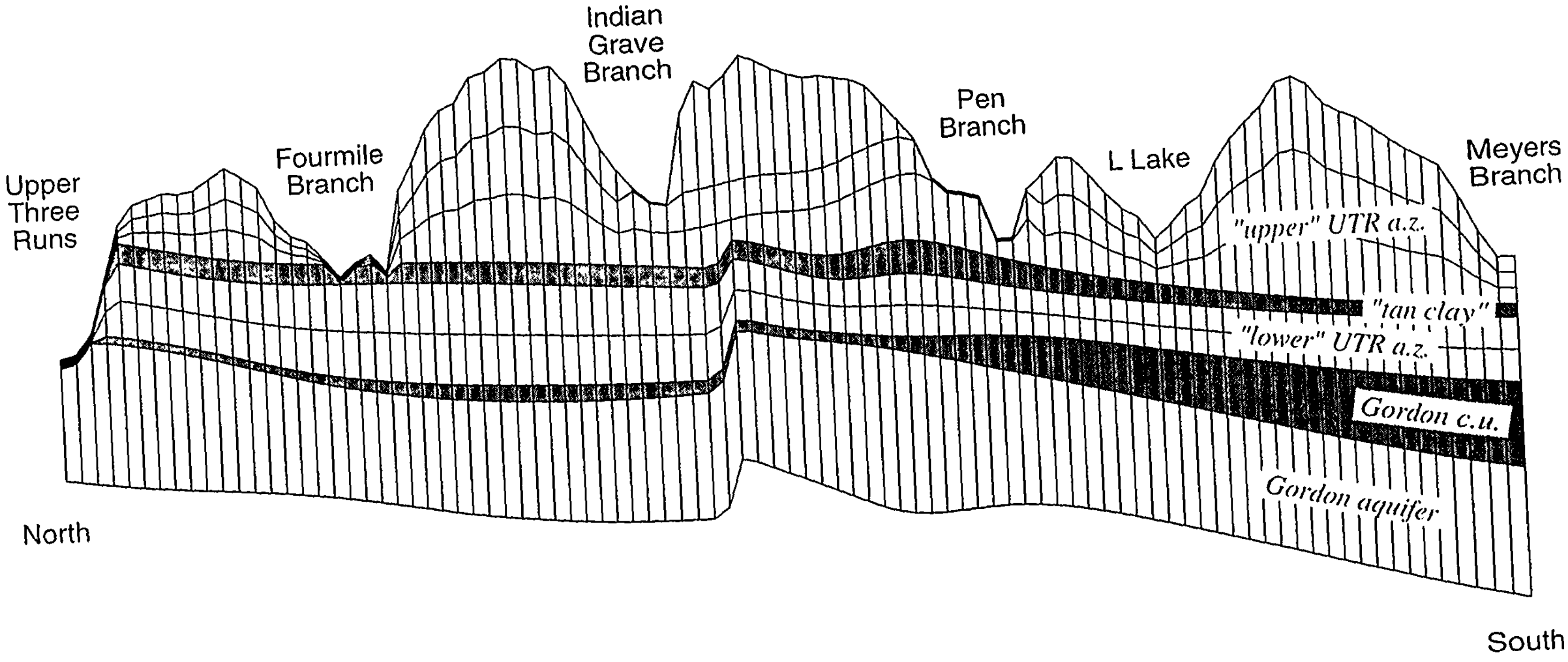


Figure 3-2. Typical Cross-Sectional Slice Through Finite-Element Mesh

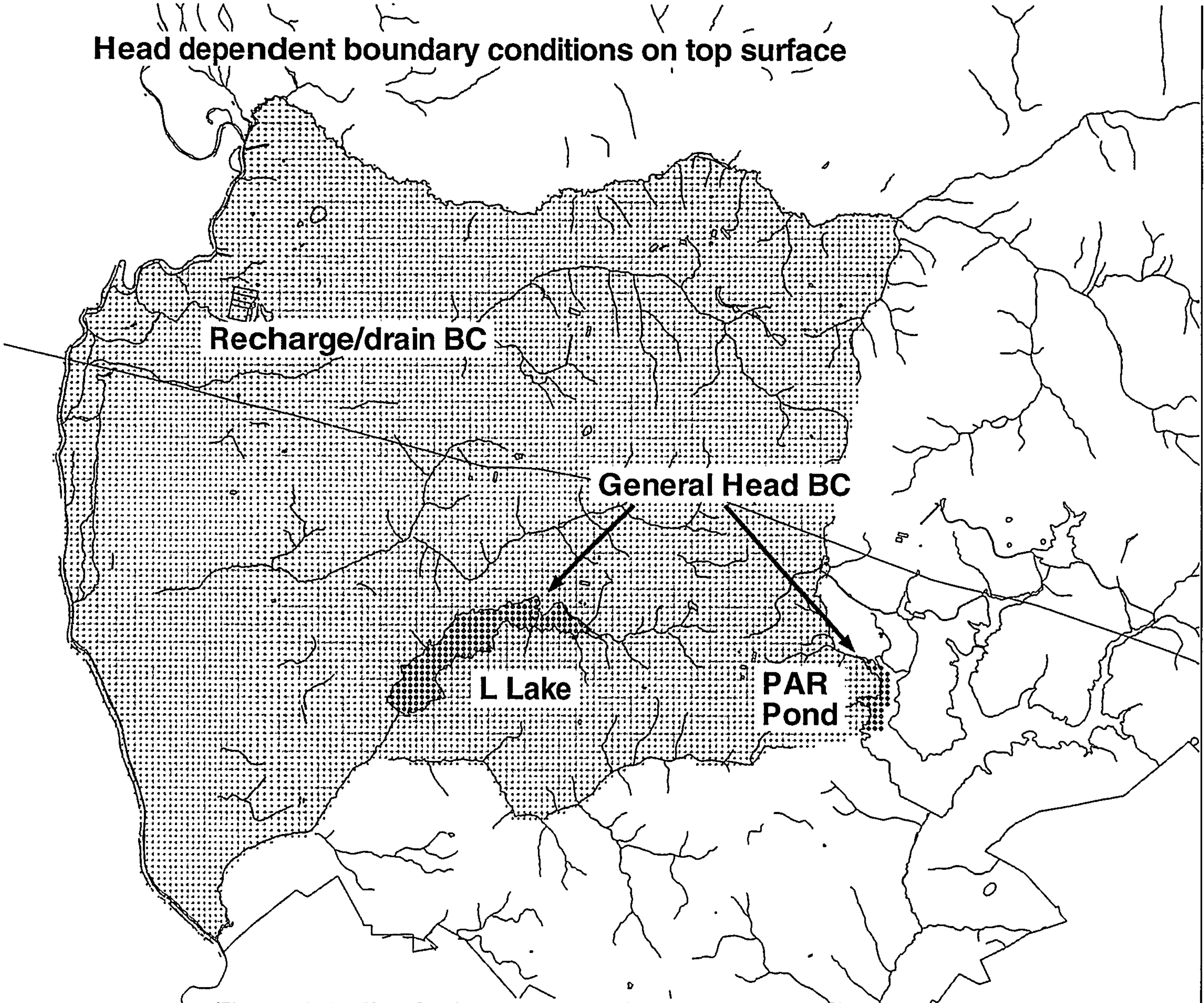


Figure 3-3. Top Surface Boundary Conditions

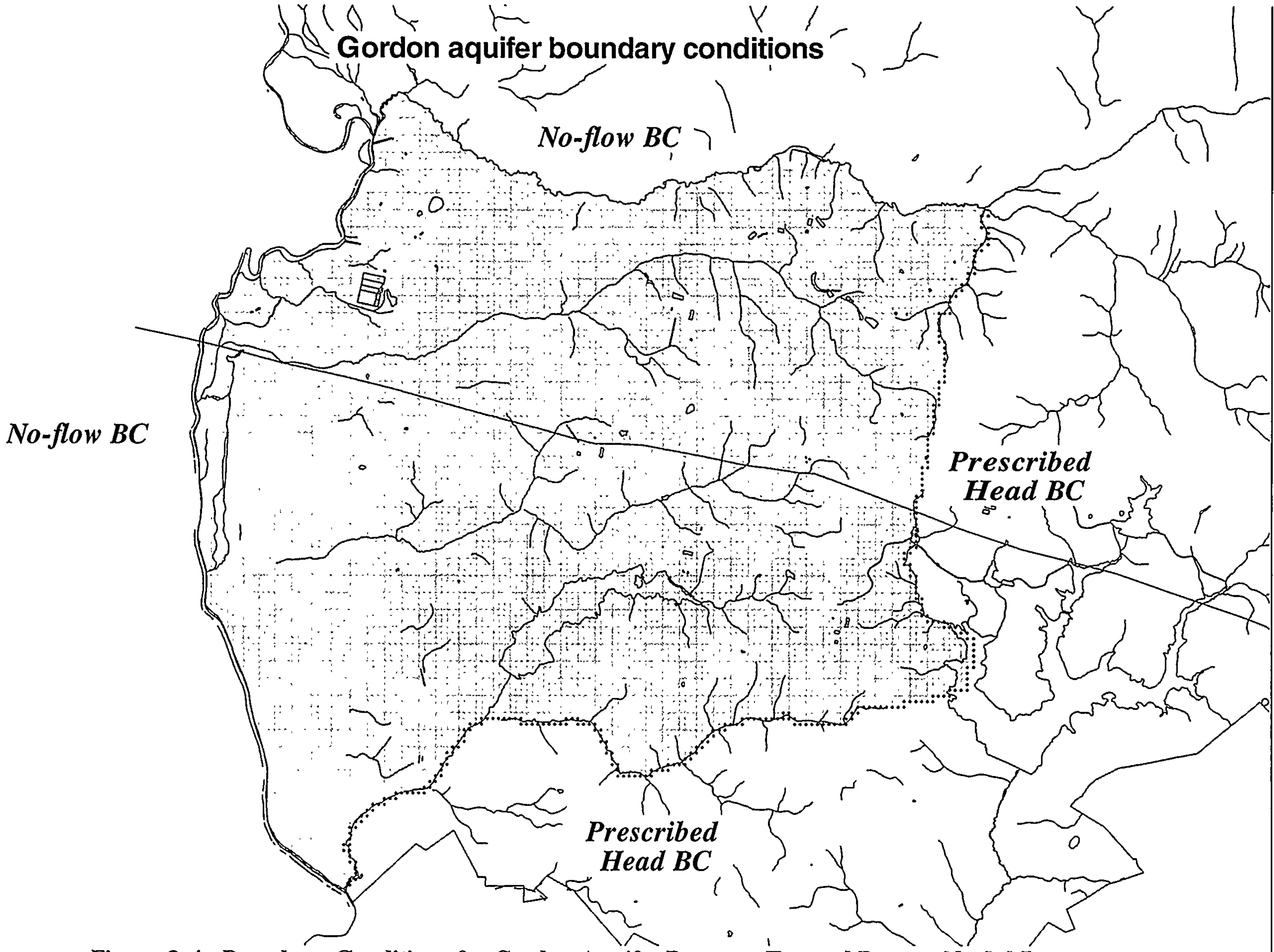


Figure 3-4. Boundary Conditions for Gordon Aquifer Between Top and Bottom Nodal Layers

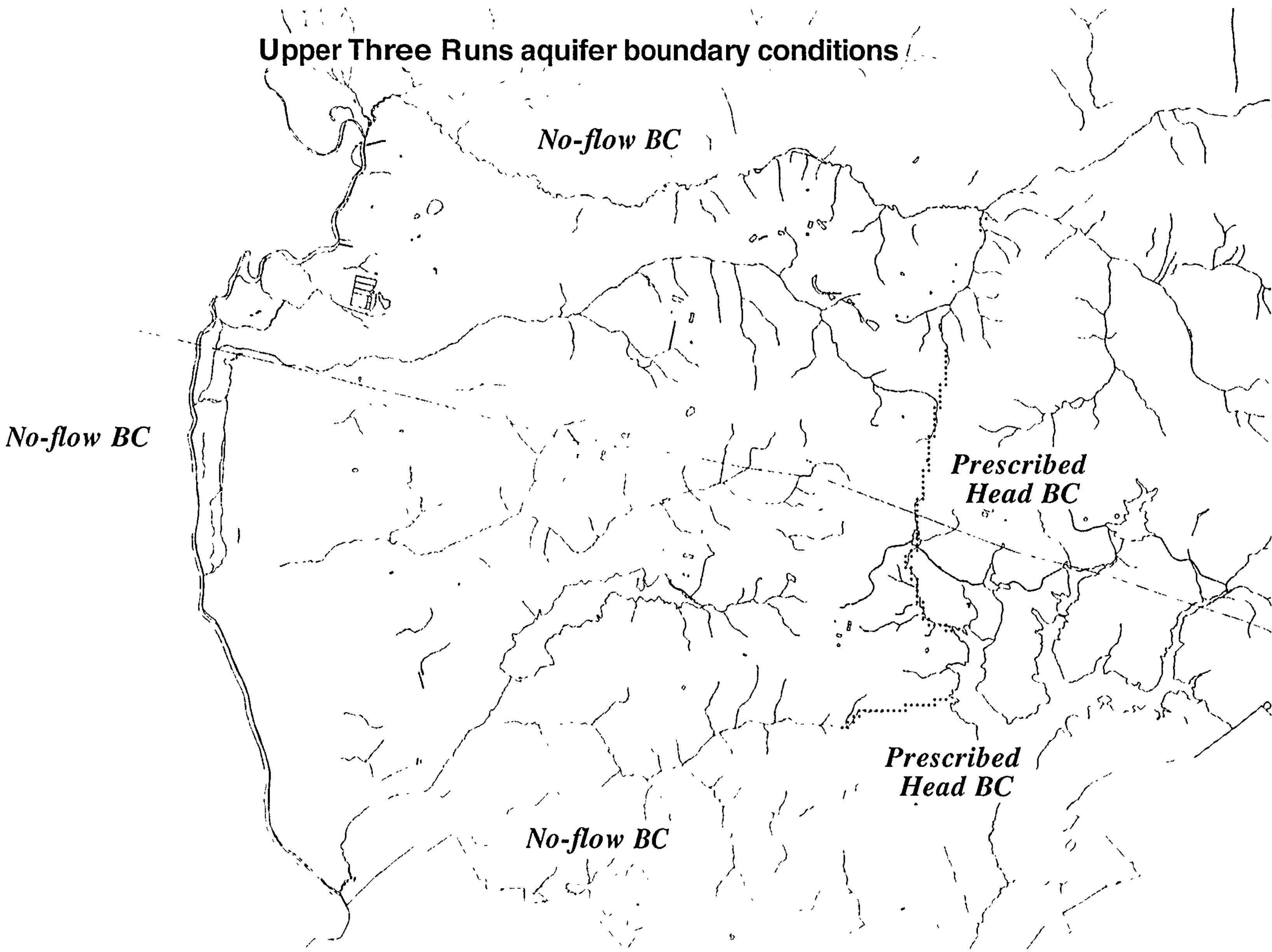


Figure 3-5. Boundary Conditions for Upper Three Runs Aquifer Between Top and Bottom Nodal Layers

4.0 GROUNDWATER FLOW MODEL RESULTS

4.1 Calibration results

Table 4-1 summarizes the calibration results for groundwater flow targets. The maximum rate of local recharge is set to 12.5 in/yr in the FACT recharge/drain boundary condition, except for the General Separations Area (Section 3.3). The modeled rate is 17% lower than the prior estimate of 15 in/yr, but very close to the midpoint of the uncertainty range (13 in/yr). Based on total area, which includes the Savannah River flood plain and other wetland areas, the average recharge rate is 9.7 in/yr. Excellent agreement is observed for Meyers Branch, Pen Branch and Fourmile Branch base flow. Simulated base flow to Upper Three Runs between Road C and Road A is 53% higher than the prior estimate. A possible explanation is that Upper Three Runs receives significantly more base flow from the south side (model side), due to significantly steeper terrain and aquifer head gradients compared to the north side. The prior estimate is based on the assumption that base flow should be partitioned equally to each side. Another possibility is that the prior estimate has much larger uncertainty than estimated, because it results from taking the difference of two nearly equal flow rates (Appendix E). Or, the model may simply have an undetected bias. A large discrepancy is noted for the combined baseflow from Steel Creek and L Lake. The data suggests a large net loss of 2.2 ft^3/s for this reach. While the model predicts L Lake to be losing at a rate of 0.3 ft^3/s, Steel Creek gains at a rate of 4.1 ft^3/s for a net gain of 3.8 ft^3/s. The reason for the discrepancy is unclear. Like Upper Three Runs, the Steel Creek base flow estimate is the result of averaging small differences between large flows, and could have more uncertainty than initially thought. The small portion of Par Pond within the model domain is simulated to be gaining, as would be expected for an area away from the dam. Overall, calibration goals for groundwater flow are met. The most notable exception is base flow to Steel Creek/L Lake.

Table 4-2 summarizes the calibration results for hydraulic head targets. Figure 4-1 graphically compares simulated head with measured head for each aquifer zone. Figures 4-2 through 4-4 illustrate the spatial distribution of head residuals. Appendix F contains a detailed listing of head residual information. Agreement is excellent in the Gordon aquifer, except for 4 double-digit outliers. At TNX Area, the simulated heads for TBG-5B and P-26A are 15 to 18 ft low, while the residual at nearby XSB-1A is only -2.5 ft. The scale of the model appears to be too large to reproduce the sudden change in head in this area. In K Area, simulated head at P-25B is 15 ft low. A possible explanation is that the Gordon aquifer is experiencing high recharge through the Pen Branch Fault. Northeast of P-25B, the residual for PW-83N is +11 ft. Here the large discrepancy may be due to the target value being a single reading that is not reflective of the long-term average water level. The average Gordon aquifer residual is biased low by 1.3 ft, mainly due to the very low residuals at TBG-5B and P-26A. In the "lower" UTR aquifer zone, the largest residuals (~30 ft) are located in the General Separations Area along the steep slopes adjacent to Upper Three Runs. The coarse resolution of the mesh may be hindering the ability of the model to reproduce gradients in this area. Flach and Harris (1997) also experienced difficulty in matching heads in this area. Significantly low values are also observed south and west of F Area near Fourmile Branch, and within H Area proper. Significantly high values are seen at the CMP Pits and in C Area. Maximum absolute value residuals in the "upper" aquifer zone of the UTRA are much smaller in magnitude compared to the "lower" zone. Predicted heads are systematically low west of F Area, and high in C Area. The average residuals in the "lower" and "upper" UTR aquifer zones show almost no bias (Table 4-2). The root-mean-square head residuals meet the overall calibration goals set in Section 3.5.

Table 4-3 summarizes the calibration results for hydraulic conductivity. Figures 4-5 through 4-12 show variation in conductivity for each model layer in plan view. Horizontal conductivity is shown for transmissive zones, and vertical conductivity for confining zones. Figure 4-13 illustrates a typical north-south vertical slice, in this case passing through K Area. The calibrated values are consistent with field data (Section 2.2) and previous groundwater flow models (e.g. HSI GeoTrans, 1998, Figure 4-6; HydroGeoLogic, 1998 (draft), Table 6.5; Flach, 1998, Table 4; Flach and Harris, 1997; GeoTrans, 1993, Table 4.1; GeoTrans, 1992, Table 3.6; Camp Dresser & McKee, 1989, Table 3-3).

4.2 Nominal Simulation

Figures 4-14 through 4-16 illustrate simulated hydraulic head averaged over the entire thickness of the Gordon aquifer and "lower" and "upper" UTR aquifer zones. Simulated head in the aquifer zone containing the water table is shown in Figure 4-17, and Figure 4-18 illustrates simulated water table elevation. For comparison to Figure 4-15, see Figure 2-20 which shows the Gordon potentiometric surface as based on measured water levels. The estimated water table based directly on head data is shown in Figure 2-14, and can be compared to Figures 4-15 through 4-18. Figures 4-19 through 4-21 illustrate flow directions that are vertically averaged over the entire thickness of the aquifer zones. Figure 4-22 shows simulated seepage faces, and Figure 4-23 illustrates rates of recharge and discharge. Figures 4-22 and 4-23 can be compared to Figure 2-21, which is based on field observations.

Example particle tracing results are shown in Figure 4-24. A water balance for the model is depicted in Figure 4-25.

4.3 Uncertainty Analysis

Uncertainty in the nominal model can be estimated by varying the input parameters within their uncertainty range, and in a correlated manner such that agreement with calibration targets is preserved as much as possible. The nominal model is sensitive to recharge, which drives overall groundwater flow in this system, and Gordon confining unit (GCU) vertical conductivity (K_V), which controls recharge to the Gordon aquifer (equal to leakance from the Upper Three Runs aquifer). Both of these input parameters have significant uncertainty. Table 4-4 summarizes four variations of these two parameters within their estimated range of uncertainty. For each uncertainty case, the model is recalibrated to maintain agreement with the prior targets by adjusting conductivity values in the Upper Three Runs aquifer, and Gordon aquifer if necessary. Table 4-5 summarizes the calibration results for each sensitivity case.

Uncertainty cases 1 and 2 involve recharge perturbations of ±20%, except over the General Separations Area which is left unaltered at 15 in/yr. As seen in Table 4-5, the results for cases 1 and 2 show equivalent agreement to hydraulic head targets compared to the nominal or base case. For higher recharge (case 1), predicted base flows are biased high for Pen Branch and Fourmile Branch, the most reliable targets. For lower recharge (case 2), simulated base flows are low for these streams. Horizontal conductivities in the "upper" and "lower" UTRA aquifer zones were adjusted by ±20% to compensate for the ±20% variations in recharge for cases 1 and 2, respectively. The resulting Kh values for the uncertainty cases remain well within the data range. No changes were made to the Gordon aquifer unit horizontal conductivity, or vertical conductivity in confining units/zones.

Uncertainty cases 3 and 4 involve Gordon vertical conductivity increases and decreases by a factor of 5. For these cases, adjustment to Gordon aquifer unit horizontal conductivity in addition to UTRA Kh was required to maintain agreement with head targets to the extent possible. Despite model recalibration, uncertainty cases 3 and 4 show significantly poorer agreement to calibration targets compared to the nominal case. For higher Gordon confining unit leakance, head residuals are large, and Pen Branch and Fourmile Branch base flows are significantly biased low. Horizontal conductivities for both the Gordon and UTR aquifers are barely credible. For lower Gordon confining unit leakance, head residuals are similar to the base case, and uncertainty cases 1 and 2. Simulated base flows for Pen Branch and Fourmile

Branch base flows are biased high. Reasonable horizontal conductivities are obtained for the UTR aquifer. However, the Gordon aquifer horizontal conductivity is significantly low compared to field data.

More detailed information about each uncertainty analysis case is presented in Appendix G. In the appendix, model results in various forms are reproduced for each uncertainty case for comparison to the nominal results (Figures 4-1 through 4-12, 4-14 through 4-18, and 4-22 through 4-24). Of particular interest are the particle tracing results presented in Figures G-1-20, G-2-20, G-3-20 and G-4-20. For variations in recharge (Figures G-1-20 and G-2-20), the simulated groundwater paths are similar to the nominal results (Figure 4-24). The largest deviation occurs for the pathline leaving the northeast corner of the P-area. Although time markers are not shown in these figures, groundwater travel times also vary roughly proportional to the recharge variation. The variations in Gordon confining unit leakance considered in uncertainty cases 3 and 4 produce significant changes to simulated groundwater flow paths (Figures G-3-20 and G-4-20). For increased leakance, groundwater from reactor areas migrates deeper, typically to the Gordon aquifer, and discharges to surface far from the facilities (Figure G-3-20). For decreased leakance, groundwater remains more shallow, typically above the Gordon aquifer, and discharges to nearby stream reaches.

The uncertainty results presented so far are generic. For specific applications of the model, additional uncertainty analysis should be performed, tailored to the sub-region and output parameter(s) of interest. For example, uncertainty cases 5 and 6 shown parenthetically in Table 4-4 would be useful for investigating uncertainty in plume migration, because they effectively provide upper and lower bounds on horizontal flow rates. Similarly, effective porosity should be considered for groundwater travel time and transport uncertainty analysis, because pore velocity is inversely proportional to this parameter. Specifically, transport sensitivity runs should include total porosity for an upper estimate (~40%), and a conservative (low) estimate for effective porosity (~25%).

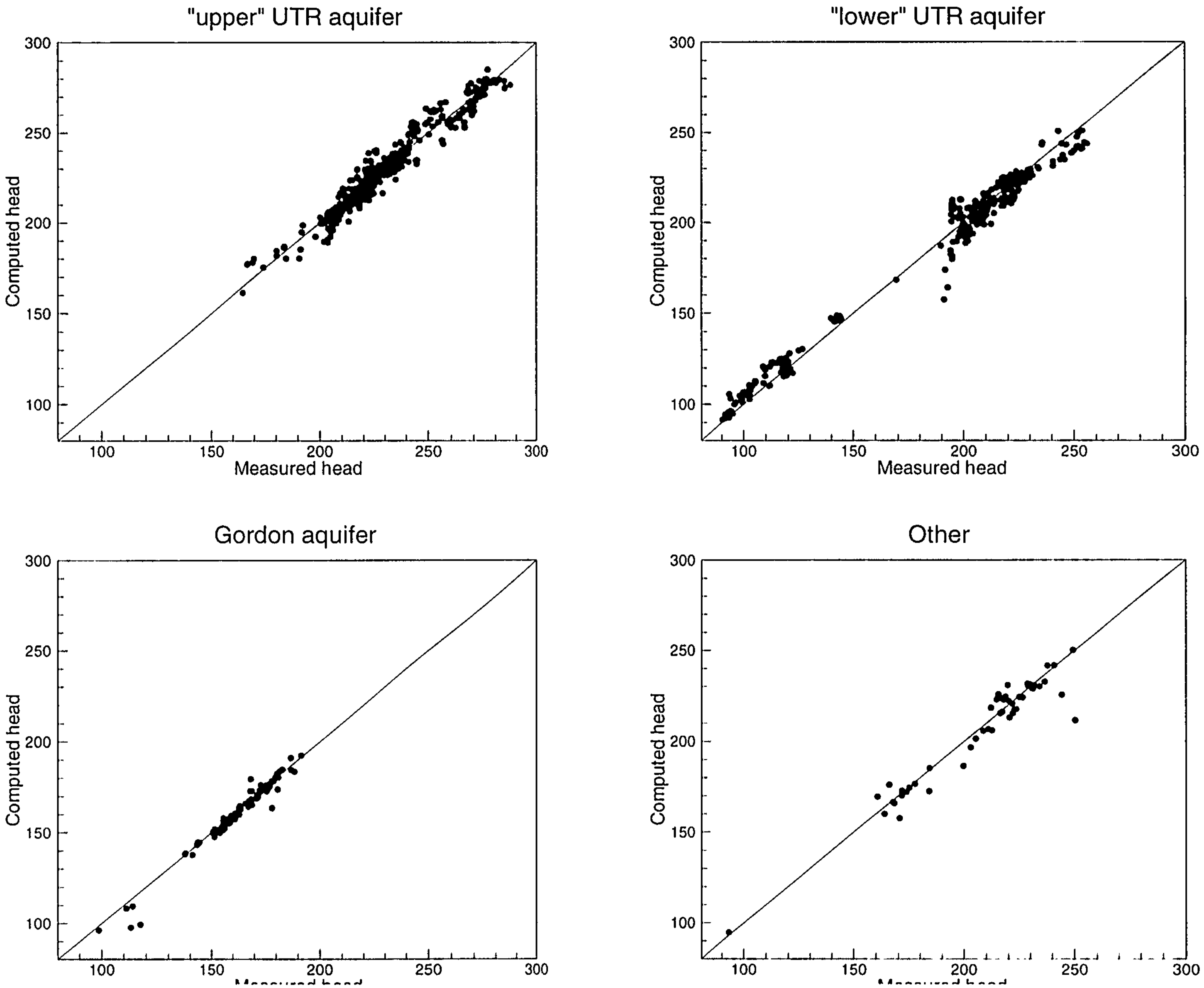


Figure 4-1. Simulated Versus Measured Head for Each Aquifer Zone

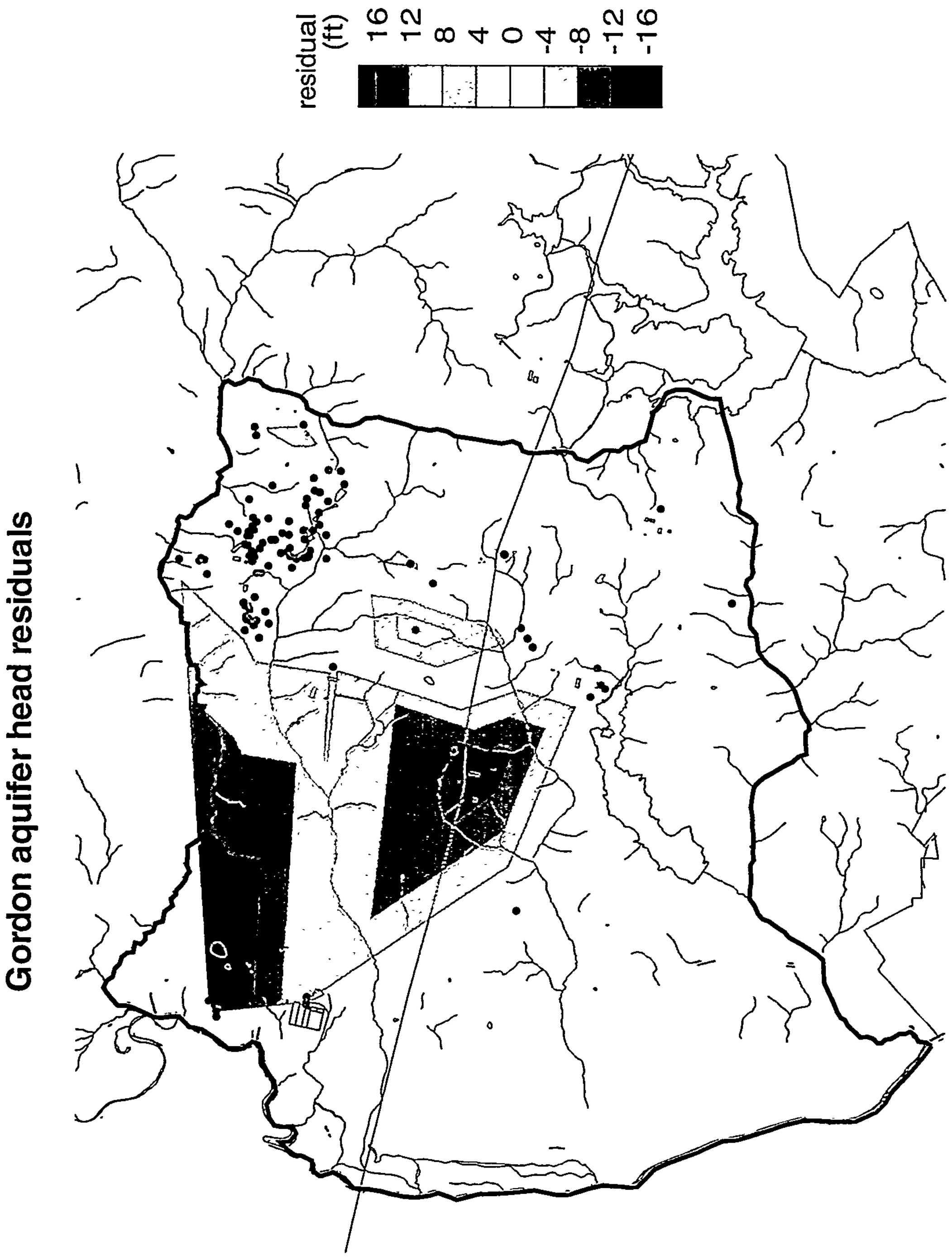


Figure 4-2. Head Residuals in the Gordon Aquifer

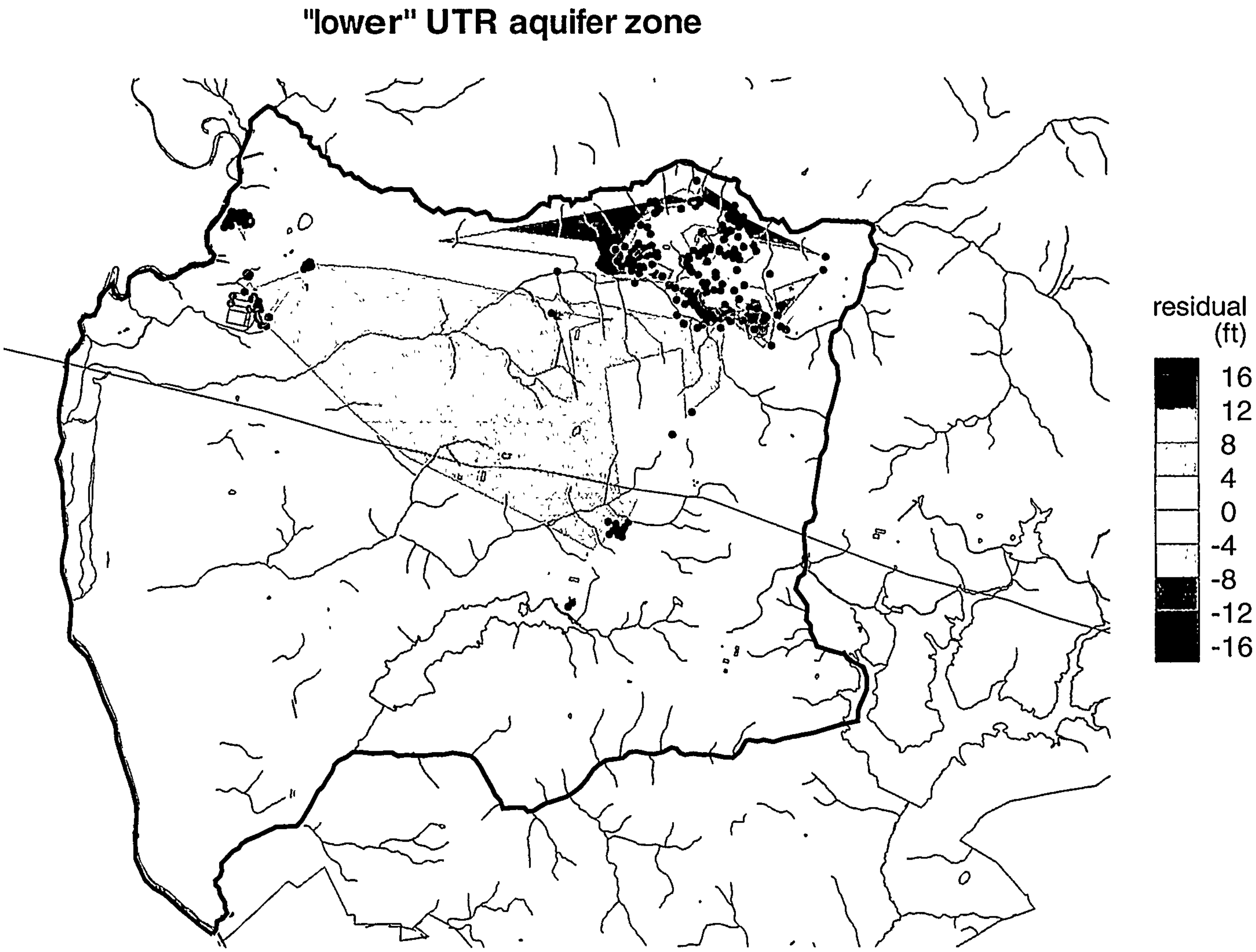


Figure 4-3. Head Residuals in the "Lower" UTR Aquifer Zone

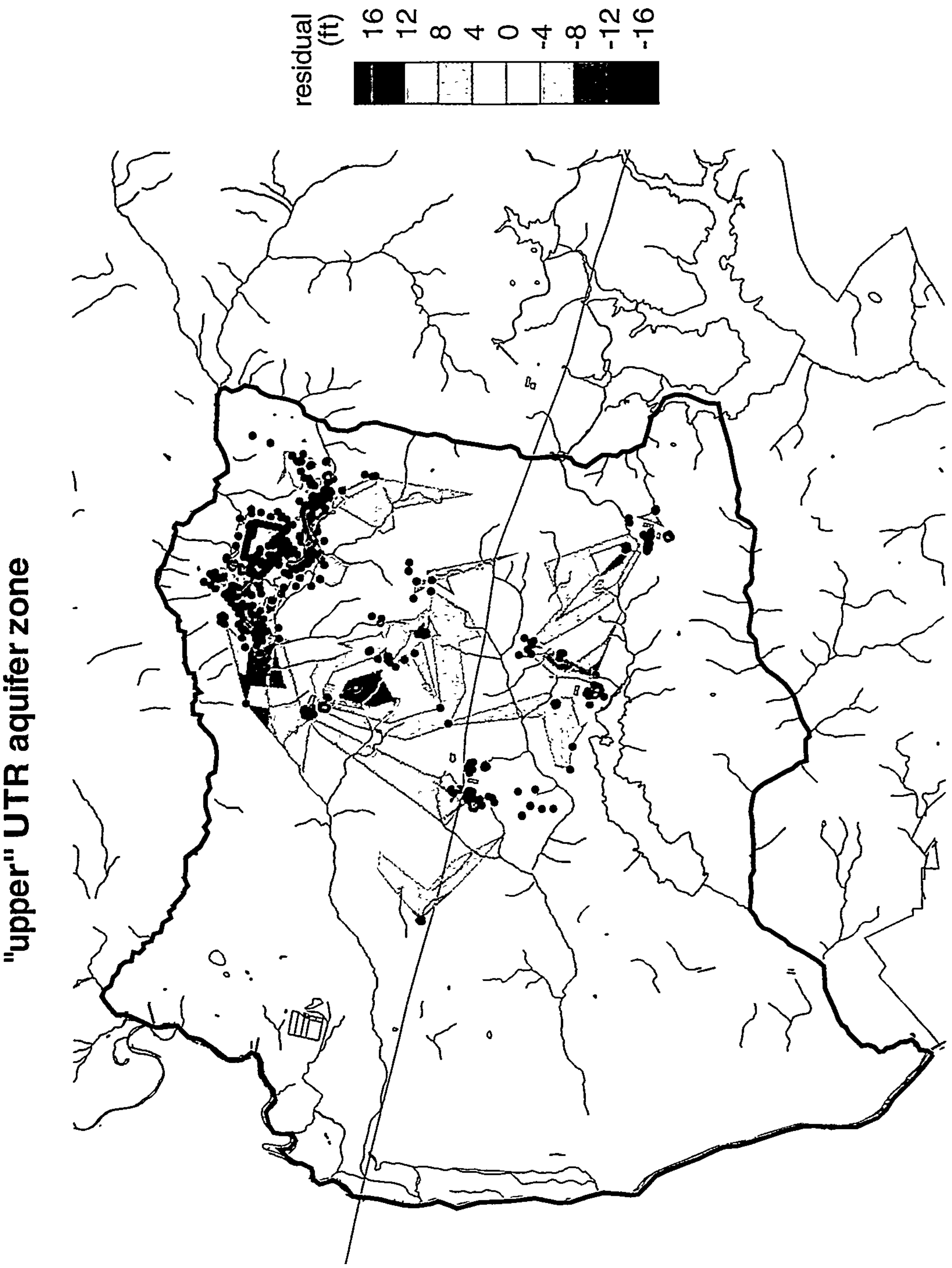


Figure 4-4. Head Residuals in the "Upper" UTR Aquifer Zone

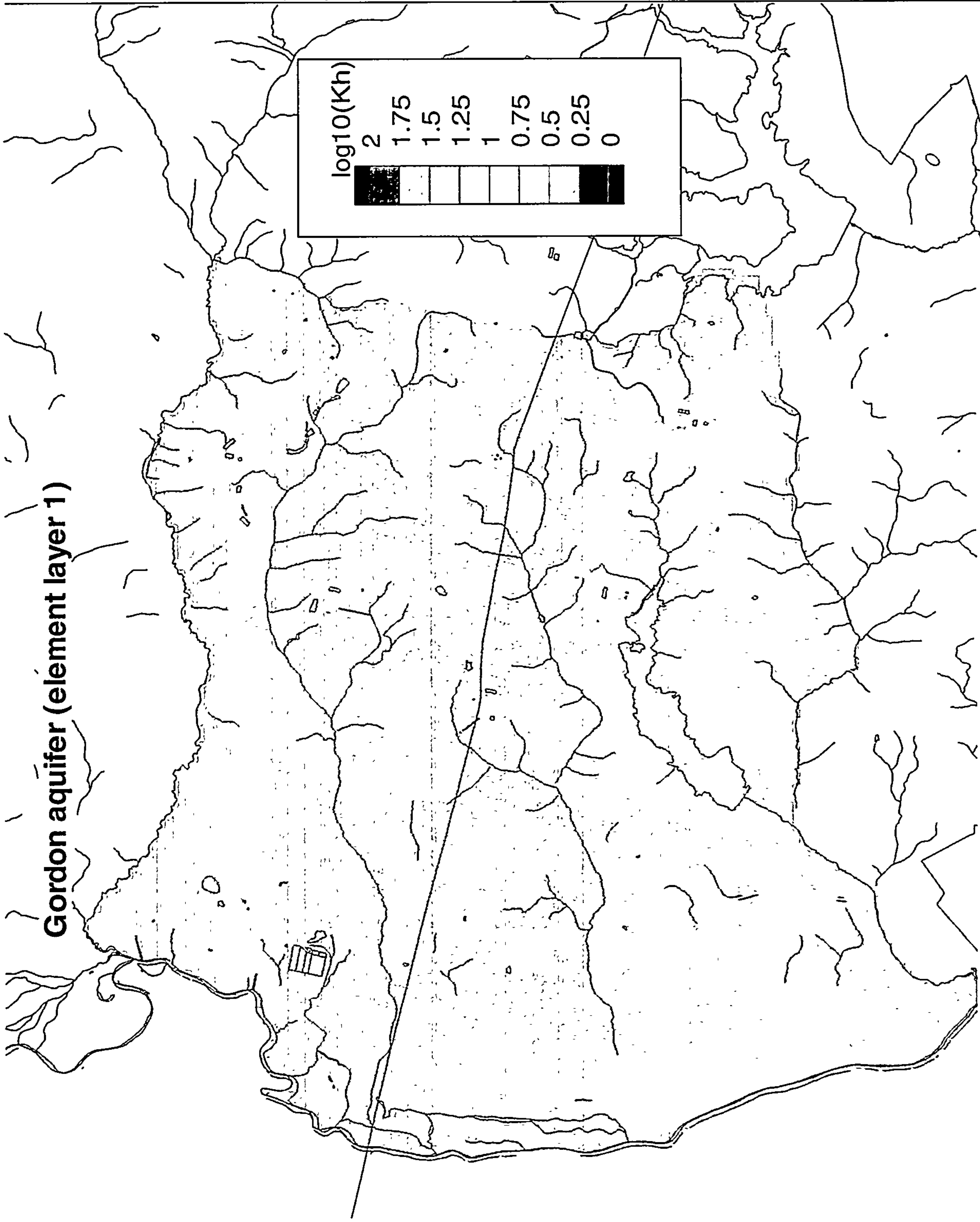


Figure 4-5. Horizontal Conductivity in the Gordon Aquifer (Element Layer 1)

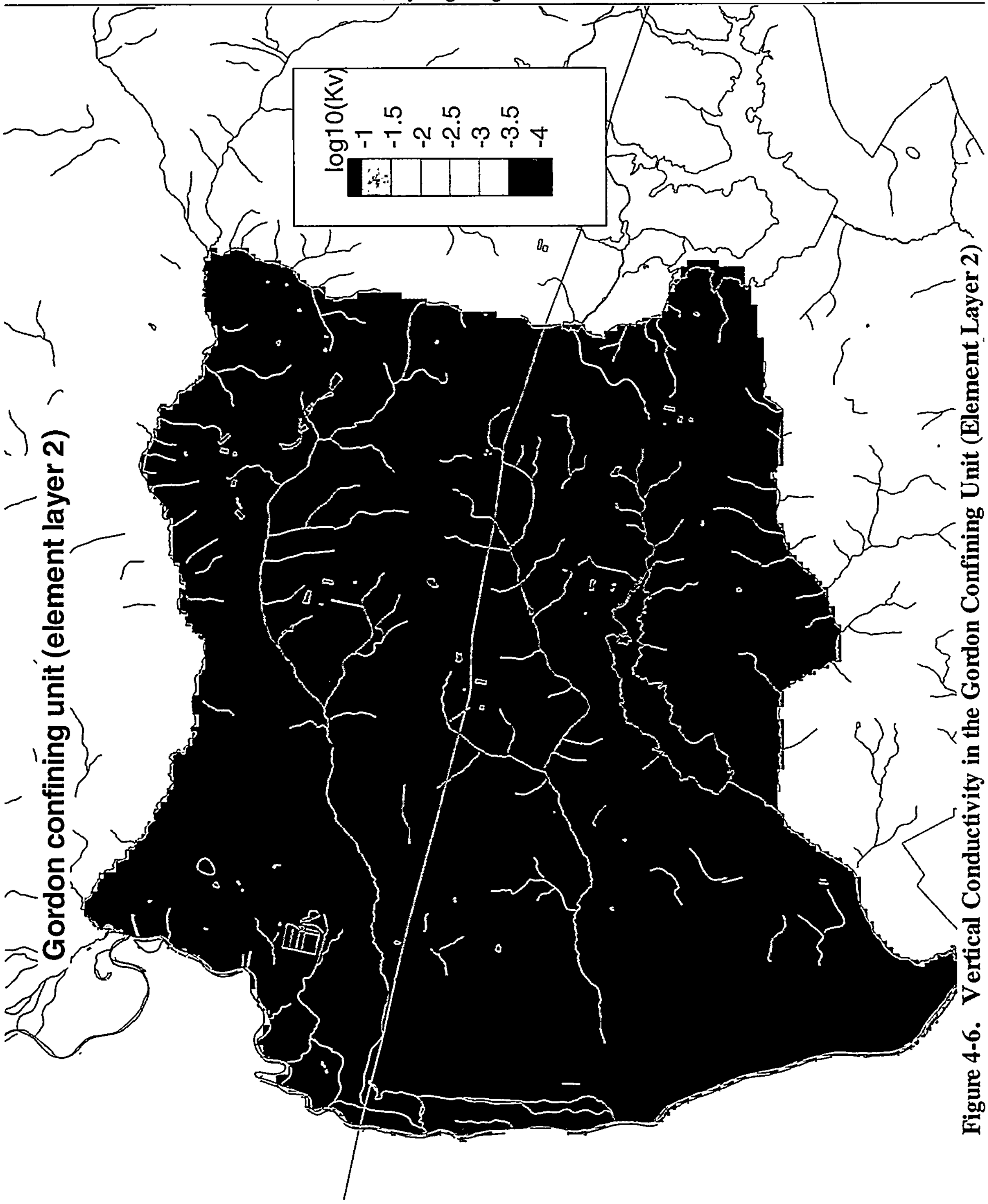


Figure 4-6. Vertical Conductivity in the Gordon Confining Unit (Element Layer 2)

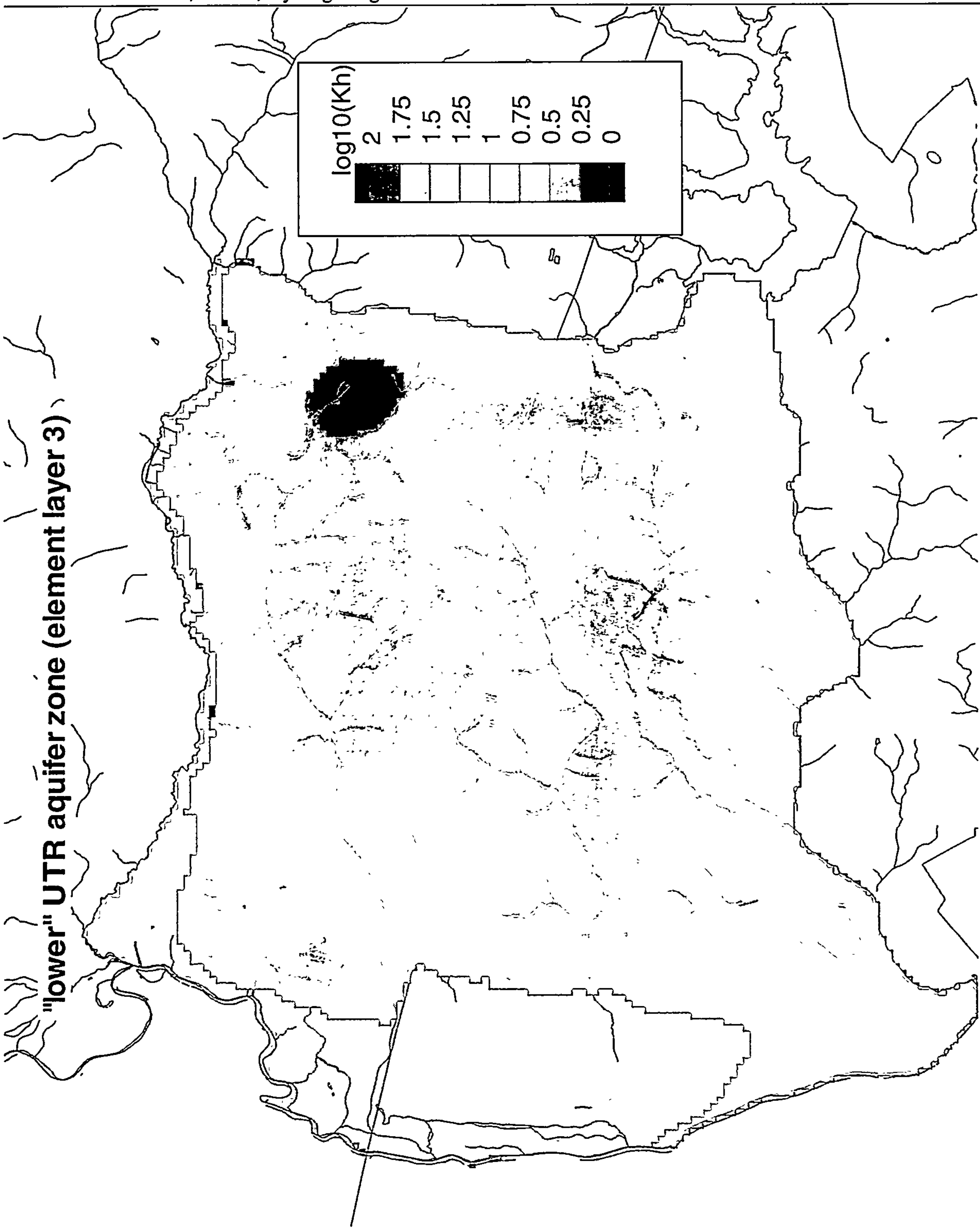


Figure 4-7. Horizontal Conductivity in the Lower Half of the "Lower" UTR Aquifer Zone (Element Layer 3)

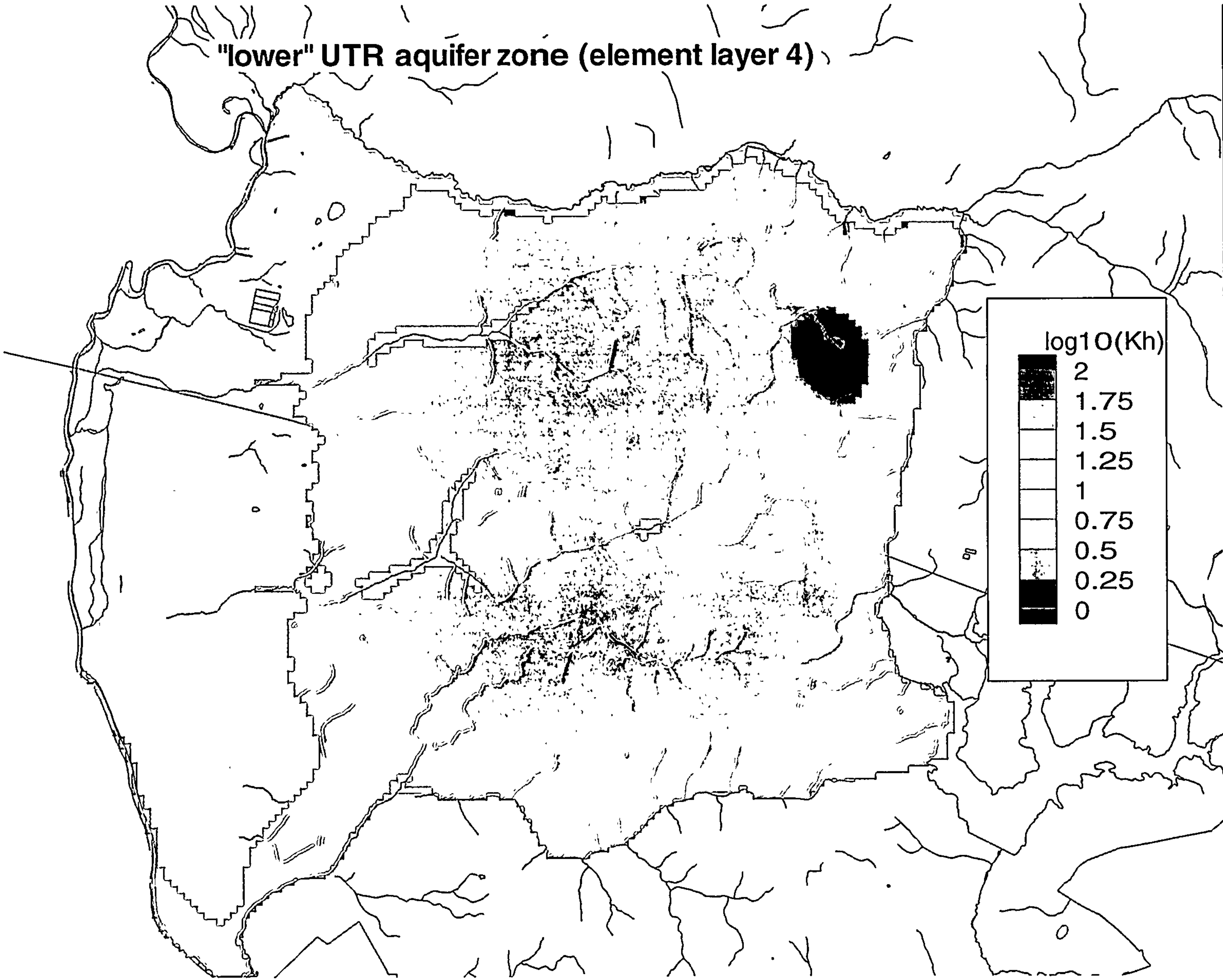


Figure 4-8. Horizontal Conductivity in the Upper Half of the "Lower" UTR Aquifer Zone (Element Layer 4)

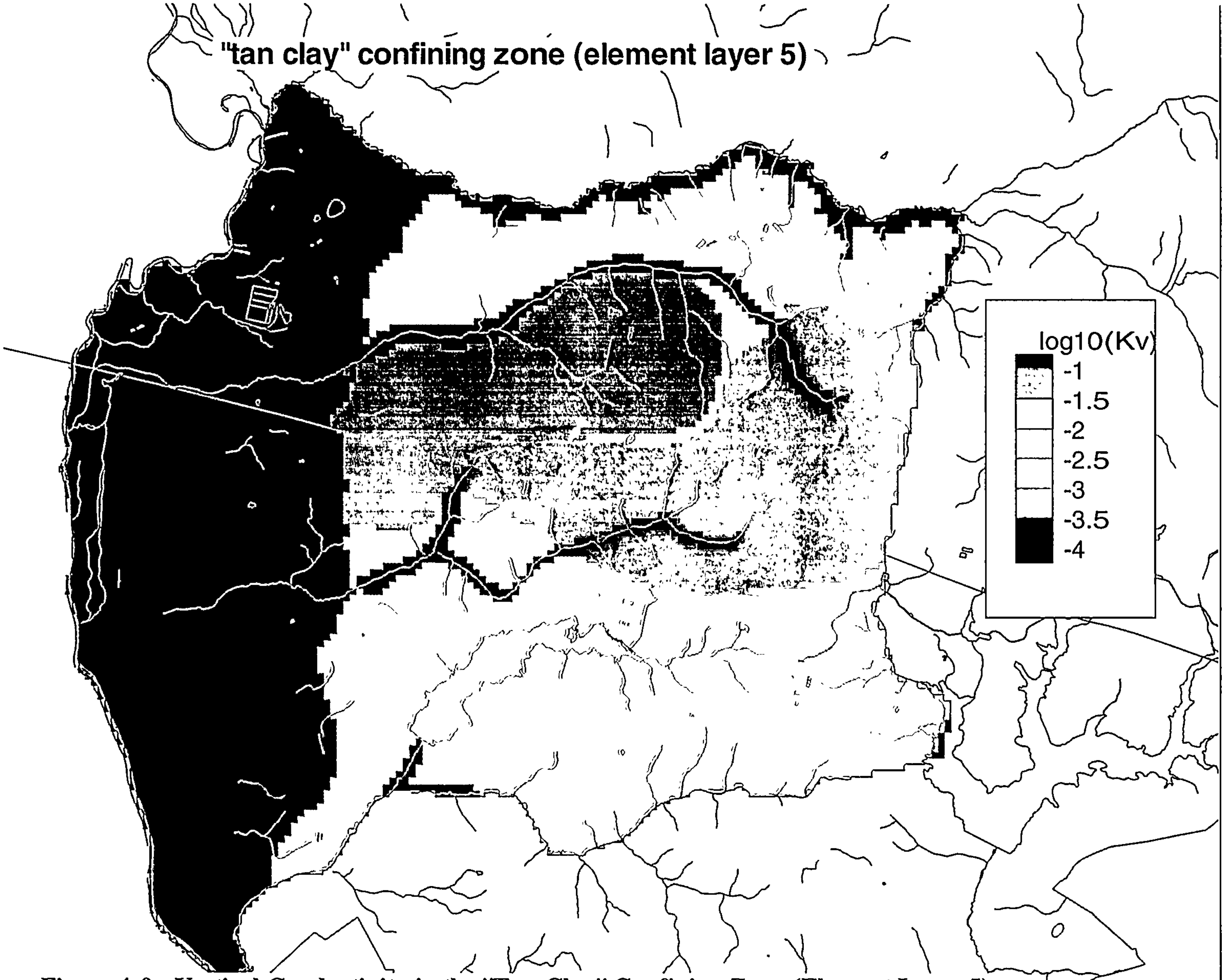


Figure 4-9. Vertical Conductivity in the "Tan Clay" Confining Zone (Element Layer 5)

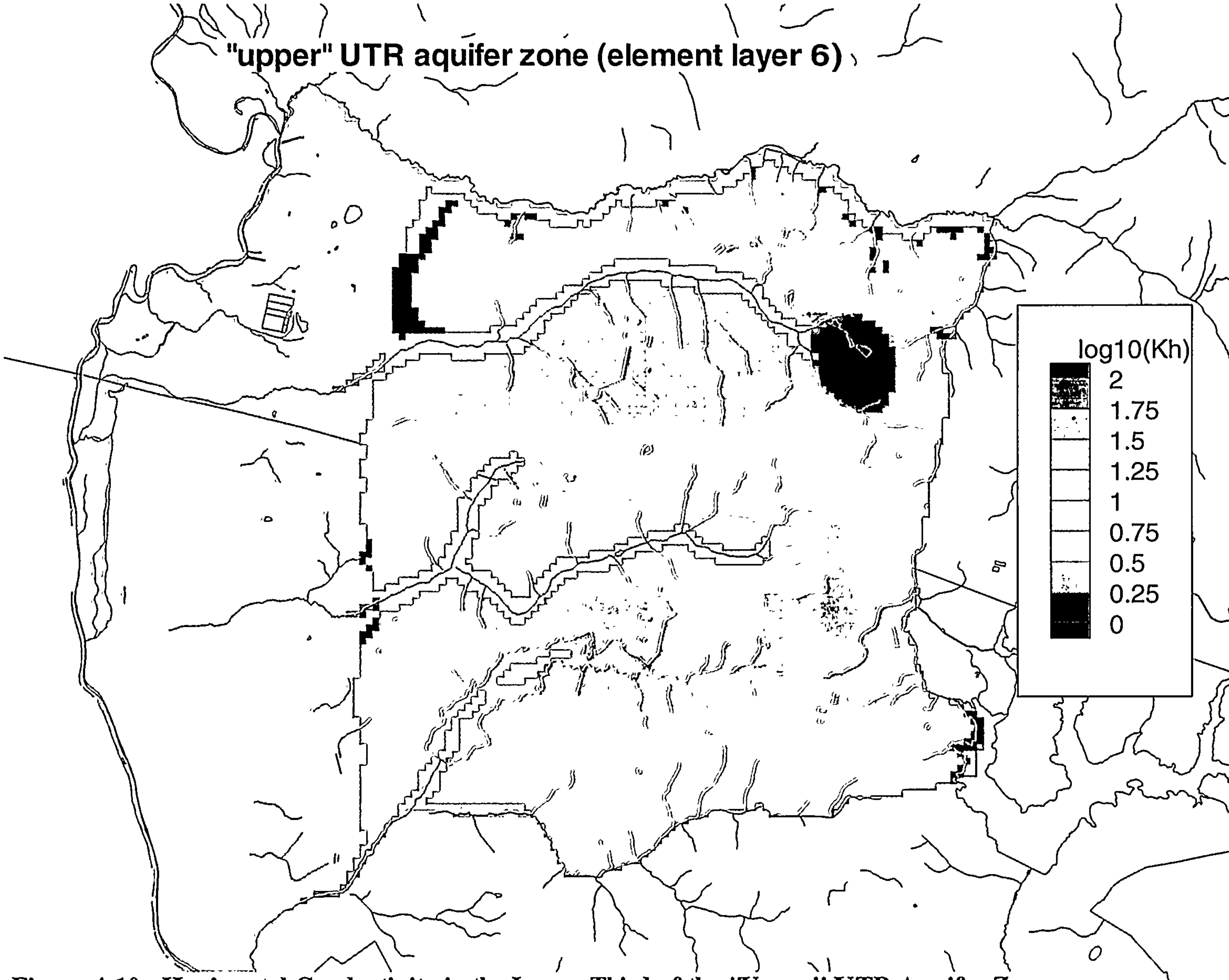


Figure 4-10. Horizontal Conductivity in the Lower Third of the "Upper" UTR Aquifer Zone (Element Layer 6; Transmissive Zone in K-Area)

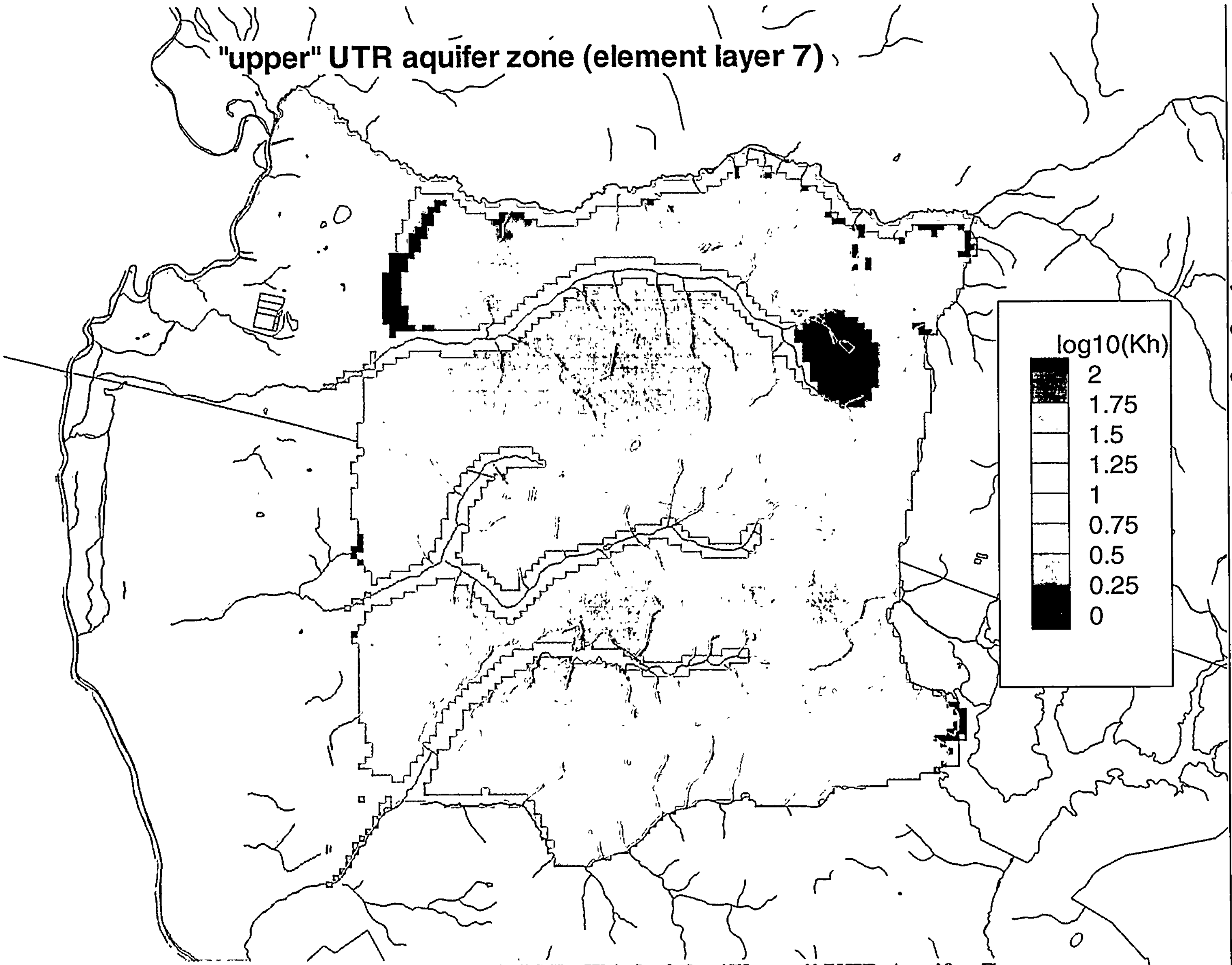


Figure 4-11. Horizontal Conductivity in the Middle Third of the "Upper" UTR Aquifer Zone (Element Layer 7; AA Horizon in K-Area)

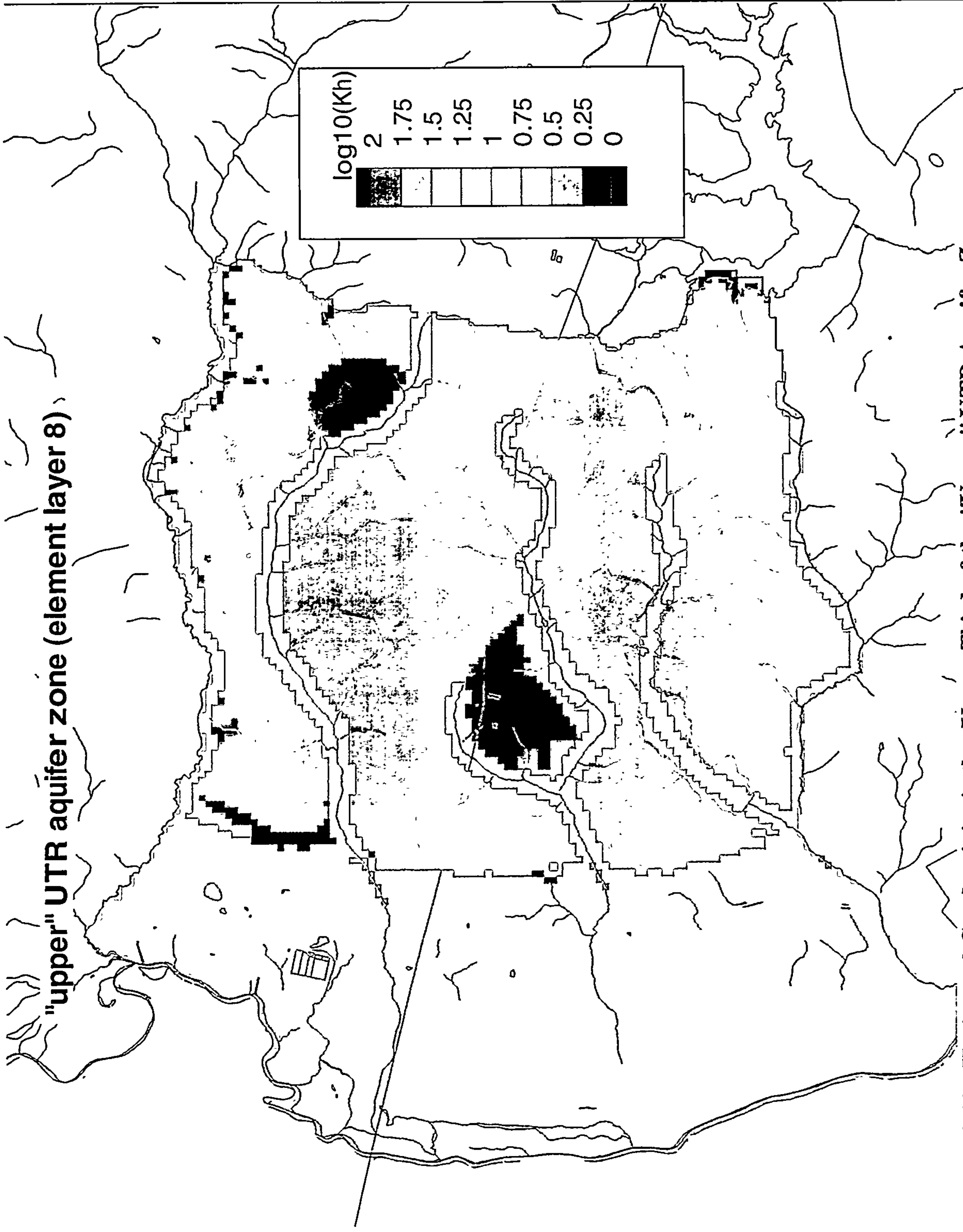


Figure 4-12. Horizontal Conductivity in the Upper Third of the "Upper" UTR Aquifer Zone (Element Layer 8; A Horizon in K-Area)

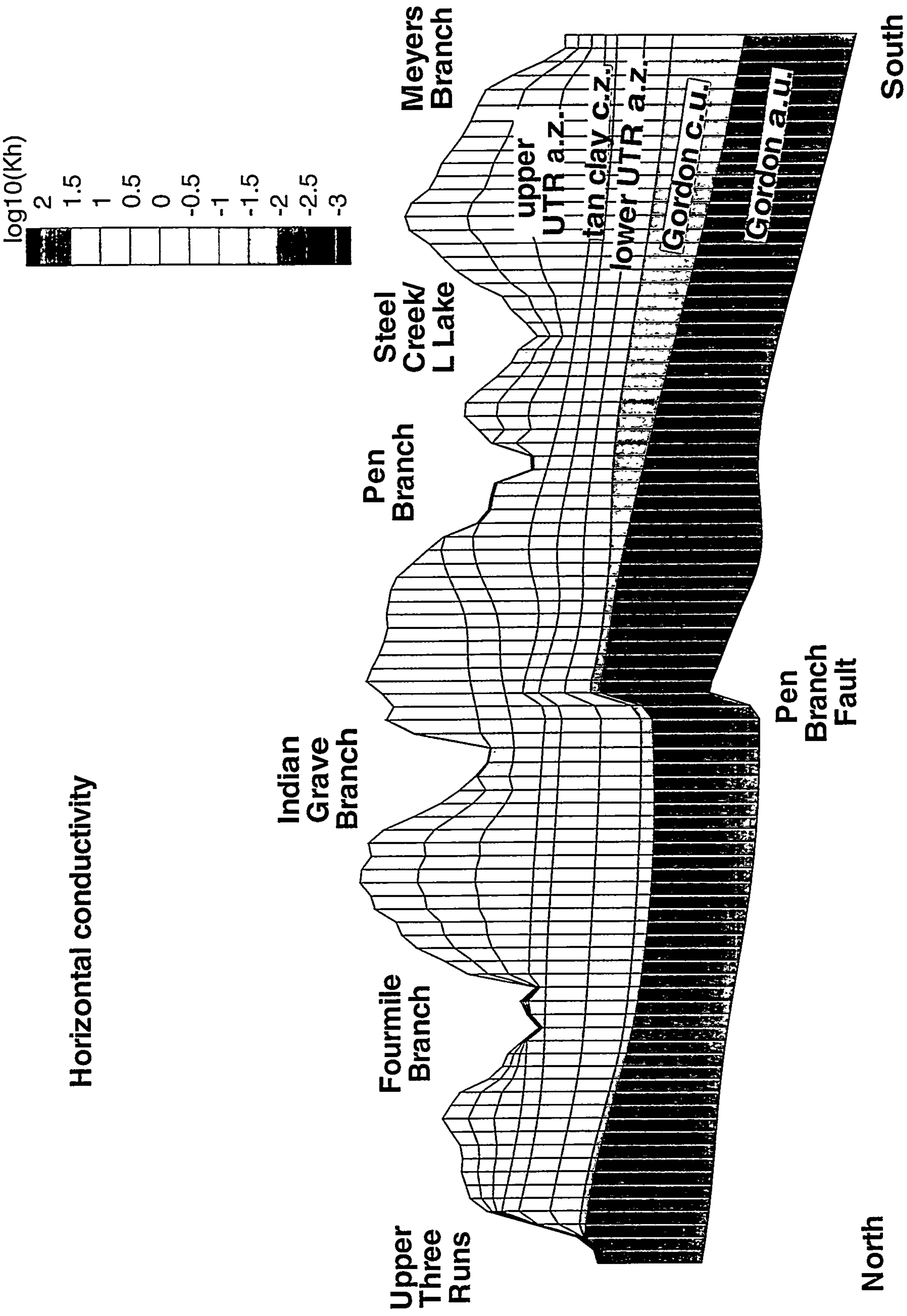


Figure 4-13. Horizontal Conductivity Along a Cross-Section Through K-Area

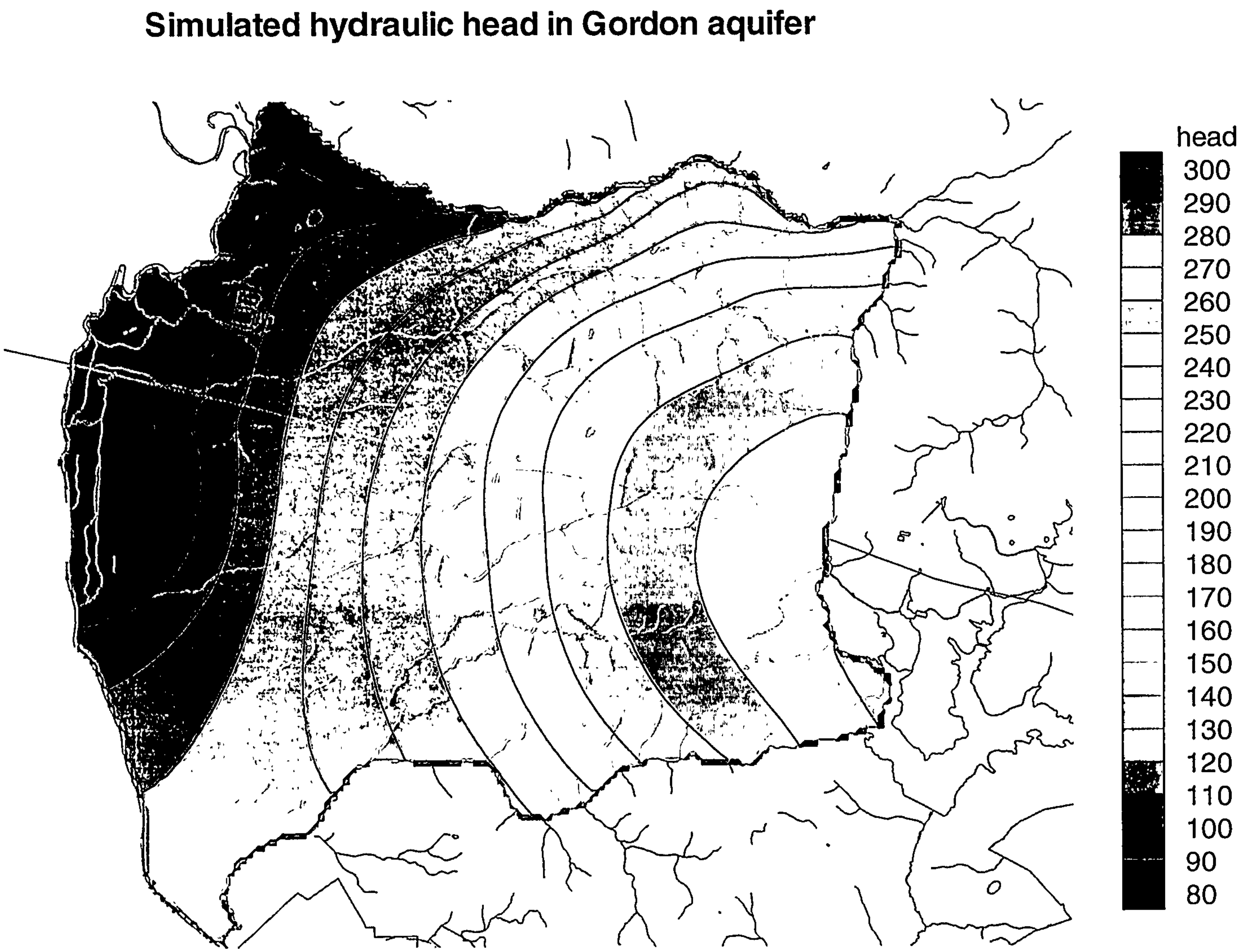


Figure 4-14. Simulated Hydraulic Head in the Gordon Aquifer

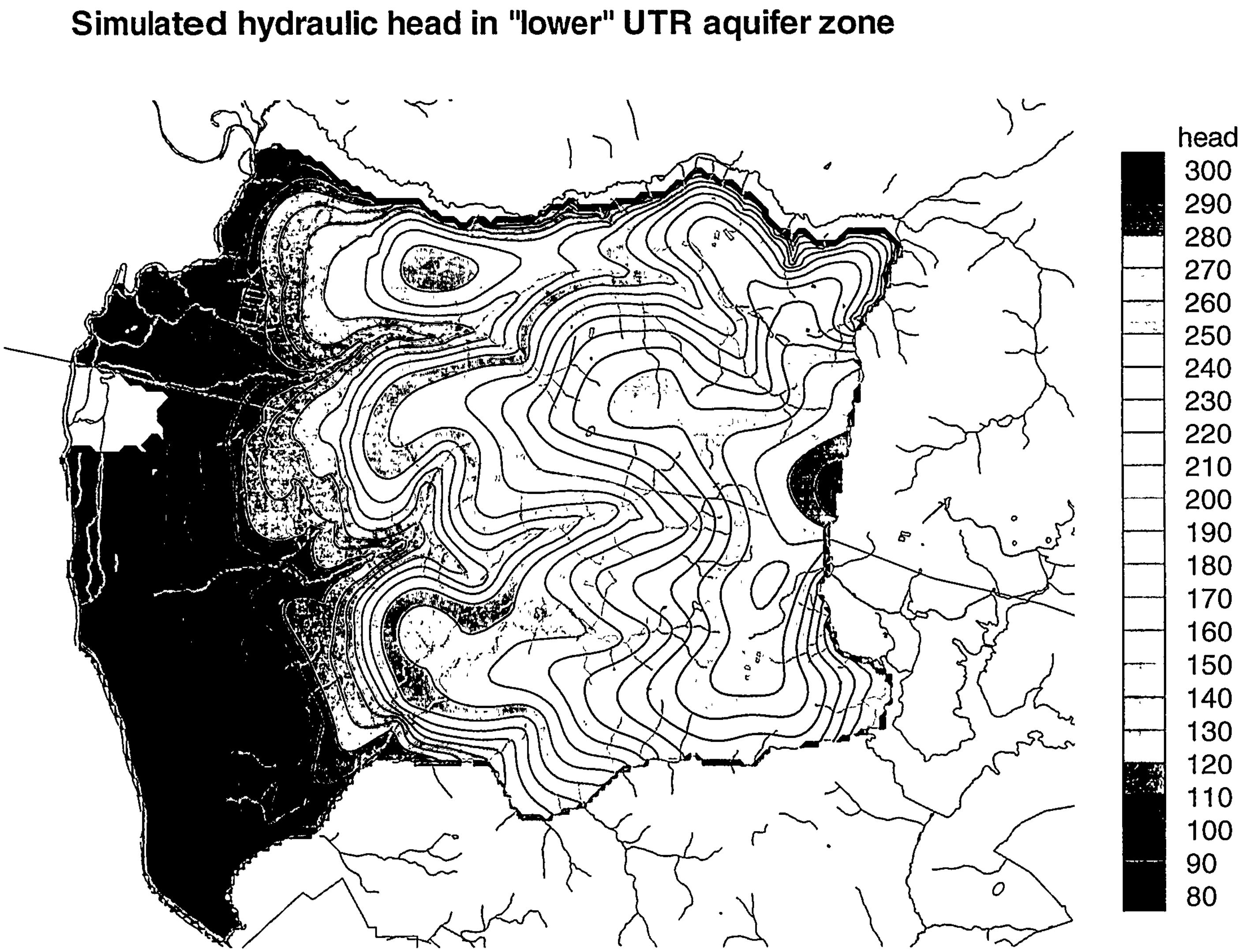


Figure 4-15. Simulated Hydraulic Head in the "Lower" UTR Aquifer

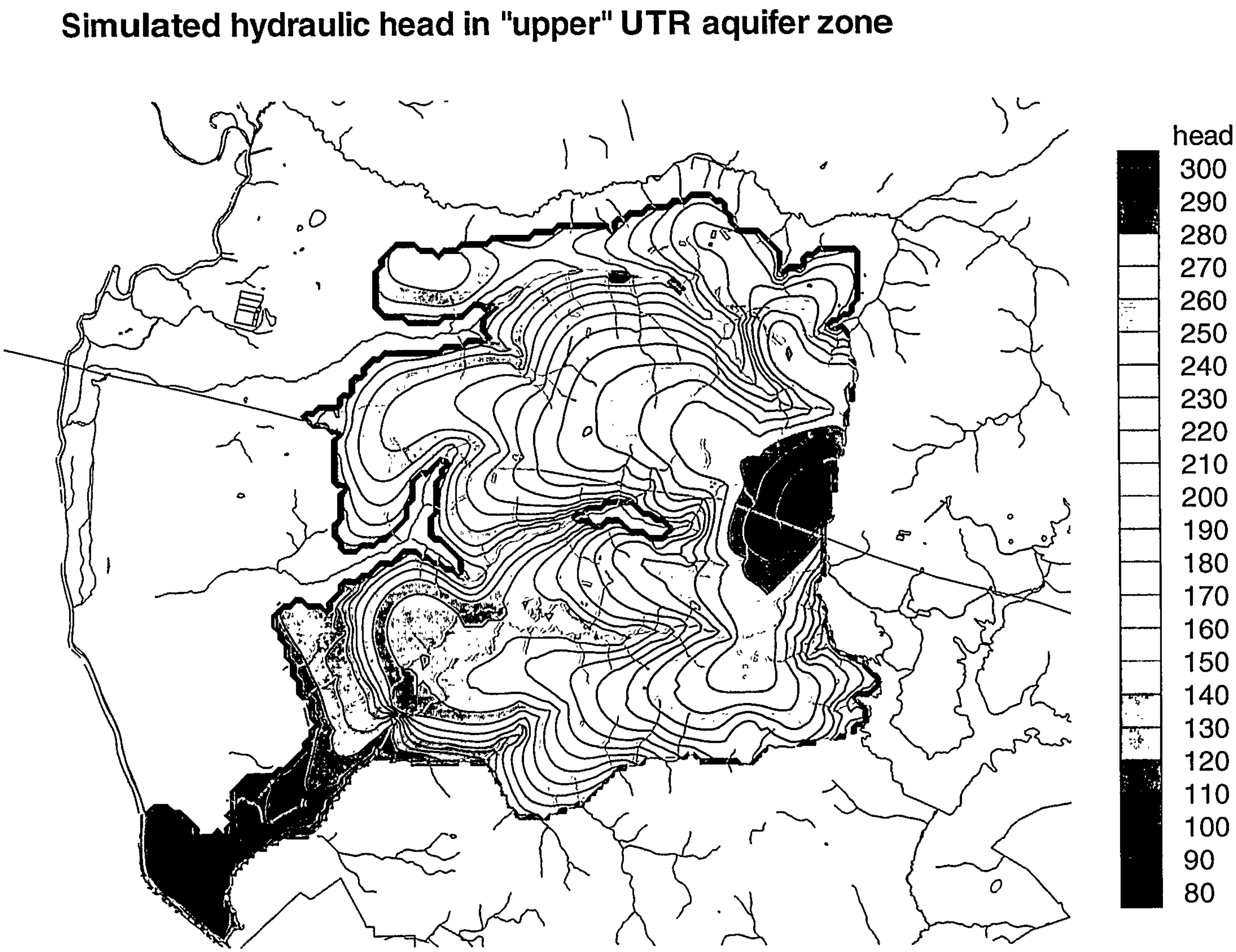


Figure 4-16. Simulated Hydraulic Head in the "Upper" UTR Aquifer

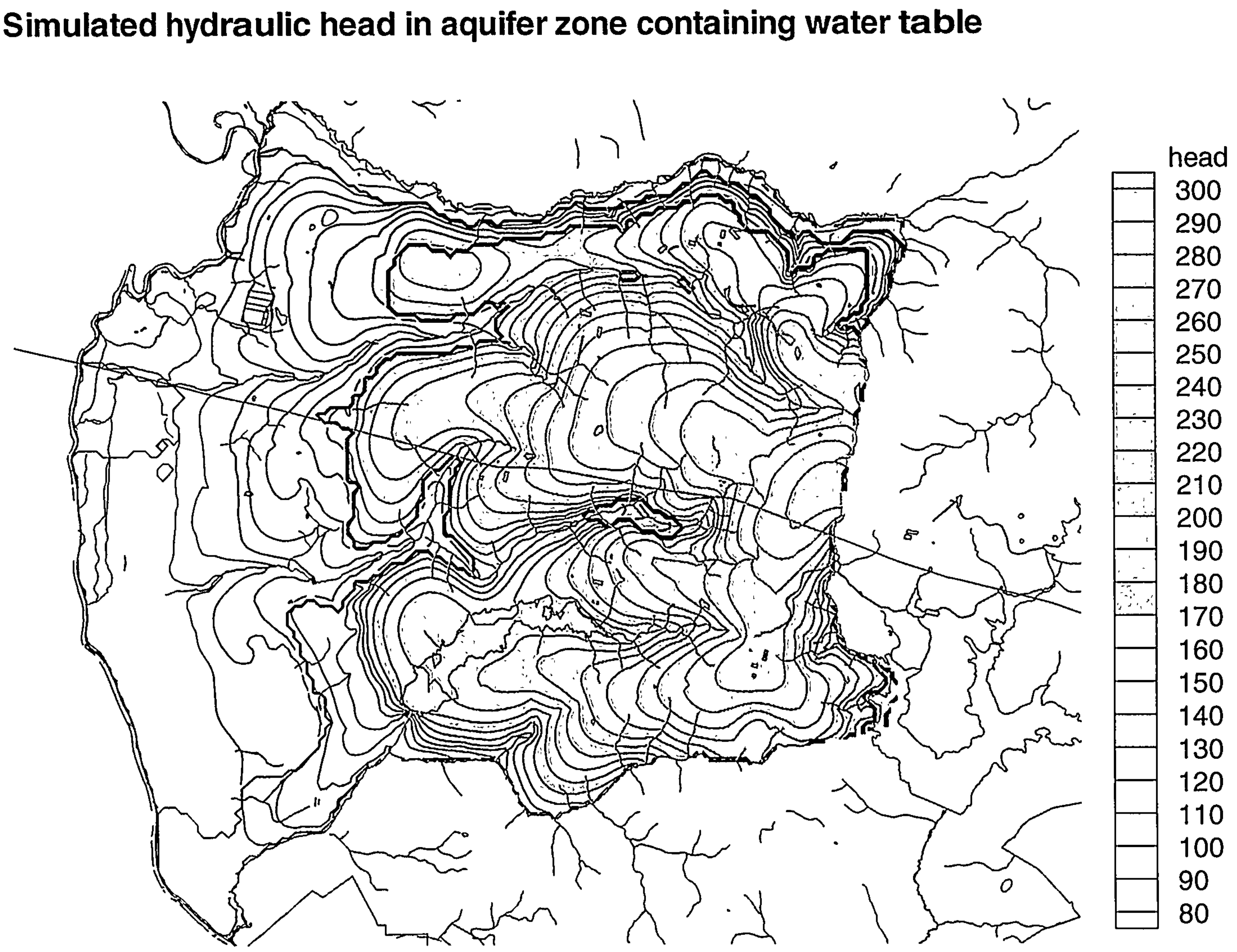

Simulated hydraulic head in aquifer zone containing water table

Figure 4-17. Simulated Hydraulic Head in the Aquifer Zone Containing the Water Table

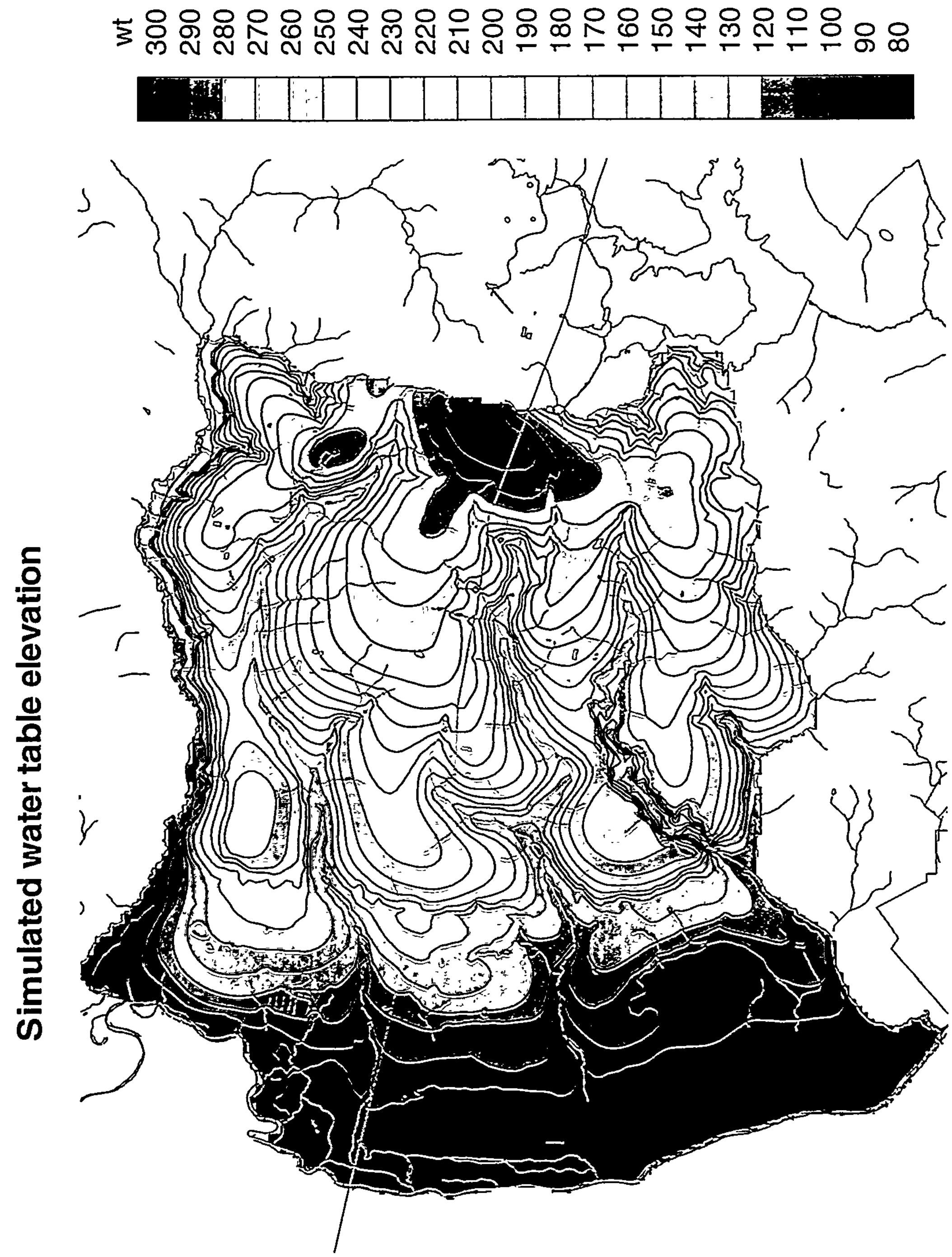
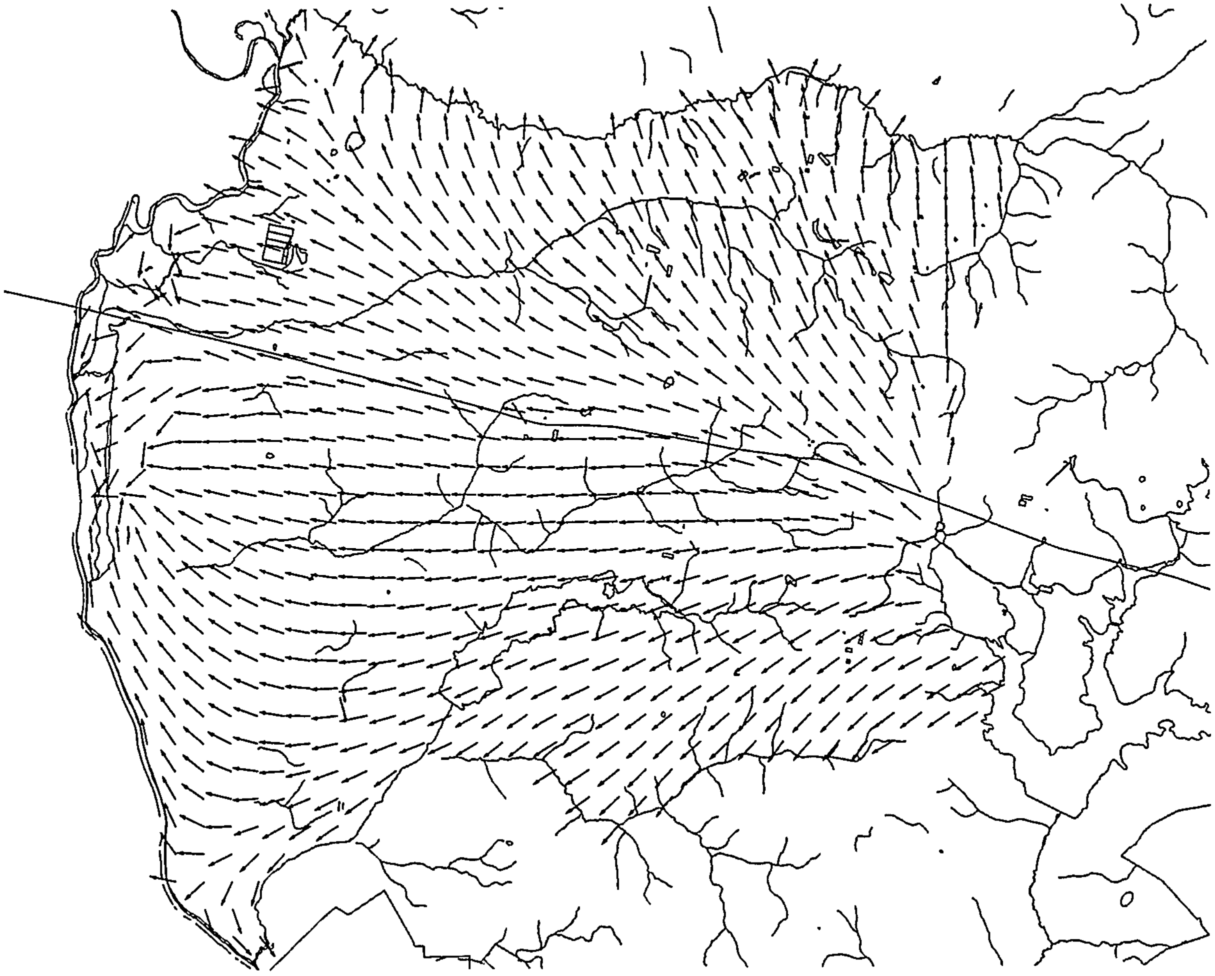
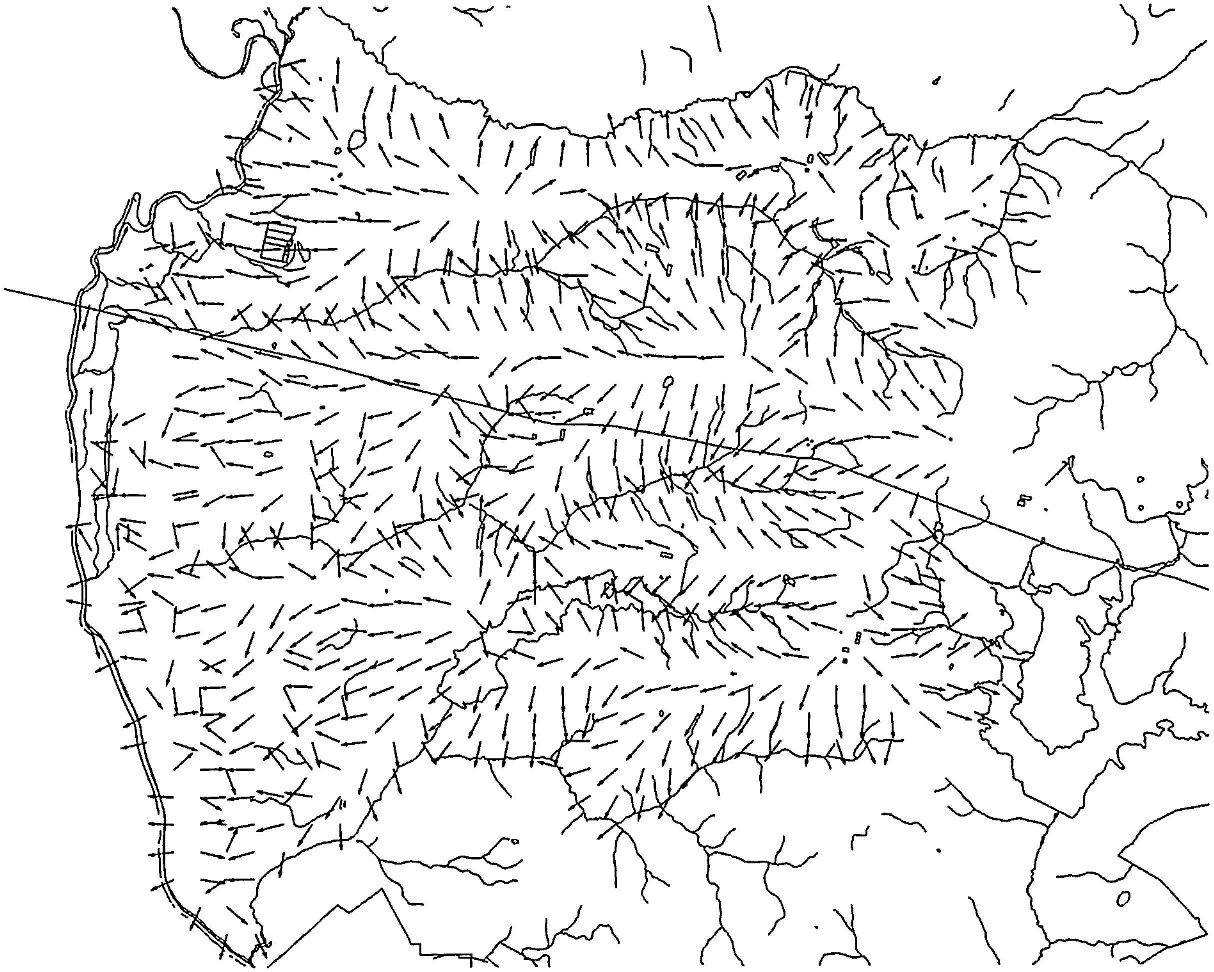


Figure 4-18. Simulated Water Table Elevations



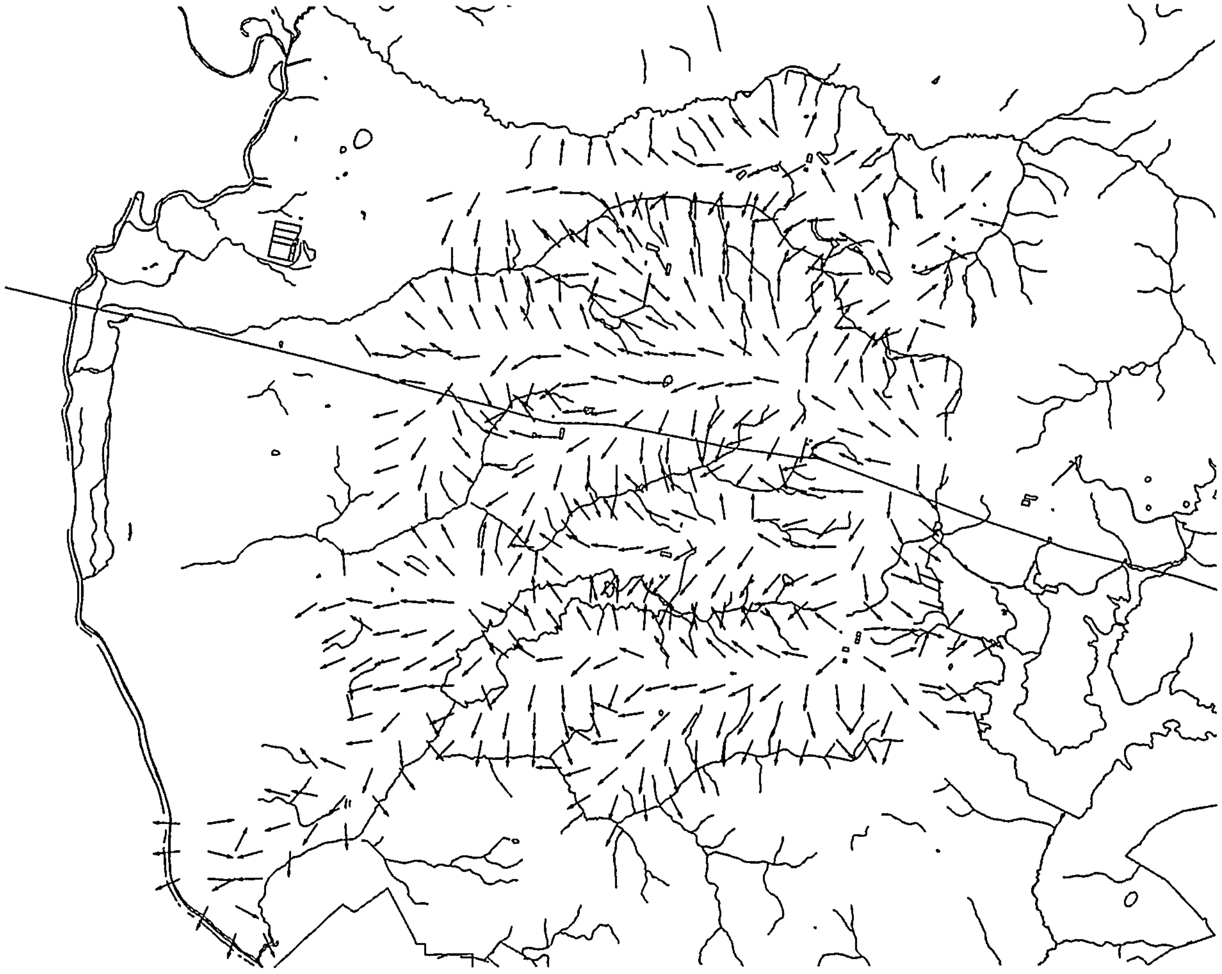
Groundwater flow directions in Gordon aquifer unit

Figure 4-19. Simulated Flow Directions in the Gordon Aquifer



Groundwater flow directions in "lower" UTR aquifer zone

Figure 4-20. Simulated Flow Directions in the "Lower" UTR Aquifer



Groundwater flow directions in "upper" UTR aquifer zone

Figure 4-21. Simulated Flow Directions in the "Upper" UTR Aquifer

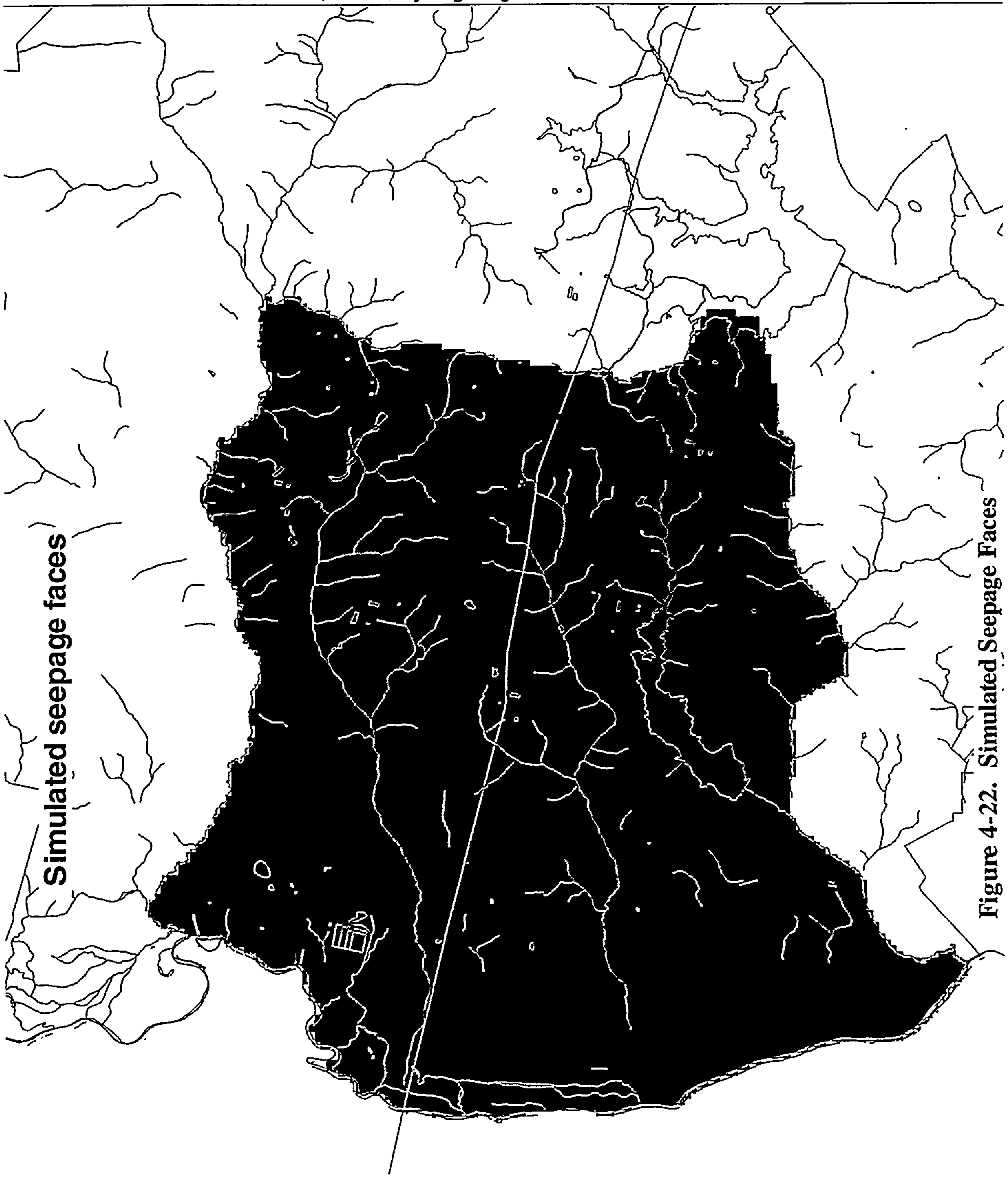


Figure 4-22. Simulated Seepage Faces

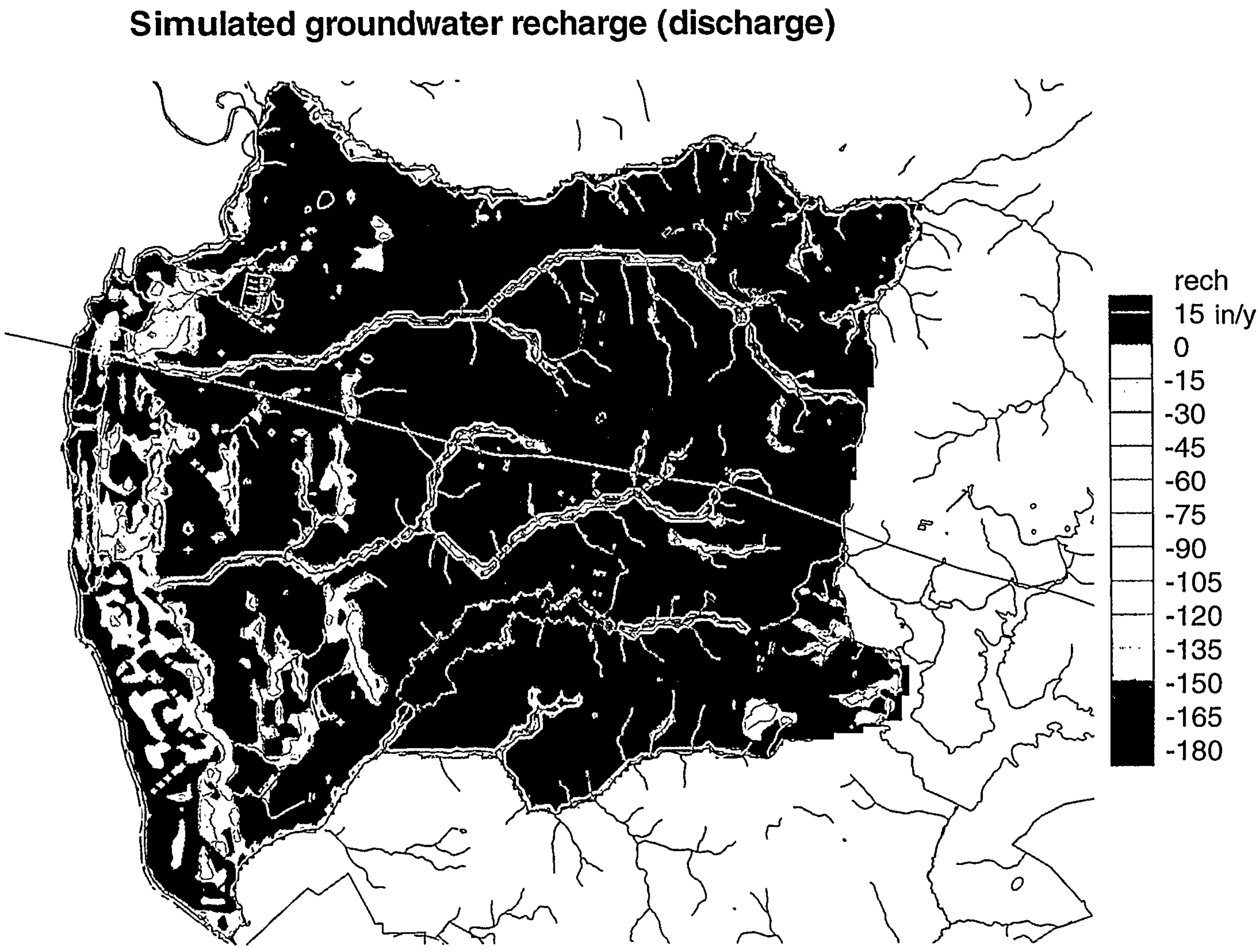


Figure 4-23. Simulated Rates of Recharge and Discharge

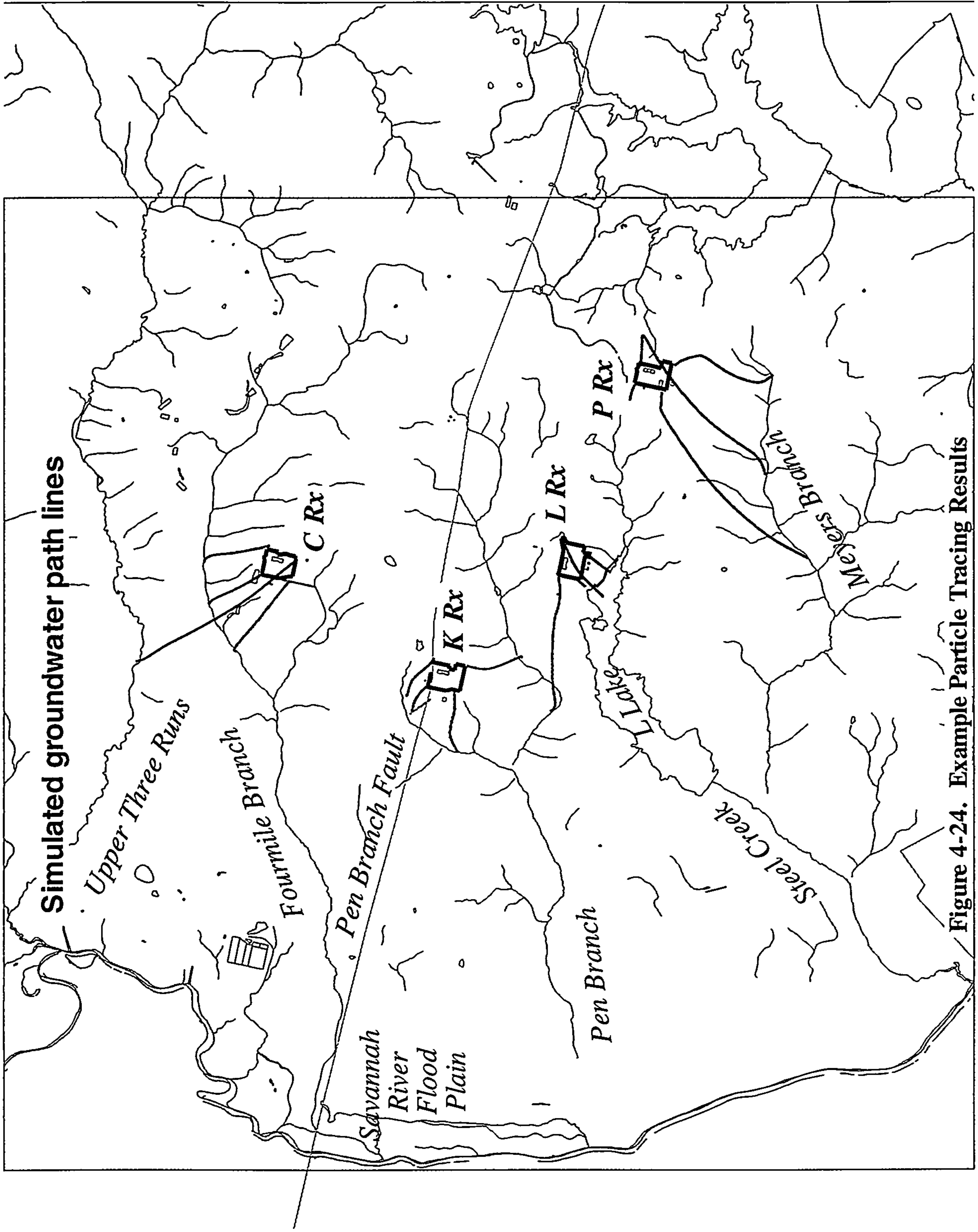
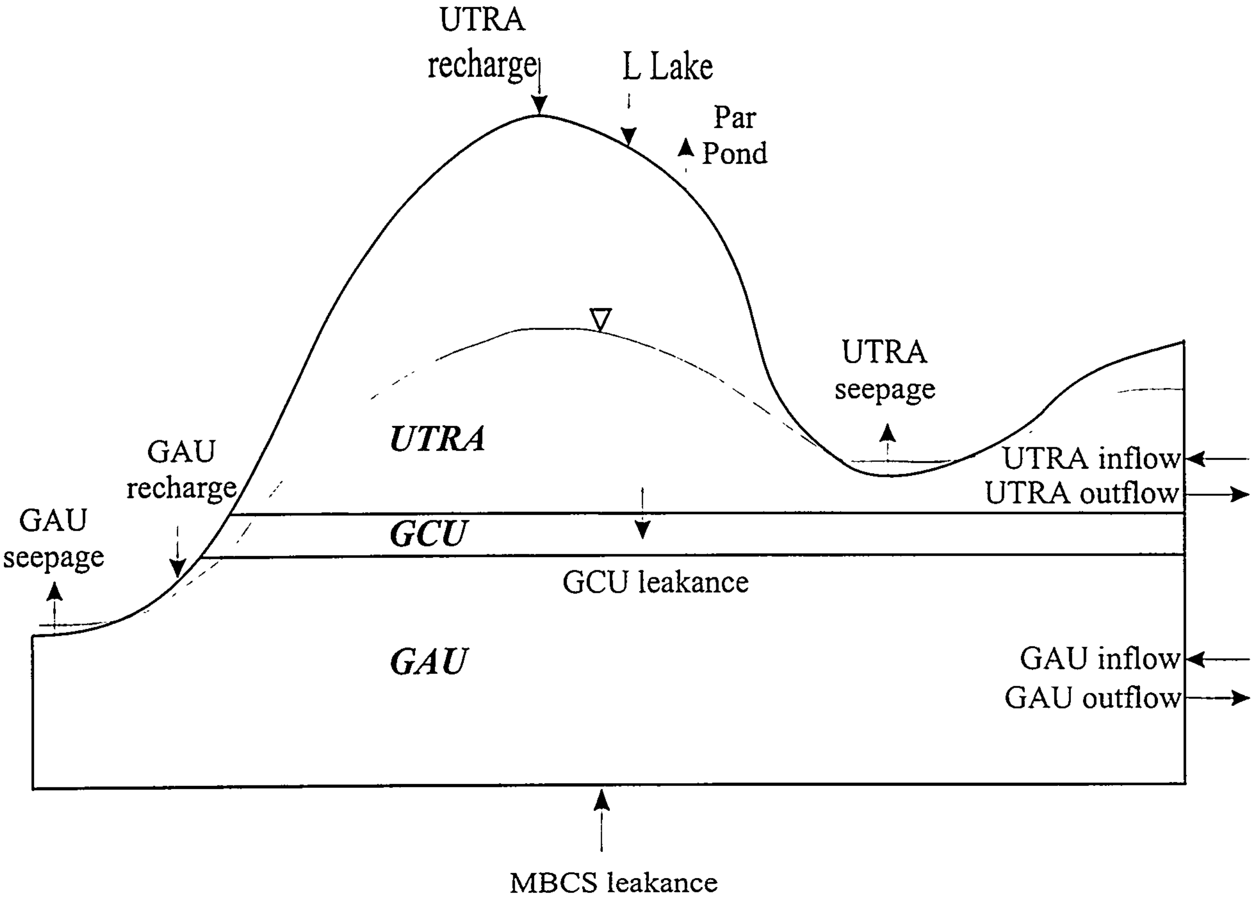


Figure 4-24. Example Particle Tracing Results



Flow component (cfs)	Entire model	UTR aquifer	Gordon aquifer
Recharge	+79.9694	+78.3983	+1.5711
Seepage	-80.7454	-64.3827	-16.3627
In flows (head BCs)	+104.9055	+0.5450	+104.3605
Out flows (head BCs)	-106.6514	-2.2367	-104.4148
L Lake	+0.2734	+0.2734	N/A
Par Pond	-0.1225	-0.1225	N/A
Gordon c.u. leakage	N/A	-12.4745	+12.4745
Meyers Br. c.s. leakage	+2.3717	N/A	+2.3717
Net total flow	**+0.0007**	**+0.0003**	**+0.0003**

Figure 4-25. Water Balance

Table 4-1. Calibration Summary for Groundwater Flow Targets

Flow target	Prior estimate	Range or Uncertainty	Model value (in/yr for recharge; ft^3/s otherwise)	Difference
Surface recharge	15 in/yr	10 – 16 in/yr	12.5 max. local (9.7 based on total area)	–17%
Meyers Branch base flow (headwaters to Road 9)	**3.2**	±20 – 25%	2.9	–9%
Steel Creek base flow (above Road B to Road A; includes L-Lake)	–2.2 (losing reach)	±20 – 25%	3.8 (drain BCs: +4.1 gen. head BCs: –0.3)	+6 ft^3/s
Pen Branch base flow (headwaters to Road A13; includes Indian Grave Branch)	13.3	±15 – 20%	14.7	+11%
Fourmile Branch base flow (headwaters to Road A12)	14.1	±15 – 20%	14.0	–1%
Upper Three Runs base flow (Road C to Road A)	4.5	±20 – 25%	6.7	+49%
L Lake	-	-	–0.3 (losing lake)	-
Par Pond (portion within model)	-	-	0.1	-

Table 4-2. Calibration Summary for Hydraulic Head Targets

Measure (ft)	Gordon aquifer	"lower" UTR aquifer	"upper" UTR aquifer	Overall
RMS difference	3.9	6.7	5.1	5.64
Avg. difference	-1.3	0.3	0.2	-
Median difference	-0.9	0.6	0.0	-
Avg. |difference|	2.0	5.3	3.8	-
Max. difference	-18	-34	+16	-

Table 4-3. Calibration Summary for Hydraulic Conductivity

Hydrostratigraphic Unit	**Nominal K_h (ft/day)**	**Range**	**Nominal K_v (ft/day)**	**Range**
Gordon aquifer	35	-	$K_h/100$	-
Gordon confining unit	$K_v \times 100$	-	10^{-4}	-
“lower” UTR aquifer zone	5.6	5 to 1.6	$K_h/100$	$K_h/100$
“tan clay” UTR confining zone	$K_v \times 100$	$K_v \times 100$	4×10^{-3}	4×10^{-2} to 4×10^{-4}
“upper” UTR aquifer zone	5.6	9.6 to 1.6	$K_h/100$	$K_h/100$
Transmissive zone – K area	8	-	$K_h/100$	-
AA horizon – K area	5	-	$K_h/100$	-
A horizon and above – K area	1	-	$K_h/100$	-
Alluvium	30	-	$K_h/100$	-

Table 4-4. Summary of Uncertainty Cases

	GCU Kv		
Recharge	5×10^{-4} ft/day	10^{-4} ft/day	2×10^{-5} ft/day
15 in/yr	-	Case 1	(Case 5)
12.5 in/yr	Case 3	Nominal	Case 4
10 in/yr	(Case 6)	Case 2	-

Table 4-5. Calibration Summary for Uncertainty Cases

Calibration measure	Nominal	Case 1	Case 2	Case 3	Case 4
Overall RMS head residual (ft)	5.6	5.8	5.5	9.5	5.7
Gordon aquifer RMS head residual (ft)	3.9	3.3	3.5	3.6	3.6
"lower" UTRA RMS head residual (ft)	6.7	6.9	6.5	12.5	6.9
"upper" UTRA RMS head residual (ft)	5.1	5.3	4.9	7.9	5.0
Meyers Branch base flow residual (cfs)	-0.3	0.3	-0.9	-1.7	0.0
Steel Creek base flow residual (cfs)	6.0	6.8	5.2	4.3	6.0
Pen Branch base flow residual (cfs)	1.4	4.5	-1.8	-5.0	3.2
Fourmile Branch base flow residual (cfs)	-0.1	2.4	-2.8	-7.0	2.6
Upper Three Runs base flow residual (cfs)	2.2	2.5	1.8	7.1	0.1
Nominal "lower" UTR aquifer zone, Kh (ft/day)	5.6	6.7	4.5	0.84	7.6
Nominal "tan clay" UTR confining zone, Kv (ft/day)	4×10^{-3}	4×10^{-3}	4×10^{-3}	4×10^{-2}	2×10^{-3}
Nominal "upper" UTR aquifer zone, Kh (ft/day)	5.6	6.7	4.5	0.84	7.6
Nominal Gordon aquifer unit, Kh (ft/d)	35	35	35	88	12

5.0 SUMMARY AND RECOMMENDATIONS

Important attributes of the baseline CKLP model are:

- the present baseline model is current with available reactor characterization data through Spring 1998. All the characterization data has been incorporated into a project database that can be easily updated as additional field data is obtained.
- aquifer zones are sub-divided by several vertical mesh layers
- model preprocessing has been fully automated using the *make* software language
- both the vadose and saturated zones are simulated in the model
- groundwater flow beneath the model boundaries are simulated to the top of the Meyers Branch confining system
- the alluvial valley has been included in the model to realistically illustrate the extent to which the Savannah River has incised the hydrostratigraphic units. The Savannah River has cut down to the Gordon aquifer at the northern and southern ends of the valley but does not incise the Meyers Branch confining system within the model area.
- the model is based on the FACT code

Important implications of the CKLP model:

- the model meets the planning objectives of the *General Groundwater Strategy for Reactor Area Projects* (WSRC, 1997) by providing a common framework for analyzing groundwater flow, contaminant migration and remedial alternatives across ERD programs
- the CKLP groundwater flow model provides a good understanding of the groundwater flow regime for these reactor areas on a regional scale. The model is suited to assist in scoping characterization and remedial activities by providing a common base for the subsequent finer scale transport and remedial/feasibility models for each of these areas.
- the model has been constructed to incorporate new data as it is collected, providing quick and cost-effective updates.

Recommendations for future refinements to the CKLP model are:

- additional head data are needed for the Upper Three Runs aquifer above and below the "tan clay" confining zone on a regional scale to provide data away from the reactor facilities
- pump tests in non-contaminated areas are needed for each reactor area in order to provide direct, field scale, conductivity measurements. In addition, previous conductivity measurements derived from slug tests and pump tests should be reviewed to determine data quality and validity of the measurements.
- baseflow measurements should be completed during the 1999 fiscal year.
- a field survey and walk-down of the NPDES outfalls is recommended in order to assess the elevation of these drainages and how deep they have incised the hydrostratigraphic units due to process water flows since the 1950s.
- evaluate high and low head residual areas for both UTR and Gordon aquifers by looking at both hydrostratigraphy and well screen intervals.
- utilization of mathematical optimization algorithms such as the new FACT/Data Fusion Modeling code to improve and automate model calibration. The software also provides better estimates of model uncertainty, which is desirable for regulatory applications.
- Additional documentation on data preprocessing algorithms and software.

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APPENDIX A. DATA COLLECTION AND HYDROGEOLOGIC MODEL METHODOLOGY

Hydrogeologic Data Collection

Data utilized in this analysis include coordinates and elevations of SRS and off-site wells, geophysical logs, drill-core descriptions, and results from permeability. The study included collecting permeability data from the recent and historical literature. These data originate from the results of different types of tests. These include aquifer pumping tests, borehole permeability ("slug") tests, and laboratory tests performed on undisturbed samples.

Project Database

The project database used for the C, K, L, and P groundwater model area (CKLP GWMA) is designed to support groundwater modeling conducted by the Environmental Sciences Section (ESS) of the Savannah River Technology Center (SRTC) such as that described in Flach, and Harris (1997). The scope of the groundwater modeling project database (GWMPD) for the CKLP GWMA includes the area bounded by Savannah River Site (SRS) local grid coordinates 10,000 to 85,000 North and 0 to 100,000 East.

The primary function of GWMPD is to record and report hydrogeologic parameters within the context of their spatial position and hydrostratigaphic assignment. The database is designed to accommodate geologic, geotechnical, geophysical, and stratigraphic data from any type of sampling location (site type). Current site types include soil borings, wells, and cone-penetrometer test (CPT) sites. Hydrogeologic data fall within three main categories: 1) field data collected during drilling and sampling; 2) Field analyses of borehole and aquifer permeability; and 3) laboratory analyses of core and undisturbed samples. The GWMPD also records "subjective" data such as stratigraphic analyses ("picks" for unit boundaries) in addition to the "objective" measurements described above.

The database is compiled in Paradox® software and incorporates a relational structure which defines unique data locations (sites) by their coordinates and elevations. The sites are used as the key field by which different types of data are related. The unique site identifiers allow multiple data types to be associated with a single data site. The database is constructed so that revisions made to the "subjective" data (hydrostratigraphic "picks") are documented. The database records and dates each revision to the picked boundaries, and automatically regenerates updated output files for re-loading into EarthVision®. This aspect of the database facilitates data evaluation and revision. and provides a means by which to maintain a history of the "subjective" data set.

The GWMPD maintains a bibliographic record of all documents reviewed and summarized for data which are incorporated into the database. The database also records whether the documents serve as original sources for the data they contain. or summarize data extracted from previous reports. For example. a report that lists permeability values for undisturbed samples and includes copies of the laboratory reports in an appendix would be considered a "source" document. Similarly, a report that tabulates slug test results from several wells as average hydraulic conductivity values, and does not provide the test parameters or details of the individual analyses would be considered a "summary" document for those slug test results.

Data Qualification

Boundaries or "picks" for hydrostratigraphic units beneath the CKLP GWMA were established by the same method used in WSRC-RP-96-0399 for the General Separations Area (Smits and others, 1997). Because the CKLP GWMA includes the GSA modeling area. the picks were used to correlate hydrostratigraphic boundaries from within the GSA to cores in the remainder of the model area. The GWMPD uses the hydrostratigraphic nomenclature described in Aadland and others (1995). A rigorous Quality Review of the data was performed, comparing the core descriptions and geophysical logs with the list of unit boundaries. Geologists made refinements to these boundaries to ensure internal consistency between the unit boundaries and the lithology of the hydrostratigraphic units.

Hydrostratigraphic horizons include tops of the "tan clay" confining zone (TCCZ). "lower" aquifer zone (LAZ), Gordon confining unit (GCU), Gordon aquifer (GAU), and the Meyers Branch Confining System (MBCS).

Hydrogeologic Model

Hydrostratigraphic Methods

Hydrostratigraphic unit boundaries for the CKLP GWMA are based on the recent hydrostratigraphic anaysis of the GSA (Smits and others, 1997). Because the CKLP GWMA includes the GSA modeling area the hydrostratigraphic picks were used to correlate the hydrostratigraphic boundaries on the cores in the remainder of the model area. Boundaries are determined through evaluation of:

Geophysical data. Gamma-ray logs in combination with resistivity logs are used to evaluate the potential confining properties of the strata. In general, low resistivity and high gamma-ray values indicate clay-rich sediment that impedes the flow of ground water.

Core description data. Core descriptions are used (in conjunction with the geophysical logs) to select boundaries between confining and transmissive units. Percentage of mud and estimated porosity are the primary criteria used. If core recovery is good, the foot-by-foot description is an excellent tool for determining the vertical extent of a confining or transmissive lithology.

The database was used to prepare a hydrogeologic model of the CKLP GWMA. The model was constructed with EarthVision® software. EarthVision® processes sets of spatial and property data by calculating minimum-tension grids to contour a "best fit" of the data. The grids can contour data in 3 dimensions (x,y,z), such as the top of a geologic unit, as two-dimensional grids, or contour data in 4-dimensions: x,y,z, and a "property." An example of a property might be the variation of the percentage of mud within a geologic unit. Only 3 dimension hydrogeologic modeling was performed for this study.

Two-Dimensional Grid Calculation

Data for hydrostratigraphic unit tops were exported from the Paradox® database into EarthVision®. After minor format changes, the data was processed by an algorithm, producing a two-dimensional grid of the unit top surface. The two-dimensional grids were calculated so as to incorporate effects of the Pen Branch Fault. The off-set is assumed to be a consistent, vertical displacement along the trace of the fault. The south side of the fault is displaced up relative to the north side.

The EarthVision® model utilizes digitized x,y,z data for all U.S. Geological Survey topographic coverage of the GSA. The data was processed in the same manner as the data for the unit boundaries to produce a grid representing the topography of the study area. The high density of data points in this data set produced a two-dimensional grid of exceptional accuracy and detail. This grid was then used in subsequent grid calculation to determine the extent of the hydrostratigraphic units that crop out in the study area.

Geologic Structure Builder

Altitude-Contour Maps

Altitude-contour maps were constructed for each hydrostratigraphic unit and zone discussed in Section XXX using the two-dimensional grids calculated from the scattered data for the unit tops. The maps are plotted using the *Contour and Basemap* module of EarthVision®. Contour intervals are chosen by individual data sets so as to convey the information clearly and concisely, but virtually any level of detail is possible. An effort was made to keep the contour interval to within one-tenth of the range of the z-values. This serves to minimize the number of contour lines, yet generally maintains a level of detail suitable for interpretation of the map.

Isopach Maps

Two-dimensional grids of unit thickness (isopach grids) were calculated by first comparing the two-dimensional grids of the unit base and unit top with the two-dimensional grid of the topography. Isopach maps of vertical unit thickness were calculated from comparison of the two-dimensional grids of the unit base and unit top. A value was then written to the corresponding nodes of the resultant grid (the isopach grid) equal to the vertical distance between the base and upper surface of the unit.

The resultant two-dimensional isopach grids were contoured using EarthVision® in the same fashion as the structure-contour maps.

REFERENCES

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Smits, A. D., M. K. Harris, K. L. Hawkins, and G. P. Flach, 1997. *Integrated Hydrogeological Model of the General Separations Area, Volume 1: Hydrogeologic Framework* (U), WSRC-TR-96-0399, Rev. 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC, 29808.

Appendix B-1: Locations of Sites within the Model Area

Well ID	SRS Northing (ft)	SRS Easting (ft)	Surface Elevation (ft m.s.l.)	Reference[1]
BGO-1D	73737.9	58779.3	293	WSRC. 1996d
BGO-3A	75561.7	58806.8	288.7	WSRC. 1996d
BGO-3D	75351.3	58809.2	290.8	WSRC. 1996d
BGO-5C	76476.9	58794.5	294.2	WSRC. 1996d
BGO-6A	76487.2	58316.8	283.8	WSRC. 1996d
BGO-6B	76553.24	58346.46	284.5	WSRC. 1996d
BGO-8A	76569	57618.3	281.3	WSRC. 1996d
BGO-9AA	76975.69	57371.94	282.8	WSRC. 1996d
BGO-10A	76805.18	57050.92	299.1	WSRC. 1996d
BGO-10AA	76997.88	56990.54	298.8	WSRC. 1996d
BGO-12A	76804.63	56250.68	311.4	WSRC. 1996d
BGO-14A	76377.54	55838.32	300.2	WSRC. 1996d
BGO-16A	75756.95	56194.15	302.8	WSRC. 1996d
BGO-18A	75599.89	56699.67	292.9	WSRC. 1996d
BGO-20AA	74953.76	57114.81	280.88	Rust. 1996
BGO-21D	74688.53	57470.66	283	WSRC. 1996d
BGO-23D	74238.09	58132.96	287	WSRC. 1996d
BGO-25A	76158.5	55668.08	294.7	WSRC. 1996d
BGO-26A	76144.6	55014.2	285.1	WSRC. 1996d
BGO-27C	75666.3	54671.4	273.9	WSRC. 1996d
BGO-29A	75560	54103.5	262.1	WSRC. 1996d
BGO-31C	74978	54816.2	271.1	WSRC. 1996d
BGO-33C	74479.7	55681.4	277.4	WSRC. 1996d
BGO-35C	73953.9	56545.7	271.4	WSRC. 1996d
BGO-37C	73498.2	57279.2	284.3	WSRC, 1996d
BGO-39A	73572.52	57821.93	293.7	WSRC. 1996d
BGO-41A	76469.52	55403.69	298.3	WSRC. 1996d
BGO-42C	76404.71	55522.27	295.9	WSRC. 1996d
BGO-43AA	77066.01	56268.64	312.2	WSRC. 1996d
BGO-44AA	76757.02	57880.51	283.3	WSRC. 1996d
BGO-45A	75830.03	54550.14	276.9	WSRC. 1996d
BGO-46B	75012.1	54444.65	263.4	WSRC. 1996d
BGO-47A	74728.83	54914.04	264.8	WSRC. 1996d
BGO-48C	74599.64	55124.38	274.7	WSRC. 1996d
BGO-49A	73902.78	56205.08	269.1	WSRC. 1996d
BGO-50A	75201.16	54179.77	253.5	WSRC. 1996d
BGO-51AA	74113.1	57867	287.2	WSRC. 1996d
BGO-52AA	74638	57178.1	281.6	WSRC. 1996d
BGO-53AA	76065	55431.5	288.9	WSRC. 1996d
BGT-1	76700.6	59178.4	282.9	WSRC, unknown
BGT-2	76957.6	59607.2	276.4	WSRC. unknown
BGT-3	77197.6	60045.9	275.7	Rust. 1996
BGT-4	77437.6	60484.5	259.2	WSRC. unknown

Appendix B-1: Locations of Sites within the Model Area (Continued)

Well ID	SRS Northing (ft)	SRS Easting (ft)	Surface Elevation (ft m.s.l.)	Reference[1]
BGT-5	77677.6	60924.1	225.7	Rust, 1996
BGT-6	77254.8	58746.7	282.2	WSRC, unknown
BGT-7	77717.8	58935.7	276.4	WSRC, unknown
BGT-8	78161.5	59118.6	249.3	WSRC, unknown
BGT-9	78642.3	59316.7	226	Rust, 1996
BGT-10	79104.6	59507.2	215.2	WSRC, unknown
BGT-11	79566.9	59697.7	222.5	Rust, 1996
BGT-12	77291.2	58045.9	284.2	WSRC, unknown
BGT-13	77488.9	58074	287.8	WSRC, unknown
BGT-14	77984	58143.4	280.7	WSRC, unknown
BGT-15	78479.2	58212.8	277.5	WSRC, unknown
BGT-16	78974.1	58283.5	250.7	WSRC, unknown
BGT-17	79469.7	58350	240.7	WSRC, unknown
BGT-18	79965.3	58416.5	216.5	Rust, 1996
BGT-20	80956.4	58549.6	159.5	Rust, 1996
BGT-21	77280.7	56952.5	294.2	WSRC, unknown
BGT-22	77860.3	56970.3	281	Rust, 1996
BGT-23	78279.7	56997	270	WSRC, unknown
BGT-24	78779.2	57019.2	265.8	WSRC, unknown
BGT-25	79278.7	57041.4	264.8	WSRC, unknown
BGT-26	79778.2	57063.7	250.2	WSRC, unknown
BGT-27	80277.7	57085.9	256.9	WSRC, unknown
BGT-28	80777.2	57108.1	258.3	Rust, 1996
BGT-29	81276.7	57130.4	243	WSRC, unknown
BGT-30	81726.3	57150.4	219	WSRC, unknown
BGT-31	77229	56189.8	308.76	WSRC, unknown
BGT-32	77791.4	56121.1	310.12	WSRC, unknown
BGT-33	78404.5	56037.2	290.42	WSRC, unknown
BGT-34	78803.9	56027.5	286.76	WSRC, unknown
BGT-35	79305.8	55929.9	267.73	WSRC, unknown
BGT-36	79801.9	55867.5	261.36	WSRC, unknown
BGT-37	80298	55805	251.6	WSRC, unknown
BGT-38	80870.5	55733	240.14	WSRC, unknown
BGT-39	81290.2	55680.3	241.88	WSRC, unknown
BGT-40	77297.2	55644.4	332.32	WSRC, unknown
BGT-41	77734.8	55490.1	328.37	WSRC, unknown
BGT-42	78240.7	55313.1	310.92	WSRC, unknown
BGT-43	79655.9	54816	277.08	WSRC, unknown
BGT-44	80127.7	54650.4	276.2	WSRC, unknown
BGT-45	80461.7	54533.1	285.28	WSRC, unknown
BGT-46	76714.3	55355	310	WSRC, unknown
BGT-47	77051.85	54986.57	317.32	Rust, 1996
BGT-48	77135.7	54895.1	314.33	WSRC, unknown

Appendix B-1: Locations of Sites within the Model Area (Continued)

Well ID	SRS Northing (ft)	SRS Easting (ft)	Surface Elevation (ft m.s.l.)	Reference[1]
BGT-49	76203.9	54946.3	297.26	WSRC. unknown
BGT-50	76359.3	54756.2	296.27	WSRC. unknown
BGT-51	75519.8	54505.7	272.64	WSRC. unknown
BGT-53	75837.68	53422.04	278.25	Rust. 1996
BGT-54	75941.7	52889.1	279.96	WSRC. unknown
BGT-56	73521.2	56265.8	262.94	WSRC. unknown
BGT-57	73268.5	56104.2	259.35	WSRC. unknown
BGT-58	73406.9	57399.6	285.76	WSRC. unknown
BGT-59	72802.6	57123.2	281.88	WSRC. unknown
BGT-60	73120.6	58057.2	291.42	WSRC. unknown
BGT-61	72911.77	58490.09	284.3	Rust. 1996
BGT-62	72854.4	58608	282.03	WSRC. unknown
BGT-63	73319.4	59146.3	293.67	WSRC. unknown
BGT-63A	73646.4	58768.1	290.79	WSRC. unknown
BGT-64	73013.7	59500	283.25	WSRC. unknown
BGT-66	74476.6	60033.7	244.04	WSRC. unknown
BGT-67	74443.06	60426.74	242.03	Rust. 1996
BGX-1A	76831.89	58590.35	289.1	WSRC. 1996d
BGX-2B	77203.4	58256.5	289.2	WSRC. 1996d
BGX-4A	77879.2	57215.6	288.8	WSRC. 1996d
BGX-7D	78349.3	58312.8	277.1	WSRC. 1996d
BGX-9D	76936	59522.1	277.4	WSRC. 1996d
BGX-11D	75300.7	59581.4	273.8	WSRC. 1996d
BRR-1D	77365.2	50588.2	293.8	WSRC. 1996d
BRR-3D	77398.3	50203.5	289.5	WSRC. 1996d
BRR-6B	77054.6	51100	293.9	WSRC. 1996d
BRR-7B	77575.4	50707.5	289.6	WSRC. 1996d
BRR-8B	77634.7	50116.5	276.7	WSRC. 1996d
CCP-1A	66659.2	46981.3	287.1	WSRC, 1996d
CFD-1	55486.64	54875.37	268.8	WSRC. 1994
CFD-5	55769.51	54803.57	257.8	WSRC, 1994
CFD-18	56297.09	54935.66	248.3	WSRC. 1994
CMP-30B	51729.8	53166.9	286.5	WSRC. 1996d
CMP-32B	52220	54052.8	251.7	WSRC. 1996d
CPC-1	66855.77	47183.78	285.1	WSRC. 1996d
CRP-5DR	68549.1	44515	274.6	WSRC. 1996d
CRP-9D	69156.7	44243.2	268.4	WSRC. 1996d
CSD-4D	63143.8	50058.9	306.5	WSRC. 1996d
FAC-1SB	78138	55243	312.2	WSRC. 1992b
FCH-1	79488.82	52843.11	316.8	WSRC. 1993
FCH-2	78500	52599.59	288.7	WSRC. 1993
FCH-3	78059.22	52087.22	307.2	WSRC, 1993
FCH-4	77514.56	52021.03	297.5	WSRC. 1993

Appendix B-1: Locations of Sites within the Model Area (Continued)

Well ID	SRS Northing (ft)	SRS Easting (ft)	Surface Elevation (ft m.s.l.)	Reference[1]
FCH-5	76992.12	51667.65	284.2	WSRC, 1993
FCH-6	76410.33	51245.7	291.5	WSRC, 1993
FIW-1MC	76165.3	51354.4	293.3	WSRC, 1996d
FIW-2MA	75930.8	51184.5	290.5	WSRC, 1996d
FNB-1A	80154.5	54288.8	282.4	WSRC, 1996d
FNB-3A	80557.2	54116.6	282.2	WSRC, 1996d
FSB-1TA	75649.1	51658.3	275.4	WSRC, 1996d
FSB-PC	74090.2	50140	230.8	WSRC, 1996d
FSB-PD	74549.2	49849.81	252.6	WSRC, 1996d
FSB-76A	76131.9	51391.6	291.5	WSRC, 1996d
FSB-78A	74757.7	50172.8	270.5	WSRC, 1996d
FSB-79A	73664.5	50149.6	216.1	WSRC, 1996d
FSB-87A	75601.7	50115.8	285.6	WSRC, 1996d
FSB-89C	75553.2	51345.2	279.1	WSRC, 1996d
FSB-91C	75213.3	50953.5	277	WSRC, 1996d
FSB-93C	74897.3	50458.3	274	WSRC, 1996d
FSB-95C	74971.7	50016.7	281.8	WSRC, 1996d
FSB-96A	74882.2	49778.7	277.7	WSRC, 1996d
FSB-97A	75171.2	49965.7	283.8	WSRC, 1996d
FSB-98A	75389.8	50121.6	280.7	WSRC, 1996d
FSB-99A	75675.6	50314.8	285.3	WSRC, 1996d
FSB-100A	75534.4	50958.4	283.8	WSRC, 1996d
FSB-101A	75719	51191.3	282.9	WSRC, 1996d
FSB-112A	74231.4	48809.1	227	WSRC, 1996d
FSB-113A	74167.5	51068.1	221.3	WSRC, 1996d
FSB-114A	75297.4	52046.6	250	WSRC, 1996d
FSB-115C	72515.5	49736	205.8	WSRC, 1996d
FSB-116C	72725.5	50645.9	200.5	WSRC, 1996d
FSB-120A	75538.9	49175.7	278	WSRC, 1996d
FSB-121C	75155.7	48413.1	254.4	WSRC, 1996d
FSB-122C	73881.8	48195	216	WSRC, 1996d
FSB-123C	74566.7	51750.5	236.3	WSRC, 1996d
GAPWR-TW-1	51036.5	1544.1	219	Falls, 1998
HAA-1TA	69892.2	62953.3	290.2	WSRC, 1996d
HAA-2AA	70925.4	61285.1	291.4	WSRC, 1996d
HAA-3AA	71488	60201.9	274.5	WSRC, 1996d
HAA-4AA	72223.2	61929.6	299.2	WSRC, 1996d
HAA-6AA	71441	63860.2	279.8	WSRC, 1996d
HC-12A	73187	59504	287.3	WSRC, 1996d
HCA-4AA	72513.7	62942.5	308.6	WSRC, 1996d
HCH-1	72796.38	60923.42	284	WSRC, 1993
HCH-2	72519.61	60091.79	270.9	WSRC, 1993
HCH-3	71998.82	59917.33	264	WSRC, 1993

Appendix B-1: Locations of Sites within the Model Area (Continued)

Well ID	SRS Northing (ft)	SRS Easting (ft)	Surface Elevation (ft m.s.l.)	Reference[1]
HCH-4	72449.59	59139.93	269.9	WSRC. 1993
HCH-5	71810.36	59331.53	255	WSRC. 1996d
HIW-1BD	72564.6	58342.2	275.8	WSRC. 1996d
HIW-1MC	72500	58471.8	272.3	WSRC. 1996d
HIW-2A	73249.7	56753	276.3	WSRC. 1996d
HIW-2MC	73226.4	56698.4	269	WSRC. 1996d
HIW-4MC	73160.1	56570.1	263.4	WSRC. 1996d
HIW-5MC	73557.9	56498.9	266.1	WSRC. 1996d
HMD-1C	78731.7	56973.3	262.7	WSRC. 1996d
HMD-2C	79665.8	57269.7	259.3	WSRC. 1996d
HMD-3C	79578.7	57745.2	257.2	WSRC. 1996d
HMD-4C	79160.4	58188.5	248.5	WSRC. 1996d
HPC-1	70395.4	62493.6	293.5	WSRC, 1996d
HPT-1A	74847.1	60587	232.9	WSRC. 1996d
HPT-2A	75061.8	60200.5	257.8	WSRC. 1996d
HSB-PC	72119.31	55650.03	227.8	WSRC. 1996d
HSB-TB	72394	58696.1	267.1	WSRC. 1996d
HSB-65A	72436.2	58436	270.7	WSRC. 1996d
HSB-68A	71526.9	56892.1	247.4	WSRC, 1996d
HSB-69A	71549.4	56465.1	234.1	WSRC. 1996d
HSB-83A	71648.6	58606.1	234.9	WSRC. 1996d
HSB-84A	71586.2	56359.1	226.7	WSRC. 1996d
HSB-85A	73791.9	58943.4	292.1	WSRC. 1996d
HSB-86A	72520.2	55985.9	260	WSRC. 1996d
HSB-101C	72001.9	58604.4	256.3	WSRC. 1996d
HSB-103C	71593.9	58323.6	245.2	WSRC. 1996d
HSB-104C	71376.8	58082.6	245.5	WSRC. 1996d
HSB-105C	71447.3	57883.8	247.2	WSRC. 1996d
HSB-106C	71720.9	57651.5	250.7	WSRC. 1996d
HSB-107C	71698.5	57432	259.3	WSRC, 1996d
HSB-109C	71684.8	56895.6	259.4	WSRC. 1996d
HSB-110C	71779.3	56680.7	253.4	WSRC. 1996d
HSB-111C	71919.4	56501.9	253.7	WSRC. 1996d
HSB-112C	72156.4	56417.4	252.6	WSRC. 1996d
HSB-113C	72312.3	56160.4	258.7	WSRC, 1996d
HSB-115C	72653.2	56043.2	266.8	WSRC. 1996d
HSB-117A	72733.6	55170.1	234.8	WSRC. 1996d
HSB-118A	72696.4	55775.6	245	WSRC. 1996d
HSB-119A	73082.5	56100.2	254.8	WSRC. 1996d
HSB-120A	73395.1	56431.9	266	WSRC. 1996d
HSB-121A	72024.8	57389.6	272.3	WSRC. 1996d
HSB-122A	72195.9	57747.4	269.4	WSRC, 1996d
HSB-123A	72189.8	58124.8	263.6	WSRC. 1996d

Appendix B-1: Locations of Sites within the Model Area (Continued)

Well ID	SRS Northing (ft)	SRS Easting (ft)	Surface Elevation (ft m.s.l.)	Reference[1]
HSB-124A	72199.6	58514.6	263.9	WSRC. 1996d
HSB-132C	71472.4	58787.7	238.3	WSRC. 1996d
HSB-139A	71127.4	57365.4	231.5	WSRC. 1996d
HSB-140A	70050.3	56535.4	234	WSRC. 1996d
HSB-141A	71213.6	59168.7	252.6	WSRC. 1996d
HSB-142C	73119	53505.3	201.6	WSRC. 1996d
HSB-143C	73738.2	52773.2	220.1	WSRC. 1996d
HSB-144A	71892.1	56200.5	233.6	WSRC. 1996d
HSB-145C	71098.9	57769	233.7	WSRC, 1996d
HSB-146A	70478.9	58454	249.5	WSRC. 1996d
HSB-148C	70151.5	55344.2	248.9	WSRC. 1996d
HSB-151C	72997.9	54014.9	211.6	WSRC. 1996d
HSB-152C	72012	54346.7	212.1	WSRC. 1996d
HSL-6AA	72692.6	60555.7	274.6	WSRC. 1996d
HSL-8AA	72729.4	61113.8	286.7	WSRC. 1996d
IDB-2A	77284.4	75391.1	302.4	Harris. 1997
IDP-3A	85104.3	3778.11	282.2	WSRC. 1996d
IDQ-3A	80553.7	35854	203.2	WSRC, 1996d
KAC-9D	53197.8	42588.1	260.2	Harris, 1997
LAC-5DL	45365.4	51352	239.8	WSRC. 1996d
LAC-6DL	45272.8	51188.1	239.8	WSRC, 1996d
LAC-7DL	45097.1	51118.4	239.4	WSRC. 1996d
LAC-8DL	45096.6	51300.9	234	WSRC. 1996d
LCO-5A	44987	50866	230	WSRC, 1996d
LCO-5DL	44974.5	50887.5	230.3	WSRC, 1996d
LCO-8DL	45586.1	51380.6	243.4	WSRC, 1996d
LFW-10SB	83162.5	46137.5	168.4	WSRC. 1991e
LWN-1SB	68131.9	33690.8	282.5	WSRC, 1996d
LWN-2SB	66548.6	34739.1	231	WSRC. 1996d
LWN-3SB	66900.2	32092.1	245.7	WSRC. 1996d
LWR-2SB	71766	45998.8	248.1	WSRC. 1996d
LWR-3SB	71243.3	47068.9	249.1	WSRC. 1996d
LWR-4SB	70051.6	46749.6	293.8	WSRC. 1996d
LWR-9SB	71658.83	45406.62	238.2	WSRC. 1996d
M121A	62170.7	56819.9	303.7	WSRC. 1996d
MWD-1A	69592.8	75121.9	327.5	WSRC, 1996d
NPN-1A	66632.1	70856.2	335.9	WSRC. 1996d
OFS-1SB	74967.5	54032.6	261.6	Amidon. 1995
OFS-2SB	74671	53848	257.5	Amidon. 1995
OFS-3SB	74270	54579	258.1	Amidon. 1995
OFS-4SB	73874	55188	258.7	Amidon. 1995
OFS-5SB	73623	54298	228.7	Amidon, 1995
P-13TA	35600	60000	252.4	WSRC. 1996d

Appendix B-1: Locations of Sites within the Model Area (Continued)

Well ID	SRS Northing (ft)	SRS Easting (ft)	Surface Elevation (ft m.s.l.)	Reference[1]
P-14TA	72444.9	76439.6	294.4	WSRC, 1996d
P-18TA	67578.5	47652.7	296.9	WSRC, 1996d
P-19TA	55295.9	60034.6	297.4	WSRC, 1996d
P-20TA	56094.1	76768.1	287.7	WSRC, 1996d
P-21TA	24674.6	40739.2	207	WSRC, 1996d
P-22TA	20593.4	73555.3	215.4	WSRC, 1996d
P-23TA	48063.3	30931.3	181.5	WSRC, 1996d
P-24TA	43096.2	66565.2	313.3	WSRC, 1996d
P-25TA	52493.6	42261	265.1	WSRC, 1996d
P-26TA	71958.6	18051.5	152.2	WSRC, 1996d
P-27TA	70382	64022.9	274.1	WSRC, 1996d
P-28TA	79284.3	55441.1	285.6	WSRC, 1996d
PBF-3	58766.62	60380.36	316.65	Harris, 1997
PBF-4	58148.66	29985.13	208.1	Harris, 1997
PBF-5	53591.29	30319.43	240.6	Harris, 1997
PBF-6	55621.75	12814.48	92.5	Harris, 1997
PBF-7	55420.69	59568.97	285.42	Harris, 1997
PBF-8	55744.48	59812.89	292.01	Harris, 1997
PPC-1	42727.22	66137.83	313.3	Harris, 1997
RCP-1A	56968.1	74238.3	294.8	WSRC, 1996d
RSF-1	58505.3	74869.4	300.8	WSRC, 1996d
RSF-2	57670.4	74628.6	300.3	WSRC, 1996d
RSF-3	57621.4	75206.7	304.8	WSRC, 1996d
SDS-21	78951	67087	251	WSRC, 1993b
SDS-22	76887	66304	283	WSRC, 1993b
SSW-1	71223.25	33206.83	311.3	WSRC, 1989
SSW-2	72230.42	28236.98	167.3	WSRC, 1996d
SSW-3	70517.63	40532.31	178.7	WSRC, 1989
T18N1A	57015.7	45553.2	258.4	WSRC, 1996d
T18S1A	46111.5	43897.6	233.5	WSRC, 1996d
T18W1A	48773.1	40275.2	244.4	WSRC, 1996d
USGS-MP	98367.1	-8045.7	245	Falls, 1998
VG-1	11543.5	17064.2	156.6	Bechtel, 1982
VG-7	28828.3	5392.8	250.6	Bechtel, 1982
VG-8	-12412.6	22580.5	103.7	Bechtel, 1982
YSC-1A	78039.9	65438.93	268.9	WSRC, 1996d
YSC-1C	78186.24	65855.46	272.5	WSRC, 1996d
YSC-2A	78311.53	66100.08	281.7	WSRC, 1996d
YSC-3SB	77680	65920	277	WEGS, 1990
YSC-4A	77050.08	65883.5	287.5	WSRC, 1996d
YSC-5A	74295.9	67134.9	273	WSRC, 1996d

Notes:

Appendix B-1: Locations of Sites within the Model Area (Continued)

Well ID	SRS Northing (ft)	SRS Easting (ft)	Surface Elevation (ft m.s.l.)	Reference[1]

ft - feet

ft m.s.l. - feet above mean sea level

1 - Detailed description of references in Appendix D

Appendix B-2: Hydrostratigraphic Boundaries

		TCCZ		LAZ		GCU		GAU		MBCS	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
BGO-3A	288.7	198	91	189	100	131	158	122	167	41	248
BGO-5C	294.2	218	76	201	93						
BGO-6A	283.8	210	74	195	89	121	163	120	164		
BGO-6B	284.5	203	82	192	93	137	148	123	162		
BGO-8A	281.3	213	68	199	82	130	151	120	161		
BGO-9AA	282.8	224	59	211	72	135	148	125	158		
BGO-10A	299.1	209	90	207	92	131	168	124	175		
BGO-10AA	298.8	219	80	207	92	130	169	126	173		
BGO-12A	311.4	199	112	186	125	137	174	132	179		
BGO-14A	300.2	220	80	212	88	133	167	127	173		
BGO-16A	302.8	196	107	183	120	131	172	126	177		
BGO-18A	292.9	194	99	199	94	131	162	126	167		
BGO-20AA	280.9	206	75	194	87	125	156	114	167	43	238
BGO-25A	294.7	212	83	201	94	138	157	128	167		
BGO-26A	285.1	219	66	205	80	133	152	129	156		
BGO-27C	273.9	199	75	192	82						
BGO-29A	262.1	196	66	185	77	124	138	113	149		
BGO-31C	271.1	198	73	188	83						
BGO-33C	277.4	200	77	191	86						
BGO-35C	271.4	204	67	197	74						
BGO-37C	284.3	199	85	191	93						
BGO-39A	293.7	204	90	202	92	113	181	102	192	29	265
BGO-41A	298.3	217	81	208	90	138	160	131	167		
BGO-42C	295.9	216	80	209	87						
BGO-43AA	312.2	195	117	187	125	135	177	127	185		
BGO-44AA	283.3	222	61	199	84	131	152	120	163		
BGO-45A	276.9	207	70	201	76	134	143	130	147		
BGO-46B	263.4	199	64	193	70	128	135	126	137		
BGO-47A	264.8	198	67	190	75	131	134	125	140		
BGO-48C	274.7	198	77	192	83						
BGO-49A	269.1	201	68	192	77	119	150	115	154		
BGO-50A	253.5	194	60	184	70	133	121	129	125		
BGO-51AA	287.2	205	82	194	93	107	180	93	194	32	255
BGO-52AA	281.6	207	75	197	85	125	157	116	166	18	264
BGO-53AA	288.9	223	66	216	73	138	151	132	157	29	260
BGT-1	282.9	222	61	208	75						
BGT-2	276.4	213	63	198	78						
BGT-3	275.7	212	64	198	78	143	133	141	135	65	211
BGT-4	259.2	213	46	204	55	149	110				
BGT-5	225.7	214	12	206	20	154	72	146	80	72	154
BGT-6	282.2	218	64								
BGT-7	276.4	212	64	199	77						
BGT-8	249.3	221	28	217	32	149	100				
BGT-9	226.0	210	16	205	21	149	77	141	85	64	162
BGT-10	215.2	201	14	194	21	156	59	147	68		
BGT-11	222.5	ND	ND	223	0	151	72	146	77	68	155
BGT-12	284.2	225	59	214	70						
BGT-13	287.8	224	64	216	72						
BGT-14	280.7	215	66	209	72						
BGT-15	277.5	209	69	201	77	150	128				
BGT-16	**250.7**					**151**	**100**				

Appendix B-2: Hydrostratigraphic Boundaries (Continued)

		TCCZ		LAZ		GCU		GAU		MBCS	
Well ID	Surface Elevation (ft m.s.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g l.)
BGT-17	**240.7**					**150**	**91**				
BGT-18	216.5	abs.	abs.	217	0	162	55	147	70	55	162
BGT-20	159.5	abs.	abs.	abs.	abs	151	9	140	20	70	90
BGT-21	294.2	223	71	216	78						
BGT-22	281.0	231	50	216	65	126	155	114	167	53	228
BGT-23	270.0	216	54	210	60						
BGT-24	265.8	227	39	220	46						
BGT-25	264.8	229	36	224	41						
BGT-27	256.9	217	40	207	50	152	105				
BGT-28	258.3	216	42	194	64	156	102	150	108	48	210
BGT-29	243.0	219	24	215	28						
BGT-30	**219.0**					**147**	**72**	**141**	**78**		
BGT-31	308.8	220	89	215	94						
BGT-32	310.1	237	73	234	76						
BGT-33	290.4	239	51	223	67						
BGT-34	286.8	228	59	218	69						
BGT-35	267.7	217	51	212	56						
BGT-36	261.4	226	35	215	46	148	113				
BGT-37	251.6	222	30	215	37	133	119				
BGT-40	332.3	209	123	203	129						
BGT-41	328.4	224	104	219	109	149	179	142	186		
BGT-42	310.9	224	87	219	92						
BGT-43	277.1	205	72	201	76						
BGT-44	276.2	214	62	209	67						
BGT-45	285.3	218	67	209	76	150	135				
BGT-46	310.0	213	97	205	105	134	176	125	185		
BGT-47	317.3	214	103	210	107	137	180	128	189		
BGT-48	314.3	217	97	209	105						
BGT-49	297.3	222	75	214	83	135	162	126	171		
BGT-50	296.3	221	75	214	82	132	164	124	172		
BGT-51	272.6	193	80	186	87						
BGT-53	278.3	200	78	191	87	120	158	109	169	32	246
BGT-54	280.0	205	75	196	84						
BGT-56	262.9	182	81	175	88						
BGT-57	259.4	179	80	169	90						
BGT-58	285.8	192	94	190	96	112	174	103	183		
BGT-59	281.9	182	100	173	109						
BGT-60	291.4	186	105	176	115						
BGT-61	284.3	184	100	178	106	108	176	101	183		
BGT-62	282.0	190	92	176	106						
BGT-63	293.7	195	99	189	105						
BGT-63A	290.8	198	93	194	97						
BGT-64	283.3	195	88	188	95	123	160				
BGT-66	244.0	195	49	188	56						
BGT-67	242.0	186	57	174	69	135	107	128	115	27	215
BGX-1A	289.1	211	78	198	91	132	157	127	162		
BGX-2B	289.2	216	73	198	91	140	149	127	162		
BGX-4A	288.8	225	64	213	76	130	159	124	165		
BGX-7D	277.1	225	52	220	57	157	120	144	133		
BGX-9D	277.4	207	70	202	75	139	138	131	146		

Appendix B-2: Hydrostratigraphic Boundaries (Continued)

		TCCZ		LAZ		GCU		GAU		MBCS	
Well ID	Surface Elevation (ft m.s.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
BGX-11D	273.8	193	81	177	97	126	148	117	157		
BRR-1D	293.8	195	99								
BRR-3D	289.5	208	82	194	96						
BRR-6B	293.9	178	116	166	128	123	171	108	186		
BRR-7B	289.6	202	88	190	100	135	155	122	168		
BRR-8B	276.7	205	72	200	77	131	146	126	151		
CCP-1A	287.1	176	112	162	125						
CFD-1	268.8	188	81	179	90	111	158	107	162	-45	314
CFD-5	257.8	180	78	173	85	93	165	89	169	28	230
CFD-18	248.3	167	81	150	99	97	151	90	158	-4	253
CMP-30B	286.5	210	77	197	90	95	192	87	200	-10	297
CMP-32B	251.7	217	35	202	50	100	152	93	159		
CPC-1	285.1	166	120	156	129	96	190	87	199	-8	294
CRP-5DR	274.6	183	92	169	106	106	169				
CRP-9D	268.4	163	105	143.4	125	94	175	92	177		
CSD-4D	306.5	150	157	134	173						
FAC-1SB	312.2	224	88	217	95	149	163				
FCH-1	316.8	214	103	202	115	142	175	126	191	67	250
FCH-2	288.7	213	76	197	92	142	147	130	159	58	231
FCH-3	307.2	207	100	196	111	140	167	131	176	59	248
FCH-4	297.5	197	101	187	111	128	170	121	177	42	256
FCH-5	284.2	196	88	191	93	129	155	128	156	36	248
FCH-6	291.5	189	103	182	110	124	168	121	171	25	267
FIW-1MC	293.3	190	103	185	108	121	172				
FIW-2MA	290.5	189	102	180	111	121	170	117	174		
FNB-1A	282.4	208	74	202	80	151	131	138	145		
FNB-3A	282.2	211	71	208	75	146	136	140	142		
FSB-PC	230.8	161	70	157	74						
FSB-1TA	275.4	191	84	187	88	117	158	115	160	24	251
FSB-76A	291.5	abs.	abs.	abs.	abs.	121	171	117	175		
FSB-78A	270.5	163	108	147	124	105	166	100	171		
FSB-79A	216.1	173	43	164	52	103	113	100	116	18	198
FSB-87A	285.6	176	110	173	113	115	171	109	177		
FSB-89C	279.1	186	93	180	99						
FSB-91C	277.0	168	109	161	116						
FSB-93C	274.0	166	108	151	123						
FSB-95C	281.8	174	108	158	124						
FSB-96A	277.7	167	111	154	124	109	169	101	177		
FSB-97A	283.8	163	121	152	132	111	173	107	177		
FSB-98A	280.7	172	109	160	121	109	172	107	174		
FSB-99A	285.3	178	107	173	112	115	170	112	173		
FSB-100A	283.8	185	99	183	101	118	166	114	170		
FSB-101A	282.9	191	92	183	100	119	164	116	167		
FSB-112A	227.0	164	63	144	83	103	124	98	129		
FSB-113A	221.3	178	43	171	50	109	112	104	117	22	199
FSB-114A	250.0	178	72	173	77	114	136	110	140		
FSB-115C	205.8	181	25	165	41	101	105	86	120	6	200
FSB-116C	200.5	176	25	171	30						
FSB-120A	278.0	181	97	165	113	112	166	110	168		
FSB-121C	254.4	173	81	162	92						

Appendix B-2: Hydrostratigraphic Boundaries (Continued)

Well ID	Surface Elevation (ft m.s.l.)	TCCZ		LAZ		GCU		GAU		MBCS	
		Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
FSB-122C	216.0	164	52	148	68	104	112				
FSB-123C	236.3	183	53	172	64						
GAPWR-TW-1	219.0	151	68	143	76	87	132	55	164	-31	250
HAA-1TA	290.2	208	83	204	86	117	173	110	181		
HAA-2AA	291.4	190	102	186	106	125	167	119	173	30	262
HAA-3AA	274.5	191	84	179	96	128	147	123	152	10	265
HAA-4AA	299.2	202	97	194	106	125	175	119	181		
HAA-6AA	279.8	210	70	183	97	125	155	120	160	23	257
HC-12A	287.3	195	92	190	97						
HCA-4AA	308.6	234	75	230	79	124	185	117	192		
HCH-1	284.0	202	82	187	97	135	149	126	158	18	266
HCH-2	270.9	196	75	180	91	131	140	123	148	0	271
HCH-3	264.0	197	67	179	85	130	134	123	141		
HCH-4	269.9	193	77	183	87	123	147	114	156		
HCH-5	255.0	192	63	180	75	123	132	119	136	-10	265
HIW-1BD	275.8	205	71								
HIW-1MC	272.3	187	86	180	93						
HIW-2A	276.3	202	75	195	81	116	160	110	166		
HIW-2MC	269.0	199	70	194	76						
HIW-4MC	263.4	197	66	190	73	112	151				
HIW-5MC	266.1	184	82	178	88						
HMD-1C	262.7	229	34	226	37	139	124	127	136		
HMD-2C	259.3	222	37	216	43	143	116	138	121		
HMD-3C	257.2	223	34	218	39	154	103	149	108		
HMD-4C	248.5	224	25	220	29	153	96	141	108		
HPC-1	293.5	195	99	188	106	116	178	110	184	28	266
HPT-1A	232.9	ND	ND	ND	ND	119	114	115	118	53	180
HPT-2A	257.8	ND	ND	ND	ND	121	137	118	140	57	201
HSB-PC	227.8	188	40	178	50						
HSB-TB	267.1	207	60	199	68	110	157	106	161	9	258
HSB-65A	270.7	204	67	199	72	119	152	113	158		
HSB-68A	247.4	198	49	193	54	116	131	110	137		
HSB-69A	234.1	187	47	181	53	115	119	112	122		
HSB-83A	234.9	195	40	188	47	114	121	104	131	12	223
HSB-84A	226.7	205	22	181	46	119	108	111	116		
HSB-85A	292.1	204	88	200	92	126	166	119	173		
HSB-86A	260.0	185	75	178	82	112	148	109	151		
HSB-101C	256.3	195	61	189	67						
HSB-103C	245.2	195	50	181	64						
HSB-104C	245.5	194	52	185	61						
HSB-105C	247.2	190	57	183	64						
HSB-106C	250.7	192	59	184	67						
HSB-107C	259.3	199	60	191	68						
HSB-109C	259.4	203	56	189	70						
HSB-110C	253.4	192	61	188	65						
HSB-111C	253.7	188	66	172	82						
HSB-112C	252.6	191	62	186	67						
HSB-113C	258.7	188	71	174	85						
HSB-115C	266.8	209	58	197	70						
HSB-117A	234.8	216	19	192	43	123	112	117	118		

Appendix B-2: Hydrostratigraphic Boundaries (Continued)

Well ID	Surface Elevation (ft m.s.l.)	TCCZ		LAZ		GCU		GAU		MBCS	
		Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g l)
HSB-118A	245.0	183	62	173	72	119	126	114	131		
HSB-119A	254.8	213	42	195	60	115	140	111	144		
HSB-120A	266.0	203	63	196	70	112	154	110	156		
HSB-121A	272.3	197	75	184	88	113	159	109	163		
HSB-122A	269.4	188	81	177	92	110	159	108	161		
HSB-123A	263.6	196	68	186	78	114	150	108	156		
HSB-124A	263.9	abs.	abs.	abs.	abs.	118	146				
HSB-132C	238.3	163	75	158	80						
HSB-139A	231.5	190	42	179	53	119	113	115	117		
HSB-140A	234.0	194	40	181	53	111	123	105	129		
HSB-141A	252.6	181	72	167	86	119	134	113	140		
HSB-142C	201.6	abs.	abs.								
HSB-143C	220.1	198	22	179	41						
HSB-144A	233.6	186	48	179	55	109	125	104	130		
HSB-145C	233.7	184	50	175	59						
HSB-146A	249.5	174	76	163	87	119	131	112	138		
HSB-148C	248.9	187	62	171	78						
HSB-151C	211.6	193	19	183	29						
HSB-152C	212.1	198	14	186	26						
HSL-6AA	274.6	174	101	169	106	126	149	121	154	9	266
HSL-8AA	286.7	193	94	186	101	137	150	129	158		
IDB-2A	302.4	245	57	228	74	142	160	138	164	-13	316
IDP-3A	282.2	190	92	182	100	161	121	140	142	73	209
IDQ-3A	203.2	abs.	abs.	203	0	132	71	124	79	55	148
KAC-9D	260.2	170	91	159	102	95	165	89	171		
LAC-5DL	239.8										
LAC-6DL	239.8										
LAC-7DL	239.4										
LAC-8DL	234.0	207	27	196	38						
LCO-5A	230.0	150	80	141	89	78	152	66	164		
LCO-5DL	230.3										
LCO-8DL	243.4										
LFW-10SB	168.4	abs.	abs.	abs.	abs.	abs.	abs.	168	0	44	124
LWN-1SB	282.5	162	121	151	132	132	151	119	164		
LWN-2SB	231.0	168	63	151	80	90	141	82	149	11	220
LWN-3SB	245.7	165	81	156	90	96	150	89	157	12	234
LWR-2SB	248.1	177	71	167	81	146	102	131	117	17	231
LWR-3SB	249.1	178	72	162	88	95	154	86	163	12	238
LWR-4SB	293.8	178	116	165	129	104	190	96	198	7	287
LWR-9SB	238.2	179	59	161	77	110	128	108	130		
M121A	303.7	155	149	139	165	89	215	74	230	-5	309
MWD-1A	327.5	218	110	211	117	133	195	130	198	22	306
NPN-1A	335.9	235	101	224	112	110	226	105	231	2	334
OFS-1SB	261.6	196	66	186	76	129	133	126	136		
OFS-2SB	257.5	198	60	188	70	125	133	121	137		
OFS-3SB	258.1	196	62	185	73	125	133	120	138		
OFS-4SB	258.7	196	63	192	67	127	132	122	137		
OFS-5SB	228.7	189	40	178	51	122	107	117	112		
P-13TA	252.4	108	144	86	167	32	220	10	243	-103	355
P-14TA	294.4	213	81	203	92	139	155	131	163	26	269

Appendix B-2: Hydrostratigraphic Boundaries (Continued)

		TCCZ		LAZ		GCU		GAU		MBCS	
Well ID	**Surface Elevation (ft m.s.l.)**	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)	Elev. (ft m.s.l.)	Depth (ft b.g.l.)
P-18TA	296.9	175	122	167	130	91	206	86	211	-17	314
P-19TA	297.4	195	103	174	123	120	178	114	184	-56	353
P-20TA	287.7	161	127	152	136	84	204	75	213	-10	298
P-21TA	207.0	99	108	93	114	48	160	-24	231	-115	322
P-22TA	215.4	158	57	147	69	37	178	-19	234	-91	306
P-23TA	181.5	140	42	129	53	89	93	58	124	-4	186
P-24TA	313.3	193	121	181	132	115	198	99	214	-40	354
P-25TA	265.1	145	120	136	129	100	165	95	171	13	253
P-26TA	152.2			152	0	71	81	65	87	14	138
P-27TA	274.1	180	94	169	105	129	145	127	147	49	225
P-28TA	285.6	215	71	211	75	141	145	133	153	64	222
PBF-3	316.7	138	179	137	180	79	238	50	267	-23	340
PBF-4	208.1	153	55	129	79	66	142	41	167	-32	240
PBF-5	240.6	153	88	143	98	103	138	78	163	6	235
PBF-6	92.5	abs.	abs.	abs.	abs.	abs.	abs.	93	0	-2	95
PBF-7	285.4	184	101	174	111	118	168	114	172	-55	340
PBF-8	292.0	196	96	173	119	114	178	110	182	-44	336
PPC-1	313.3	187	126	168	145	120	193	106	208	-56	370
RCP-1A	294.8	152	143	140	155	83	212	78	217		
RSF-1	300.8	153	148	144	157						
RSF-2	300.3	172	128	163	137						
RSF-3	304.8	140	165	129	176						
SDS-21	251.0	205	47	199	53	163	89	148	104		
SDS-22	283.0	191	93	188	96	149	134	138	145		
SSW-1	311.3	195	116	175	136	126	185	123	188	12	300
SSW-2	167.3	abs.	abs.	167	0	109	59	96	72	-10	177
SSW-3	178.7	139	40	134	45	89	90	84	95		
T18N1A	258.4	135	123	121	138	82	177	74	185	-12	270
T18S1A	233.5	137	97	124	110	96	138	71	163	-4	238
T18W1A	244.4	164	81	139	106	94	150	84	160	-26	270
USGS-MP	245.0	178	67	172	73	133	112	113	132	80	165
VG-1	156.6	60	97	47	110	-1	158	-80	237	-198	355
VG-7	250.6	105	146	90	161	39	212	-32	283	-123	374
VG-8	103.7	24	80	6	98	-38	142	-117	221	-239	343
YSC-1A	268.9	210	59	199	70	159	110	154	115	69	200
YSC-1C	272.5	215	58	213	60	164	109	157	116		
YSC-2A	281.7	220	62	215	67	162	120	151	131		
YSC-3SB	277.0	211	66	205	72	149	128	140	137		
YSC-4A	287.5	223	65	214	74	160	128	145	143	87	201
YSC-5A	273.0	221	52	209	64	136	137	128	145		

Notes:
TCCZ - Tan Clay Confining Zone
LAZ - Lower Aquifer Zone
GCU - Gordon Confining Unit
GAU - Gordon Aquifer Unit
MBCS - Meyers Branch Confining System
ft m.s.l. - feet above mean sea level
ft b.g.l. - feet below ground level
Blank field indicates unit not penetrated
ND - Unit boundary not delineated
abs. - Unit absent

Appendix C-1. Permeability Values Recorded from Pumping Tests (Continued)

Pumped Well	Observation Well	Test Interval Top (ft b.g.l.)	Test Interval Bottom (ft b.g.l.)	Permeability (ft/day)	Analysis Method	Reference[1]
FSB-PC	FSB-25PC	75.1	125.0	0.80	Aqetsolv (Hantush leaky)	WSRC, 1995b
FSB-PC	FSB-50PC	75.1	125.0	1.40	Aqetsolv (Hantush leaky)	WSRC, 1995b
FSB-PC	FSB-79C	75.1	125.0	3.00	Aqetsolv (Hantush leaky)	WSRC, 1995b
FSB-PC	FSB-100PC	75.1	125.0	2.10	Aqetsolv (Hantush leaky)	WSRC, 1995b
FSB-PC	FSB-103C	75.1	125.0	3.60	Aqetsolv (Hantush leaky)	WSRC, 1995b
FSB-PC	FSB-106C	75.1	125.0	3.40	Aqetsolv (Hantush leaky)	WSRC, 1995b
FSB-PC	FSB-110C	75.1	125.0	1.20	Aqetsolv (Hantush leaky)	WSRC, 1995b
FSB-PC	FSB-150PC	75.1	125.0	1.30	Aqetsolv (Hantush leaky)	WSRC, 1995b
FSB-PD	FSB-25PD	37.3	81.0	46.40	Aqetsolv (Neuman method)	WSRC, 1995b
FSB-PD	FSB-50PD	37.3	81.0	62.50	Aqetsolv (Neuman method)	WSRC, 1995b
FSB-PD	FSB-100PD	37.3	81.0	48.30	Aqetsolv (Neuman method)	WSRC, 1995b
FSB-PD	FSB-150PD	37.3	81.0	49.20	Aqetsolv (Neuman method)	WSRC, 1995b
FSB-76A	FSB-76A	244.1	254.6	1.29	Jacob Semi-Logarithmic	Woodward-Clyde, 1985a
FSB-78A	FSB-78A	233.0	243.4	0.82	Jacob Semi-Logarithmic	Woodward-Clyde, 1985a
FSB-79A	FSB-79A	181.6	192.0	142.90	Jacob Semi-Logarithmic	Woodward-Clyde, 1985a
FSB-87A	FSB-87A	242.0	252.5	51.02	Jacob Semi-Logarithmic	Woodward-Clyde, 1985a
HPT-1A	DRB-6WW	127.0	178.0	1.47E-04	Hantush-Jacob	CH2M Hill, 1989
HPT-1A	HC-10A	127.0	178.0	1.26E-03	Hantush-Jacob	CH2M Hill, 1989
HPT-1A	HPT-2A	127.0	178.0	2.86E-04	Hantush-Jacob	CH2M Hill, 1989
HSB-PC	HSB-25PC	57.0	110.6	0.90	Hantush-Jacob	WSRC, 1995b
HSB-PC	HSB-50PC	57.0	110.6	1.30	Hantush-Jacob	WSRC, 1995b
HSB-PC	HSB-100PC	57.0	110.6	1.30	Hantush-Jacob	WSRC, 1995b
HSB-PC	HSB-136C	57.0	110.6	1.60	Hantush-Jacob	WSRC, 1995b
HSB-PC	HSB-137C	57.0	110.6	1.10	Hantush-Jacob	WSRC, 1995b
HSB-PC	HSB-150PC	57.0	110.6	1.20	Hantush-Jacob	WSRC, 1995b
HSB-65A	HSB-65A	197.5	208.2	1.74	Jacob Semi-Logarithmic	Woodward-Clyde, 1985b
HSB-68A	HSB-68A	189.4	199.9	1.13	Jacob Semi-Logarithmic	Woodward-Clyde, 1985b
HSB-83A	HSB-83A	158.9	169.7	10.48	Jacob Semi-Logarithmic	Woodward-Clyde, 1985b
HSB-84A	HSB-68A	150.8	162.0	33.80	Aqtesolv (Non-Leaky Theis)	
HSB-84A	HSB-69A	150.8	162.0	17.29	Aqtesolv (Non-Leaky Theis)	

Appendix C-1. Permeability Values Recorded from Pumping Tests (Continued)

Pumped Well	Observation Well	Test Interval Top (ft b.g.l.)	Test Interval Bottom (ft b.g.l.)	Permeability (ft/day)	Analysis Method	Reference[1]
HSB-84A	HSB-83A	150.8	162.0	39.72	Aqtesolv (Non-Leaky Theis)	
HSB-84A	HSB-86A	150.8	162.0	34.25	Aqtesolv (Non-Leaky Theis)	
HSB-84A	HSB-118A	150.8	162.0	39.12	Aqtesolv (Non-Leaky Theis)	
HSB-84A	HSB-139A	150.8	162.0	27.88	Aqtesolv (Non-Leaky Theis)	
HSB-85A	HSB-85A	221.0	231.0	8.72	Aqtesolv (Non-Leaky Theis)	
HSB-86A	HSB-86A	186.1	196.9	5.46	Aqtesolv (Non-Leaky Theis)	
HSB-101C	HSB-101C	80.0	90.0	1.68	Hantush and Jacob (1955) Leaky Artesian Solution	Evans, 1991
YSC-1A	YSC-1A	132.0	192.1	62.00	Cooper-Jacob	WEGS, 1990
YSC-1A	YSC-1A	132.0	192.1	37.00	Recovery	WEGS, 1990
YSC-1A	YSC-1A	132.0	192.1	22.00	Theis	WEGS, 1990
YSC-1A	YSC-1A	132.0	192.1	52.00	WHIP(Recovery)	WEGS, 1990
YSC-1A	YSC-1A	132.0	192.1	57.00	WHIP(Theis)	WEGS, 1990
YSC-1A	YSC-4A	132.0	192.1	40.00	Theis Non-Eq.	WEGS, 1990
YSC-1A	YSC-4A	132.0	192.1	43.00	WHIP(Theis)	WEGS, 1990
YSC-1A	YSC-4A	132.0	192.1	47.00	WHIP(Recovery)	WEGS, 1990
YSC-1A	YSC-4A	132.0	192.1	52.00	Recovery	WEGS, 1990

Notes:

ft b.g.l. - feet below ground level

ft/day - feet per day

1 - Detailed description of references in Appendix D

Appendix C-2. Permeability Values Recorded from Slug Tests

Well ID	Screen Top (ft b.g.l.)	Screen Bottom (ft b.g.l.)	Permeability (ft/day)	Solution Method	Test Type	Reference[1]
BGO-1D	48	68	0.31	Bouwer-Rice 1976	Falling Head	S&ME. 1988
BGO-3A	175	185	3.25142	Bouwer-Rice	Rising Head	Amidon. 1995
BGO-3A	175	185	5.191	Bouwer-Rice	Falling Head	Amidon. 1995
BGO-3D	51.7	71.8	0.14	Bouwer-Rice 1976	Falling Head	S&ME. 1988
BGO-5C	101	111	0.13	Hvorslev	Falling Head	S&ME. 1988
BGO-6A	166.3	176.3	0.77	Hvorslev	Falling Head	S&ME. 1988
BGO-8A	166	176	0.21	Hvorslev	Falling Head	S&ME. 1988
BGO-10A	178	188	0.16	Hvorslev	Falling Head	S&ME. 1988
BGO-10AA	208	218	0.43	Bouwer-Rice 1976	Falling Head	WSRC. 1992a
BGO-12A	195	205	0.005	Hvorslev	Falling Head	S&ME. 1988
BGO-14A	180.6	190.6	0.04	Hvorslev	Falling Head	S&ME. 1988
BGO-16A	190.3	200.3	0.15	Hvorslev	Falling Head	S&ME. 1988
BGO-18A	183.4	193.4	11.98	Hvorslev	Falling Head	S&ME. 1988
BGO-21D	45.3	65.3	0.79	Bouwer-Rice 1976	Falling Head	S&ME. 1988
BGO-23D	45	65	1.11	Bouwer-Rice 1976	Falling Head	S&ME. 1988
BGO-25A	180.6	190.6	0.5	Hvorslev	Falling Head	S&ME. 1988
BGO-41A	185	195	0.13	Bouwer-Rice 1976	Falling Head	WSRC, 1992a
BGO-42C	100	110	0.45	Bouwer-Rice 1976	Falling Head	WSRC, 1992a
BGO-43AA	240	250	0.86	Bouwer-Rice 1976	Falling Head	WSRC. 1992a
BGO-44AA	212	222.1	4.36	Bouwer-Rice 1976	Falling Head	WSRC, 1992a
BGO-45A	150	160	2.45	Bouwer-Rice 1976	Falling Head	WSRC, 1992a
BGO-46B	113	123	2.33	Bouwer-Rice 1976	Falling Head	WSRC. 1992a
BGO-47A	168	178	3.07	Bouwer-Rice 1976	Falling Head	WSRC. 1992a
BGO-48C	88	98	2.15	Bouwer-Rice 1976	Falling Head	WSRC. 1992a
BGO-49A	184	194	0.49	Bouwer-Rice 1976	Falling Head	WSRC, 1992a
BGO-50A	153	163	0.4	Bouwer-Rice 1976	Falling Head	WSRC.

Appendix C-2. Permeability Values Recorded from Slug Tests (Continued)

Well ID	Screen Top (ft b.g.l.)	Screen Bottom (ft b.g.l.)	Permeability (ft/day)	Solution Method	Test Type	Reference[1]
						1992a
BGO-51AA	248	263.6	0.7762	Bouwer-Rice 1976	Rising Head	Amidon, 1995
BGO-51AA	248	263.6	1.188	Bouwer-Rice 1976	Falling Head	Amidon, 1995
BGO-52AA	235	247.8	0.8996	Bouwer-Rice 1976	Rising Head	Amidon, 1995
BGO-52AA	235	247.8	8.15	Bouwer-Rice 1976	Falling Head	Amidon, 1995
BGO-53AA	240	250	1.11744	Bouwer-Rice 1976	Falling Head	Rust, 1996
BGX-1A	165	175.02	0.01	Bouwer-Rice 1976	Falling Head	WSRC, 1991a
BGX-2B	142	151.95	0.21	Bouwer-Rice 1976	Falling Head	WSRC, 1991a
BGX-4A	172	182	1.83	Bouwer-Rice 1976	Falling Head	WSRC, 1991a
BGX-7D	63	83.03	20.38	Bouwer-Rice 1976	Rising Head	WSRC, 1991a
BGX-9D	45	65.01	0.36	Bouwer-Rice 1976	Rising Head	WSRC, 1991a
CMP-30B	172.2	195.5	1.1	Bouwer Rice	Rising Head	WSRC, 1996c
CMP-30B	172.2	195.5	1.4	Bouwer Rice	Falling Head	WSRC, 1996c
FSB-89C	113	123	0.524	Hvorslev	Falling Head	WSRC, 1991d
FSB-91C	117.9	127.9	0.141	Hvorslev	Falling Head	WSRC, 1991d
FSB-93C	122	132	5.27	Hvorslev	Falling Head	WSRC, 1991d
FSB-97A	188	198	0.852	Hvorslev	Falling Head	WSRC, 1991d
FSB-101A	180	190	33.2	Hvorslev	Falling Head	Sirrine, 1987
FSB-112A	136	146	1.7	Bouwer-Rice 1976	Rising Head	WEGS, 1991
FSB-113A	130	140	0.62	Bouwer-Rice 1976	Rising Head	WEGS, 1991
FSB-114A	145	155	0.44	Bouwer-Rice 1976	Rising Head	WEGS, 1991
FSB-115C	32	42	0.36	Bouwer-Rice 1976	Rising Head	WEGS, 1991
FSB-116C	30	40	0.69	Bouwer-Rice 1976	Rising Head	WEGS, 1991
FSB-120A	169	179	0.65	Bouwer-Rice 1976	Rising Head	WEGS, 1991
FSB-121C	96	106	11	Bouwer-Rice 1976	Rising Head	WEGS, 1991
FSB-122C	46	56	2.6	Bouwer-Rice 1976	Rising Head	WEGS, 1991
FSB-123C	71	81	6.7	Bouwer-Rice 1976	Rising Head	WEGS,

Appendix C-2. Permeability Values Recorded from Slug Tests (Continued)

Well ID	Screen Top (ft b.g.l.)	Screen Bottom (ft b.g.l.)	Permeability (ft/day)	Solution Method	Test Type	Reference[1]
						1991
HAA-1TA	310	320	0.548	Bouwer-Rice 1976	Rising Head	WSRC. 1995a
HAA-1TA	310	320	0.786	Bouwer-Rice 1976	Falling Head	WSRC. 1995a
HAA-2AA	252	262	19.858	Bouwer-Rice 1976	Rising Head	WSRC. 1995a
HAA-2AA	252	262	30.6552	Bouwer-Rice 1976	Falling Head	WSRC. 1995a
HAA-3AA	258	268	0.3229	Bouwer-Rice 1976	Rising Head	WSRC. 1995a
HAA-3AA	258	268	0.504	Bouwer-Rice 1976	Falling Head	WSRC. 1995a
HAA-6AA	244	254	0.224	Bouwer-Rice 1976	Rising Head	WSRC. 1995a
HAA-6AA	244	254	0.2587	Bouwer-Rice 1976	Falling Head	WSRC. 1995a
HCA-4AA	265	275	13.1717	Bouwer-Rice 1976	Rising Head	WSRC. 1995a
HCA-4AA	265	275	13.78	Bouwer-Rice 1976	Falling Head	WSRC. 1995a
HSB-69A	141	151	8.79	Hvorslev	Rising Head	WSRC. 1991c
HSB-101C	80	90	4	Hvorslev	Falling Head	WSRC. 1991c
HSB-103C	76	86	3.1	Hvorslev	Falling Head	WSRC. 1991c
HSB-105C	85	95	4.3	Hvorslev	Falling Head	WSRC. 1991c
HSB-106C	82	92	24.4	Hvorslev	Falling Head	WSRC. 1991c
HSB-109C	81	91	0.952	Hvorslev	Falling Head	Sirrine. 1988
HSB-110C	72	82	0.709	Hvorslev	Falling Head	Sirrine. 1988
HSB-111C	103	113	1.7	Hvorslev	Falling Head	WSRC. 1991c
HSB-112C	102	112	4.2	Hvorslev	Falling Head	WSRC. 1991c
HSB-113C	97	107	0.992	Hvorslev	Falling Head	Sirrine. 1988
HSB-117A	140	150	0.16	Hvorslev	Falling Head	WSRC. 1991c
HSB-118A	144	154	12	Hvorslev	Falling Head	WSRC. 1991c
HSB-122A	85.8	94.8	6.8	Hvorslev	Falling Head	Sirrine. 1988
HSB-132C	60.2	69.2	0.22	Hvorslev	Rising Head	Sirrine. 1988
HSB-132C	60.2	69.2	0.28	Hvorslev	Falling Head	Sirrine. 1988
HSB-139A	134.4	143.4	3.82	Hvorslev	Falling Head	Sirrine. 1988
HSB-140A	143	153	12	Bouwer-Rice 1976	Rising Head	WEGS. 1991
HSB-141A	162	172	1.9	Bouwer-Rice 1976	Rising Head	WEGS. 1991

Appendix C-2. Permeability Values Recorded from Slug Tests (Continued)

Well ID	Screen Top (ft b.g.l.)	Screen Bottom (ft b.g.l.)	Permeability (ft/day)	Solution Method	Test Type	Reference[1]
HSB-142C	30	40	0.6	Bouwer-Rice 1976	Rising Head	WEGS, 1991
HSB-143C	41	51	2.4	Bouwer-Rice 1976	Rising Head	WEGS, 1991
HSB-144A	145	155	0.22	Bouwer-Rice 1976	Rising Head	WEGS, 1991
HSB-145C	59	69	0.38	Bouwer-Rice 1976	Rising Head	WEGS, 1991
HSB-146A	154	164	9.4	Bouwer-Rice 1976	Rising Head	WEGS, 1991
HSB-148C	80	90	1.8	Bouwer-Rice 1976	Rising Head	WEGS, 1991
HSB-151C	31	41	0.8	Bouwer-Rice 1976	Rising Head	WEGS, 1991
HSB-152C	29	59	0.8	Bouwer-Rice 1976	Rising Head	WEGS, 1991
HSL-6AA	246	266	4.2	Bouwer-Rice 1976	Falling Head	WSRC, 1995a
HSL-6AA	246	266	6.7602	Bouwer-Rice 1976	Rising Head	WSRC, 1995a
LAC-5DL	53.6	63.6	0.61	Bouwer-Rice 1976	Rising Head	WSRC, 1996a
LAC-6DL	52	62	1.33	Bouwer-Rice 1976	Rising Head	WSRC, 1996a
LAC-7DL	52	62	0.27	Bouwer-Rice 1976	Rising Head	WSRC, 1996a
LAC-8DL	43.6	53.6	0.74	Bouwer-Rice 1976	Rising Head	WSRC, 1996a
LCO-5A	190	200	0.1	Bouwer-Rice 1976	Rising Head	WSRC, 1996a
LCO-5DL	45.4	55.4	4.62	Bouwer-Rice 1976	Rising Head	WSRC, 1996a
LCO-8DL	55	65	12.17	Bouwer-Rice 1976	Rising Head	WSRC, 1996a
YSC-1C	65	75	2.4	Bouwer-Rice	Rising Head	WEGS, 1990

Notes:
ft b.g.l. - feet below ground level
ft/day - feet per day
1 - Detailed description of references in Appendix D

Appendix C-3. Permeability Values Recorded from Laboratory Tests

Well ID	Interval Top (ft b.g.l.)	Interval Bottom (ft b.g.l.)	Permeability-vertical (ft/day)	Permeability-horizontal (ft/day)	Reference[1]
BGO-3A	162	164	1.14E-05	2.10E-05	Amidon, 1995
BGO-3A	266.1	267	1.40E-04	2.30E-04	Amidon, 1995
BGO-9AA	62	63.5	5.68E-05	2.07E-04	WSRC, 1992
BGO-9AA	137.4	137.7	1.38E-01	1.00E-01	Core Laboratories, 1995
BGO-9AA	142	142.3	2.27E-02	2.69E-02	Core Laboratories, 1995
BGO-9AA	158.7	158.8	3.49E-01	2.08E-02	Core Laboratories, 1995
BGO-9AA	222	223.5	7.67E-05	1.76E-03	WSRC, 1992a
BGO-10A	220	221.5	3.12E-06	5.96E-05	WSRC, 1992a
BGO-20AA	268	270	4.26E-06	1.22E-02	RUST, 1996
BGO-39A	280.5	282.5	1.36E-03	6.53E-03	RUST, 1996
BGO-41A	88	90	9.66E-02	8.52E-04	WSRC, 1992a
BGO-41A	164	166	2.84E-05	3.69E-04	WSRC, 1992a
BGO-43AA	185	187	8.80E-06	2.44E-05	WSRC, 1992a
BGO-44AA	226	227.5	3.41E-02	2.36E-01	WSRC, 1992a
BGO-45A	75	76.8	5.40E-05	7.10E-05	WSRC, 1992a
BGO-45A	144	145	2.04E-04	1.28E-04	WSRC, 1992a
BGO-47A	145.5	147	3.41E-03	5.68E-03	WSRC, 1992a
BGO-49A	75	77	3.70E-08	5.20E-05	WSRC, 1992a
BGO-51AA	298	299.75	2.27E-05	1.11E-05	Amidon, 1995
BGO-53AA	265	267	2.27E-05	2.84E-05	RUST, 1996
BGT-9	72	74	8.24E-04	1.70E-03	RUST, 1996
BGT-9	80	82	8.24E-04	3.12E-03	RUST, 1996
BGT-11	70	71	3.12E-04	9.90E-04	RUST, 1996
BGT-11	179.8	179.8	1.16E-04	1.22E-04	RUST, 1996
BGT-18	175	177	5.96E-05	1.56E-04	RUST, 1996
BGT-18	192	194	1.99E-03	4.54E-03	RUST, 1996
BGT-22	55	57	5.68E-06	3.12E-05	RUST, 1996
BGT-22	165	167	8.52E-04	1.85E-02	RUST, 1996
BGT-22	275	276	3.41E-05		RUST, 1996
BGT-28	207.3	208.7	7.10E-05	7.10E-04	RUST, 1996
BGT-47	108	109	2.84E-03		RUST, 1996
BGT-47	178	179	5.68E-03	1.68E-02	RUST, 1996
BGT-53	88	90	5.11E-05	1.70E-05	RUST, 1996
BGT-53	314	315.6	1.42E-05	1.33E-05	RUST, 1996
BGT-61	102	104	1.42E-05	4.26E-05	RUST, 1996
BGT-61	178	179.1	7.67E-06	8.52E-06	RUST, 1996
BGT-67	57	59	6.82E-02	3.41E-03	RUST, 1996
BGT-67	112	113	7.67E-05	1.16E-05	RUST, 1996
BGX-1A	80	82	3.41E-06	2.53E-05	WSRC, 1991a
BGX-2B	75	77	4.26E-06	1.99E-05	WSRC, 1991a
BGX-2B	156	156.8	1.85E-05	3.98E-05	WSRC, 1991a
BGX-4A	65	67	8.24E-06	1.70E-05	WSRC, 1991a
BGX-7D	123	124.5	6.53E-05		WSRC, 1992a

Appendix C-3. Permeability Values Recorded from Laboratory Tests (Continued)

Well ID	Interval Top (ft b.g.l.)	Interval Bottom (ft b.g.l.)	Permeability-vertical (ft/day)	Permeability-horizontal (ft/day)	Reference[1]
BGX-9D	70	70.8	9.66E-05	3.41E-04	WSRC, 1991a
BGX-9D	102.5	104.5	1.25E-04	4.54E-04	WSRC, 1992a
BGX-11D	94	96	1.14E-03		WSRC, 1992a
BGX-11D	154	156	1.87E-05	9.09E-05	WSRC, 1992a
CPC-1	137.3	137.6	3.42E+00	1.48E+00	Core Laboratories, 1995
FAC-1SB	170	172	3.12E-05	2.64E-04	WSRC, 1992b
FCH-1	54.8	56.3	3.69E-02	1.09E-01	WSRC, 1993
FCH-1	104.8	107.8	2.06E-05		WSRC, 1993
FCH-1	145.8	146.8	8.78E-04	1.17E-03	WSRC, 1993
FCH-1	169.8	170.8	1.02E-03		WSRC, 1993
FCH-1	208.8	211.8	2.07E-05	2.06E-05	WSRC, 1993
FCH-1	260.3	261.8	7.29E-02		WSRC, 1993
FCH-2	57.9	59.4	9.46E-05	2.25E-04	WSRC, 1993
FCH-2	80.1	83.1	2.26E-05		WSRC, 1993
FCH-2	135.7	138.7	1.94E-05	2.55E-05	WSRC, 1993
FCH-2	150.1	153.1	2.24E-05		WSRC, 1993
FCH-2	205.7	208.7	2.38E-05	2.16E-05	WSRC, 1993
FCH-2	229.4	230.9	1.60E-04		WSRC, 1993
FCH-3	40.8	41.9	1.46E-04	2.90E-04	WSRC, 1993
FCH-3	104.8	107.8	6.64E-05		WSRC, 1993
FCH-3	130.9	132.2	1.52E-03	1.60E-03	WSRC, 1993
FCH-3	174.8	176	1.55E-03		WSRC, 1993
FCH-3	199.2	202.2	6.36E-05	6.90E-05	WSRC, 1993
FCH-3	265.1	266.2	2.05E-04		WSRC, 1993
FCH-4	33.1	34.7	9.20E-05	2.24E-04	WSRC, 1993
FCH-4	103.9	106.9	2.98E-05		WSRC, 1993
FCH-4	120	122.5	1.62E-05	2.11E-05	WSRC, 1993
FCH-4	174.9	177.4	1.86E-05		WSRC, 1993
FCH-4	190.5	193.5	2.67E-05	3.27E-05	WSRC, 1993
FCH-4	262.7	264.3	1.58E-04		WSRC, 1993
FCH-5	90	93	3.01E-05		WSRC, 1993
FCH-5	122.2	124.2	1.10E+00	1.52E+00	WSRC, 1993
FCH-5	160	162	1.31E+00		WSRC, 1993
FCH-5	191.2	194.2	2.76E-05	3.24E-05	WSRC, 1993
FCH-5	259	259.5	1.15E-04		WSRC, 1993
FCH-6	105.7	108.2	1.86E-04		WSRC, 1993
FCH-6	170.7	171.7	1.11E-03		WSRC, 1993
FCH-6	268.2	269.7	9.40E-04		WSRC, 1993
FIW-1MC	104	106	4.30E-05	1.50E-03	AT&E, 1992
FIW-2MA	103.5	105.5	3.70E-05	2.30E-02	AT&E, 1992
FIW-2MA	171.2	172	2.10E-05	4.30E-05	AT&E, 1992
FSB-89C	97	97.7	8.83E-05		AT&E, 1987
FSB-91C	110	110.7	5.40E-05		AT&E, 1987

Appendix C-3. Permeability Values Recorded from Laboratory Tests (Continued)

Well ID	Interval Top (ft b.g.l.)	Interval Bottom (ft b.g.l.)	Permeability-vertical (ft/day)	Permeability-horizontal (ft/day)	Reference[1]
FSB-96A	117	119.5		8.43E-04	RUST, 1994
FSB-96A	172	173		1.05E-05	RUST, 1994
FSB-97A	126.33	127.08	1.15E-04		AT&E, 1987
FSB-97A	127.5	128.25	1.87E-05		AT&E, 1987
FSB-101A	166.5	167	3.81E-06		AT&E, 1987
FSB-114A	138.5	140		5.96E-05	WEGS, 1991
FSB-120A	168	168.4		8.50E-03	WEGS, 1991
FSB-122C	70	72	9.00E-04		WEGS, 1991
HCH-1	55	58	2.28E-01	2.58E-01	WSRC, 1993
HCH-1	155	156.5	4.32E-02	1.01E-01	WSRC, 1993
HCH-1	270	273	4.54E-05	5.42E-05	WSRC, 1993
HCH-2	65	68	1.37E-01	1.79E-01	WSRC, 1993
HCH-2	145	148	1.47E-04	1.76E-04	WSRC, 1993
HCH-2	276.3	278	3.12E-04	4.63E-04	WSRC, 1993
HCH-3	85	88	1.54E-03	2.09E-03	WSRC, 1993
HCH-3	140	141.5	1.10E-03	1.16E-03	WSRC, 1993
HCH-3	255	258	4.80E-03	1.10E-02	WSRC, 1993
HCH-4	80	83	7.10E-05	8.80E-05	WSRC, 1993
HCH-4	230	231.6	2.52E-04	3.46E-04	WSRC, 1993
HCH-5	140	142.5	1.23E-01	1.58E-01	WSRC, 1993
HCH-5	271.6	273.4	2.75E-04	3.24E-04	WSRC, 1993
HIW-1MC	79	81	5.40E-04	1.40E-02	AT&E, 1992
HIW-2A	78	80	1.02E-05	1.14E-03	RUST, 1994
HIW-2A	165	165.4	2.84E-04	3.41E-04	RUST, 1994
HMD-1C	132	134	1.33E-06	5.96E-06	WSRC, 1991b
HMD-2C	117	118.6	1.14E-06	5.40E-06	WSRC, 1991b
HMD-3C	107.3	108.6	1.90E-03	3.41E-03	WSRC, 1991b
HMD-4C	29	31	9.09E-03	7.67E-02	WSRC, 1991b
HSB-TB	112	112.6	5.30E-01	1.97E-01	Core Laboratories, 1995
HSB-TB	127	127.3	1.40E-01	5.29E-01	Core Laboratories, 1995
HSB-TB	151	151.3	4.00E-02	1.00E-01	Core Laboratories, 1995
HSB-TB	154.4	154.6		1.73E+00	Core Laboratories, 1995
HSB-69A	120	120.8	1.52E-04		AT&E, 1988
HSB-107C	60.9	62	1.75E-04		WSRC, 1990
HSB-117A	111.67	112.34	1.81E-03		AT&E, 1988
HSB-118A	128	129	1.57E-05		WSRC, 1991c
HSB-119A	141.1	141.5	9.34E-04		WSRC, 1991c
HSB-120A	155	155.5	2.72E-03		WSRC, 1991c
HSB-121A	164	165	7.51E-05		WSRC, 1991c
HSB-122A	65	65.5	7.40E-04		WSRC, 1991c
HSB-122A	161	161.5	1.79E-05		WSRC, 1991c
HSB-123A	150.5	151.5	6.69E-04		WSRC, 1991c
HSB-139A	115	115.6	2.20E-04		AT&E, 1988

Appendix C-3. Permeability Values Recorded from Laboratory Tests (Continued)

Well ID	Interval Top (ft b.g.l.)	Interval Bottom (ft b.g.l.)	Permeability-vertical (ft/day)	Permeability-horizontal (ft/day)	Reference[1]
HSB-140A	124	126	1.64E-04		WEGS. 1991
HSB-146A	131	132	3.40E-04		WEGS. 1991
HSB-148C	66	68	1.09E-03		WEGS. 1991
IDP-3A	261.25	262.75	3.41E-02		Law Engineering. 1988
IDQ-3A	49	51	2.04E-04		Law Engineering. 1988
IDQ-3A	75	77	7.83E-03		Law Engineering. 1988
IDQ-3A	172	174	4.83E-05		Law Engineering. 1988
LCO-5A	18.1	19.9	9.94E-04	3.41E-03	WSRC. 1996a
MWD-1A	115.5	116	7.04E-05	2.69E-04	AT&E. 1988
OFS-1SB	67	68.65	3.41E-05		Amidon. 1995
OFS-2SB	108	108.3		3.60E-02	Core Laboratories. 1995
OFS-2SB	114	114.2	7.60E-02	1.32E-03	Core Laboratories. 1995
OFS-3SB	63	65	6.82E-05	1.70E-01	Amidon. 1995
OFS-3SB	135	137	4.80E-06	8.00E-06	Amidon. 1995
OFS-4SB	25.2	25.5		6.04E+00	Core Laboratories. 1995
OFS-4SB	45	47	6.25E-04	5.40E-03	Amidon. 1995
OFS-4SB	47.5	47.8		7.50E-01	Core Laboratories. 1995
OFS-4SB	56	56.3	2.77E+01	5.80E+00	Core Laboratories. 1995
OFS-4SB	78	78.4		2.17E-01	Core Laboratories. 1995
OFS-4SB	85.6	86	1.60E-03		Core Laboratories. 1995
OFS-4SB	98.4	98.75	5.37E-03	1.80E-01	Core Laboratories, 1995
OFS-4SB	109	109.35	1.89E-01		Core Laboratories. 1995
OFS-4SB	114.5	115	1.93E-03		Core Laboratories. 1995
OFS-4SB	126.4	126.7		2.49E+00	Core Laboratories. 1995
OFS-4SB	135	136.5	1.14E-05	6.53E-05	Amidon, 1995
OFS-4SB	143	143.3		7.72E+00	Core Laboratories. 1995
OFS-4SB	167	167.3		2.41E+01	Core Laboratories. 1995
OFS-4SB	175.7	176		3.18E+01	Core Laboratories. 1995
OFS-5SB	27	28.9	1.42E+00	1.42E+00	Amidon. 1995
OFS-5SB	56.5	56.8		1.11E+01	Core Laboratories. 1995
OFS-5SB	108	108.3	4.27E-01	1.22E-01	Core Laboratories. 1995
OFS-5SB	108.6	109.6	4.50E-06	1.79E-05	Amidon, 1995
OFS-5SB	129.5	129.8	3.62E+01	2.92E+01	Core Laboratories. 1995
OFS-5SB	158.2	159.2		3.26E+01	Core Laboratories. 1995
P-18TA	180	182	7.60E-05	5.60E-05	Bledsoe, 1987
P-18TA	261	263	3.90E-02	8.80E-02	Bledsoe. 1987
P-18TA	410	412	9.00E-05	1.00E-04	Bledsoe. 1987
P-18TA	643	645	6.80E-05		Bledsoe. 1987
P-19TA	190	192.9	3.40E-05	7.90E-03	Bledsoe. 1987
P-19TA	282	283	9.60E-03	9.90E-02	Bledsoe. 1987
P-19TA	355	358	3.90E-05	5.90E-05	Bledsoe. 1987
P-19TA	495	497	8.50E-05	6.50E-03	Bledsoe. 1987
P-19TA	548	550	1.90E-02	7.90E-03	Bledsoe. 1987

Appendix C-3. Permeability Values Recorded from Laboratory Tests (Continued)

Well ID	Interval Top (ft b.g.l.)	Interval Bottom (ft b.g.l.)	Permeability-vertical (ft/day)	Permeability-horizontal (ft/day)	Reference[1]
P-21TA	160	162	1.90E-03	1.70E-02	PSI, 1986
P-21TA	325	327	3.40E-01	1.50E+00	PSI, 1986
P-21TA	380	382	5.40E-02	6.80E-01	PSI, 1986
P-21TA	495	497	6.30E-04	7.70E-04	PSI, 1986
P-21TA	522	524	1.80E-05	2.80E-05	PSI, 1986
P-21TA	560	562	9.40E-05	8.50E-05	PSI, 1986
P-22TA	61	63	4.80E-04	9.70E-04	PSI, 1986
P-22TA	140	142	3.70E-04	1.90E-04	PSI, 1986
P-22TA	331	333	1.40E-04	1.20E-04	Bledsoe, 1987
P-22TA	390	392	1.02E-03		PSI, 1986
P-22TA	612	614	1.20E-04	2.80E-04	PSI, 1986
P-23TA	97	99	3.60E-04		Bledsoe, 1987
P-23TA	185	187	9.60E-05	1.10E-04	Bledsoe, 1987
P-23TA	224	226	4.20E-05	3.60E-05	Bledsoe, 1987
P-23TA	301	303	3.40E-05	1.10E-01	Bledsoe, 1987
P-23TA	361	363	9.60E-04		Bledsoe, 1987
P-23TA	401	403	1.10E-04	2.40E-04	Bledsoe, 1987
YSC-1A	65	67	7.38E-05	8.24E-05	WEGS, 1990
YSC-1A	113.1	113.7	1.48E-04	4.54E-05	WEGS, 1990
YSC-1C	59	60.9	1.25E-05	5.96E-04	WEGS, 1990
YSC-1C	113	114.5	2.58E-04	3.98E-05	WEGS, 1990
YSC-2A	121.8	122.6	2.61E-06	0.00E+00	WEGS, 1990
YSC-3SB	69	71	1.28E-05	1.45E-05	WEGS, 1990
YSC-3SB	127	128	4.54E-06	5.11E-05	WEGS, 1990
YSC-4A	71.3	72	1.73E-03	8.80E-05	WEGS, 1990
YSC-4A	130.3	130.8	1.82E-03	0.00E+00	WEGS, 1990
YSC-4A	140	141.1	2.67E-06	0.00E+00	WEGS, 1990
YSC-5A	54	55	1.62E-05	4.26E-05	WEGS, 1990
YSC-5A	108.3	108.6	1.16E-04	5.34E-02	Core Laboratories, 1995
YSC-5A	110.3	110.6	1.43E-01	1.88E-01	Core Laboratories, 1995
YSC-5A	136	137	1.39E-03	1.59E-05	WEGS, 1990

Notes:

ft b.g.l. - feet below ground level

ft/day - feet per day

1 - Detailed description of references in Appendix D

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Appendix E-1. Stream Base Flow Estimates Based on USGS Gauging Station Data

Groundwater flow in upper aquifers at the Savannah River Site is recharge driven. with streams intercepting flow from higher elevations. Nearly all recharge within the CKLP reactor region discharges to streams within or bounding the same area. usually the nearest stream. For this type of groundwater flow system. recharge and discharge estimates. coupled with head measurements and confining unit leakance estimates, define the overall horizontal conductivities of upper aquifers required to calibrate a numerical flow model. Because conductivity data at the model scale are typically non-existent. stream base flow estimates are important model calibration targets. In this appendix, simple hydrograph separation techniques are used to estimate the long-term average rate of groundwater discharge to certain stream reaches within the CKLP reactor area.

The U. S. Geological Survey has monitored stream flows at numerous locations across the Savannah River Site for decades. The data are published annually for the preceding water year (Cooney and others, 1998, for example), and made available electronically from the United States NWIS-W data retrieval web site (http://h2o-nwisw.er.usgs.gov/nwis-w/US/). Figure E-1 illustrates the location and identification number of each USGS gauging station. Industrial discharges from SRS operations are monitored near outfalls by the USGS. separate from NPDES outfall monitoring conducted by SRS. Figures E-2, E-3 and E-4 show the relationship between USGS and NPDES gauging stations for the General Separations Area/C-Area, K-Area , and L- and P-Areas. respectively.

Given the locations of the USGS gauging stations, regional scale base flows are most easily estimated for the stream reaches and wetland areas enclosed by the polygons depicted in Figure E-5. For example, base flow between the headwaters of Meyers Branch and Road 9 is more conveniently estimated than base flow over the entire reach, because there is not a gauging station on Meyers Branch just above its confluence with Steel Creek. Similarly, base flow will be estimated for portions of Upper Three Runs and Steel Creek. On the other hand, gauging stations are located where Pen Branch and Fourmile Branch enter the Savannah River Swamp, so base flow for the entire drainage can be conveniently estimated.

Figure E-6 is an example hydrograph produced from USGS data for the two gauging stations located on Meyers Branch for water years 1993 through 1996. Station 021973561 is located at Road 9 and station 02197354 monitors the P007 outfall. Discharges to P007 are small relative to the total flow at Road 9. Not surprisingly. the downstream data exhibits a seasonal variation with elevated average flows occurring from late fall through early spring. Over shorter periods, individual rainfall events are readily observed as a step increase in daily flow followed by an exponential decline. Presumably these peaks are due to direct precipitation, surface runoff and subsurface stormflow, and not reflective of base flow.

Because downstream USGS gauging stations measure total stream flow, the base flow component must be separated from other contributors to a hydrograph of total flow. These include the direct precipitation, surface runoff and subsurface stormflow components mentioned above, as well as process water discharges to outfalls. Shirmohammadi and others (1984) observed that "daily values of precipitation and streamflow are not sufficient for detailed hydrograph analysis using traditional hydrograph separation techniques" and developed an approximate method for partitioning daily total streamflow data, such as that available from the USGS for SRS streams. Hydrograph separation for this project is accomplished with a simplified version of the approach of Shirmohammadi and others (1984). The following steps are applied to the time series of daily total stream flow:

1) Compute the average, F_{avg}, of the downstream flow, F

2) Subtract outfall flows from the downstream flow leaving "natural" flow components, $F_{natural}$. For Steel Creek and Upper Three Runs, flow entering the polygonal area of interest from upstream is also subtracted.

3) Remove the remaining direct precipitation, surface runoff and subsurface stormflow components by creating a "clipped" time series, $F_{base\ flow}$, according to

   $$F_{base\ flow} = \min[F_{natural}, 1.05 \times \max(F_{natural,\ previous}, F_{avg})]$$

4) Smooth the base flow component, $F_{base\ flow}$, over 4 water years, 1993 to 1996, for easier visualization using a running digital filter:

   $$F_{smooth} = (F_{base\ flow,i-1} + F_{base\ flow,i} + F_{base\ flow,i+1})/3$$

5) Average the smoothed base flow component, F_{smooth}, over the 4 water years from 1993 to 1996, producing $F_{smthavg}$.

The third step is based on the assumption that the base flow component responds slowly to rainfall events, and therefore cannot increase very rapidly from one day to the next (5% or less). No restriction on the rate of decrease is imposed. The fourth step does not affect the average computed in the fifth step.

The maximum rate of base flow increase, specified in step 3, was selected according to the recommendations of Linsley and others (1982, chapter 7). As a rule of thumb, the duration of direct runoff following the end of a rainfall is approximately $A^{0.2}$ days, where A is the drainage area in square miles (Linsley and others, 1982, equation 7-4). Pen Branch has a drainage area of 21 square miles resulting in runoff terminating after about 2 days. The drainage area of Fourmile Branch is 22 square miles yielding essentially the same duration. Taking these streams as representative, base flow should typically depart from total flow at the start of a rainfall event and rejoin the total flow after 2 days plus the duration of the rain. The total time of departure would be roughly 2 to 3 days. However, inspection of several individual rainfall events in comparison to the qualitative guidelines of Linsley and others (1982, Figure 7-5) suggests that runoff often lasts longer, sometimes up to roughly 6 days following a heavy rain. The maximum rate of base flow increase was set to 1.05 to yield a 2 to 6 day duration. Figure E-6 shows a sample segment of total and estimated base flow for Meyers Branch.

Applying the above procedure to the appropriate data for each drainage basin yields the results illustrated in Figures E-7 through E-12. In these figures, the upper plots (a) show the reference downstream flow and any outfall or upstream flows. Additional detail on the more significant outfall flow rates is provided by Figures E-13 through E-20. Note that generally outfall and upstream flows form a large component of the downstream flow. The curves (b) at the bottom of Figures E-6 through E-11 show the "base flow", "smooth" and "smthavg" components as defined in steps 3) to 5) above.

Table E-1 summarizes the bottom line results. The appropriate base flow target for CKLP model calibration is gotten by multiplying the base flow estimate for the stream reach by the fraction of the reach contained within the model domain. For Upper Three Runs between Road C and Road A, which lies on the CKLP model boundary, a reasonable assumption is that each side contributes equally. The main branch of Meyers Branch forms a boundary of the model, but a major tributary just south of Dunbarton Road is totally outside the model domain. Overall, perhaps 1/3 of this reach lies within the model. Far more uncertain is the fraction of base flow to the larger Upper Three Runs reach that should be attributed to groundwater from within the model: 1/4 is suggested in Table E-1. The Steel Creek estimate is negative and indicates a losing reach, presumably reflecting artificial flows to L-Lake to maintain the current lake level.

The stated accuracy of the various raw USGS gauging station data is typically "good" (<10% error 95% of the time), "fair" (<15% error 95% of the time) or "poor" (less than "fair" accuracy) (Cooney and others, 1998, p. 16). Uncertainty in the long-term average flows ultimately used in this analysis are much smaller than uncertainty in a daily flow. Larger contributors to overall uncertainty are biases in the hydrograph separation procedure, and the estimated fraction of the analyzed reach that lies within the model domain. The uncertainty of the results summarized in Table E-1 can be estimated by considering different values for the assumed maximum rate of base flow increase. As shown by Table E-2, the base flow estimates appear to have an uncertainty around plus or minus 10% due to uncertainty in the chosen rate. Biases in hydrograph separation technique might add another 5 to 10%. For example, base flow continues to decrease during flood conditions before ascending. The hydrograph separation technique used here allows baseflow to increase immediately, and might produce slightly high estimates. Some of the model calibration targets contain added uncertainty in the amount that should be partitioned to the model domain. Overall, the baseflow targets may have an uncertainty of 15 to 25%.

References

Cooney, T. W., P. A. Drewes, K. H. Jones, J. W. Gissendanner and B. W. Church, 1998, Water resources data – South Carolina, Water year 1997, Volume 1, U. S. Geological Survey Water-Data Report SC-97-1.

Linsley, R. K. Jr., M. A. Kohler and J. L. H. Paulhus, 1982, Hydrology for engineers, 3rd edition, McGraw-Hill, New York.

Shirmohammadi, A., W. G. Knisel and J. M. Sheridan, 1984, An approximate method for partitioning daily streamflow data, Journal of Hydrology, v74, p. 335-354.


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2197310
21973012
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2197331
2197334
2197340
2197338
2197339
21973405
21973424
2197342
21973426
2197345
21973455
21973471
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21973515
2197354
2197351
21973525
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2197353
21973537
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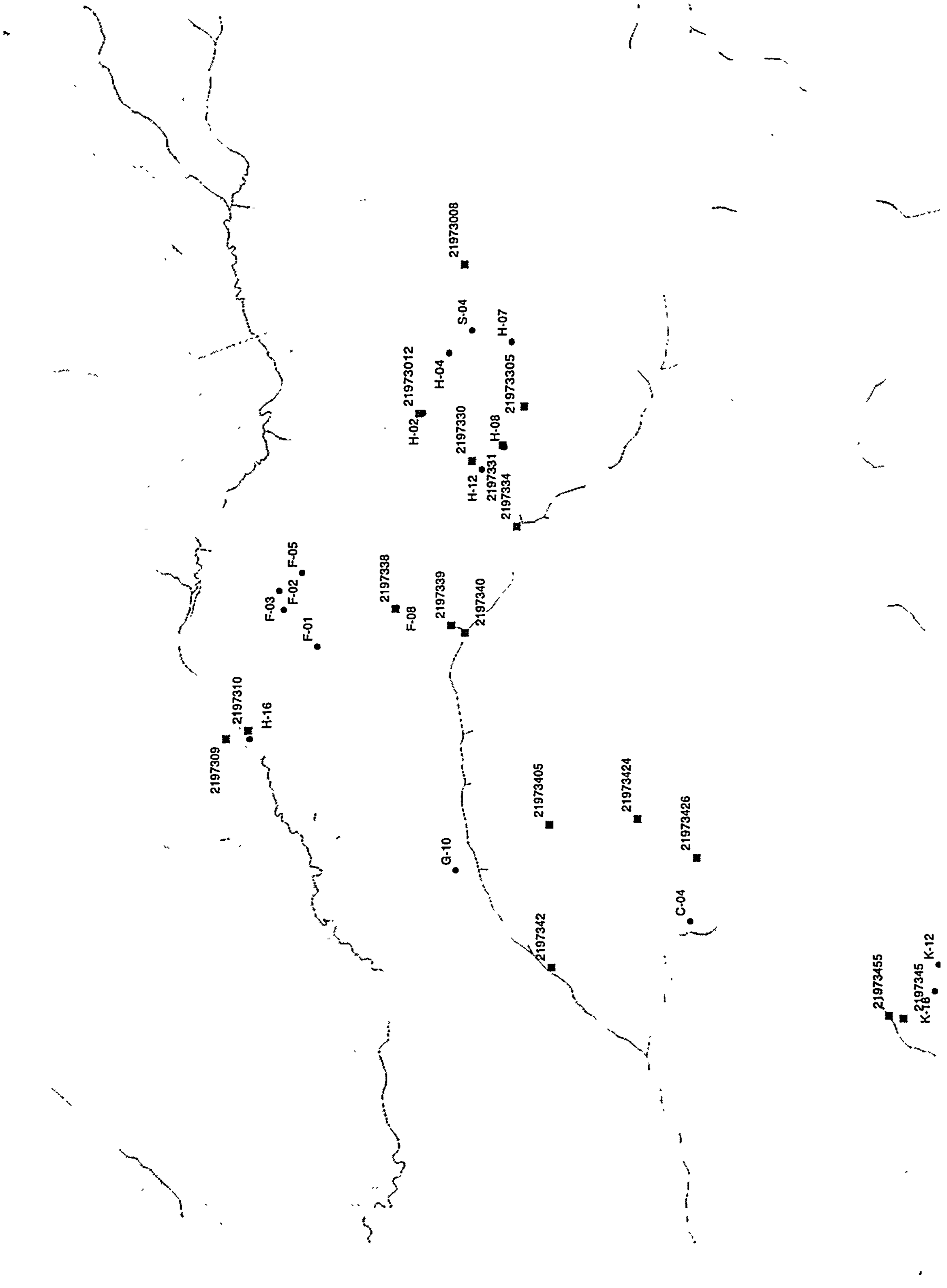
2197344

Figure E-1.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F-03
F-02
F-01
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F-08
2197339
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2197310
H-16
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C-04
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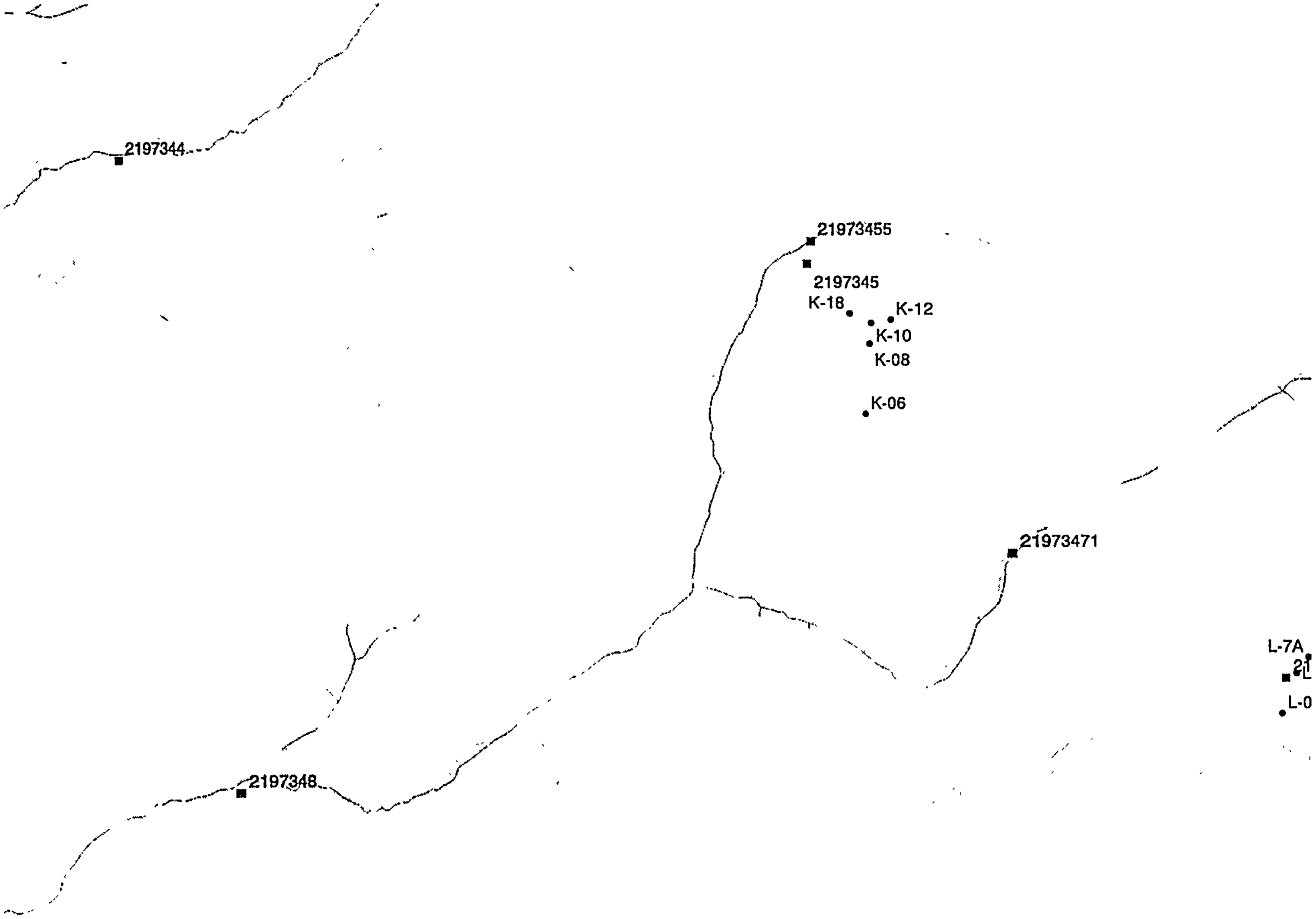
K-18
K-12

Figure E-2.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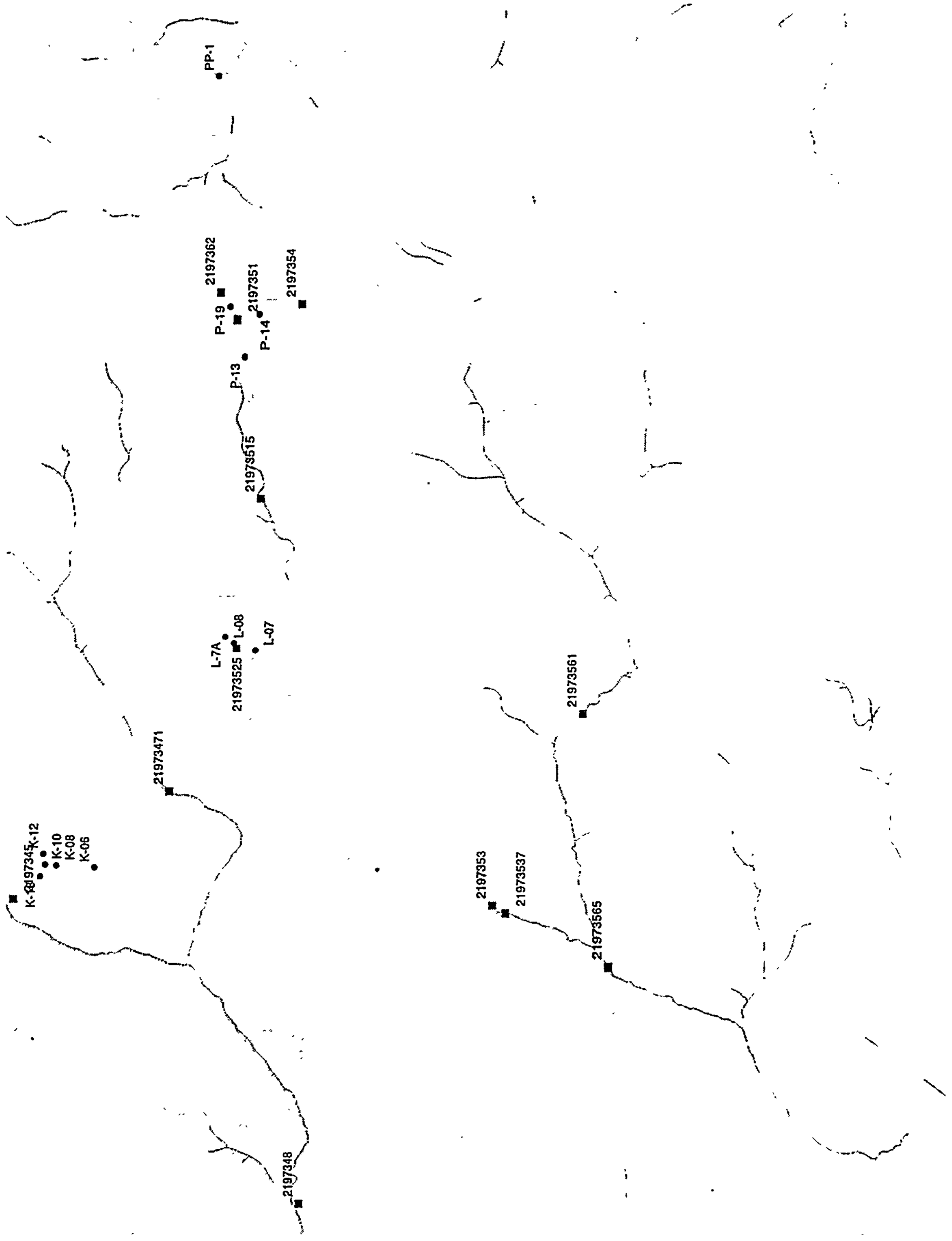
L-7A
21
L
L-0
2197348

Figure E-3.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21973561
21973471
K-18
2197345
K-12
K-10
K-08
K-06
2197353
21973537
21973565
2197348

Figure E-4.


21973026
21973028
2197306
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2197324
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2197400

Figure E-5.

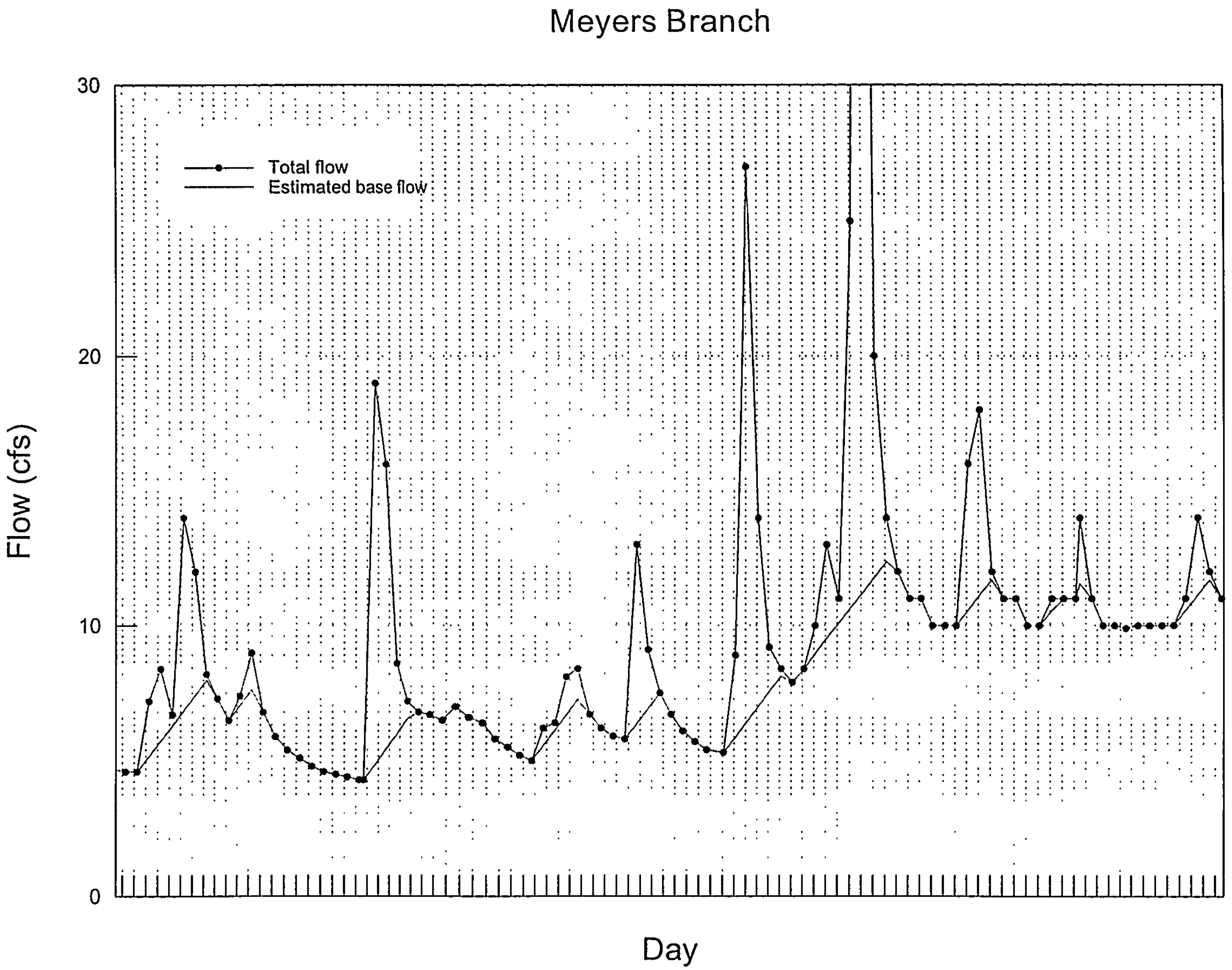
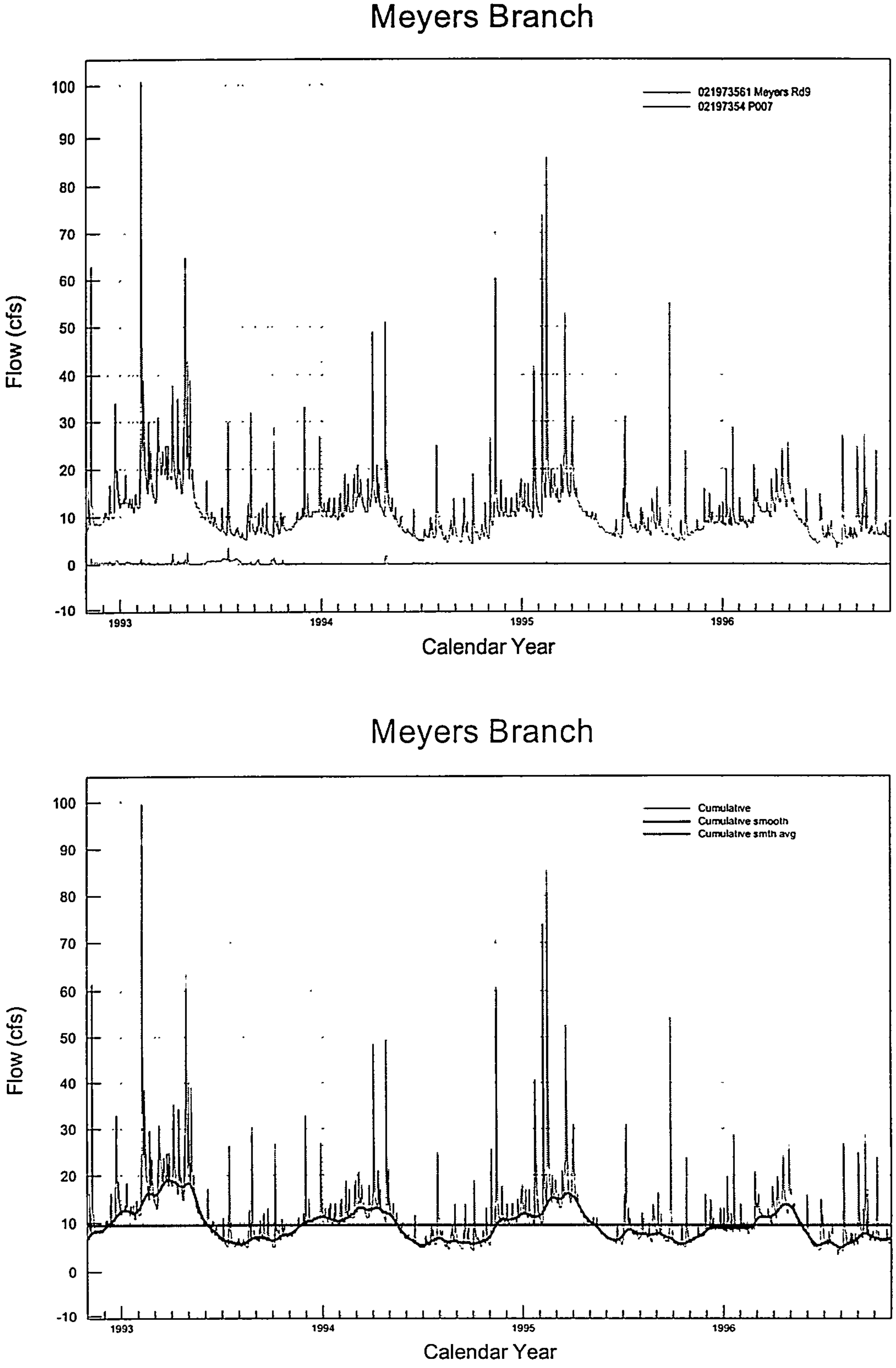

Meyers Branch
Total flow
Estimated base flow
Flow (cfs)
30
20
10
0
Day

Figure E-6.


Meyers Branch

Meyers Branch

Figure E-7.

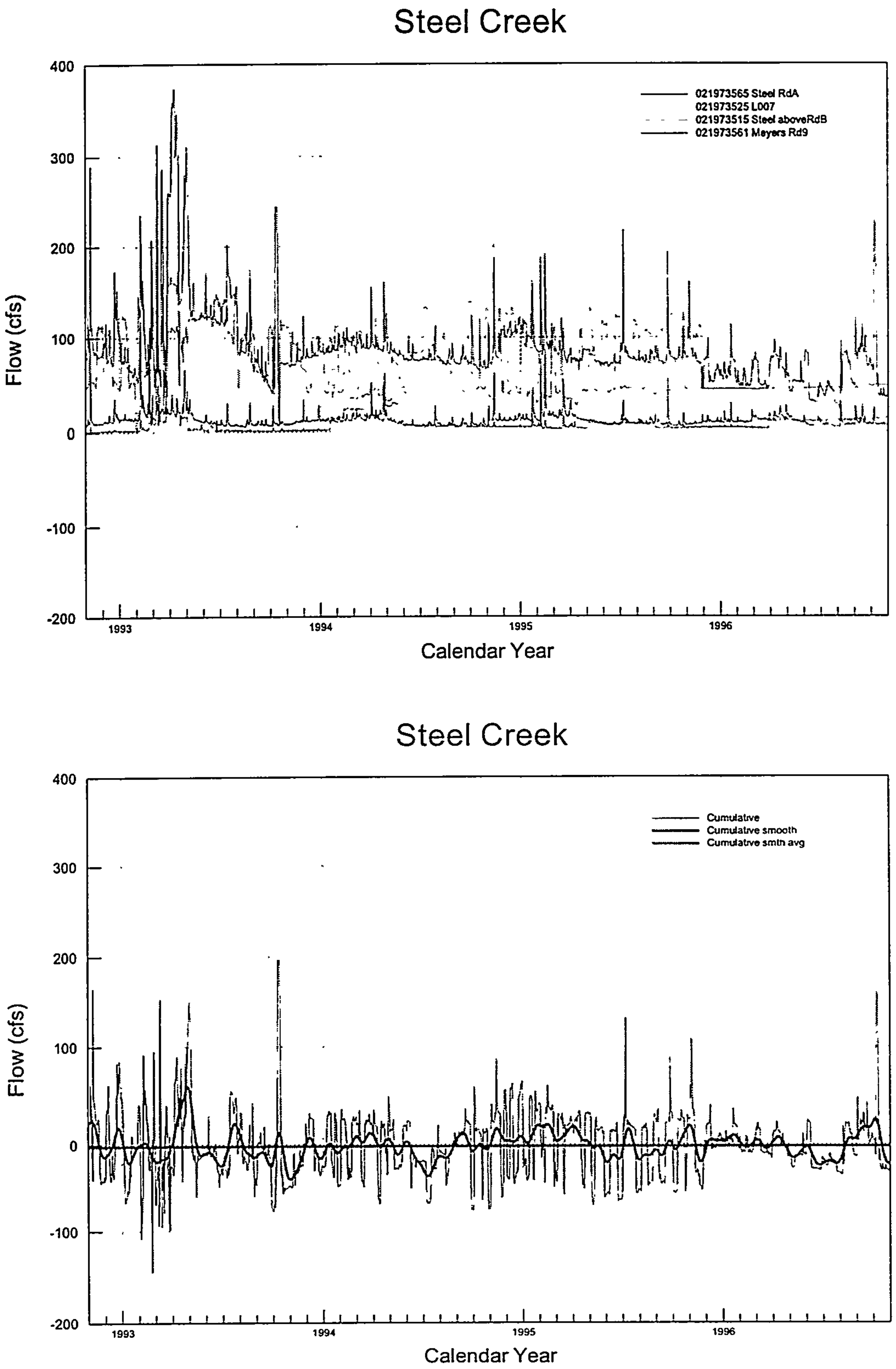

Steel Creek
021973565 Steel RdA
021973525 L007
021973515 Steel aboveRdB
021973561 Meyers Rd9
Flow (cfs)
400
300
200
100
0
-100
-200
1993
1994
1995
1996
Calendar Year
Steel Creek
Cumulative
Cumulative smooth
Cumulative smth avg
Flow (cfs)
400
300
200
100
0
-100
-200
1993
1994
1995
1996
Calendar Year

Figure E-8.

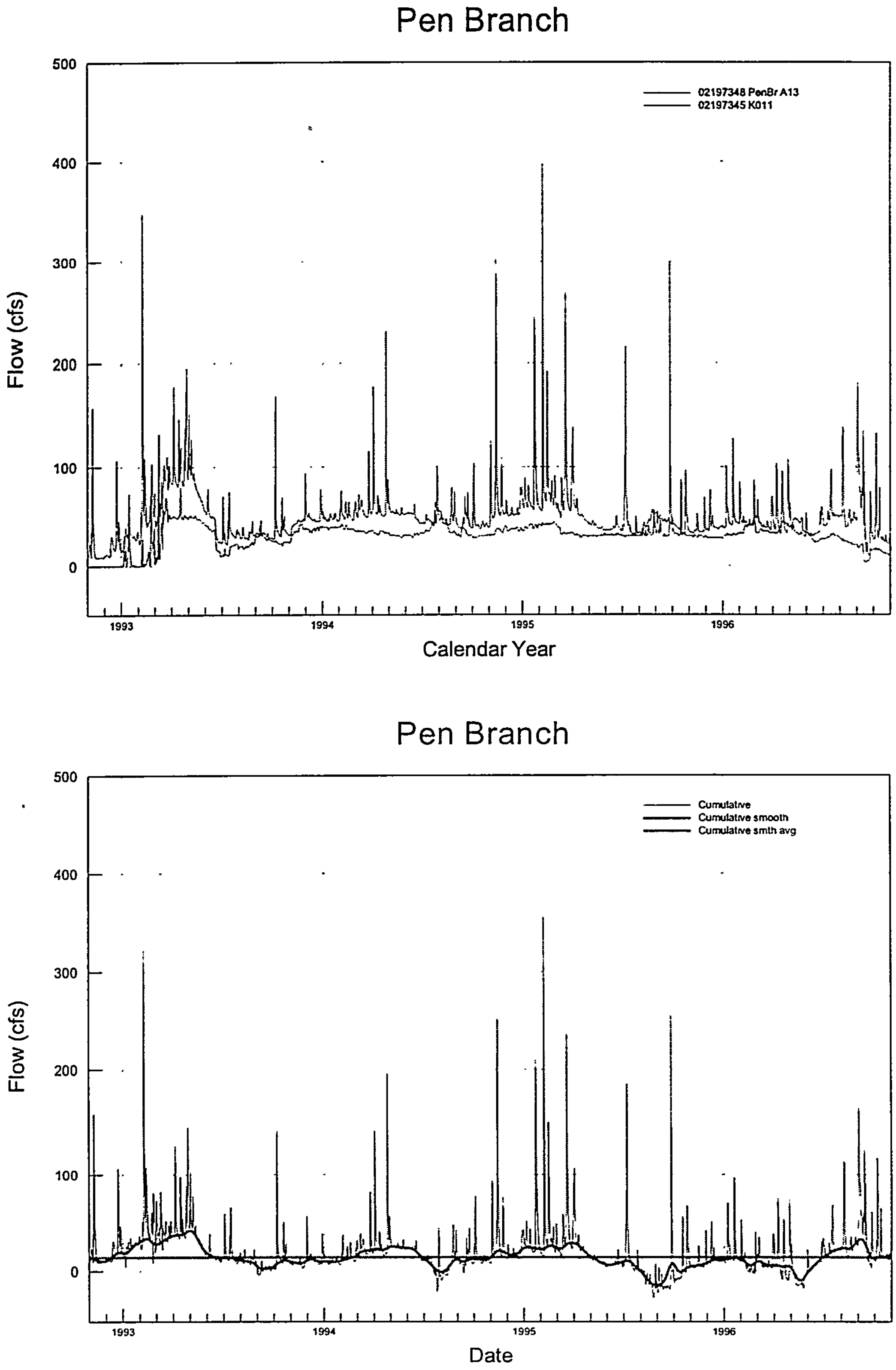
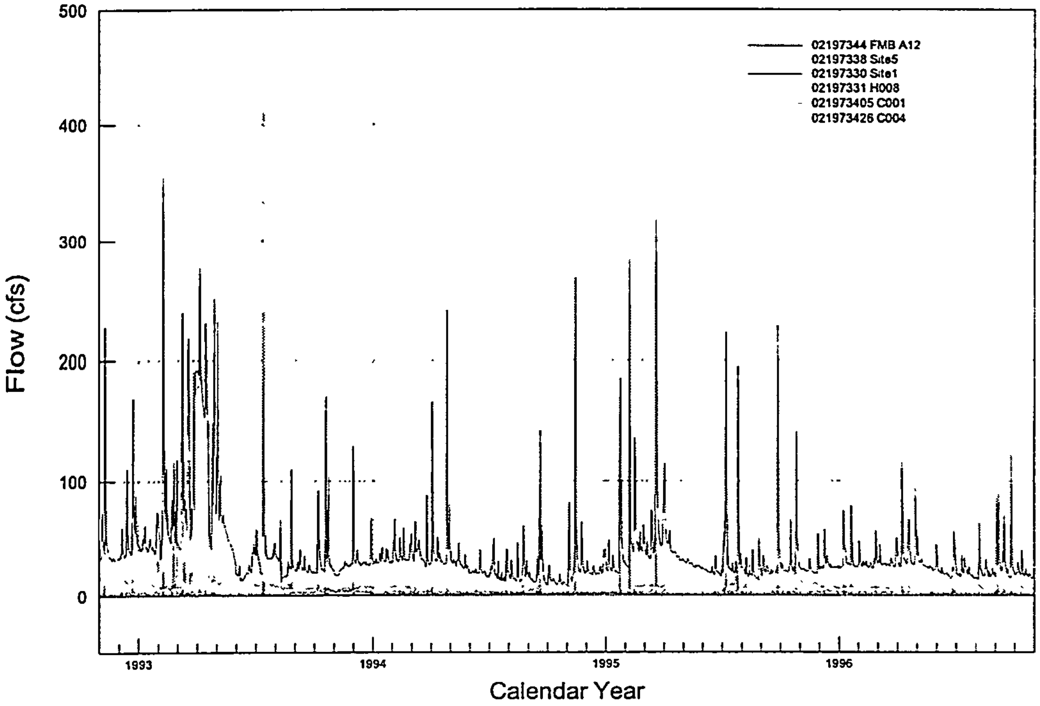

Pen Branch
Flow (cfs)
500
400
300
200
100
0
02197348 PenBr A13
02197345 K011
1993
1994
1995
1996
Calendar Year
Pen Branch
Flow (cfs)
500
400
300
200
100
0
Cumulative
Cumulative smooth
Cumulative smth avg
1993
1994
1995
1996
Date

Figure E-9.

Fourmile Branch



Fourmile Branch

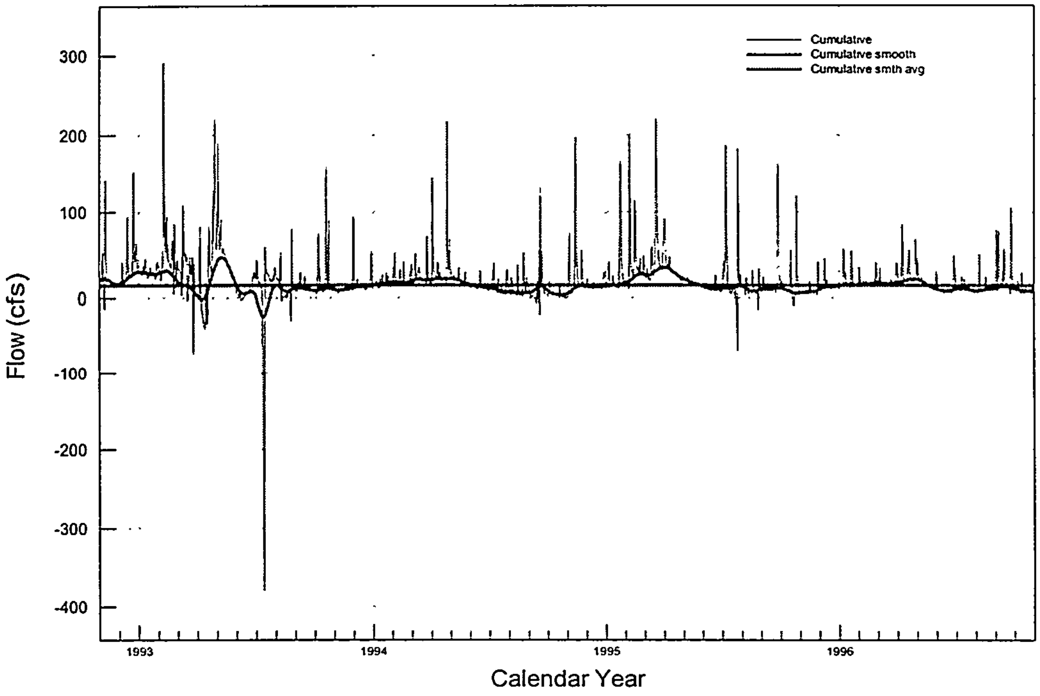
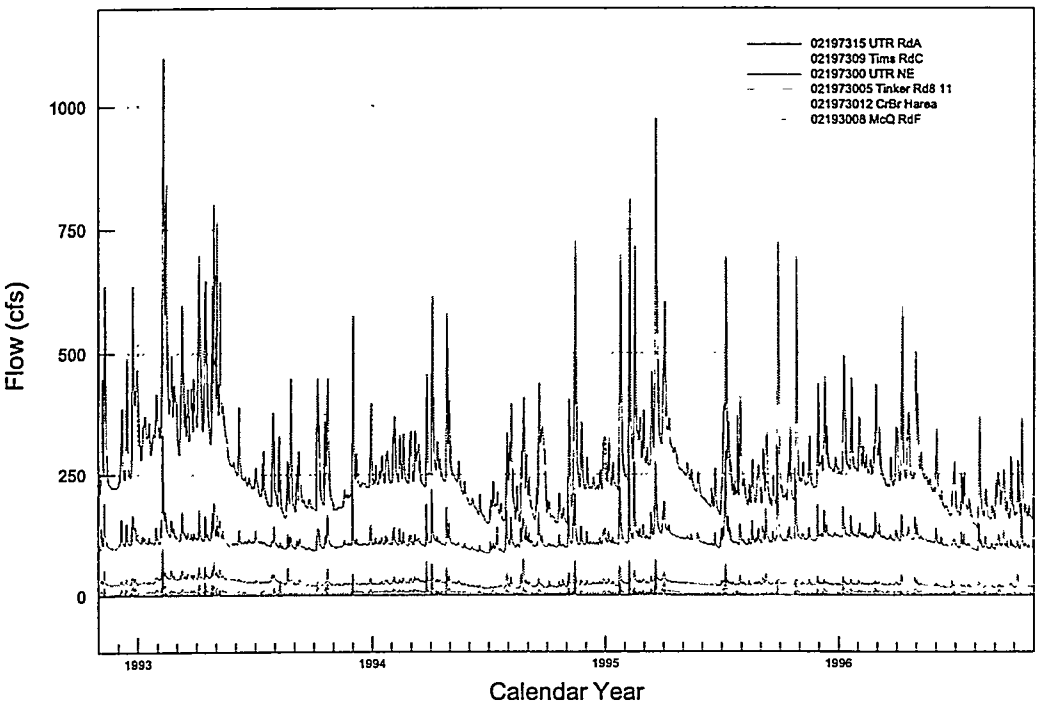


Figure E-10.

Upper Three Runs



Upper Three Runs

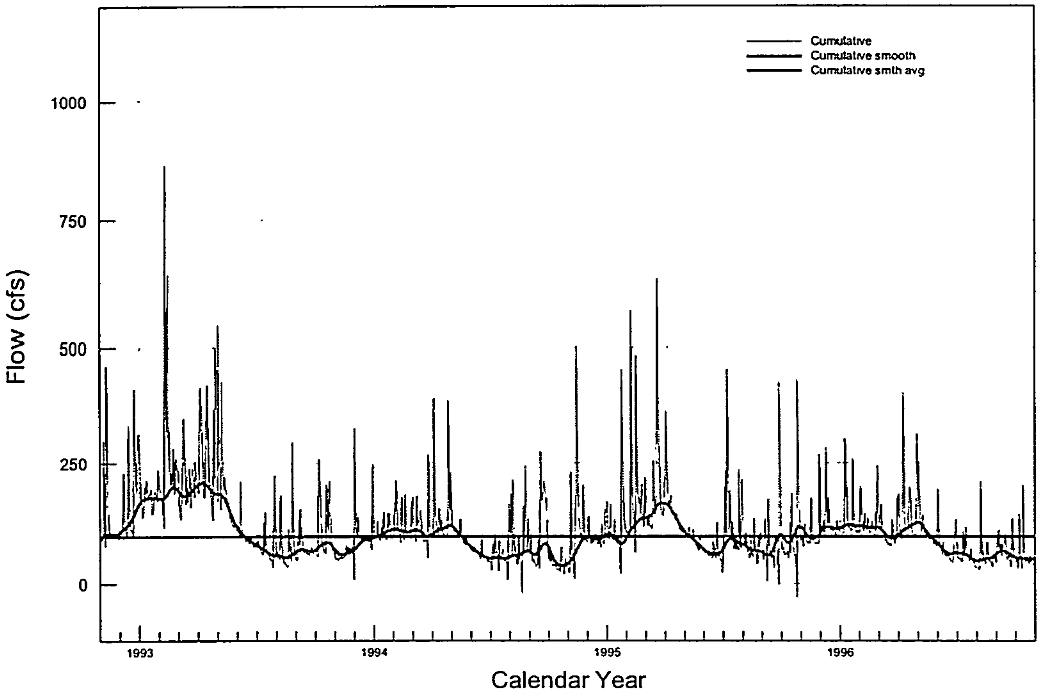
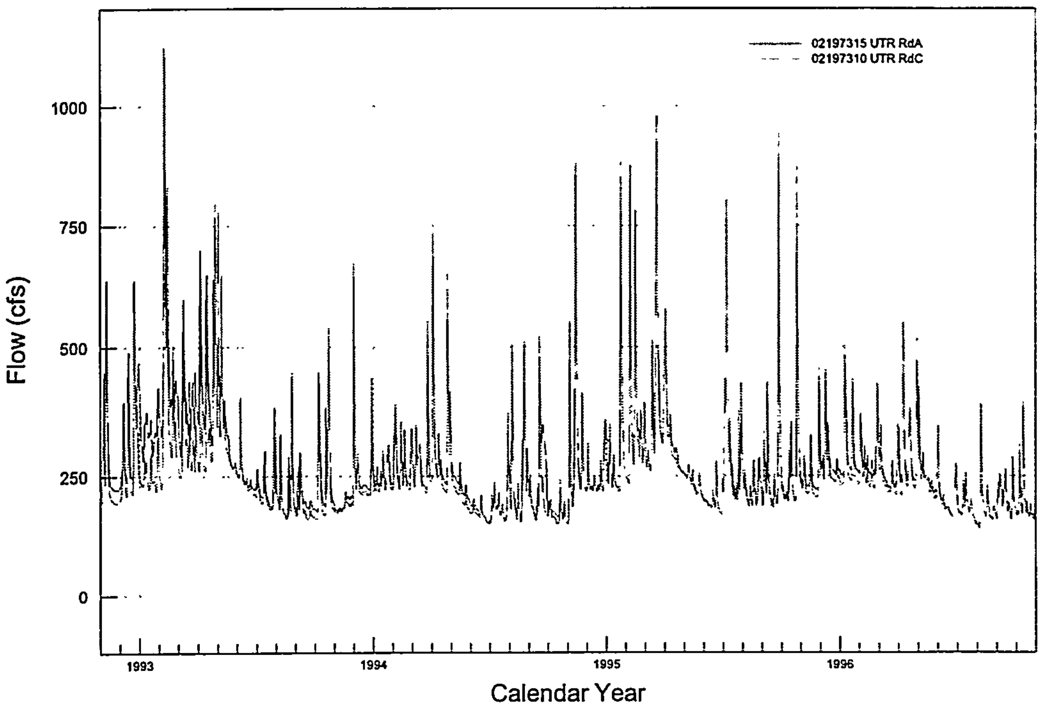
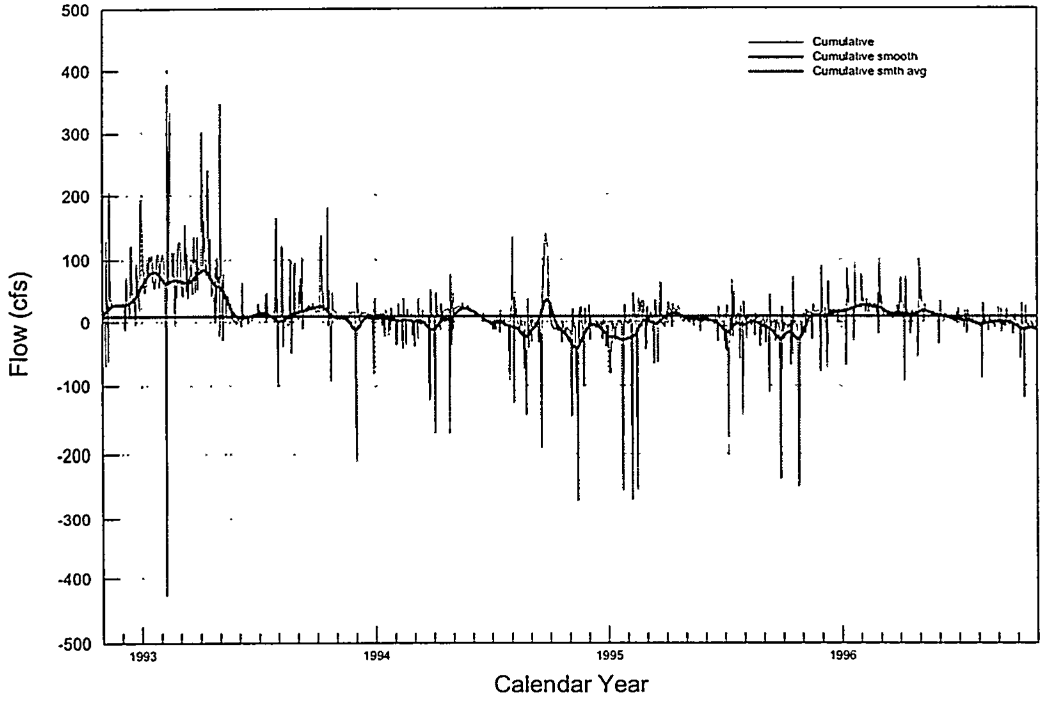


Figure E-11.



Upper Three Runs



Upper Three Runs

Figure E-12.

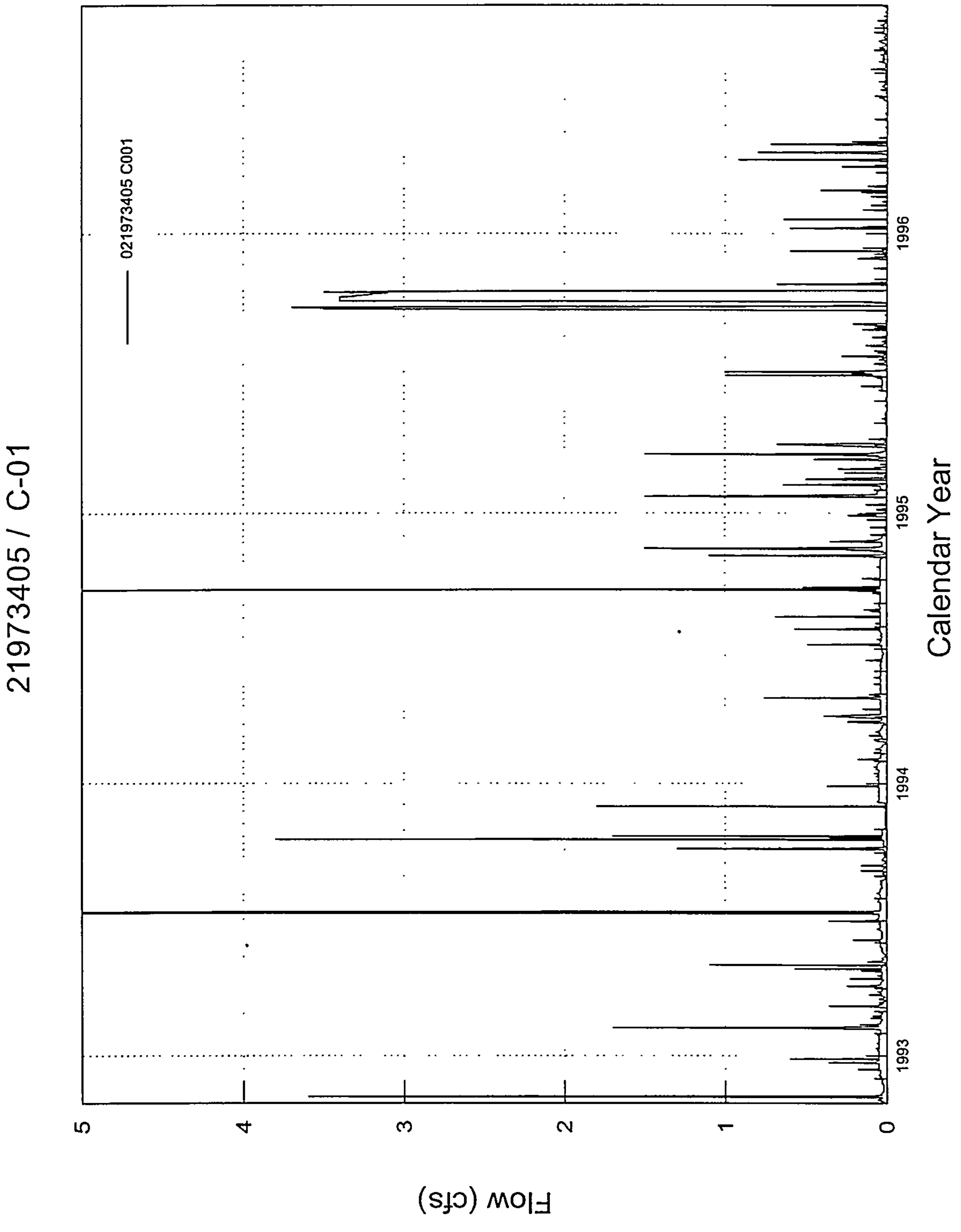

21973405 / C-01
021973405 C001
Flow (cfs)
0
1
2
3
4
5
1993
1994
1995
1996
Calendar Year

Figure E-13.

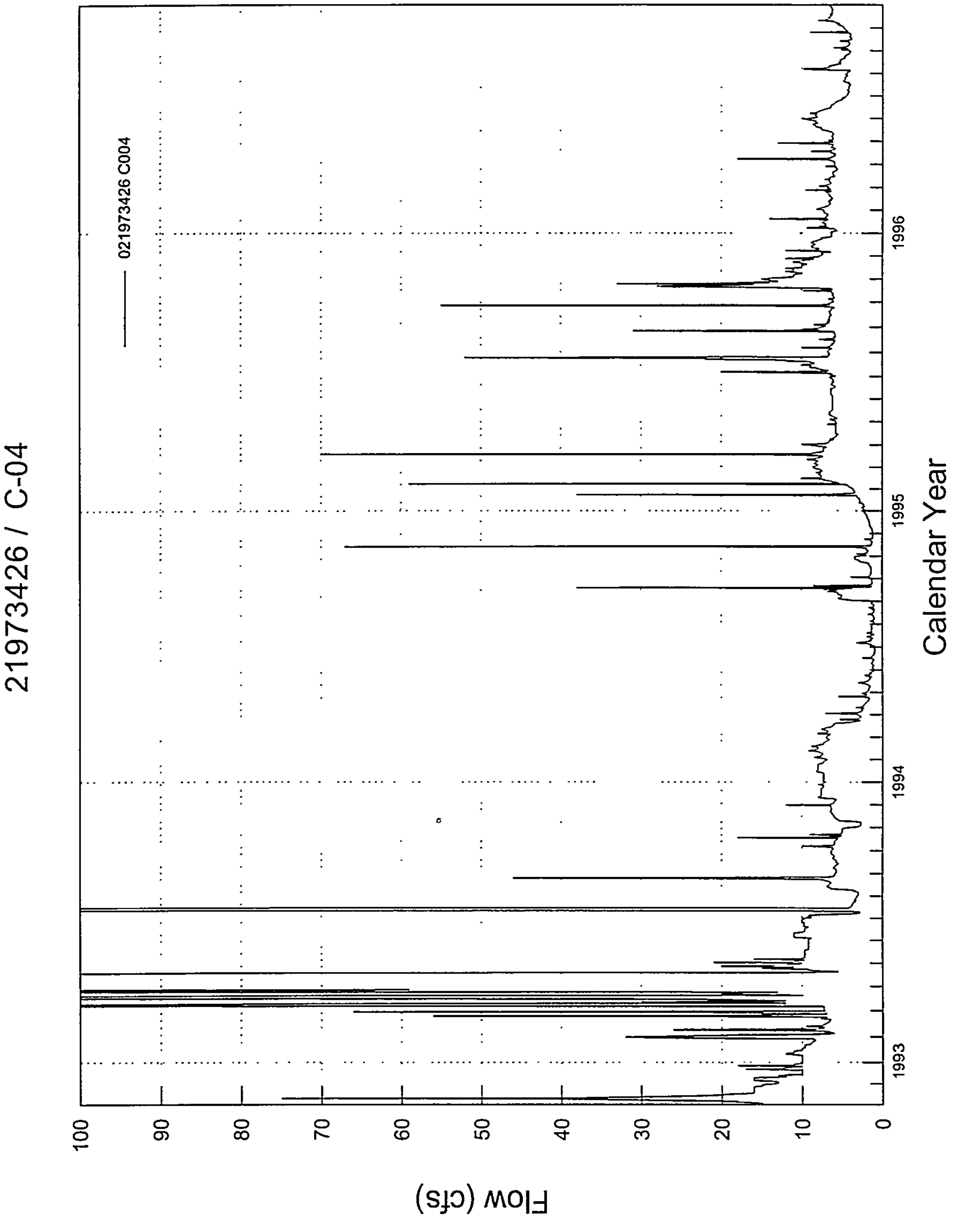
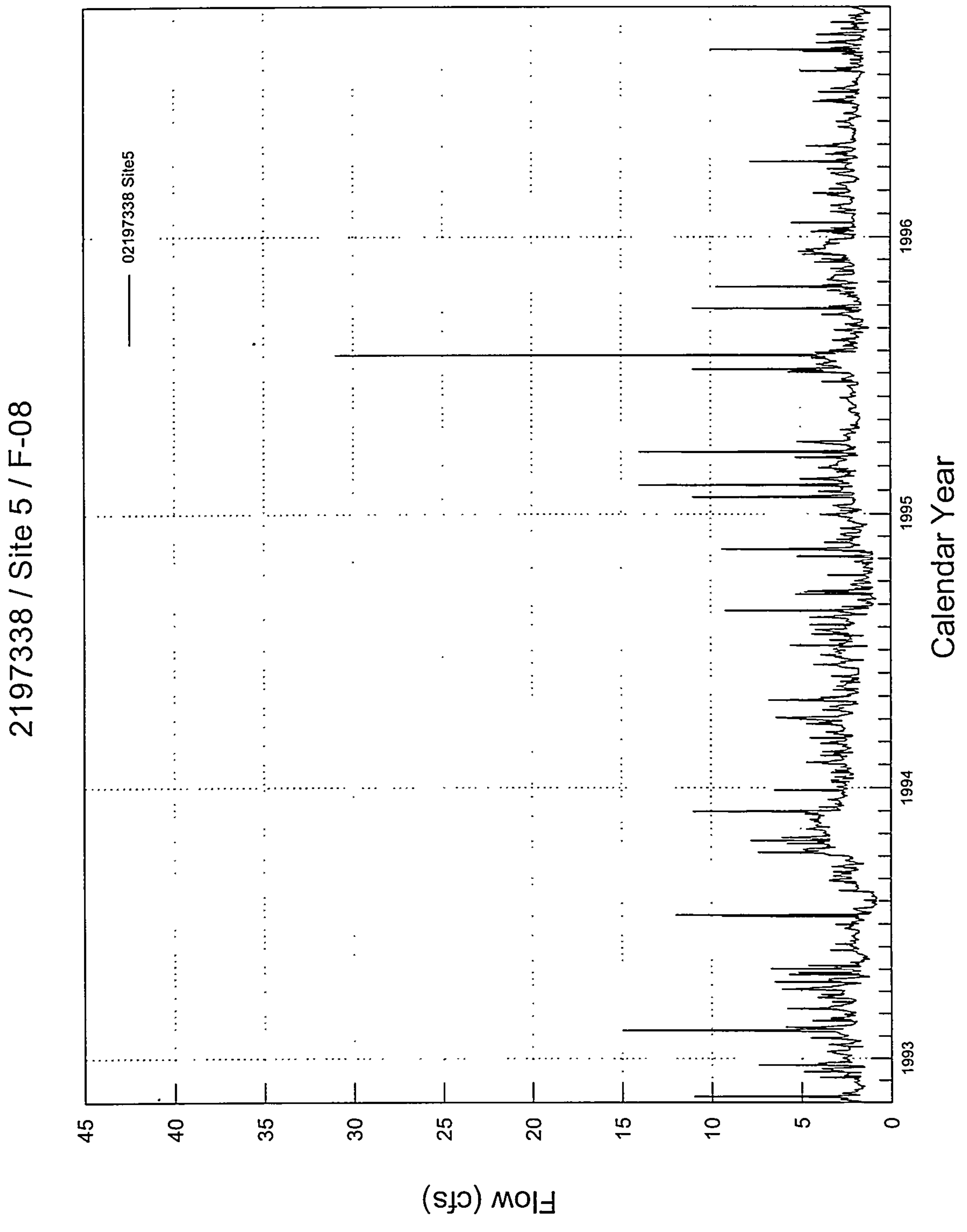

21973426 / C-04
021973426 C004
Flow (cfs)
100
90
80
70
60
50
40
30
20
10
0
1993
1994
1995
1996
Calendar Year

Figure E-14.


2197338 / Site 5 / F-08
02197338 Site5
Flow (cfs)
45
40
35
30
25
20
15
10
5
0
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1994
1995
1996
Calendar Year

Figure E-15.

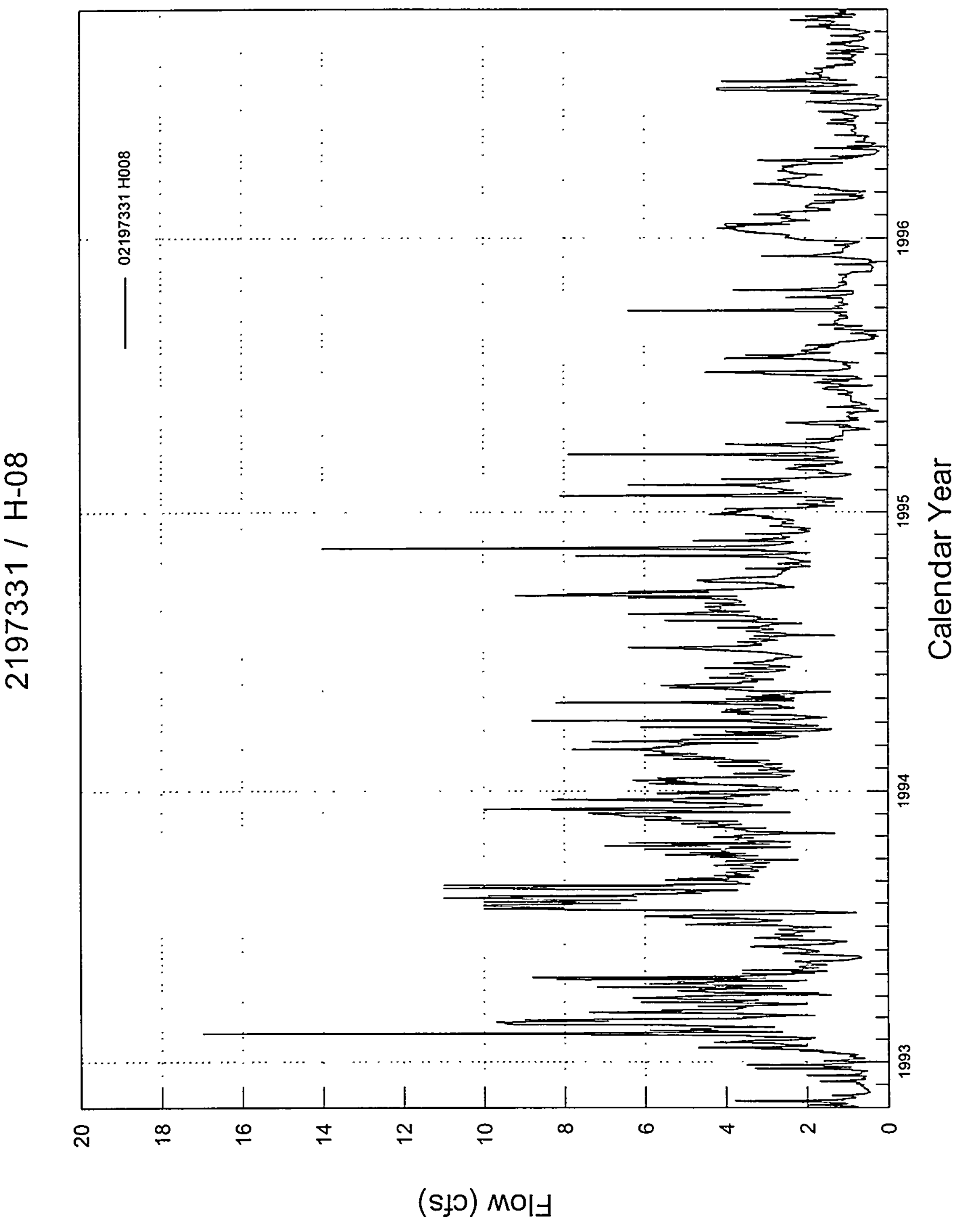
2197331 / H-08
02197331 H008
Flow (cfs)
0
2
4
6
8
10
12
14
16
18
20
1993
1994
1995
1996
Calendar Year

Figure E-16.

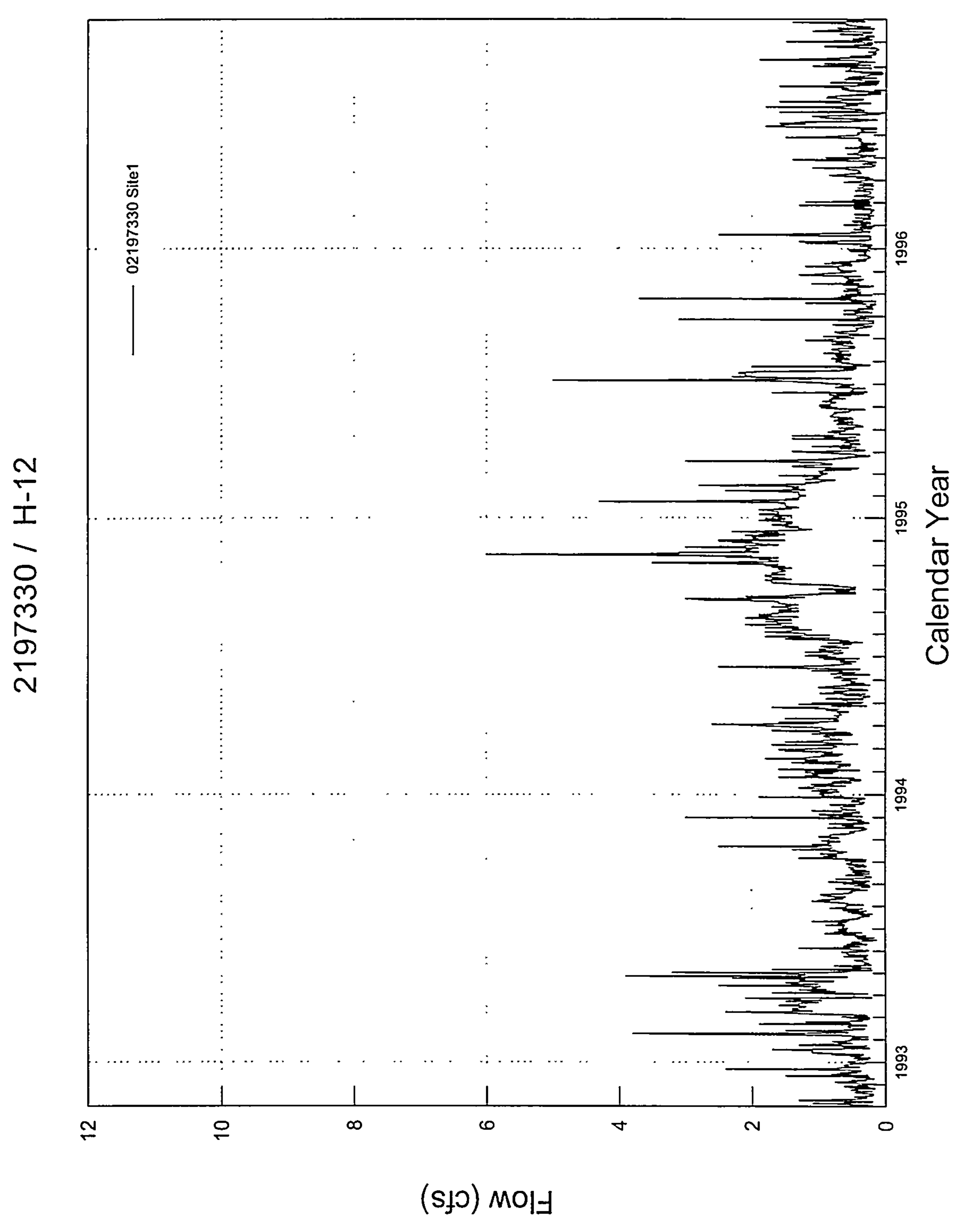

Figure E-17.

Figure E-17.

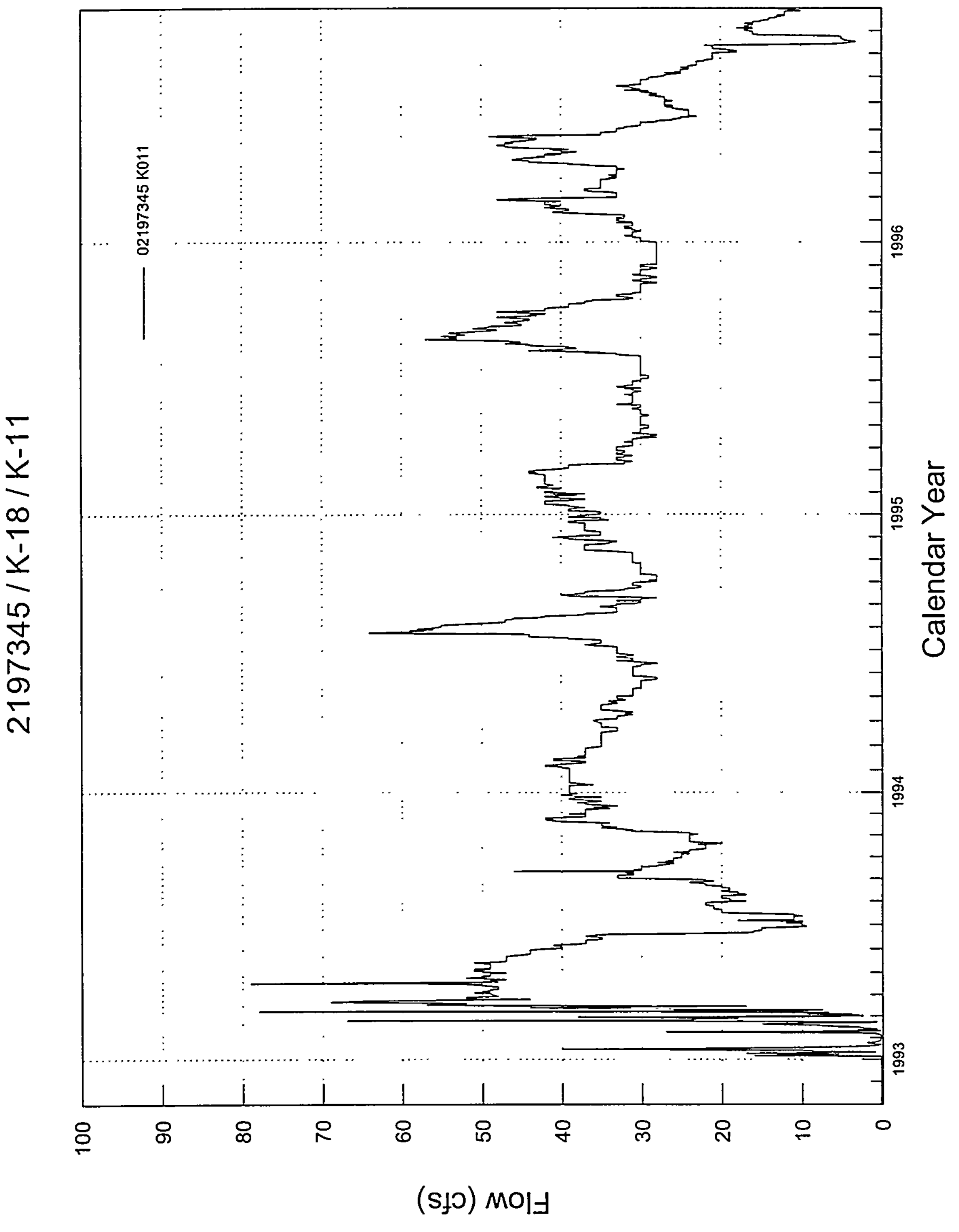
2197345 / K-18 / K-11
02197345 K011
Flow (cfs)
100
90
80
70
60
50
40
30
20
10
0
1993
1994
1995
1996
Calendar Year

Figure E-18.

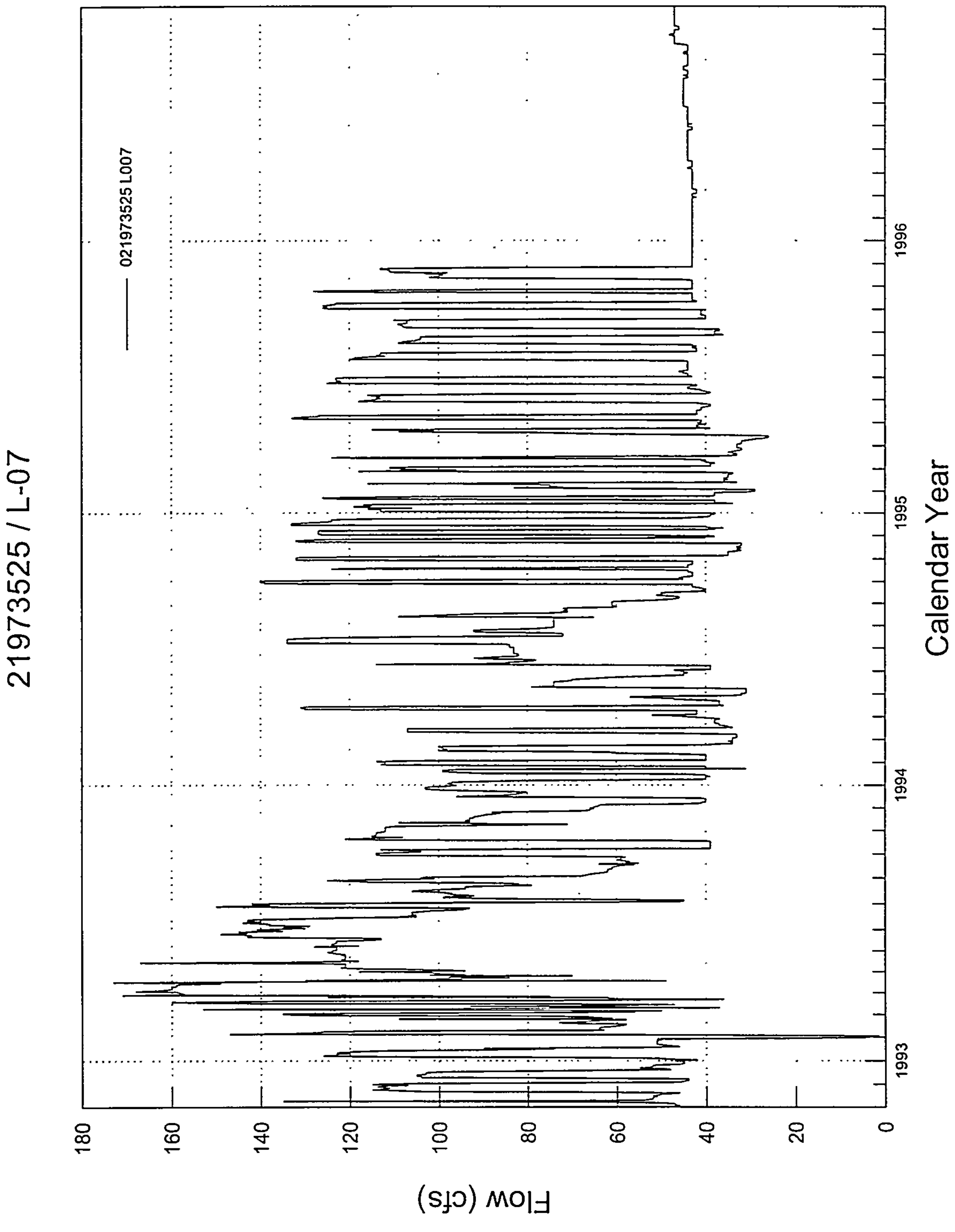
21973525 / L-07
021973525 L007
Flow (cfs)
0
20
40
60
80
100
120
140
160
180
1993
1994
1995
1996
Calendar Year

Figure E-19.

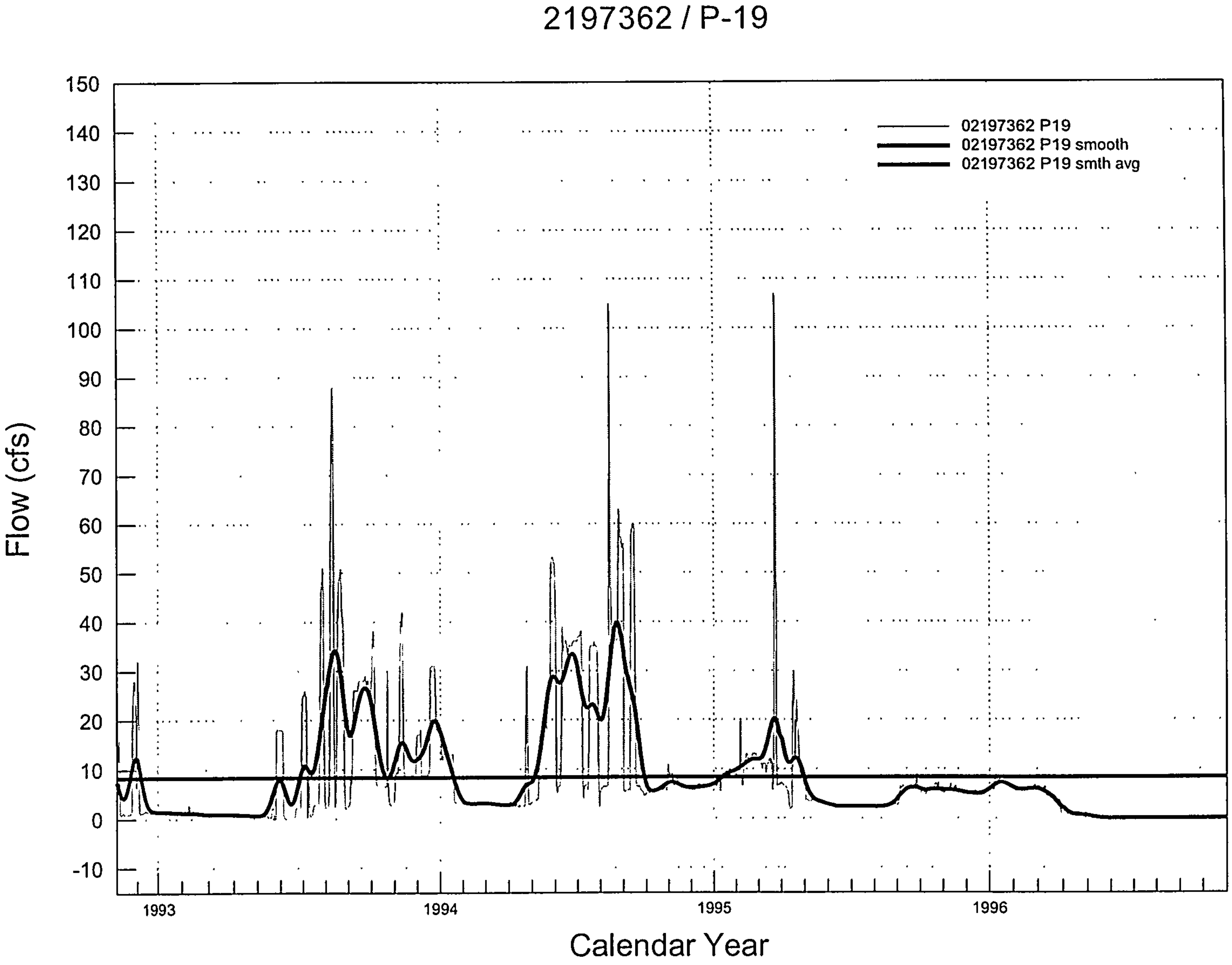
2197362 / P-19
02197362 P19
02197362 P19 smooth
02197362 P19 smth avg
Flow (cfs)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
1993
1994
1995
1996
Calendar Year

Figure E-20.

Table E-1. Base flow estimates based on hydrograph separation of USGS gauging station data.

Stream reach	**Estimated base flow (cfs)**	**Fraction of reach within CKLP model**	**Base flow target (cfs)**
Meyers Branch (headwaters to Road 9)	9.5	1/3 ?	3.2 ?
Steel Creek (above Road B to Road A; includes L-Lake)	-2.2	1	-2.2
Pen Branch (headwaters to Road A13; includes Indian Grave Branch)	13.3	1	13.3
Fourmile Branch (headwaters to Road A12)	14.1	1	14.1
Upper Three Runs (Tims Branch at Road C/UTR near site boundary/Tinker Creek at Road 8-11 to UTR at Road A)	97	1/4 ??	24 ??
Upper Three Runs (Road C to Road A)	8.9	1/2	4.5

Table E-2. Sensitivity of base flow estimates to the assumed maximum rate of daily base flow increase.

Stream reach	**Estimated base flow for r = 1.025 (cfs)**	**Estimated base flow for r = 1.05 (cfs)**	**Estimated base flow for r = 1.10 (cfs)**
Meyers Branch (headwaters to Road 9)	9.2 (-3%)	9.5	9.8 (+3%)
Steel Creek (above Road B to Road A; includes L-Lake)	-2.2 (0%)	-2.2	-2.2 (0%)
Pen Branch (headwaters to Road A13; includes Indian Grave Branch)	12.3 (-8%)	13.3	14.3 (+8%)
Fourmile Branch (headwaters to Road A12)	13.0 (-8%)	14.1	15.1 (+7%)
Upper Three Runs (Tims Branch at Road C/UTR near site boundary/Tinker Creek at Road 8-11 to UTR at Road A)	91 (-6%)	97	104 (+7%)
Upper Three Runs (Road C to Road A)	7.7 (-13%)	8.9	10.1 (+13%)

Appendix E-2. ***Summary of Stream Baseflow and Water Table Work Conducted in Support of the R-Reactor and K-Reactor Groundwater Modeling Efforts*****, SRT-EST-98-110, Westinghouse Savannah River Company Inter-Office Memorandum from R. A. Hiergesell to R. Falise, January 12, 1997, Westinghouse Savannah River Company, Aiken ,SC, 13 pp.**

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WESTINGHOUSE SAVANNAH RIVER COMPANY SRT-EST-98-110
INTER-OFFICE MEMORANDUM

January 12, 1997

TO: Ron Falise, 730-2B

FROM: R.A. Hiergesell, 773-42A

SUBJECT: Summary of stream baseflow and water table work conducted in support of the R-Reactor and K-Reactor groundwater modeling efforts.

The purpose of this memorandum is to summarize the work that has been done to characterize stream baseflow and the water table configuration in the vicinity of the R-Area and K-Area Reactors. This information provides important measurements which must be used in the groundwater flow model calibration process an the models will be calibrated such that these measurements are adhered to as closely as possible.

Baseflow measurements

Stream baseflow measurements have been obtained along reaches of Mill Creek, Indian Grave Branch and the upper part of Pen Branch, above the confluence with Indian Grave Branch. At least parts of these drainage basins fall within the model domains for the R-Area and K-Area reactor ground water flow models.

Measurements were obtained at times when streamflow was thought to reflect baseflow conditions. The baseflow component of streamflow is that component derived directly from discharge of the underlying aquifer. At times between significant precipitation events the measured streamflow reflects that portion of streamflow that originates in the aquifer. Following a significant precipitation event we have been waiting 6-8 days for streamflow to recede back to baseflow conditions.

To obtain in-stream flow measurements two types of instruments are used, a cutthroat flume for stream reaches with flow rates less than 0.2 to 0.4 cubic feet/second (cfs) while an instream flow velocity indicator is utilized to acquire stream flow rates greater than approximately 0.4 cfs. The general strategy is to start at the headwaters of a stream and obtain measurements at different stations while working in the downstream direction. If possible, measurements were obtained at the confluence of significant tributary branches of the main stream so that the relative contribution of different tributaries could be quantified. All measurements were obtained within a short a period of time as possible, generally over a period of 1 to 2 days.

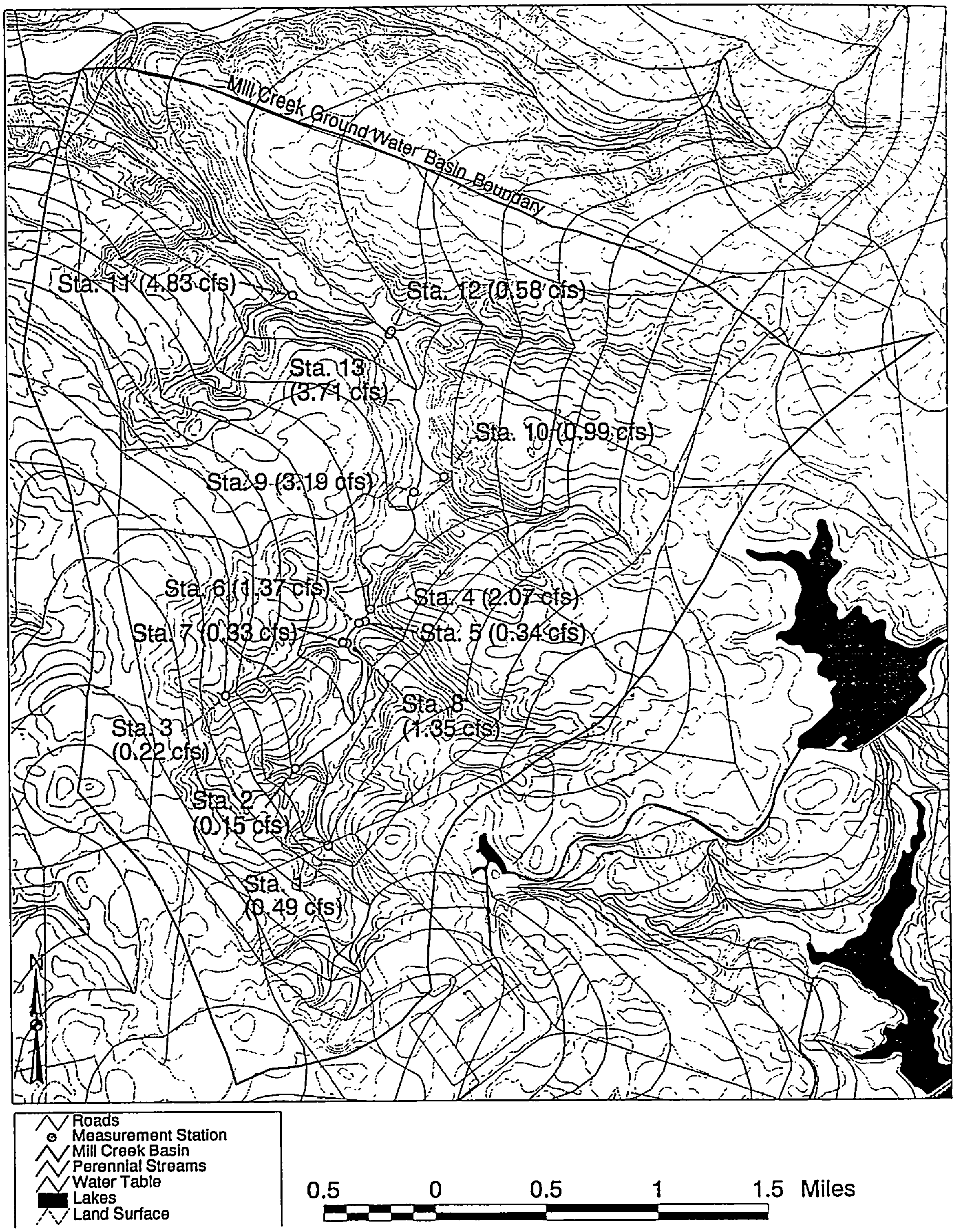
For each of the stream basins maps illustrating the ground water basin boundary, the trace of the stream and the position of measurement stations are attached to this memorandum. Also illustrated on each map is the configuration of the water table. Actual labels of water table contours are not illustrated on these maps, however. In addition to these maps, the measurements that were obtained to calculate flow rate at each station are included.

Water table map development

Work has also been conducted to refine the water table configuration maps within the ground water flow model domain areas. This work has involved obtaining water level measurements from selected wells and careful examination of flowing reaches of the headwater segments of streams. Information obtained in this way has been utilized to refine previously existing maps of the water table configuration in the vicinity of the R-Area and the K-Area Reactor. A refined map was utilized as a calibration target for the R-Area ground water model and another refined map will be utilized during calibration when the K-Area mode is developed.

Additonal work remains to be done on both of these work components. Additional baseflow measurements will be obtained as the absence of precipitation allows, and a regional water table map for all of the reactor areas is being developed.

Mill Creek Baseflow Measurements



MILL CREEK BASEFLOW

Station 1 (12/4/97)
Mill Creek where Woodward Rd. crosses, upstream side of road.
Approximate UTM Coordinates: 445115E, 3682835N
Flume Measurement: 8" throat, fluid height=0.5 ft., Q=1.06cfs or 475gmp

Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	9	0.30	0.01	0.06	0.018
2	1.5	1	12	0.39	0.03	0.08	0.031
3	2.5	1	16	0.52	0.18	0.23	0.121
4	3.5	1	18	0.59	0.40	0.45	0.266
5	4.5	1	11	0.36	0.11	0.16	0.058
						Tot. flow=	0.49

Station 2 (12/4/97)
Along Monroe-Owens Rd. First tributary north of main channel of Mill Creek.
Approximate UTM Coordinates: 444846E, 3683390N

Flume Measurement: 8" throat, fluid height=0.19 ft., Q=0.152cfs or 69gmp

Station 3 (12/4/97)
Along Monroe-Owens Rd. Second tributary north of main channel of Mill Creek.
Approximate UTM Coordinates: 444344E, 3683928N
Flume Measurement: 8" throat, fluid height=0.23 ft., Q=0.22cfs or 101gmp

Station 4 (12/4/97)
Main branch of Mill Creek, downstream of first major tributary entering from south.
Approximate UTM Coordinates: 445355E, 3684472N

Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	14	0.46	0.16	0.21	0.096
2	1.5	1	15	0.49	0.35	0.40	0.197
3	2.5	1	14	0.46	0.26	0.31	0.142
4	3.5	1	24	0.79	0.34	0.39	0.307
5	4.5	1	22	0.72	0.24	0.29	0.209
6	5.5	1	25	0.82	0.36	0.41	0.336
7	6.5	1	30	0.98	0.40	0.45	0.443
8	7.5	1	26	0.85	0.22	0.27	0.230
9	8.5	1	25	0.82	0.07	0.12	0.098
10	9.25	0.5	20	0.66	-0.02	0.03	0.010
						Tot. flow=	2.07

Station 5 (12/4/97)
Tributary to Mill Creek, entering from south, just upstream of confluence with Mill Ck..
Approximate UTM Coordinates: 445348E, 3684437N

Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	4	0.13	0.06	0.11	0.014
2	1.5	1	10	0.33	0.15	0.20	0.066
3	2.5	1	17	0.56	0.37	0.42	0.234
4	3.5	1	8	0.26	0.04	0.09	0.024
						Tot. flow=	0.34

Station 6 (12/4/97) Main branch of Mill Creek, upstream of first major tributary entering from south.
Approximate UTM Coordinates: 445318E, 3684317N

Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	9	0.30	0.38	0.43	0.127
2	1.5	1	20	0.66	0.10	0.15	0.098
3	2.5	1	20	0.66	0.51	0.56	0.367
4	3.5	1	20	0.66	0.79	0.84	0.551
5	4.5	1	15	0.49	0.05	0.10	0.049
6	5.5	1	17	0.56	0.04	0.09	0.050
7	6.5	1	10	0.33	0.35	0.40	0.131
						Tot. flow=	1.37

Station 7 (12/4/97) Northernmost trib. to Mill Ck that crosses powerline road, just above entry into Mill Ck.
Approximate UTM Coordinates: 445200E, 3684304N

Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	24	0.79	0.37	0.42	0.331
						Tot. flow=	0.33

Station 8 (12/4/97) Main branch of Mill Creek, upstream of confluence with northernmost powerline tirbutary
Approximate UTM Coordinates: 445216E, 3684298N

Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	12	0.39	0.04	0.09	0.035
2	1.5	1	13	0.43	0.26	0.31	0.132
3	2.5	1	13	0.43	0.38	0.43	0.183
4	3.5	1	14	0.46	0.44	0.49	0.225
5	4.5	1	18	0.59	0.48	0.53	0.313
6	5.5	1	20	0.66	0.35	0.40	0.262
7	6.5	1	20	0.66	0.25	0.30	0.197
						Tot. flow=	1.35

Station 9 Main branch of Mill Creek, upstream of confluence with 2'nd major trib. from south
(12/4/97) Approximate UTM Coordinates: 445744E, 3685452N

Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	22	0.72	0.02	0.07	0.051
2	1.5	1	30	0.98	0.06	0.11	0.108
3	2.5	1	40	1.31	0.04	0.09	0.118
4	3.5	1	50	1.64	0.12	0.17	0.279
5	4.5	1	48	1.57	0.16	0.21	0.331
6	5.5	1	48	1.57	0.20	0.25	0.394
7	6.5	1	45	1.48	0.22	0.27	0.399
8	7.5	1	43	1.41	0.20	0.25	0.353
9	8.5	1	48	1.57	0.13	0.18	0.283
10	9.5	1	48	1.57	0.11	0.16	0.252
11	10.5	1	56	1.84	0.07	0.12	0.220
12	11.5	1	54	1.77	0.10	0.15	0.266
13	12.5	1	46	1.51	0.04	0.09	0.136
						Tot. flow=	3.19

Station 10 2'nd major tributary to Mill Ck. from south, just upstream from confluence.
(12/4/97) Approximate UTM Coordinates: 445899E, 3685493N

Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	6	0.20	0.24	0.29	0.057
2	1.5	1	6	0.20	0.58	0.63	0.124
3	2.5	1	5	0.16	0.61	0.66	0.108
4	3.5	1	6	0.20	0.78	0.83	0.163
5	4.5	1	7	0.23	0.64	0.69	0.158
6	5.5	1	7	0.23	0.65	0.70	0.161
7	6.5	1	8	0.26	0.55	0.60	0.157
8	7.5	1	8	0.26	0.17	0.22	0.058
						Tot. flow=	0.99

Station 11 Main branch of Mill Creek, at USGS station site where "buried cable road" crosses.
(12/8/97) Approximate UTM Coordinates: 444821E, 3686806N

Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	19	0.62	0.04	0.09	0.056
2	1.5	1	22	0.72	0.43	0.48	0.346
3	2.5	1	22	0.72	0.54	0.59	0.426
4	3.5	1	22	0.72	0.58	0.63	0.455
5	4.5	1	22	0.72	0.63	0.68	0.491
6	5.5	1	22	0.72	0.70	0.75	0.541
7	6.5	1	22	0.72	0.67	0.72	0.520
8	7.5	1	24	0.79	0.65	0.70	0.551
9	8.5	1	24	0.79	0.58	0.63	0.496
10	9.5	1	25	0.82	0.41	0.46	0.377
11	10.5	1	22	0.72	0.34	0.39	0.282
12	11.5	1	19	0.62	0.41	0.46	0.287
						Tot. flow=	4.83

Station 12 (12/8/97) 1'st major tributary from east as you proceed upstream from Tinker Ck. Measured very close to confluence with Mill Creek.

Approximate UTM Coordinates: 445559E, 3686545N

Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	9	0.30	0.23	0.28	0.083
2	1.5	1	12	0.39	0.50	0.55	0.217
3	2.5	1	12	0.39	0.53	0.58	0.228
4	3.5	1	8	0.26	0.16	0.21	0.055
						Tot. flow=	0.58

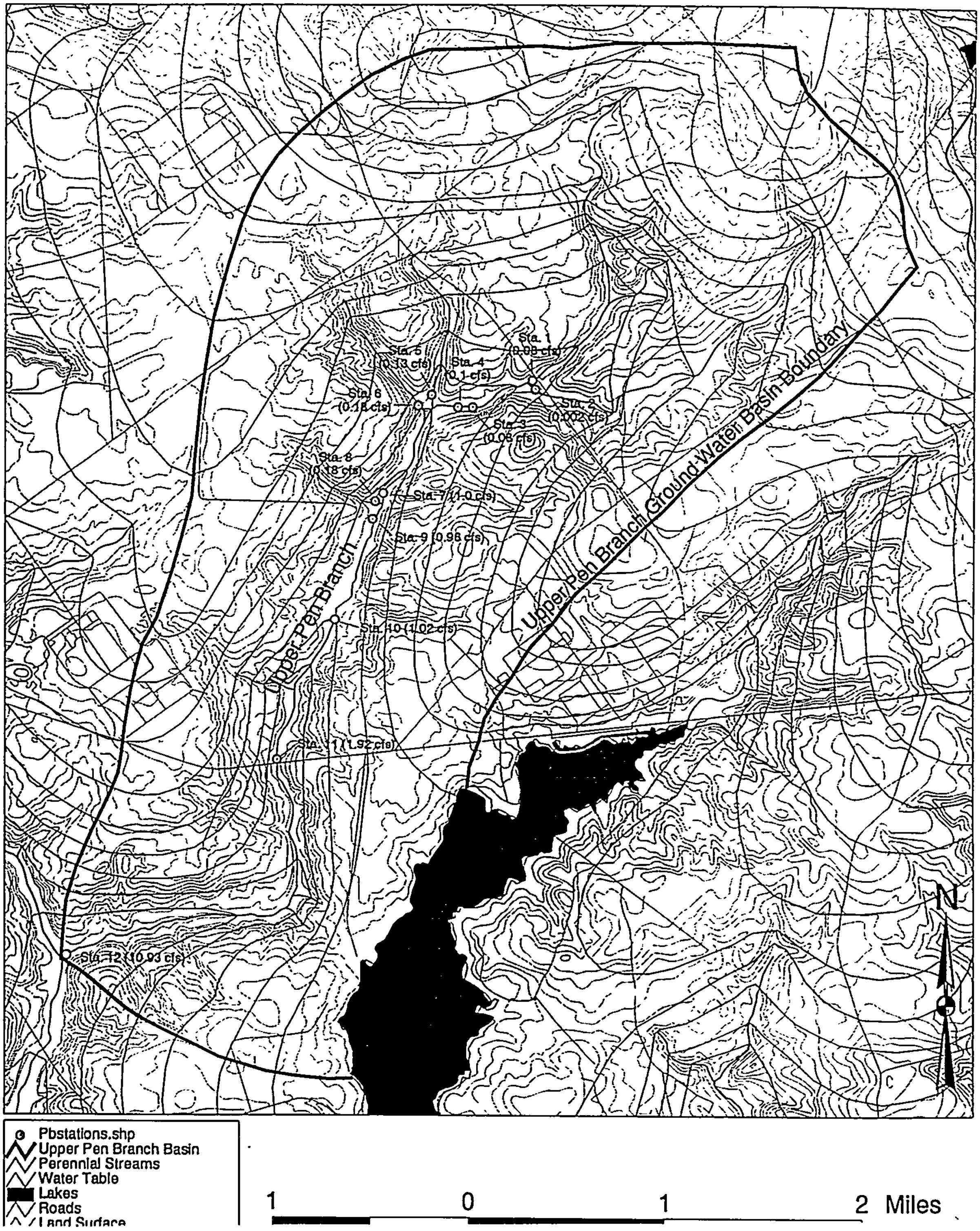
Station 13 (12/8/97) Main branch of Mill Creek, just upstream of confluence with 1'st major tributary to enter Mill Creek from east, as you proceed upstream from Tinker Creek.

Approximate UTM Coordinates: 445534E, 3686510N

Flowmeter Measurement

Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	8	0.26	0.25	0.30	0.079
2	1.5	1	16	0.52	0.34	0.39	0.205
3	2.5	1	19	0.62	0.67	0.72	0.449
4	3.5	1	22	0.72	0.79	0.84	0.606
5	4.5	1	21	0.69	0.85	0.90	0.620
6	5.5	1	19	0.62	0.71	0.76	0.474
7	6.5	1	20	0.66	0.71	0.76	0.499
8	7.5	1	20	0.66	0.65	0.70	0.459
9	8.5	1	12	0.39	0.56	0.61	0.240
10	9.5	1	8	0.26	0.27	0.32	0.084
						Tot. flow=	3.71

Upper Pen Branch Ground Water Basin



PEN BRANCH BASEFLOW

Station 1 Just downstream from Road C, Approx UTM Coord. 441732E, 3676976N
(10/14/97) Near confluence of easternmost two headwater tributaries
Flume Measurement 4" throat width, fluid height=0.2', **Q=0.082cfs** or 37.3gpm

Station 2 Just downstream from Road C, Approx UTM Coord. 441740E, 3676937N
(10/14/97) Near confluence of easternmost two headwater tributaries
Flume Measurement, 4" throat width, fluid height=0.03', **Q=0.0019cfs** or 0.84gpm

Station 3 Just downstream from powerline road, approximately 150 ft.
(10/14/97) Approx UTM coordinates 441114E, 3676771N
Flume Measurement; 4" throat width, height=0.192, **Q=0.078cfs** or 35gpm

Station 4 Just downstream from powerline road, approximately 200 ft.
(10/14/97) Approx UTM coordinates 441044E, 36767791N
Flume Measurement; 4" throat width, height=0.22, **Q=0.101cfs** or 45.1gpm

Station 5 On central headwater tributary of Pen Branch, just upstream of confluence with
(10/14/97) the headwater branch containing the eastern two headwater tributaries.
Approx UTM coordinates 440930E, 36768281N
Flume Measurement; 4" throat width, height=0.25, **Q=0.13cfs** or 58.3gpm

Station 6 On westernmost headwater tributary of Pen Branch, just upstream from confluence
(10/14/97) with the main branch (containing the three eastermost headwater tributaries.)
Approx UTM coordinates 440850E, 36767511N
Flume Measurement; 4" throat width, height=0.29, **Q=0.175cfs** or 78.4gpm

Station 7 On main segment Pen Branch, approx 780 ft downstream from Sta. 6
(10/15/97) Approx UTM coordinates 440523E, 36760281N
Flume Measurement; 4" throat width, height=0.38, **Q=0.3cfs** or 135gpm

Flowmeter Measurement

Segment	depth(cm)	depth(ft)	width(ft)	velocity(ft/sec)	Q (cfs)
1	8	0.26	1	0.96	0.25
2	10	0.33	1	0.96	0.31
3	9	0.30	1	0.69	0.20
4	9	0.30	1	0.79	0.23
				Tot Flow =	1.00

Station 8 On lateral tributary to main branch of Pen Branch, close to sta. 7.
(10/15/97) Approx UTM coordinates 440487E, 36759941N
Flume Measurement; 4" throat width, height=0.29, **Q=0.175cfs** or 78.4gpm

Station 9 On main fork of Pen Branch, close to stations 7 and 8, downstream of their confluence
(10/15/97) Approx UTM coordinates 440479E, 36758991N
Flowmeter Measurement

Segment	depth(cm)	depth(ft)	width(ft)	velocity(ft/sec)		Q (cfs)
1	9	0.30	1	0.08		0.02
2	10	0.33	1	0.31		0.10
3	13	0.43	1	0.52		0.22
4	12	0.39	1	0.39		0.15
5	12	0.39	1	0.5		0.20
6	13	0.43	1	0.52		0.22
7	12	0.39	1	0.21		0.08
8	9	0.30	1	-0.13		-0.04
					Tot Flow =	0.96

Station 10 On Pen Branch at Road 6.2, approximately 100 ft downstream from bridge.
(10/15/97) Approx UTM coordinates 440122E, 3674981N
Flowmeter Measurement

Tape msmt	Segment	depth(cm)	depth(ft)	width(ft)	velocity(ft/sec)		Q (cfs)
1.5	1	8	0.26	1	0.22		0.06
2.5	2	10	0.33	1	0.2		0.07
3.5	3	9	0.30	1	0.49		0.14
4.5	4	10	0.33	1	0.55		0.18
5.5	5	8	0.26	1	0.63		0.17
6.5	6	10	0.33	1	0.52		0.17
7.5	7	7	0.23	1	0.41		0.09
8.5	8	7	0.23	1	0.32		0.07
9.5	9	8	0.26	1	0.21		0.06
10.5	10	6	0.20	1	0.06		0.01
						Tot Flow =	1.02

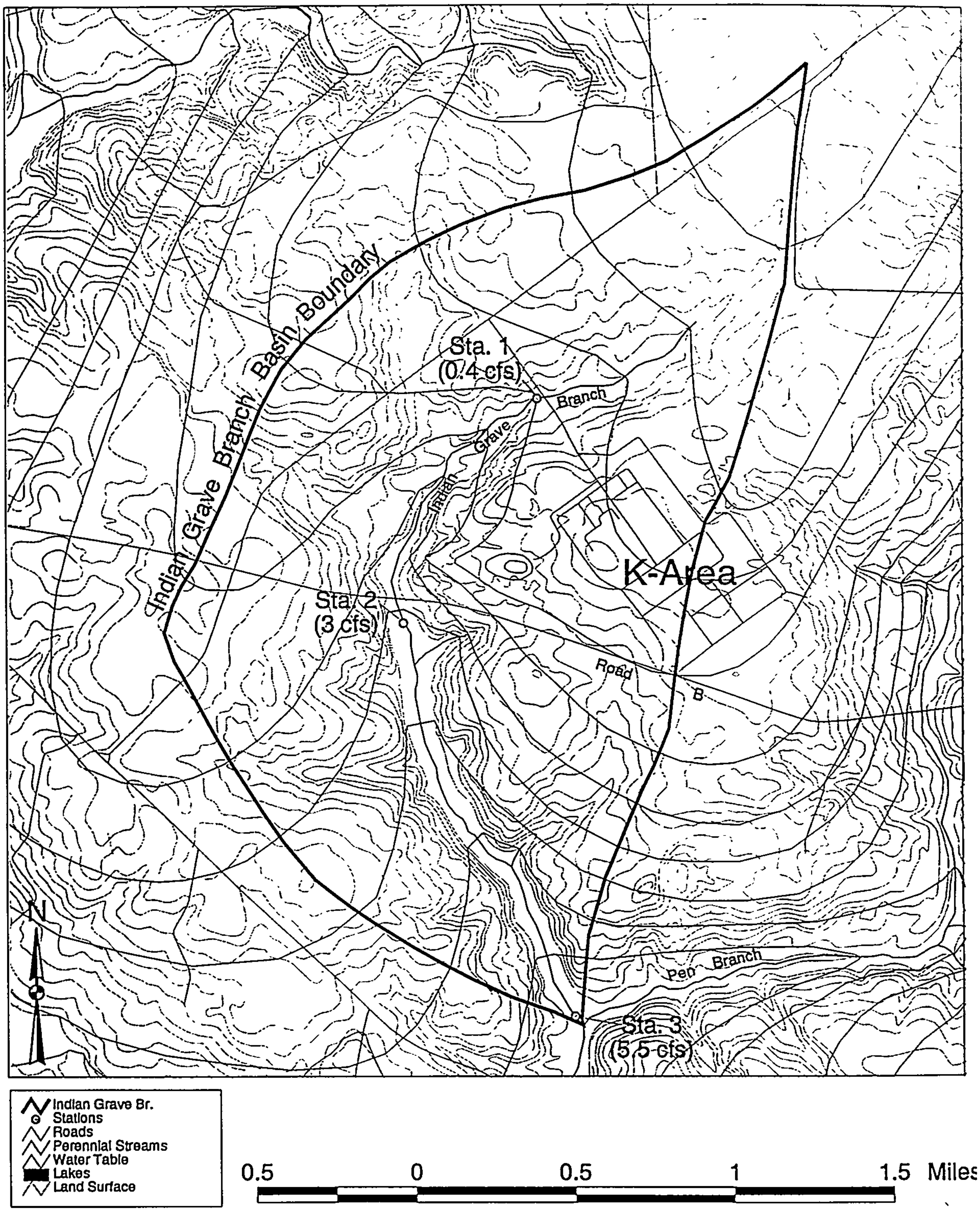
Station 11 On Pen Branch at B Road, approximately 75 ft upstream from bridge.
(10/15/97) Approx UTM coordinates 439666E, 3673894N
Flowmeter Measurement

Tape msmt	Segment	depth(cm)	depth(ft)	width(ft)	velocity(ft/sec)		Q (cfs)
1.5	1	9	0.30	1	0.11		0.03
2.5	2	15	0.49	1	0.26		0.13
3.5	3	14	0.46	1	0.28		0.13
4.5	4	14	0.46	1	0.84		0.39
5.5	5	10	0.33	1	0.87		0.29
6.5	6	10	0.33	1	0.9		0.30
7.5	7	10	0.33	1	0.99		0.32
8.5	8	10	0.33	1	0.82		0.27
9.5	9	9	0.30	1	0.18		0.05
10.5	10	6	0.20	1	0.07		0.01
						Tot Flow =	1.92

Station 12 On Pen Branch just upstream from confluence with Indinian Grave Branch
12/18/97 Approx UTM coordinates 437922E, 3672243N

Segment	Tape	depth(cm)	depth(ft)	width(ft)	velocity (ft/sec)	corr. velocity (ft/sec)	Q (cfs)
1	0.5	24	0.79	1	-0.05	0	0.00
2	1.5	26	0.85	1	0.22	0.27	0.23
3	2.5	39	1.28	1	0.9	0.95	1.22
4	3.5	35	1.15	1	0.8	0.85	0.98
5	4.5	33	1.08	1	0.91	0.96	1.04
6	5.5	29	0.95	1	0.88	0.93	0.88
7	6.5	27	0.89	1	0.94	0.99	0.88
8	7.5	26	0.85	1	0.98	1.03	0.88
9	8.5	27	0.89	1	0.87	0.92	0.82
10	9.5	26	0.85	1	0.97	1.02	0.87
11	10.5	26	0.85	1	0.79	0.84	0.72
12	11.5	24	0.79	1	0.59	0.64	0.50
13	12.5	25	0.82	1	0.48	0.53	0.43
14	13.5	30	0.98	1	0.62	0.67	0.66
15	14.5	26	0.85	1	0.66	0.71	0.61
16	15.5	16	0.52	1	0.38	0.43	0.23
						Tot Flow =	10.93

Indian Grave Branch Baseflow



INDIAN GRAVE BRANCH BASEFLOW

Station 1 Indian Grave Branch, approximately 100 ft. downstream from road 6.4
(12/18/97) Approximate UTM Coordinates:437677E, 3675456N

Flowmeter Measurement Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	6	0.20	-0.03	0.02	0.004
2	1.5	1	12	0.39	-0.04	0.01	0.004
3	2.5	1	12	0.39	0.45	0.50	0.197
4	3.5	1	12	0.39	0.40	0.45	0.177
						Tot. flow=	0.38

Station 2 Indian Grave Branch about 150 yards downstream from Road B
(12/18/97) Approximate UTM Coordinates: 436979E, 3674290N

Flowmeter Measurement Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	7	0.23	0.02	0.07	0.016
2	1.5	1	14	0.46	0.27	0.32	0.147
3	2.5	1	17	0.56	0.56	0.61	0.340
4	3.5	1	20	0.66	0.48	0.53	0.348
5	4.5	1	22	0.72	0.47	0.52	0.375
6	5.5	1	26	0.85	0.36	0.41	0.350
7	6.5	1	30	0.98	0.56	0.61	0.600
8	7.5	1	24	0.79	0.38	0.43	0.339
9	8.5	1	24	0.79	-0.23	0.28	0.220
10	9.5	1	21	0.69	0.18	0.23	0.158
11	10.5	1	16	0.52	0.07	0.12	0.063
12	11.5	1	10	0.33	0.02	0.07	0.023
						Tot. flow=	2.98

Station 3 Indian Grave Branch just above confluence with Pen Branch
(12/18/97) Approximate UTM Coordinates: 437845E, 3672268N

Flowmeter Measurement Segment	Tape	width (ft.)	depth (cm)	depth (ft)	flow vel. (ft/sec)	corrected flow vel. (ft/sec)	Q (cfs)
1	0.5	1	6	0.20	0.20	0.25	0.049
2	1.5	1	9	0.30	0.64	0.69	0.204
3	2.5	1	12	0.39	1.13	1.18	0.465
4	3.5	1	16	0.52	1.33	1.38	0.724
5	4.5	1	16	0.52	1.39	1.44	0.756
6	5.5	1	20	0.66	1.51	1.56	1.024
7	6.5	1	20	0.66	1.63	1.68	1.102
8	7.5	1	17	0.56	1.02	1.07	0.597
9	8.5	1	14	0.46	0.87	0.92	0.423
10	9.5	1	12	0.39	0.37	0.42	0.165
						Tot. flow=	5.51

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APPENDIX F. HYDRAULIC HEAD TARGET AND RESIDUAL DATA

Hydraulic Head Targets

Table F-1 summarizes the hydraulic head data available for model calibration. When multiple measurements are available for a given well, the mean water level is shown. Otherwise, the single reading is given. The sample standard deviation of the mean, sample standard deviation of the population, and number of readings follow the target head, where applicable. The "category" column refers to the aquifer zone: 1=Gordon aquifer, 2="lower" UTRA, 3="upper" UTRA, and 4=mixed or other. The average head target has a "2 sigma" uncertainty of ±0.76 ft, not counting one time readings which inflate the overall average uncertainty.

Table F-1. Hydraulic Head Targets for Model Calibration

Well ID	SRS Easting (ft)	SRS Northing (ft)	Screen Bottom (ft msl)	Screen Top (ft msl)	Mean Head (ft msl)	Sample Std. Dev. of Mean	Sample Std. Dev.	No. of Meas	Cat
BG 26	58809.70	73958.40	210.7	230.7	239.35	0.85	1.20	2	3
BG 27	58810.00	74356.70	234.4	254.4	240.95	0.85	1.20	2	3
BG 28	58810.20	74752.00	239.7	259.7	247.10	0.60	0.85	2	3
BG 29	58809.90	75151.60	231.6	251.6	245.00	0.60	0.85	2	3
BG 30	58809.10	75550.10	231.7	251.7	237.55	0.05	0.07	2	3
BG 31	58803.70	75949.90	223.3	243.3	233.70	0.50	0.71	2	3
BG 32	58803.50	76349.90	226.9	246.9	233.40	0.30	0.42	2	3
BG 33	58526.00	76479.90	221.2	241.2	232.90	0.30	0.42	2	3
BG 34	58107.40	76493.60	217.4	237.4	232.85	0.45	0.64	2	3
BG 35	57726.40	76495.30	228.0	248.0	232.90	0.20	0.28	2	3
BG 36	57620.30	76747.60	223.3	243.3	232.50	0.60	0.85	2	3
BG 37	57251.00	76804.90	227.8	247.8	232.85	0.55	0.78	2	3
BG 38	56851.10	76805.00	225.9	245.9	232.30	0.40	0.57	2	3
BG 39	56451.30	76804.90	226.0	246.0	231.70	0.50	0.71	2	3
BG 40	56051.00	76805.10	221.9	241.9	231.40	0.50	0.71	2	3
BG 41	55868.80	76576.30	221.0	241.0	230.75	0.25	0.35	2	3
BG 42	55869.50	76178.80	217.1	237.1	230.70	0.60	0.85	2	3
BG 43	56039.40	75852.50	222.9	242.9	230.50	0.40	0.57	2	3
BG 51	58599.30	73864.30	221.2	241.2	240.70	-1.00	-1.00	1	3
BG 52	55524.30	75910.40	223.8	243.8	229.10	0.25	1.25	25	3
BG 53	55073.90	76157.30	214.7	234.7	228.04	0.31	0.94	9	3
BG 54	54830.30	75837.90	215.2	235.2	228.42	0.29	1.51	27	3
BG 55	54590.50	75525.30	214.9	234.9	226.30	0.61	3.19	27	3
BG 56	54481.90	75206.50	210.9	230.9	225.05	0.27	0.76	8	3
BG 57	54820.00	75000.40	214.6	234.6	225.27	0.15	0.45	9	3
BG 58	55162.30	74790.90	218.2	238.2	226.78	0.27	0.81	9	3
BG 59	55508.30	74593.40	217.7	237.7	229.63	0.39	1.90	24	3
BG 60	55850.30	74386.30	215.5	235.5	230.55	0.37	1.81	24	3
BG 61	56360.80	74075.40	225.0	245.0	232.51	0.44	2.16	24	3
BG 62	56530.90	73971.60	222.5	242.5	233.22	0.44	1.40	10	3
BG 63	56870.50	73754.50	224.2	244.2	235.24	0.43	1.35	10	3
BG 64	57212.40	73547.20	227.3	247.3	238.13	0.38	1.21	10	3
BG 65	57552.70	73340.60	230.9	250.9	235.74	0.42	1.31	10	3
BG 66	57805.00	73585.00	231.0	251.0	235.20	0.60	1.81	9	3
BG 67	57902.60	73954.10	224.7	244.7	236.33	0.56	2.88	26	3
BG 68	58251.50	76553.60	216.5	242.9	232.22	-1.00	-1.00	1	3
BG 69	58226.20	76553.80	222.2	242.2	232.48	-1.00	-1.00	1	3
BG 80	57962.60	76596.50	226.2	248.6	232.73	-1.00	-1.00	1	3
BG 81	57983.00	76621.90	222.9	246.9	227.35	-1.00	-1.00	1	3
BG 84	57955.40	76695.90	227.2	247.2	232.58	-1.00	-1.00	1	3

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

BG 85	57928.90	76719.00	228.0	248.0	232.55	-1.00	-1.00	1	3
BG 86	57979.40	76721.40	228.0	248.0	232.48	-1.00	-1.00	1	3
BG 87	57951.90	76748.90	226.2	245.8	232.30	-1.00	-1.00	1	3
BG 91	56649.40	78031.30	205.4	235.4	218.57	0.47	1.95	17	4
BG 92	56828.00	79019.60	197.2	227.2	208.80	0.76	3.11	17	2
BG 93	57160.80	79930.80	180.5	210.5	198.85	1.09	4.50	17	2
BG 94	57494.00	80867.20	152.8	182.8	191.12	0.28	1.20	18	2
BG 95	58407.00	80059.90	152.5	182.5	192.79	0.27	1.14	18	2
BG 96	58297.80	79396.30	177.2	207.2	197.66	0.70	2.87	17	2
BG 98	57398.70	77597.90	212.5	242.5	224.46	-1.00	-1.00	1	3
BG 99	58404.10	76904.60	215.9	245.9	232.53	-1.00	-1.00	1	3
BG 100	58899.10	77815.60	203.3	233.3	224.80	-1.00	-1.00	1	3
BG 103	59752.10	77883.60	169.5	199.5	199.79	0.34	1.32	15	2
BG 104	59888.00	77038.80	215.8	245.8	224.79	-1.00	-1.00	1	3
BG 107	60120.10	74803.60	208.3	228.3	235.28	0.35	1.47	18	3
BG 108	59827.90	74383.00	217.3	247.3	238.77	0.31	1.33	18	3
BG 109	59626.10	73926.20	228.4	258.4	240.12	0.35	1.44	17	3
BG 110	59277.20	73354.70	224.3	254.3	241.23	0.51	2.09	17	3
BG 113	59386.00	77410.20	196.4	216.4	217.10	-1.00	-1.00	1	4
BG 115	57884.50	77207.20	198.9	218.9	215.80	-1.00	-1.00	1	4
BG 119	57004.90	77743.70	209.2	229.2	215.37	-1.00	-1.00	1	4
BG 122	56789.70	78581.10	189.9	209.9	211.22	0.37	1.51	17	2
BG 124	57095.00	77254.00	214.8	234.8	231.82	-1.00	-1.00	1	4
BGO 1D	58779.30	73737.90	225.0	245.0	237.92	0.37	2.78	56	3
BGO 2D	58809.70	74552.90	218.9	238.9	238.00	0.19	1.34	51	3
BGO 3A	58806.80	75561.70	103.7	113.7	162.93	0.14	0.55	15	1
BGO 3C	58806.40	75550.40	178.7	188.7	225.54	0.25	1.02	17	2
BGO 3D	58809.20	75351.30	227.6	247.6	235.46	0.20	1.13	33	3
BGO 3DR	58820.00	75512.30	217.5	237.6	231.77	0.16	0.61	15	3
BGO 4D	58803.70	76150.10	220.6	240.6	231.82	0.31	1.44	21	3
BGO 5C	58794.50	76476.90	183.2	193.2	216.22	0.41	2.75	46	2
BGO 5D	58784.80	76477.50	219.3	239.3	230.40	0.36	2.50	48	3
BGO 6A	58316.80	76487.20	107.5	117.5	159.25	0.09	0.61	50	1
BGO 6B	58346.50	76553.20	139.7	149.7	218.79	0.16	0.94	34	2
BGO 6C	58307.00	76487.10	158.0	168.0	219.97	0.16	1.14	52	2
BGO 6D	58297.10	76487.30	217.2	237.2	231.37	0.11	0.78	53	3
BGO 7D	57917.20	76494.50	220.2	240.2	232.69	0.33	2.30	48	3
BGO 8A	57618.30	76569.00	105.3	115.3	160.96	0.77	2.43	10	1
BGO 8AR	57617.50	76598.80	94.6	104.6	160.82	0.22	1.39	40	1
BGO 8C	57618.70	76579.20	174.3	184.3	224.34	0.32	2.24	48	2
BGO 8D	57617.80	76588.80	220.6	240.6	232.73	0.48	3.37	49	3
BGO 9AA	57371.90	76975.70	73.8	83.8	157.89	0.10	0.53	31	1
BGO 9D	57478.90	76811.60	209.2	229.2	230.04	0.52	3.75	52	3
BGO 10A	57050.90	76805.20	111.1	121.1	170.57	1.50	6.17	17	4
BGO 10AA	56990.50	76997.90	80.8	90.8	157.44	0.68	3.62	28	1
BGO 10AR	57063.80	76806.00	96.5	106.5	158.45	0.10	0.60	35	1
BGO 10B	56978.80	76982.10	139.0	149.0	219.55	0.25	1.33	28	2
BGO 10C	57041.10	76805.20	157.3	167.3	220.23	0.15	1.11	54	2
BGO 10D	57030.60	76805.10	230.5	250.5	231.80	0.24	0.72	9	3
BGO 10DR	57073.70	76804.80	218.3	238.3	231.49	0.29	1.70	35	3
BGO 11D	56651.30	76805.10	216.3	236.3	230.71	0.39	2.43	38	3
BGO 11DR	56650.40	76849.30	213.1	233.0	230.11	0.23	0.90	15	4
BGO 12AR	56259.90	76803.80	99.3	109.3	157.79	0.11	0.51	22	1
BGO 12AX	56258.00	76834.80	99.5	109.5	157.21	0.19	0.73	15	1
BGO 12C	56241.10	76805.20	153.6	163.6	220.05	0.24	0.77	10	2
BGO 12CR	56215.20	76806.00	144.0	154.0	221.87	0.22	1.04	22	2
BGO 12CX	56230.40	76834.50	141.2	151.2	229.96	0.23	0.93	16	2
BGO 12D	56231.10	76805.20	217.8	237.8	231.31	0.21	1.30	38	3
BGO 12DR	56214.70	76834.60	212.7	232.8	219.57	0.25	0.96	15	4

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

BGO 13D	55840.00	76805.30	228.5	248.5	231.03	0.90	2.39	7	3
BGO 13DR	55840.40	76824.70	210.3	220.3	230.73	0.23	1.42	39	2
BGO 14A	55838.30	76377.50	109.6	119.6	157.95	0.16	0.59	14	1
BGO 14AR	55788.90	76351.80	96.8	106.8	159.35	0.20	1.18	36	1
BGO 14C	55839.00	76367.70	192.1	202.1	221.36	0.95	3.55	14	2
BGO 14CR	55789.00	76337.80	190.1	200.1	223.55	0.22	1.40	39	2
BGO 14DR	55789.40	76322.10	218.1	238.1	230.43	0.27	1.63	37	3
BGO 15D	55859.10	75973.50	218.7	238.7	229.74	0.20	1.45	51	3
BGO 16A	56194.20	75757.00	102.5	112.5	160.96	0.22	1.06	22	1
BGO 16AR	56217.10	75743.20	103.7	113.7	160.91	0.09	0.50	30	1
BGO 16B	56183.80	75767.50	136.0	146.0	218.14	0.22	1.25	33	2
BGO 16D	56202.10	75751.40	217.3	237.3	230.81	0.16	1.16	52	3
BGO 17D	56399.40	75599.60	204.0	224.0	230.77	0.27	0.82	9	4
BGO 17DR	56407.20	75604.00	216.9	236.9	231.96	0.37	2.08	32	3
BGO 18A	56699.70	75599.90	99.5	109.5	161.04	0.11	0.76	52	1
BGO 18D	56711.20	75600.00	219.6	239.6	231.88	0.17	1.16	49	3
BGO 19D	56997.30	75350.00	196.8	216.8	234.16	0.25	1.29	26	4
BGO 19DR	56800.70	75520.00	196.7	216.7	231.26	0.22	0.87	15	4
BGO 20A	57100.40	74966.40	86.3	96.3	163.56	0.55	2.14	15	1
BGO 20AA	57089.50	74949.80	18.3	28.3	161.48	0.13	0.51	16	4
BGO 20B	57119.80	74951.50	131.0	141.0	226.92	0.24	1.02	18	2
BGO 20C	57106.00	74937.60	174.0	184.0	228.16	0.27	1.08	16	2
BGO 20D	57113.80	74962.20	216.3	236.3	233.91	0.21	1.48	49	3
BGO 21D	57470.70	74688.50	217.7	237.7	234.83	0.24	1.77	55	3
BGO 22D	57817.30	74482.20	194.2	214.2	232.60	0.20	0.94	21	3
BGO 22DR	57831.50	74471.50	219.2	239.2	236.04	0.99	4.30	19	3
BGO 22DX	57770.74	74560.48	217.9	237.9	233.90	0.23	0.73	10	3
BGO 23D	58133.00	74238.10	222.0	242.0	235.84	0.15	1.07	52	3
BGO 24D	58438.80	74012.40	221.0	241.0	236.79	0.15	1.05	52	3
BGO 25A	55668.10	76158.50	104.1	114.1	160.63	0.17	1.16	49	1
BGO 26A	55014.20	76144.60	81.0	91.0	160.92	0.81	4.67	33	1
BGO 26D	55015.20	76128.00	213.4	233.5	227.69	0.22	1.47	46	3
BGO 27C	54671.40	75666.30	154.9	163.9	220.61	0.23	1.48	41	2
BGO 27D	54680.20	75677.30	209.3	229.3	227.41	0.21	1.47	47	3
BGO 28D	54457.90	75348.30	210.1	230.1	226.10	0.22	1.47	46	3
BGO 29A	54103.50	75560.00	102.5	112.5	159.55	0.15	0.96	43	1
BGO 29C	54099.10	75577.80	176.8	186.8	222.83	0.24	1.36	33	2
BGO 29D	54099.40	75592.50	208.5	228.5	226.12	0.25	1.46	35	3
BGO 30C	54512.30	75181.00	178.4	188.4	219.02	0.20	1.35	45	2
BGO 30D	54499.20	75187.70	207.8	227.8	225.48	0.22	1.48	46	3
BGO 31C	54816.20	74978.00	176.4	186.4	225.33	0.23	1.49	44	2
BGO 31D	54841.70	74985.30	211.1	231.1	226.43	0.23	1.54	46	3
BGO 32D	55250.20	74727.00	214.5	234.5	227.47	0.22	1.47	46	3
BGO 33C	55681.40	74479.70	177.8	187.8	224.93	0.20	1.36	45	2
BGO 33D	55695.40	74468.70	213.1	233.1	229.91	0.34	2.34	46	3
BGO 34D	56082.60	74228.80	212.7	232.7	232.68	0.26	1.72	45	3
BGO 35C	56545.70	73953.90	161.9	171.9	228.57	0.23	1.50	42	2
BGO 35D	56556.50	73946.00	219.4	239.4	234.51	0.38	2.49	43	3
BGO 36D	56888.10	73743.80	223.3	243.3	236.60	0.35	2.40	46	3
BGO 37C	57279.20	73498.20	168.8	178.8	229.91	0.23	1.24	29	2
BGO 37D	57292.90	73490.80	226.1	246.1	237.87	0.30	2.03	45	3
BGO 38D	57557.50	73329.30	222.3	242.3	235.20	0.25	1.65	45	3
BGO 39A	57821.90	73573.20	84.8	94.8	167.49	0.13	0.47	13	1
BGO 39C	57816.10	73563.30	174.9	184.9	229.34	1.25	4.66	14	2
BGO 39D	57831.00	73583.50	224.7	244.7	234.58	0.50	3.33	44	3
BGO 40D	54638.60	76125.80	216.6	226.5	222.20	0.26	1.55	35	3
BGO 41A	55403.70	76469.50	103.3	113.3	158.32	0.12	0.61	27	1
BGO 42C	55522.30	76404.70	185.9	195.9	223.18	0.25	1.44	32	2

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

BGO 43A	56253.40	77061.40	105.9	115.9	158.76	0.34	1.72	26	1
BGO 43AA	56268.60	77066.00	62.2	72.2	156.65	0.18	0.98	31	1
BGO 43CR	56237.20	77035.20	178.4	188.4	225.21	0.29	1.57	29	2
BGO 43D	56238.80	77056.70	198.2	208.2	231.27	0.25	1.41	32	2
BGO 44A	57851.20	76755.20	98.0	108.0	158.40	0.08	0.45	32	1
BGO 44AA	57880.50	76757.00	61.2	71.3	158.68	0.08	0.44	30	1
BGO 44B	57865.80	76756.00	148.1	158.1	221.28	0.31	1.79	33	2
BGO 44C	57894.90	76757.80	190.6	200.6	220.82	0.18	1.01	33	2
BGO 44D	57910.00	76759.50	223.4	233.4	232.53	0.17	0.95	31	3
BGO 45A	54550.10	75830.00	116.9	126.9	160.72	0.09	0.50	34	4
BGO 45B	54563.60	75840.30	137.0	147.0	218.73	0.43	2.53	34	2
BGO 45C	54577.40	75835.00	190.5	200.5	222.62	0.39	2.29	34	2
BGO 45D	54585.60	75854.30	209.6	229.6	227.70	0.25	1.43	34	3
BGO 46B	54444.70	75012.10	140.4	150.4	217.94	0.20	1.14	31	2
BGO 46C	54433.90	75022.20	178.0	188.0	219.37	0.30	1.72	34	2
BGO 46D	54420.00	75033.80	202.1	212.1	224.96	0.32	1.82	33	4
BGO 47A	54914.00	74728.80	86.8	96.8	162.32	0.08	0.47	32	1
BGO 47C	54933.40	74752.00	178.6	188.6	222.67	0.22	1.25	32	2
BGO 47D	54922.90	74739.70	203.4	213.4	226.27	0.24	1.36	32	4
BGO 48C	55124.40	74599.60	176.7	186.7	223.33	0.22	1.27	33	2
BGO 48D	55121.00	74586.40	202.0	212.0	226.52	0.24	1.38	33	4
BGO 49A	56205.10	73902.80	75.1	85.1	167.18	1.49	4.94	11	1
BGO 49C	56202.20	73917.20	166.0	176.0	227.74	0.29	1.65	33	2
BGO 49D	56198.80	73931.50	218.5	238.5	234.48	0.28	1.51	29	3
BGO 50A	54179.80	75201.20	90.5	100.5	160.09	0.09	0.56	36	1
BGO 50C	54197.00	75190.40	162.5	172.5	218.08	0.40	2.24	32	2
BGO 50D	54209.10	75181.30	208.0	228.0	225.02	0.25	1.41	33	3
BGO 51A	57841.80	74133.00	75.1	85.1	165.89	0.26	1.00	15	1
BGO 51AA	57867.00	74113.10	29.2	39.2	168.18	0.13	0.48	14	4
BGO 51B	57848.30	74127.70	116.9	126.9	229.39	0.35	1.36	15	2
BGO 51C	57854.40	74123.10	175.1	185.1	230.27	0.30	1.16	15	2
BGO 51D	57860.60	74118.00	220.1	240.1	235.17	0.29	1.11	15	3
BGO 52A	57184.00	74632.60	81.7	91.7	163.71	0.12	0.46	15	1
BGO 52AA	57178.10	74638.00	36.6	46.6	162.94	0.11	0.44	15	1
BGO 52B	57189.80	74627.30	126.7	136.7	227.45	0.26	1.02	15	2
BGO 52B	57189.80	74627.30	126.7	136.7	227.45	0.26	1.02	15	2
BGO 52C	57195.50	74622.00	178.7	188.7	228.68	0.27	1.03	15	2
BGO 52D	57201.40	74617.30	219.4	239.4	233.60	0.28	1.10	15	3
BGO 53A	55423.90	76070.80	78.7	88.7	158.95	0.12	0.46	15	1
BGO 53AA	55431.50	76065.00	38.9	48.9	155.61	0.11	0.42	15	1
BGO 53B	55416.20	76076.60	143.5	153.5	221.27	0.55	2.15	15	2
BGO 53C	55408.30	76082.50	183.2	193.2	222.01	0.27	1.00	14	2
BGO 53D	55425.50	76056.00	225.3	245.3	229.13	0.26	0.98	14	3
BGX 1A	58590.40	76831.90	114.1	124.1	158.77	0.69	3.77	30	1
BGX 1C	58599.80	76820.00	176.0	186.0	215.82	0.19	1.09	34	2
BGX 1D	58608.60	76809.50	214.7	234.7	229.54	0.12	0.73	35	3
BGX 2B	58256.50	77203.40	137.2	147.2	212.74	0.20	1.19	34	2
BGX 2D	58265.60	77192.40	181.1	191.1	215.22	0.27	1.59	36	2
BGX 3D	57780.10	77577.00	201.6	221.6	214.62	0.39	2.32	35	4
BGX 4A	57215.60	77879.20	106.8	116.8	155.11	0.08	0.45	34	1
BGX 4C	57202.20	77886.20	170.7	180.7	214.48	0.27	1.55	33	2
BGX 4D	57186.20	77893.90	203.8	223.8	215.70	0.27	1.55	34	2
BGX 5D	57308.60	78402.00	195.0	215.0	209.00	0.28	1.65	34	2
BGX 6D	57524.90	78740.10	191.0	211.0	205.73	0.28	1.67	35	2
BGX 7D	58312.80	78349.30	194.1	214.1	205.54	0.27	1.44	29	2
BGX 8DR	58942.50	77589.60	183.1	203.1	205.39	0.21	1.15	31	2
BGX 9D	59522.10	76936.00	212.4	232.4	226.47	0.39	2.31	35	3
BGX 10D	59765.50	76183.30	216.2	236.2	225.41	0.33	1.90	34	3
BGX 11D	59581.40	75300.70	216.7	236.7	235.34	0.22	1.22	31	3

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

BGX 12C	59675.30	74427.90	174.1	184.1	234.17	0.51	2.94	33	2
BGX 12D	59674.30	74410.90	223.7	243.7	238.78	0.30	1.80	35	3
BRD 1	29277.70	55860.50	148.9	178.9	167.10	0.30	1.69	32	3
BRD 2	29357.10	56093.30	148.5	178.5	169.27	0.60	3.37	32	3
BRD 3	29538.90	55918.70	158.5	188.5	169.95	0.14	0.44	10	3
BRD 4	29219.20	56060.40	129.1	159.1	165.91	0.36	1.96	30	4
BRD 5D	29252.60	55955.70	148.4	168.4	166.75	0.37	1.84	25	3
BRR 1D	50588.20	77365.20	200.4	220.4	217.15	0.46	2.11	21	3
BRR 2D	50306.30	77431.40	196.1	216.1	215.49	0.47	2.20	22	3
BRR 3D	50203.50	77398.30	197.1	217.1	215.18	0.43	2.06	23	3
BRR 4D	50104.50	77360.50	198.7	218.7	215.10	0.45	2.06	21	3
BRR 5D	50009.00	77266.70	202.1	222.1	214.85	0.43	1.91	20	3
BRR 6C	51094.70	77062.90	156.0	166.0	211.63	0.26	0.57	5	2
BRR 7BR	50707.50	77575.40	141.6	151.6	204.87	0.03	0.05	2	2
BRR 7C	50698.10	77572.90	175.9	185.9	209.81	0.34	0.75	5	2
BRR 7D	50688.30	77570.70	201.9	221.9	217.88	0.30	0.67	5	3
BRR 8B	50116.50	77634.70	138.7	148.7	204.34	0.38	0.85	5	2
BRR 8C	50125.60	77632.00	182.7	192.7	208.50	0.38	0.84	5	4
BRR 8DR	50142.30	77627.30	204.0	219.0	214.34	0.19	0.33	3	3
CBR 1D	52822.10	60419.50	230.9	250.9	253.45	0.56	2.55	21	3
CBR 2D	52694.00	60368.90	233.8	253.8	252.91	0.53	2.49	22	3
CBR 3D	52627.20	60388.50	234.1	254.1	253.02	0.53	2.51	22	3
CCB 1	46990.10	65438.50	198.4	228.4	226.06	0.72	3.37	22	3
CCB 2	46893.60	65306.10	198.6	228.6	222.53	0.74	4.24	33	3
CCB 3	47006.60	65187.50	205.6	235.6	225.15	0.66	3.60	30	3
CCB 4	47181.60	65310.20	211.2	241.2	226.12	0.70	3.96	32	3
CDB 1	45685.50	67514.60	195.7	216.6	213.86	0.55	3.23	35	3
CDB 2	45617.70	67415.30	195.1	216.1	214.92	0.59	3.43	34	3
CMP 8A	54270.20	52671.20	13.7	23.5	182.94	0.30	1.62	29	1
CMP 8B	54280.20	52674.60	156.6	166.6	198.46	0.14	0.76	32	2
CMP 9B	53842.30	51691.60	149.0	159.0	194.72	0.13	0.68	28	2
CMP 10	54006.50	51390.40	188.8	218.8	220.11	0.42	2.06	24	4
CMP 10B	54005.90	51380.70	137.4	147.4	195.01	0.13	0.74	31	2
CMP 10C	53994.30	51402.70	179.6	189.6	198.92	0.26	0.51	4	2
CMP 11	53640.60	51481.30	185.2	215.2	212.03	0.45	2.36	27	4
CMP 11B	53661.90	51456.60	139.7	149.7	195.01	0.16	0.85	29	2
CMP 11D	53647.00	51467.90	209.5	229.9	221.20	1.04	2.32	5	3
CMP 12A	53524.60	51949.20	22.1	32.1	181.59	0.36	1.92	29	1
CMP 12B	53517.70	51943.30	148.0	158.0	194.64	0.14	0.76	31	2
CMP 13B	53937.80	51855.50	134.2	144.2	194.67	0.14	0.75	31	2
CMP 14B	52587.30	52376.40	130.0	140.0	194.55	0.12	0.68	31	2
CMP 14C	52579.60	52371.70	185.1	215.1	212.44	0.63	3.29	27	4
CMP 14D	52589.50	52363.50	204.1	224.5	216.16	0.91	2.04	5	3
CMP 15A	52896.80	51357.20	14.2	24.2	180.60	0.31	1.67	29	1
CMP 15B	52904.70	51349.50	145.1	155.1	202.85	0.38	2.20	33	2
CMP 15C	52907.80	51361.40	220.6	250.6	239.61	0.69	2.93	18	3
CMP 16B	53849.90	51576.70	141.7	151.7	194.77	0.14	0.75	31	2
CMP 16C	53856.00	51569.50	215.6	235.6	223.48	0.47	0.94	4	3
CMP 30B	53166.90	51729.80	97.4	107.5	194.72	0.17	0.30	3	2
CMP 30C	53208.20	51718.40	179.5	189.5	210.85	0.20	0.40	4	2
CMP 30D	53202.90	51709.70	211.6	231.6	221.12	1.07	2.62	6	3
CMP 31B	53259.80	52319.10	110.0	120.0	194.41	0.13	0.26	4	2
CMP 32B	54052.80	52220.00	97.7	107.7	195.54	0.15	0.37	6	2
CMP 32C	54061.10	52214.60	185.2	195.2	195.93	0.17	0.34	4	2
CMP 32D	54069.20	52209.20	218.6	228.6	220.90	0.08	0.17	5	3
CRP 1	44372.20	68617.70	187.8	217.8	207.91	0.42	2.28	30	3
CRP 2	44336.40	69043.00	171.8	201.8	207.12	0.35	2.02	33	3
CRP 3	44001.00	68665.50	184.0	214.0	207.80	0.52	1.64	10	3

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

CRP 3C	44023.80	68701.60	121.1	131.1	196.71	0.22	0.57	7	2
CRP 3D	44012.90	68693.60	194.3	214.3	207.39	0.32	1.06	11	3
CRP 4	44101.20	68447.40	180.7	210.7	207.89	0.49	2.71	31	3
CRP 5C	44527.70	68535.60	110.1	120.1	198.20	0.27	0.77	8	2
CRP 5D	44515.00	68549.10	194.6	214.6	211.58	0.48	1.65	12	3
CRP 6DR	44017.50	68311.50	194.2	214.2	210.50	-1.00	-1.00	1	3
CRP 7D	44081.80	69196.70	188.0	208.0	206.46	0.53	1.75	11	3
CRP 8D	43681.70	68650.40	191.0	211.0	207.63	0.79	1.93	6	3
CRP 9D	44243.20	69156.70	191.4	211.4	207.13	0.46	1.21	7	3
CRP 10D	43742.70	68999.80	189.5	209.5	204.96	0.89	1.98	5	3
CRP 11D	44164.40	68713.50	193.7	203.6	206.91	0.86	1.93	5	3
CSA 1	50197.00	61808.40	232.0	262.0	243.30	0.65	3.40	27	3
CSA 2	50218.60	61761.80	218.2	248.2	243.73	0.72	3.83	28	3
CSA 3	50173.20	61720.20	218.6	248.6	242.97	0.65	3.41	28	3
CSA 4	50132.70	61781.90	218.4	248.4	242.67	0.65	3.46	28	3
CSB 1A	44974.00	67593.00	194.9	224.9	213.18	0.47	2.39	26	3
CSB 2A	44802.60	67310.20	192.6	222.6	210.49	0.61	3.11	26	3
CSB 3A	44648.30	67385.60	193.0	223.0	210.42	0.53	3.04	33	3
CSB 4A	44618.50	67561.80	188.0	218.0	210.60	0.51	3.07	36	3
CSB 5A	44618.90	67751.60	185.9	215.9	210.66	0.50	2.97	36	3
CSB 6A	44863.80	67812.40	189.8	219.8	211.13	0.54	3.02	31	3
CSD 1D	50170.50	63255.80	238.4	273.4	244.91	0.56	2.68	23	3
CSD 2D	50144.00	63126.20	233.8	258.8	248.86	0.30	1.04	12	3
CSD 4D	50058.90	63143.80	213.5	263.5	243.99	0.64	2.94	21	3
CSD 8D	49903.10	63195.00	226.8	256.8	243.13	0.57	2.68	22	3
CSD 9D	49838.80	63080.90	226.2	256.2	243.22	0.62	2.82	21	3
CSD 10D	49806.50	63094.10	224.5	254.5	243.12	0.62	2.82	21	3
CSD 11D	49763.90	63956.30	220.9	250.9	242.95	0.65	3.00	21	3
CSD 12D	49937.30	63004.70	224.5	254.5	243.59	0.63	2.87	21	3
CSD 13D	49665.50	62897.80	202.4	252.4	242.42	0.63	2.96	22	3
CSF 1D	49431.30	62368.60	228.2	248.2	243.36	0.17	0.29	3	3
CSF 2D	50880.70	61053.30	235.2	255.2	250.98	0.34	0.48	2	3
CSO 1	52484.20	61071.10	232.0	262.0	251.03	0.67	3.71	31	3
CSO 2	52559.00	61114.30	209.7	239.7	252.22	0.61	3.05	25	3
CSR 1	52804.30	64413.10	237.2	267.2	256.06	0.71	3.67	27	3
CSR 3	53229.90	65234.80	238.1	268.1	254.36	0.74	3.83	27	3
CSR 4	53214.40	64412.80	237.6	267.6	256.11	0.74	3.78	26	3
DBP 1	18661.80	66691.40	93.2	123.2	119.77	0.42	2.39	32	2
DBP 2	18407.30	66478.20	84.3	114.3	117.38	0.28	1.64	34	2
DBP 3	18427.50	66775.50	86.4	116.4	120.98	0.38	2.25	35	2
DBP 4	18342.10	66679.60	84.2	114.2	118.93	0.34	1.93	32	2
DBP 5	18605.20	66485.60	96.1	116.1	117.60	0.56	2.03	13	2
DCB 1A	19856.30	64028.50	90.1	120.1	115.24	0.15	0.76	26	2
DCB 2A	20895.20	63436.10	97.4	127.4	124.79	0.24	1.31	29	2
DCB 3A	20899.90	62674.90	96.2	126.2	120.60	0.21	1.11	28	2
DCB 4A	20493.80	62678.80	92.5	122.5	119.15	0.15	0.86	31	2
DCB 5A	20139.80	63126.10	85.9	115.9	118.85	0.15	0.80	30	2
DCB 6	19979.30	64167.90	109.5	129.5	116.77	0.16	0.90	30	2
DCB 7	20036.30	64001.40	108.9	128.9	117.98	0.16	0.87	30	2
DCB 8	21014.10	63473.90	110.3	130.3	126.49	0.27	1.48	30	2
DCB 9	19807.40	64190.60	97.3	117.3	114.78	0.16	0.85	28	2
DCB 10	19852.30	63803.10	99.8	119.8	116.60	0.36	1.99	30	2
DCB 11	19248.60	64638.30	106.8	126.8	122.00	0.30	1.59	29	2
DCB 12	18529.80	65150.00	92.0	112.0	109.74	0.14	0.75	29	2
DCB 13	19235.40	63842.50	102.0	122.1	116.91	0.92	4.59	25	2
DCB 14	19392.40	64909.80	94.6	114.6	109.79	0.23	0.60	7	2
DCB 15	17635.90	64607.40	99.8	119.9	111.55	0.48	2.29	23	2
DCB 16	17611.20	63956.00	100.1	120.1	111.94	0.25	1.32	27	2
DCB 17A	19841.80	64583.20	109.4	119.4	116.60	0.18	0.30	3	2

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

DCB 17B	19844.70	64588.80	99.2	101.7	116.92	0.17	0.29	3	2
DCB 17C	19846.50	64593.70	87.4	89.9	116.07	0.17	0.29	3	2
DCB 18A	19881.30	64051.80	110.1	120.1	116.17	0.44	0.88	4	2
DCB 18B	19874.50	64046.10	100.5	103.0	113.32	0.44	0.77	3	2
DCB 18C	19869.40	64041.40	87.7	90.2	112.73	0.38	0.66	3	2
DCB 19A	19890.30	64022.10	111.9	121.9	119.95	0.90	1.56	3	2
DCB 19B	19885.30	64016.50	101.9	104.4	117.38	0.41	0.71	3	2
DCB 19C	19879.70	64010.90	89.1	91.6	116.52	0.38	0.66	3	2
DCB 20A	20106.50	63931.00	110.9	120.9	117.17	0.17	0.29	3	2
DCB 20B	20102.60	63935.30	100.3	102.8	116.50	0.10	0.17	3	2
DCB 20C	20098.10	63940.40	89.4	91.9	116.39	0.19	0.33	3	2
DCB 20D	20087.90	63953.30	46.2	48.7	114.00	0.10	0.17	3	1
DCB 21A	19854.70	63914.80	110.1	120.1	116.93	0.41	0.70	3	2
DCB 21B	19851.50	63920.00	102.2	104.7	113.41	0.25	0.44	3	2
DCB 21C	19849.20	63925.30	88.3	90.8	112.93	0.28	0.49	3	2
DCB 22A	19794.20	63907.60	109.8	119.8	112.77	0.14	0.29	4	2
DCB 22B	19790.70	63913.10	100.9	103.4	112.75	0.23	0.39	3	2
DCB 22C	19788.70	63919.10	88.1	90.6	112.95	0.46	0.81	3	2
DCB 23A	19608.30	63870.40	105.7	115.7	111.79	0.14	0.31	5	2
DCB 23B	19607.00	63876.30	94.1	96.6	108.75	0.10	0.18	3	2
DCB 23C	19605.70	63882.50	86.6	89.1	109.02	0.18	0.31	3	2
DCB 23D	19602.20	63900.00	49.1	51.6	111.19	0.13	0.23	3	1
DCB 24A	19983.10	63321.60	109.2	119.2	115.47	0.14	0.24	3	2
DCB 24B	19972.40	63318.20	100.6	103.1	115.21	0.01	0.01	2	2
DCB 24C	19966.40	63315.70	87.6	90.1	116.27	0.14	0.25	3	2
DOB 1	23567.80	68438.10	114.7	144.7	143.16	0.41	2.74	45	2
DOB 2	23340.80	68568.00	115.3	145.3	143.18	0.44	2.96	45	2
DOB 3	23633.30	68693.50	115.9	145.9	143.15	0.55	3.18	34	2
DOB 4	23815.60	68514.40	109.2	139.2	142.37	0.53	3.06	34	2
DOB 7	23485.70	68315.80	125.7	145.7	143.10	0.49	1.85	14	2
DOB 8	23710.40	68429.20	128.3	148.3	143.65	0.48	1.81	14	2
DOB 9	23690.70	68811.60	128.5	148.5	144.10	0.42	0.73	3	2
DOB 10	23291.40	68490.90	128.3	148.3	143.24	0.45	1.67	14	2
DOB 11	23400.80	68445.20	126.7	131.7	140.92	0.32	0.56	3	2
DOB 12	23398.78	68450.08	133.1	138.1	140.48	0.38	1.50	16	2
DOB 14	23527.50	68335.00	132.6	137.6	139.68	0.33	0.58	3	2
DOB 15	23189.90	68139.60	110.9	116.0	141.92	0.20	0.34	3	2
DOB 16	23190.80	68133.90	103.5	108.6	141.39	0.19	0.32	3	2
DOL 1	23586.10	68794.40	109.2	119.2	144.27	0.40	0.69	3	2
F 10	50444.30	75155.30	266.5	276.5	270.35	1.25	1.77	2	3
F 18A	50108.00	74170.20	194.4	204.4	203.79	1.24	3.71	9	3
FAB 1	54915.50	77798.80	215.4	235.4	228.30	0.23	0.79	12	3
FAB 2	55137.50	77470.10	216.5	236.5	229.05	0.21	0.76	13	3
FAB 3	55030.80	77151.20	211.8	231.8	228.78	0.21	0.70	11	4
FAB 4	54759.70	77584.60	214.2	234.2	228.49	0.22	0.70	10	3
FAC 3	55322.70	78018.30	224.8	254.8	229.11	0.28	1.58	31	3
FAC 4	55472.90	78223.80	207.8	237.8	228.52	0.26	1.45	31	3
FAC 5	55241.30	77960.30	214.0	234.0	224.91	0.60	3.18	28	3
FAC 5P	55314.80	78175.70	225.7	235.7	229.98	0.38	0.76	4	3
FAC 6	55335.50	78129.00	216.2	236.2	220.71	0.83	4.17	25	3
FAC 7	55356.20	78123.40	215.7	235.7	223.18	1.03	5.57	29	3
FAC 8	55366.00	78090.90	216.0	236.0	227.17	0.73	3.91	29	3
FAC 9C	55339.30	78030.50	197.4	207.4	217.42	0.28	0.57	4	2
FAC 10C	55298.40	78119.70	200.2	210.2	217.42	0.28	0.63	5	2
FAC 11C	55231.90	78100.30	201.4	211.4	217.49	0.28	0.63	5	2
FAC 12C	55226.40	78047.20	198.0	208.0	217.55	0.28	0.63	5	2
FAL 2	53757.40	78231.90	206.6	238.0	217.13	0.30	1.74	33	3
FBP 1A	51080.70	78893.00	161.8	191.8	206.67	0.38	2.14	32	2

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

FBP 2A	50534.10	79711.40	137.1	167.1	191.59	0.48	2.71	32	2
FBP 3A	50913.40	79838.90	141.0	171.0	194.16	0.47	2.79	35	2
FBP 4	51368.20	79320.00	165.2	195.2	212.35	0.34	1.93	32	2
FBP 5D	51073.90	79193.80	192.6	212.6	205.23	0.41	1.53	14	4
FBP 6D	50547.10	79672.90	178.3	198.3	194.77	0.55	2.20	16	2
FBP 7D	50878.90	79805.70	183.2	203.2	194.09	0.28	0.68	6	2
FBP 8D	51386.40	79291.80	172.8	192.8	207.08	0.49	1.82	14	2
FBP 9D	51074.00	79565.10	177.9	197.9	200.29	0.71	2.54	13	2
FBP 11D	50767.90	79099.30	192.0	212.1	203.03	0.15	0.41	7	4
FBP 12D	51165.70	78932.30	182.1	202.1	208.42	0.45	1.58	12	2
FBP 13D	50694.10	79748.90	172.7	192.7	194.94	0.91	3.51	15	2
FC 1A	53115.10	79664.50	96.7	101.7	143.51	-1.00	-1.00	1	1
FC 1B	53115.00	79672.40	151.8	156.8	210.78	-1.00	-1.00	1	2
FC 1C	53115.10	79680.10	183.9	188.9	214.00	-1.00	-1.00	1	2
FC 1D	53114.50	79688.30	217.2	222.2	223.63	-1.00	-1.00	1	3
FC 3A	57620.00	78726.60	21.5	26.5	175.47	-1.00	-1.00	1	4
FC 3B	57629.90	78727.70	61.2	66.2	150.63	-1.00	-1.00	1	1
FC 3C	57639.00	78728.00	121.0	126.0	151.80	-1.00	-1.00	1	1
FC 3D	57647.90	78728.40	165.9	170.9	206.43	-1.00	-1.00	1	2
FC 3E	57655.50	78728.80	185.7	190.7	205.33	-1.00	-1.00	1	2
FC 3F	57663.20	78729.10	205.1	210.1	206.25	-1.00	-1.00	1	2
FC 4A	53896.50	82242.50	-28.0	-23.0	173.31	-1.00	-1.00	1	4
FC 4B	53901.30	82249.00	76.1	81.1	140.96	-1.00	-1.00	1	1
FC 4C	53905.90	82255.40	116.3	121.3	137.64	-1.00	-1.00	1	1
FC 4D	53910.70	82262.20	146.4	151.4	151.03	-1.00	-1.00	1	4
FC 4E	53915.30	82268.90	176.4	181.4	185.19	-1.00	-1.00	1	2
FCA 1N	53675.90	79037.30	296.8	298.3	299.27	0.23	0.74	10	3
FCA 2C	53712.20	78296.00	295.3	299.3	297.99	0.09	0.42	20	3
FCA 2D	53715.20	78295.80	219.0	239.0	225.03	0.35	2.28	42	3
FCA 9D	53733.10	78600.50	221.9	241.9	225.27	0.23	1.26	31	3
FCA 9DR	53734.50	78608.80	207.7	227.7	224.00	0.41	1.52	14	3
FCA 10A	53571.90	78640.40	221.0	241.0	225.27	0.22	1.40	42	3
FCA 10C	53717.70	78642.50	295.9	298.4	302.96	0.83	1.67	4	3
FCA 10D	53732.00	78640.00	219.5	239.5	226.38	0.27	1.25	22	3
FCA 16A	53568.80	78899.50	215.1	235.1	225.18	0.20	1.28	42	3
FCA 16B	53571.00	78898.00	295.3	299.3	298.00	0.41	1.73	18	3
FCA 16D	53719.50	78898.50	221.1	241.1	224.96	0.26	1.37	28	3
FCA 16T	53579.00	78898.00	291.3	292.8	297.63	-1.00	-1.00	1	3
FCA 19D	53719.10	78271.90	209.7	229.7	217.22	0.34	1.85	29	3
FCB 1	54871.80	76835.40	205.6	235.6	230.23	0.24	0.34	2	3
FCB 2	55046.70	76679.70	205.2	235.2	229.12	0.61	3.37	31	4
FCB 3	54874.40	76427.80	195.3	225.3	223.94	0.31	1.72	30	2
FCB 4	54605.90	76780.40	204.5	234.5	228.18	0.60	3.42	32	3
FCB 5	54773.00	76492.60	217.1	237.1	228.82	0.33	1.76	29	3
FCB 6	54733.40	76582.10	215.1	235.1	229.08	0.27	1.40	26	3
FCB 7	54957.10	76913.90	218.3	238.3	231.03	-1.00	-1.00	1	3
FET 1D	53299.90	76165.60	206.9	226.9	223.54	0.27	1.43	27	3
FET 2D	52981.20	76045.80	209.5	229.5	222.25	0.29	1.52	27	3
FET 3D	53025.70	75961.00	203.0	223.0	222.39	0.29	1.51	27	3
FET 4D	53149.00	75959.30	205.1	225.1	222.67	0.28	1.49	28	3
FIW 1D	51420.00	76114.90	198.9	218.9	214.73	-1.00	-1.00	1	3
FIW 1ID	51362.50	76171.60	194.0	214.0	216.62	1.12	1.59	2	3
FIW 2IC	51202.60	75924.50	125.3	175.2	210.81	0.70	1.40	4	2
FIW 2MA	51184.50	75930.80	100.5	110.5	151.50	0.39	0.79	4	1
FIW 2MD	51202.40	75934.90	190.9	220.8	215.21	0.65	1.30	4	3
FNB 1	54271.60	80151.50	177.2	207.2	210.94	0.40	2.22	30	2
FNB 1A	54288.80	80154.50	107.9	117.9	144.29	0.10	0.25	7	1
FNB 2	54362.10	80442.30	180.8	210.8	207.10	0.42	2.33	31	2
FNB 2A	54355.80	80454.70	111.1	121.1	143.59	0.15	0.40	7	1

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

FNB 3	54105.80	80553.10	182.1	212.1	209.27	0.43	2.37	31	2
FNB 3A	54116.60	80557.20	109.2	119.2	143.14	0.22	0.59	7	1
FNB 4	53843.50	80409.80	179.6	209.6	213.61	0.48	2.70	31	2
FNB 5	54295.20	80556.10	193.5	203.5	206.66	0.40	1.12	8	2
FNB 6	54096.28	80822.49	200.6	210.6	208.73	0.21	0.43	4	4
FNB 7	54398.46	80649.18	192.4	202.4	203.95	0.22	0.44	4	2
FNB 8	54550.33	80521.45	195.4	205.4	202.85	0.15	0.33	5	2
FOB 1D	50026.60	73812.76	175.4	195.4	203.43	0.95	1.90	4	3
FOB 2D	49527.75	73973.78	175.5	195.5	204.68	1.14	2.29	4	3
FOB 3D	49082.37	74138.79	183.4	203.4	204.97	1.21	2.42	4	3
FOB 4D	49338.12	74430.27	174.0	194.1	205.97	1.06	2.13	4	3
FOB 5C	49730.31	74607.04	129.3	149.3	202.89	1.04	2.08	4	2
FOB 7C	50235.60	76074.12	148.9	168.9	208.05	0.55	1.10	4	2
FOB 7D	50244.28	76085.38	193.9	213.9	211.69	0.51	1.03	4	3
FOB 8D	49940.18	75772.14	191.4	211.4	210.59	0.62	1.24	4	3
FOB 9C	50797.38	75773.51	155.5	175.5	210.24	0.60	1.19	4	2
FOB 9D	50782.52	75774.99	192.6	212.6	213.10	0.63	1.27	4	3
FOB 11C	51920.55	75613.91	156.2	176.2	212.44	0.78	1.56	4	2
FOB 11D	51909.29	75602.78	199.0	219.0	216.11	0.93	1.87	4	3
FOB 12D	49785.91	75596.56	179.3	199.3	209.84	0.67	1.34	4	3
FRB 4	53653.31	76076.19	214.6	229.6	222.98	0.12	0.25	4	3
FSB 0PD	49849.80	74549.20	171.6	215.3	207.37	0.34	0.76	5	3
FSB 50PD	49874.60	74600.90	174.7	219.8	207.07	1.12	2.25	4	3
FSB 76	51388.80	76141.60	197.0	227.0	217.84	0.31	2.27	54	3
FSB 76A	51391.60	76131.90	36.9	47.4	155.12	0.13	0.97	58	1
FSB 76B	51394.00	76122.40	99.2	109.7	151.64	0.09	0.67	57	1
FSB 76C	51396.40	76112.40	154.8	165.3	212.78	0.18	1.48	68	2
FSB 77	50713.10	75129.40	186.4	216.4	212.04	0.20	1.55	62	3
FSB 78	50164.70	74764.00	187.7	217.7	208.55	0.27	2.23	69	3
FSB 78A	50172.80	74757.70	27.0	37.5	156.10	0.10	0.78	60	1
FSB 78B	50178.80	74765.90	82.4	92.8	154.52	0.10	0.77	58	1
FSB 78C	50170.20	74772.50	141.6	151.4	207.77	0.16	1.31	66	2
FSB 79	50139.70	73663.10	174.1	204.1	201.93	0.24	2.00	67	3
FSB 79A	50149.60	73664.50	24.0	34.4	158.05	0.20	1.56	59	1
FSB 79B	50159.20	73666.10	80.7	91.2	158.12	0.12	0.89	59	1
FSB 79C	50171.30	73668.00	149.8	159.6	196.78	0.14	1.14	66	2
FSB 87A	50115.80	75601.70	33.1	43.6	153.84	0.10	0.75	58	1
FSB 87B	50104.90	75597.00	90.0	100.5	150.64	0.09	0.66	59	1
FSB 87C	50093.40	75591.90	148.8	159.3	208.44	0.23	1.83	61	2
FSB 87D	50081.10	75586.30	187.4	216.8	213.81	0.22	0.84	15	3
FSB 88C	51518.00	75619.40	158.4	168.4	212.29	0.21	1.59	58	2
FSB 88D	51527.00	75621.80	202.1	222.1	215.85	0.21	1.58	59	3
FSB 89C	51345.20	75553.20	156.1	166.1	211.69	0.19	1.40	56	2
FSB 89D	51335.80	75548.30	201.9	221.9	215.23	0.22	1.61	56	3
FSB 90C	51148.60	75382.90	158.1	168.1	210.81	0.23	1.73	59	2
FSB 90D	51140.70	75376.90	205.1	225.1	215.00	0.69	4.03	34	3
FSB 91C	50953.50	75213.30	149.1	159.1	210.54	0.17	1.34	62	2
FSB 91D	50946.60	75207.60	200.9	220.9	213.37	0.21	1.58	57	3
FSB 92C	50564.00	75053.20	147.6	157.6	208.67	0.66	3.71	32	2
FSB 92D	50557.60	75045.80	201.7	221.7	211.69	0.19	1.45	56	3
FSB 93C	50458.30	74897.30	142.0	152.0	208.65	0.17	1.32	64	2
FSB 93D	50452.40	74888.50	197.9	217.9	210.51	0.21	1.69	62	3
FSB 94C	50180.00	74869.00	139.8	149.8	207.66	0.30	2.36	62	2
FSB 94DR	50162.90	74869.10	183.3	203.4	209.92	0.22	1.43	43	3
FSB 95C	50016.70	74971.70	145.8	155.8	205.64	0.30	1.05	12	2
FSB 95CR	49987.80	75001.90	151.9	161.9	207.72	0.19	1.25	44	2
FSB 95D	50008.90	74977.50	207.8	227.8	208.76	0.39	1.09	8	3
FSB 95DR	49996.00	74991.70	187.0	207.0	210.16	0.22	1.44	44	3

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

FSB 96A	49778.70	74882.20	85.7	95.7	152.05	0.11	0.37	12	1
FSB 96AR	49746.60	74914.90	79.0	89.0	153.36	0.08	0.52	43	1
FSB 97A	49965.70	75171.20	85.8	95.8	152.23	0.09	0.69	58	1
FSB 97C	49970.60	75179.60	143.8	153.8	208.01	0.18	1.43	62	2
FSB 97D	49975.50	75188.90	196.9	216.9	210.49	0.18	1.48	65	3
FSB 98A	50121.60	75389.80	84.7	94.7	150.61	0.14	0.51	14	1
FSB 98AR	50105.80	75362.00	82.1	92.1	151.79	0.06	0.37	39	1
FSB 98C	50116.50	75381.20	148.4	158.4	208.97	0.23	1.68	55	2
FSB 98D	50111.60	75371.90	200.3	220.3	211.99	0.20	1.57	60	3
FSB 99A	50314.80	75675.60	92.9	102.9	150.65	0.08	0.64	57	1
FSB 99C	50320.60	75683.70	157.2	167.2	209.43	0.19	1.43	57	2
FSB 99D	50326.90	75691.70	198.1	218.1	211.89	0.21	1.71	64	3
FSB100A	50958.40	75534.40	95.8	105.8	151.49	0.09	0.68	57	1
FSB101A	51191.30	75719.00	92.9	102.9	151.71	0.10	0.79	57	1
FSB102C	50834.80	73582.90	145.9	155.9	195.31	0.06	0.48	57	2
FSB103C	49651.30	74210.00	147.1	157.1	202.53	0.14	1.17	67	2
FSB104C	49248.60	73872.60	150.7	160.7	200.94	0.17	1.26	57	2
FSB104D	49255.40	73865.20	190.4	210.4	204.41	0.20	1.49	57	3
FSB105C	49828.00	75234.20	141.5	151.5	207.70	0.36	2.95	66	2
FSB105D	49833.30	75244.30	203.7	223.7	208.26	0.31	1.02	11	3
FSB105DR	49841.00	75258.10	188.5	208.6	210.56	0.23	1.51	43	3
FSB106C	50651.30	74190.10	156.0	166.0	201.25	0.11	0.89	62	2
FSB106D	50636.80	74193.00	202.9	222.9	207.31	0.36	1.83	26	3
FSB107C	51158.10	75184.00	150.8	160.8	209.90	0.40	3.00	57	2
FSB107D	51149.80	75177.20	200.9	220.9	213.49	0.19	1.49	61	3
FSB108D	51142.30	76260.70	203.8	223.8	217.47	0.23	2.05	80	3
FSB109D	50488.60	75855.90	205.8	225.8	213.14	0.25	1.93	60	3
FSB110C	50150.60	74190.70	137.2	147.2	201.19	0.23	1.80	63	2
FSB110D	50141.60	74193.30	191.1	211.1	205.45	0.17	1.31	63	3
FSB111C	51526.30	75383.30	159.0	169.0	211.82	0.21	1.58	57	2
FSB111D	51515.90	75382.90	201.7	221.7	215.18	0.27	2.04	56	3
FSB112A	48809.10	74231.40	81.0	91.0	153.49	0.07	0.45	45	1
FSB112C	48794.80	74227.50	129.1	139.1	201.88	0.19	1.30	46	2
FSB112D	48780.00	74223.70	188.9	208.9	205.91	0.20	1.36	45	3
FSB113A	51068.10	74167.50	81.0	91.3	158.69	0.44	3.02	47	1
FSB113C	51084.20	74160.70	154.0	164.0	202.46	0.21	1.47	47	2
FSB113D	51098.40	74154.80	189.6	209.6	207.29	0.20	1.31	44	3
FSB114A	52046.60	75297.40	95.2	105.0	155.64	0.07	0.46	44	1
FSB114C	52033.80	75288.50	158.0	168.0	213.33	0.18	1.21	47	2
FSB114D	52018.60	75278.60	197.7	217.8	216.88	0.21	1.39	44	3
FSB115C	49736.00	72515.50	163.8	173.8	184.41	0.12	0.84	49	4
FSB115D	49728.30	72504.30	182.5	192.5	191.34	0.18	1.25	48	3
FSB116C	50645.90	72725.50	160.5	170.5	189.72	0.09	0.62	44	2
FSB116D	50629.70	72727.40	186.4	196.4	191.79	0.19	1.36	51	3
FSB117D	50486.80	74070.40	189.7	209.7	205.05	0.16	1.06	42	3
FSB118D	51276.30	74697.90	191.3	211.3	211.35	0.24	1.60	44	3
FSB119D	50600.60	74599.70	193.1	213.1	208.05	0.18	1.31	52	3
FSB120A	49175.70	75538.90	99.0	109.0	151.31	0.94	6.21	44	1
FSB120C	49171.10	75549.80	150.7	160.7	206.01	0.19	1.29	44	2
FSB120D	49163.70	75568.70	196.5	216.5	209.21	0.26	1.81	50	3
FSB121C	48413.10	75155.70	148.4	158.4	204.07	0.19	1.29	45	2
FSB121DR	48429.70	75151.90	191.3	211.3	206.86	0.22	1.35	39	3
FSB122C	48195.00	73881.80	160.0	170.0	199.71	0.18	1.19	44	4
FSB122D	48201.70	73865.50	186.6	206.6	203.47	0.23	1.54	45	3
FSB123C	51750.50	74566.70	155.3	165.3	210.18	0.22	1.50	45	2
FSB123D	51734.80	74562.70	194.1	214.1	212.06	0.19	1.30	45	3
FSB150PC	49990.10	74090.00	107.6	160.1	198.18	0.77	1.54	4	2
FSB150PD	49717.90	74615.80	176.2	221.3	206.97	1.07	2.14	4	3
FSL 1D	52992.50	79063.10	208.5	228.6	224.48	0.19	1.18	39	3

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

FSL 2D	52790.60	78636.50	208.7	228.8	224.82	0.20	1.34	44	3
FSL 3D	52465.20	77765.20	205.9	226.0	222.49	0.31	2.02	42	3
FSL 4D	52230.40	77452.40	204.0	224.1	217.14	0.22	1.33	38	3
FSL 5D	51903.30	77047.70	203.5	223.7	220.43	0.24	1.46	37	3
FSL 6D	51727.90	76733.10	202.1	222.1	219.79	0.22	1.35	37	3
FSL 7D	51485.60	76327.80	199.5	219.6	217.91	0.33	2.05	38	3
FSL 8D	51513.50	76054.70	202.7	222.8	217.19	0.23	1.37	35	3
FSL 9D	51543.90	75768.40	201.4	221.5	216.18	0.61	3.62	35	3
FSS 1D	53897.60	75257.60	209.9	229.9	223.45	0.24	1.59	44	3
FSS 2D	53918.90	75103.50	204.4	224.4	222.67	0.26	1.74	44	3
FSS 3D	53548.00	74960.50	205.8	225.8	220.42	0.25	1.69	44	3
FSS 4D	52876.10	75537.80	202.6	222.6	218.67	0.29	1.90	44	3
FST 1D	49102.00	81242.60	119.5	129.5	125.75	0.42	1.11	7	1
FTF 2	53275.10	77336.00	219.4	239.4	224.87	0.37	1.48	16	3
FTF 3	53244.80	77235.30	218.2	221.2	223.36	0.62	3.09	25	3
FTF 4	53268.20	77132.90	216.6	236.6	223.97	0.36	1.82	26	3
FTF 5	53168.30	77035.60	215.3	235.3	224.01	0.58	2.76	23	3
FTF 6	53062.00	77151.40	216.9	236.9	223.93	0.48	2.14	20	3
FTF 7	53089.70	77235.90	222.1	226.1	223.57	0.39	2.11	29	3
FTF 8	53059.90	77336.20	219.6	239.6	227.10	1.28	3.63	8	3
FTF 9	52769.50	77482.80	216.4	236.4	223.65	0.34	1.41	17	3
FTF 10	52905.00	77336.00	215.1	235.1	224.17	0.24	0.81	11	3
FTF 11	52748.80	77180.70	215.8	235.8	224.80	0.56	1.84	11	3
FTF 12	52648.50	77321.40	215.0	235.0	226.67	0.31	1.63	27	3
FTF 13	53098.40	76637.80	216.1	236.1	225.25	0.61	2.72	20	3
FTF 15	53230.00	76732.00	197.5	227.5	225.11	0.64	3.44	29	3
FTF 16	52879.80	76758.60	203.8	233.8	223.17	0.53	2.87	29	3
FTF 17	52884.00	76872.00	200.6	230.6	222.85	0.38	2.06	30	3
FTF 18	52879.20	76955.80	202.3	232.3	223.14	0.57	3.04	28	3
FTF 19	52670.40	77139.10	198.3	228.3	222.25	0.39	2.12	29	3
FTF 20	52500.00	77015.00	198.3	228.3	221.65	0.33	1.80	30	3
FTF 21	52498.60	76866.70	198.7	228.7	222.94	0.27	1.49	30	3
FTF 22	52494.70	76751.30	212.6	242.6	221.64	0.37	2.04	30	3
FTF 23	52660.30	76611.80	201.2	231.2	222.06	0.40	2.13	29	3
FTF 24A	52780.80	77256.60	212.7	232.7	222.35	0.58	3.06	28	3
FTF 25A	52868.70	77308.40	212.8	232.8	223.06	0.36	1.95	29	3
FTF 26	52875.40	77250.00	206.3	226.3	223.07	0.36	1.93	28	3
FTF 27	52823.50	77227.20	213.5	243.5	223.24	0.44	2.33	28	3
H 6	58335.40	72009.10	225.2	235.2	231.04	0.86	1.91	5	3
H 7	58336.10	71949.20	224.9	234.9	228.96	0.48	1.07	5	3
H 8	58233.90	71615.40	218.4	228.4	227.01	0.18	0.48	7	3
H 9	58275.30	71572.60	207.4	217.4	226.76	0.33	0.74	5	3
H 10	57822.80	71607.20	222.5	232.5	227.27	0.39	1.04	7	3
H 11	57779.40	71565.90	212.0	222.0	227.70	0.41	0.92	5	3
H 18A	57337.70	71339.60	217.5	227.5	224.12	0.26	1.11	18	3
H 19	57041.70	71434.20	219.6	221.1	223.76	0.34	0.77	5	3
HAA 1A	62967.90	69879.10	94.9	104.9	181.12	0.20	0.57	8	1
HAA 1AA	62960.40	69885.70	13.6	23.6	180.99	0.29	0.81	8	4
HAA 1B	62976.00	69872.20	119.3	129.3	251.41	0.57	1.60	8	2
HAA 1C	62983.00	69866.20	147.4	157.4	252.00	0.58	1.63	8	2
HAA 1D	62991.00	69859.10	261.8	281.8	276.42	0.54	1.53	8	3
HAA 1TA	62953.30	69892.20	-29.8	-19.8	180.69	0.45	1.27	8	4
HAA 2A	61276.00	70930.40	107.3	117.3	177.01	0.19	0.49	7	1
HAA 2AA	61285.10	70925.40	29.4	39.4	177.65	0.23	0.64	8	4
HAA 2B	61267.50	70935.40	127.2	137.2	253.24	0.42	1.26	9	2
HAA 2C	61258.90	70940.40	171.9	181.9	254.82	0.35	1.04	9	2
HAA 2D	61250.60	70945.40	260.3	280.4	276.53	0.28	0.89	10	3
HAA 3A	60190.40	71470.90	96.8	106.8	175.78	0.19	0.57	9	1

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

HAA 3AA	60201.90	71488.00	6.5	16.5	175.03	0.19	0.58	9	4
HAA 3B	60178.40	71453.20	125.9	135.9	240.66	0.43	1.34	10	2
HAA 3C	60167.40	71436.90	163.3	173.3	243.95	0.49	1.48	9	2
HAA 3D	60154.30	71418.40	246.7	266.7	265.35	0.96	4.07	18	3
HAA 4A	61920.00	72223.00	105.4	115.3	174.73	0.20	0.55	8	1
HAA 4AA	61929.60	72223.20	32.2	42.2	174.95	0.22	0.62	8	1
HAA 4B	61909.90	72222.90	124.5	135.0	250.16	0.32	0.92	8	4
HAA 4C	61899.90	72223.10	158.3	168.3	251.39	0.34	0.84	6	2
HAA 4D	61890.00	72223.30	255.7	275.7	269.87	0.37	1.04	8	3
HAA 6A	63870.00	71440.90	95.6	105.6	178.92	0.19	0.57	9	1
HAA 6AA	63860.20	71441.00	25.8	35.8	178.60	0.18	0.54	9	1
HAA 6B	63879.80	71440.40	131.3	141.4	235.67	0.27	0.82	9	2
HAA 6C	63889.90	71440.60	161.1	171.1	235.86	0.28	0.84	9	2
HAA 6D	63900.20	71440.30	247.1	267.2	265.14	0.37	1.18	10	3
HAC 1	61415.20	72171.00	258.8	278.8	269.40	0.31	1.64	28	3
HAC 2	61366.90	72220.20	258.8	278.8	268.99	0.34	1.79	28	3
HAC 3	61313.60	72183.40	255.0	275.0	269.11	0.29	1.56	29	3
HAC 4	61372.00	72120.30	254.1	274.1	269.63	0.31	1.66	28	3
HAP 1	63398.80	71209.80	256.3	276.3	270.84	0.31	1.48	23	3
HAP 2	63519.80	71122.90	243.8	263.8	270.32	0.24	1.27	28	3
HC 1A	61867.00	71755.00	89.5	94.5	175.80	0.00	0.00	2	1
HC 1D	61867.00	71746.00	206.5	211.5	268.20	-1.00	-1.00	1	3
HC 1E	61864.00	71746.00	251.5	256.5	275.00	0.50	0.71	2	3
HC 2A	61866.00	71794.00	72.2	77.2	175.80	0.50	0.71	2	1
HC 2B	61876.00	71785.00	85.7	90.7	175.00	1.00	1.41	2	1
HC 2C	61872.00	71784.00	135.7	140.7	253.70	0.50	0.71	2	2
HC 2D	61866.00	71784.00	178.2	183.2	255.80	0.50	0.71	2	2
HC 2E	61861.00	71784.00	205.7	210.7	269.50	1.00	1.41	2	3
HC 2F	61861.00	71780.00	250.7	255.7	274.30	0.00	0.00	2	3
HC 4A	63409.00	71606.00	150.0	155.0	244.70	0.00	0.00	2	2
HC 6A	62060.00	72150.00	156.2	161.2	252.20	0.50	0.71	2	2
HC 6B	62070.00	72150.00	210.2	215.2	268.90	1.00	1.41	2	3
HC 8A	60058.50	77481.80	13.3	16.3	175.63	-1.00	-1.00	1	4
HC 8B	60058.40	77487.50	132.5	137.5	155.47	-1.00	-1.00	1	1
HC 8C	60065.10	77484.40	187.3	192.3	197.49	-1.00	-1.00	1	2
HC 10A	61593.40	75806.70	114.0	117.0	163.34	-1.00	-1.00	1	1
HC 10B	61600.10	75801.30	164.8	169.8	208.91	1.11	1.92	3	2
HC 11C	62131.40	74496.40	190.8	195.8	236.60	1.00	1.41	2	4
HC 12B	59488.40	73186.90	177.3	182.3	240.75	1.43	2.48	3	2
HCA 1	63109.00	72521.70	253.7	273.7	269.37	0.26	1.52	34	3
HCA 2	62943.30	72265.90	242.0	273.4	270.22	0.28	1.57	32	3
HCA 3	63108.70	72651.70	253.8	273.8	269.16	0.24	1.42	34	3
HCA 4	62942.90	72523.70	241.9	273.3	269.30	0.25	1.57	40	3
HCA 4A	62929.90	72515.50	103.7	113.7	175.57	0.17	0.52	10	1
HCA 4AA	62942.50	72513.70	33.6	43.6	175.22	0.17	0.53	10	1
HCA 4B	62942.30	72532.90	126.6	136.6	245.93	0.25	0.80	10	2
HCA 4C	62931.80	72532.80	153.8	163.8	246.64	0.26	0.83	10	2
HCB 1	63921.50	71426.80	222.6	252.6	263.59	0.26	1.45	30	3
HCB 2	63797.90	71289.70	239.9	269.9	268.15	0.23	1.27	32	3
HCB 3	63919.90	71098.80	233.6	263.6	266.55	0.18	0.97	30	3
HCB 4	64054.50	71244.20	235.9	265.9	264.49	0.25	1.35	30	3
HET 1D	60546.00	71948.30	240.3	260.3	267.71	0.38	2.02	29	3
HET 2D	60094.40	72006.00	239.7	259.7	258.53	0.36	2.00	31	3
HET 3D	60110.50	72093.90	239.9	259.9	258.88	0.33	1.92	33	3
HET 4D	60166.50	72178.10	239.5	259.6	259.25	0.32	1.77	31	3
HHP 1D	60533.88	71026.79	260.4	270.4	271.15	0.00	0.00	2	3
HHP 2D	60803.08	70886.58	263.2	273.2	273.85	0.00	0.00	2	3
HIW 1ID	58480.00	72506.90	213.0	228.0	231.88	0.58	0.81	2	3
HIW 1MD	58486.00	72546.30	214.9	239.7	232.38	0.33	0.58	3	3

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

HIW 1PD	58395.30	72543.30	215.5	240.5	231.91	0.30	0.52	3	3
HIW 2A	56753.00	73249.70	78.3	88.3	167.23	0.24	0.60	6	1
HIW 2D	56750.20	73269.20	210.9	230.8	229.66	0.69	2.06	9	3
HIW 2MC	56698.40	73226.40	154.0	184.0	226.69	0.60	1.20	4	2
HIW 2MC	56698.40	73226.40	124.1	139.0	226.69	0.60	1.20	4	2
HIW 4MC	56570.10	73160.10	150.4	180.4	219.68	-1.00	-1.00	1	2
HIW 4MC	56570.10	73160.10	120.8	135.7	219.68	-1.00	-1.00	1	2
HIW 5MC	56498.90	73557.90	154.2	184.1	227.80	1.04	2.32	5	2
HIW 5MC	56498.90	73557.90	124.4	139.2	227.80	1.04	2.32	5	2
HMD 1D	56973.30	78731.70	199.7	219.7	209.46	0.29	1.71	35	2
HMD 2D	57269.70	79665.80	190.8	210.8	200.74	0.29	1.72	36	2
HMD 3D	57745.20	79578.70	187.7	207.7	200.07	0.29	1.70	35	2
HMD 4D	58188.50	79160.40	188.9	208.9	199.62	0.47	2.76	35	2
HOB 1D	56917.49	72993.46	204.2	224.2	230.51	1.43	2.85	4	3
HOB 2D	57273.89	72811.95	200.4	220.4	228.91	1.19	2.37	4	3
HOB 3D	58034.78	72326.22	207.7	227.7	229.11	1.48	2.96	4	3
HOB 4D	58370.03	72223.65	210.4	230.4	229.91	0.30	0.52	3	3
HOB 6D	57421.25	70577.88	186.9	196.9	207.14	0.83	1.65	4	3
HOB 7D	56289.34	71879.82	197.4	217.4	220.84	1.02	2.04	4	3
HR3 11	60146.50	71402.80	200.4	230.0	259.66	0.35	1.96	32	3
HR3 13	60065.50	71649.40	205.1	234.8	258.78	0.49	2.79	32	3
HR8 11	59559.80	71945.70	207.9	237.6	246.21	0.25	1.43	34	3
HR8 12	59330.10	71780.10	206.3	235.9	239.79	0.22	1.24	33	3
HR8 13	59300.20	71559.60	201.7	231.4	237.79	0.17	0.98	32	3
HR8 14	59612.10	71431.40	202.3	231.9	243.91	0.09	0.33	13	3
HSB 50PC	55690.30	72161.10	119.5	169.6	218.00	1.23	2.47	4	2
HSB 65	58432.00	72425.60	212.4	242.4	232.49	0.34	2.51	56	3
HSB 65A	58436.00	72436.20	62.5	73.2	171.33	0.15	1.13	55	1
HSB 65B	58439.40	72445.60	123.3	133.3	224.31	0.13	0.95	56	2
HSB 65C	58447.10	72439.60	207.8	218.6	232.49	0.24	1.77	56	3
HSB 66	56928.30	72429.20	198.1	228.1	224.69	0.38	3.08	67	3
HSB 67	58424.30	71505.00	200.7	230.7	223.34	0.31	2.50	64	3
HSB 68	56901.00	71528.00	213.3	243.3	221.58	0.18	1.21	43	3
HSB 68A	56892.10	71526.90	47.5	58.0	171.75	0.13	1.00	57	1
HSB 68B	56882.10	71525.50	123.5	134.5	216.59	0.29	2.23	59	2
HSB 68C	56872.70	71524.10	168.4	179.5	217.60	0.21	1.63	58	2
HSB 69	56475.10	71546.90	199.0	229.0	219.43	0.11	0.86	62	3
HSB 69A	56465.10	71549.40	83.1	93.1	171.68	0.39	2.82	53	1
HSB 70	55758.90	72606.90	205.7	235.7	223.89	0.43	3.15	54	3
HSB 70C	55757.10	72597.30	164.9	174.9	223.17	0.24	1.82	56	2
HSB 71	55279.20	72875.90	204.8	234.8	223.99	0.46	3.41	54	3
HSB 71C	55281.50	72866.60	171.9	181.9	222.61	0.28	2.07	55	2
HSB 83A	58606.10	71648.60	65.2	76.0	172.85	0.31	2.53	69	1
HSB 83B	58594.90	71639.60	121.2	132.1	222.82	0.16	1.21	59	2
HSB 83C	58614.80	71636.90	160.2	171.2	224.65	0.13	1.01	57	2
HSB 83D	58601.70	71628.10	198.7	228.7	224.84	0.15	1.18	59	3
HSB 84A	56359.10	71586.20	64.7	75.9	171.79	0.13	0.94	56	1
HSB 84B	56352.40	71603.30	121.8	132.9	210.75	0.10	0.80	58	2
HSB 84C	56360.10	71597.10	170.9	181.8	213.48	0.26	2.02	59	2
HSB 84D	56349.90	71583.90	199.5	219.5	218.91	0.11	0.85	55	3
HSB 85A	58943.40	73791.90	61.1	71.1	168.75	0.10	0.80	69	1
HSB 85B	58953.30	73789.30	133.2	143.2	233.66	0.22	1.80	70	2
HSB 85C	58947.40	73802.30	214.2	224.2	238.69	0.23	1.80	60	3
HSB 86A	55985.90	72520.20	63.1	73.9	168.59	0.12	0.88	58	1
HSB 86B	55976.90	72519.00	113.8	124.0	221.55	0.17	1.31	59	2
HSB 86C	55984.60	72529.70	189.4	199.4	223.55	0.23	1.71	58	4
HSB 86D	55996.50	72522.10	206.6	236.6	223.52	0.23	1.73	57	3
HSB100C	58806.50	72077.20	153.0	163.0	226.55	0.16	1.21	59	2

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

HSB100D	58796.90	72073.80	216.9	236.9	233.49	0.21	1.65	64	3
HSB100PC	55720.00	72058.30	117.6	167.7	217.15	1.19	2.38	4	2
HSB100PD	56379.50	71445.30	195.0	214.9	217.41	0.64	1.28	4	3
HSB101C	58604.40	72001.90	166.3	176.3	225.47	0.15	1.10	57	2
HSB101D	58594.80	71997.50	216.1	236.1	230.80	0.18	1.44	62	3
HSB102C	58399.70	71960.10	166.7	176.7	224.62	0.15	1.10	56	2
HSB102D	58393.40	71952.40	216.3	236.3	228.24	0.21	1.53	54	3
HSB103C	58323.60	71593.90	159.2	169.2	223.31	0.16	1.24	58	2
HSB103D	58315.60	71588.10	213.7	233.7	225.59	0.17	1.27	59	3
HSB104C	58082.60	71376.80	163.5	173.5	220.59	0.13	1.02	58	2
HSB104D	58075.80	71370.20	210.6	230.6	224.91	0.20	1.51	58	3
HSB105C	57883.80	71447.30	152.2	162.2	219.57	0.12	0.94	57	2
HSB105D	57877.40	71454.80	211.8	231.8	225.29	0.16	1.29	62	3
HSB106C	57651.50	71720.90	158.7	168.7	221.73	0.13	0.99	57	2
HSB106D	57644.80	71727.80	210.7	230.7	225.88	0.17	1.29	55	3
HSB107C	57432.00	71698.50	159.3	169.3	219.29	0.12	0.89	57	2
HSB107D	57412.20	71696.60	215.1	235.1	224.69	0.16	1.19	58	3
HSB108C	57155.50	71688.70	186.0	196.0	218.54	0.18	1.34	58	2
HSB108D	57145.60	71688.00	212.0	232.0	223.46	0.16	1.14	49	3
HSB109C	56895.60	71684.80	168.4	178.4	218.75	0.12	0.95	59	2
HSB109D	56885.50	71685.60	213.0	233.0	222.85	0.16	1.12	47	3
HSB110C	56680.70	71779.30	171.4	181.4	219.07	0.12	0.92	58	2
HSB110D	56672.10	71785.20	211.4	231.4	222.09	0.17	1.26	57	3
HSB111C	56501.90	71919.40	140.7	150.7	220.27	0.13	1.01	58	2
HSB111D	56494.50	71926.20	185.7	195.7	222.03	0.15	1.13	57	4
HSB111E	56487.20	71932.80	211.7	231.7	222.02	0.17	1.27	56	3
HSB112C	56417.40	72156.40	140.6	150.6	221.59	0.16	1.22	55	2
HSB112D	56408.10	72161.60	188.3	198.3	222.75	0.19	1.43	57	4
HSB112E	56399.50	72166.60	211.7	231.7	222.54	0.18	1.41	64	3
HSB113C	56160.40	72312.30	154.7	164.7	221.87	0.16	1.22	56	2
HSB113C	56160.40	72312.30	151.7	161.7	221.87	0.16	1.22	56	2
HSB113D	56164.30	72302.70	216.2	236.2	222.52	0.20	1.58	60	3
HSB114C	56107.00	72464.60	185.6	195.6	223.38	0.21	1.59	56	2
HSB114D	56104.60	72474.20	212.8	232.8	223.29	0.23	1.73	56	3
HSB115C	56043.20	72653.20	182.8	192.8	224.36	0.34	2.60	57	2
HSB115D	56039.80	72662.30	213.9	233.9	223.93	0.24	1.98	67	3
HSB116C	55989.10	72888.10	180.5	190.5	225.04	0.22	1.60	55	2
HSB116D	55988.20	72898.10	214.5	234.5	226.21	0.50	3.80	57	3
HSB117A	55170.10	72733.60	84.8	94.8	166.67	0.10	0.74	55	1
HSB117C	55162.90	72740.70	165.1	175.1	221.61	0.29	2.10	54	2
HSB117D	55155.60	72747.60	200.3	220.3	223.87	0.35	2.75	62	3
HSB118A	55775.60	72696.40	91.0	101.0	167.58	0.12	0.92	56	4
HSB119A	56100.20	73082.50	93.3	103.3	166.93	0.11	0.85	58	1
HSB120A	56431.90	73395.10	91.0	101.0	166.22	0.11	0.82	55	1
HSB121A	57389.60	72024.80	88.3	98.3	171.56	0.12	0.91	56	4
HSB122A	57747.40	72195.90	85.4	95.4	171.34	0.12	0.88	56	1
HSB123A	58124.80	72189.80	93.6	103.6	171.67	0.34	2.68	61	4
HSB124AR	58531.70	72202.70	94.6	104.6	172.00	0.14	0.87	39	4
HSB125C	58592.80	71503.60	145.6	155.6	223.34	0.16	1.17	56	2
HSB125D	58584.10	71498.20	199.4	219.4	221.34	0.15	1.14	57	3
HSB126C	57178.20	70627.70	176.3	181.3	203.91	0.07	0.51	53	2
HSB126D	57169.60	70633.40	190.5	200.5	205.15	0.07	0.56	58	3
HSB127C	56792.10	71210.10	148.4	158.4	210.33	0.08	0.58	57	2
HSB127D	56788.00	71218.90	197.8	217.8	218.19	0.09	0.69	56	3
HSB129C	55110.00	71830.40	147.8	157.8	205.75	0.19	1.39	56	2
HSB129D	55103.40	71837.10	185.2	205.2	208.53	0.13	0.94	56	3
HSB130C	54643.60	70762.40	159.9	169.9	199.92	0.07	0.54	59	2
HSB130D	54651.70	70757.20	182.1	202.1	200.17	0.10	0.74	59	3
HSB131C	56894.90	70374.70	148.5	158.5	203.87	0.08	0.57	56	2

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

HSB131D	56891.10	70365.00	195.7	205.7	205.15	0.12	0.88	58	3
HSB132C	58787.70	71472.40	168.6	178.6	221.62	0.12	0.88	56	2
HSB132D	58799.30	71469.50	206.5	226.5	221.32	0.18	1.31	55	3
HSB133C	59110.30	71949.50	173.3	183.3	230.55	0.18	1.39	57	2
HSB133D	59102.30	71943.50	208.5	228.5	235.09	0.22	1.65	57	3
HSB134C	58289.90	71210.30	149.1	159.1	220.87	0.13	0.98	58	2
HSB134D	58296.50	71217.30	205.8	225.8	222.33	0.24	1.83	59	3
HSB135C	56560.80	71390.20	147.3	157.3	206.71	0.07	0.54	55	2
HSB135D	56552.80	71396.70	199.9	219.9	218.31	0.11	0.80	55	3
HSB136C	55949.60	71900.30	160.5	170.5	217.46	0.14	1.09	57	2
HSB136D	55941.70	71906.00	200.2	220.2	220.81	0.17	1.24	56	3
HSB137C	55700.20	72269.90	163.8	173.8	220.25	0.19	1.43	58	2
HSB137D	55696.10	72278.90	205.3	225.3	222.19	0.21	1.55	56	3
HSB138D	55260.70	73160.20	208.1	228.1	223.65	0.33	2.49	57	3
HSB139A	57365.40	71127.40	87.6	97.6	173.56	0.13	0.99	55	4
HSB139C	57374.50	71129.80	148.5	158.5	214.48	0.10	0.77	57	2
HSB139D	57384.40	71133.20	206.7	226.7	222.60	0.24	1.80	58	3
HSB140A	56535.40	70050.30	81.0	91.0	175.70	0.09	0.57	43	1
HSB140C	56551.80	70049.20	161.6	171.6	204.23	0.68	2.78	17	2
HSB140D	56560.60	70036.00	194.1	214.1	213.61	0.42	2.79	44	3
HSB141A	59168.70	71213.60	80.6	90.6	174.97	0.19	1.33	48	1
HSB141C	59170.20	71196.70	154.7	164.7	228.85	0.34	1.55	21	2
HSB141CR	59167.20	71226.70	152.1	162.1	229.52	0.87	3.81	19	2
HSB141D	59170.90	71184.40	217.8	237.8	241.18	0.70	4.84	48	3
HSB142C	53505.30	73119.00	161.6	171.6	198.26	0.34	2.28	45	2
HSB142D	53493.10	73113.00	189.7	199.7	198.03	0.36	2.45	46	3
HSB143C	52773.20	73738.20	169.1	179.1	209.27	0.17	1.10	44	2
HSB143D	52774.50	73754.00	196.9	216.9	213.14	0.20	1.33	45	3
HSB144A	56200.50	71892.10	78.6	88.6	170.91	0.07	0.47	45	1
HSB145C	57769.00	71098.90	164.7	174.7	213.44	0.27	1.80	46	2
HSB145D	57753.90	71088.00	184.2	194.2	220.54	0.24	1.62	46	4
HSB146A	58454.00	70478.90	85.5	95.5	175.93	0.08	0.53	44	1
HSB146C	58473.10	70471.60	152.3	162.3	209.92	0.19	1.25	45	2
HSB146D	58493.00	70469.70	204.0	224.1	222.42	0.51	3.45	46	3
HSB147D	55804.40	73827.90	215.2	235.2	231.32	0.36	2.40	45	3
HSB148C	55344.20	70151.50	158.9	168.9	201.72	0.09	0.67	50	2
HSB148D	55355.70	70160.90	198.1	218.1	213.31	0.23	1.66	51	3
HSB149D	57286.30	71338.80	207.0	227.0	222.44	0.50	3.33	45	3
HSB150D	58692.80	71692.60	206.9	226.9	226.94	0.41	2.82	48	3
HSB150PC	55543.90	72236.40	119.5	169.6	218.15	1.40	2.79	4	2
HSB151C	54014.90	72997.90	170.6	180.6	207.91	0.18	1.22	46	2
HSB151D	54026.40	72997.80	197.6	207.6	207.27	0.22	1.43	44	3
HSB152C	54346.70	72012.00	173.1	183.1	199.03	0.07	0.48	45	2
HSB152D	54362.10	72011.70	197.0	207.0	205.63	0.38	1.39	13	3
HSL 1D	58925.00	72179.60	219.8	239.8	235.28	0.38	2.30	36	3
HSL 2D	59423.50	72190.80	225.2	245.3	241.92	0.30	1.82	36	3
HSL 3D	59770.60	72251.50	233.7	253.8	250.33	0.40	2.52	39	3
HSL 4D	60171.90	72453.70	245.0	265.1	261.88	0.32	2.03	39	3
HSL 5D	60339.40	72562.20	247.8	267.7	266.03	0.53	3.12	35	3
HSL 5D	60339.40	72562.20	242.6	247.7	266.03	0.53	3.12	35	3
HSL 6A	60549.50	72684.50	104.7	114.7	168.23	0.15	0.51	12	1
HSL 6AA	60555.70	72692.60	18.6	28.6	168.95	0.14	0.52	13	1
HSL 6B	60543.60	72676.30	127.9	137.9	244.32	0.33	1.15	12	4
HSL 6C	60537.60	72667.50	157.6	167.6	245.19	0.32	1.14	13	2
HSL 6D	60531.10	72659.70	243.9	264.0	260.01	0.38	2.40	41	3
HSL 6D	60531.10	72659.70	239.4	243.9	260.01	0.38	2.40	41	3
HSL 7D	60723.00	72674.40	242.3	262.4	259.75	0.33	2.03	39	3
HSL 8A	61113.90	72721.00	108.8	118.8	172.61	0.15	0.54	13	1

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

HSL 8AA	61113.80	72729.40	28.7	38.7	175.50	0.76	2.73	13	1
HSL 8B	61115.00	72710.20	138.7	148.7	248.98	0.32	1.15	13	2
HSL 8C	61115.90	72700.50	171.7	181.7	250.16	0.26	1.01	15	2
HSL 8D	61117.10	72688.10	248.4	268.4	260.66	0.24	1.62	44	3
HSS 1D	64675.60	67610.30	236.5	256.5	268.77	0.66	3.42	27	3
HSS 2D	64785.90	67355.90	234.5	254.5	267.87	0.66	3.42	27	3
HSS 3D	64709.50	68257.50	262.6	282.6	281.85	0.72	3.73	27	3
HTF 1	62067.00	71745.00	236.9	256.9	272.74	0.30	1.67	31	3
HTF 2	62175.00	71610.00	237.0	257.0	274.27	0.29	1.59	31	3
HTF 4	61942.00	71630.00	235.2	255.2	274.27	0.27	1.50	30	3
HTF 5	62110.00	71390.00	264.3	284.3	277.24	0.61	2.85	22	3
HTF 6	62228.00	71259.00	263.6	283.6	276.06	0.60	2.76	21	3
HTF 7	62112.00	71130.00	263.5	283.5	275.95	0.35	1.80	26	3
HTF 8	61965.00	71270.00	263.6	283.6	273.68	0.61	2.73	20	3
HTF 9	61698.00	71652.00	245.8	265.8	273.46	0.25	1.43	32	3
HTF 10	61838.00	71520.00	245.2	265.2	273.16	0.27	1.46	29	3
HTF 11	61722.00	71398.00	238.9	258.9	273.88	0.33	1.83	30	3
HTF 12	61593.00	71520.00	242.9	262.9	273.41	0.36	2.12	34	3
HTF 13	61586.00	71856.00	262.6	282.6	274.15	0.32	1.70	28	3
HTF 14	61462.00	71858.00	261.9	281.9	273.44	0.50	2.30	21	3
HTF 15	61353.00	71700.00	260.7	280.7	273.36	0.24	1.34	32	3
HTF 16	61950.00	72150.00	248.3	268.3	269.67	0.41	2.00	24	3
HTF 17	61188.00	72600.00	238.4	258.4	262.39	0.57	3.17	31	3
HTF 18	61223.30	71771.80	251.7	271.7	271.60	0.27	1.56	33	3
HTF 19	61079.20	71902.50	245.7	265.7	268.96	0.26	1.47	33	3
HTF 20	61086.40	72073.30	251.9	271.9	267.77	0.37	2.12	33	3
HTF 21	61261.00	71998.20	242.6	262.6	269.38	0.28	1.58	31	3
HTF 22	62553.60	71363.40	251.4	271.4	275.41	0.33	1.82	31	3
HTF 23	62670.30	71363.10	256.8	276.8	274.48	0.39	2.21	32	3
HTF 24	62775.60	71362.60	257.8	277.8	274.05	0.32	1.75	30	3
HTF 25	62902.00	71224.30	252.5	272.5	274.57	0.54	2.98	31	3
HTF 26	62815.70	71090.70	255.5	275.5	275.35	0.50	2.76	31	3
HTF 27	62660.30	71057.90	259.1	279.1	276.72	0.71	4.03	32	3
HTF 28	62515.70	71080.10	251.9	271.9	275.84	0.26	1.38	29	3
HTF 29	62414.90	71229.90	259.9	289.9	275.57	0.28	1.54	30	3
HTF 31	62662.50	70747.00	246.7	266.7	275.64	0.28	1.44	27	3
HTF 32	62807.90	70880.60	251.1	271.1	274.71	0.27	1.48	31	3
HTF 34	61978.50	71144.10	251.7	271.7	275.63	0.30	1.33	20	3
HWP 1D	59852.50	72158.08	239.9	249.9	245.25	0.20	0.29	2	3
HWP 2D	59918.86	72368.22	253.0	263.0	262.46	0.12	0.16	2	3
HWS 1A	50234.80	64885.10	225.2	255.2	244.81	0.38	1.95	27	3
HWS 2	50346.40	64786.30	215.3	245.3	245.40	0.41	2.10	27	3
HXB 1	52557.80	60549.70	214.2	244.2	251.40	0.56	2.85	26	3
HXB 2	52892.80	60866.50	212.1	242.1	252.55	0.62	3.12	25	3
HXB 3	52707.30	60631.20	212.2	242.2	251.89	0.61	3.04	25	3
HXB 4D	52617.30	60685.70	234.9	254.9	253.62	0.46	2.22	23	3
HXB 5D	52510.40	60587.70	234.2	254.2	252.73	0.46	2.19	23	3
IDP 3A	37781.10	85104.30	-86.7	-81.3	167.02	0.24	1.02	18	4
IDP 3B	37785.30	85119.50	95.7	100.7	157.13	0.52	2.13	17	1
IDP 3C	37790.10	85133.70	164.1	169.1	201.89	0.92	3.70	16	2
IDP 3D	37794.30	85148.40	208.8	228.8	209.08	-1.00	-1.00	1	3
IDP 4	38615.40	82812.60	189.5	199.6	193.17	0.52	1.96	14	2
IDP 5	38284.50	83521.50	186.4	206.6	198.18	0.80	3.40	18	2
IDP 6	38248.50	84113.90	184.5	209.1	201.31	0.79	3.36	18	2
IDP 7	38713.90	84460.10	188.6	208.6	201.08	0.83	3.53	18	2
IDP 8	39174.30	84740.40	185.4	204.5	198.90	1.12	4.74	18	2
IDQ 3A	35854.00	80553.70	-189.8	-184.3	165.87	0.26	1.12	18	4
IDQ 3B	35858.80	80578.40	108.4	113.4	139.94	1.40	6.09	19	1
IDQ 3C	35863.50	80601.70	136.6	141.6	164.21	0.88	3.62	17	2

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

IDQ 4	36726.20	83125.10	185.6	205.6	198.18	0.77	3.25	18	2
IDQ 5	36851.80	82763.60	187.4	207.5	196.99	0.50	1.75	12	2
IDQ 6	37299.30	82414.40	181.9	202.1	193.62	0.71	3.08	19	2
IDQ 7	37836.30	82107.40	174.6	194.8	187.94	0.60	2.15	13	2
IDQ 8	34688.10	83602.80	180.4	200.4	189.25	0.35	1.05	9	2
IDQ 9	34053.40	82729.60	173.9	193.9	181.84	0.46	1.21	7	2
IDQ 10	33610.10	82135.80	165.7	185.7	174.03	0.45	1.63	13	2
IDQ 12	37116.50	81913.70	164.9	184.9	187.82	0.59	2.04	12	2
K 301AP	40034.00	54284.00	193.3	197.7	208.77	-1.00	-1.00	1	3
K 301P	39842.00	54320.00	194.4	201.0	204.90	0.32	1.94	36	3
KAB 1	39919.70	53055.60	194.0	224.0	205.94	0.60	3.10	27	3
KAB 2	40277.90	52410.80	198.6	228.6	209.89	0.87	4.61	28	3
KAB 3	39918.40	51807.70	193.0	223.0	204.06	0.68	3.42	25	3
KAB 4	39457.00	52807.10	187.0	217.0	203.15	0.69	3.53	26	3
KAC 1	42614.80	53167.00	199.0	229.0	219.27	0.50	2.81	32	3
KAC 2	42677.20	53255.50	195.4	225.4	221.51	0.56	3.12	31	3
KAC 3	42723.90	53201.80	195.8	225.8	221.96	0.47	2.68	32	3
KAC 4	42676.40	53053.50	178.0	208.0	218.07	0.47	2.65	32	3
KAC 5	42716.30	53161.70	204.3	224.3	222.40	0.44	2.39	29	3
KAC 6	42693.50	53139.90	204.6	224.6	222.34	0.46	2.45	28	3
KAC 7	42574.50	53252.90	203.0	223.0	219.45	0.42	2.29	30	3
KAC 8	42641.90	53136.00	192.3	212.3	221.18	0.52	2.02	15	3
KAC 9	42588.10	53197.80	195.7	215.7	220.84	0.49	1.89	15	3
KBP 2D	40230.71	52063.71	184.3	194.3	203.35	0.05	0.06	2	3
KCB 1	39523.10	53453.00	183.6	213.6	204.62	0.49	2.79	32	3
KCB 2	39337.20	53634.40	187.7	217.7	202.81	0.71	3.98	31	3
KCB 3	39139.20	53440.50	184.1	214.1	202.20	0.43	2.48	33	3
KCB 4	39315.60	53256.10	188.9	218.9	205.48	0.75	2.70	13	3
KCB 5	39090.70	53353.70	189.3	209.3	200.43	0.58	1.54	7	3
KCB 6	39108.00	53559.20	188.7	208.7	200.97	0.71	1.73	6	3
KCB 7	39812.30	53435.60	196.5	216.5	205.33	0.60	1.68	8	3
KDB 1	40425.90	54050.50	184.8	205.8	208.11	0.23	1.72	55	3
KDB 2	40241.40	53907.30	182.5	203.5	206.73	0.25	1.85	55	3
KDB 3	40393.70	53794.60	184.2	205.4	207.52	0.23	1.79	59	3
KDB 4	40150.30	53787.40	189.2	209.2	206.50	0.23	0.99	18	3
KDB 5	40033.10	54052.20	188.5	208.5	204.89	0.29	1.64	31	3
KDT 1D	40380.00	54154.10	193.7	213.7	208.10	0.37	1.63	19	3
KRB 8	40302.10	54893.60	195.8	215.8	208.55	0.20	0.65	11	3
KRB 13	39986.60	55344.20	197.8	217.8	205.47	0.22	0.53	6	3
KRB 16D	40390.30	54888.00	191.5	211.5	209.22	0.24	1.03	19	3
KRB 17D	39991.90	55446.40	186.8	206.8	205.94	0.26	1.11	19	3
KRB 18D	40084.90	55563.70	185.8	205.8	204.54	0.22	0.95	19	3
KRB 19D	40207.40	55620.90	186.8	206.8	203.82	0.21	0.92	19	3
KRP 1	42471.20	54544.00	207.0	237.0	218.37	0.45	2.56	33	3
KRP 2	42681.60	54503.60	199.2	229.2	219.13	0.40	2.18	30	3
KRP 3	42814.30	54248.70	207.5	237.5	219.14	0.48	2.57	29	3
KRP 4	42590.30	54362.90	188.7	218.7	218.32	0.36	2.04	32	3
KRP 5	42181.80	54606.60	200.8	210.8	216.03	0.21	0.41	4	3
KRP 6	42226.90	54206.70	203.1	213.1	217.44	0.07	0.19	7	3
KRP 7	41871.70	54390.30	203.1	213.2	215.38	0.07	0.18	6	3
KRP 8	42280.42	54470.74	200.1	210.1	217.15	-1.00	-1.00	1	3
KRP 9	42400.03	54360.10	200.8	210.8	218.40	-1.00	-1.00	1	3
KSB 1	39806.80	54044.40	175.6	205.6	204.05	0.29	2.12	52	3
KSB 2	39703.40	53927.60	173.8	203.8	203.81	0.30	2.21	55	3
KSB 3	39625.30	54040.20	169.7	199.7	203.05	0.30	2.22	54	3
KSB 4A	39756.70	54140.40	169.6	199.6	203.16	0.51	3.68	51	3
KSB 5C	39969.90	54165.60	172.9	182.9	204.88	0.06	0.10	3	3
KSB 5D	39970.50	54156.50	194.5	214.5	204.54	0.37	0.98	7	3

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

KSM 1D	40328.20	54188.00	193.7	213.7	208.14	0.22	1.18	28	3
KSS 1D	40219.10	47758.90	157.4	177.5	174.31	0.44	2.33	28	3
KSS 2D	40437.00	46803.80	144.6	164.7	164.65	0.43	2.28	28	3
KSS 3D	40748.00	46644.30	139.3	159.3	163.82	0.56	2.96	28	4
LAC 1	51318.80	45238.80	191.1	221.1	216.48	0.54	2.96	30	3
LAC 2	51270.20	45330.40	193.4	223.4	216.09	0.65	3.68	32	3
LAC 3	51186.80	45201.90	190.7	220.7	216.55	0.51	2.90	32	3
LAC 4	51270.40	45213.10	185.3	215.3	216.07	0.53	2.86	29	3
LAC 5DL	51352.00	45365.40	176.2	186.2	219.74	0.89	2.18	6	3
LAC 5DU	51348.60	45345.90	207.9	227.8	219.48	0.79	2.10	7	3
LAC 6DL	51188.10	45272.80	175.9	185.9	217.89	0.90	2.21	6	3
LAC 6DU	51185.80	45252.50	201.7	221.7	218.97	0.93	2.27	6	3
LAC 7DL	51118.40	45097.10	177.4	187.4	215.11	0.93	2.29	6	3
LAC 7DU	51120.10	45114.70	204.9	224.8	218.06	0.97	2.38	6	3
LAC 8DL	51300.90	45096.60	180.4	190.4	217.45	0.87	2.12	6	3
LAC 8DU	51301.80	45116.00	199.8	219.8	218.07	0.93	2.29	6	3
LAW 1C	50603.60	44562.40	-34.0	-29.0	176.21	0.29	0.64	5	4
LAW 1D	50595.60	44562.00	6.6	11.6	176.50	0.17	0.55	10	1
LAW 1E	50579.00	44561.20	90.1	95.1	205.04	0.59	1.33	5	2
LAW 1F	50567.10	44562.10	165.9	185.9	203.89	0.96	2.87	9	3
LAW 2B	49635.50	45641.00	-9.8	-4.8	176.23	0.17	0.52	10	1
LAW 2C	49638.70	45610.90	171.2	191.2	209.21	0.43	2.41	32	3
LAW 3B	52269.50	45600.70	-1.0	4.0	178.20	0.17	0.55	10	1
LAW 3C	52272.90	45616.10	194.9	214.9	235.20	0.58	2.01	12	3
LBP 1D	53508.08	48716.40	246.3	256.3	257.11	0.06	0.13	4	3
LBP 2D	53476.51	48924.92	241.9	251.9	256.15	0.16	0.22	2	3
LBP 3D	53007.66	48912.68	242.8	252.8	256.60	0.10	0.17	3	3
LCO 1	50957.70	45198.20	195.8	225.8	214.76	0.60	3.35	31	3
LCO 2	51043.40	45317.80	196.6	226.6	215.14	0.58	3.30	32	3
LCO 3	51113.20	45203.00	196.3	226.3	229.09	0.51	2.81	30	3
LCO 4	51036.10	45087.40	192.3	222.3	212.57	0.61	3.52	33	3
LCO 5A	50866.00	44987.00	30.0	40.0	177.24	0.28	0.68	6	1
LCO 5C	50881.80	44988.50	110.5	120.5	210.99	0.60	1.48	6	2
LCO 5DL	50887.50	44974.50	174.9	184.9	212.95	0.86	2.10	6	3
LCO 6DL	50921.20	45069.30	178.0	188.0	213.67	0.83	2.02	6	3
LCO 7DL	51055.90	44946.90	170.2	180.2	213.31	0.83	2.03	6	3
LCO 8DL	51380.60	45586.10	178.4	188.4	220.55	0.83	2.04	6	3
LCO 8DU	51361.70	45586.10	211.1	226.1	220.60	0.84	2.05	6	3
LDB 1	50590.50	45886.50	185.0	215.0	216.92	0.40	2.87	51	3
LDB 2	50784.60	46007.40	184.5	214.5	218.97	0.38	2.76	53	3
LDB 3	50525.80	46068.90	199.3	219.3	218.46	0.42	2.35	31	3
LDB 4	50339.50	45809.00	200.7	220.7	216.50	0.46	2.50	30	3
LFW 6	45241.20	84537.80	141.1	160.4	154.07	0.34	1.93	32	4
LFW 6R	45194.00	84413.90	134.5	154.5	153.64	0.41	1.16	8	4
LFW 7	45318.90	84310.30	140.5	159.8	152.01	0.23	1.20	27	4
LFW 8	45415.30	84032.60	139.9	159.2	150.03	0.21	1.22	34	4
LFW 8R	45414.60	83949.00	135.1	155.1	149.78	0.32	0.90	8	4
LFW 10A	45935.60	84369.60	129.2	159.2	151.27	0.41	2.55	39	4
LFW 16	45852.60	84748.90	131.2	161.2	155.54	0.29	1.63	31	4
LFW 17	45607.30	84602.80	128.5	158.5	153.88	0.49	2.74	32	4
LFW 18	45459.40	84577.30	130.1	160.1	153.05	0.58	3.56	37	4
LFW 19	45135.40	84817.20	130.0	160.0	156.16	0.29	1.67	33	4
LFW 20	45582.90	85262.60	135.0	165.0	158.98	0.33	1.85	32	4
LFW 21	46149.40	84178.30	128.9	158.9	148.75	0.59	3.65	38	4
LFW 22	46325.20	84223.60	122.4	152.4	151.34	0.30	1.75	34	4
LFW 23	46456.10	84251.30	125.1	155.1	151.34	0.67	3.86	33	4
LFW 23R	46512.90	84206.10	118.4	138.4	149.12	1.14	3.03	7	1
LFW 24	46520.80	84544.20	124.5	154.5	154.38	0.36	2.04	33	4
LFW 25	46425.70	84967.20	123.2	153.2	156.78	0.35	2.03	33	4

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

LFW 26	45633.80	85654.60	143.2	164.2	161.19	0.33	1.88	32	4
LFW 27	45596.10	85839.10	142.9	163.9	162.11	0.33	1.91	33	4
LFW 28	45555.30	86079.60	141.1	162.1	163.48	0.31	1.95	39	4
LFW 29	45503.30	86372.70	143.9	164.9	164.72	0.36	2.07	33	4
LFW 30	45170.90	86318.40	141.7	162.7	164.80	0.35	2.09	35	4
LFW 31	44869.00	86262.20	145.0	166.0	164.64	0.40	2.62	42	4
LFW 32	44935.90	85836.80	144.3	165.3	162.31	0.28	1.77	40	4
LFW 32C	44923.00	85837.80	98.6	113.6	160.85	-1.00	-1.00	1	1
LFW 33	44973.00	85633.80	144.4	165.4	161.01	0.31	1.84	35	4
LFW 34	45016.90	85409.50	143.7	164.7	159.85	0.28	1.73	37	4
LFW 35	45378.80	85237.40	143.4	164.4	158.79	0.31	1.76	33	4
LFW 36	45582.30	83535.50	130.3	151.3	145.93	0.20	1.19	35	4
LFW 36R	45519.10	83537.30	122.0	142.0	146.13	0.30	0.91	9	1
LFW 37	45667.70	83113.20	129.8	150.8	142.84	0.17	0.98	35	4
LFW 38	46018.50	83172.30	130.5	151.5	143.44	0.33	1.81	30	4
LFW 39	46218.50	83213.10	131.2	152.2	143.63	0.33	1.83	30	4
LFW 40	46395.10	83248.80	131.2	152.2	143.54	0.32	1.68	28	4
LFW 41	46626.90	83304.90	130.3	151.3	145.21	0.44	2.57	34	4
LFW 42	46532.90	83776.20	130.2	151.2	147.51	0.49	2.67	30	4
LFW 43B	45240.50	86459.20	90.4	100.4	165.85	0.21	1.15	30	1
LFW 43C	45234.90	86480.60	128.5	138.5	166.02	0.20	1.09	30	1
LFW 43D	45244.50	86443.20	150.9	170.9	166.57	0.27	1.47	30	4
LFW 44D	45022.60	84524.40	139.5	159.3	155.33	0.15	0.67	19	4
LFW 45D	45142.00	84217.80	134.7	154.7	152.58	0.16	0.83	28	4
LFW 46D	45162.80	84054.00	137.3	157.1	151.48	0.14	0.62	19	4
LFW 46D	45162.80	84054.00	109.5	119.6	151.48	0.14	0.62	19	1
LFW 47C	45161.60	83823.30	105.7	115.8	148.91	0.11	0.46	19	1
LFW 47D	45150.80	83838.60	134.9	154.7	149.43	0.11	0.61	29	4
LFW 48C	45413.30	83856.40	108.2	118.2	148.96	0.15	0.66	20	1
LFW 48D	45426.70	83856.90	134.9	155.0	149.42	0.13	0.61	21	4
LFW 55C	45205.90	83613.20	94.1	104.1	146.97	0.09	0.40	19	1
LFW 55D	45189.30	83601.30	121.2	141.4	147.10	0.09	0.41	19	1
LFW 56D	45306.60	83398.00	131.3	151.4	145.50	0.09	0.48	29	4
LFW 57B	45440.60	83196.70	68.4	78.4	143.76	0.09	0.40	21	1
LFW 57C	45411.10	83200.10	107.8	117.9	143.94	0.08	0.38	21	1
LFW 57D	45417.40	83190.20	130.6	150.4	143.96	0.08	0.39	21	4
LFW 58D	45700.20	82940.60	127.5	147.6	141.99	0.10	0.55	28	4
LFW 59B	46047.40	83027.10	66.0	76.0	142.81	0.12	0.53	21	1
LFW 59C	46052.00	83011.00	100.3	110.3	142.62	0.16	0.62	16	1
LFW 59D	46056.10	83000.10	129.3	149.3	142.68	0.44	2.31	28	4
LFW 60B	45710.20	82517.50	67.7	77.7	137.86	0.07	0.21	10	1
LFW 60C	45711.90	82529.60	98.3	108.3	138.31	0.35	1.56	20	1
LFW 60D	45722.30	82531.50	123.8	143.8	138.22	0.08	0.45	32	4
LFW 61C	46489.60	83084.40	111.0	121.1	142.09	0.17	0.80	21	1
LFW 61D	46471.10	83089.10	130.3	150.4	144.12	0.29	1.44	24	4
LFW 62B	45915.50	83001.20	62.8	72.8	142.30	0.10	0.44	21	1
LFW 62C	45906.70	83012.70	108.4	118.4	142.74	0.14	0.61	19	1
LFW 62D	45922.90	82991.60	127.6	147.6	143.42	0.22	1.05	22	4
LFW 63B	45550.70	82740.80	66.1	76.1	140.17	0.08	0.35	20	1
LFW 63C	45559.20	82746.10	96.2	106.2	140.19	0.09	0.41	19	1
LFW 63D	45569.10	82751.80	126.4	146.4	140.56	0.15	0.67	20	4
LFW 64B	45268.80	82736.40	51.9	61.9	140.04	0.07	0.24	11	1
LFW 64C	45271.30	82744.80	83.0	93.0	140.33	0.20	0.90	20	1
LFW 64D	45280.70	82737.80	115.2	135.2	140.34	0.06	0.29	21	1
LFW 65B	46061.80	82589.20	53.5	63.5	137.91	0.07	0.31	18	1
LFW 65C	46064.40	82592.90	86.1	96.1	137.90	0.10	0.44	19	1
LFW 65D	46071.80	82598.40	111.5	131.5	138.38	0.20	0.91	21	1
LFW 66B	46195.90	82838.30	70.3	80.3	140.70	0.15	0.37	6	1

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

LFW 66C	46186.00	82836.50	100.0	110.0	140.72	0.43	1.22	8	1
LFW 66D	46173.70	82835.10	121.8	141.8	141.90	0.26	1.01	15	1
LFW 67B	46517.10	82847.10	55.6	65.6	139.07	0.12	0.51	19	1
LFW 67C	46527.50	82844.20	86.1	96.1	138.71	0.20	0.79	15	1
LFW 67D	46529.90	82855.00	120.6	140.6	141.98	0.36	1.60	20	1
LFW 68B	46885.30	83023.30	56.7	66.7	140.21	0.15	0.47	10	1
LFW 68C	46876.20	83027.50	88.3	98.3	139.61	0.22	0.71	10	1
LFW 68D	46868.00	83031.60	124.6	144.6	142.64	0.38	1.70	20	1
LFW 69B	45492.00	82451.20	52.0	57.0	137.56	0.06	0.18	10	1
LFW 69C	45494.50	82458.60	79.1	89.1	137.75	0.07	0.31	19	1
LFW 69D	45501.00	82452.00	119.0	139.0	137.84	0.07	0.34	20	1
LFW 70B	45825.50	82300.50	61.5	66.5	136.20	0.07	0.22	10	1
LFW 70C	45833.40	82309.00	78.8	88.8	136.23	0.06	0.20	10	1
LFW 70D	45839.80	82316.30	118.3	138.3	135.67	0.12	0.37	10	1
LFW 71B	46340.40	82616.70	57.0	67.0	137.74	0.11	0.47	20	1
LFW 71C	46329.80	82615.80	80.4	90.4	137.90	0.09	0.40	20	1
LFW 71D	46319.80	82615.10	115.5	135.5	137.38	0.15	0.68	19	1
LFW 72B	46944.30	82872.10	50.9	60.9	138.08	0.16	0.54	11	1
LFW 72C	46937.10	82875.80	87.8	97.8	137.63	0.24	0.76	10	1
LFW 72D	46943.00	82881.50	120.0	140.0	138.74	0.27	0.87	10	1
LFW 74C	45097.80	85813.80	101.0	116.0	163.04	0.27	0.73	7	1
LFW 74D	45098.00	85828.10	152.7	167.7	162.91	0.21	0.70	11	2
LFW 75C	45357.00	85856.80	100.6	115.6	162.61	0.31	0.93	9	1
LFW 75D	45355.60	85868.00	151.0	166.0	162.92	0.34	1.01	9	4
LRP 1	49128.70	48548.60	185.8	215.8	209.13	0.57	3.08	29	3
LRP 2	49214.40	48352.90	184.7	214.7	209.61	0.94	5.04	29	3
LRP 3	49057.70	48333.60	191.4	221.4	209.45	0.55	3.06	31	3
LRP 4	48964.70	48440.20	173.3	203.3	208.59	0.54	3.02	31	3
LSB 1	50700.90	45153.10	192.7	222.7	211.61	0.48	2.91	37	3
LSB 2	50824.50	45224.00	195.0	225.0	212.39	0.51	3.02	35	3
LSB 3	50729.70	45388.70	196.6	226.6	217.16	0.51	3.15	38	3
LSB 4	50513.00	45321.60	191.5	221.5	216.84	0.74	4.53	38	3
MGA 36	57891.50	73904.00	234.2	254.2	237.38	0.33	0.80	6	3
MGC 9	55610.70	75372.10	217.3	237.3	229.44	0.30	1.51	25	3
MGC 11	55770.70	75252.30	219.2	239.2	230.70	0.58	1.00	3	3
MGC 19	56408.70	74770.10	230.6	234.6	232.01	0.38	1.92	25	3
MGC 32	57448.80	73982.10	232.0	252.0	244.87	0.30	1.42	23	3
MGC 36	57776.00	73738.90	234.4	254.4	235.82	0.34	1.67	24	3
MGE 9	55489.40	75215.10	218.1	238.1	228.78	0.23	0.97	17	3
MGE 21	56446.20	74487.80	227.9	247.9	234.00	0.47	1.64	12	3
MGE 30	57175.40	73935.80	229.3	249.3	235.74	0.66	3.11	22	3
MGE 34	57495.10	73695.00	237.2	257.2	238.08	0.48	1.43	9	3
MGG 15	55851.50	74699.00	223.3	243.3	232.50	1.11	2.93	7	3
MGG 19	56174.30	74456.00	226.0	246.0	232.35	0.70	2.44	12	3
MGG 23	56491.80	74214.00	227.1	247.1	235.00	0.38	1.32	12	3
MGG 28	56895.40	73905.00	230.3	250.3	235.31	0.34	1.03	9	3
MGG 36	57541.70	73413.00	232.5	252.5	237.48	0.42	1.75	17	3
NBG 1	53879.30	79300.40	200.9	232.3	224.47	0.18	1.06	35	3
NBG 2	53958.40	79099.80	203.6	233.6	224.96	0.18	1.06	34	3
NBG 3	54068.10	78939.60	202.1	233.5	217.54	0.36	2.08	33	3
NBG 4	54329.20	78942.10	196.1	227.5	217.05	0.31	1.80	34	4
NBG 5	54515.60	78943.40	194.9	226.4	217.77	0.35	2.06	34	4
NPM 1	56851.60	62153.40	257.1	277.1	287.08	0.67	1.77	7	3
NPM 2	58252.00	63056.80	244.2	264.2	271.63	0.72	2.27	10	3
NPM 3	55417.60	62109.20	247.2	267.2	274.40	0.59	1.86	10	3
NPM 4	57215.00	60883.20	256.7	276.7	284.24	0.68	2.05	9	3
NPM 19A	57551.80	62970.70	248.2	268.2	270.59	0.71	2.24	10	3
NPM 19B	57558.30	62981.80	217.7	227.7	268.72	0.70	2.22	10	3
NPM 19C	57575.40	62977.10	193.5	203.5	267.70	0.68	2.25	11	3

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

NPM 19D	57567.90	62960.90	97.5	107.5	243.14	0.45	1.42	10	2
NPM 19E	57582.60	62991.70	33.9	43.9	188.42	1.01	3.20	10	1
NPM 34A	56301.20	60774.50	279.8	289.8	290.62	0.67	2.11	10	3
NPM 34B	56315.10	60768.90	225.6	235.6	271.02	0.51	1.62	10	3
NPM 34C	56329.10	60764.20	181.8	191.8	267.58	0.51	1.60	10	3
NPM 34D	56354.90	60752.00	86.4	96.4	253.73	0.50	1.59	10	2
NPM 34E	56342.80	60758.80	33.1	43.1	187.04	0.18	0.58	10	1
PAC 1	66753.40	43543.30	253.9	283.9	284.74	0.22	1.27	32	3
PAC 2	66980.90	43527.70	247.9	277.9	271.02	0.29	1.64	31	3
PAC 3	66861.40	43585.60	252.9	282.9	271.35	0.38	2.15	32	3
PAC 4	66863.20	43495.40	250.6	280.6	284.42	0.17	0.92	31	3
PAC 5	66907.10	43561.70	255.1	275.1	275.05	0.48	2.56	29	3
PAC 6	66894.70	43580.10	255.2	275.2	274.58	0.38	2.02	28	3
PBP 1D	65727.60	45611.30	269.1	279.1	280.30	0.00	0.00	2	3
PBP 2D	65359.88	45481.46	262.8	272.8	278.37	1.02	1.45	2	3
PBP 3D	65510.20	45603.52	268.9	278.9	279.85	0.05	0.07	2	3
PCB 1A	65070.60	41988.20	263.5	293.5	280.73	0.52	2.75	28	3
PCB 2A	64891.40	41821.40	257.8	287.8	279.51	0.51	2.70	28	3
PCB 3A	64706.30	42036.00	262.7	292.7	281.56	0.51	2.86	31	3
PCB 4A	64901.40	42171.00	262.9	292.9	279.70	0.48	2.61	29	3
PDB 2	64743.10	43513.10	247.7	268.7	277.85	0.39	2.36	36	3
PDB 3	64938.20	43542.20	248.1	269.1	278.07	0.39	2.32	35	3
PDB 4	64623.80	43455.10	266.2	286.2	278.92	0.44	1.44	11	3
PDB 5	64584.40	44106.60	264.2	284.2	277.70	0.39	1.28	11	3
PRP 1A	63032.70	45349.80	232.9	262.9	249.09	0.42	2.31	30	3
PRP 2	63229.00	45389.50	234.1	264.1	255.53	0.88	4.84	30	3
PRP 3	63165.50	45200.70	228.6	258.6	255.38	0.67	3.59	29	3
PRP 4	63345.90	45268.90	232.9	262.9	257.61	0.47	2.61	31	3
PSB 1A	64141.40	43619.30	257.4	287.4	276.46	0.42	2.65	39	3
PSB 2A	63916.50	43612.40	257.2	287.2	276.32	0.44	2.77	39	3
PSB 3A	63590.40	43599.80	256.5	286.5	275.15	0.46	2.89	39	3
PSB 4A	63347.00	43534.20	255.5	285.5	274.28	0.51	3.20	39	3
PSB 5A	63606.50	43440.50	262.3	292.3	275.68	0.48	3.05	40	3
PSB 6A	63975.70	43436.00	262.1	292.1	277.17	0.45	2.80	38	3
PSB 7A	64301.00	43553.30	259.0	289.0	276.94	0.41	2.53	39	3
PSS 1D	75773.30	37298.40	182.1	202.1	198.17	0.71	3.76	28	4
PSS 2D	75910.10	36037.90	177.1	197.1	195.23	0.69	3.59	27	4
PSS 3D	76138.70	35974.10	178.5	198.5	197.97	0.90	3.12	12	4
PW 83N	52202.00	61394.00	4.0	9.0	168.43	-1.00	-1.00	1	1
RAC 1	74570.70	55107.30	247.3	277.3	273.93	0.38	1.95	27	3
RAC 2	74555.50	55026.30	243.4	273.4	272.62	0.26	1.31	26	3
RAC 3	74667.50	55015.30	242.3	272.3	272.37	0.30	1.56	27	3
RAC 4	74588.80	54984.00	238.2	268.2	271.64	0.33	1.71	27	3
RBW 1CL	74227.40	62038.50	105.5	115.5	255.93	0.37	0.64	3	2
RBW 1CU	74214.00	62047.40	156.1	166.1	255.80	0.40	0.69	3	2
RBW 1D	74237.50	62031.60	243.0	263.1	259.01	0.45	0.78	3	3
RBW 2CL	71795.10	58712.00	96.4	106.4	269.44	0.53	0.91	3	2
RBW 2CU	71785.90	58715.40	145.1	155.1	269.85	0.57	0.99	3	2
RBW 2D	71776.70	58719.90	284.9	304.9	297.55	0.72	1.25	3	3
RCP 1A	74238.30	56968.10	46.8	56.8	194.20	0.23	0.69	9	1
RCP 1D	74223.50	56967.90	261.3	281.3	281.78	0.64	2.20	12	3
RDB 1D	74844.50	57097.30	265.5	285.5	286.08	0.26	1.29	25	3
RDB 2D	74782.20	56879.80	265.7	285.7	285.22	0.22	1.09	24	3
RDB 3D	74899.00	56881.90	265.8	285.8	283.06	0.32	1.59	25	3
RPC 1CL	74261.86	57923.24	103.3	113.3	256.90	0.17	0.30	3	2
RPC 1D	74215.65	57931.26	264.5	284.5	276.77	0.16	0.28	3	3
RPC 7DL	74726.38	58812.32	209.9	219.9	274.90	0.67	0.95	2	3
RPC 7DU	74720.18	58803.87	240.8	277.8	275.68	0.57	0.81	2	3

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

RPC 8DL	74671.66	58276.90	204.1	214.1	278.92	0.92	1.29	2	3
RPC 8DU	74664.76	58279.13	273.0	288.0	290.58	1.11	1.56	2	3
RPC 9DL	74507.87	57908.37	216.4	226.4	279.10	0.70	0.99	2	3
RPC 9DU	74507.71	57898.35	268.3	283.3	280.96	0.54	0.76	2	3
RPC 10DL	74551.49	57380.20	200.5	210.5	280.56	0.87	1.22	2	3
RPC 10DU	74540.11	57380.29	272.5	287.4	290.42	0.10	0.14	2	3
RPC 11DL	75240.08	57380.02	180.2	190.2	278.49	0.54	0.76	2	3
RPC 11DU	75250.01	57380.43	271.2	286.2	289.45	0.00	0.01	2	3
RRP 1	75634.60	54563.50	242.4	272.4	265.67	0.64	3.35	27	3
RRP 2	75829.80	54468.30	242.5	272.5	264.47	0.66	3.37	26	3
RRP 3	75853.00	54303.00	238.1	268.1	264.51	0.72	3.84	28	3
RRP 4	75723.30	54294.50	238.3	268.3	263.90	0.67	3.48	27	3
RSB 7	75044.30	57692.80	272.7	292.6	285.76	0.81	4.28	28	3
RSB 8	75178.20	57612.90	274.3	294.3	287.79	0.88	4.21	23	3
RSC 2	74378.60	58543.00	261.9	281.9	278.28	0.73	3.42	22	3
RSC 3	74699.70	58724.70	258.6	278.6	276.60	0.93	4.35	22	3
RSC 9	74565.30	59241.20	251.6	271.6	271.79	0.79	3.63	21	3
RSD 1	75035.10	57440.80	267.9	287.7	286.45	0.60	3.32	31	3
RSD 3	74702.30	57451.60	269.3	289.1	286.76	0.74	4.10	31	3
RSD 4	75154.60	57441.40	270.6	290.6	288.43	0.53	2.75	27	3
RSD 5	75207.00	57439.90	269.6	289.6	287.07	0.56	2.89	27	3
RSD 6	75256.60	57441.30	270.1	290.1	286.97	0.48	2.49	27	3
RSD 7	75178.40	57394.30	267.3	287.3	285.13	0.46	2.46	28	3
RSD 8	75229.60	57394.00	267.3	287.3	285.43	0.45	2.33	27	3
RSD 9	75185.90	57245.60	251.7	271.7	283.71	0.35	1.75	25	3
RSE 1A	74712.70	57734.50	274.8	294.8	288.53	0.77	4.49	34	3
RSE 1B	74698.10	57731.40	275.7	295.7	288.84	0.99	5.32	29	3
RSE 1C	74684.10	57730.80	268.5	288.5	288.72	1.11	5.88	28	3
RSE 2	74743.50	57594.90	269.7	289.5	286.39	1.08	5.60	27	3
RSE 3A	74931.20	57445.80	268.2	288.0	285.20	0.75	4.03	29	3
RSE 4A	75101.10	57528.40	260.6	270.6	286.51	0.65	3.44	28	3
RSE 7	74783.70	58481.50	266.5	286.3	280.80	0.86	4.79	31	3
RSE 8	74869.40	58538.80	271.2	291.0	284.00	1.32	6.99	28	3
RSE 9	74971.10	58463.30	266.7	286.7	279.23	0.77	4.15	29	3
RSE 10	74848.30	58420.70	270.7	290.5	281.52	1.16	5.93	26	3
RSE 11	74787.70	58357.60	262.1	272.1	282.54	1.36	6.94	26	3
RSE 12	74842.30	58318.20	259.1	269.1	276.09	0.40	1.31	11	3
RSE 18	74839.50	58247.20	268.1	288.1	279.50	0.76	3.87	26	3
RSE 19	74791.20	58318.40	262.5	282.5	280.66	1.15	5.88	26	3
RSE 24	74638.90	57370.40	237.6	257.6	279.63	0.57	3.00	28	3
RSE 25	74544.50	55824.50	237.5	257.5	275.41	0.47	2.56	29	3
RSF 1	74869.40	58505.30	228.8	238.8	277.64	0.68	3.66	29	3
RSF 2	74628.60	57670.40	224.8	235.3	278.38	0.60	3.25	29	3
RSF 3	75206.70	57621.40	229.8	239.8	279.63	0.64	3.39	28	3
RSP 1D	74426.80	56879.40	274.7	289.7	289.71	1.19	1.68	2	3
RSP 2D	75568.60	55947.10	260.3	280.3	278.40	-1.00	-1.00	1	3
SBG 1	63749.10	74619.40	190.7	220.7	237.86	0.30	1.53	26	4
SBG 2	64939.60	74570.20	205.9	235.9	237.79	0.33	1.76	28	3
SBG 3	65265.60	73699.90	206.6	236.6	237.52	0.37	1.99	29	3
SBG 4	65010.20	72399.80	185.6	215.6	240.93	0.27	1.37	26	4
SBG 5	64499.00	72208.30	199.4	219.4	249.31	0.30	1.52	25	4
SBG 6	63860.00	73599.30	208.1	238.1	244.49	0.33	1.73	28	3
SCA 2	64697.10	73850.60	215.9	245.9	242.16	0.36	1.58	19	3
SCA 3	64571.20	73959.30	220.3	240.3	241.30	0.33	1.06	10	3
SCA 3A	64571.20	73965.00	267.1	277.1	271.08	0.48	1.94	16	3
SCA 4	64563.50	73856.50	220.4	240.4	241.53	0.37	1.48	16	3
SCA 4A	64567.20	73855.20	265.3	275.3	268.78	0.42	1.47	12	3
SCA 5	64630.80	74092.90	223.7	243.7	241.33	0.25	1.02	17	3
SCA 6	64637.50	73706.20	221.3	241.1	241.98	0.26	1.03	16	3

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

SLP 1	64449.10	72958.40	228.0	248.0	245.10	0.34	1.82	28	3
SLP 2	64529.70	72863.40	217.7	237.7	244.72	0.30	1.58	28	3
TBG 1	17134.70	71429.50	89.1	109.1	100.58	0.20	1.38	46	2
TBG 3	17177.70	71324.10	88.9	108.9	103.11	0.27	1.70	40	2
TBG 4	17177.70	71267.10	89.3	109.3	103.07	0.27	1.62	35	2
TBG 5	17354.50	71226.50	92.4	112.4	102.65	0.35	2.02	34	2
TBG 5A	17348.80	71206.80	70.0	80.0	103.90	0.28	1.67	36	2
TBG 5B	17354.80	71216.80	46.2	56.2	113.25	0.45	2.79	38	1
TBG 6	17290.50	71482.30	89.1	109.1	102.65	0.25	1.50	37	2
TBG 7	17548.10	71298.50	84.7	104.7	105.45	0.33	2.09	40	2
TIR 1L	16169.25	71019.05	65.7	67.7	93.17	0.31	0.97	10	4
TIR 1M	16170.12	71024.12	84.6	86.6	93.87	0.79	2.36	9	2
TIR 1U	16170.93	71028.98	90.0	92.0	93.23	0.25	0.75	9	2
TIR 2	16096.27	71068.64	84.2	86.2	92.41	0.27	0.82	9	2
TIR 3B	16522.86	71099.07	83.5	85.5	95.75	0.34	1.09	10	2
TNX 1D	16699.60	71613.50	79.6	99.6	99.45	0.15	0.92	38	2
TNX 2D	16788.20	71452.00	82.8	102.8	99.29	0.16	0.99	38	2
TNX 3D	17043.10	71236.70	84.9	104.9	99.78	0.19	1.24	43	2
TNX 4D	17223.00	71002.70	85.5	105.5	103.13	0.31	2.01	43	2
TNX 5D	17363.70	70995.30	88.5	108.5	104.96	0.32	1.98	38	2
TNX 6D	17428.70	70717.60	89.8	109.8	105.32	0.34	2.08	38	2
TNX 7D	17080.60	71738.10	83.6	103.6	101.19	0.16	1.06	43	2
TNX 8D	16168.30	70591.90	74.0	94.0	94.04	0.17	1.05	38	2
TNX 9D	16145.80	70791.40	75.4	95.4	93.82	0.15	1.02	45	2
TNX 10D	16166.70	70999.30	77.0	97.0	94.12	0.18	1.07	37	2
TNX 11D	16165.50	71199.30	73.2	93.2	94.12	0.16	1.02	39	2
TNX 12D	16176.30	71598.30	73.1	93.1	94.99	0.12	0.72	38	2
TNX 13D	15938.80	70842.00	87.9	89.9	92.03	0.25	0.55	5	2
TNX 14D	15971.10	70931.80	85.8	87.8	92.12	0.08	0.16	4	2
TNX 15D	16002.10	71021.10	85.9	87.9	91.73	0.55	1.65	9	2
TNX 16D	16012.20	71111.30	86.1	88.1	91.45	0.44	1.39	10	2
TNX 17D	16047.40	71583.80	89.7	91.7	93.31	0.17	0.39	5	2
TNX 18D	15898.00	70748.20	84.9	86.9	91.70	0.15	0.31	4	2
TNX 19D	15848.40	70626.70	84.9	86.9	91.46	0.54	1.21	5	2
TNX 20D	15826.10	70579.00	86.2	88.2	91.52	0.59	1.32	5	2
TNX 21D	15833.50	70446.80	86.9	88.9	91.82	0.54	1.22	5	2
TNX 22D	15757.70	70184.70	85.8	87.8	90.16	0.40	0.89	5	2
TNX 23D	16927.00	71414.50	84.8	104.8	99.34	0.57	1.39	6	2
TNX 24D	17534.60	71536.90	99.8	114.8	108.99	0.20	0.55	8	2
TNX 26D	16251.00	70424.40	87.8	90.1	94.24	0.38	1.21	10	2
TNX 27D	16609.14	71180.09	81.3	101.3	96.39	0.40	1.20	9	2
TRW 1	16947.00	71162.80	81.4	106.4	93.43	1.21	4.02	11	2
TRW 2	16803.80	71259.60	77.2	112.2	93.96	1.22	3.45	8	2
XSB 1	16901.00	71133.10	92.0	112.0	102.82	0.47	0.66	2	2
XSB 1A	16883.00	71105.40	43.6	53.6	98.70	0.21	1.23	36	1
XSB 1B	16872.90	71105.00	64.6	74.6	102.71	0.35	2.10	37	2
XSB 1D	16893.50	71104.80	87.9	107.9	99.00	0.27	1.77	42	2
XSB 2D	16823.10	71086.00	84.0	104.0	98.54	0.18	1.22	45	2
XSB 3A	16901.30	70915.30	87.4	103.2	99.80	0.19	1.20	39	2
XSB 4	16851.10	71024.50	94.3	114.3	98.27	0.36	0.63	3	2
XSB 4D	16826.20	70997.90	83.9	103.9	98.61	0.20	1.27	42	2
YSB 1A	17808.80	71162.20	98.4	128.4	118.28	0.77	5.05	43	2
YSB 2A	17850.20	71010.00	97.7	127.7	119.20	0.74	4.85	43	2
YSB 3A	17755.20	70859.00	96.7	126.7	119.40	0.40	2.65	44	2
YSB 4A	17739.80	71020.70	97.6	127.6	118.08	0.71	4.64	43	2
YSC 1A	65438.90	78039.90	76.8	136.9	163.03	0.57	1.28	5	1
YSC 1C	65855.50	78186.20	197.5	207.5	217.37	0.75	2.98	16	2
YSC 1D	65859.10	78170.70	216.8	236.8	221.34	0.26	0.37	2	3

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

YSC 2A	66100.10	78311.50	134.7	144.7	162.89	0.20	0.79	16	1
YSC 2D	66130.70	78320.40	197.9	218.0	216.15	0.55	2.35	18	4
YSC 4C	65901.90	77059.70	195.9	205.9	227.53	0.62	2.47	16	2
YSC 5A	67134.90	74295.90	116.0	121.0	180.77	1.13	4.52	16	1
Z 2	53181.60	74785.30	214.0	214.5	218.74	0.38	1.27	11	3
Z 3	51328.30	75086.20	206.6	207.1	212.57	0.71	2.02	8	3
Z 8	51584.90	76640.50	213.6	214.1	218.90	0.60	2.08	12	3
Z 9	50570.50	77732.00	207.5	227.5	214.89	0.42	2.08	25	3
Z 12	61400.90	71198.90	251.3	251.8	274.33	0.22	0.53	6	3
Z 13	62203.60	70785.80	256.6	257.1	275.24	0.80	2.65	11	3
Z 15	63419.20	72802.10	253.8	254.3	263.72	0.26	0.63	6	3
Z 17	43797.80	72260.90	148.2	148.7	169.17	0.31	1.03	11	2
Z 18	43774.10	73077.20	159.9	160.4	184.23	0.63	2.09	11	4
Z 20	43722.40	74080.70	173.4	193.4	184.74	0.36	0.80	5	3
Z 20B	43721.00	74085.00	175.6	195.6	190.67	1.09	3.09	8	3
ZBG 1	65584.10	76584.20	220.0	240.1	234.05	0.50	3.04	37	3
ZBG 1A	65598.80	76588.50	276.0	281.0	279.89	1.22	4.22	12	3
ZBG 2	67472.90	76170.50	210.9	230.9	221.73	0.39	2.42	38	4
ZDT 1	65114.80	71644.40	227.0	247.0	239.89	0.16	0.92	32	3
ZDT 2	65059.90	71696.50	225.1	245.1	241.42	0.18	1.01	32	3
ZW 2	54388.70	80701.50	194.8	204.8	207.07	0.57	2.34	17	2
ZW 3	57078.20	80746.50	194.6	205.1	200.66	0.46	1.89	17	4
ZW 4	56556.90	77667.40	229.2	239.7	232.21	0.51	2.10	17	3
ZW 5	54708.60	75767.40	221.0	231.0	227.26	0.27	1.25	21	3
ZW 6	52030.80	76166.00	216.7	227.2	220.19	0.85	3.30	15	3
ZW 7	60300.70	72399.50	254.5	264.8	265.83	0.39	1.55	16	3
ZW 8	63801.50	70800.80	254.1	264.1	270.85	0.21	0.91	18	3
ZW 9	61400.30	73198.40	242.4	252.4	251.97	0.45	1.93	18	3
ZW 10	63401.00	73212.40	242.2	252.2	249.72	0.86	4.13	23	3
CMP 10C	53994.30	51402.70	179.6	189.6	198.53	-1.00	-1.00	1	2
CMP 10D	53994.30	51392.50	209.6	229.6	229.84	-1.00	-1.00	1	3
CMP 11D	53647.00	51467.90	209.5	229.9	223.34	-1.00	-1.00	1	3
CMP 14D	52589.50	52363.50	204.1	224.5	217.43	-1.00	-1.00	1	3
CMP 15C	52907.80	51361.40	220.6	250.6	244.53	-1.00	-1.00	1	3
CMP 30B	53166.90	51729.80	97.4	107.5	195.00	-1.00	-1.00	1	2
CMP 30C	53208.20	51718.40	179.5	189.5	210.55	-1.00	-1.00	1	2
CMP 30D	53202.90	51709.70	211.6	231.6	227.97	-1.00	-1.00	1	3
CMP 31C	53255.70	52389.70	197.9	207.9	210.78	-1.00	-1.00	1	4
CMP 32B	54052.80	52220.00	97.7	107.7	195.31	-1.00	-1.00	1	2
CMP 32C	54061.10	52214.60	185.2	195.2	195.44	-1.00	-1.00	1	2
CMP 32D	54069.20	52209.20	218.6	228.6	220.77	-1.00	-1.00	1	3
NPM 2	58252.00	63056.80	244.2	264.2	267.00	-1.00	-1.00	1	3
NPM 3	55417.60	62109.20	247.2	267.2	267.60	-1.00	-1.00	1	3
NPM 4	57215.00	60883.20	256.7	276.7	272.70	-1.00	-1.00	1	3
NPN 1	70879.60	66661.40	257.3	277.4	277.50	-1.00	-1.00	1	3
NPN 2	72541.50	67394.10	257.9	278.0	273.50	-1.00	-1.00	1	3
NPN 3	70029.20	67989.80	260.0	280.1	276.70	-1.00	-1.00	1	3
NPN 4	71021.80	65357.20	265.4	285.5	278.50	-1.00	-1.00	1	3
NTN 1	45562.30	56993.70	212.4	232.4	233.70	-1.00	-1.00	1	3
NTN 2	46735.10	57935.50	207.2	227.2	235.20	-1.00	-1.00	1	3
NTS 1	43893.90	46082.00	164.3	184.4	180.40	-1.00	-1.00	1	3
NTS 2	45825.20	46262.60	174.7	194.8	192.30	-1.00	-1.00	1	3
NTW 1	40257.70	48776.50	168.9	188.8	183.60	-1.00	-1.00	1	3
NTW 2	39353.20	49309.30	171.5	191.5	183.90	-1.00	-1.00	1	3
NTW 3	41208.70	50040.00	176.7	196.6	191.80	-1.00	-1.00	1	3
NTW 4	41678.20	48636.30	166.0	185.8	180.40	-1.00	-1.00	1	3
P 13A	60000.00	35600.00	-67.3	-57.4	173.07	0.17	1.24	56	1
P 13B	60000.00	35600.00	-7.2	3.0	175.65	0.22	1.64	56	1
P 15A	51376.30	46755.30	-97.0	-87.0	176.77	0.23	1.63	51	4

Table F-1. Hydraulic Head Targets for Model Calibration (Continued)

P 18A	47688.10	67592.80	12.0	22.0	168.48	0.16	1.27	64	1
P 18B	47680.90	67578.90	67.0	77.0	169.01	0.16	1.30	64	1
P 19A	60031.30	55347.10	-36.7	-26.7	186.83	-1.00	1.60	-1	1
P 21B	40757.60	24641.80	-82.2	-72.2	134.01	0.16	1.29	64	1
P 23A	30914.50	48114.90	-38.8	-28.8	146.11	0.17	1.44	69	4
P 23B	30925.30	48101.20	41.5	46.5	137.85	0.19	1.58	69	1
P 24A	66569.70	43142.20	-1.9	8.9	191.47	-1.00	1.00	-1	1
P 25B	42241.90	52521.40	80.6	90.6	178.24	0.65	5.17	64	1
P 26A	18055.90	72010.40	22.0	32.0	117.48	0.33	2.73	69	1
P 27B	64000.30	70405.90	74.8	94.8	179.76	0.15	1.18	62	1

Hydraulic Head Residuals

The complete contents of the FACT code observation well file are listed in Table F-2. FACT does not compute a hydraulic head for wells outside of the saturated zone and model domain (model area). Wells outside the model area are denoted by a simulated head of "`0.0`" in Table F-2. The associated (large negative) residual is meaningless, and ignored in the calculation of summary statistics.

Table F-2. Summary of Group Statistical Parameters

```
Group Statistics for Steady-state Analysis Only
          Overall rms hydraulic head difference:      5.64

** GROUP  1 **  rms of (FACT-data) differences:      3.389
                avg of (FACT-data) differences:     -1.271
                avg of |FACT-data| differences:      2.009
                max of (FACT-data) differences:    -18.142

"BGO  3A "  57666.62  55791.31  103.7  113.7  162.9  162.7    -0.2
"BGO  6A "  57379.75  56798.46  107.5  117.5  159.2  159.2     0.0
"BGO  8A "  56713.52  57023.70  105.3  115.3  161.0  158.4    -2.6
"BGO  8AR"  56718.93  57053.02   94.6  104.6  160.8  158.3    -2.5
"BGO  9AA"  56557.06  57472.74   73.8   83.8  157.9  156.9    -1.0
"BGO 10AA"  56188.61  57573.76   80.8   90.8  157.4  156.6    -0.8
"BGO 10AR"  56220.41  57370.81   96.5  106.5  158.4  157.2    -1.2
"BGO 12AR"  55433.62  57535.80   99.3  109.3  157.8  156.7    -1.1
"BGO 12AX"  55438.21  57566.51   99.5  109.5  157.2  156.6    -0.6
"BGO 14A "  54932.60  57206.47  109.6  119.6  158.0  157.6    -0.4
"BGO 14AR"  54878.94  57191.60   96.8  106.8  159.3  157.6    -1.7
"BGO 16A "  55151.72  56525.53  102.5  112.5  161.0  159.6    -1.4
"BGO 16AR"  55171.25  56507.27  103.7  113.7  160.9  159.6    -1.3
"BGO 18A "  55613.51  56266.77   99.5  109.5  161.0  160.5    -0.5
"BGO 20A "  55873.74  55563.80   86.3   96.3  163.6  162.7    -0.9
"BGO 25A "  54720.59  57027.64  104.1  114.1  160.6  158.0    -2.6
"BGO 26A "  54078.09  57150.00   81.0   91.0  160.9  157.3    -3.6
"BGO 29A "  53065.74  56767.52  102.5  112.5  159.5  157.6    -1.9
"BGO 39A "  56289.81  54051.04   84.8   94.8  167.5  167.3    -0.2
"BGO 41A "  54526.63  57386.82  103.3  113.3  158.3  156.9    -1.4
"BGO 43A "  55480.82  57789.12  105.9  115.9  158.8  155.9    -2.9
"BGO 43AA"  55496.65  57790.46   62.2   72.2  156.7  155.9    -0.8
"BGO 44A "  56980.04  57157.41   98.0  108.0  158.4  157.9    -0.5
"BGO 44AA"  57009.08  57153.08   61.2   71.3  158.7  157.9    -0.8
"BGO 47A "  53685.72  55785.97   86.8   96.8  162.3  160.6    -1.7
"BGO 49A "  54776.87  54709.58   75.1   85.1  167.2  164.2    -3.0
"BGO 50A "  53065.78  56400.69   90.5  100.5  160.1  158.5    -1.6
"BGO 51A "  56425.66  54594.46   75.1   85.1  165.9  165.9     0.0
"BGO 52A "  55886.11  55219.91   81.7   91.7  163.7  163.7     0.0
"BGO 52AA"  55881.46  55226.42   36.6   46.6  162.9  163.6     0.7
"BGO 53A "  54463.49  56992.63   78.7   88.7  158.9  158.0    -0.9
"BGO 53AA"  54469.72  56985.38   38.9   48.9  155.6  157.9     2.3
"BGX  1A "  57719.04  57078.74  114.1  124.1  158.8  158.2    -0.6
"BGX  4A "  56592.03  58389.00  106.8  116.8  155.1  153.5    -1.6
"CMP  8A "  48469.95  34344.23   13.7   23.5  182.9  184.7     1.8
"CMP 12A "  47590.53  33793.03   22.1   32.1  181.6  183.6     2.0
"CMP 15A "  46853.37  33344.49   14.2   24.2  180.6  182.5     1.9
```

Table F-2. Summary of Group Statistical Parameters (Continued)

"DCB 20D "	17380.30	52486.69	46.2	48.7	114.0	109.5	-4.5
"DCB 23D "	16894.13	52535.54	49.1	51.6	111.2	108.3	-2.9
"FC 1A "	52952.32	60987.82	96.7	101.7	143.5	144.6	1.1
"FC 3B "	57173.69	59132.82	61.2	66.2	150.6	150.3	-0.3
"FC 3C "	57182.65	59131.22	121.0	126.0	151.8	150.4	-1.4
"FC 4B "	54258.68	63352.39	76.1	81.1	141.0	137.7	-3.3
"FC 4C "	54264.51	63357.69	116.3	121.3	137.6	138.2	0.6
"FIW 2MA"	50287.63	57737.11	100.5	110.5	151.5	151.3	-0.2
"FNB 1A "	54202.25	61223.09	107.9	117.9	144.3	144.5	0.2
"FNB 2A "	54330.20	61502.80	111.1	121.1	143.6	143.7	0.1
"FNB 3A "	54117.53	61652.79	109.2	119.2	143.1	143.2	0.1
"FSB 76A "	50532.01	57890.76	36.9	47.4	155.1	151.1	-4.0
"FSB 76B "	50532.38	57880.96	99.2	109.7	151.6	151.2	-0.4
"FSB 78A "	49054.13	56799.99	27.0	37.5	156.1	152.1	-4.0
"FSB 78B "	49061.71	56806.76	82.4	92.8	154.5	152.1	-2.4
"FSB 79A "	48804.15	55735.50	24.0	34.4	158.0	154.9	-3.1
"FSB 79B "	48813.87	55735.07	80.7	91.2	158.1	155.0	-3.1
"FSB 87A "	49173.86	57637.40	33.1	43.6	153.8	149.7	-4.1
"FSB 87B "	49162.22	57635.06	90.0	100.5	150.6	149.7	-0.9
"FSB 96A "	48694.53	57003.71	85.7	95.7	152.1	150.9	-1.2
"FSB 96AR"	48669.93	57042.37	79.0	89.0	153.4	150.7	-2.7
"FSB 97A "	48937.53	57247.51	85.8	95.8	152.2	150.5	-1.7
"FSB 98A "	49135.47	57428.92	84.7	94.7	150.6	150.3	-0.3
"FSB 98AR"	49114.24	57405.01	82.1	92.1	151.8	150.4	-1.4
"FSB 99A "	49383.87	57668.31	92.9	102.9	150.7	150.0	-0.7
"FSB100A "	49984.05	57396.38	95.8	105.8	151.5	151.8	0.3
"FSB101A "	50250.24	57528.52	92.9	102.9	151.7	151.8	0.1
"FSB112A "	47610.81	56568.72	81.0	91.0	153.5	150.5	-3.0
"FSB113A "	49807.16	56036.54	81.0	91.3	158.7	155.5	-3.2
"FSB114A "	50999.20	56938.31	95.2	105.0	155.6	154.6	-1.0
"FSB120A "	48241.24	57771.43	99.0	109.0	151.3	147.6	-3.7
"HAA 1A "	60555.31	49367.75	94.9	104.9	181.1	180.4	-0.7
"HAA 2A "	59118.96	50747.84	107.3	117.3	177.0	176.7	-0.3
"HAA 3A "	58169.46	51502.24	96.8	106.8	175.8	174.6	-1.2
"HAA 4A "	60017.63	51878.30	105.4	115.3	174.7	175.1	0.4
"HAA 4AA"	60027.07	51876.50	32.2	42.2	174.9	175.0	0.1
"HAA 6A "	61762.41	50707.86	95.6	105.6	178.9	178.4	-0.5
"HAA 6AA"	61752.85	50710.00	28.5	35.8	178.6	178.3	-0.3
"HC 1A "	59868.49	51431.54	89.5	94.5	175.8	175.8	0.0
"HC 2A "	59875.62	51469.90	72.2	77.2	175.8	175.7	-0.1
"HC 2B "	59883.53	51459.02	85.7	90.7	175.0	175.8	0.8
"HC 8B "	59291.27	57414.80	132.5	137.5	155.5	156.5	1.0
"HC 10A "	60443.26	55451.59	114.0	117.0	163.3	164.7	1.4
"HCA 4A "	61066.28	51954.44	103.7	113.7	175.6	175.5	-0.1
"HCA 4AA"	61078.23	51950.06	33.6	43.6	175.2	175.4	0.2
"HIW 2A "	55177.01	53956.84	78.3	88.3	167.2	166.5	-0.7
"HSB 65A "	56654.09	52811.20	62.5	73.2	171.3	170.9	-0.4
"HSB 68A "	54954.88	52242.77	47.5	58.0	171.8	170.4	-1.4
"HSB 69A "	54541.89	52353.55	83.1	93.1	171.7	169.8	-1.9
"HSB 83A "	56656.73	52005.45	65.2	76.0	172.9	172.6	-0.3
"HSB 84A "	54445.85	52411.59	64.7	75.9	171.8	169.6	-2.2
"HSB 85A "	57432.27	54031.78	61.1	71.1	168.8	168.5	-0.3
"HSB 86A "	54275.00	53402.77	63.1	73.9	168.6	167.0	-1.6
"HSB117A "	53521.40	53781.12	84.8	94.8	166.7	165.5	-1.2
"HSB119A "	54503.71	53929.02	93.3	103.3	166.9	166.0	-0.9
"HSB120A "	54893.16	54165.82	91.0	101.0	166.2	165.7	-0.5
"HSB122A "	55930.58	52719.32	85.4	95.4	171.3	170.4	-0.9
"HSB140A "	54298.97	50872.60	81.0	91.0	175.7	172.8	-2.9
"HSB141A "	57116.59	51462.98	80.6	90.6	175.0	174.0	-1.0
"HSB144A "	54354.32	52743.78	78.6	88.6	170.9	168.7	-2.2

Table F-2. Summary of Group Statistical Parameters (Continued)

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"HSB146A "   56264.76   50892.93    85.5    95.5   175.9   174.4     -1.5
"HSL  6A "   58773.03   52614.66   104.7   114.7   168.2   172.9      4.7
"HSL  6AA"   58780.78   52621.29    18.6    28.6   168.9   172.8      3.9
"HSL  8A "   59332.69   52533.01   108.8   118.8   172.6   173.3      0.7
"HSL  8AA"   59334.34   52541.25    28.7    38.7   175.5   173.2     -2.3
"LAW  1D "   43189.65   27176.23     6.6    11.6   176.5   174.7     -1.8
"LAW  2B "   42474.87   28431.27    -9.8    -4.8   176.2   174.0     -2.2
"LAW  3B "   45042.93   27844.21    -1.0     4.0   178.2   178.4      0.2
"LCO  5A "   43542.51   27535.73    30.0    40.0   177.2   175.6     -1.6
"NPM 19E "   53855.72   43750.52    33.9    43.9   188.4   183.6     -4.8
"NPM 34E "   52178.77   41824.18    33.1    43.1   187.0   184.5     -2.5
"PW  83N "   48260.52   43306.42     4.0     9.0   168.4   179.6     11.2
"TBG  5B "   16217.09   60159.71    46.2    56.2   113.2    97.7    -15.5
"XSB  1A "   15732.44   60148.84    43.6    53.6    98.7    96.2     -2.5
"YSC  1A "   64669.04   56836.46    76.8   136.9   163.0   160.0     -3.0
"YSC  2A "   65372.26   56964.66   134.7   144.7   162.9   159.8     -3.1
"YSC  5A "   65549.56   52821.66   116.0   121.0   180.8   173.8     -7.0
"P   13A "   50525.24   16454.79   -67.3   -57.4   173.1   176.1      3.0
"P   13B "   50525.24   16454.79    -7.2     3.0   175.7   176.1      0.4
"P   18A "   45134.06   50308.26    12.0    22.0   168.5   165.1     -3.4
"P   18B "   45124.13   50296.16    67.0    77.0   169.0   165.2     -3.8
"P   19A "   54661.51   35763.86   -36.7   -26.7   186.8   191.1      4.3
"P   23B "   24685.04   34727.78    41.5    46.5   137.8   138.6      0.8
"P   24A "   58519.49   22466.26    -1.9     8.9   191.5   192.4      0.9
"P   25B "   36673.35   36698.53    80.6    90.6   178.2   163.5    -14.7
"P   26A "   17067.87   60790.20    22.0    32.0   117.5    99.4    -18.1
"P   27B "   61674.68   49668.39    74.8    94.8   179.8   180.4      0.6

** GROUP  2 **  rms of (FACT-data) differences:      6.703
                avg of (FACT-data) differences:      0.309
                avg of |FACT-data| differences:      5.291
                max of {FACT-data} differences:    -33.655

"BG   92  "  56450.00   59585.06   197.2   227.2   208.8   211.8      3.0
"BG   93  "  56964.98   60407.16   180.5   210.5   198.8   193.3     -5.5
"BG   94  "  57485.58   61253.82   152.8   182.8   191.1   157.4    -33.7
"BG   95  "  58210.78   60274.34   152.5   182.5   192.8   164.0    -28.8
"BG   96  "  57966.00   59647.94   177.2   207.2   197.7   191.8     -5.9
"BG 103   "  59074.01   57865.93   169.5   199.5   199.8   199.6     -0.2
"BG 122   "  56321.37   59164.11   189.9   209.9   211.2   216.3      5.1
"BGO  3C "   57663.88   55780.34   178.7   188.7   225.5   226.5      1.0
"BGO  5C "   57844.87   56689.07   183.2   193.2   216.2   221.6      5.4
"BGO  6B "   57422.52   56856.84   139.7   149.7   218.8   221.6      2.8
"BGO  6C "   57370.14   56800.40   158.0   168.0   220.0   222.5      2.5
"BGO  8C "   56716.03   57033.59   174.3   184.3   224.3   224.3      0.0
"BGO 10B "   56173.88   57560.73   139.0   149.0   219.6   223.2      3.6
"BGO 10C "   56198.04   57374.75   157.3   167.3   220.2   224.0      3.8
"BGO 12C "   55415.52   57541.08   153.6   163.6   220.1   225.0      4.9
"BGO 12CR"   55390.36   57547.24   144.0   154.0   221.9   224.7      2.8
"BGO 12CX"   55411.15   57571.96   141.2   151.2   230.0   224.6     -5.4
"BGO 13DR"   55027.63   57643.46   210.3   220.3   230.7   227.8     -2.9
"BGO 14C "   54931.25   57196.74   192.1   202.1   221.4   226.5      5.1
"BGO 14CR"   54876.13   57177.89   190.1   200.1   223.5   226.4      2.9
"BGO 16B "   55143.73   56537.96   136.0   146.0   218.1   224.9      6.8
"BGO 20B "   55889.62   55545.19   131.0   141.0   226.9   226.5     -0.4
"BGO 20C "   55873.23   55534.46   174.0   184.0   228.2   227.3     -0.9
"BGO 27C "   53643.34   56753.42   154.9   163.9   220.6   222.9      2.3
"BGO 29C "   53065.14   56785.84   176.8   186.8   222.8   222.1     -0.7
"BGO 30C "   53386.81   56311.81   178.4   188.4   219.0   221.4      2.4
"BGO 31C "   53641.87   56050.06   176.4   186.4   225.3   221.3     -4.0
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Table F-2. Summary of Group Statistical Parameters (Continued)

"BGO 33C "	54384.56	55382.76	177.8	187.8	224.9	222.6	-2.3
"BGO 35C "	55120.65	54688.75	161.9	171.9	228.6	224.3	-4.3
"BGO 37C "	55743.38	54090.51	168.8	178.8	229.9	226.6	-3.3
"BGO 39C "	56282.08	54042.56	174.9	184.9	229.3	229.0	-0.3
"BGO 42C "	54629.16	57298.77	185.9	195.9	223.2	226.2	3.0
"BGO 43CR"	55459.53	57766.86	178.4	188.4	225.2	225.3	0.1
"BGO 43D "	55465.56	57787.56	198.2	208.2	231.3	226.0	-5.3
"BGO 44B "	56994.49	57155.16	148.1	158.1	221.3	222.4	1.1
"BGO 44C "	57023.33	57150.87	190.6	200.6	220.8	223.6	2.8
"BGO 45B "	53574.07	56946.03	137.0	147.0	218.7	222.9	4.2
"BGO 45C "	53586.46	56937.98	190.5	200.5	222.6	224.4	1.8
"BGO 46B "	53285.57	56160.65	140.4	150.4	217.9	219.3	1.4
"BGO 46C "	53277.11	56172.78	178.0	188.0	219.4	220.4	1.0
"BGO 47C "	53709.52	55804.63	178.6	188.6	222.7	220.8	-1.9
"BGO 48C "	53864.66	55615.85	176.7	186.7	223.3	220.8	-2.5
"BGO 49C "	54777.03	54724.27	166.0	176.0	227.7	222.9	-4.8
"BGO 50C "	53080.36	56386.55	162.5	172.5	218.1	220.0	1.9
"BGO 51B "	56430.92	54587.93	116.9	126.9	229.4	228.1	-1.3
"BGO 51C "	56435.93	54582.16	175.1	185.1	230.3	229.5	-0.8
"BGO 52B "	55890.68	55213.52	126.7	136.7	227.4	226.6	-0.8
"BGO 52B "	55890.68	55213.52	126.7	136.7	227.4	226.6	-0.8
"BGO 52C "	55895.16	55207.15	178.7	188.7	228.7	227.7	-1.0
"BGO 53B "	54457.17	57000.00	143.5	153.5	221.3	224.6	3.3
"BGO 53C "	54450.67	57007.32	183.2	193.2	222.0	225.7	3.7
"BGX 1C "	57725.76	57065.15	176.0	186.0	215.8	220.0	4.2
"BGX 2B "	57469.67	57511.55	137.2	147.2	212.7	218.1	5.4
"BGX 2D "	57476.29	57498.90	181.1	191.1	215.2	219.5	4.3
"BGX 4C "	56580.37	58398.63	170.7	180.7	214.5	219.1	4.6
"BGX 4D "	56566.33	58409.49	203.8	223.8	215.7	222.2	6.5
"BGX 5D "	56791.69	58881.04	195.0	215.0	209.0	216.0	7.0
"BGX 6D "	57073.56	59166.78	191.0	211.0	205.7	211.2	5.5
"BGX 7D "	57762.99	58620.70	194.1	214.1	205.5	210.2	4.7
"BGX 8DR"	58220.98	57746.68	183.1	203.1	205.4	211.8	6.4
"BGX 12C "	58280.41	54501.71	174.1	184.1	234.2	229.9	-4.3
"BRR 6C "	50435.16	58863.14	156.0	166.0	211.6	211.4	-0.2
"BRR 7BR"	50162.98	59444.94	141.6	151.6	204.9	206.2	1.3
"BRR 7C "	50153.27	59444.45	175.9	185.9	209.8	207.6	-2.2
"BRR 8B "	49597.22	59625.82	138.7	148.7	204.3	200.5	-3.8
"CMP 8B "	48480.44	34345.48	156.6	166.6	198.5	205.2	6.7
"CMP 9B "	47847.73	33475.01	149.0	159.0	194.7	210.3	15.6
"CMP 10B "	47943.12	33136.89	137.4	147.4	195.0	212.4	17.4
"CMP 10C "	47936.35	33160.82	179.6	189.6	198.9	212.7	13.8
"CMP 11B "	47622.42	33282.65	139.7	149.7	195.0	210.8	15.8
"CMP 12B "	47582.56	33788.69	148.0	158.0	194.6	207.8	13.2
"CMP 13B "	47975.22	33615.47	134.2	144.2	194.7	209.5	14.8
"CMP 14B "	46762.54	34405.77	130.0	140.0	194.6	200.6	6.0
"CMP 15B "	46859.50	33335.32	145.1	155.1	202.9	208.3	5.4
"CMP 16B "	47831.28	33361.04	141.7	151.7	194.8	210.8	16.0
"CMP 30B "	47195.03	33652.79	97.4	107.5	194.7	207.0	12.3
"CMP 30C "	47233.06	33633.06	179.5	189.5	210.8	208.2	-2.6
"CMP 31B "	47408.43	34209.90	110.0	120.0	194.4	204.3	9.9
"CMP 32B "	48163.49	33948.09	97.7	107.7	195.5	207.0	11.5
"CMP 32C "	48170.49	33941.09	185.2	195.2	195.9	208.6	12.7
"CRP 3C "	41780.37	52154.68	121.1	131.1	196.7	203.0	6.3
"CRP 5C "	42238.74	51887.54	110.1	120.1	198.2	207.7	9.5
"DBP 1 "	16554.65	55461.46	93.2	121.4	119.8	120.9	1.1
"DBP 2 "	16261.38	55305.83	84.3	114.3	117.4	118.3	0.9
"DBP 3 "	16342.95	55592.44	86.4	116.4	121.0	119.4	-1.6
"DBP 4 "	16239.48	55516.39	84.2	114.2	118.9	118.5	-0.4
"DBP 5 "	16456.49	55271.93	96.1	116.1	117.6	119.9	2.3

Table F-2. Summary of Group Statistical Parameters (Continued)

"DCB 1A "	17169.39	52608.40	90.1	120.1	115.2	122.8	7.6
"DCB 2A "	18062.42	51812.95	97.4	127.4	124.8	129.5	4.7
"DCB 3A "	17908.76	51067.40	96.2	126.2	120.6	127.9	7.3
"DCB 4A "	17512.34	51155.65	92.5	122.5	119.1	125.5	6.4
"DCB 5A "	17259.08	51666.78	85.9	115.9	118.8	123.8	5.0
"DCB 6 "	17318.69	52719.18	109.5	128.2	116.8	124.1	7.3
"DCB 7 "	17339.83	52544.47	108.9	128.9	118.0	124.4	6.4
"DCB 8 "	18186.59	51825.20	110.3	130.3	126.5	130.3	3.8
"DCB 9 "	17155.27	52777.13	97.3	117.3	114.8	122.5	7.7
"DCB 10 "	17118.62	52388.76	99.8	119.8	116.6	122.6	6.0
"DCB 11 "	16701.76	53331.22	106.8	117.0	122.0	117.1	-4.9
"DCB 12 "	16105.05	53981.19	92.0	112.0	109.7	115.5	5.8
"DCB 13 "	16523.39	52555.56	102.0	117.6	116.9	117.5	0.6
"DCB 14 "	16898.86	53566.89	94.6	114.6	109.8	119.0	9.2
"DCB 15 "	15117.88	53636.30	99.8	114.5	111.5	110.1	-1.4
"DCB 16 "	14958.28	53004.27	100.1	114.7	111.9	110.3	-1.6
"DCB 17A "	17270.54	53154.00	109.4	119.4	116.6	123.1	6.5
"DCB 17B "	17274.54	53158.87	99.2	101.7	116.9	123.2	6.3
"DCB 17C "	17277.32	53163.29	87.4	89.9	116.1	123.2	7.1
"DCB 18A "	17198.69	52626.00	110.1	120.1	116.2	123.1	6.9
"DCB 18B "	17190.86	52621.83	100.5	103.0	113.3	123.0	9.7
"DCB 18C "	17184.89	52618.30	87.7	90.2	112.7	122.9	10.2
"DCB 19A "	17201.32	52595.07	111.9	121.9	120.0	123.2	3.2
"DCB 19B "	17195.27	52590.63	101.9	104.4	117.4	123.1	5.7
"DCB 19C "	17188.62	52586.32	89.1	91.6	116.5	122.9	6.4
"DCB 20A "	17393.86	52461.01	110.9	120.9	117.2	124.9	7.7
"DCB 20B "	17390.93	52466.03	100.3	102.8	116.5	124.8	8.3
"DCB 20C "	17387.59	52471.95	89.4	91.9	116.4	124.7	8.3
"DCB 21A "	17144.19	52497.52	110.1	120.1	116.9	122.8	5.9
"DCB 21B "	17142.14	52503.27	102.2	104.7	113.4	122.7	9.3
"DCB 21C "	17140.99	52508.93	88.3	90.8	112.9	122.6	9.7
"DCB 22A "	17083.51	52503.06	109.8	119.8	112.8	122.3	9.5
"DCB 22B "	17081.23	52509.16	100.9	103.4	112.8	122.2	9.4
"DCB 22C "	17080.53	52515.45	88.1	90.6	112.9	122.1	9.2
"DCB 23A "	16893.94	52505.32	105.7	115.7	111.8	120.7	8.9
"DCB 23B "	16893.90	52511.36	94.1	96.6	108.8	120.6	11.8
"DCB 23C "	16893.92	52517.70	86.6	89.1	109.0	120.6	11.6
"DCB 24A "	17146.45	51890.59	109.2	119.2	115.5	123.1	7.6
"DCB 24B "	17135.28	51889.49	100.6	103.1	115.2	122.9	7.7
"DCB 24C "	17128.89	51888.29	87.6	90.1	116.3	122.7	6.4
"DOB 1 "	21716.60	56149.98	114.7	144.7	143.2	147.4	4.2
"DOB 2 "	21521.56	56324.23	115.3	145.3	143.2	146.1	2.9
"DOB 3 "	21833.77	56386.18	115.9	145.9	143.2	147.5	4.3
"DOB 4 "	21974.85	56173.09	109.2	139.2	142.4	148.6	6.2
"DOB 7 "	21610.86	56047.42	125.7	145.7	143.1	147.0	3.9
"DOB 8 "	21854.23	56111.62	128.3	148.3	143.7	148.4	4.7
"DOB 9 "	21914.47	56489.76	128.5	148.5	144.1	147.6	3.5
"DOB 10 "	21457.21	56259.09	128.3	148.2	143.2	146.0	2.8
"DOB 11 "	21554.72	56191.64	126.7	131.7	140.9	146.4	5.5
"DOB 12 "	21553.76	56196.84	133.1	138.1	140.5	146.5	6.0
"DOB 14 "	21655.74	56057.51	132.6	137.6	139.7	147.2	7.5
"DOB 15 "	21284.89	55936.57	110.9	116.0	141.9	145.5	3.6
"DOB 16 "	21284.59	55930.81	103.5	108.6	141.4	145.5	4.1
"DOL 1 "	21808.58	56494.69	109.2	119.2	144.3	146.9	2.6
"FAC 9C "	54788.19	58927.09	197.4	207.4	217.4	224.4	7.0
"FAC 10C "	54766.72	59022.85	200.2	210.2	217.4	224.2	6.8
"FAC 11C "	54697.64	59017.70	201.4	211.4	217.5	224.5	7.0
"FAC 12C "	54681.22	58966.90	198.0	208.0	217.5	224.5	7.0
"FBP 1A "	50801.97	60656.16	161.8	191.8	206.7	200.1	-6.6
"FBP 2A "	50437.47	61570.32	137.1	167.1	191.6	173.8	-17.8

Table F-2. Summary of Group Statistical Parameters (Continued)

"FBP 3A "	50834.99	61616.17	141.0	171.0	194.2	182.3	-11.9
"FBP 4 "	51171.97	61014.05	165.2	195.2	212.3	199.1	-13.2
"FBP 6D "	50442.18	61529.96	178.3	198.3	194.8	179.8	-15.0
"FBP 7D "	50794.34	61590.87	183.2	203.2	194.1	184.4	-9.7
"FBP 8D "	51183.90	60982.69	172.8	192.8	207.1	199.7	-7.4
"FBP 9D "	50935.15	61314.97	177.9	197.9	200.3	192.0	-8.3
"FBP 12D "	50893.28	60676.93	182.1	202.1	208.4	202.8	-5.6
"FBP 13D "	50601.77	61573.73	172.7	192.7	194.9	181.3	-13.6
"FC 1B "	52953.86	60995.57	151.8	156.8	210.8	209.9	-0.9
"FC 1C "	52955.56	61003.08	183.9	188.9	214.0	210.9	-3.1
"FC 3D "	57191.44	59129.76	165.9	170.9	206.4	208.9	2.5
"FC 3E "	57198.96	59128.57	185.7	190.7	205.3	209.7	4.4
"FC 3F "	57206.55	59127.26	205.1	210.1	206.2	210.7	4.5
"FC 4E "	54276.52	63368.94	176.4	168.5	185.2	0.0	-185.2
"FCB 3 "	54000.00	57456.08	195.3	225.3	223.9	228.3	4.4
"FIW 2IC"	50304.02	57727.18	125.3	175.2	210.8	210.7	-0.1
"FNB 1 "	54184.80	61223.73	177.2	207.2	210.9	208.0	-2.9
"FNB 2 "	54333.78	61489.36	180.8	210.8	207.1	204.8	-2.3
"FNB 3 "	54106.12	61651.03	182.1	212.1	209.3	203.0	-6.3
"FNB 4 "	53819.76	61565.40	179.6	209.6	213.6	205.2	-8.4
"FNB 5 "	54292.00	61614.58	193.5	203.5	206.7	202.4	-4.3
"FNB 7 "	54412.36	61684.16	192.4	202.4	203.9	200.6	-3.3
"FNB 8 "	54534.35	61527.65	195.4	205.4	202.8	203.0	0.2
"FOB 5C "	48589.99	56744.62	129.3	149.3	202.9	196.2	-6.7
"FOB 7C "	49389.26	58074.58	148.9	168.9	208.0	206.1	-1.9
"FOB 9C "	49876.26	57663.74	155.5	175.5	210.2	208.7	-1.5
"FOB 11C "	50941.71	57274.11	156.2	176.2	212.4	213.4	1.0
"FSB 76C "	50532.65	57870.68	154.8	165.3	212.8	212.6	-0.2
"FSB 78C "	49054.67	56815.01	141.6	151.4	207.8	199.4	-8.4
"FSB 79C "	48826.10	55734.41	149.8	159.6	196.8	189.4	-7.4
"FSB 87C "	49149.91	57632.47	148.8	159.3	208.4	203.9	-4.5
"FSB 88C "	50549.09	57363.18	158.4	168.4	212.3	211.5	-0.8
"FSB 89C "	50366.31	57334.35	156.1	166.1	211.7	210.2	-1.5
"FSB 90C "	50138.59	57208.65	158.1	168.1	210.8	208.5	-2.3
"FSB 91C "	49912.50	57083.32	149.1	159.1	210.5	206.3	-4.2
"FSB 92C "	49498.22	57007.70	147.6	157.6	208.7	203.5	-5.2
"FSB 93C "	49362.42	56877.18	142.0	152.0	208.6	201.6	-7.0
"FSB 94C "	49084.32	56907.36	139.8	149.8	207.7	200.2	-7.5
"FSB 95C "	48945.94	57041.77	145.8	155.8	205.6	200.4	-5.2
"FSB 95CR"	48923.95	57077.32	151.9	161.9	207.7	200.7	-7.0
"FSB 97C "	48944.07	57254.71	143.8	153.8	208.0	201.2	-6.8
"FSB 98C "	49128.70	57421.57	148.4	158.4	209.0	203.2	-5.8
"FSB 99C "	49391.23	57675.02	157.2	167.2	209.4	205.7	-3.7
"FSB102C "	49457.41	55513.22	145.9	155.9	195.3	189.1	-6.2
"FSB103C "	48430.15	56372.68	147.1	157.1	202.5	193.0	-9.5
"FSB104C "	47966.11	56126.38	150.7	160.7	200.9	188.6	-12.3
"FSB105C "	48815.94	57337.76	141.5	151.5	207.7	200.8	-6.9
"FSB106C "	49404.17	56145.31	156.0	166.0	201.2	196.4	-4.8
"FSB107C "	50106.53	57012.12	150.8	160.8	209.9	207.1	-2.8
"FSB110C "	48914.53	56249.99	137.2	147.2	201.2	194.3	-6.9
"FSB111C "	50508.12	57130.51	159.0	169.0	211.8	210.3	-1.5
"FSB112C "	47596.01	56567.88	129.1	139.1	201.9	189.7	-12.2
"FSB113C "	49821.49	56026.54	154.0	164.0	202.5	197.4	-5.1
"FSB114C "	50984.82	56932.27	158.0	168.0	213.3	211.9	-1.4
"FSB116C "	49094.38	54713.83	160.5	170.5	189.7	187.1	-2.6
"FSB120C "	48239.01	57783.04	150.7	160.7	206.0	198.8	-7.2
"FSB121C "	47415.63	57555.15	148.4	158.4	204.1	193.7	-10.4
"FSB123C "	50557.64	56285.14	155.3	165.3	210.2	204.3	-5.9
"FSB150PC"	48736.60	56184.86	107.6	160.1	198.2	192.7	-5.5
"HAA 1B "	60561.80	49359.31	119.3	129.3	251.4	247.6	-3.8

Table F-2. Summary of Group Statistical Parameters (Continued)

"HAA 1C "	60567.40	49351.99	147.4	157.4	252.0	249.5	-2.5
"HAA 2B "	59111.69	50754.50	127.2	137.2	253.2	240.7	-12.5
"HAA 2C "	59104.31	50761.18	171.9	181.9	254.8	244.3	-10.5
"HAA 3B "	58154.04	51487.42	125.9	135.9	240.7	231.4	-9.3
"HAA 3C "	58139.89	51473.76	163.3	173.3	244.0	234.8	-9.2
"HAA 4C "	59997.99	51882.57	158.3	168.3	251.4	242.0	-9.4
"HAA 6B "	61771.90	50705.33	131.3	141.4	235.7	243.2	7.5
"HAA 6C "	61781.82	50703.43	161.1	171.1	235.9	244.2	8.3
"HC 2C "	59879.41	51458.87	135.7	140.7	253.7	241.1	-12.6
"HC 2D "	59873.54	51460.12	178.2	183.2	255.8	243.8	-12.0
"HC 4A "	61345.81	50965.20	150.0	155.0	244.7	243.7	-1.0
"HC 6A "	60139.40	51777.79	156.2	161.2	252.2	242.3	-9.9
"HC 8C "	59297.17	57410.38	187.3	192.3	197.5	202.2	4.7
"HC 10B "	60448.69	55444.91	164.8	169.8	208.9	209.1	0.2
"HC 12B "	57839.58	53326.69	177.3	182.3	240.8	233.8	-7.0
"HCA 4B "	61082.03	51968.88	126.6	136.6	245.9	234.8	-11.1
"HCA 4C "	61071.73	51970.96	153.8	163.8	246.6	243.1	-3.5
"HIW 2MC"	55118.76	53945.40	154.0	184.0	226.7	223.1	-3.6
"HIW 2MC"	55118.76	53945.40	124.1	139.0	226.7	222.2	-4.5
"HIW 4MC"	54979.48	53907.23	150.4	180.4	219.7	222.1	2.4
"HIW 4MC"	54979.48	53907.23	120.8	135.7	219.7	221.2	1.5
"HIW 5MC"	54992.54	54311.14	154.2	184.1	227.8	223.3	-4.5
"HIW 5MC"	54992.54	54311.14	124.4	139.2	227.8	222.4	-5.4
"HMD 1D "	56532.27	59273.24	199.7	219.7	209.5	214.6	5.1
"HMD 2D "	57016.40	60125.31	190.8	210.8	200.7	198.5	-2.2
"HMD 3D "	57463.40	59941.25	187.7	207.7	200.1	196.5	-3.6
"HMD 4D "	57810.04	59439.92	188.9	208.9	199.6	198.8	-0.8
"HSB 50PC"	53911.20	53112.98	119.5	169.6	218.0	209.7	-8.3
"HSB 65B "	56659.37	52819.69	123.3	133.3	224.3	226.7	2.4
"HSB 68B "	54944.81	52243.48	123.5	134.5	216.6	212.4	-4.2
"HSB 68C "	54935.32	52244.06	168.4	179.5	217.6	212.5	-5.1
"HSB 70C "	54067.23	53525.76	164.9	174.9	223.2	214.1	-9.1
"HSB 71C "	53658.01	53888.06	171.9	181.9	222.6	212.5	-10.1
"HSB 83B "	56643.90	51998.97	121.2	132.1	222.8	223.0	0.2
"HSB 83C "	56662.80	51992.19	160.2	171.2	224.6	223.9	-0.7
"HSB 84B "	54442.86	52429.71	121.8	132.9	210.8	209.8	-1.0
"HSB 84C "	54449.10	52422.04	170.9	181.8	213.5	210.1	-3.4
"HSB 85B "	57441.42	54027.18	133.2	143.2	233.7	230.7	-3.0
"HSB 86B "	54265.95	53403.47	113.8	124.0	221.6	213.9	-7.7
"HSB100C "	56941.86	52383.02	153.0	163.0	226.5	227.6	1.1
"HSB100PC"	53918.88	53006.25	117.6	167.7	217.2	209.1	-8.1
"HSB101C "	56728.52	52351.38	166.3	176.3	225.5	226.6	1.1
"HSB102C "	56519.60	52353.05	166.7	176.7	224.6	225.2	0.6
"HSB103C "	56369.03	52010.68	159.2	169.2	223.3	221.8	-1.5
"HSB104C "	56088.16	51848.43	163.5	173.5	220.6	218.5	-2.1
"HSB105C "	55908.36	51958.72	152.2	162.2	219.6	217.9	-1.7
"HSB106C "	55738.02	52274.64	158.7	168.7	221.7	219.1	-2.6
"HSB107C "	55518.66	52298.37	159.3	169.3	219.3	217.7	-1.6
"HSB108C "	55246.16	52346.27	186.0	196.0	218.5	216.9	-1.6
"HSB109C "	54991.13	52396.49	168.4	178.4	218.8	214.5	-4.3
"HSB110C "	54800.57	52533.61	171.4	181.4	219.1	214.2	-4.9
"HSB111C "	54654.81	52707.82	140.7	150.7	220.3	213.4	-6.9
"HSB112C "	54621.43	52957.21	140.6	150.6	221.6	214.8	-6.8
"HSB113C "	54402.46	53163.13	154.7	164.7	221.9	214.6	-7.3
"HSB113C "	54402.46	53163.13	151.7	161.7	221.9	214.5	-7.4
"HSB114C "	54381.89	53323.21	185.6	195.6	223.4	216.7	-6.7
"HSB115C "	54358.70	53520.95	182.8	192.8	224.4	217.2	-7.2
"HSB116C "	54354.62	53761.97	180.5	190.5	225.0	218.1	-6.9
"HSB117C "	53515.83	53789.56	165.1	175.1	221.6	210.5	-11.1
"HSB125C "	56613.57	51866.38	145.6	155.6	223.3	222.4	-0.9

Table F-2. Summary of Group Statistical Parameters (Continued)

"HSB126C "	55047.77	51303.73	176.3	181.3	203.9	205.7	1.8
"HSB127C "	54791.20	51953.68	148.4	158.4	210.3	209.1	-1.2
"HSB129C "	53274.82	52910.16	147.8	157.8	205.8	202.8	-3.0
"HSB130C "	52596.56	51962.46	159.9	169.9	199.9	203.0	3.1
"HSB131C "	54718.06	51115.16	148.5	158.5	203.9	206.1	2.2
"HSB132C "	56797.72	51795.34	168.6	178.6	221.6	223.9	2.3
"HSB133C "	57212.47	52194.94	173.3	183.3	230.6	229.6	-1.0
"HSB134C "	56256.31	51642.47	149.1	159.1	220.9	218.1	-2.8
"HSB135C "	54602.40	52177.94	147.3	157.3	206.7	209.3	2.6
"HSB136C "	54110.61	52803.97	160.5	170.5	217.5	209.7	-7.8
"HSB137C "	53943.50	53217.34	163.8	173.8	220.2	211.1	-9.1
"HSB139C "	55344.17	51754.05	148.5	158.5	214.5	212.0	-2.5
"HSB140C "	54314.78	50868.11	161.6	171.6	204.2	206.6	2.4
"HSB141C "	57114.54	51446.14	154.7	164.7	228.8	224.9	-3.9
"HSB141CR"	57117.85	51476.11	152.1	162.1	229.5	224.9	-4.6
"HSB142C "	51973.10	54504.23	161.6	171.6	198.3	195.0	-3.3
"HSB143C "	51385.74	55262.11	169.1	179.1	209.3	198.8	-10.5
"HSB145C "	55723.63	51641.80	164.7	174.7	213.4	213.5	0.1
"HSB146C "	56281.92	50881.82	152.3	162.3	209.9	214.6	4.7
"HSB148C "	53154.84	51219.25	158.9	168.9	201.7	207.8	6.1
"HSB150PC"	53783.65	53217.07	119.5	169.6	218.1	209.2	-8.9
"HSB151C "	52446.39	54279.83	170.6	180.6	207.9	199.8	-8.1
"HSB152C "	52565.96	53246.49	173.1	183.1	199.0	196.6	-2.4
"HSL 6C "	58757.86	52600.50	157.6	167.6	245.2	237.3	-7.9
"HSL 8B "	59331.52	52522.22	138.7	148.7	249.0	238.5	-10.5
"HSL 8C "	59330.38	52512.54	171.7	181.7	250.2	239.8	-10.4
"LAW 1E "	43173.25	27178.90	90.1	95.1	205.0	205.3	0.3
"LCO 5C "	43558.27	27533.91	110.5	120.5	211.0	209.7	-1.3
"NPM 19D "	53834.94	43723.45	97.5	107.5	243.1	250.7	7.6
"NPM 34D "	52189.19	41815.02	86.4	96.4	253.7	250.9	-2.8
"TBG 1 "	16046.02	60413.52	89.1	109.1	100.6	106.7	6.1
"TBG 3 "	16066.17	60301.49	88.9	108.9	103.1	107.8	4.7
"TBG 4 "	16054.32	60245.73	89.3	109.3	103.1	108.1	5.0
"TBG 5 "	16218.81	60169.26	92.4	112.4	102.6	110.4	7.8
"TBG 5A "	16209.14	60151.18	70.0	80.0	103.9	110.1	6.2
"TBG 6 "	16209.40	60432.78	89.1	109.1	102.7	108.5	5.8
"TBG 7 "	16423.15	60199.44	84.7	104.7	105.5	112.3	6.8
"TIR 1M "	15018.24	60217.55	84.6	86.6	93.9	95.7	1.8
"TIR 1U "	15020.04	60222.14	90.0	92.0	93.2	95.7	2.5
"TIR 2 "	14955.26	60276.45	84.2	86.2	92.4	95.0	2.6
"TIR 3B "	15378.85	60217.52	83.5	85.5	95.8	100.0	4.2
"TNX 1D "	15658.69	60683.97	79.6	99.6	99.4	101.1	1.7
"TNX 2D "	15711.77	60507.57	82.8	102.8	99.3	102.4	3.1
"TNX 3D "	15916.34	60243.98	84.9	104.9	99.8	106.4	6.6
"TNX 4D "	16043.66	59977.69	85.5	105.5	103.1	109.9	6.8
"TNX 5D "	16179.74	59941.20	88.5	108.5	105.0	111.4	6.4
"TNX 6D "	16185.59	59656.06	89.8	109.8	105.3	112.7	7.4
"TNX 7D "	16057.27	60726.63	83.6	103.6	101.2	104.8	3.6
"TNX 8D "	14926.59	59795.15	74.0	94.0	94.0	95.5	1.5
"TNX 9D "	14946.06	59994.97	75.4	95.1	93.8	95.3	1.5
"TNX 10D "	15009.73	60193.98	77.0	95.9	94.1	95.7	1.6
"TNX 11D "	15050.14	60389.86	73.2	93.2	94.1	95.8	1.7
"TNX 12D "	15143.66	60777.90	73.1	93.1	95.0	94.8	-0.2
"TNX 13D "	14754.11	60087.50	87.9	89.9	92.0	93.4	1.4
"TNX 14D "	14804.37	60168.63	85.8	87.8	92.1	93.8	1.7
"TNX 15D "	14853.26	60249.53	85.9	87.9	91.7	94.2	2.5
"TNX 16D "	14881.89	60335.66	86.1	88.1	91.5	94.3	2.8
"TNX 17D "	15014.56	60790.52	89.7	91.7	93.3	92.6	-0.7
"TNX 18D "	14694.70	60004.24	84.9	86.9	91.7	93.1	1.4
"TNX 19D "	14620.92	59895.70	84.9	86.9	91.5	92.6	1.1

Table F-2. Summary of Group Statistical Parameters (Continued)

"TNX 20D "	14589.19	59853.68	86.2	88.2	91.5	92.4	0.9
"TNX 21D "	14568.94	59722.83	86.9	88.9	91.8	92.3	0.5
"TNX 22D "	14440.30	59482.22	85.8	87.8	90.2	91.5	1.3
"TNX 23D "	15839.74	60442.04	84.8	104.8	99.3	104.2	4.9
"TNX 24D "	16459.51	60435.43	99.8	114.8	109.0	111.6	2.6
"TNX 26D "	14972.66	59614.12	87.8	90.1	94.2	96.3	2.1
"TNX 27D "	15480.09	60278.84	81.3	101.3	96.4	101.1	4.7
"TRW 1 "	15806.97	60191.68	81.4	106.4	93.4	105.5	12.1
"TRW 2 "	15687.03	60316.14	77.2	112.2	94.0	103.2	9.2
"XSB 1 "	15755.80	60172.19	92.0	112.0	102.8	105.0	2.2
"XSB 1B "	15722.48	60150.55	64.6	74.6	102.7	102.8	0.1
"XSB 1D "	15742.58	60146.07	87.9	107.9	99.0	105.0	6.0
"XSB 2D "	15669.81	60142.32	84.0	104.0	98.5	104.1	5.6
"XSB 3A "	15710.81	59959.09	87.4	103.2	99.8	105.7	5.9
"XSB 4 "	15684.42	60076.34	94.3	114.3	98.3	104.7	6.4
"XSB 4D "	15654.53	60055.50	83.9	103.9	98.6	104.4	5.8
"YSB 1A "	16649.82	60011.91	98.4	128.4	118.3	115.6	-2.7
"YSB 2A "	16658.67	59854.43	97.7	127.7	119.2	116.4	-2.8
"YSB 3A "	16534.35	59726.48	96.7	126.7	119.4	115.8	-3.6
"YSB 4A "	16552.90	59887.85	97.6	127.6	118.1	115.3	-2.8
"YSC 1C "	65106.95	56892.95	197.5	207.5	217.4	213.6	-3.8
"YSC 4C "	64918.13	55781.42	195.9	205.9	227.5	223.8	-3.7
"Z 17 "	42299.33	55683.19	148.2	148.7	169.2	168.3	-0.9
"ZW 2 "	54413.69	61737.37	194.8	204.8	207.1	199.9	-7.2
"CMP 10C "	47936.35	33160.82	179.6	189.6	198.5	212.7	14.2
"CMP 30B "	47195.03	33652.79	97.4	107.5	195.0	207.0	12.0
"CMP 30C "	47233.06	33633.06	179.5	189.5	210.6	208.2	-2.4
"CMP 32B "	48163.49	33948.09	97.7	107.7	195.3	207.0	11.7
"CMP 32C "	48170.49	33941.09	185.2	195.2	195.4	208.6	13.2

```
** GROUP  3 **  rms of (FACT-data) differences:      5.061
                avg of (FACT-data) differences:      0.155
                avg of |FACT-data| differences:      3.830
                max of {FACT-data} differences:     16.291
```

"BG 26 "	57336.11	54222.44	210.7	230.7	239.3	238.7	-0.6
"BG 27 "	57419.22	54611.98	234.4	254.4	240.9	238.5	-2.4
"BG 28 "	57501.60	54998.60	239.7	259.7	247.1	0.0	-247.1
"BG 29 "	57584.39	55389.53	231.6	251.6	245.0	234.8	-10.2
"BG 30 "	57666.46	55779.48	231.7	251.7	237.5	233.9	-3.6
"BG 31 "	57744.30	56171.67	223.3	243.3	233.7	232.6	-1.1
"BG 32 "	57827.27	56562.97	226.9	246.9	233.4	231.3	-2.1
"BG 33 "	57582.86	56747.83	221.2	241.2	232.9	231.4	-1.5
"BG 34 "	57176.26	56848.26	217.4	237.4	232.8	231.7	-1.1
"BG 35 "	56803.94	56929.14	228.0	248.0	232.9	231.7	-1.2
"BG 36 "	56752.61	57197.98	223.3	243.3	232.5	231.7	-0.8
"BG 37 "	56403.29	57330.81	227.8	247.8	232.9	232.2	-0.7
"BG 38 "	56012.15	57414.05	225.9	245.9	232.3	232.8	0.5
"BG 39 "	55621.07	57497.08	226.0	246.0	231.7	233.4	1.7
"BG 40 "	55229.56	57580.50	221.9	241.9	231.4	233.1	1.7
"BG 41 "	55003.77	57394.58	221.0	241.0	230.8	232.4	1.6
"BG 42 "	54921.81	57005.62	217.1	237.1	230.7	230.2	-0.5
"BG 43 "	55020.15	56651.13	222.9	242.9	230.5	230.6	0.1
"BG 51 "	57110.74	54174.14	221.2	241.2	240.7	238.6	-2.1
"BG 52 "	54528.35	56814.86	223.8	243.8	229.1	230.1	1.0
"BG 53 "	54139.12	57150.01	214.7	234.7	228.0	230.0	2.0
"BG 54 "	53834.44	56888.23	215.2	235.2	228.4	228.5	0.1
"BG 55 "	53534.89	56632.32	214.9	234.9	226.3	227.2	0.9
"BG 56 "	53362.38	56343.07	210.9	230.9	225.0	225.9	0.9
"BG 57 "	53650.24	56071.18	214.6	234.6	225.3	225.7	0.4

Table F-2. Summary of Group Statistical Parameters (Continued)

"BG 58 "	53941.50	55795.09	218.2	238.2	226.8	225.7	-1.1
"BG 59 "	54238.88	55529.97	217.7	237.7	229.6	226.4	-3.2
"BG 60 "	54530.35	55256.29	215.5	235.5	230.6	227.1	-3.5
"BG 61 "	54965.05	54846.04	225.0	245.0	232.5	228.5	-4.0
"BG 62 "	55109.85	54709.14	222.5	242.5	233.2	229.1	-4.1
"BG 63 "	55396.89	54426.18	224.2	244.2	235.2	230.0	-5.2
"BG 64 "	55688.22	54152.33	227.3	247.3	238.1	231.3	-6.8
"BG 65 "	55978.13	53879.49	230.9	250.9	235.7	232.5	-3.2
"BG 66 "	56275.73	54066.09	231.0	251.0	235.2	234.5	-0.7
"BG 67 "	56447.94	54406.83	224.7	244.7	236.3	235.5	-0.8
"BG 68 "	57329.68	56876.99	216.5	242.9	232.2	231.4	-0.8
"BG 69 "	57304.98	56882.44	222.2	242.2	232.5	231.6	-0.9
"BG 80 "	57056.01	56979.02	226.2	248.6	232.7	232.0	-0.7
"BG 81 "	57081.25	57000.00	222.9	246.9	227.3	231.9	4.6
"BG 84 "	57069.64	57077.74	227.2	247.2	232.6	231.9	-0.7
"BG 85 "	57048.52	57105.85	228.0	248.0	232.6	231.9	-0.7
"BG 86 "	57098.42	57097.69	228.0	248.0	232.5	231.8	-0.7
"BG 87 "	57077.23	57130.31	226.2	245.8	232.3	231.8	-0.5
"BG 98 "	56712.64	58075.77	212.5	242.5	224.5	227.9	3.4
"BG 99 "	57551.92	57188.59	215.9	245.9	232.5	230.0	-2.5
"BG 100 "	58225.51	57976.77	203.3	233.3	224.8	216.3	-8.5
"BG 104 "	59031.30	57011.34	215.8	245.8	224.8	220.4	-4.4
"BG 107 "	58793.60	54776.73	208.3	228.3	235.3	233.0	-2.3
"BG 108 "	58420.34	54426.07	217.3	247.3	238.8	238.8	0.0
"BG 109 "	58127.98	54021.21	228.4	258.4	240.1	241.9	1.8
"BG 110 "	57667.88	53534.74	224.3	254.3	241.2	242.6	1.4
"BGO 1D "	57260.53	54013.08	225.0	245.0	237.9	239.7	1.8
"BGO 2D "	57459.71	54803.95	218.9	238.9	238.0	237.3	-0.7
"BGO 3D "	57625.22	55585.01	227.6	247.6	235.5	234.1	-1.4
"BGO 3DR"	57669.26	55740.24	217.5	237.6	231.8	233.6	1.8
"BGO 4D "	57785.92	56367.50	220.6	240.6	231.8	231.8	0.0
"BGO 5D "	57835.51	56691.67	219.3	239.3	230.4	230.6	0.2
"BGO 6D "	57360.50	56802.66	217.2	237.2	231.4	231.6	0.2
"BGO 7D "	56990.40	56888.68	220.2	240.2	232.7	231.9	-0.8
"BGO 8D "	56717.15	57043.17	220.6	240.6	232.7	231.4	-1.3
"BGO 9D "	56627.61	57289.98	209.2	229.2	230.0	230.4	0.4
"BGO 10D "	56187.75	57376.83	230.5	250.5	231.8	232.6	0.8
"BGO 10DR"	56229.85	57367.58	218.3	238.3	231.5	232.0	0.5
"BGO 11D "	55816.74	57455.69	216.3	236.3	230.7	231.9	1.2
"BGO 12D "	55405.74	57543.15	217.8	237.8	231.3	232.3	1.0
"BGO 13D "	55023.21	57624.57	228.5	248.5	231.0	233.6	2.6
"BGO 14DR"	54873.25	57162.45	218.1	238.1	230.4	231.0	0.6
"BGO 15D "	54868.95	56806.97	218.7	238.7	229.7	230.3	0.6
"BGO 16D "	55158.28	56518.41	217.3	237.3	230.8	230.5	-0.3
"BGO 17DR"	55328.25	56331.59	216.9	236.9	232.0	230.5	-1.5
"BGO 18D "	55624.78	56264.47	219.6	239.6	231.9	231.2	-0.7
"BGO 20D "	55885.97	55556.90	216.3	236.3	233.9	232.9	-1.0
"BGO 21D "	56178.17	55214.98	217.7	237.7	234.8	234.1	-0.7
"BGO 22D "	56474.30	54941.13	194.2	214.2	232.6	233.3	0.7
"BGO 22DR"	56485.97	54927.71	219.2	239.2	236.0	235.4	-0.6
"BGO 22DX"	56445.03	55027.38	217.9	237.9	233.9	235.1	1.2
"BGO 23D "	56732.35	54636.72	222.0	242.0	235.8	236.3	0.5
"BGO 24D "	56984.54	54352.38	221.0	241.0	236.8	237.9	1.1
"BGO 26D "	54075.62	57133.55	213.4	233.5	227.7	229.6	1.9
"BGO 27D "	53654.23	56762.35	209.3	229.3	227.4	227.7	0.3
"BGO 28D "	53368.39	56486.76	210.1	230.1	226.1	226.3	0.2
"BGO 29D "	53068.49	56800.16	208.5	228.5	226.1	227.9	1.8
"BGO 30D "	53375.39	56321.08	207.8	227.8	225.5	225.8	0.3
"BGO 31D "	53668.33	56051.90	211.1	231.1	226.4	225.6	-0.8
"BGO 32D "	54014.20	55714.31	214.5	234.5	227.5	225.9	-1.6

Table F-2. Summary of Group Statistical Parameters (Continued)

"BGO 33D "	54395.96	55369.09	213.1	233.1	229.9	226.6	-3.3
"BGO 34D "	54724.82	55053.93	212.7	232.7	232.7	227.7	-5.0
"BGO 35D "	55129.57	54678.78	219.4	239.4	234.5	229.1	-5.4
"BGO 36D "	55411.89	54412.06	223.3	243.3	236.6	230.1	-6.5
"BGO 37D "	55755.24	54080.42	226.1	246.1	237.9	231.5	-6.4
"BGO 38D "	55980.48	53867.44	222.3	242.3	235.2	232.3	-2.9
"BGO 39D "	56300.85	54059.22	224.7	244.7	234.6	234.5	-0.1
"BGO 40D "	53706.79	57209.70	216.6	226.5	222.2	230.3	8.1
"BGO 44D "	57038.45	57149.39	223.4	233.4	232.5	231.8	-0.7
"BGO 45D "	53598.50	56955.15	209.6	229.6	227.7	228.8	1.1
"BGO 49D "	54776.67	54738.97	218.5	238.5	234.5	228.1	-6.4
"BGO 50D "	53090.30	56375.14	208.0	228.0	225.0	225.8	0.8
"BGO 51D "	56440.93	54575.88	220.1	240.1	235.2	235.3	0.1
"BGO 52D "	55899.95	55201.33	219.4	239.4	233.6	233.0	-0.6
"BGO 53D "	54461.98	56977.82	225.3	245.3	229.1	231.0	1.9
"BGX 1D "	57732.18	57053.05	214.7	234.7	229.5	229.6	0.1
"BGX 9D "	58652.02	56986.86	212.4	232.4	226.5	224.0	-2.5
"BGX 10D "	58733.61	56200.00	216.2	236.2	225.4	227.1	1.7
"BGX 11D "	58370.03	55374.96	216.7	236.7	235.3	233.3	-2.0
"BGX 12D "	58275.90	54485.29	223.7	243.7	238.8	238.8	0.0
"BRD 1 "	24686.69	42660.07	148.9	178.9	167.1	177.3	10.2
"BRD 2 "	24812.76	42871.28	148.5	178.5	169.3	178.1	8.8
"BRD 3 "	24954.28	42662.69	158.5	188.5	169.9	180.1	10.2
"BRD 5D "	24681.93	42758.41	148.4	168.4	166.8	176.9	10.1
"BRR 1D "	50002.58	59264.14	200.4	220.4	217.1	214.2	-2.9
"BRR 2D "	49740.61	59387.51	196.1	216.1	215.5	211.7	-3.8
"BRR 3D "	49633.17	59376.50	197.1	217.1	215.2	211.1	-4.1
"BRR 4D "	49528.48	59360.11	198.7	218.7	215.1	210.5	-4.6
"BRR 5D "	49415.56	59288.22	202.1	222.1	214.9	210.2	-4.7
"BRR 7D "	50143.22	59444.34	201.9	221.9	217.9	214.5	-3.4
"BRR 8DR"	49620.92	59613.22	204.0	219.0	214.3	209.7	-4.6
"CBR 1D "	48664.46	42224.29	230.9	250.9	253.5	262.5	9.0
"CBR 2D "	48528.64	42201.43	233.8	253.8	252.9	262.1	9.2
"CBR 3D "	48467.37	42234.49	234.1	254.1	253.0	261.9	8.9
"CCB 1 "	44003.41	48346.16	198.4	228.4	226.1	238.8	12.7
"CCB 2 "	43881.49	48236.71	198.6	228.6	222.5	238.8	16.3
"CCB 3 "	43967.36	48097.21	205.6	235.6	225.1	239.8	14.7
"CCB 4 "	44164.05	48180.84	211.2	241.2	226.1	240.3	14.2
"CDB 1 "	43158.97	50648.13	195.7	216.6	213.9	223.6	9.7
"CDB 2 "	43072.00	50565.10	195.1	216.1	214.9	223.7	8.8
"CMP 11D "	47610.19	33296.80	209.5	229.9	221.2	234.4	13.2
"CMP 14D "	46762.01	34392.70	204.1	224.5	216.2	211.6	-4.6
"CMP 15C "	46865.00	33346.32	220.6	250.6	239.6	234.5	-5.1
"CMP 16C "	47835.75	33352.73	215.6	235.6	223.5	233.7	10.2
"CMP 30D "	47226.07	33625.65	211.6	231.6	221.1	228.8	7.7
"CMP 32D "	48177.29	33934.12	218.6	228.6	220.9	0.0	-220.9
"CRP 1 "	42103.71	52000.00	187.8	217.8	207.9	207.9	0.0
"CRP 2 "	42157.12	52423.62	171.8	201.8	207.1	204.3	-2.8
"CRP 3 "	41750.56	52124.11	184.0	214.0	207.8	204.7	-3.1
"CRP 3D "	41768.04	52149.12	194.3	214.3	207.4	204.7	-2.7
"CRP 4 "	41803.23	51889.94	180.7	210.7	207.9	206.9	-1.0
"CRP 5D "	42229.13	51903.38	194.6	214.6	211.6	209.5	-2.1
"CRP 6DR"	41693.10	51774.41	194.2	214.2	210.5	207.3	-3.2
"CRP 7D "	41940.04	52626.90	188.0	208.0	206.5	201.4	-5.1
"CRP 8D "	41435.10	52175.72	191.0	211.0	207.6	202.3	-5.3
"CRP 9D "	42089.59	52554.22	191.4	211.4	207.1	203.0	-4.1
"CRP 10D "	41567.41	52504.81	189.5	209.5	205.0	200.3	-4.7
"CRP 11D "	41920.37	52137.09	193.7	203.6	206.9	205.7	-1.2
"CSA 1 "	46385.49	44128.63	232.0	262.0	243.3	255.9	12.6
"CSA 2 "	46396.93	44078.56	218.2	248.2	243.7	255.7	12.0

Table F-2. Summary of Group Statistical Parameters (Continued)

"CSA 3 "	46343.87	44047.31	218.6	248.6	243.0	255.6	12.6
"CSA 4 "	46317.09	44116.08	218.4	248.4	242.7	255.4	12.7
"CSB 1A "	42479.31	50872.75	194.9	224.9	213.2	218.8	5.6
"CSB 2A "	42252.86	50631.76	192.6	222.6	210.5	219.0	8.5
"CSB 3A "	42117.61	50737.59	193.0	223.0	210.4	217.6	7.2
"CSB 4A "	42125.10	50916.14	188.0	218.0	210.6	216.4	5.8
"CSB 5A "	42164.95	51101.71	185.9	215.9	210.7	215.3	4.6
"CSB 6A "	42417.14	51110.26	189.8	219.8	211.1	216.7	5.6
"CSD 1D "	46660.50	45549.91	238.4	273.4	244.9	254.8	9.9
"CSD 2D "	46607.64	45428.65	233.8	258.8	248.9	254.9	6.0
"CSD 4D "	46528.06	45463.56	213.5	263.5	244.0	254.4	10.4
"CSD 8D "	46386.31	45546.03	226.8	256.8	243.1	254.1	11.0
"CSD 9D "	46299.69	45447.80	226.2	256.2	243.2	254.1	10.9
"CSD 10D "	46270.84	45467.42	224.5	254.5	243.1	254.0	10.9
"CSD 11D "	46408.43	46319.64	220.9	250.9	243.0	252.3	9.3
"CSD 12D "	46380.19	45352.78	224.5	254.5	243.6	254.4	10.8
"CSD 13D "	46092.11	45304.73	202.4	252.4	242.4	253.5	11.1
"CSF 1D "	45753.00	44835.79	228.2	248.2	243.4	253.5	10.1
"CSF 2D "	46897.26	43247.88	235.2	255.2	251.0	257.5	6.5
"CSO 1 "	48469.42	42931.91	232.0	262.0	251.0	262.0	11.0
"CSO 2 "	48551.57	42958.61	209.7	239.7	252.2	261.6	9.4
"CSR 1 "	49477.36	46134.32	237.2	267.2	256.1	258.5	2.4
"CSR 3 "	50064.50	46849.58	238.1	268.1	254.4	256.0	1.6
"CSR 4 "	49878.44	46048.77	237.6	267.6	256.1	259.4	3.3
"F 10 "	49402.36	57132.45	266.5	276.5	270.4	0.0	-270.4
"F 18A "	48868.60	56238.80	194.4	204.4	203.8	197.0	-6.8
"FAB 1 "	54325.47	58788.57	215.4	235.4	228.3	231.5	3.2
"FAB 2 "	54474.28	58420.90	216.5	236.5	229.1	232.3	3.2
"FAB 4 "	54128.54	58611.44	214.2	234.2	228.5	232.1	3.6
"FAC 3 "	54769.41	58918.61	224.8	254.8	229.1	231.2	2.1
"FAC 4 "	54959.05	59088.39	207.8	237.8	228.5	226.9	-1.6
"FAC 5 "	54677.73	58878.80	214.0	234.0	224.9	229.9	5.0
"FAC 5P "	54794.41	59074.22	225.7	235.7	230.0	230.4	0.4
"FAC 6 "	54804.95	59024.23	216.2	236.2	220.7	229.6	8.9
"FAC 7 "	54824.03	59014.45	215.7	235.7	223.2	229.4	6.2
"FAC 8 "	54826.86	58980.62	216.0	236.0	227.2	229.6	2.4
"FAL 2 "	53282.73	59452.99	206.6	238.0	217.1	229.4	12.3
"FC 1D "	52956.68	61011.23	217.2	222.2	223.6	220.4	-3.2
"FCA 1N "	53370.46	60257.73	296.8	298.3	299.3	0.0	-299.3
"FCA 2C "	53251.84	59525.09	295.3	299.3	298.0	0.0	-298.0
"FCA 2D "	53254.73	59524.27	219.0	239.0	225.0	230.3	5.3
"FCA 9D "	53335.59	59818.59	221.9	241.9	225.3	229.0	3.7
"FCA 9DR"	53338.69	59826.41	207.7	227.7	224.0	227.8	3.8
"FCA 10A "	53186.21	59891.13	221.0	241.0	225.3	228.7	3.4
"FCA 10C "	53329.26	59862.87	295.9	298.4	303.0	0.0	-303.0
"FCA 10D "	53342.73	59857.45	219.5	239.5	226.4	228.8	2.4
"FCA 16A "	53237.05	60145.21	215.1	235.1	225.2	227.1	1.9
"FCA 16B "	53238.89	60143.29	295.3	299.3	298.0	0.0	-298.0
"FCA 16D "	53384.25	60112.90	221.1	241.1	225.0	227.4	2.4
"FCA 16T "	53246.72	60141.62	291.3	292.8	297.6	0.0	-297.6
"FCA 19D "	53253.58	59500.00	209.7	229.7	217.2	229.8	12.6
"FCB 1 "	54082.43	57855.31	205.6	235.6	230.2	230.9	0.7
"FCB 4 "	53810.90	57856.79	204.5	234.5	228.2	230.9	2.7
"FCB 5 "	53914.51	57540.54	217.1	237.1	228.8	232.2	3.4
"FCB 6 "	53894.39	57636.32	215.1	235.1	229.1	232.2	3.1
"FCB 7 "	54182.18	57914.36	218.3	238.3	231.0	233.1	2.1
"FET 1D "	52405.62	57526.96	206.9	226.9	223.5	228.3	4.8
"FET 2D "	52068.97	57476.04	209.5	229.5	222.2	226.7	4.5
"FET 3D "	52094.87	57383.84	203.0	223.0	222.4	226.2	3.8
"FET 4D "	52215.12	57356.54	205.1	225.1	222.7	226.8	4.1

Table F-2. Summary of Group Statistical Parameters (Continued)

"FIW 1D "	50556.26	57868.22	198.9	218.9	214.7	218.6	3.9
"FIW 1ID"	50511.80	57935.64	194.0	214.0	216.6	218.3	1.7
"FIW 2MD"	50305.99	57737.40	190.9	220.8	215.2	216.6	1.4
"FOB 1D "	48714.66	55906.09	175.4	195.4	203.4	190.7	-12.7
"FOB 2D "	48260.19	56167.31	175.5	195.5	204.7	192.2	-12.5
"FOB 3D "	47858.85	56421.32	183.4	203.4	205.0	194.9	-10.1
"FOB 4D "	48169.62	56653.25	174.0	194.1	206.0	198.9	-7.1
"FOB 7D "	49400.09	58083.79	193.9	213.9	211.7	212.4	0.7
"FOB 8D "	49037.51	57840.62	191.4	211.4	210.6	209.9	-0.7
"FOB 9D "	49862.03	57668.28	192.6	212.6	213.1	214.0	0.9
"FOB 11D "	50928.38	57265.56	199.0	219.0	216.1	218.9	2.8
"FOB 12D "	48850.11	57700.96	179.3	199.3	209.8	208.0	-1.8
"FRB 4 "	52732.71	57366.03	214.6	229.6	223.0	229.3	6.3
"FSB 0PD"	48694.84	56663.20	171.6	215.3	207.4	201.7	-5.7
"FSB 50PD"	48729.85	56708.61	174.7	219.8	207.1	202.4	-4.7
"FSB 76 "	50531.29	57900.83	197.0	227.0	217.8	218.5	0.7
"FSB 77 "	49659.91	57051.23	186.4	216.4	212.0	210.2	-1.8
"FSB 78 "	49047.52	56807.83	187.7	217.7	208.5	205.3	-3.2
"FSB 79 "	48794.18	55736.19	174.1	204.1	201.9	189.5	-12.4
"FSB 87D "	49136.71	57629.55	187.4	216.8	213.8	209.9	-3.9
"FSB 88D "	50558.40	57363.65	202.1	222.1	215.8	217.1	1.3
"FSB 89D "	50356.09	57331.51	201.9	221.9	215.2	215.8	0.6
"FSB 90D "	50129.62	57204.42	205.1	225.1	215.0	214.0	-1.0
"FSB 91D "	49904.56	57079.18	200.9	220.9	213.4	212.1	-1.3
"FSB 92D "	49490.42	57001.79	201.7	221.7	211.7	209.5	-2.2
"FSB 93D "	49354.82	56869.80	197.9	217.9	210.5	207.7	-2.8
"FSB 94DR"	49067.61	56911.01	183.3	203.4	209.9	206.0	-3.9
"FSB 95D "	48939.51	57049.06	207.8	227.8	208.8	0.0	-208.8
"FSB 95DR"	48929.85	57065.63	187.0	207.0	210.2	206.5	-3.7
"FSB 97D "	48950.80	57262.79	196.9	216.9	210.5	207.7	-2.8
"FSB 98D "	49121.97	57413.49	200.3	220.3	212.0	209.4	-2.6
"FSB 99D "	49399.05	57681.54	198.1	218.1	211.9	211.7	-0.2
"FSB104D "	47971.22	56117.73	190.4	210.4	204.4	0.0	-204.4
"FSB105D "	48823.22	57346.54	203.7	223.7	208.3	207.7	-0.6
"FSB105DR"	48833.62	57358.44	188.5	208.6	210.6	207.4	-3.2
"FSB106D "	49390.58	56151.16	202.9	222.9	207.3	0.0	-207.3
"FSB107D "	50097.00	57007.19	200.9	220.9	213.5	212.8	-0.7
"FSB108D "	50314.94	58068.57	203.8	223.8	217.5	217.8	0.3
"FSB109D "	49591.36	57808.53	205.8	225.8	213.1	213.3	0.2
"FSB110D "	48906.27	56254.41	191.1	211.1	205.4	197.5	-7.9
"FSB111D "	50497.87	57132.28	201.7	221.7	215.2	215.7	0.5
"FSB112D "	47580.74	56567.24	188.9	208.9	205.9	195.8	-10.1
"FSB113D "	49834.16	56017.82	189.6	209.6	207.3	201.6	-5.7
"FSB114D "	50967.90	56925.74	197.7	217.8	216.9	217.4	0.5
"FSB115D "	48150.84	54688.25	182.5	191.3	191.3	185.3	-6.0
"FSB116D "	49078.92	54719.06	186.4	195.1	191.8	0.0	-191.8
"FSB117D "	49218.37	56062.42	189.7	209.7	205.1	196.8	-8.3
"FSB118D "	50121.08	56512.06	191.3	211.3	211.4	209.2	-2.2
"FSB119D "	49439.73	56556.50	193.1	213.1	208.1	205.6	-2.5
"FSB120D "	48235.70	57803.07	196.5	216.5	209.2	205.6	-3.6
"FSB121DR"	47431.08	57547.99	191.3	211.3	206.9	201.1	-5.8
"FSB122D "	46940.61	56337.10	186.6	206.6	203.5	189.2	-14.3
"FSB123D "	50541.46	56284.49	194.1	214.1	212.1	209.0	-3.1
"FSB150PD"	48579.67	56755.77	176.2	221.3	207.0	202.0	-5.0
"FSL 1D "	52707.36	60425.06	208.5	228.6	224.5	224.1	-0.4
"FSL 2D "	52421.17	60049.76	208.7	228.8	224.8	226.0	1.2
"FSL 3D "	51921.73	59265.15	205.9	226.0	222.5	226.7	4.2
"FSL 4D "	51627.03	59008.00	204.0	224.1	217.1	225.6	8.5
"FSL 5D "	51222.93	58680.16	203.5	223.7	220.4	223.4	3.0
"FSL 6D "	50985.96	58408.90	202.1	222.1	219.8	222.0	2.2

Table F-2. Summary of Group Statistical Parameters (Continued)

"FSL 7D "	50664.69	58062.83	199.5	219.6	217.9	219.7	1.8
"FSL 8D "	50635.20	57789.90	202.7	222.8	217.2	219.0	1.8
"FSL 9D "	50605.41	57503.53	201.4	221.5	216.2	218.0	1.8
"FSS 1D "	52801.47	56514.53	209.9	229.9	223.5	225.8	2.3
"FSS 2D "	52790.27	56359.37	204.4	224.4	222.7	224.7	2.0
"FSS 3D "	52397.74	56296.61	205.8	225.8	220.4	222.5	2.1
"FSS 4D "	51860.55	57000.99	202.6	222.6	218.7	223.5	4.8
"FTF 2 "	52624.70	58676.94	219.4	239.4	224.9	230.7	5.8
"FTF 3 "	52574.12	58584.74	218.2	221.2	223.4	230.3	6.9
"FTF 4 "	52575.72	58479.71	216.6	236.6	224.0	230.6	6.6
"FTF 5 "	52457.78	58405.31	215.3	235.3	224.0	230.1	6.1
"FTF 6 "	52377.87	58540.68	216.9	236.9	223.9	229.8	5.9
"FTF 7 "	52422.54	58617.58	222.1	226.1	223.6	230.0	6.4
"FTF 8 "	52414.24	58721.88	219.6	239.6	227.1	230.0	2.9
"FTF 9 "	52160.67	58925.65	216.4	236.4	223.6	228.7	5.1
"FTF 10 "	52262.69	58753.89	215.1	235.1	224.2	229.2	5.0
"FTF 11 "	52077.61	58634.46	215.8	235.8	224.8	228.5	3.7
"FTF 12 "	52008.76	58792.94	215.0	235.0	226.7	228.1	1.4
"FTF 13 "	52306.70	58030.74	216.1	236.1	225.2	229.2	4.0
"FTF 15 "	52455.01	58095.52	197.5	227.5	225.1	229.0	3.9
"FTF 16 "	52117.99	58194.35	203.8	233.8	223.2	228.2	5.0
"FTF 17 "	52145.67	58304.40	200.6	230.6	222.9	228.3	5.4
"FTF 18 "	52158.40	58387.36	202.3	232.3	223.1	228.5	5.4
"FTF 19 "	51992.27	58610.07	198.3	228.3	222.2	227.6	5.4
"FTF 20 "	51799.80	58524.11	198.3	228.3	221.7	226.7	5.0
"FTF 21 "	51767.59	58379.34	198.7	228.7	222.9	226.4	3.5
"FTF 22 "	51739.79	58267.27	212.6	242.6	221.6	226.6	5.0
"FTF 23 "	51872.76	58096.39	201.2	231.2	222.1	226.8	4.7
"FTF 24A "	52124.69	58702.05	212.7	232.7	222.4	228.6	6.2
"FTF 25A "	52221.44	58734.44	212.8	232.8	223.1	229.0	5.9
"FTF 26 "	52215.85	58675.92	206.3	226.3	223.1	228.7	5.6
"FTF 27 "	52160.35	58664.41	213.5	243.5	223.2	228.8	5.6
"H 6 "	56466.89	52414.35	225.2	235.2	231.0	231.3	0.3
"H 7 "	56455.12	52355.62	224.9	234.9	229.0	230.3	1.3
"H 8 "	56285.76	52050.36	218.4	228.4	227.0	224.4	-2.6
"H 9 "	56317.35	52000.00	207.4	217.4	226.8	223.9	-2.9
"H 10 "	55881.94	52127.81	222.5	232.5	227.3	223.7	-3.6
"H 11 "	55830.90	52096.44	212.0	222.0	227.7	222.7	-5.0
"H 18A "	55351.80	51966.92	217.5	227.5	224.1	0.0	-224.1
"H 19 "	55081.94	52120.99	219.6	221.1	223.8	0.0	-223.8
"HAA 1D "	60573.75	49343.38	261.8	281.8	276.4	285.1	8.7
"HAA 2D "	59097.23	50767.79	260.3	280.4	276.5	278.2	1.7
"HAA 3D "	58123.23	51458.39	246.7	266.7	265.4	263.3	-2.1
"HAA 4D "	59988.35	51884.83	255.7	275.7	269.9	264.7	-5.2
"HAA 6D "	61791.83	50700.99	247.1	267.2	265.1	261.6	-3.5
"HAC 1 "	59513.05	51932.39	258.8	278.8	269.4	265.8	-3.6
"HAC 2 "	59476.04	51990.55	258.8	278.8	269.0	265.0	-4.0
"HAC 3 "	59416.25	51965.64	255.0	275.0	269.1	265.3	-3.8
"HAC 4 "	59460.26	51891.78	254.1	274.1	269.6	266.3	-3.3
"HAP 1 "	61253.46	50579.78	256.3	276.3	270.8	269.6	-1.2
"HAP 2 "	61353.75	50469.62	243.8	263.8	270.3	267.6	-2.7
"HC 1D "	59866.62	51422.74	206.5	211.5	268.2	266.1	-2.1
"HC 1E "	59863.68	51423.36	251.5	256.5	275.0	271.2	-3.8
"HC 2E "	59868.65	51461.16	205.7	210.7	269.5	265.7	-3.8
"HC 2F "	59867.82	51457.24	250.7	255.7	274.3	270.8	-3.5
"HC 6B "	60149.18	51775.71	210.2	215.2	268.9	261.5	-7.4
"HCA 1 "	61242.75	51923.26	253.7	273.7	269.4	260.6	-8.8
"HCA 2 "	61027.49	51707.50	242.0	273.4	270.2	262.1	-8.1
"HCA 3 "	61269.49	52050.48	253.8	273.8	269.2	259.9	-9.3
"HCA 4 "	61080.70	51959.75	241.9	273.3	269.3	260.6	-8.7

Table F-2. Summary of Group Statistical Parameters (Continued)

"HCB 1 "	61809.86	50683.36	222.6	252.6	263.6	260.4	-3.2
"HCB 2 "	61660.45	50574.96	239.9	269.9	268.1	262.9	-5.2
"HCB 3 "	61740.10	50362.86	233.6	263.6	266.6	262.9	-3.7
"HCB 4 "	61901.99	50477.10	235.9	265.9	264.5	260.8	-3.7
"HET 1D "	58616.55	51895.27	240.3	260.3	267.7	263.5	-4.2
"HET 2D "	58186.81	52045.60	239.7	259.7	258.5	256.0	-2.5
"HET 3D "	58220.83	52128.23	239.9	259.9	258.9	255.6	-3.3
"HET 4D "	58293.12	52198.95	239.5	259.6	259.2	255.7	-3.5
"HHP 1D "	58413.10	50996.42	260.4	269.9	271.2	269.3	-1.9
"HHP 2D "	58647.26	50803.30	263.2	273.2	273.8	274.1	0.3
"HIW 1ID"	56711.83	52871.21	213.0	228.0	231.9	235.7	3.8
"HIW 1MD"	56725.89	52908.50	214.9	239.7	232.4	236.2	3.8
"HIW 1PD"	56636.55	52924.42	215.5	240.5	231.9	235.6	3.7
"HIW 2D "	55178.32	53976.50	210.9	230.8	229.7	229.0	-0.7
"HOB 1D "	55284.63	53672.00	204.2	224.2	230.5	228.3	-2.2
"HOB 2D "	55595.50	53420.36	200.4	220.4	228.9	229.0	0.1
"HOB 3D "	56238.78	52787.04	207.7	227.7	229.1	231.3	2.2
"HOB 4D "	56545.37	52617.01	210.4	230.4	229.9	233.2	3.3
"HOB 6D "	55275.15	51204.47	186.9	196.9	207.1	206.4	-0.7
"HOB 7D "	54438.67	52713.30	197.4	217.4	220.8	216.1	-4.7
"HR3 11 "	58112.36	51444.75	200.4	230.0	259.7	257.5	-2.2
"HR3 13 "	58084.40	51702.80	205.1	234.8	258.8	254.9	-3.9
"HR8 11 "	57651.36	52097.77	207.9	237.6	246.2	246.0	-0.2
"HR8 12 "	57392.25	51983.55	206.3	235.9	239.8	242.2	2.4
"HR8 13 "	57317.15	51774.08	201.7	231.4	237.8	240.4	2.6
"HR8 14 "	57595.58	51583.84	202.3	231.9	243.9	248.0	4.1
"HSB 65 "	56647.98	52801.67	212.4	242.4	232.5	235.1	2.6
"HSB 65C "	56665.66	52812.22	207.8	218.6	232.5	234.6	2.1
"HSB 66 "	55177.89	53117.82	198.1	228.1	224.7	225.4	0.7
"HSB 67 "	56449.04	51902.78	200.7	221.6	223.3	222.9	-0.4
"HSB 68 "	54963.81	52241.99	213.3	238.5	221.6	214.7	-6.9
"HSB 69 "	54551.15	52349.03	199.0	227.8	219.4	212.9	-6.5
"HSB 70 "	54070.99	53534.77	205.7	235.7	223.9	219.5	-4.4
"HSB 71 "	53657.70	53897.63	204.8	234.8	224.0	217.7	-6.3
"HSB 83D "	56648.16	51986.31	198.7	225.2	224.8	226.8	2.0
"HSB 84D "	54436.38	52411.25	199.5	219.5	218.9	212.4	-6.5
"HSB 85C "	57438.35	54041.12	214.2	224.2	238.7	239.5	0.8
"HSB 86D "	54285.76	53402.43	206.6	236.6	223.5	220.6	-2.9
"HSB100D "	56931.76	52381.69	216.9	236.9	233.5	236.1	2.6
"HSB100PD"	54436.51	52269.53	195.0	214.9	217.4	209.9	-7.5
"HSB101D "	56718.21	52349.07	216.1	236.1	230.8	233.1	2.3
"HSB102D "	56511.84	52346.83	216.3	236.3	228.2	230.5	2.3
"HSB103D "	56360.00	52006.67	213.7	224.7	225.6	223.5	-2.1
"HSB104D "	56080.13	51843.39	210.6	224.6	224.9	220.6	-4.3
"HSB105D "	55903.66	51967.39	211.8	230.9	225.3	221.8	-3.5
"HSB106D "	55732.90	52282.78	210.7	230.7	225.9	223.7	-2.2
"HSB107D "	55498.90	52300.62	215.1	235.1	224.7	222.1	-2.6
"HSB108D "	55236.33	52347.64	212.0	232.0	223.5	219.6	-3.9
"HSB109D "	54981.42	52399.37	213.0	233.0	222.8	217.9	-4.9
"HSB110D "	54793.39	52541.16	211.4	231.4	222.1	218.4	-3.7
"HSB111E "	54643.22	52723.98	211.7	231.7	222.0	218.7	-3.3
"HSB112E "	54606.04	52970.91	211.7	231.7	222.5	220.5	-2.0
"HSB113D "	54404.28	53152.93	216.2	236.2	222.5	220.2	-2.3
"HSB114D "	54381.54	53333.10	212.8	232.8	223.3	221.1	-2.2
"HSB115D "	54357.27	53530.56	213.9	233.9	223.9	222.2	-1.7
"HSB116D "	54355.82	53771.94	214.5	234.5	226.2	223.4	-2.8
"HSB117D "	53510.12	53797.83	200.3	220.3	223.9	215.5	-8.4
"HSB125D "	56603.94	51862.91	199.4	219.4	221.3	225.0	3.7
"HSB126D "	55040.55	51311.10	190.5	200.5	205.2	205.0	-0.2
"HSB127D "	54789.02	51963.14	197.8	217.8	218.2	208.1	-10.1

Table F-2. Summary of Group Statistical Parameters (Continued)

"HSB129D "	53269.76	52918.08	185.2	205.2	208.5	201.6	-6.9
"HSB130D "	52603.41	51955.69	182.1	202.1	200.2	202.9	2.7
"HSB131D "	54712.33	51106.47	195.7	203.0	205.2	203.3	-1.9
"HSB132D "	56808.47	51790.09	206.5	226.5	221.3	227.8	6.5
"HSB133D "	57203.40	52190.74	208.5	228.5	235.1	238.6	3.5
"HSB134D "	56264.22	51647.94	205.8	218.9	222.3	218.6	-3.7
"HSB135D "	54595.92	52185.96	199.9	219.9	218.3	210.4	-7.9
"HSB136D "	54104.07	52811.18	200.2	220.2	220.8	212.7	-8.1
"HSB137D "	53941.36	53227.00	205.3	225.3	222.2	215.7	-6.5
"HSB138D "	53698.71	54179.56	208.1	228.1	223.7	219.7	-4.0
"HSB139D "	55354.57	51755.32	206.7	222.0	222.6	212.5	-10.1
"HSB140D "	54320.65	50853.37	194.1	214.1	213.6	206.5	-7.1
"HSB141D "	57112.67	51433.96	217.8	233.7	241.2	233.9	-7.3
"HSB142D "	51959.92	54500.90	189.7	192.3	198.0	192.3	-5.7
"HSB143D "	51390.30	55277.30	196.9	216.9	213.1	200.7	-12.4
"HSB146D "	56300.99	50875.82	204.0	224.1	222.4	220.7	-1.7
"HSB147D "	54369.35	54719.63	215.2	235.2	231.3	226.6	-4.7
"HSB148D "	53168.04	51226.05	198.1	218.1	213.3	207.8	-5.5
"HSB149D "	55301.36	51976.82	207.0	227.0	222.4	215.1	-7.3
"HSB150D "	56750.68	52030.46	206.9	226.9	226.9	229.2	2.3
"HSB151D "	52457.62	54277.34	197.6	204.4	207.3	199.5	-7.8
"HSB152D "	52580.96	53242.99	197.0	200.1	205.6	0.0	-205.6
"HSL 1D "	57079.06	52458.54	219.8	239.8	235.3	238.6	3.3
"HSL 2D "	57568.99	52365.85	225.2	245.3	241.9	245.1	3.2
"HSL 3D "	57921.13	52353.06	233.7	253.8	250.3	249.1	-1.2
"HSL 4D "	58355.70	52467.41	245.0	265.1	261.9	252.8	-9.1
"HSL 5D "	58542.10	52538.71	247.8	267.7	266.0	253.5	-12.5
"HSL 5D "	58542.10	52538.71	242.6	247.7	266.0	252.9	-13.1
"HSL 6D "	58749.88	52594.22	243.9	264.0	260.0	253.7	-6.3
"HSL 6D "	58749.88	52594.22	239.4	243.9	260.0	253.1	-6.9
"HSL 7D "	58940.64	52568.70	242.3	262.4	259.8	254.7	-5.1
"HSL 8D "	59328.98	52500.00	248.4	268.4	260.7	257.2	-3.5
"HSS 1D "	61753.98	46793.47	236.5	256.5	268.8	277.5	8.7
"HSS 2D "	61808.98	46521.70	234.5	254.5	267.9	276.3	8.4
"HSS 3D "	61921.70	47419.48	262.6	282.6	281.9	279.5	-2.4
"HTF 1 "	60062.04	51380.18	236.9	256.9	272.7	270.0	-2.7
"HTF 2 "	60139.61	51225.68	237.0	257.0	274.3	271.1	-3.2
"HTF 4 "	59915.86	51293.68	235.2	255.2	274.3	271.1	-3.2
"HTF 5 "	60030.29	51024.00	264.3	284.3	277.2	277.6	0.4
"HTF 6 "	60118.48	50871.33	263.6	283.6	276.1	278.4	2.3
"HTF 7 "	59978.19	50769.26	263.5	283.5	275.9	279.9	4.0
"HTF 8 "	59863.51	50936.77	263.6	283.6	273.7	278.6	4.9
"HTF 9 "	59681.77	51365.93	245.8	265.8	273.5	272.3	-1.2
"HTF 10 "	59791.26	51207.71	245.2	265.2	273.2	273.5	0.3
"HTF 11 "	59652.43	51112.49	238.9	258.9	273.9	273.5	-0.4
"HTF 12 "	59551.62	51258.65	242.9	262.9	273.4	272.9	-0.5
"HTF 13 "	59614.63	51588.76	262.6	282.6	274.1	271.7	-2.4
"HTF 14 "	59493.75	51616.50	261.9	281.9	273.4	271.5	-1.9
"HTF 15 "	59354.29	51484.61	260.7	280.7	273.4	273.2	-0.2
"HTF 16 "	60031.80	51800.66	248.3	268.3	269.7	265.7	-4.0
"HTF 17 "	59380.01	52399.25	238.4	258.4	262.4	258.3	-4.1
"HTF 18 "	59242.35	51581.81	251.7	271.7	271.6	270.8	-0.8
"HTF 19 "	59128.57	51739.61	245.7	265.7	269.0	267.9	-1.1
"HTF 20 "	59171.13	51905.18	251.9	271.9	267.8	266.8	-1.0
"HTF 21 "	59326.30	51795.42	242.6	262.6	269.4	266.7	-2.7
"HTF 22 "	60458.67	50905.75	251.4	271.4	275.4	274.9	-0.5
"HTF 23 "	60572.75	50881.19	256.8	276.8	274.5	274.9	0.4
"HTF 24 "	60675.65	50858.81	257.8	277.8	274.0	274.0	0.0
"HTF 25 "	60770.53	50697.25	252.5	272.5	274.6	274.2	-0.4
"HTF 26 "	60658.34	50584.51	255.5	275.5	275.4	276.9	1.5

Table F-2. Summary of Group Statistical Parameters (Continued)

"HTF 27 "	60500.00	50584.74	259.1	279.1	276.7	278.8	2.1
"HTF 28 "	60362.69	50636.52	251.9	271.9	275.8	277.7	1.9
"HTF 29 "	60295.24	50804.00	259.9	289.9	275.6	277.8	2.2
"HTF 31 "	60437.03	50280.18	246.7	266.7	275.6	279.1	3.5
"HTF 32 "	60607.03	50380.63	251.1	271.1	274.7	278.2	3.5
"HTF 34 "	59850.54	50810.81	251.7	271.7	275.6	277.7	2.1
"HWP 1D "	57981.82	52244.65	239.9	249.9	245.2	250.8	5.6
"HWP 2D "	58090.42	52436.40	253.0	260.7	262.5	0.0	-262.5
"HWS 1A "	47062.15	47130.24	225.2	255.2	244.8	251.1	6.3
"HWS 2 "	47150.77	47010.39	215.3	245.3	245.4	251.5	6.1
"HXB 1 "	48433.00	42406.60	214.2	244.2	251.4	261.5	10.1
"HXB 2 "	48826.55	42646.82	212.1	242.1	252.6	262.8	10.2
"HXB 3 "	48596.18	42455.23	212.2	242.2	251.9	262.0	10.1
"HXB 4D "	48519.48	42527.26	234.9	254.9	253.6	262.2	8.6
"HXB 5D "	48394.54	42453.62	234.2	254.2	252.7	261.7	9.0
"K 301AP"	34880.17	38881.66	193.3	197.7	208.8	204.6	-4.2
"K 301P "	34699.85	38956.80	194.4	201.0	204.9	203.1	-1.8
"KAB 1 "	34512.97	37703.87	194.0	224.0	205.9	207.1	1.2
"KAB 2 "	34729.28	36998.69	198.6	228.6	209.9	207.7	-2.2
"KAB 3 "	34252.24	36483.51	193.0	223.0	204.1	202.7	-1.4
"KAB 4 "	34008.71	37557.00	187.0	217.0	203.2	203.1	-0.1
"KAC 1 "	37172.33	37252.49	199.0	229.0	219.3	216.3	-3.0
"KAC 2 "	37251.77	37326.09	195.4	225.4	221.5	216.8	-4.7
"KAC 3 "	37286.28	37263.85	195.8	225.8	222.0	216.6	-5.4
"KAC 4 "	37208.99	37128.67	178.0	208.0	218.1	215.4	-2.7
"KAC 5 "	37270.51	37226.21	204.3	224.3	222.4	216.6	-5.8
"KAC 6 "	37243.68	37209.62	204.6	224.6	222.3	216.5	-5.8
"KAC 7 "	37150.77	37344.90	203.0	223.0	219.5	216.7	-2.8
"KAC 8 "	37192.40	37216.54	192.3	212.3	221.2	216.0	-5.2
"KAC 9 "	37152.62	37288.17	195.7	215.7	220.8	216.3	-4.5
"KBP 2D "	34610.95	36668.99	184.3	194.3	203.4	204.9	1.5
"KCB 1 "	34207.66	38175.04	183.6	213.6	204.6	203.5	-1.1
"KCB 2 "	34063.53	38391.13	187.7	217.7	202.8	201.6	-1.2
"KCB 3 "	33829.55	38242.63	184.1	214.1	202.2	199.9	-2.3
"KCB 4 "	33963.75	38025.59	188.9	218.9	205.5	202.2	-3.3
"KCB 5 "	33764.06	38167.82	189.3	209.3	200.4	199.6	-0.8
"KCB 6 "	33823.71	38365.23	188.7	208.7	201.0	199.4	-1.6
"KCB 7 "	34486.92	38097.90	196.5	216.5	205.3	206.5	1.2
"KDB 1 "	35214.96	38571.78	184.8	205.8	208.1	208.4	0.3
"KDB 2 "	35004.72	38470.07	182.5	203.5	206.7	207.6	0.9
"KDB 3 "	35130.26	38328.17	184.2	205.4	207.5	208.8	1.3
"KDB 4 "	34890.68	38371.73	189.2	209.2	206.5	207.7	1.2
"KDB 5 "	34831.09	38655.12	188.5	208.5	204.9	206.0	1.1
"KDT 1D "	35191.60	38682.66	193.7	213.7	208.1	208.3	0.2
"KRB 8 "	35269.15	39422.20	195.8	215.8	208.5	203.6	-4.9
"KRB 13 "	35054.23	39928.55	197.8	217.8	205.5	0.0	-205.5
"KRB 16D "	35354.26	39398.39	191.5	211.5	209.2	204.2	-5.0
"KRB 17D "	35080.66	40027.41	186.8	206.8	205.9	196.1	-9.8
"KRB 18D "	35196.02	40122.82	185.8	205.8	204.5	196.0	-8.5
"KRB 19D "	35327.74	40153.30	186.8	206.8	203.8	196.8	-7.0
"KRP 1 "	37318.17	38629.26	207.0	237.0	218.4	219.3	0.9
"KRP 2 "	37515.57	38546.00	199.2	229.2	219.1	220.2	1.1
"KRP 3 "	37592.37	38269.08	207.5	237.5	219.1	220.6	1.5
"KRP 4 "	37397.01	38427.35	188.7	218.7	218.3	219.4	1.1
"KRP 5 "	37048.11	38750.66	200.8	210.8	216.0	217.5	1.5
"KRP 6 "	37009.08	38350.12	203.1	213.1	217.4	217.9	0.5
"KRP 7 "	36699.81	38603.56	203.1	213.2	215.4	216.3	0.9
"KRP 8 "	37116.32	38597.27	200.1	210.1	217.2	218.1	0.9
"KRP 9 "	37210.32	38464.17	200.8	210.8	218.4	218.7	0.3
"KSB 1 "	34608.12	38694.54	175.6	205.6	204.1	203.9	-0.2

Table F-2. Summary of Group Statistical Parameters (Continued)

"KSB 2 "	34482.69	38601.79	173.8	203.8	203.8	203.5	-0.3
"KSB 3 "	34429.71	38728.16	169.7	199.7	203.0	202.0	-1.0
"KSB 4A "	34579.07	38798.85	169.6	199.6	203.2	202.6	-0.6
"KSB 5C "	34792.85	38779.18	172.9	182.9	204.9	203.9	-1.0
"KSB 5D "	34791.55	38770.15	194.5	214.5	204.5	205.3	0.8
"KSM 1D "	35147.98	38726.59	193.7	213.7	208.1	207.8	-0.3
"KSS 1D "	33704.58	32460.67	157.4	177.5	174.3	175.3	1.0
"KSS 2D "	33719.14	31481.13	144.6	164.7	164.7	161.3	-3.4
"LAC 1 "	44037.76	27687.88	191.1	221.1	216.5	217.6	1.1
"LAC 2 "	44009.27	27787.58	193.4	223.4	216.1	218.2	2.1
"LAC 3 "	43900.98	27679.23	190.7	220.7	216.6	216.7	0.1
"LAC 4 "	43985.08	27672.80	185.3	215.3	216.1	217.0	0.9
"LAC 5DL"	44096.56	27804.81	176.2	186.2	219.7	217.9	-1.8
"LAC 5DU"	44089.18	27786.44	207.9	227.8	219.5	218.9	-0.6
"LAC 6DL"	43916.99	27748.31	175.9	185.9	217.9	216.4	-1.5
"LAC 6DU"	43910.52	27728.93	201.7	221.7	219.0	217.3	-1.7
"LAC 7DL"	43812.28	27590.94	177.4	187.4	215.1	214.7	-0.4
"LAC 7DU"	43817.61	27607.80	204.9	224.8	218.1	215.9	-2.2
"LAC 8DL"	43990.69	27552.51	180.4	190.4	217.5	215.7	-1.8
"LAC 8DU"	43995.60	27571.30	199.8	219.8	218.1	216.7	-1.4
"LAW 1F "	43161.80	27182.26	165.9	185.9	203.9	205.9	2.0
"LAW 2C "	42471.74	28401.16	171.2	191.2	209.2	210.8	1.6
"LAW 3C "	45049.46	27858.57	194.9	214.9	235.2	224.1	-11.1
"LBP 1D "	46902.24	30634.31	246.3	256.3	257.1	0.0	-257.1
"LBP 2D "	46914.71	30844.84	241.9	251.9	256.1	245.8	-10.3
"LBP 3D "	46453.56	30930.34	242.8	252.8	256.6	243.9	-12.7
"LCO 1 "	43676.11	27723.24	195.8	225.8	214.8	215.6	0.8
"LCO 2 "	43784.81	27822.41	196.6	226.6	215.1	217.0	1.9
"LCO 3 "	43829.21	27695.61	196.3	226.3	229.1	216.4	-12.7
"LCO 4 "	43729.76	27598.57	192.3	222.3	212.6	215.0	2.4
"LCO 5DL"	43560.94	27519.03	174.9	184.9	212.9	212.5	-0.4
"LCO 6DL"	43613.61	27604.75	178.0	188.0	213.7	213.5	-0.2
"LCO 7DL"	43719.92	27457.02	170.2	180.2	213.3	212.9	-0.4
"LCO 8DL"	44170.42	28014.74	178.4	188.4	220.5	219.7	-0.8
"LCO 8DU"	44151.94	28018.67	211.1	226.1	220.6	220.9	0.3
"LDB 1 "	43460.04	28472.85	185.0	215.0	216.9	218.7	1.8
"LDB 2 "	43675.04	28550.75	184.5	214.5	219.0	220.2	1.2
"LDB 3 "	43434.68	28664.71	199.3	219.3	218.5	219.7	1.2
"LDB 4 "	43198.42	28449.23	200.7	220.7	216.5	217.2	0.7
"LRP 1 "	42583.67	31380.70	185.8	215.8	209.1	215.9	6.8
"LRP 2 "	42626.81	31171.46	184.7	214.7	209.6	216.8	7.2
"LRP 3 "	42469.52	31185.16	191.4	221.4	209.4	215.9	6.5
"LRP 4 "	42400.72	31308.77	173.3	203.3	208.6	214.3	5.7
"LSB 1 "	43415.55	27732.52	192.7	222.7	211.6	213.8	2.2
"LSB 2 "	43551.19	27776.17	195.0	225.0	212.4	215.1	2.7
"LSB 3 "	43492.70	27956.99	196.6	226.6	217.2	216.1	-1.1
"LSB 4 "	43266.79	27936.41	191.5	221.5	216.8	214.2	-2.6
"MGA 36 "	56426.67	54360.14	234.2	254.2	237.4	235.6	-1.8
"MGC 9 "	54500.94	56270.36	217.3	237.3	229.4	227.6	-1.8
"MGC 11 "	54632.54	56119.91	219.2	239.2	230.7	227.8	-2.9
"MGC 19 "	55156.34	55515.60	230.6	234.6	232.0	0.0	-232.0
"MGC 32 "	56009.88	54528.57	232.0	252.0	244.9	232.8	-12.1
"MGC 36 "	56279.36	54222.66	234.4	254.4	235.8	234.5	-1.3
"MGE 9 "	54349.65	56142.01	218.1	238.1	228.8	226.8	-2.0
"MGE 21 "	55134.33	55231.67	227.9	247.9	234.0	229.0	-5.0
"MGE 30 "	55732.83	54540.13	229.3	249.3	235.7	231.4	-4.3
"MGE 34 "	55995.47	54238.12	237.2	257.2	238.1	0.0	-238.1
"MGG 15 "	54596.53	55561.90	223.3	243.3	232.5	227.1	-5.4
"MGG 19 "	54861.76	55257.10	226.0	246.0	232.3	228.0	-4.3
"MGG 23 "	55122.01	54954.38	227.1	247.1	235.0	228.9	-6.1

Table F-2. Summary of Group Statistical Parameters (Continued)

"MGG	28	"	55452.54	54568.21	230.3	250.3	235.3	0.0	-235.3
"MGG	36	"	55982.43	53952.59	232.5	252.5	237.5	0.0	-237.5
"NBG	1	"	53624.12	60472.79	200.9	232.3	224.5	221.8	-2.7
"NBG	2	"	53659.78	60260.13	203.6	233.6	225.0	223.7	-1.3
"NBG	3	"	53733.78	60080.63	202.1	233.5	217.5	224.5	7.0
"NPM	1	"	52966.40	43082.52	257.1	277.1	287.1	276.7	-10.4
"NPM	2	"	54524.03	43675.02	244.2	264.2	271.6	272.6	1.0
"NPM	3	"	51554.55	43337.43	247.2	267.2	274.4	272.5	-1.9
"NPM	4	"	53057.77	41764.52	256.7	276.7	284.2	278.8	-5.4
"NPM	19A	"	53821.23	43736.38	248.2	268.2	270.6	273.9	3.3
"NPM	19B	"	53829.89	43745.89	217.7	227.7	268.7	272.5	3.8
"NPM	19C	"	53845.64	43737.74	193.5	203.5	267.7	271.9	4.2
"NPM	34A	"	52141.34	41848.19	279.8	289.8	290.6	0.0	-290.6
"NPM	34B	"	52153.77	41839.82	225.6	235.6	271.0	275.4	4.4
"NPM	34C	"	52166.49	41832.31	181.8	191.8	267.6	274.3	6.7
"PAC	1	"	58782.57	22820.40	253.9	283.9	284.7	275.5	-9.2
"PAC	2	"	59001.85	22757.84	247.9	277.9	271.0	274.0	3.0
"PAC	3	"	58897.00	22839.32	252.9	282.9	271.3	274.9	3.6
"PAC	4	"	58880.01	22750.72	250.6	280.6	284.4	274.7	-9.7
"PAC	5	"	58936.73	22806.44	255.1	275.1	275.1	274.7	-0.4
"PAC	6	"	58928.43	22827.02	255.2	275.2	274.6	274.8	0.2
"PBP	1D	"	58209.15	25056.48	269.1	279.1	280.3	277.8	-2.5
"PBP	2D	"	57822.47	25005.93	262.8	272.8	278.4	277.9	-0.5
"PBP	3D	"	57994.88	25094.07	268.9	278.9	279.8	278.2	-1.6
"PCB	1A	"	56813.22	21649.15	263.5	293.5	280.7	279.1	-1.6
"PCB	2A	"	56603.25	21523.26	257.8	287.8	279.5	278.8	-0.7
"PCB	3A	"	56466.82	21771.65	262.7	292.7	281.6	279.2	-2.4
"PCB	4A	"	56685.72	21863.14	262.9	292.9	279.7	279.4	-0.3
"PDB	2	"	56809.92	23208.82	247.7	268.7	277.9	278.2	0.3
"PDB	3	"	57006.81	23196.72	248.1	269.1	278.1	278.4	0.3
"PDB	4	"	56681.17	23176.89	266.2	286.2	278.9	279.1	0.2
"PDB	5	"	56778.08	23822.35	264.2	284.2	277.7	278.6	0.9
"PRP	1A	"	55518.77	25361.00	232.9	262.9	249.1	263.5	14.4
"PRP	2	"	55719.03	25359.02	234.1	264.1	255.5	266.4	10.9
"PRP	3	"	55617.66	25187.55	228.6	258.6	255.4	263.0	7.6
"PRP	4	"	55808.30	25216.75	232.9	262.9	257.6	267.1	9.5
"PSB	1A	"	56243.45	23437.80	257.4	287.4	276.5	277.9	1.4
"PSB	2A	"	56022.03	23477.81	257.2	287.2	276.3	277.4	1.1
"PSB	3A	"	55700.43	23533.29	256.5	286.5	275.2	276.2	1.0
"PSB	4A	"	55448.71	23519.73	255.5	285.5	274.3	275.5	1.2
"PSB	5A	"	55683.06	23374.12	262.3	292.3	275.7	276.8	1.1
"PSB	6A	"	56043.26	23292.96	262.1	292.1	277.2	277.8	0.6
"PSB	7A	"	56385.84	23340.06	259.0	289.0	276.9	278.3	1.4
"SBG	2	"	63459.26	53546.40	205.9	235.9	237.8	244.2	6.4
"SBG	3	"	63597.19	52627.33	206.6	236.6	237.5	244.8	7.3
"SBG	6	"	62201.39	52821.17	208.1	238.1	244.5	251.8	7.3
"SCA	2	"	63072.44	52892.94	215.9	245.9	242.2	249.0	6.8
"SCA	3	"	62971.90	53025.44	220.3	240.3	241.3	249.2	7.9
"SCA	3A	"	62973.08	53031.02	267.1	272.4	271.1	0.0	-271.1
"SCA	4	"	62942.99	52926.49	220.4	240.4	241.5	249.5	8.0
"SCA	4A	"	62946.34	52924.45	265.3	274.0	268.8	0.0	-268.8
"SCA	5	"	63057.97	53143.73	223.7	243.7	241.3	248.6	7.3
"SCA	6	"	62984.12	52764.09	221.3	241.1	242.0	249.6	7.6
"SLP	1	"	62644.37	52071.80	228.0	248.0	245.1	252.4	7.3
"SLP	2	"	62703.45	51962.12	217.7	237.7	244.7	251.5	6.8
"YSC	1D	"	65107.25	56877.04	216.8	236.8	221.3	220.9	-0.4
"Z	2	"	52002.92	56201.42	214.0	214.5	218.7	219.4	0.7
"Z	3	"	50252.68	56881.07	206.6	207.1	212.6	212.8	0.2
"Z	8	"	50826.83	58348.05	213.6	214.1	218.9	221.1	2.2
"Z	9	"	50061.53	59626.61	207.5	227.5	214.9	212.9	-2.0

Table F-2. Summary of Group Statistical Parameters (Continued)

"Z 12 "	59296.96	50984.50	251.3	251.8	274.3	274.3	0.0
"Z 13 "	59996.23	50413.54	256.6	257.1	275.2	279.6	4.4
"Z 15 "	61604.47	52133.04	253.8	254.3	263.7	258.2	-5.5
"Z 20 "	42603.93	57478.90	173.4	193.4	184.7	180.2	-4.5
"Z 20B "	42603.46	57483.39	175.6	195.6	190.7	180.3	-10.4
"ZBG 1 "	64508.41	55382.39	220.0	240.1	234.0	234.7	0.7
"ZBG 1A "	64523.68	55383.54	276.0	281.0	279.9	0.0	-279.9
"ZDT 1 "	63022.32	50648.11	227.0	237.6	239.9	237.8	-2.1
"ZDT 2 "	62979.45	50710.48	225.1	243.1	241.4	241.2	-0.2
"ZW 4 "	55903.68	58318.78	229.2	239.7	232.2	232.7	0.5
"ZW 5 "	53700.74	56844.58	221.0	231.0	227.3	228.5	1.2
"ZW 6 "	51164.33	57791.21	216.7	227.2	220.2	222.7	2.5
"ZW 7 "	58470.42	52387.61	254.5	264.8	265.8	255.9	-9.9
"ZW 8 "	61562.33	50095.99	254.1	264.1	270.8	268.0	-2.8
"ZW 9 "	59712.09	52940.43	242.4	252.4	252.0	253.8	1.8
"ZW 10 "	61671.98	52538.16	242.2	252.2	249.7	255.8	6.1
"CMP 10D "	47934.22	33150.84	209.6	229.6	229.8	235.9	6.1
"CMP 11D "	47610.19	33296.80	209.5	229.9	223.3	234.4	11.1
"CMP 14D "	46762.01	34392.70	204.1	224.5	217.4	211.6	-5.8
"CMP 15C "	46865.00	33346.32	220.6	250.6	244.5	234.5	-10.0
"CMP 30D "	47226.07	33625.65	211.6	231.6	228.0	228.8	0.8
"CMP 32D "	48177.29	33934.12	218.6	228.6	220.8	0.0	-220.8
"NPM 2 "	54524.03	43675.02	244.2	264.2	267.0	272.6	5.6
"NPM 3 "	51554.55	43337.43	247.2	267.2	267.6	272.5	4.9
"NPM 4 "	53057.77	41764.52	256.7	276.7	272.7	278.8	6.1
"NTN 1 "	40851.04	40382.75	212.4	232.4	233.7	238.2	4.5
"NTN 2 "	42194.02	41060.13	207.2	227.2	235.2	243.5	8.3
"NTS 1 "	36950.43	30056.38	164.3	184.4	180.4	184.4	4.0
"NTS 2 "	38877.07	29831.49	174.7	194.8	192.3	198.6	6.3
"NTW 1 "	33953.91	33448.01	168.9	188.8	183.6	186.3	2.7
"NTW 2 "	33179.95	34157.22	171.5	191.5	183.9	186.8	2.9
"NTW 3 "	35146.82	34486.17	176.7	196.6	191.8	194.8	3.0
"NTW 4 "	35314.22	33015.53	166.0	185.8	180.4	181.8	1.4

```
** GROUP  4 **  rms of (FACT-data) differences:     8.049
                avg of (FACT-data) differences:    -1.486
                avg of |FACT-data| differences:     5.188
                max of (FACT-data) differences:   -38.678
```

"BG 91 "	56069.82	58655.49	205.4	235.4	218.6	224.5	5.9
"BG 113 "	58617.49	57478.99	196.4	216.4	217.1	216.1	-1.0
"BG 115 "	57106.59	57592.61	198.9	218.9	215.8	224.7	8.9
"BG 119 "	56357.76	58300.26	209.2	229.2	215.4	225.8	10.4
"BG 124 "	56344.08	57802.53	214.8	234.8	231.8	230.7	-1.1
"BGO 10A "	56207.63	57372.71	111.1	121.1	170.6	157.6	-13.0
"BGO 11DR"	55825.05	57499.11	213.1	233.0	230.1	231.2	1.1
"BGO 12DR"	55395.81	57575.32	212.7	232.8	219.6	230.9	11.3
"BGO 17D "	55319.71	56328.91	204.0	224.0	230.8	229.1	-1.7
"BGO 19D "	55852.65	55960.45	196.8	216.8	234.2	230.2	-4.0
"BGO 19DR"	55695.69	56167.61	196.7	216.7	231.3	229.0	-2.3
"BGO 20AA"	55859.63	55549.83	36.4	28.3	161.5	0.0	-161.5
"BGO 45A "	53558.72	56938.76	116.9	126.9	160.7	169.5	8.8
"BGO 46D "	53265.93	56187.01	202.1	212.1	225.0	224.3	-0.7
"BGO 47D "	53696.69	55794.78	203.4	213.4	226.3	224.2	-2.1
"BGO 48D "	53858.59	55603.64	202.0	212.0	226.5	224.1	-2.4
"BGO 51AA"	56446.18	54569.76	31.1	39.2	168.2	165.9	-2.3
"BGX 3D "	57081.36	57976.03	201.6	221.6	214.6	223.0	8.4
"BRD 4 "	24671.03	42867.77	129.1	159.1	165.9	176.1	10.2
"BRR 8C "	49605.56	59621.29	182.7	192.7	208.5	205.9	-2.6
"CMP 10 "	47945.72	33146.25	188.8	218.8	220.1	222.1	2.0

Table F-2. Summary of Group Statistical Parameters (Continued)

"CMP 11 "	47606.72	33311.24	185.2	215.2	212.0	218.4	6.4
"CMP 14C "	46754.03	34402.77	185.1	215.1	212.4	206.1	-6.3
"FAB 3 "	54303.61	58131.15	211.8	231.8	228.8	231.6	2.8
"FBP 5D "	50857.86	60951.80	192.6	212.6	205.2	201.5	-3.7
"FBP 11D "	50538.90	60922.99	192.0	212.1	203.0	196.7	-6.3
"FC 3A "	57163.77	59133.80	54.2	26.5	175.5	0.0	-175.5
"FC 4A "	54252.64	63347.03	66.5	-23.0	173.3	0.0	-173.3
"FC 4D "	54270.62	63363.34	146.4	151.4	151.0	0.0	-151.0
"FCB 2 "	54221.13	57666.65	205.2	235.2	229.1	230.4	1.3
"FNB 6 "	54152.82	61916.51	200.6	210.6	208.7	0.0	-208.7
"FSB115C "	48160.70	54697.60	163.8	173.8	184.4	185.3	0.9
"FSB122C "	46937.44	56354.44	160.0	170.0	199.7	186.5	-13.2
"HAA 1AA"	60549.35	49375.76	35.7	23.6	181.0	0.0	-181.0
"HAA 1TA"	60543.75	49383.60	35.6	-19.8	180.7	0.0	-180.7
"HAA 2AA"	59126.82	50741.06	29.4	39.4	177.6	176.6	-1.0
"HAA 3AA"	58184.26	51516.57	9.2	16.5	175.0	174.4	-0.6
"HAA 4B "	60007.73	51880.30	124.5	135.0	250.2	211.5	-38.7
"HC 8A "	59290.18	57409.21	65.9	16.3	175.6	0.0	-175.6
"HC 11C "	60697.08	54058.07	190.8	195.8	236.6	232.7	-3.9
"HSB 86C "	54275.70	53412.33	189.4	199.4	223.6	217.6	-6.0
"HSB111D "	54648.99	52716.01	185.7	195.7	222.0	215.3	-6.7
"HSB112D "	54613.42	52964.23	188.3	198.3	222.8	217.4	-5.4
"HSB118A "	54105.93	53618.85	91.0	101.0	167.6	166.5	-1.1
"HSB121A "	55545.03	52626.35	88.3	98.3	171.6	170.2	-1.4
"HSB123A "	56298.47	52634.89	93.6	103.6	171.7	172.8	1.1
"HSB124AR"	56699.16	52562.91	94.6	104.6	172.0	171.5	-0.5
"HSB139A "	55334.77	51753.59	87.6	97.6	173.6	172.1	-1.5
"HSB145D "	55706.59	51634.28	184.2	194.2	220.5	213.1	-7.4
"HSL 6B "	58765.56	52607.86	127.9	137.9	244.3	225.5	-18.8
"KSS 3D "	33990.18	31260.46	139.3	159.3	163.8	160.0	-3.8
"LAW 1C "	43197.56	27174.96	-27.8	-29.0	176.2	0.0	-176.2
"NBG 4 "	53989.69	60028.79	196.1	227.5	217.0	223.5	6.5
"NBG 5 "	54172.29	59991.30	194.9	226.4	217.8	223.0	5.2
"SBG 1 "	62305.00	53842.04	190.7	220.7	237.9	241.6	3.7
"SBG 4 "	63077.06	51408.75	185.6	215.6	240.9	241.7	0.8
"SBG 5 "	62537.22	51327.71	199.4	219.4	249.3	250.2	0.9
"TIR 1L "	15016.33	60212.77	65.7	67.7	93.2	94.8	1.6
"YSC 2D "	65404.04	56967.00	197.9	218.0	216.2	215.4	-0.8
"Z 18 "	42445.86	56486.58	159.9	160.4	184.2	172.6	-11.6
"ZBG 2 "	66269.92	54585.02	210.9	230.9	221.7	220.6	-1.1
"ZW 3 "	57053.77	61222.21	194.6	205.1	200.7	0.0	-200.7
"CMP 31C "	47419.09	34279.81	197.9	207.9	210.8	206.7	-4.1
"P 15A "	44409.31	29159.29	-20.5	-87.0	176.8	0.0	-176.8
"P 23A "	24677.32	34743.42	-4.3	-28.8	146.1	0.0	-146.1

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APPENDIX G. Uncertainty Analysis

Four uncertainty cases were considered as summarized in the table below. For each case, numerous plots of the simulated groundwater flow results are provided for comparison to the nominal case. Discussion of the comparison is provided in the Section 4.3 of the main text.

	GCU Kv		
Recharge	5×10^{-4} ft/day	10^{-4} ft/day	2×10^{-5} ft/day
15 in/yr	-	Case 1	-
12.5 in/yr	Case 3	Nominal	Case 4
10 in/yr	-	Case 2	-

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Simulation results for uncertainty case 1

Uncertainty case 1 involves an increase in recharge of 20% to 15 in/yr over the reactor areas (Table 4-4). Summary calibration results are provided in Table 4-5. This appendix presents detailed simulation results for uncertainty case 1 for comparison to the nominal results shown in figures in the main text. The correspondence between figures for the nominal and uncertainty case 1 is as follows:

Plot type	Nominal case	Uncertainty case 1
Head residual summary	Figure 4-1	Figure G-1-1
Head residuals in Gordon aquifer	Figure 4-2	Figure G-1-2
Head residuals in "lower" UTRA	Figure 4-3	Figure G-1-3
Head residuals in "upper" UTRA	Figure 4-4	Figure G-1-4
Kh in element layer 1	Figure 4-5	Figure G-1-5
Kv in element layer 2	Figure 4-6	Figure G-1-6
Kh in element layer 3	Figure 4-7	Figure G-1-7
Kh in element layer 4	Figure 4-8	Figure G-1-8
Kv in element layer 5	Figure 4-9	Figure G-1-9
Kh in element layer 6	Figure 4-10	Figure G-1-10
Kh in element layer 7	Figure 4-11	Figure G-1-11
Kh in element layer 8	Figure 4-12	Figure G-1-12
Gordon aquifer head	Figure 4-14	Figure G-1-13
"Lower" UTRA head	Figure 4-15	Figure G-1-14
"Upper" UTRA head	Figure 4-16	Figure G-1-15
Head in aquifer containing water table	Figure 4-17	Figure G-1-16
Water table	Figure 4-18	Figure G-1-17
Seepage faces	Figure 4-22	Figure G-1-18
Recharge/discharge	Figure 4-23	Figure G-1-19
Example particle tracing	Figure 4-24	Figure G-1-20

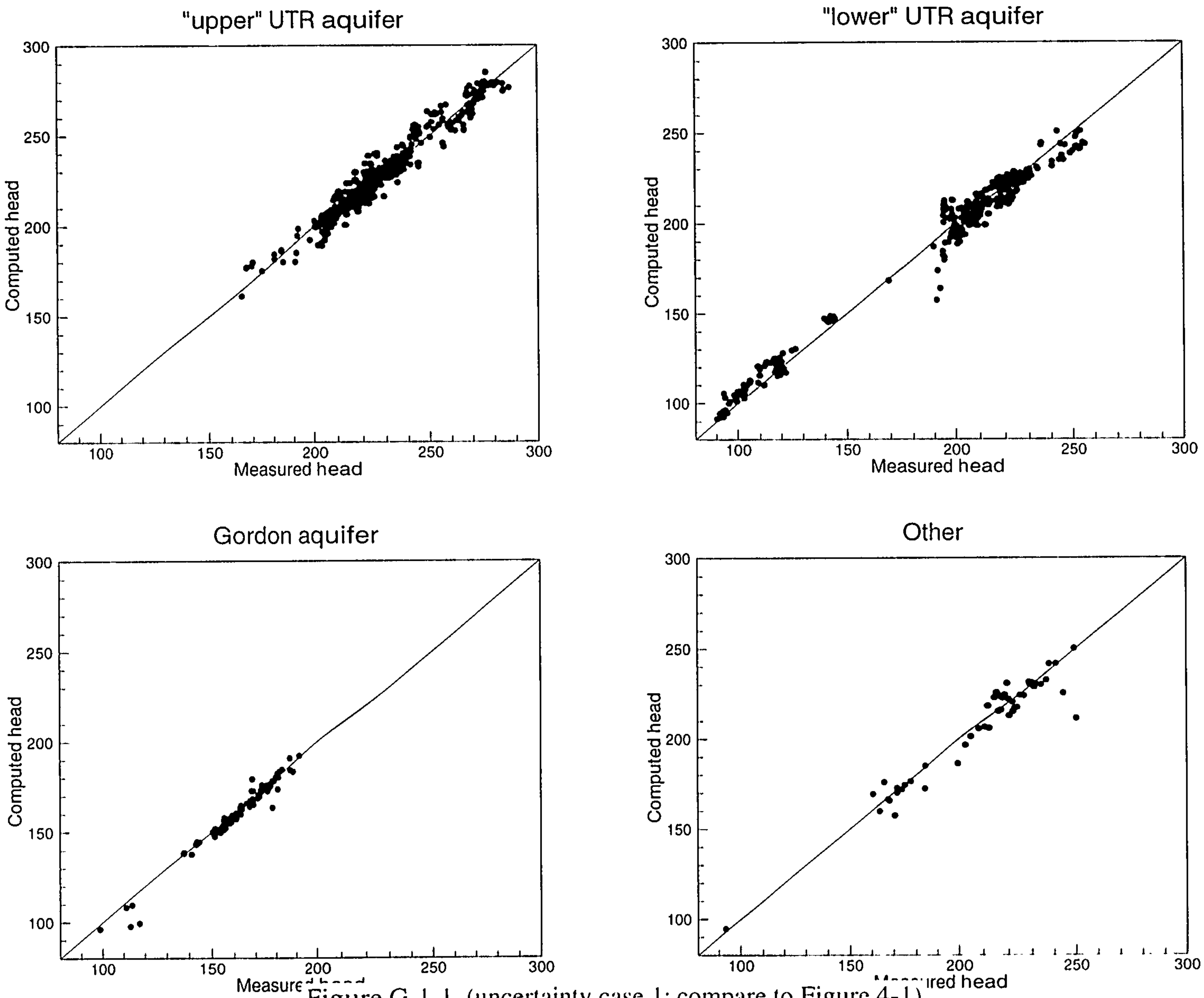


Figure G-1-1 (uncertainty case 1; compare to Figure 4-1)

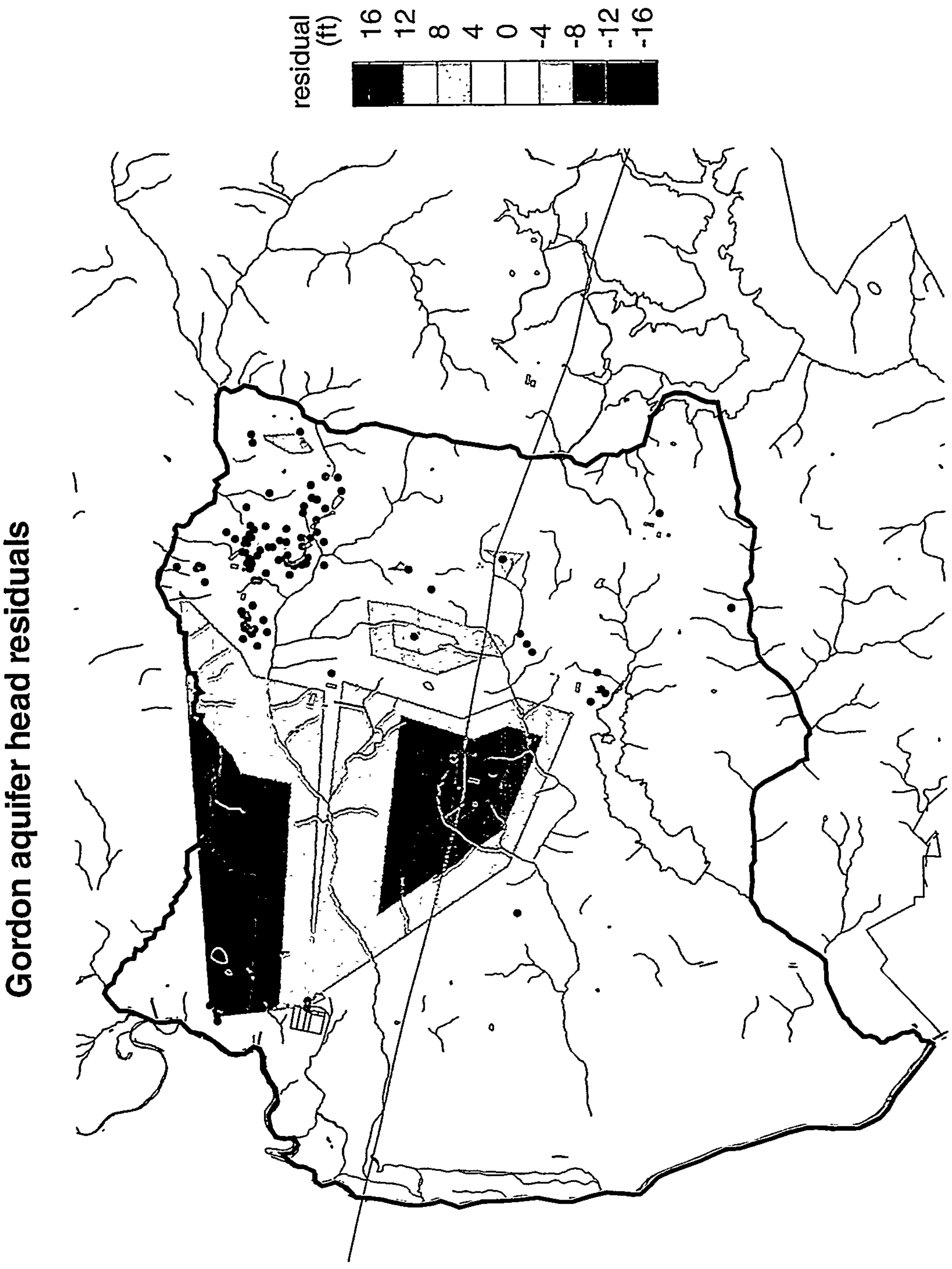


Figure G-1-2 (uncertainty case 1; compare to Figure 4-2)

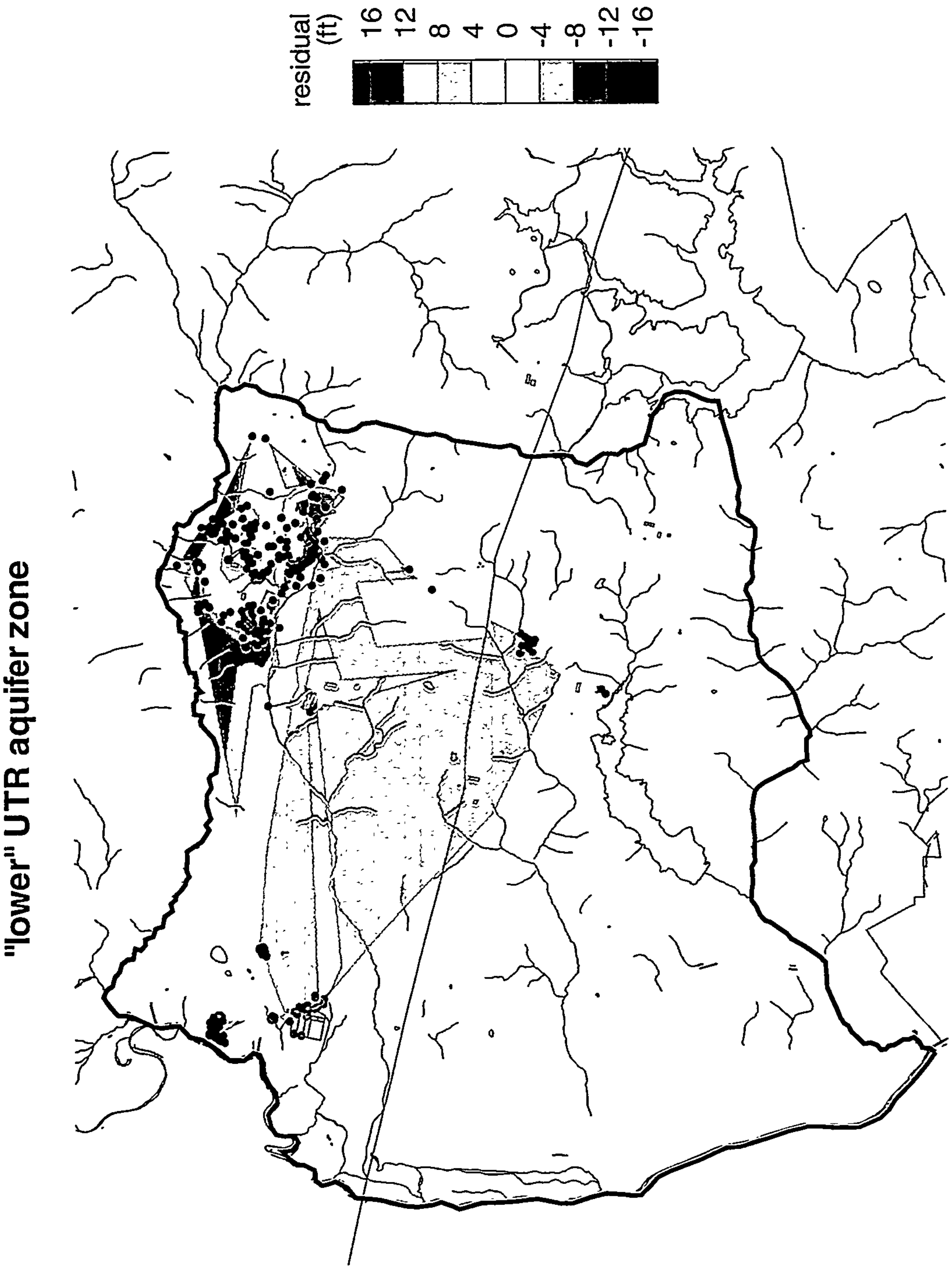
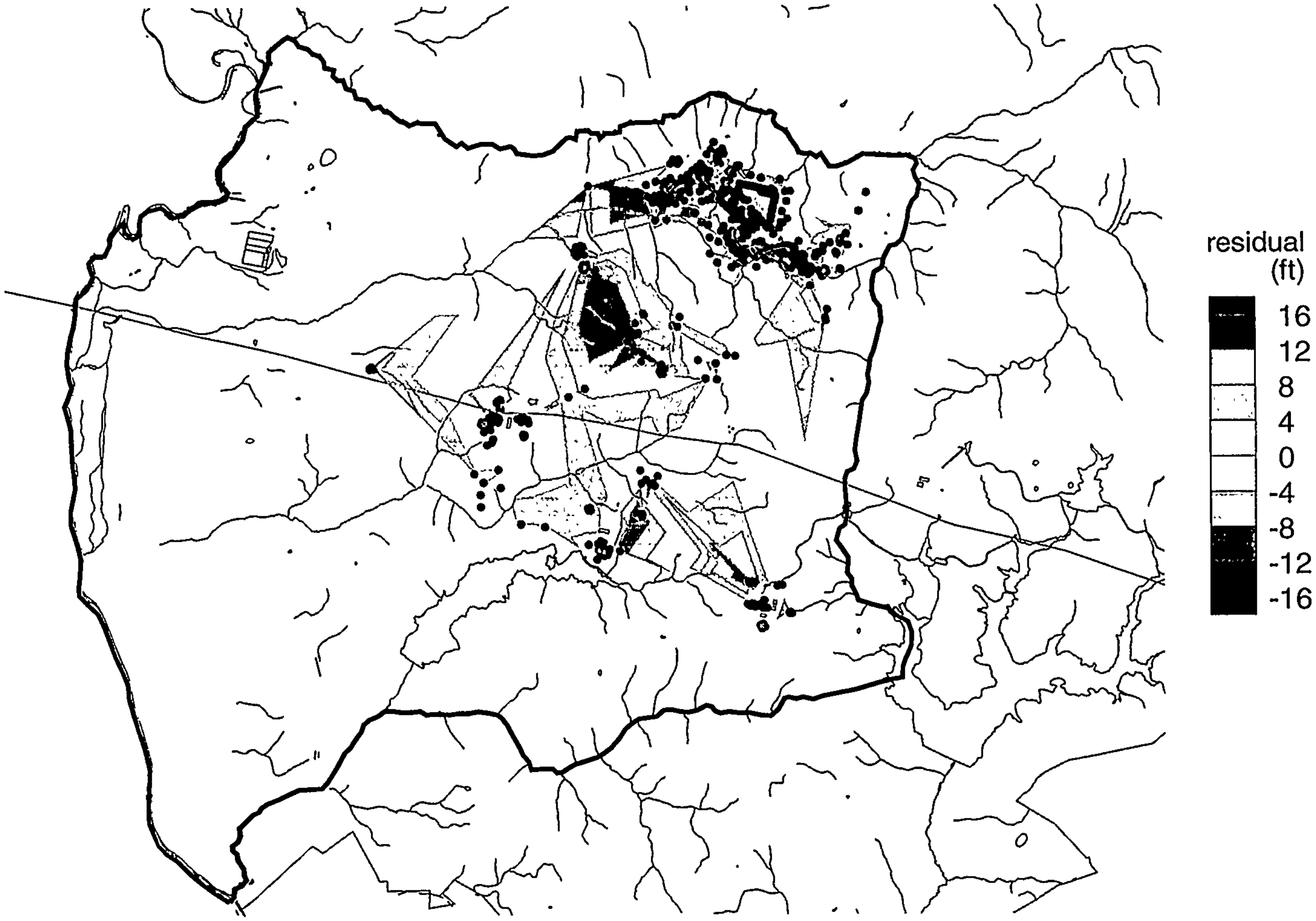
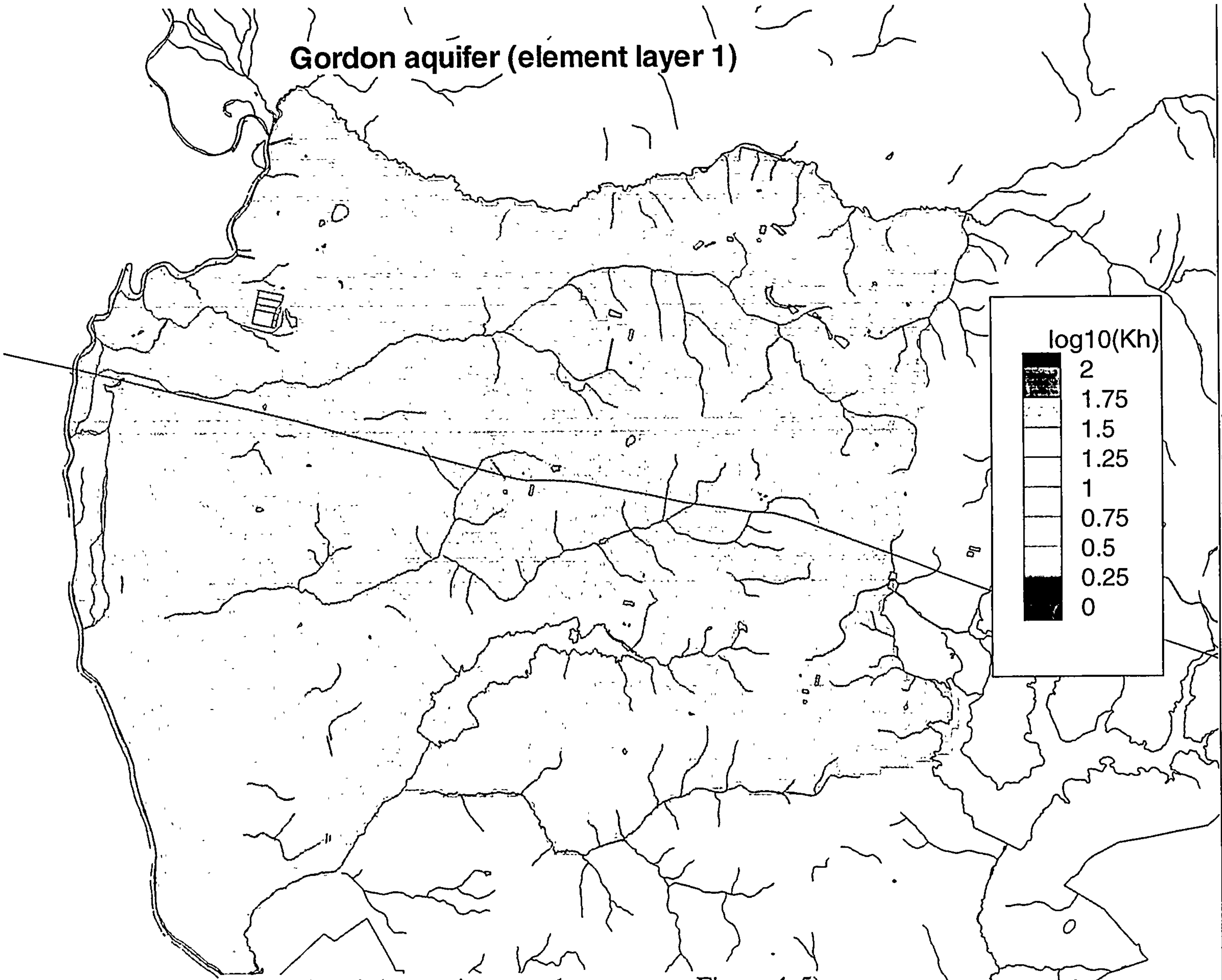


Figure G-1-3 (uncertainty case 1; compare to Figure 4-3)



"upper" UTR aquifer zone

Figure G-1-4 (uncertainty case 1; compare to Figure 4-4)



Gordon aquifer (element layer 1)

Figure G-1-5 (uncertainty case 1; compare to Figure 4-5)

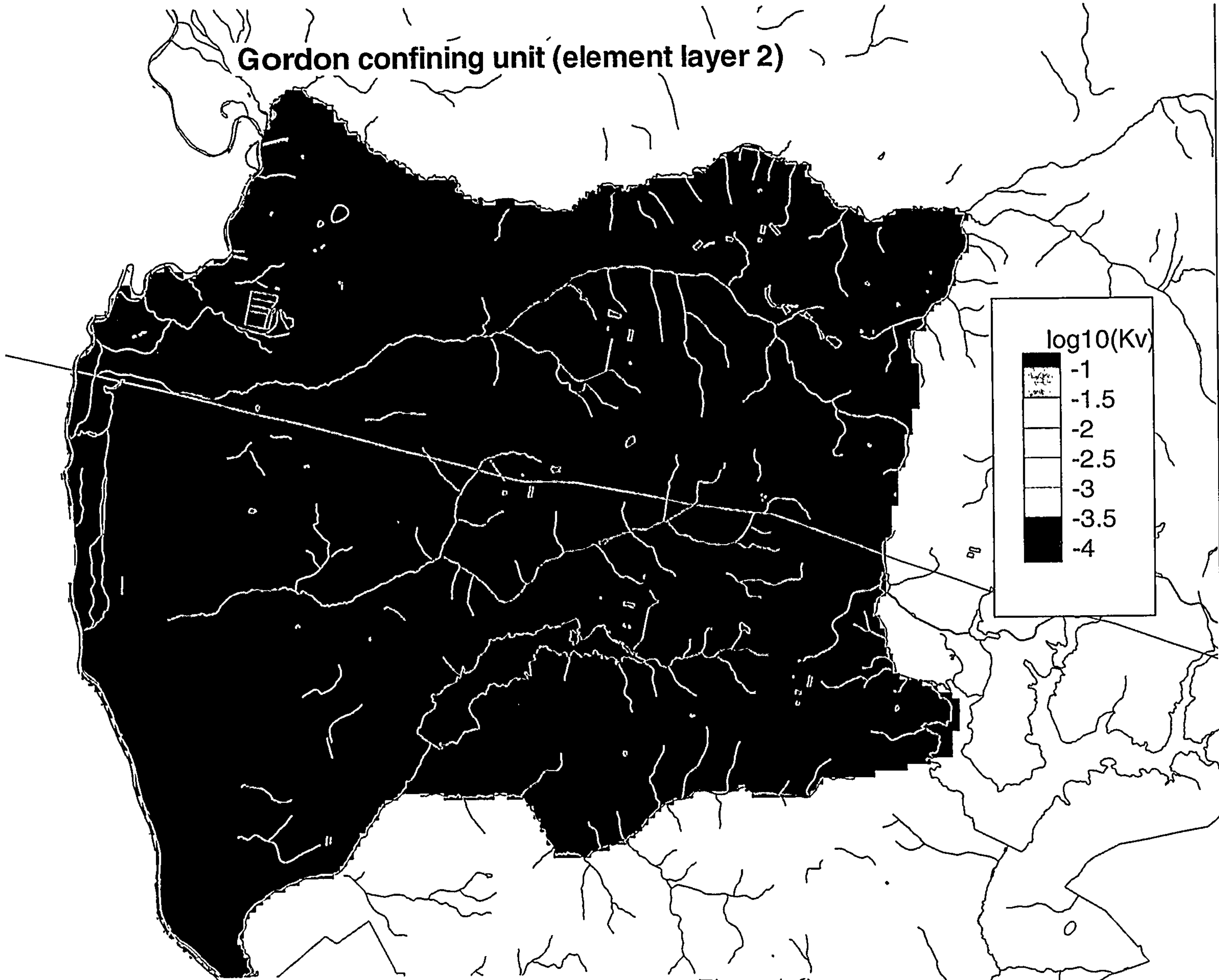

Gordon confining unit (element layer 2)

Figure G-1-6 (uncertainty case 1; compare to Figure 4-6)

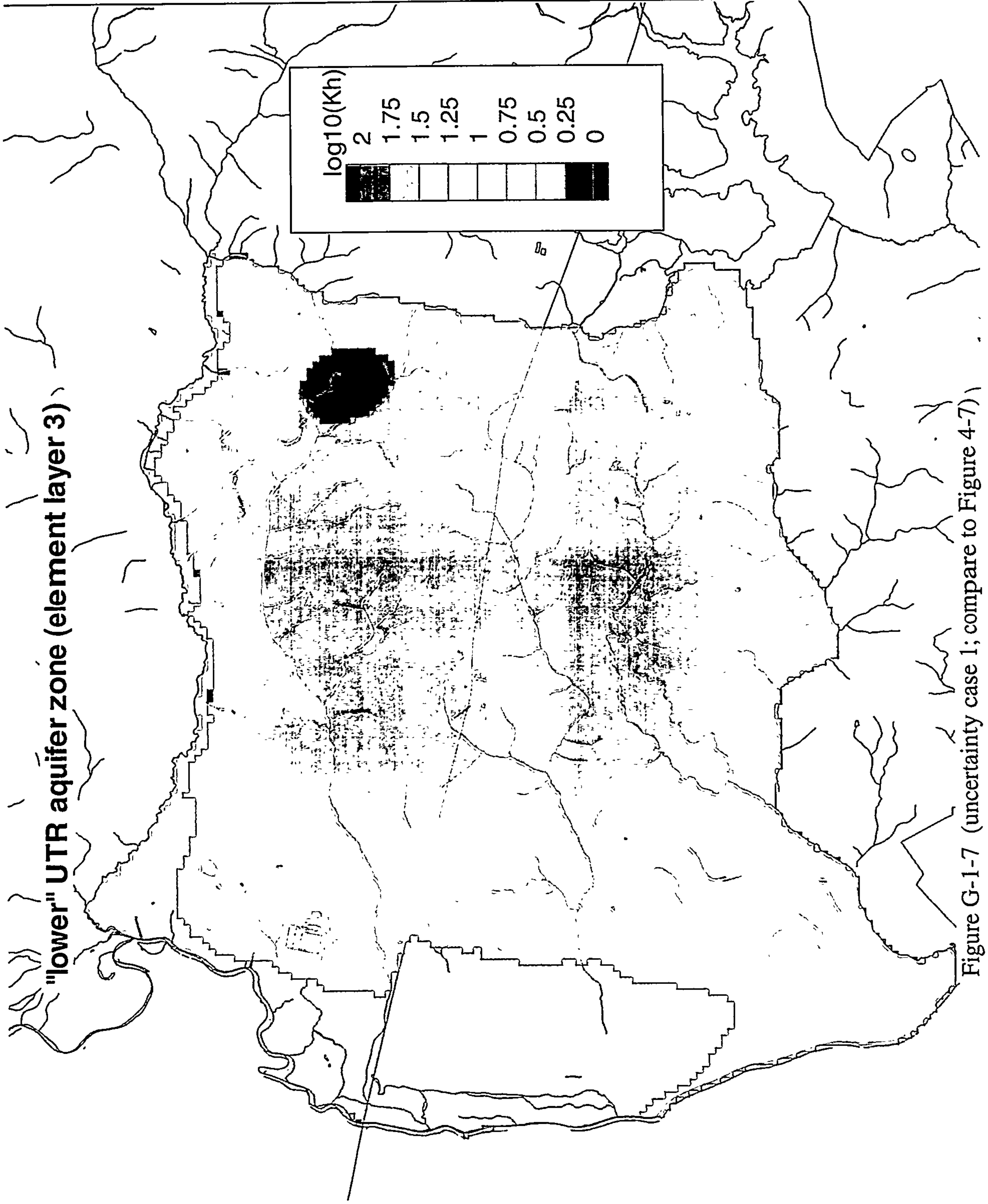


Figure G-1-7 (uncertainty case 1; compare to Figure 4-7)

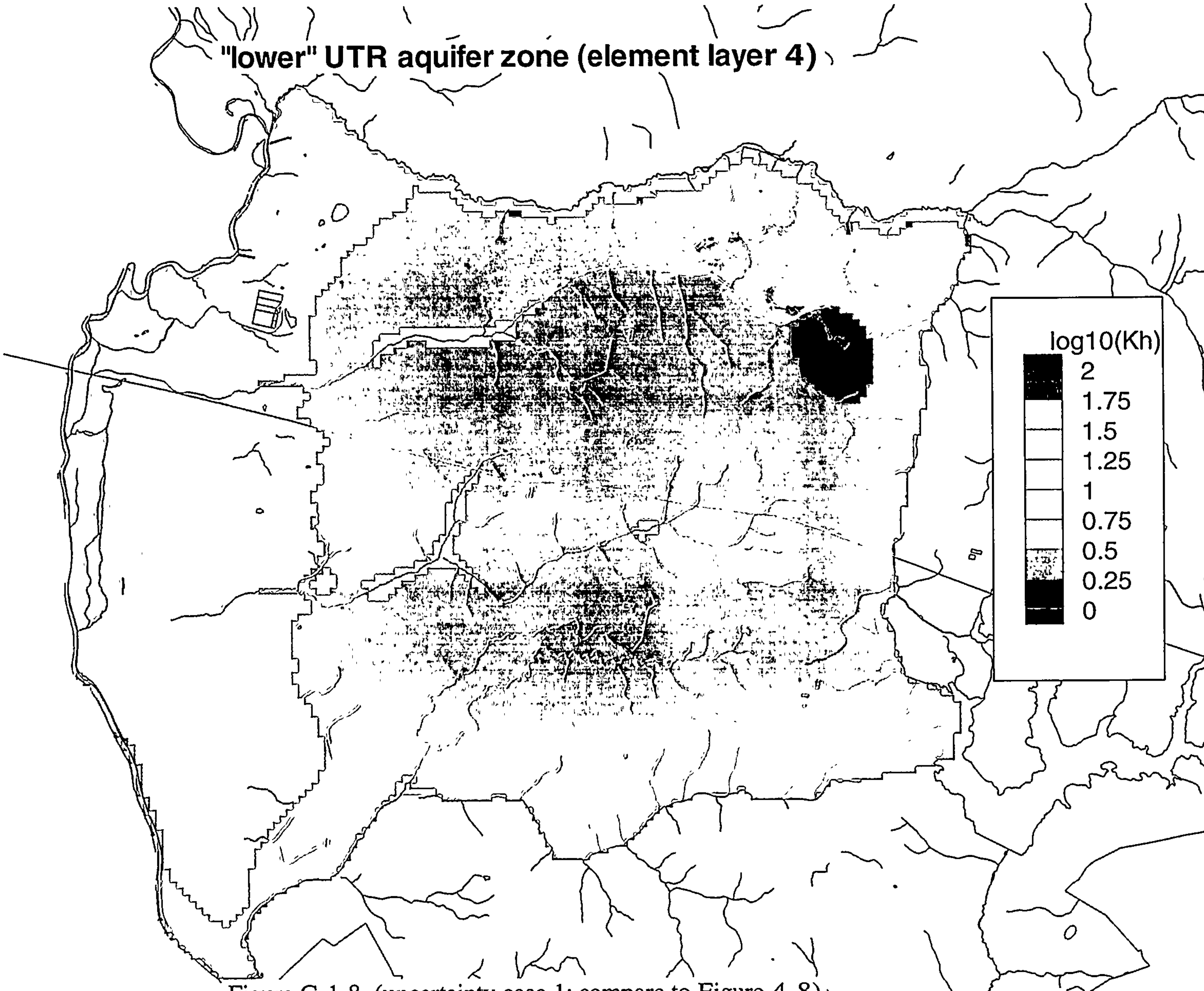


Figure G-1-8 (uncertainty case 1; compare to Figure 4-8)

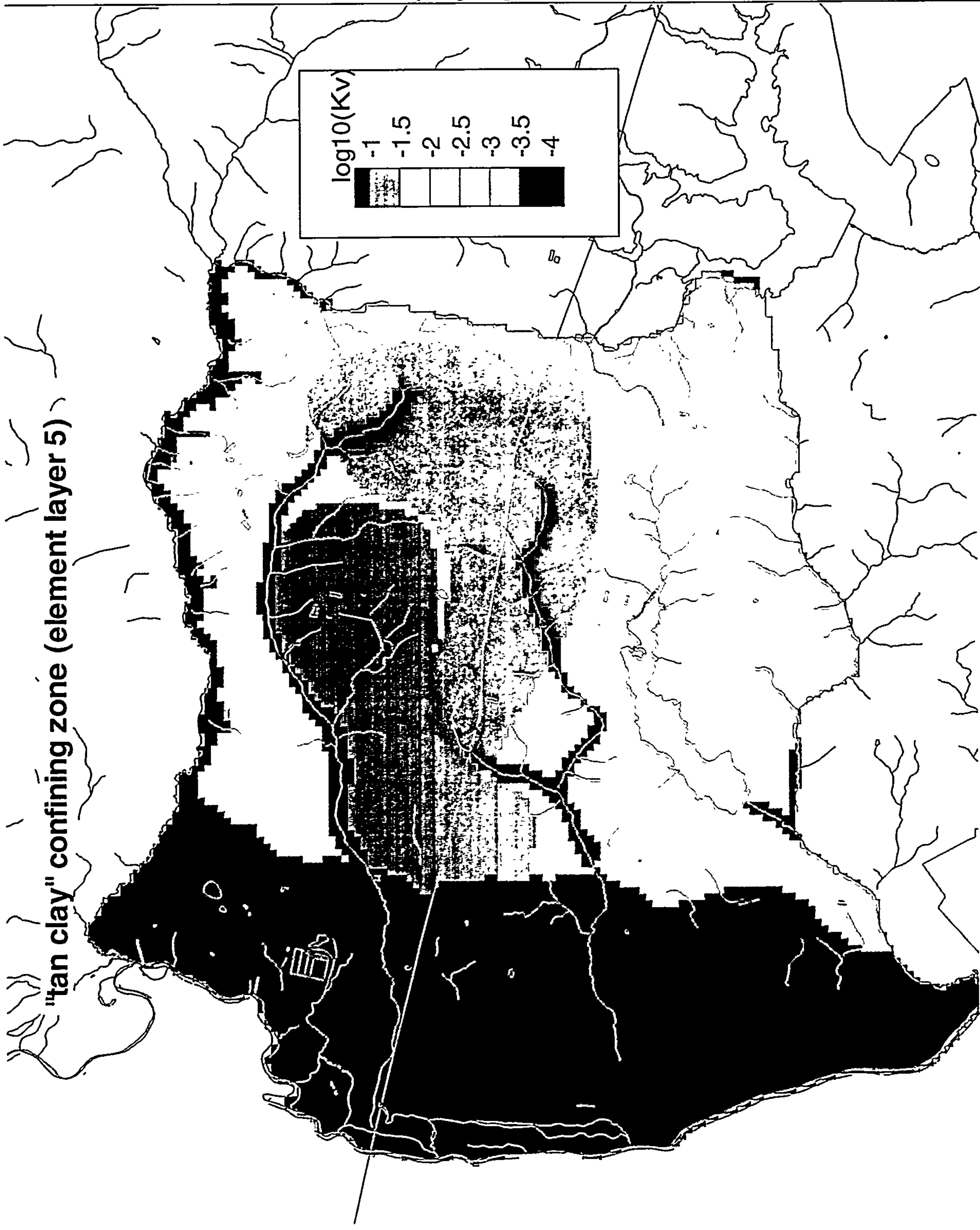


Figure G-1-9 (uncertainty case 1; compare to Figure 4-9)

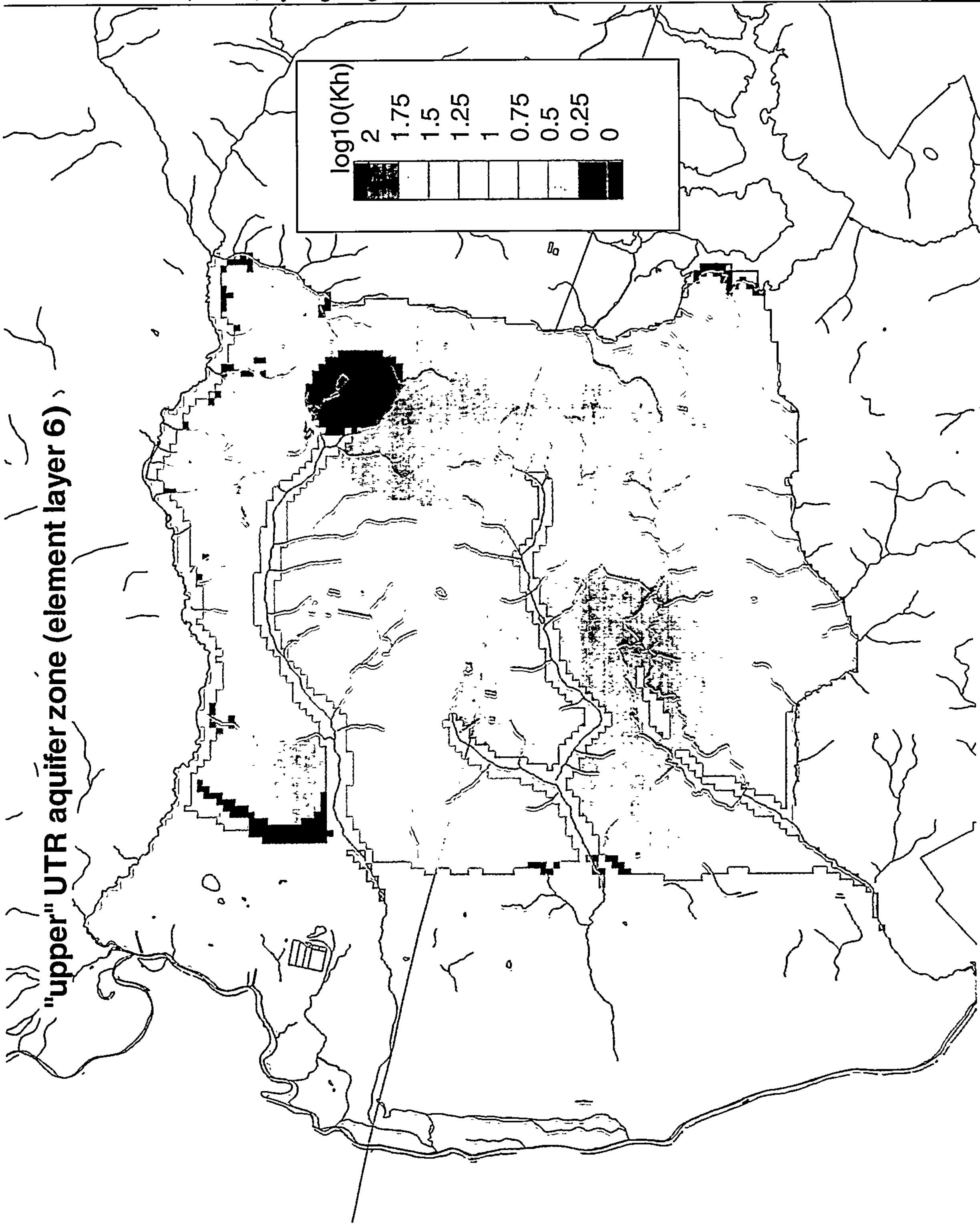


Figure G-1-10 (uncertainty case 1; compare to Figure 4-10)

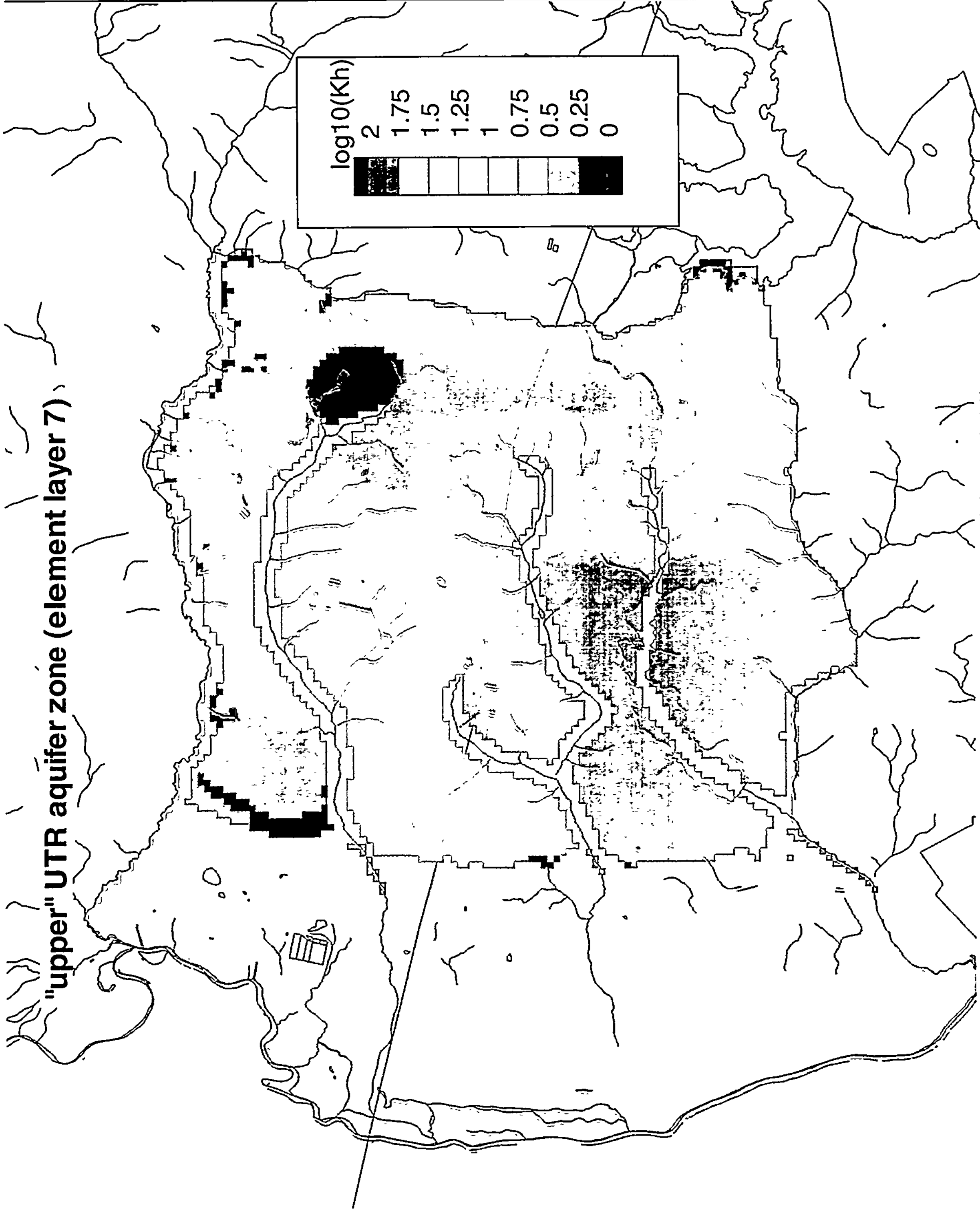


Figure G-1-11 (uncertainty case 1; compare to Figure 4-11)

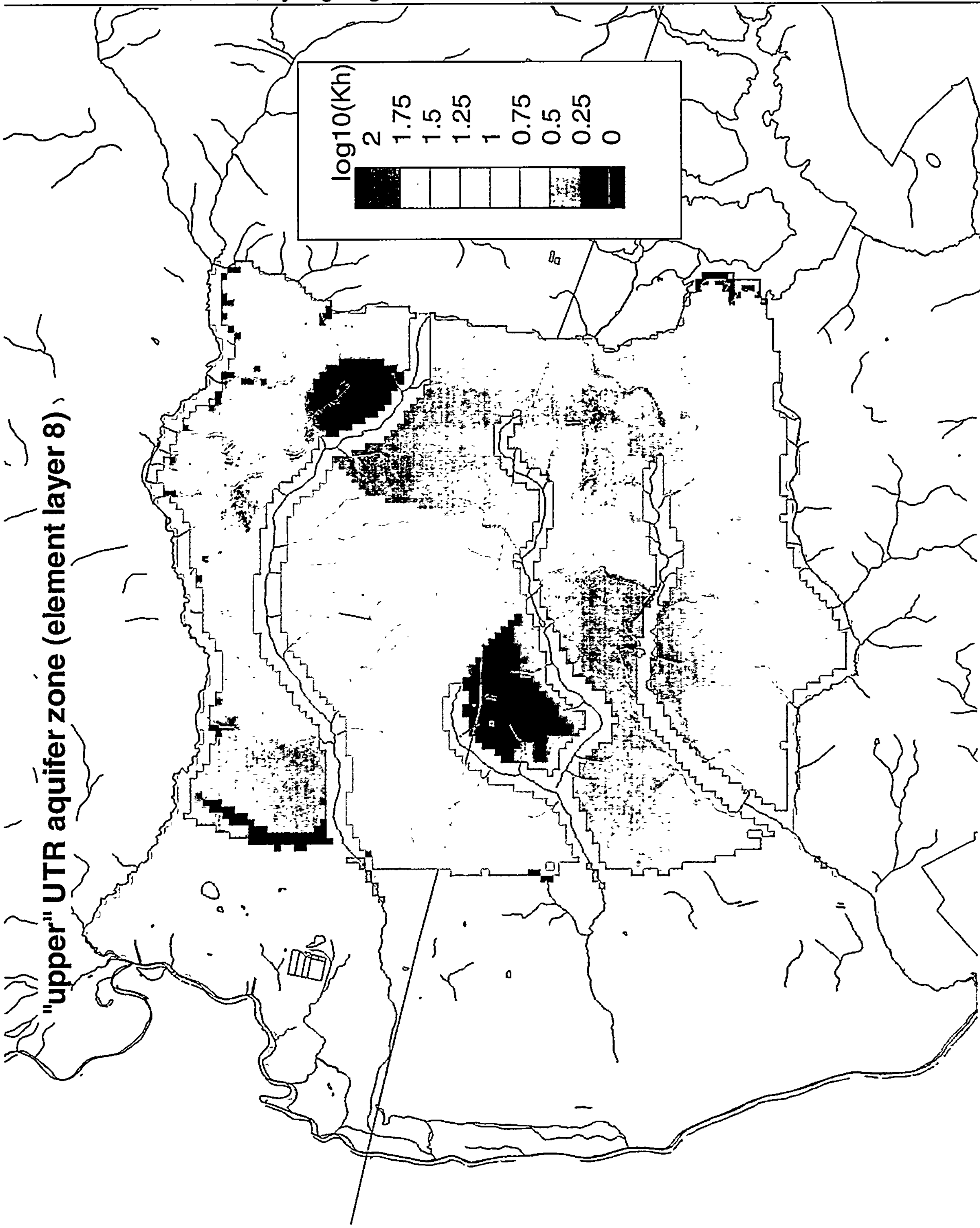


Figure G-1-12 (uncertainty case 1; compare to Figure 4-12)

Simulated hydraulic head in Gordon aquifer

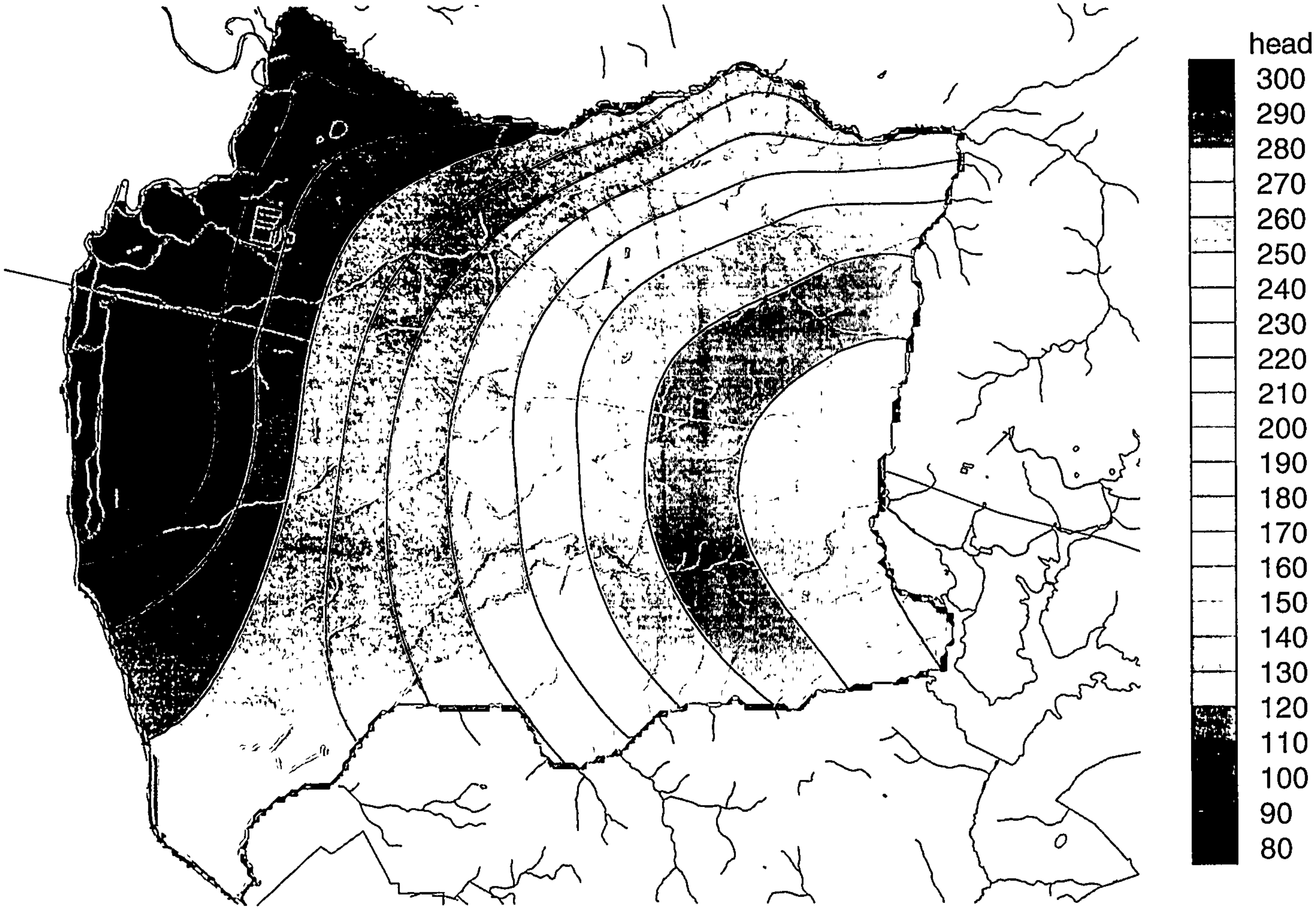


Figure G-1-13 (uncertainty case 1; compare to Figure 4-14)

Simulated hydraulic head in "lower" UTR aquifer zone

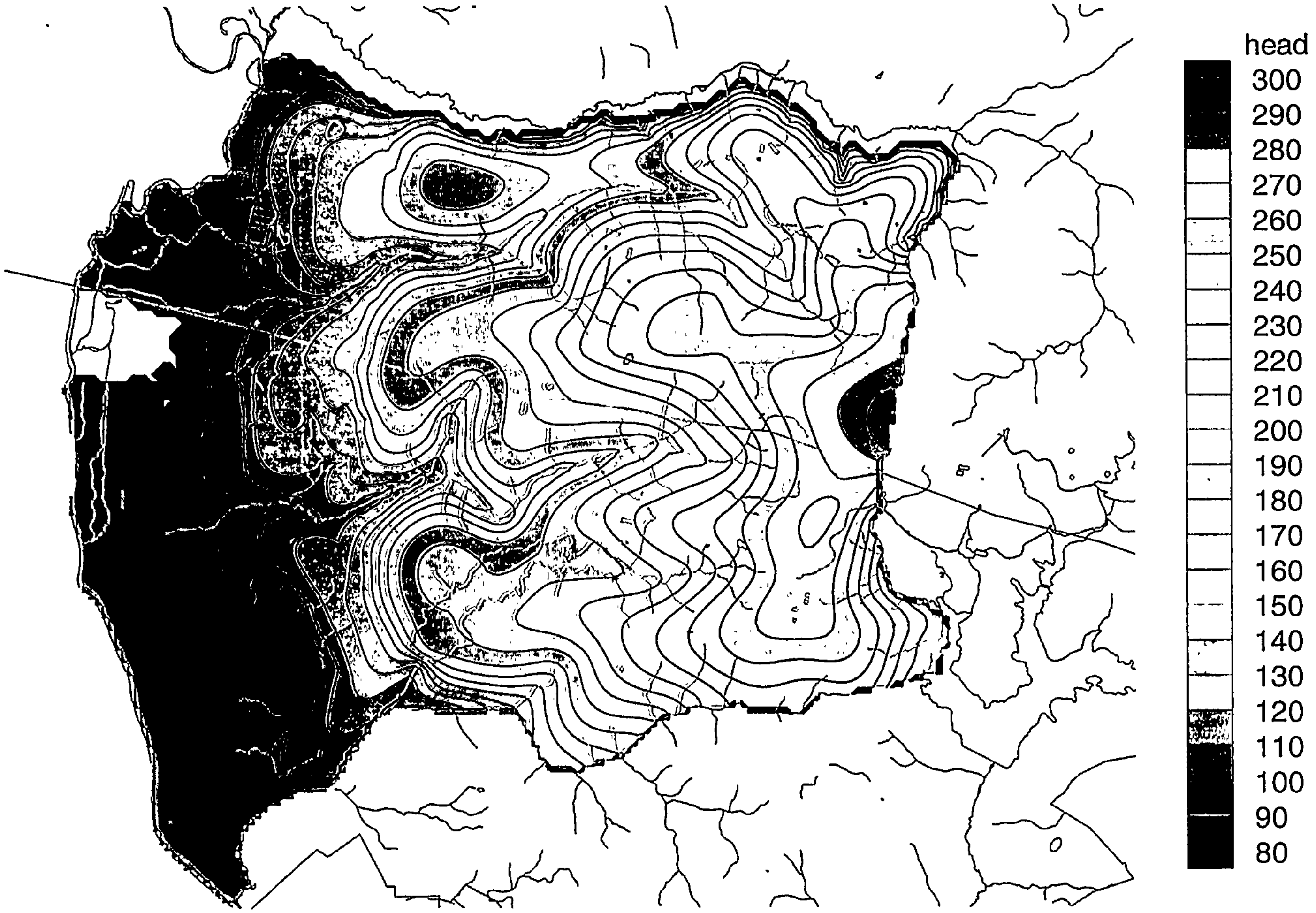
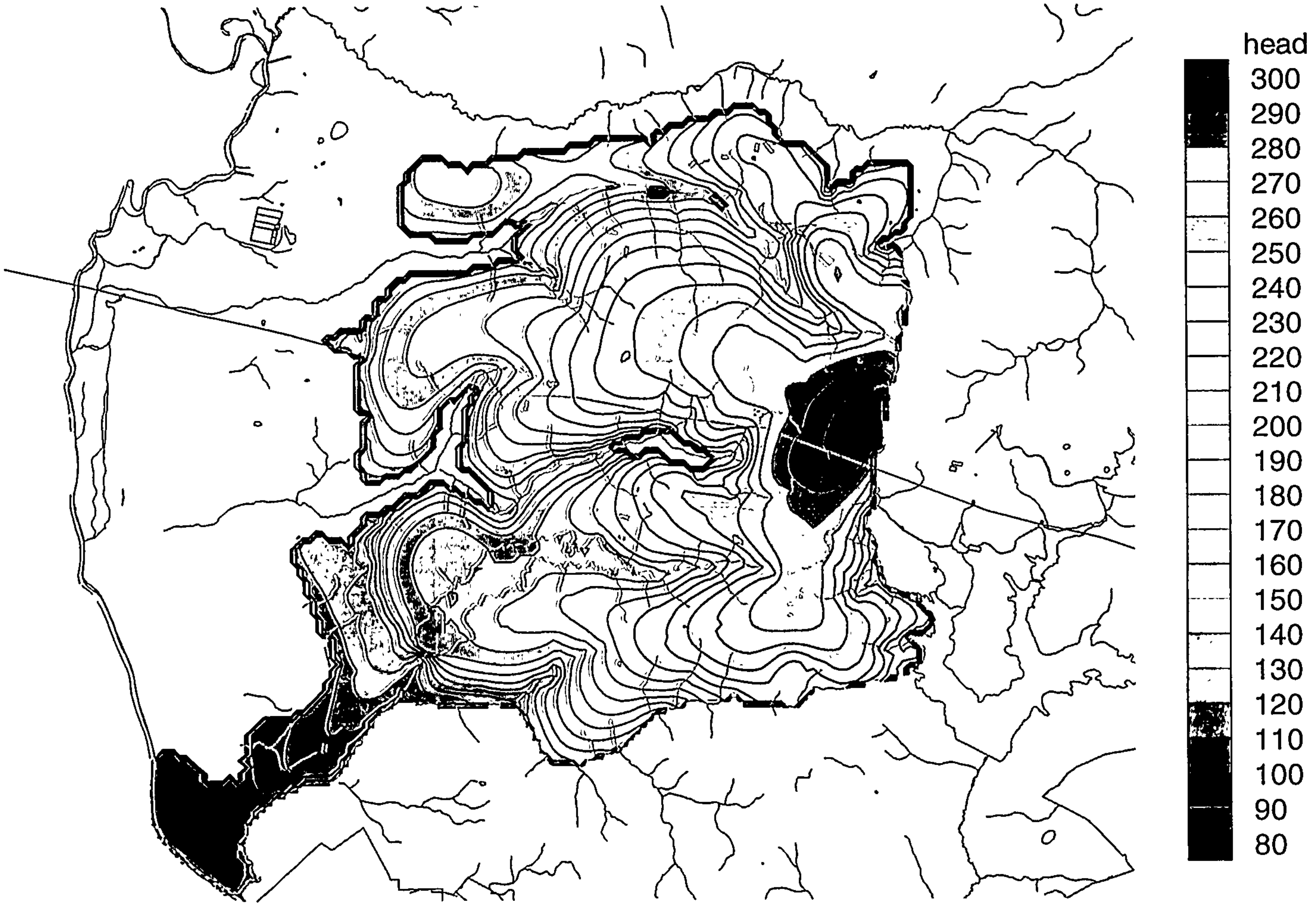


Figure G-1-14 (uncertainty case 1; compare to Figure 4-15)



Simulated hydraulic head in "upper" UTR aquifer zone

Figure G-1-15 (uncertainty case 1; compare to Figure 4-16)

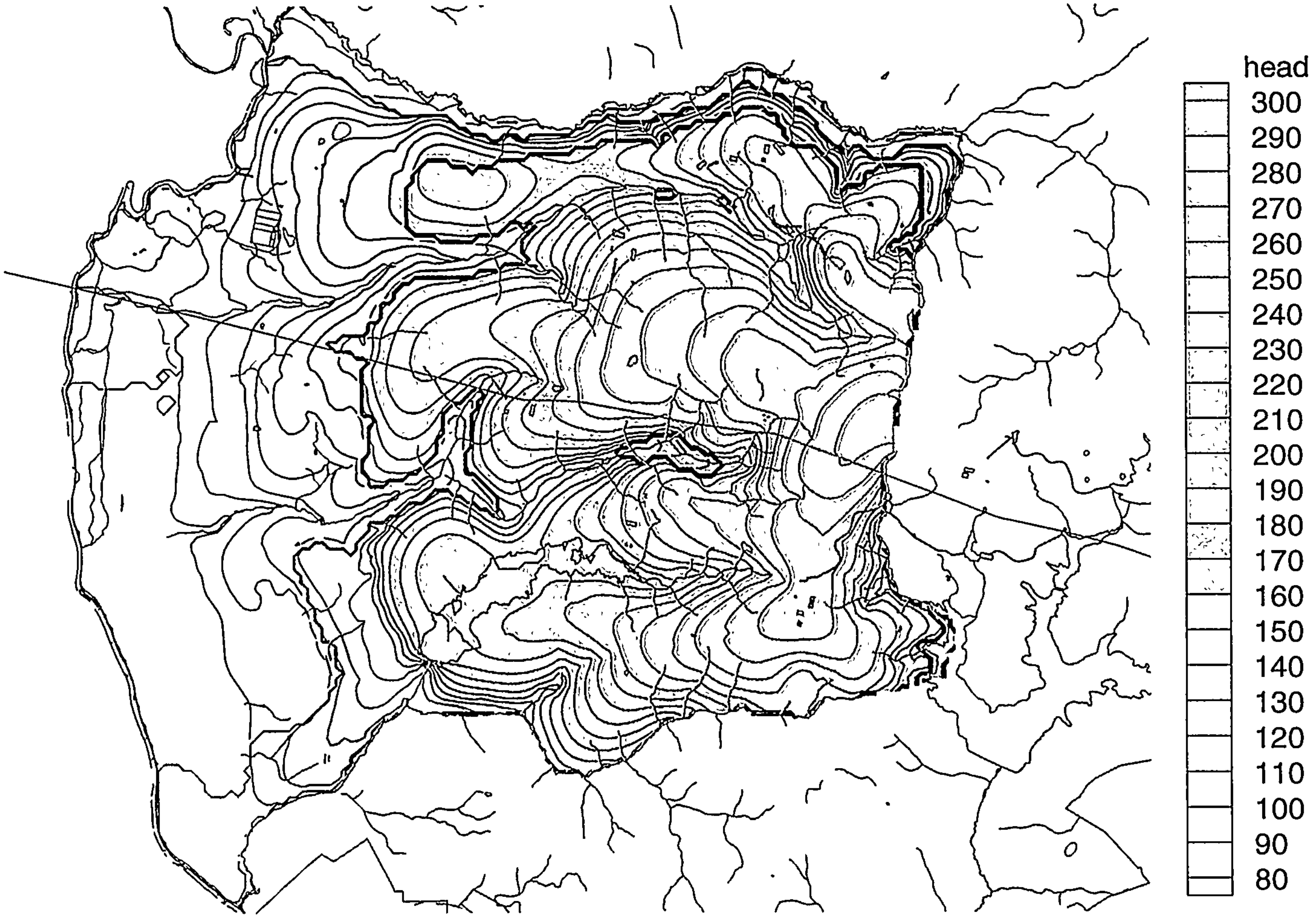

Simulated hydraulic head in aquifer zone containing water table

Figure G-1-16 (uncertainty case 1; compare to Figure 4-17)

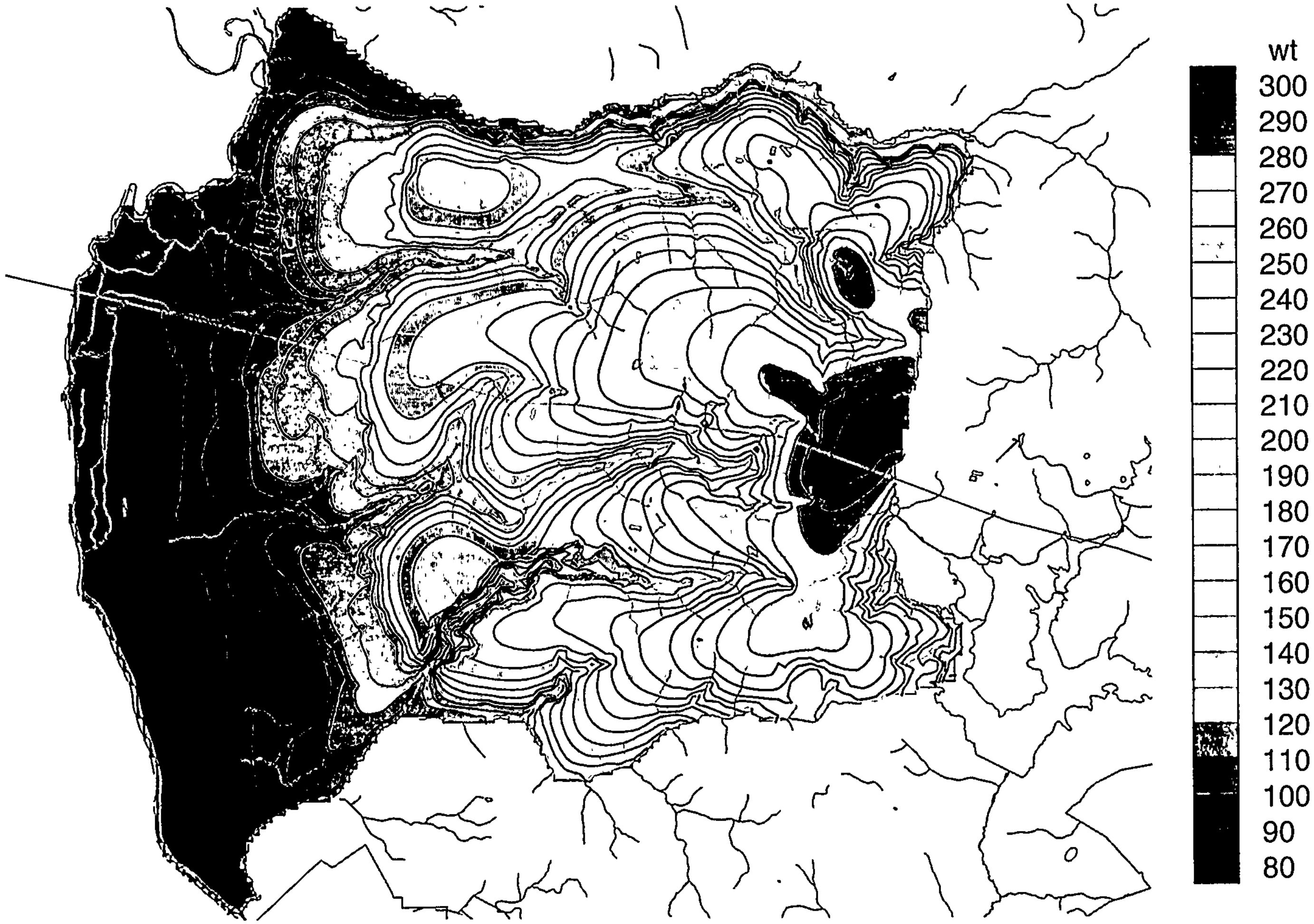

Simulated water table elevation

Figure G-1-17 (uncertainty case 1; compare to Figure 4-18)

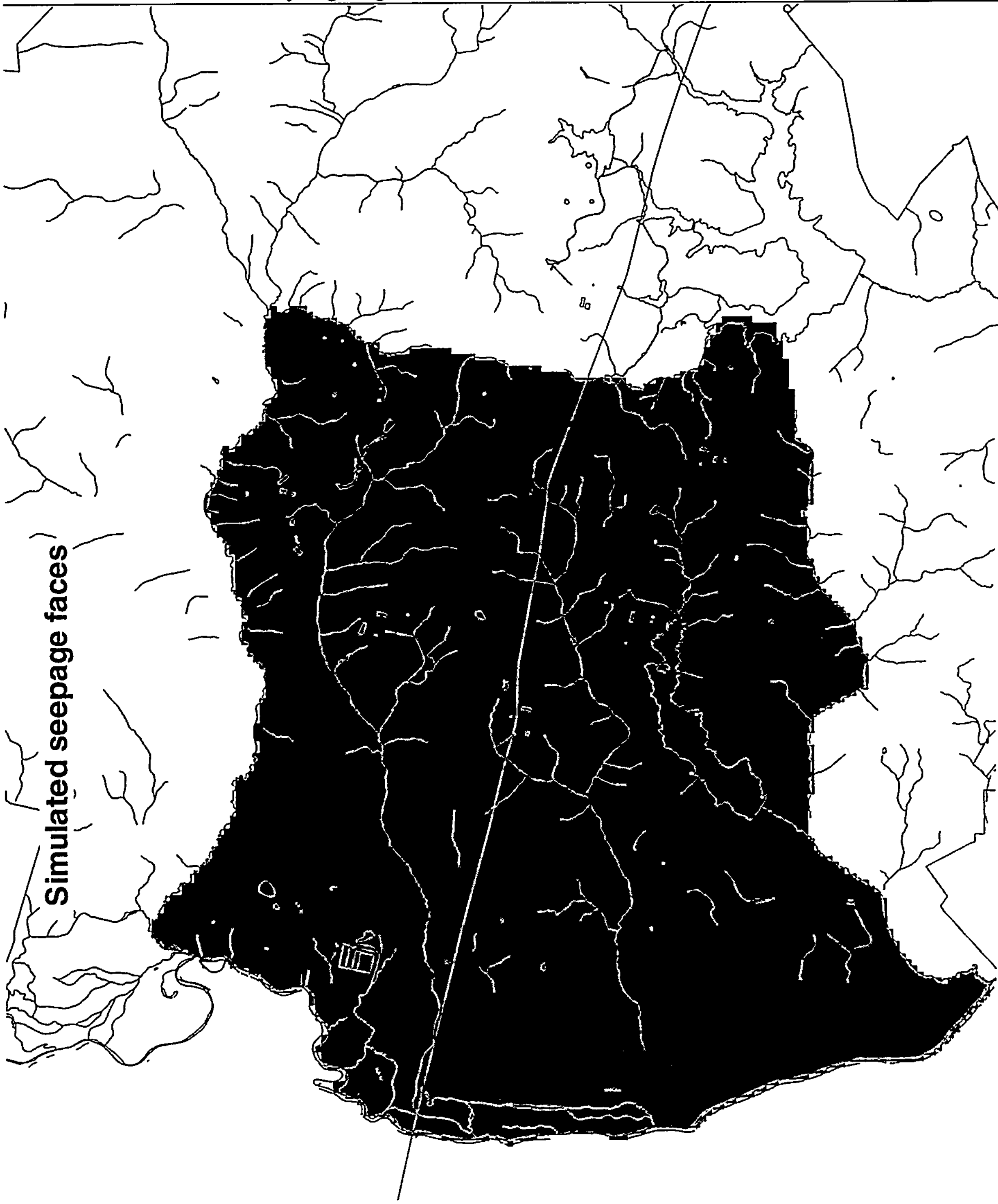


Figure G-1-18 (uncertainty case 1; compare to Figure 4-22)

Simulated groundwater recharge (discharge)

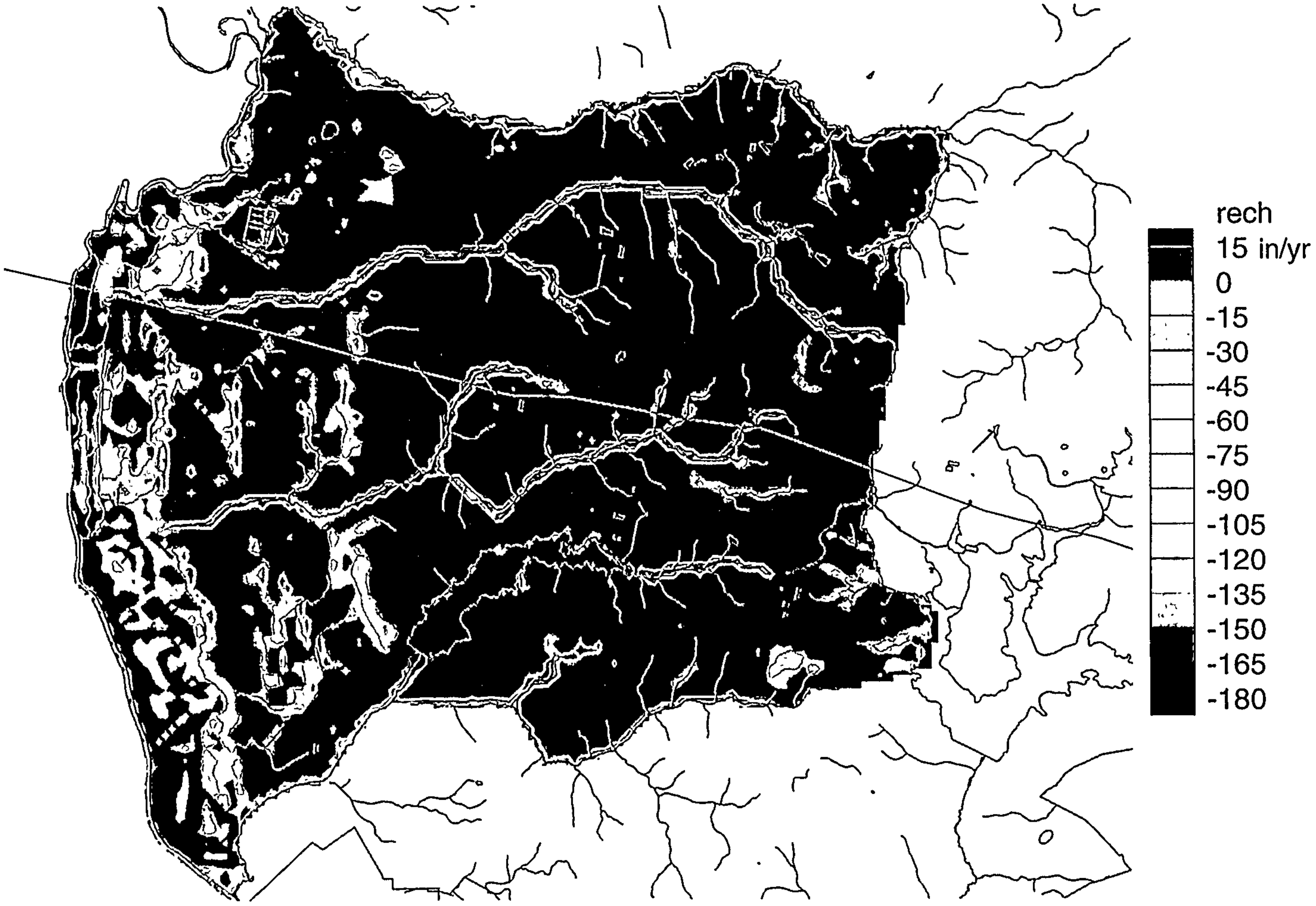


Figure G-1-19 (uncertainty case 1; compare to Figure 4-23)

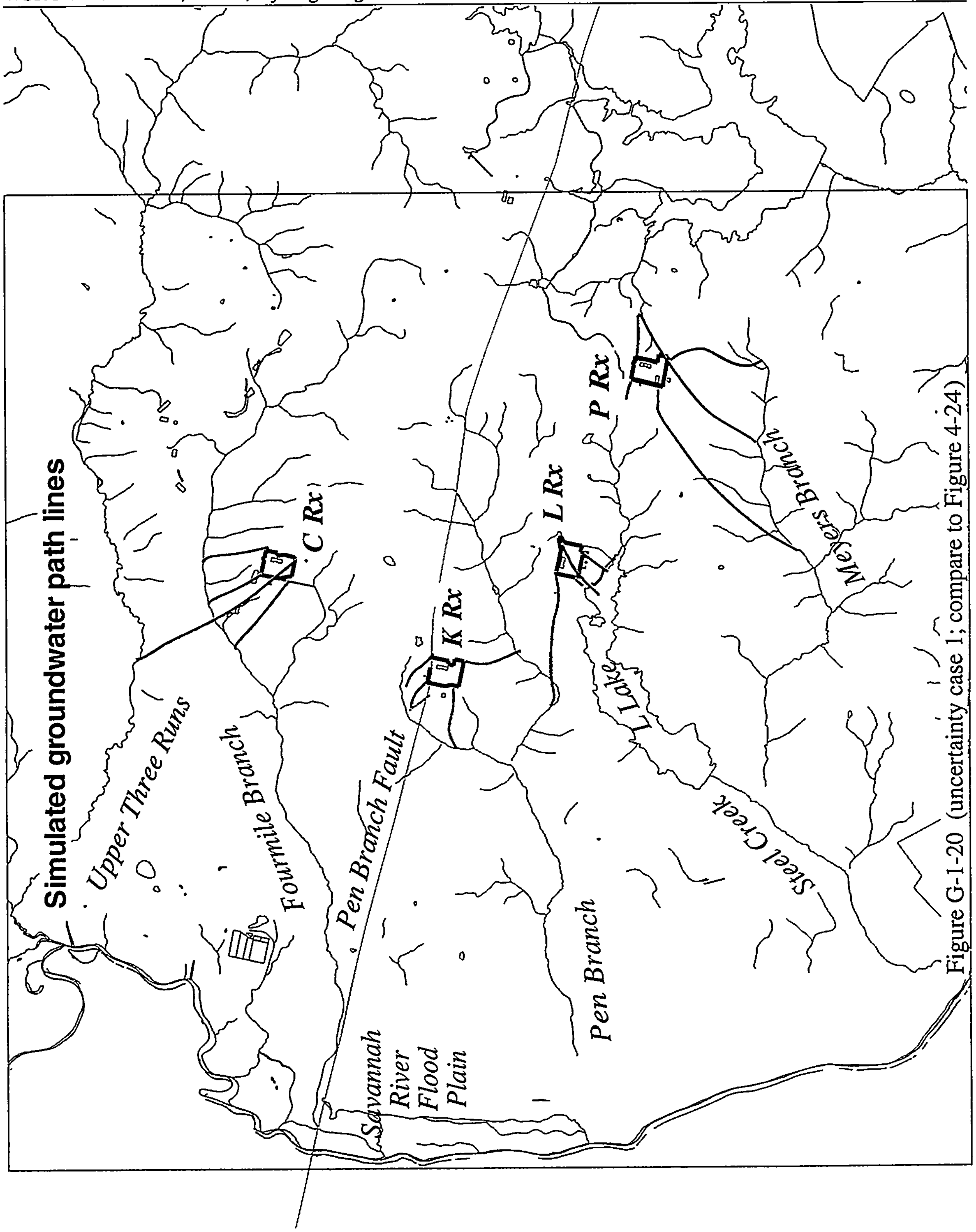


Figure G-1-20 (uncertainty case 1; compare to Figure 4-24)

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Simulation results for uncertainty case 2

Uncertainty case 1 involves a decrease in recharge of 20% to 10 in/yr over the reactor areas (Table 4-4). Summary calibration results are provided in Table 4-5. This appendix presents detailed simulation results for uncertainty case 2 for comparison to the nominal results shown in figures in the main text. The correspondence between figures for the nominal and uncertainty case 2 is as follows:

Plot type	**Nominal case**	**Uncertainty case 2**
Head residual summary	Figure 4-1	Figure G-2-1
Head residuals in Gordon aquifer	Figure 4-2	Figure G-2-2
Head residuals in "lower" UTRA	Figure 4-3	Figure G-2-3
Head residuals in "upper" UTRA	Figure 4-4	Figure G-2-4
Kh in element layer 1	Figure 4-5	Figure G-2-5
Kv in element layer 2	Figure 4-6	Figure G-2-6
Kh in element layer 3	Figure 4-7	Figure G-2-7
Kh in element layer 4	Figure 4-8	Figure G-2-8
Kv in element layer 5	Figure 4-9	Figure G-2-9
Kh in element layer 6	Figure 4-10	Figure G-2-10
Kh in element layer 7	Figure 4-11	Figure G-2-11
Kh in element layer 8	Figure 4-12	Figure G-2-12
Gordon aquifer head	Figure 4-14	Figure G-2-13
"Lower" UTRA head	Figure 4-15	Figure G-2-14
"Upper" UTRA head	Figure 4-16	Figure G-2-15
Head in aquifer containing water table	Figure 4-17	Figure G-2-16
Water table	Figure 4-18	Figure G-2-17
Seepage faces	Figure 4-22	Figure G-2-18
Recharge/discharge	Figure 4-23	Figure G-2-19
Example particle tracing	Figure 4-24	Figure G-2-20

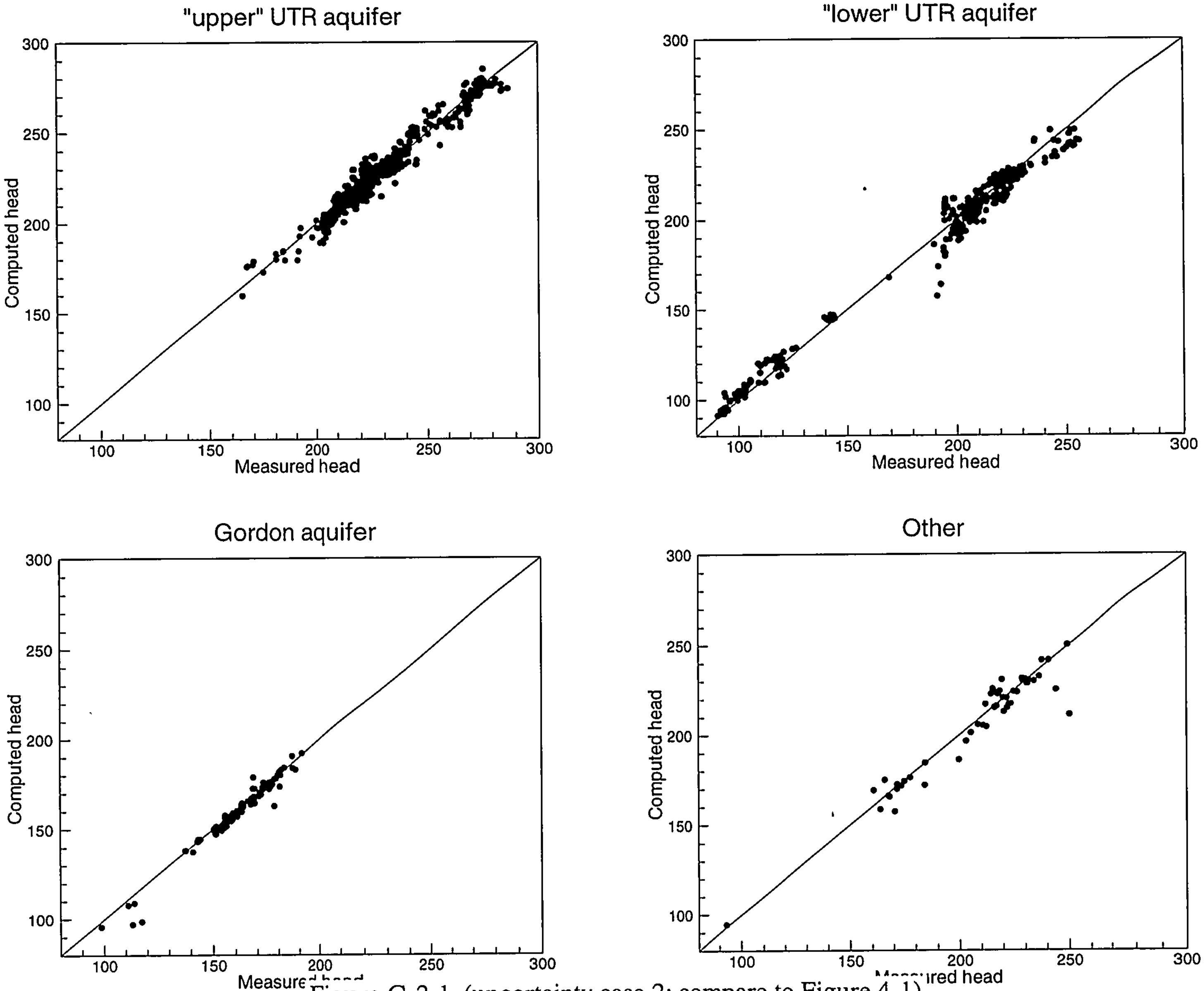


Figure G-2-1 (uncertainty case 2; compare to Figure 4-1)

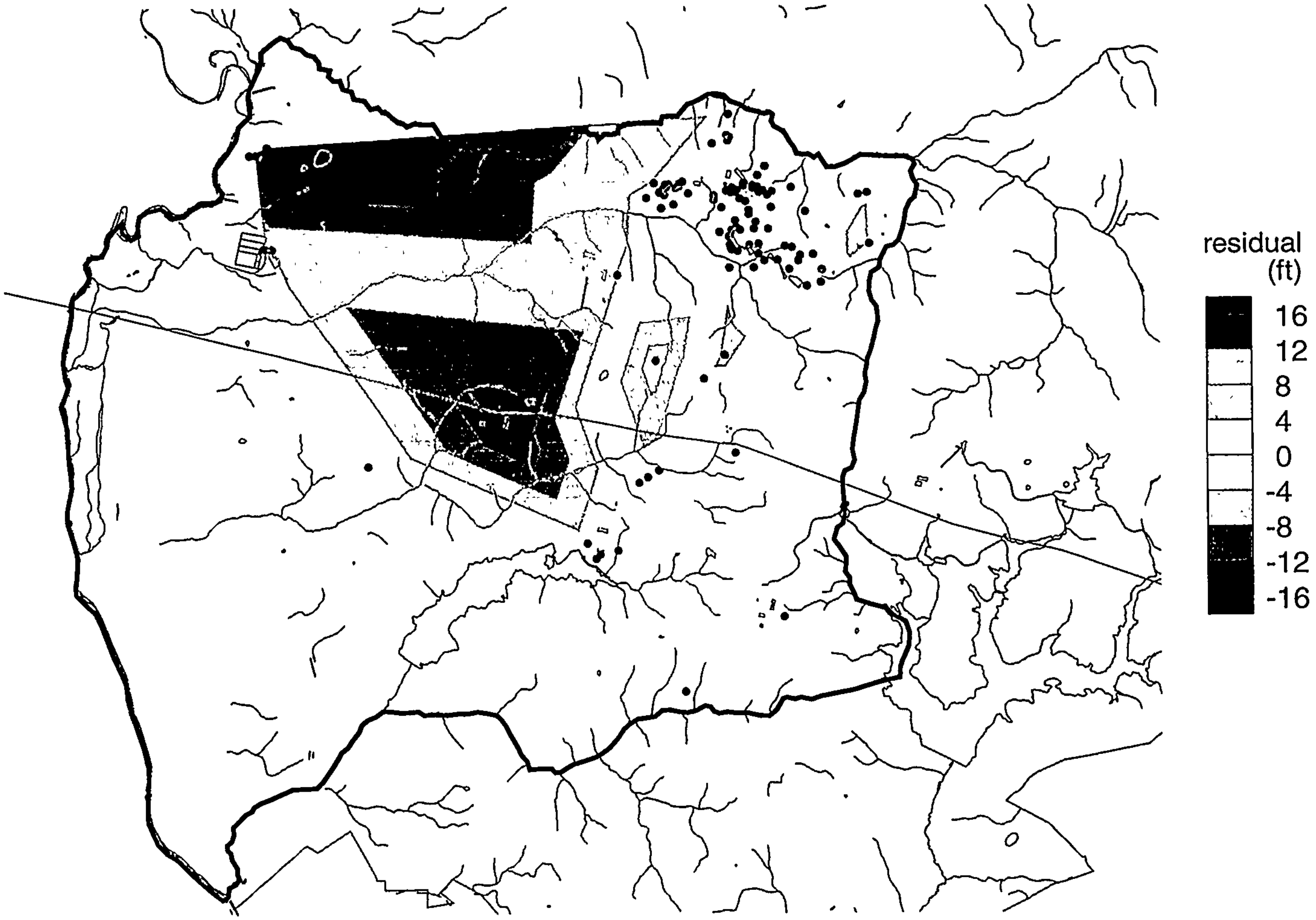

Gordon aquifer head residuals

Figure G-2-2 (uncertainty case 2; compare to Figure 4-2)

"lower" UTR aquifer zone

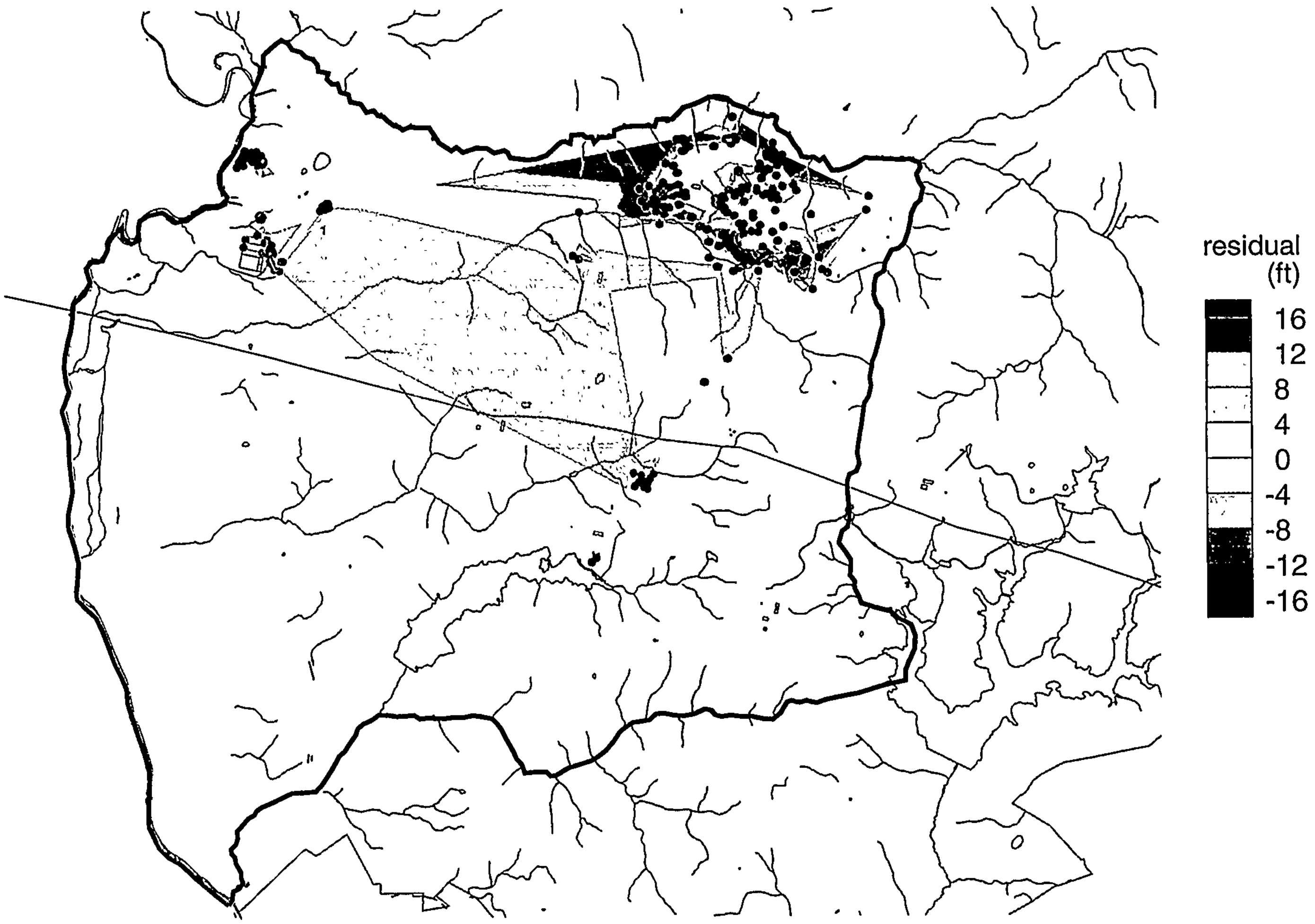


Figure G-2-3 (uncertainty case 2; compare to Figure 4-3)

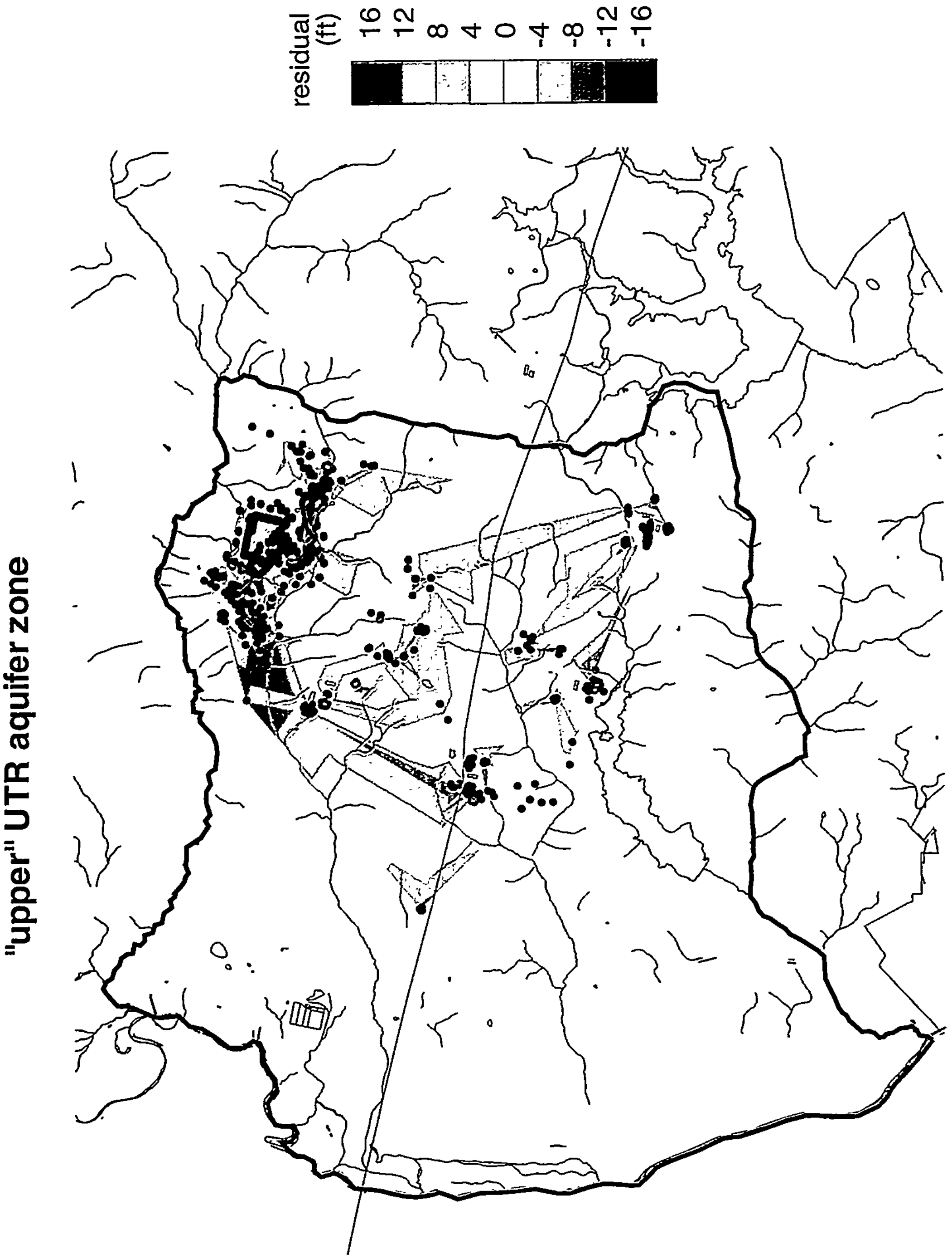

"upper" UTR aquifer zone

Figure G-2-4 (uncertainty case 2; compare to Figure 4-4)

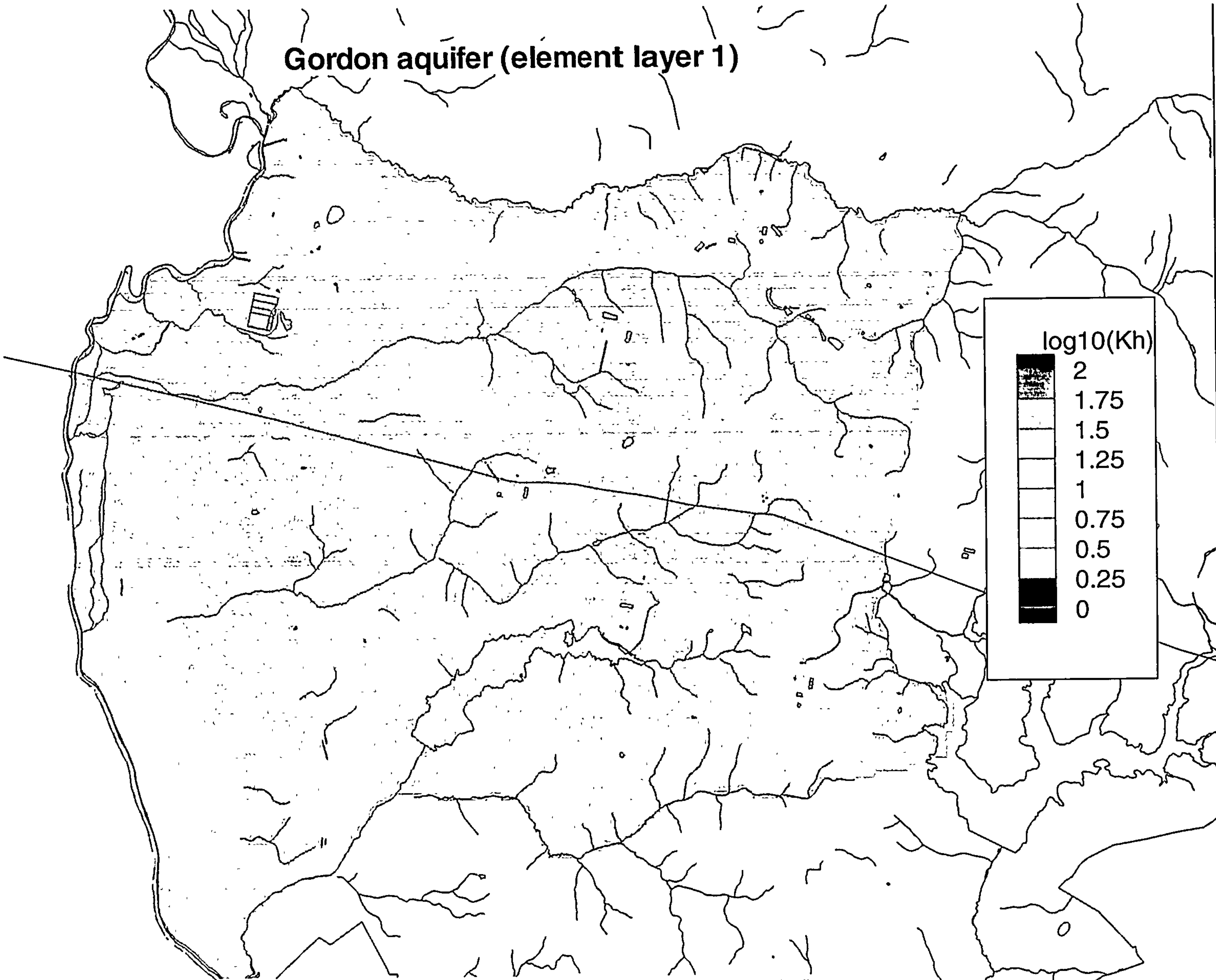

Gordon aquifer (element layer 1)

Figure G-2-5 (uncertainty case 2; compare to Figure 4-5)

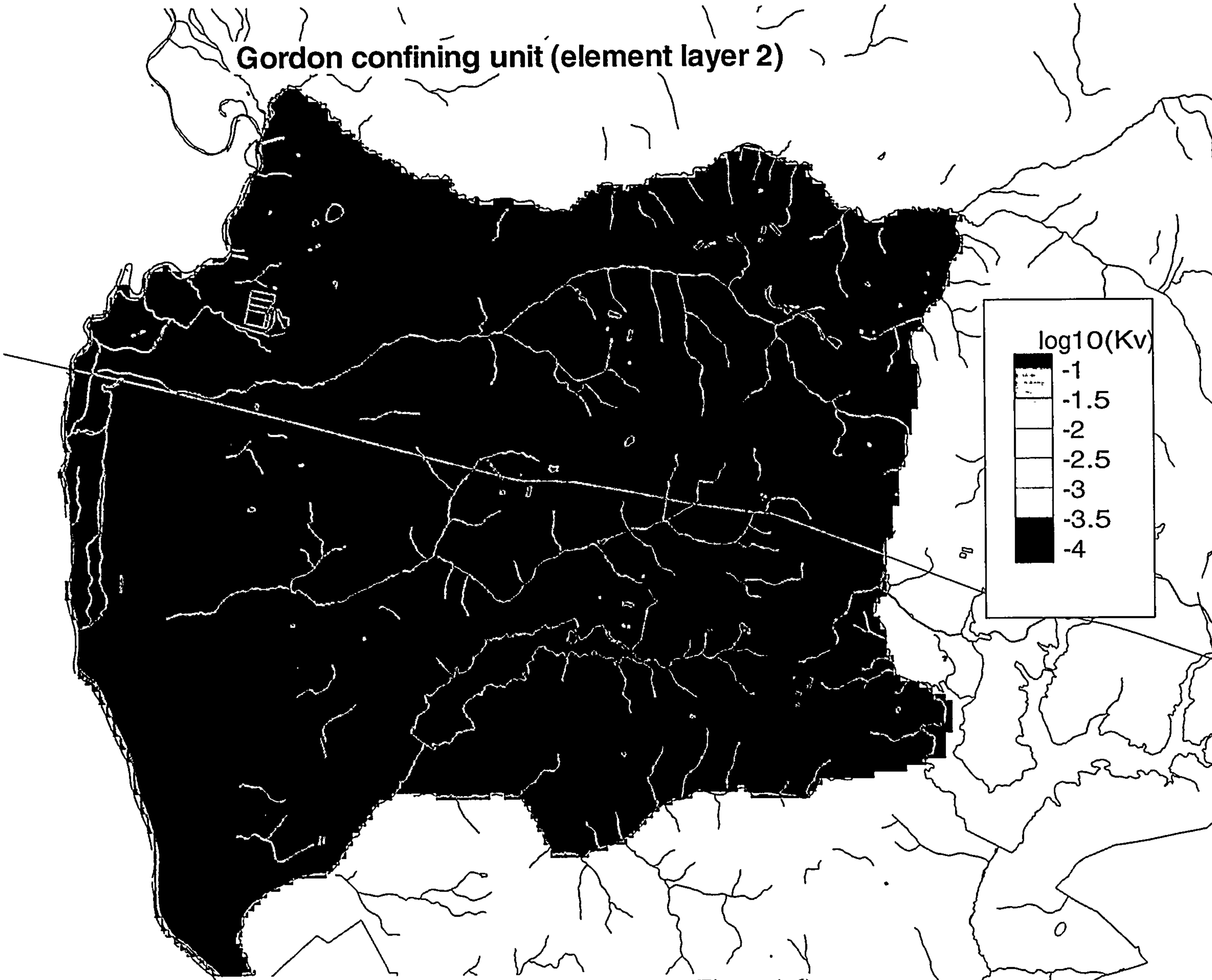
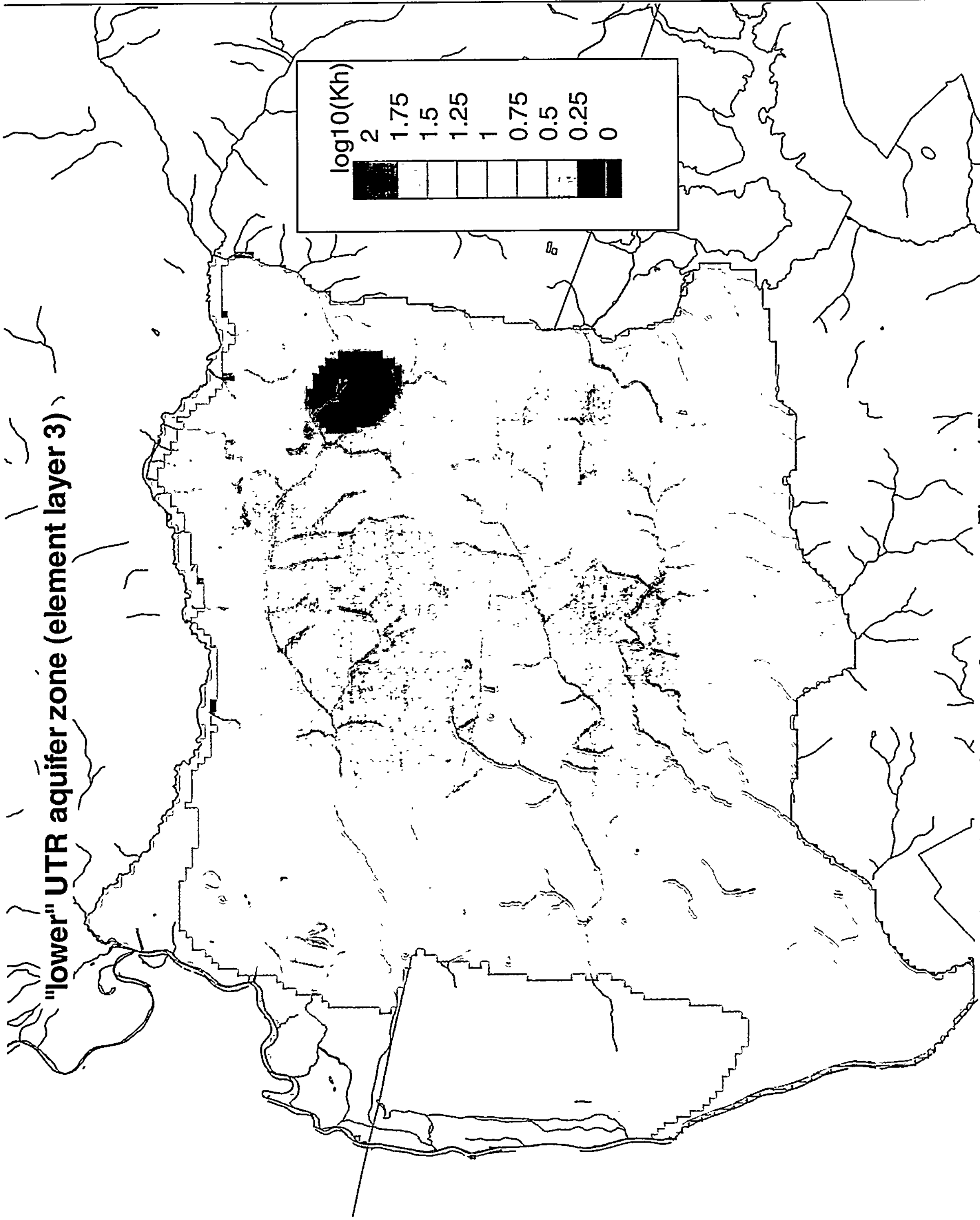

Gordon confining unit (element layer 2)

Figure G-2-6 (uncertainty case 2; compare to Figure 4-6)



"lower" UTR aquifer zone (element layer 3)

Figure G-2-7 (uncertainty case 2; compare to Figure 4-7)

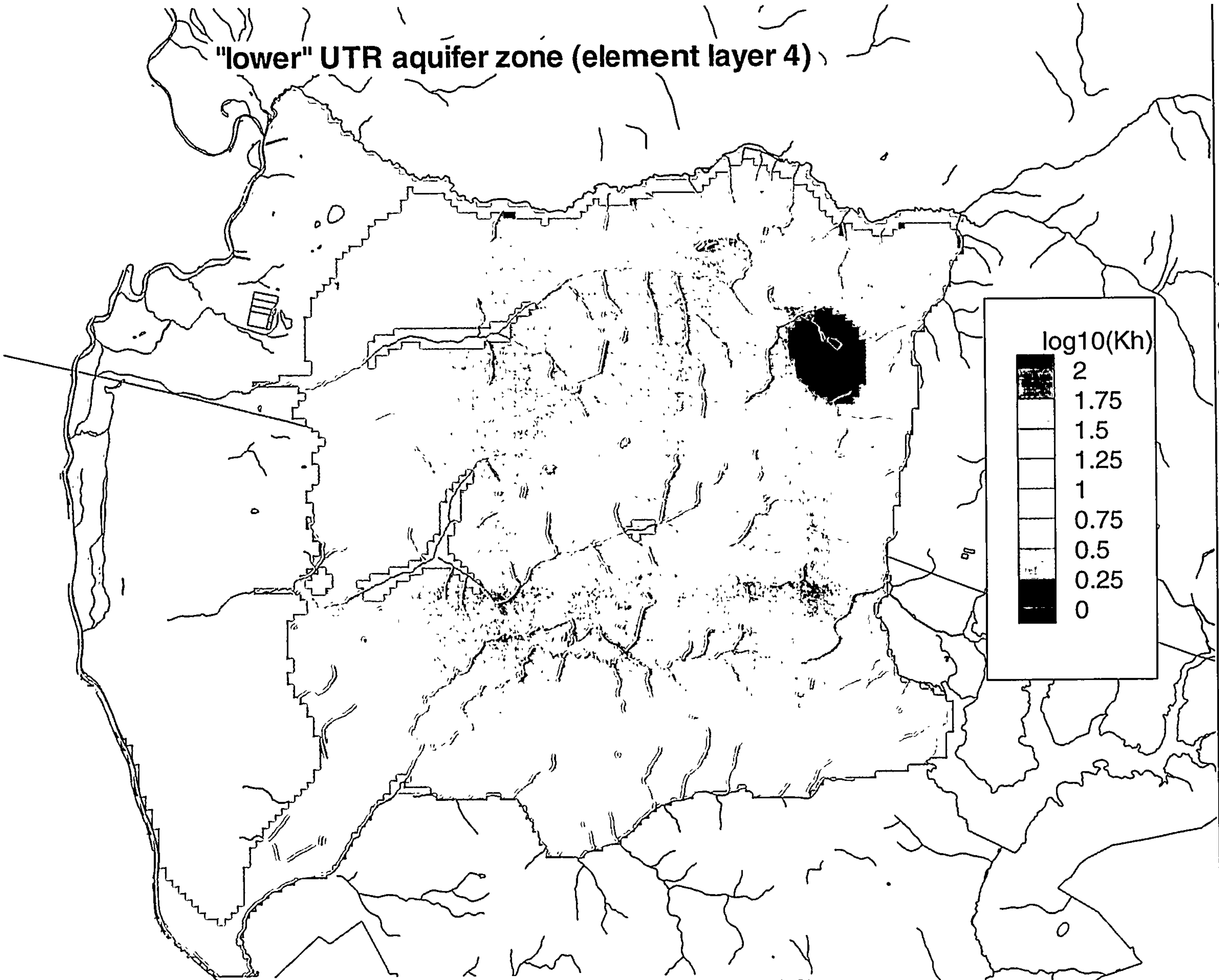


Figure G-2-8 (uncertainty case 2; compare to Figure 4-8)

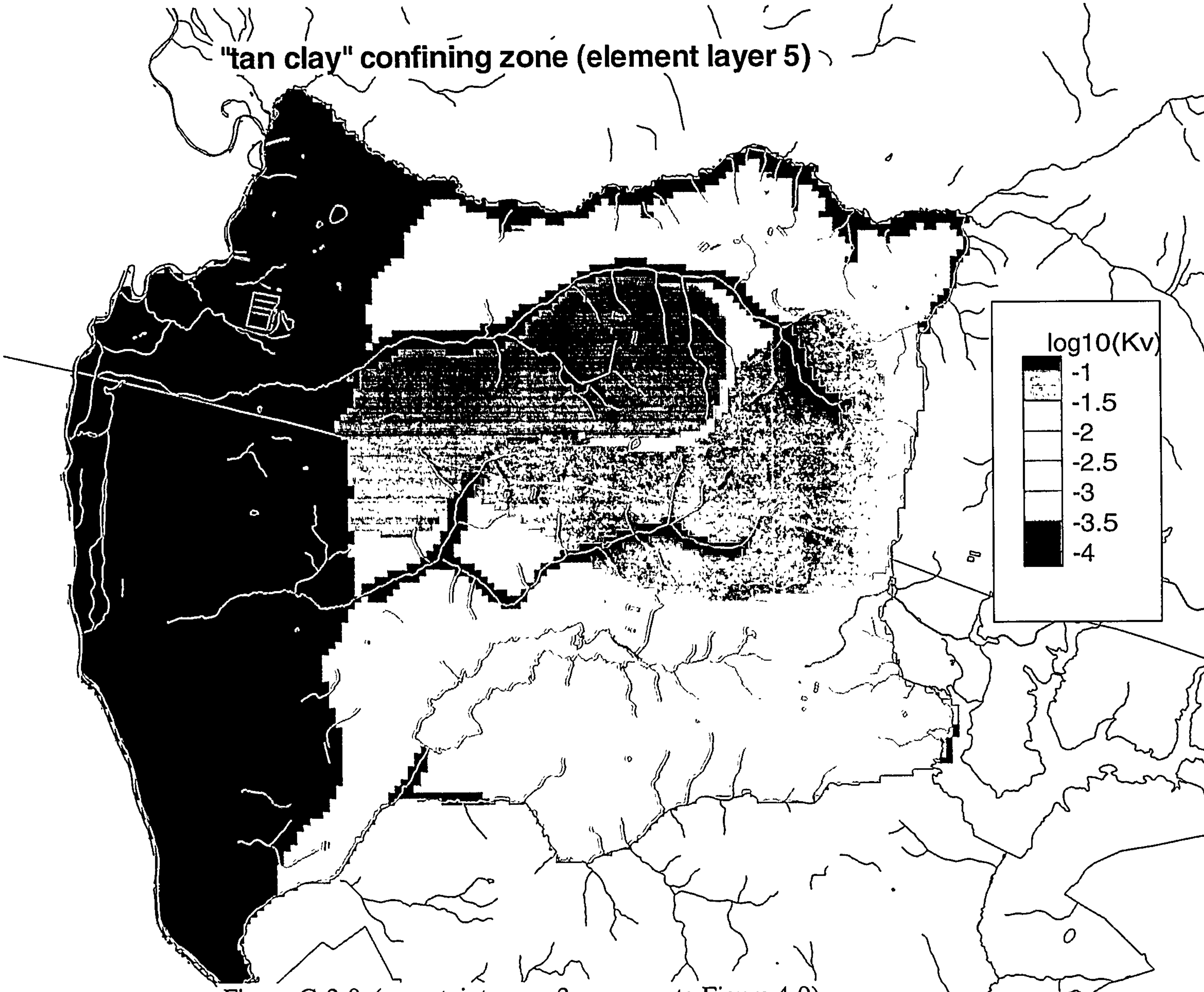


Figure G-2-9 (uncertainty case 2; compare to Figure 4-9)

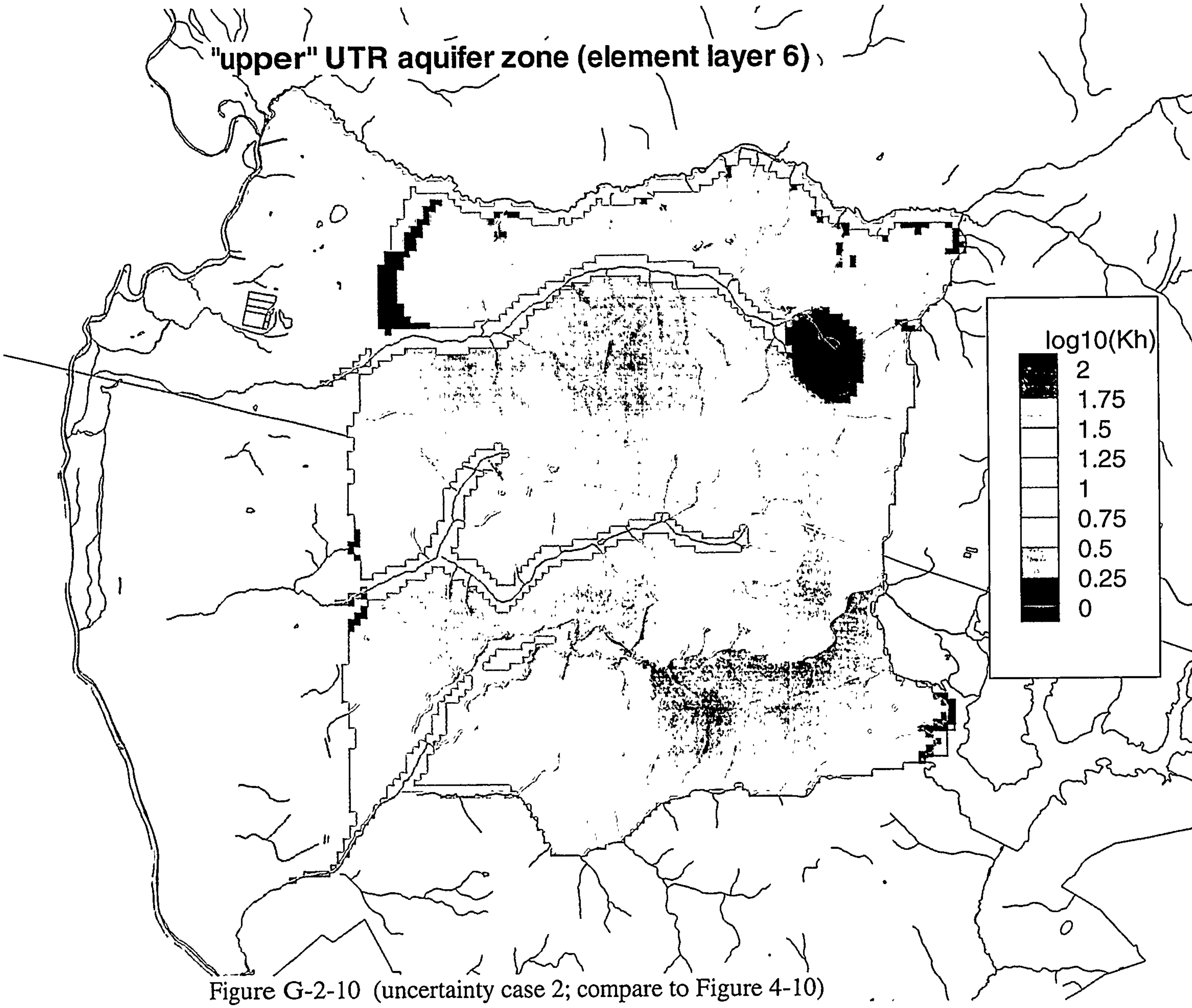


Figure G-2-10 (uncertainty case 2; compare to Figure 4-10)

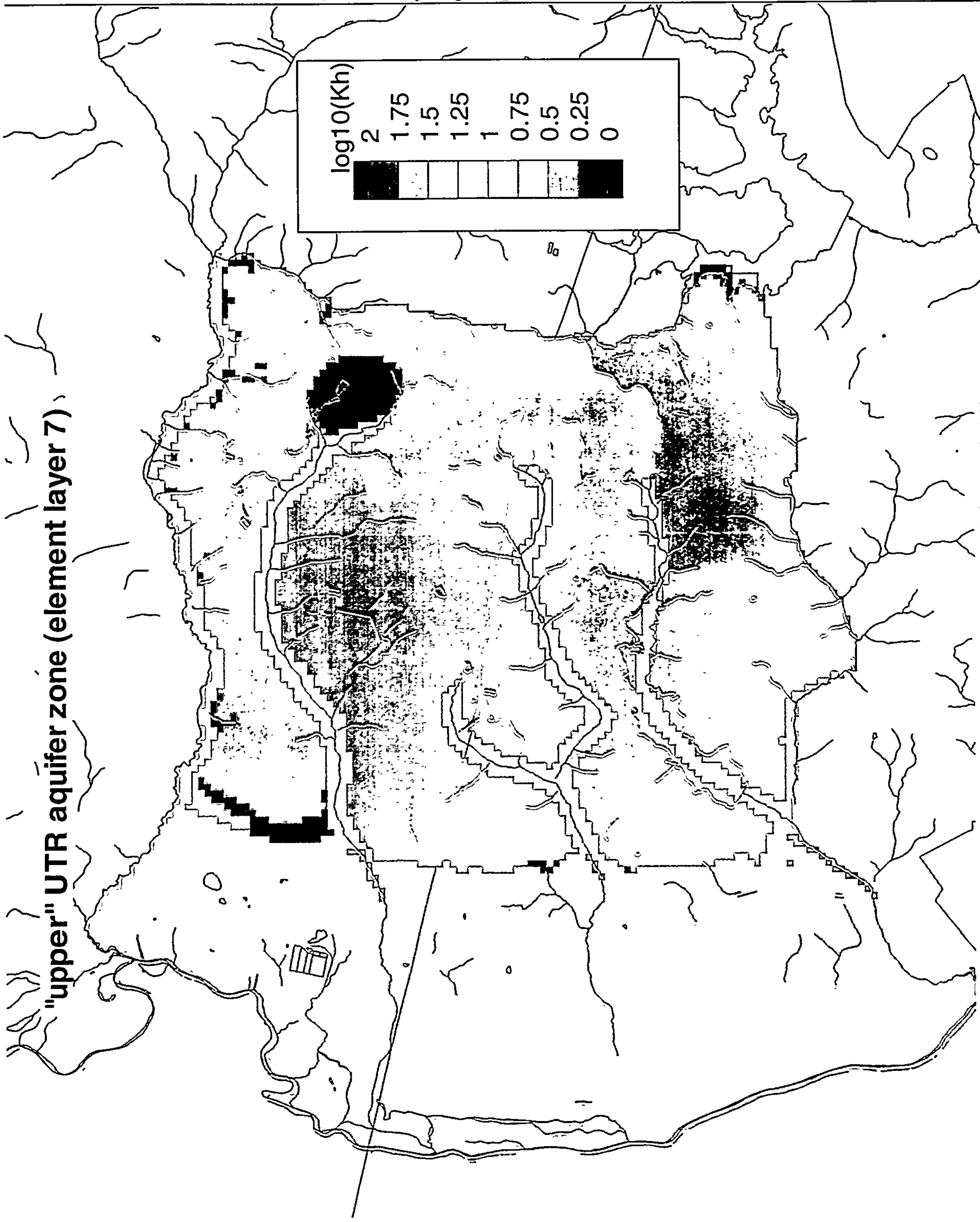


Figure G-2-11 (uncertainty case 2; compare to Figure 4-11)

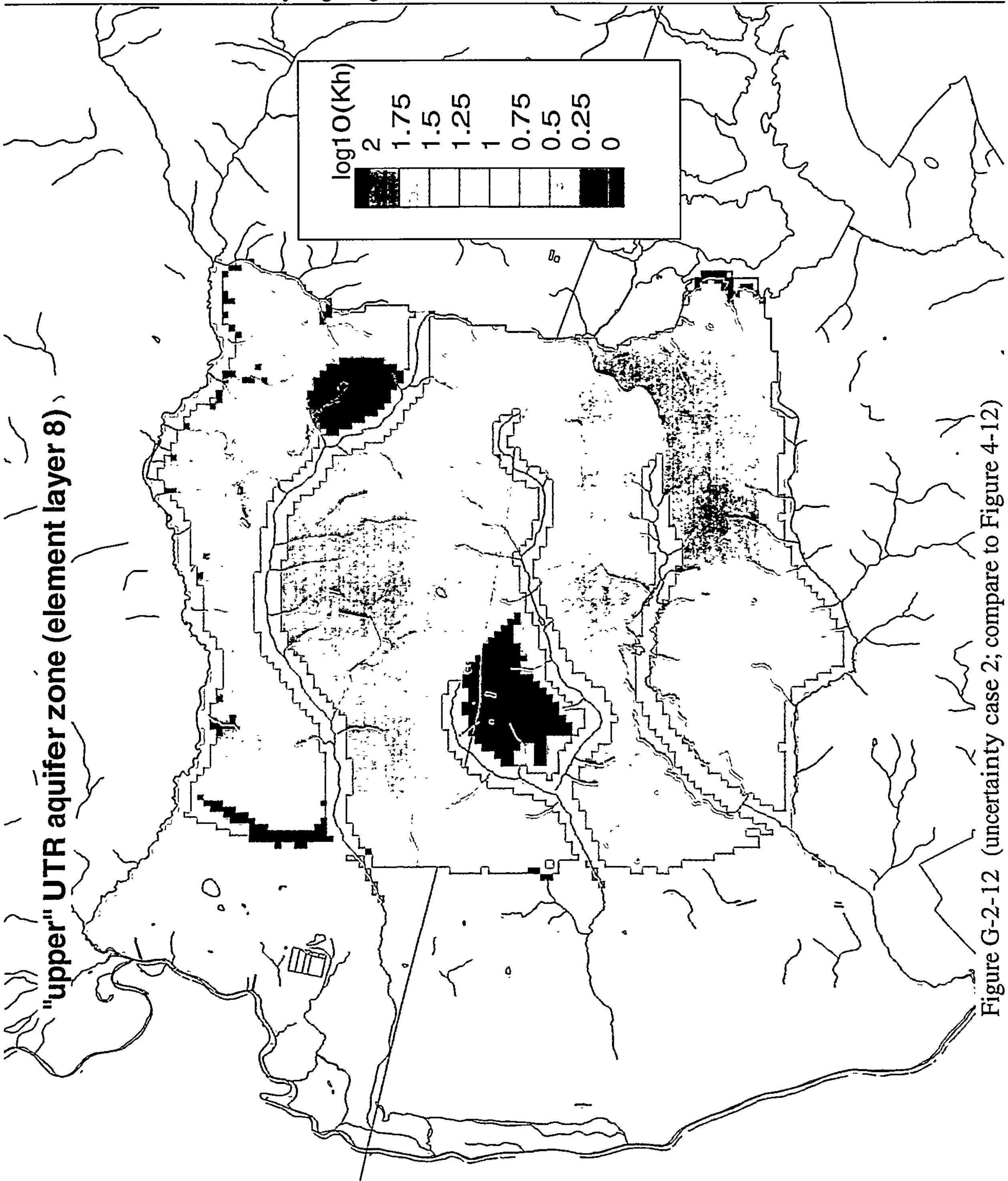


Figure G-2-12 (uncertainty case 2; compare to Figure 4-12)

Simulated hydraulic head in Gordon aquifer

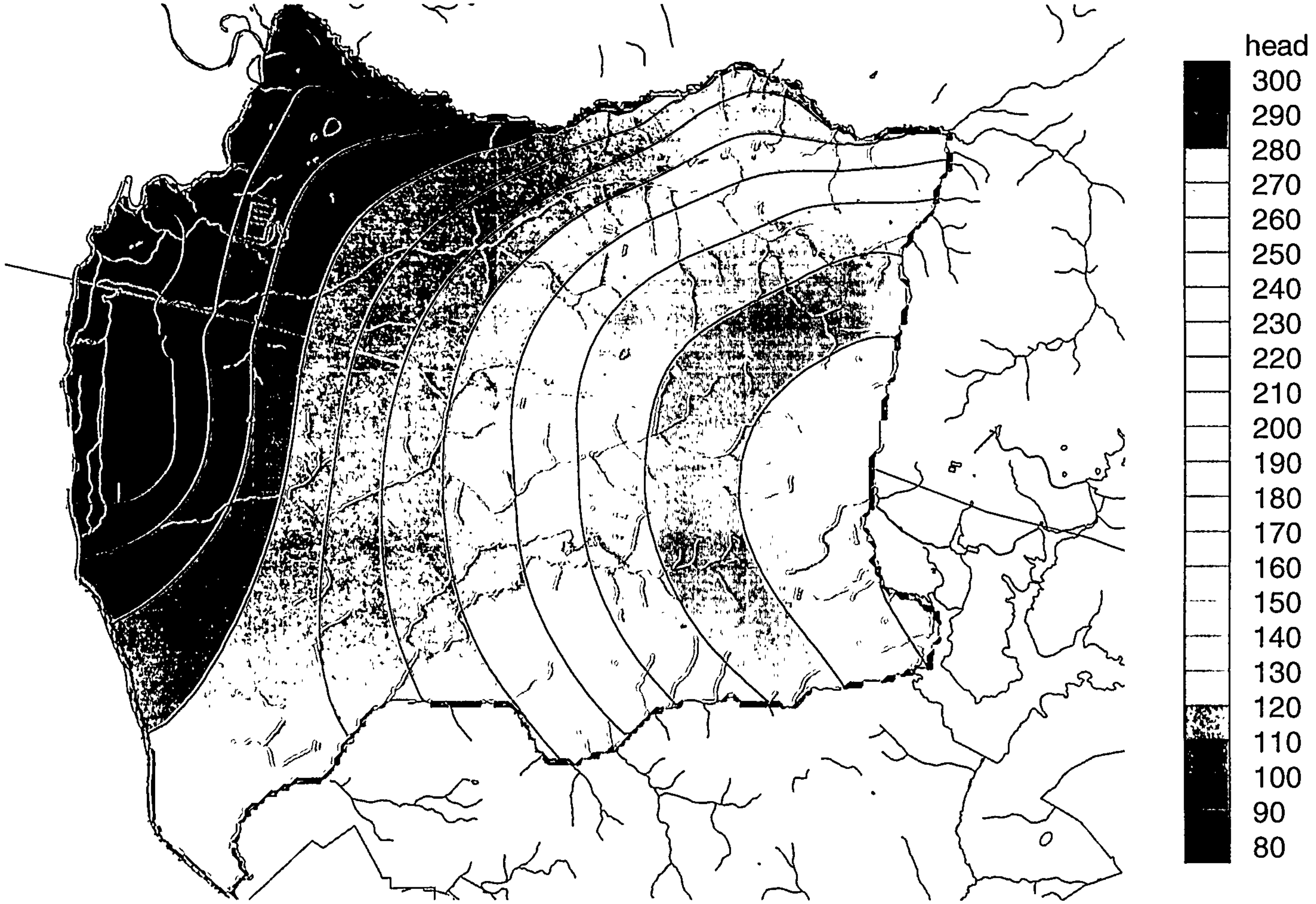


Figure G-2-13 (uncertainty case 2; compare to Figure 4-14)

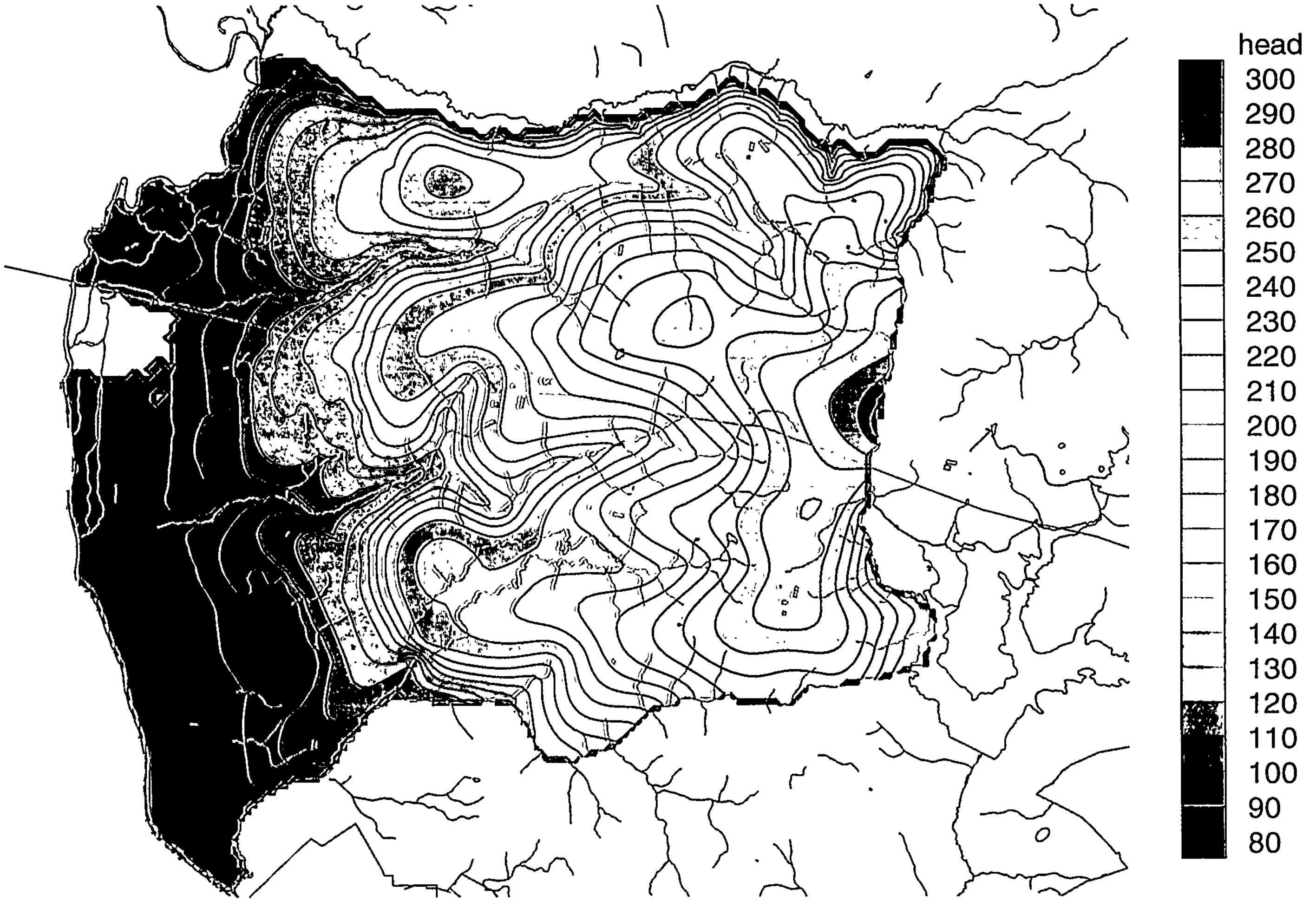

Simulated hydraulic head in "lower" UTR aquifer zone

Figure G-2-14 (uncertainty case 2; compare to Figure 4-15)

Simulated hydraulic head in "upper" UTR aquifer zone

Figure G-2-15 (uncertainty case 2; compare to Figure 4-16)

Simulated hydraulic head in aquifer zone containing water table

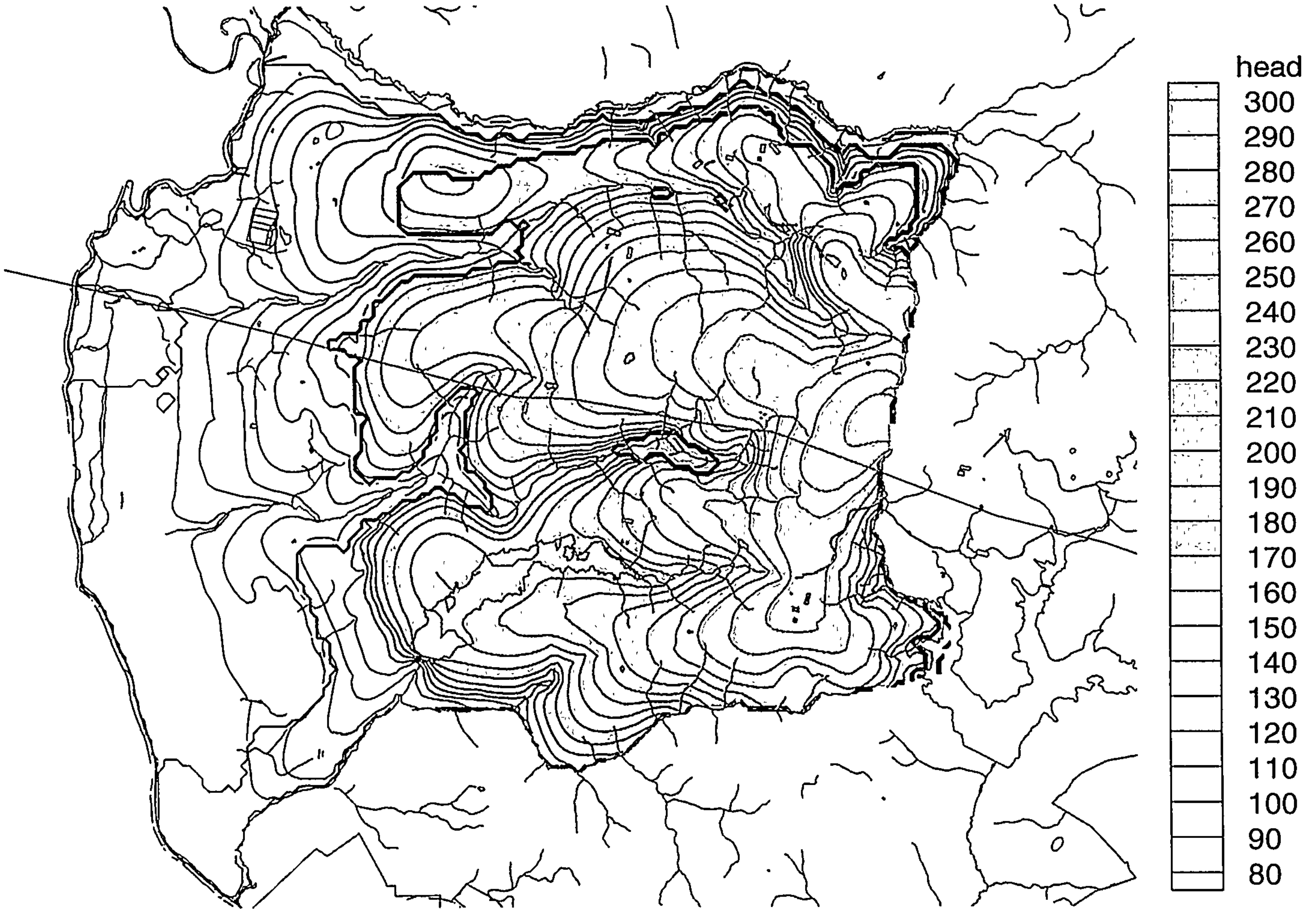


Figure G-2-16 (uncertainty case 2; compare to Figure 4-17)

Simulated water table elevation

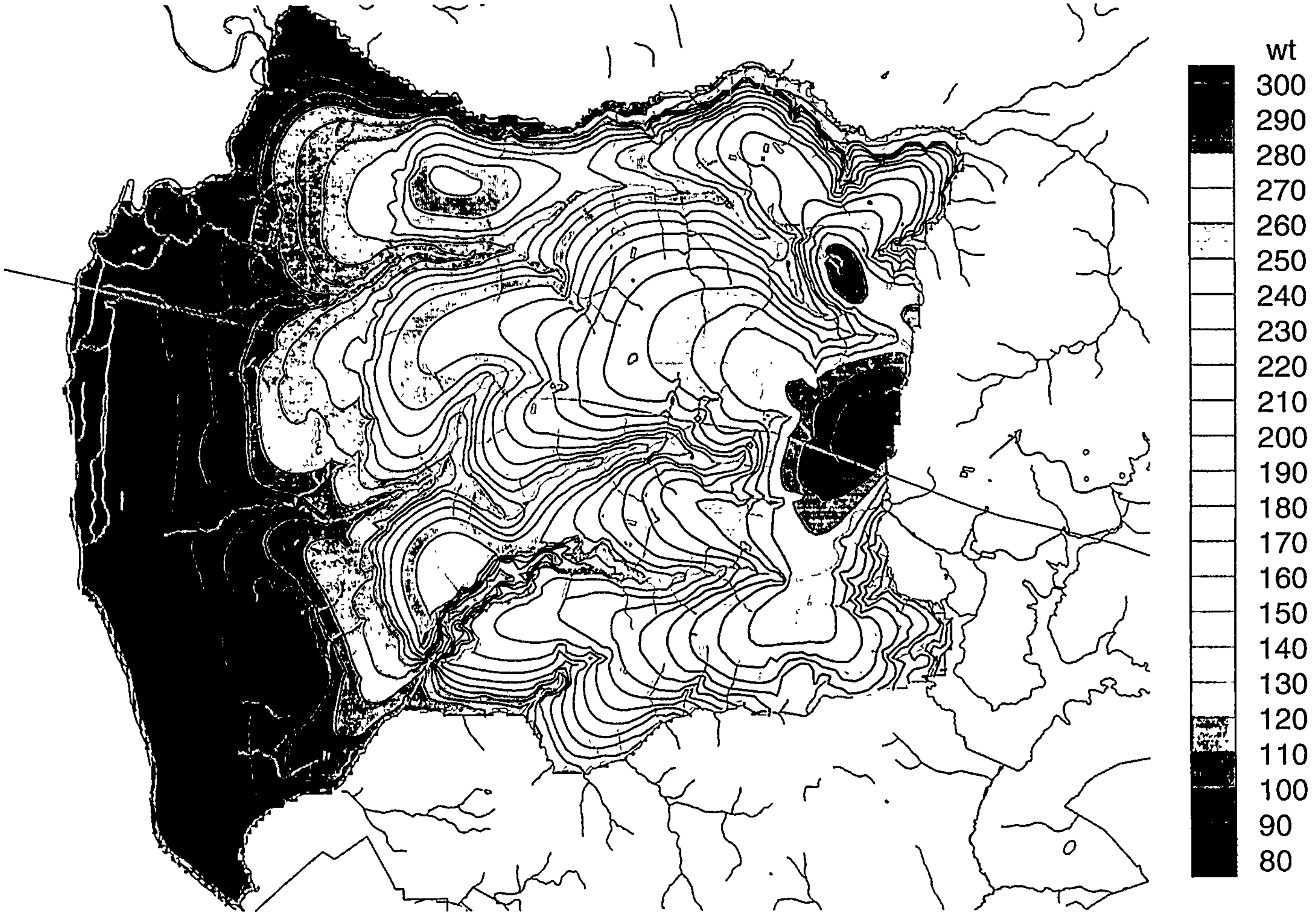


Figure G-2-17 (uncertainty case 2; compare to Figure 4-18)

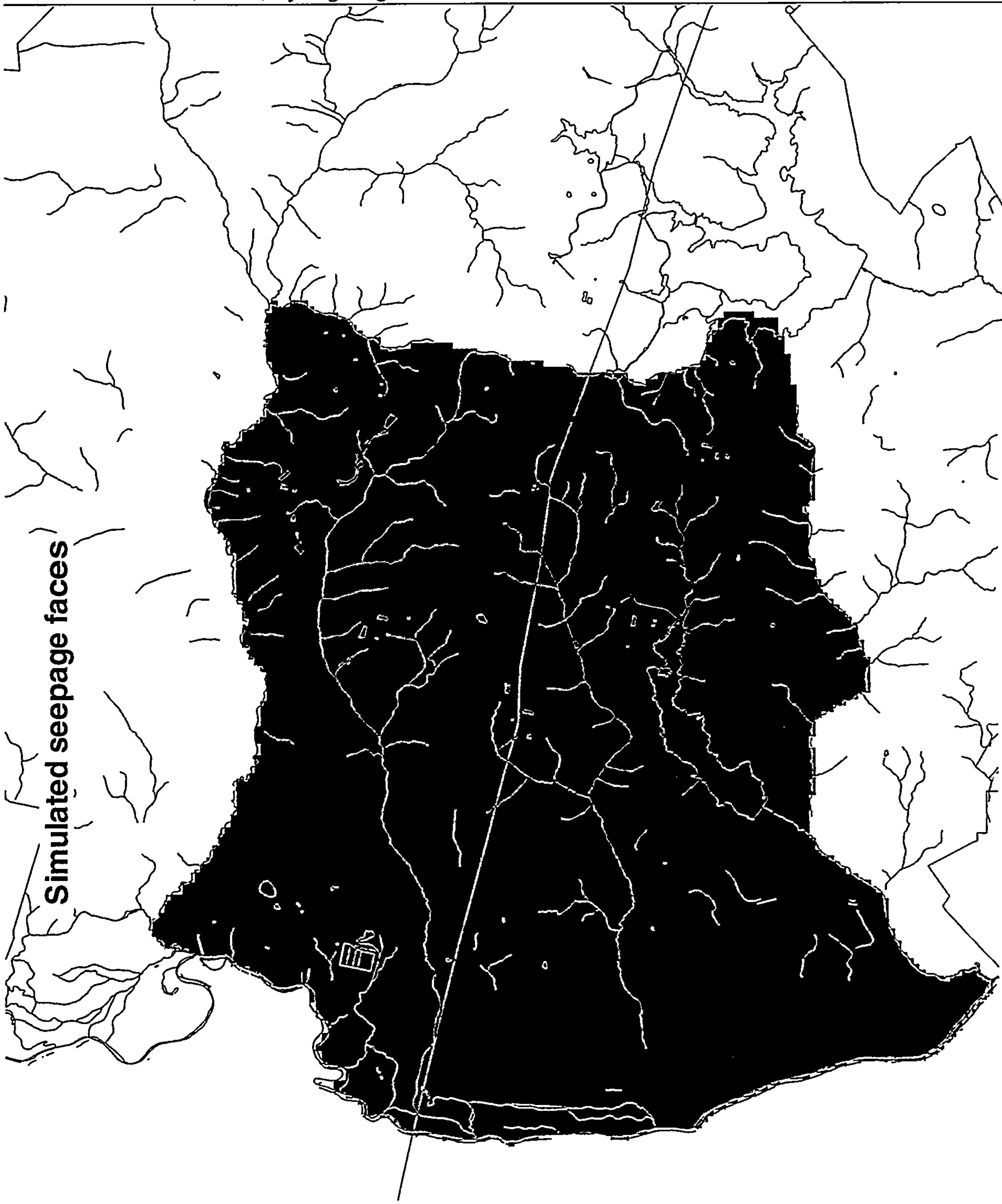
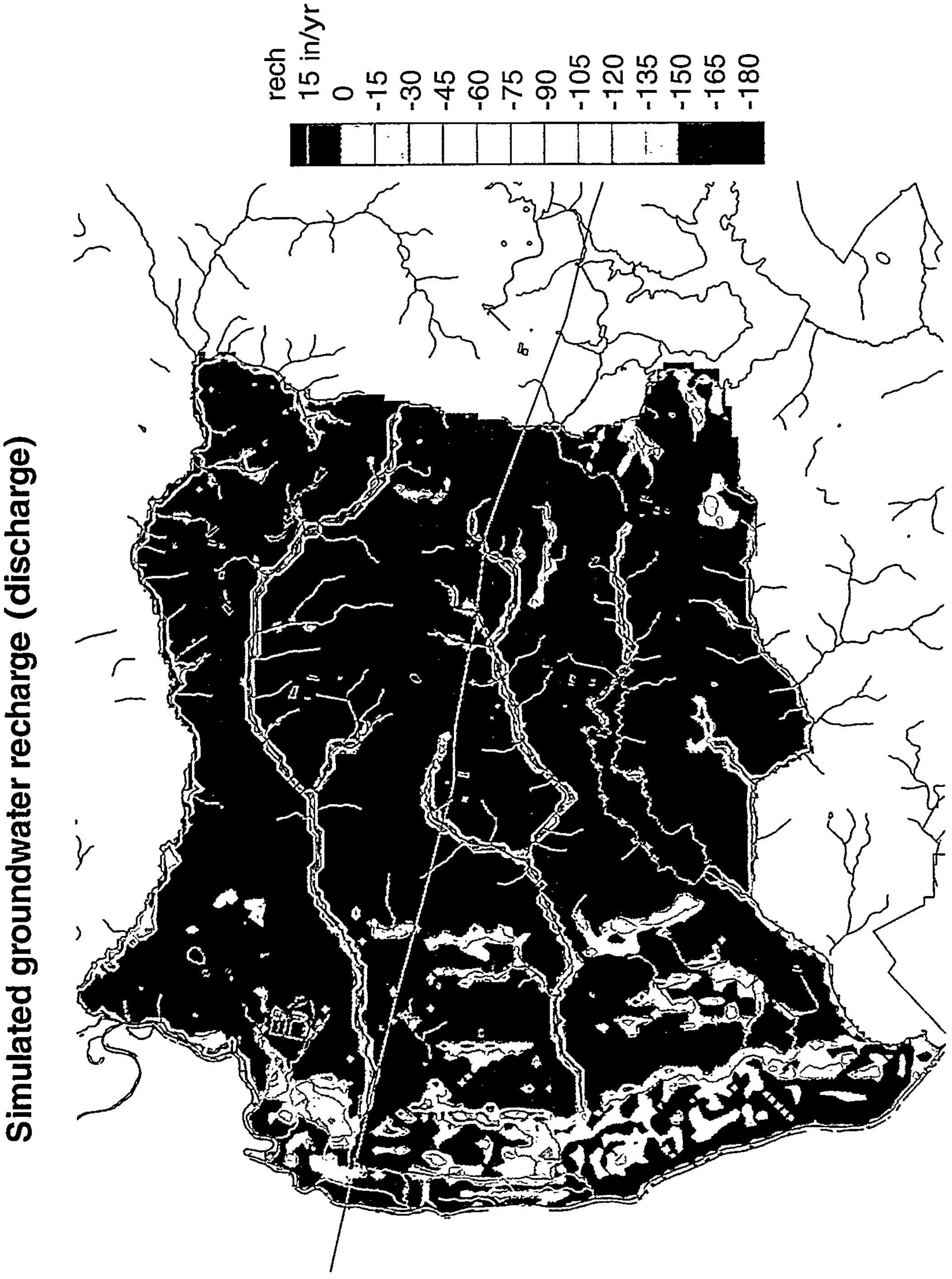


Figure G-2-18 (uncertainty case 2; compare to Figure 4-22)



Simulated groundwater recharge (discharge)

Figure G-2-19 (uncertainty case 2; compare to Figure 4-23)

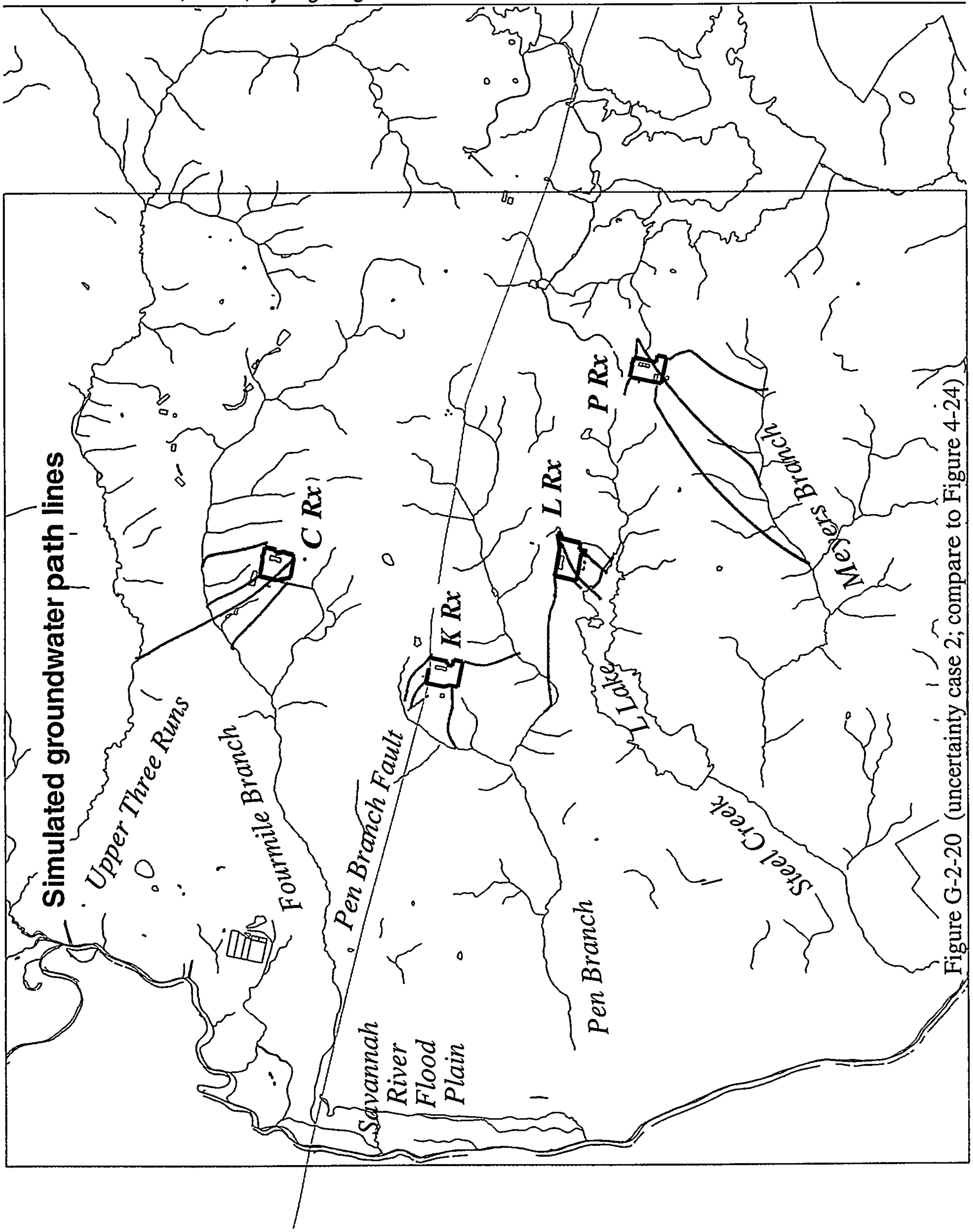


Figure G-2-20 (uncertainty case 2; compare to Figure 4-24)

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Simulation results for uncertainty case 3

Uncertainty case 3 involves an increase in Gordon confining unit vertical conductivity by a factor of 5 to 5×10^{-4} ft/day (Table 4-4). Summary calibration results are provided in Table 4-5. This appendix presents detailed simulation results for uncertainty case 3 for comparison to the nominal results shown in figures in the main text. The correspondence between figures for the nominal and uncertainty case 3 is as follows:

Plot type	Nominal case	Uncertainty case 3
Head residual summary	Figure 4-1	Figure G-3-1
Head residuals in Gordon aquifer	Figure 4-2	Figure G-3-2
Head residuals in "lower" UTRA	Figure 4-3	Figure G-3-3
Head residuals in "upper" UTRA	Figure 4-4	Figure G-3-4
Kh in element layer 1	Figure 4-5	Figure G-3-5
Kv in element layer 2	Figure 4-6	Figure G-3-6
Kh in element layer 3	Figure 4-7	Figure G-3-7
Kh in element layer 4	Figure 4-8	Figure G-3-8
Kv in element layer 5	Figure 4-9	Figure G-3-9
Kh in element layer 6	Figure 4-10	Figure G-3-10
Kh in element layer 7	Figure 4-11	Figure G-3-11
Kh in element layer 8	Figure 4-12	Figure G-3-12
Gordon aquifer head	Figure 4-14	Figure G-3-13
"Lower" UTRA head	Figure 4-15	Figure G-3-14
"Upper" UTRA head	Figure 4-16	Figure G-3-15
Head in aquifer containing water table	Figure 4-17	Figure G-3-16
Water table	Figure 4-18	Figure G-3-17
Seepage faces	Figure 4-22	Figure G-3-18
Recharge/discharge	Figure 4-23	Figure G-3-19
Example particle tracing	Figure 4-24	Figure G-3-20

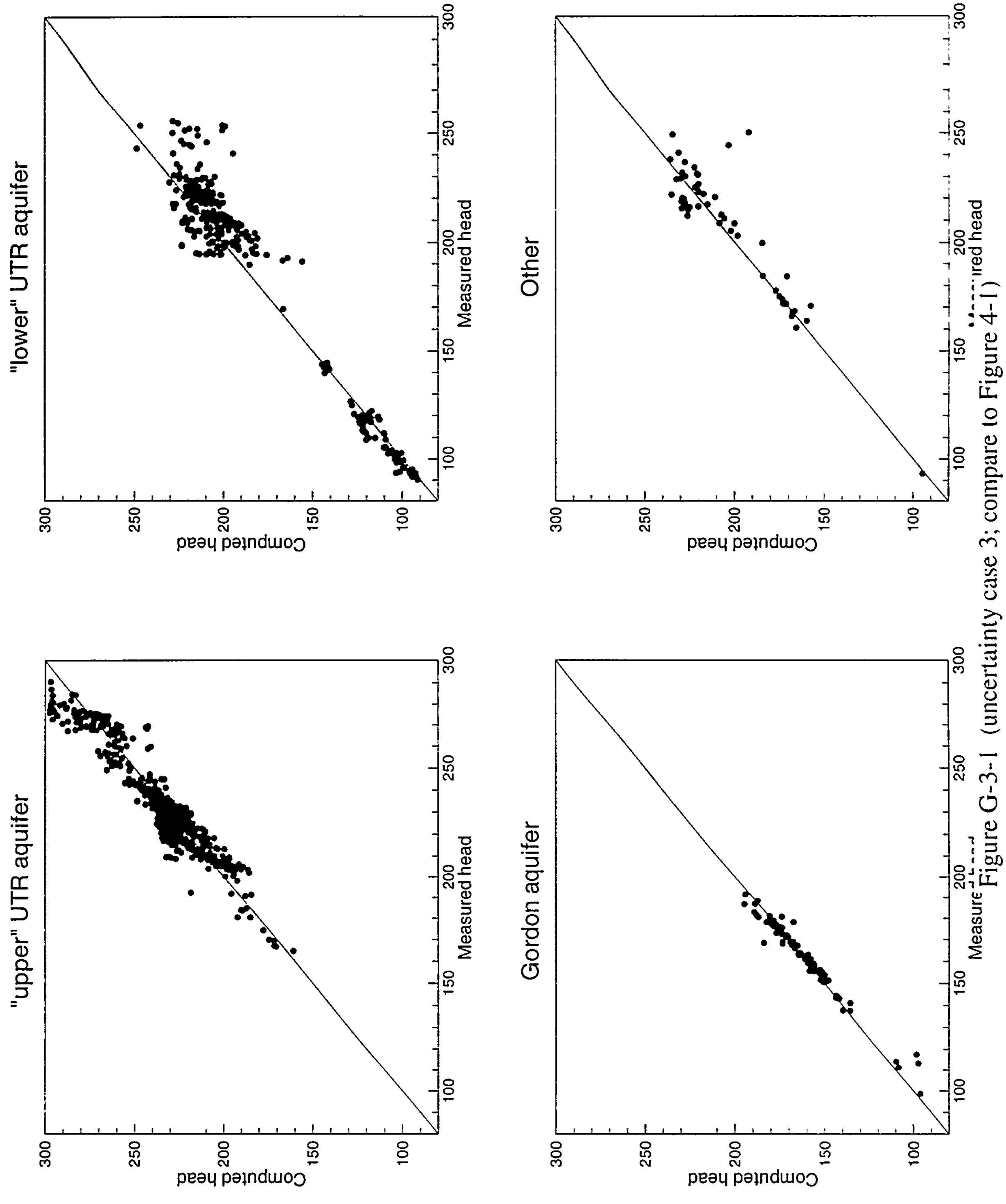


Figure G-3-1 (uncertainty case 3; compare to Figure 4-1)

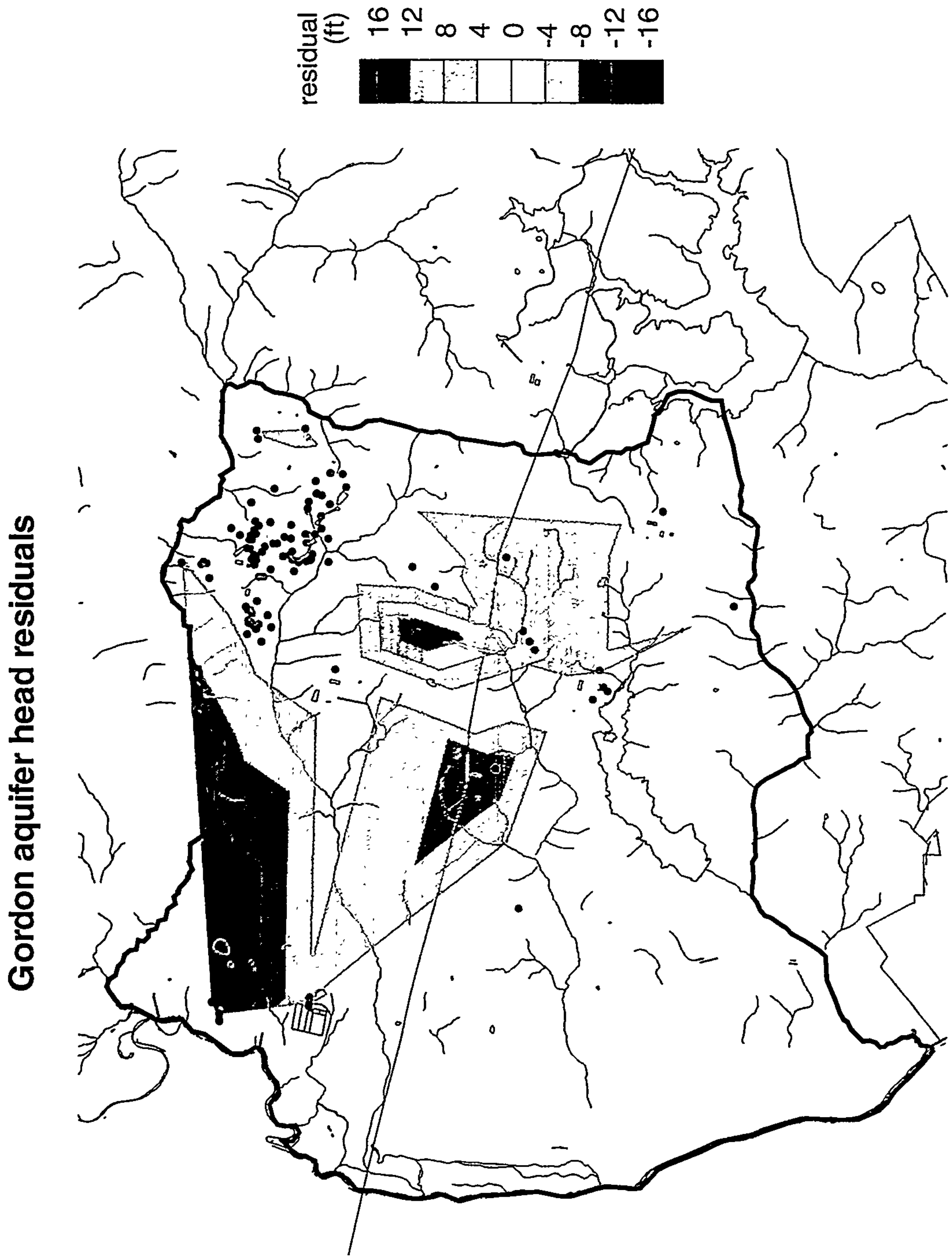


Figure G-3-2 (uncertainty case 3; compare to Figure 4-2)

"lower" UTR aquifer zone

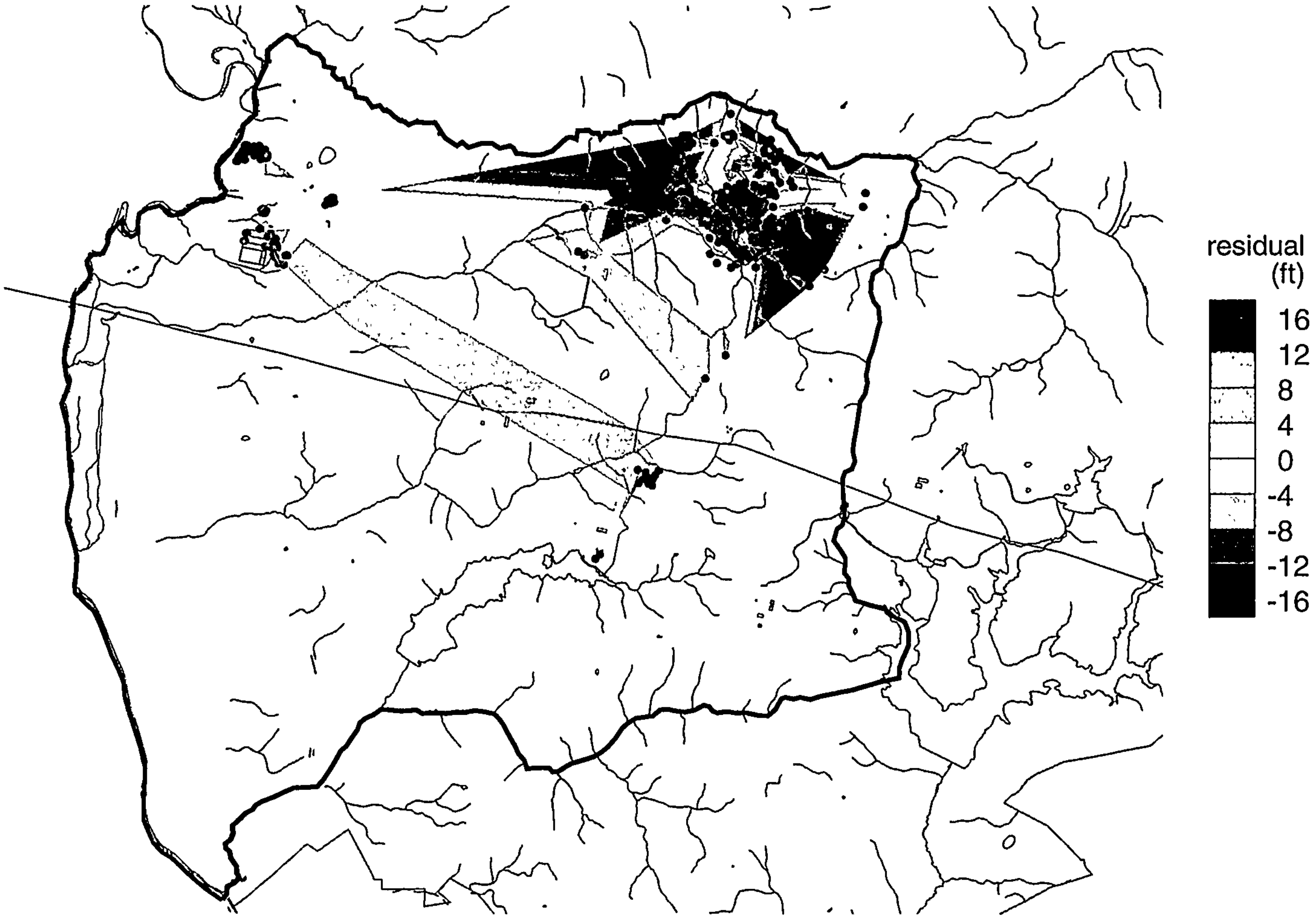
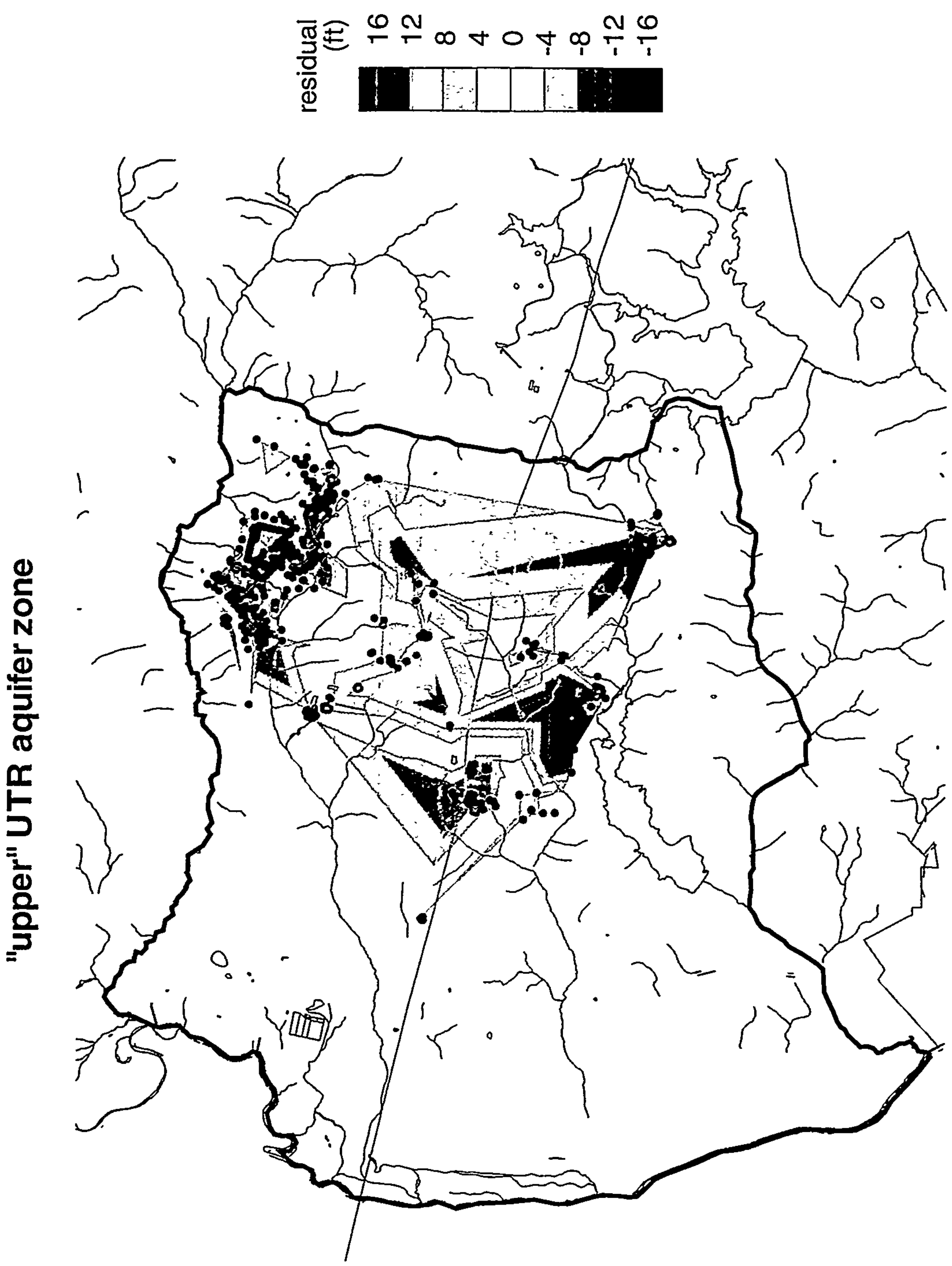


Figure G-3-3 (uncertainty case 3; compare to Figure 4-3)



"upper" UTR aquifer zone

Figure G-3-4 (uncertainty case 3; compare to Figure 4-4)

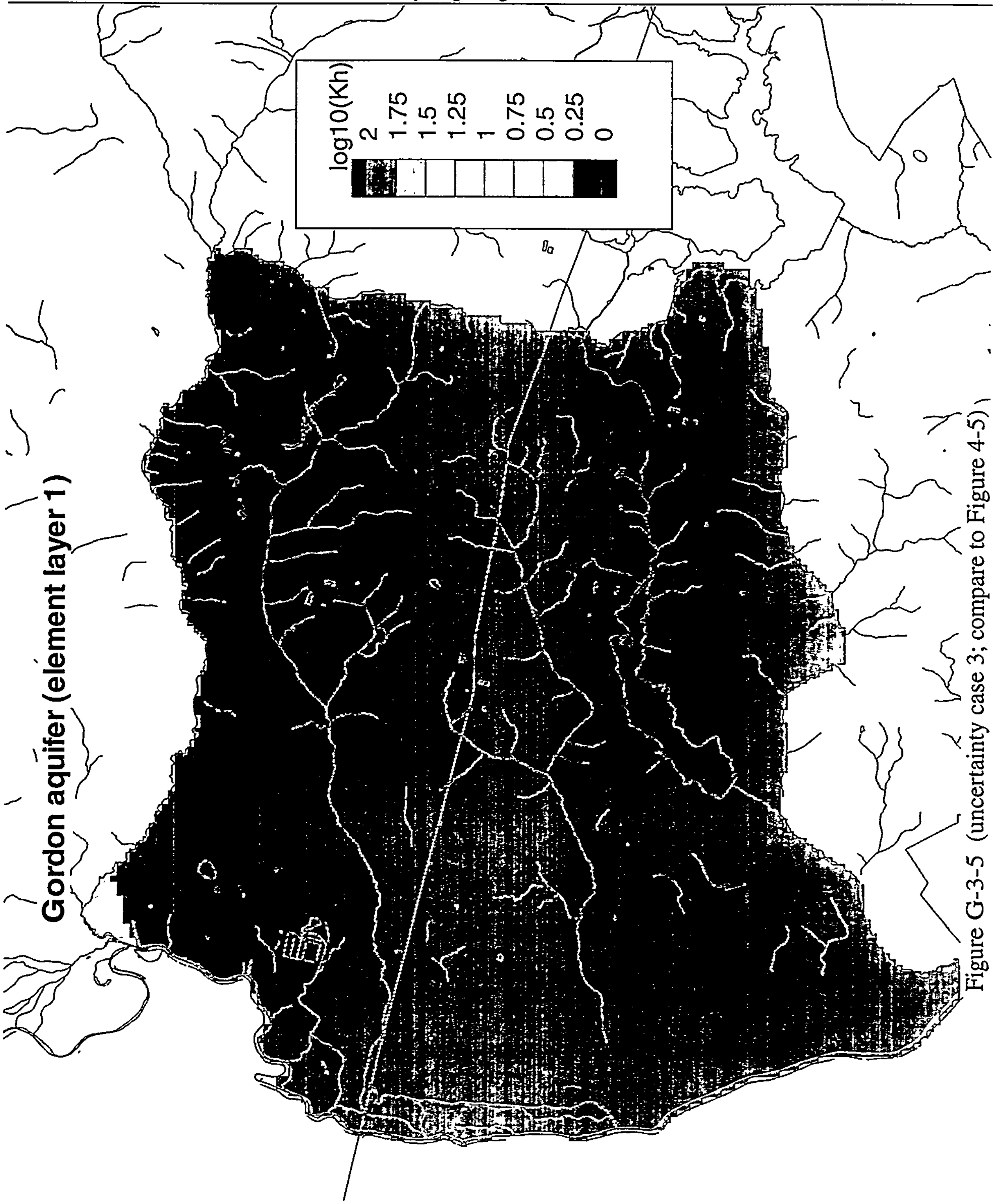


Figure G-3-5 (uncertainty case 3; compare to Figure 4-5)

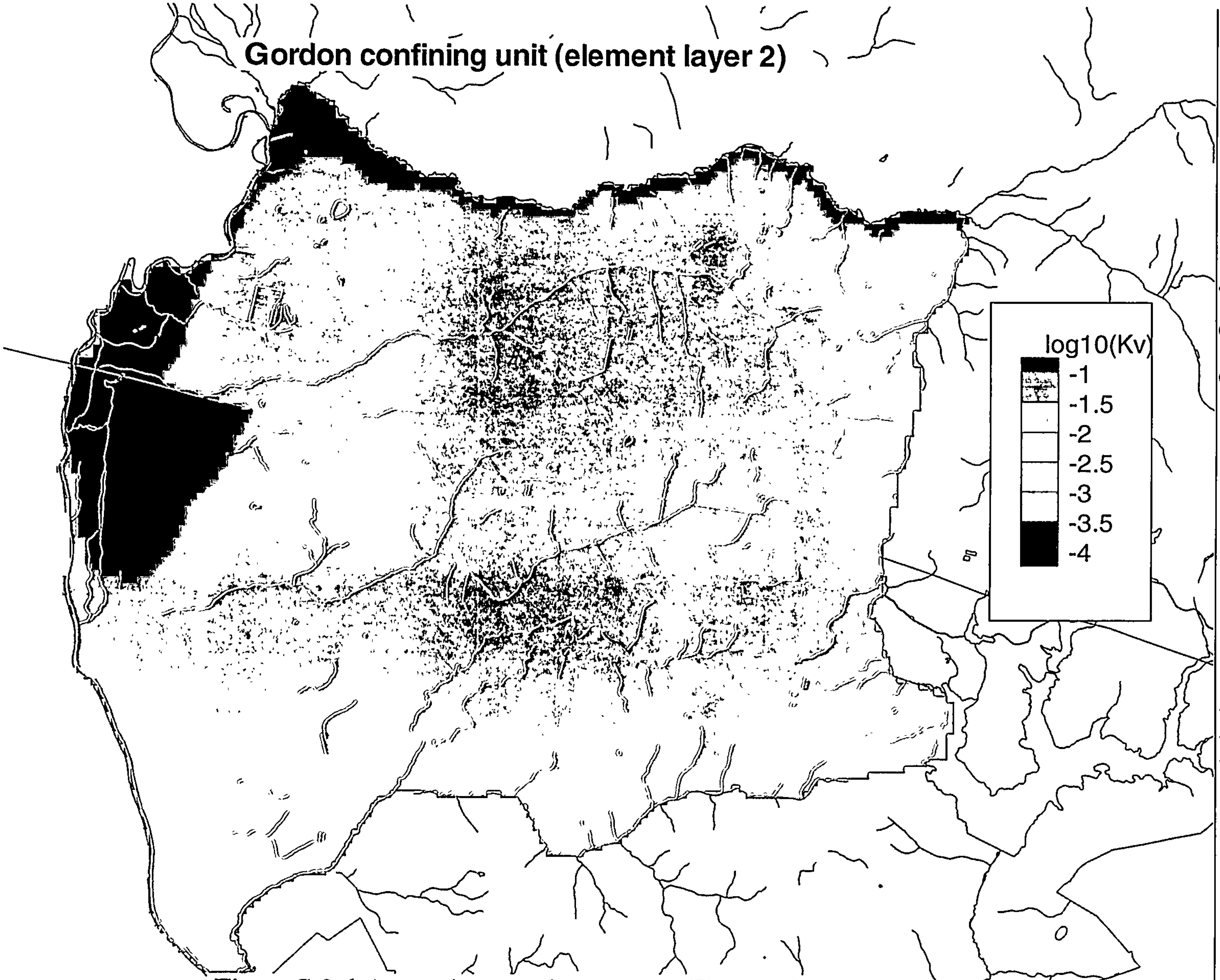
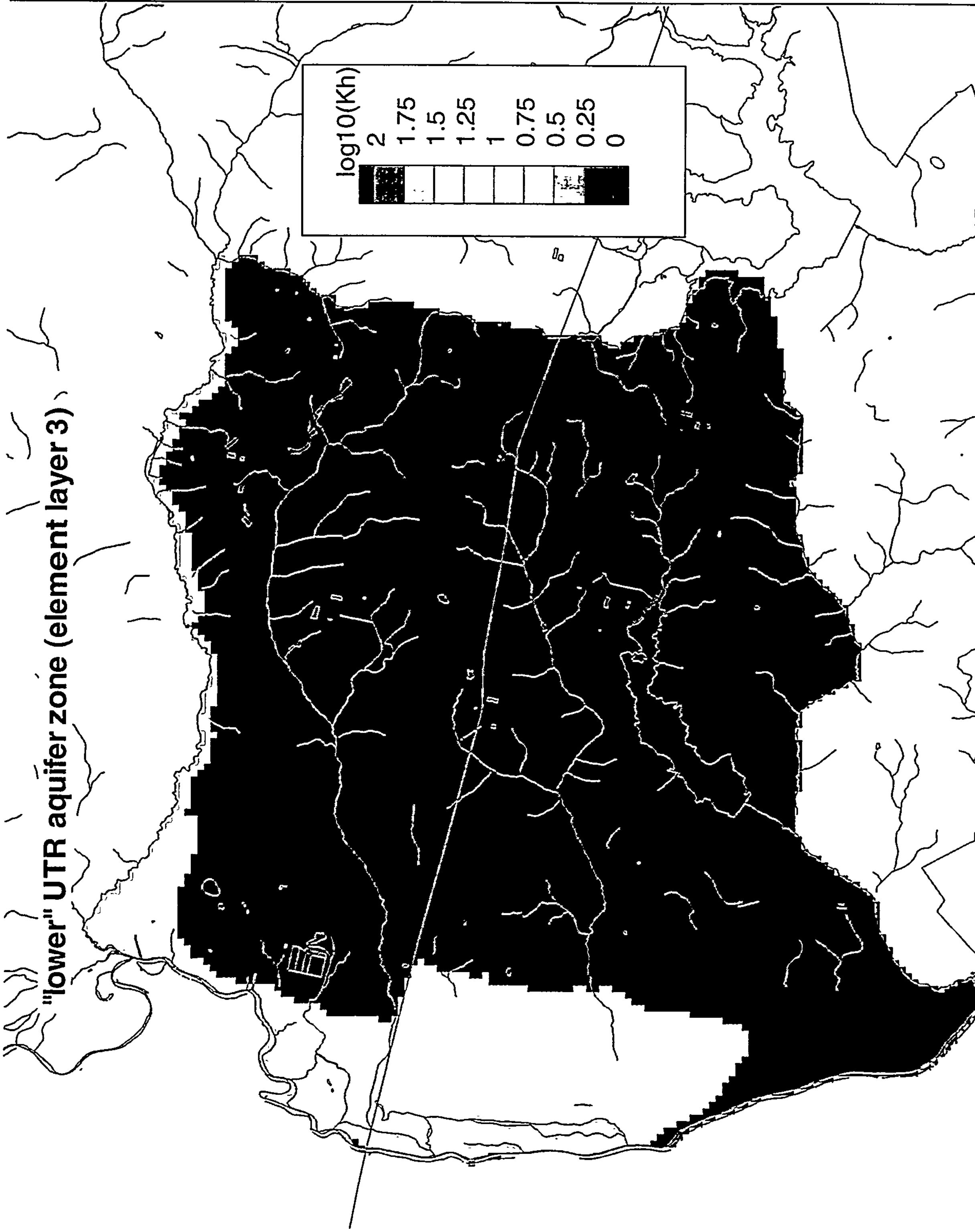


Figure G-3-6 (uncertainty case 3; compare to Figure 4-6)



"lower" UTR aquifer zone (element layer 3)

Figure G-3-7 (uncertainty case 3; compare to Figure 4-7)

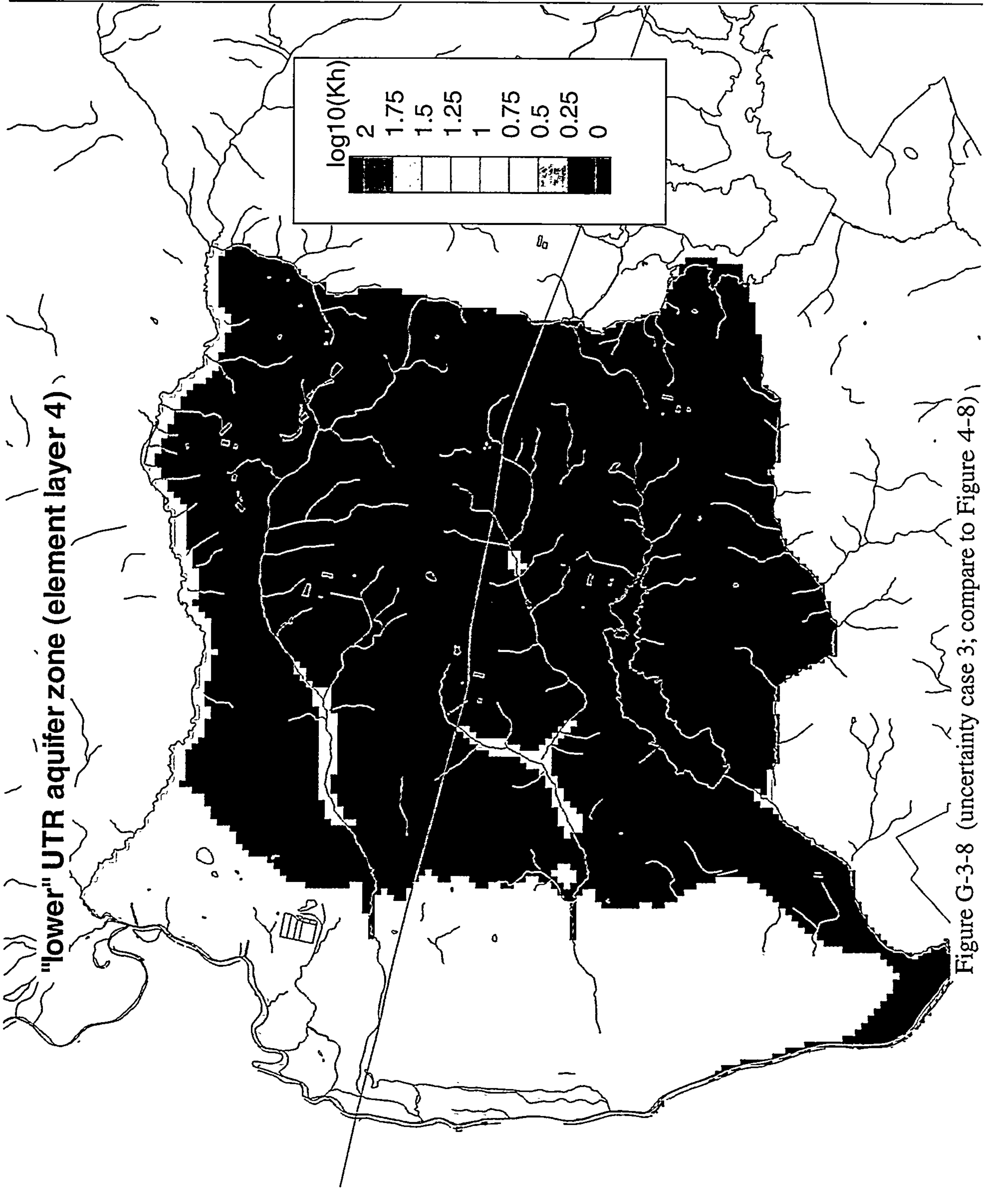

"lower" UTR aquifer zone (element layer 4)

Figure G-3-8 (uncertainty case 3; compare to Figure 4-8)

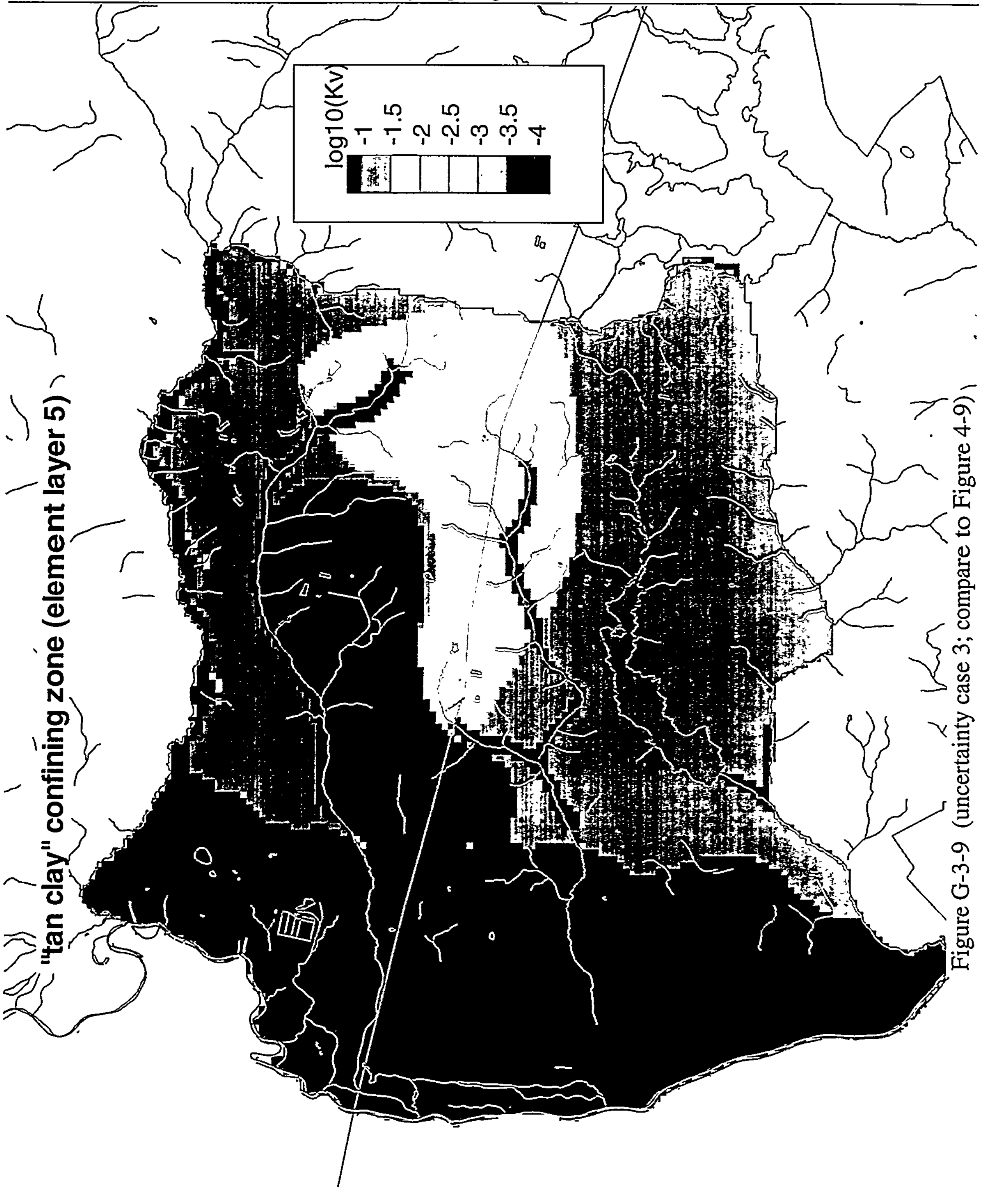


Figure G-3-9 (uncertainty case 3; compare to Figure 4-9)

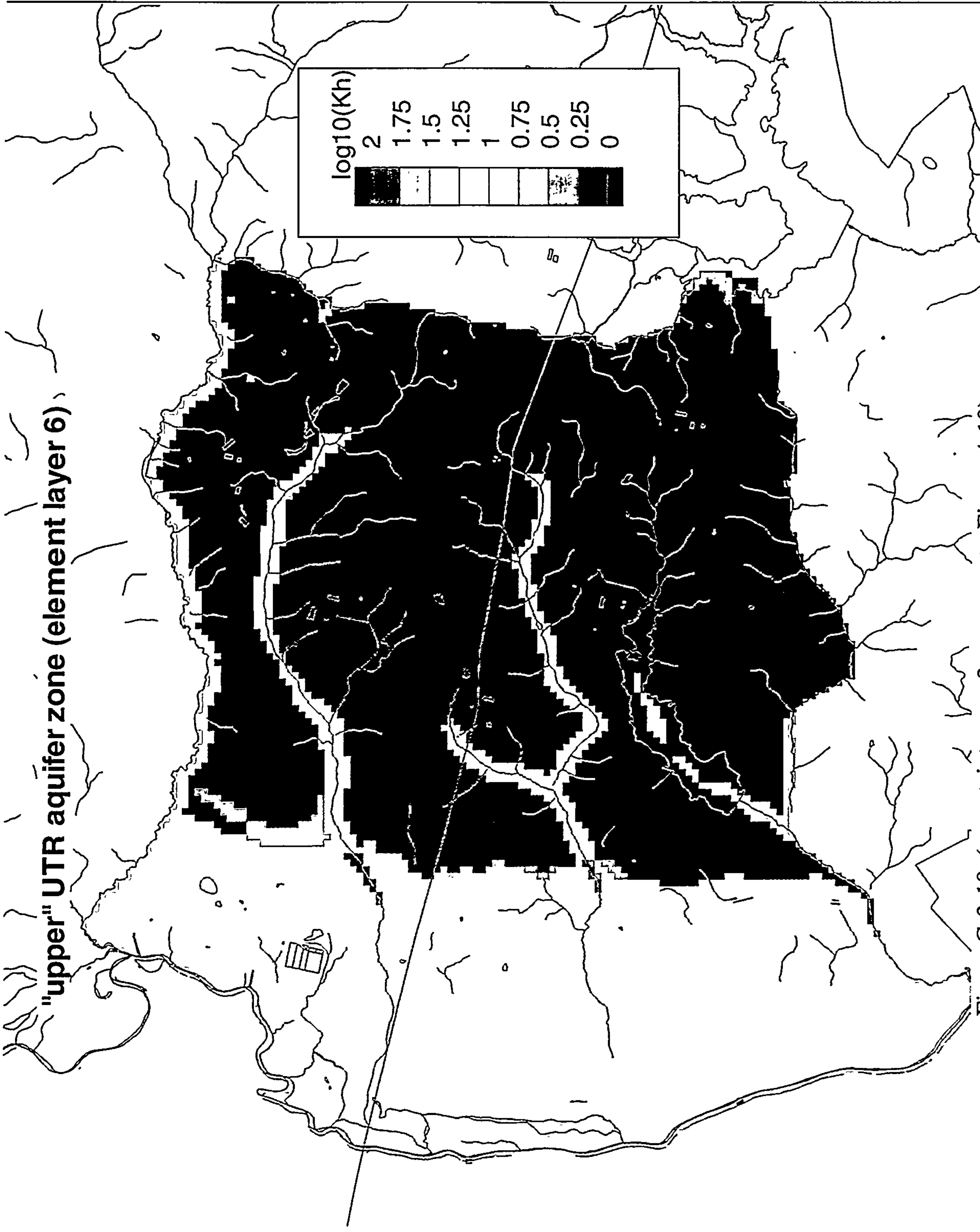
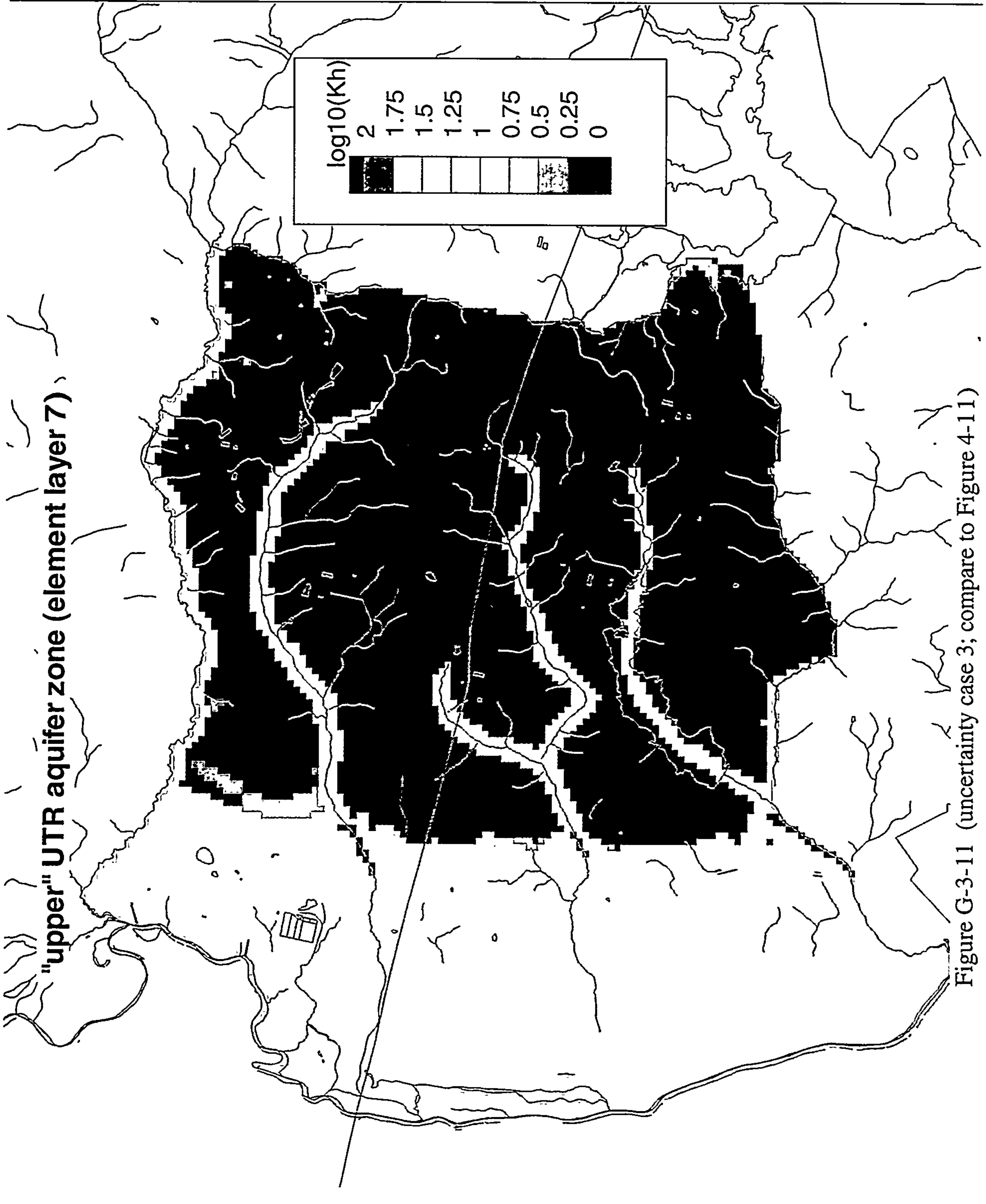


Figure G-3-10 (uncertainty case 3; compare to Figure 4-10)



"upper" UTR aquifer zone (element layer 7)

Figure G-3-11 (uncertainty case 3; compare to Figure 4-11)

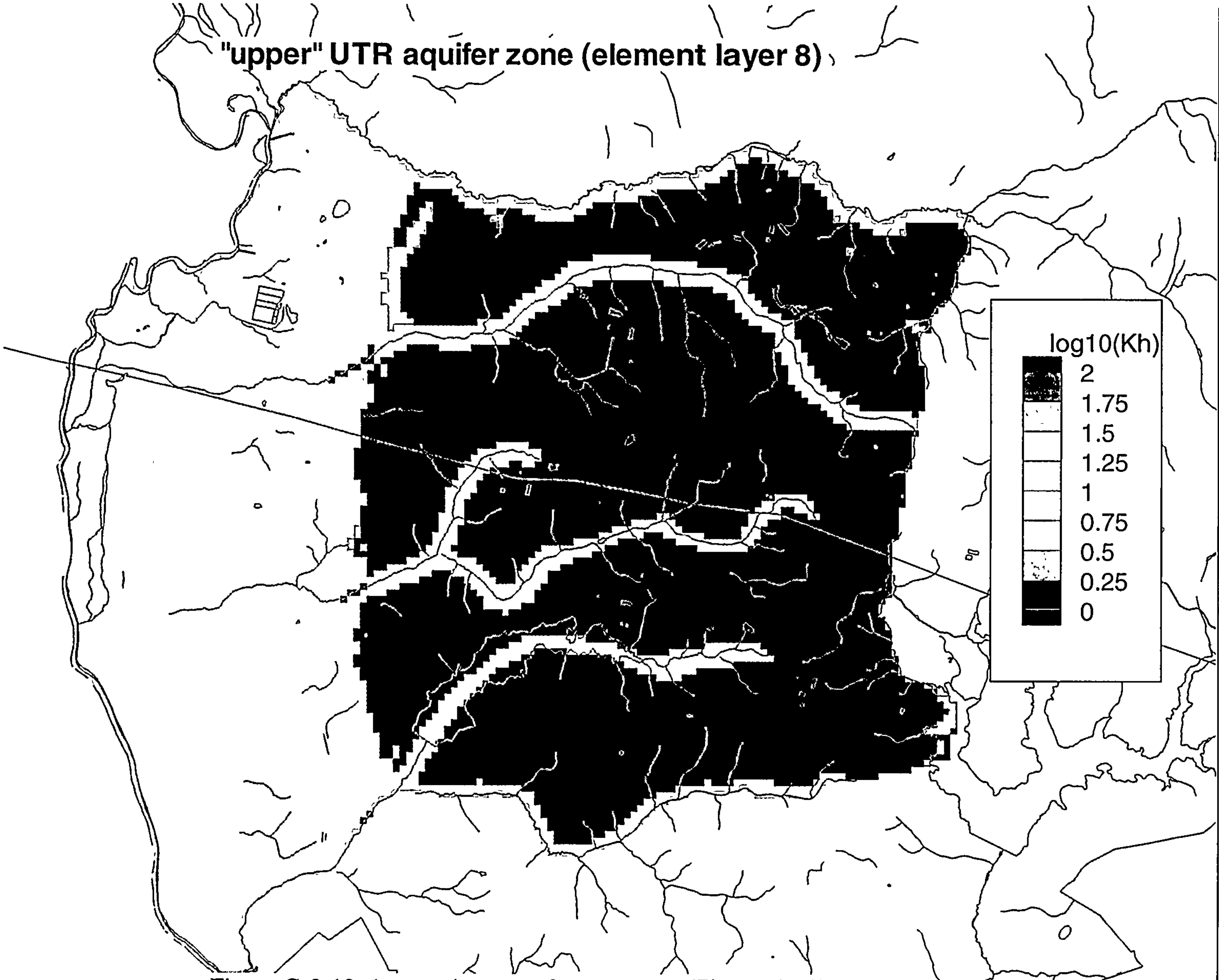


Figure G-3-12 (uncertainty case 3; compare to Figure 4-12)

Simulated hydraulic head in Gordon aquifer

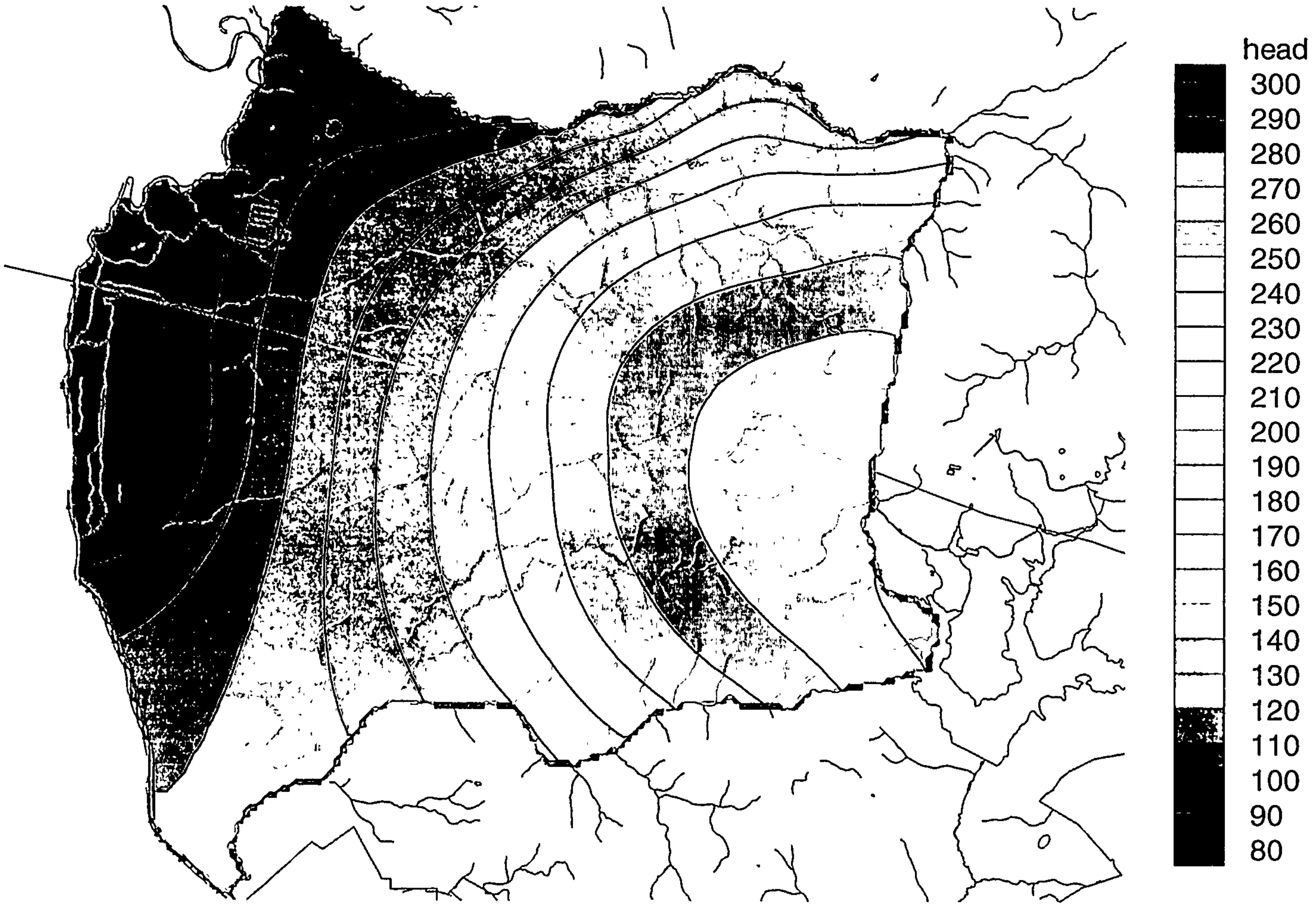
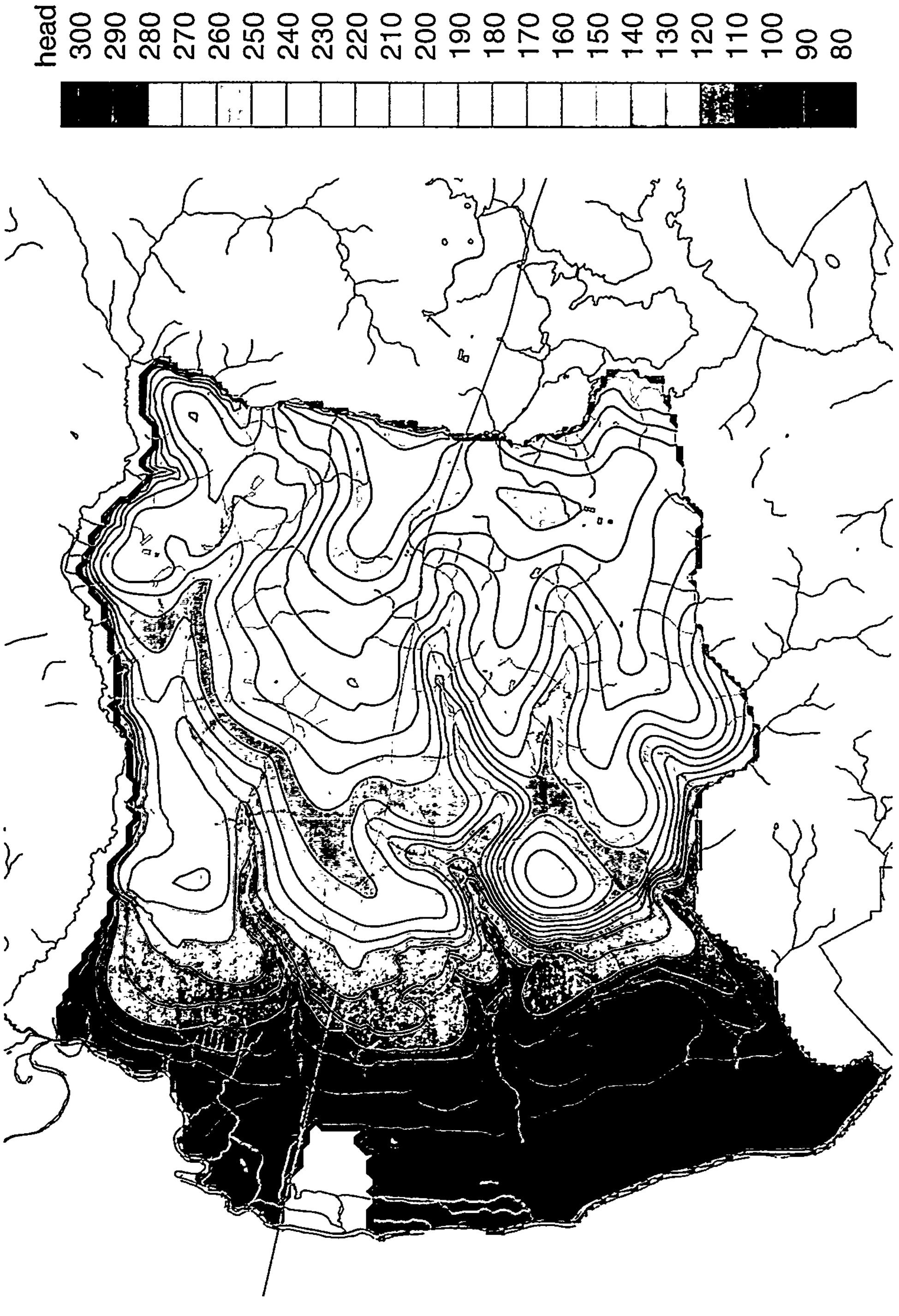


Figure G-3-13 (uncertainty case 3; compare to Figure 4-14)



Simulated hydraulic head in "lower" UTR aquifer zone

Figure G-3-14 (uncertainty case 3; compare to Figure 4-15)

Simulated hydraulic head in "upper" UTR aquifer zone

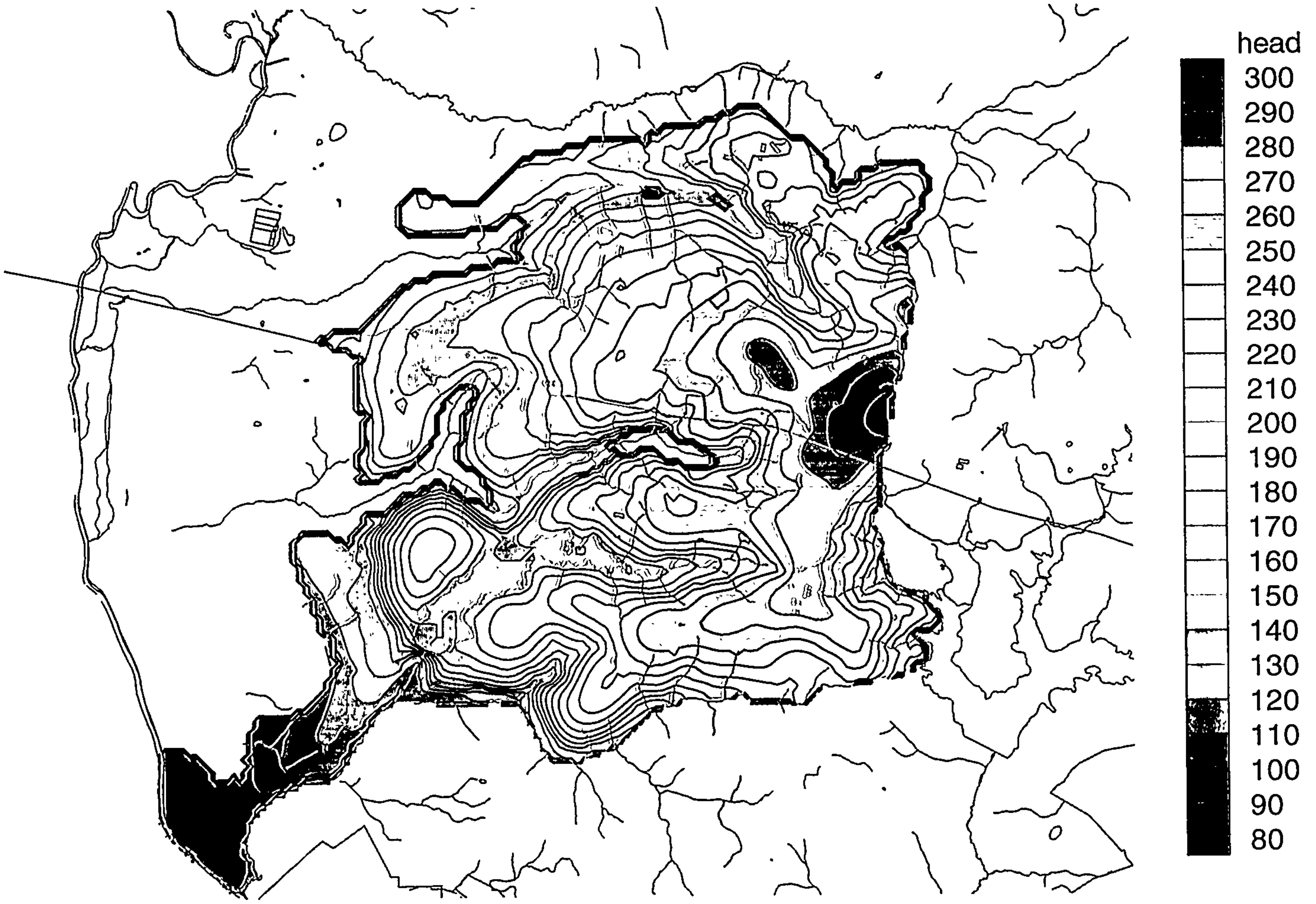


Figure G-3-15 (uncertainty case 3; compare to Figure 4-16)

Simulated hydraulic head in aquifer zone containing water table

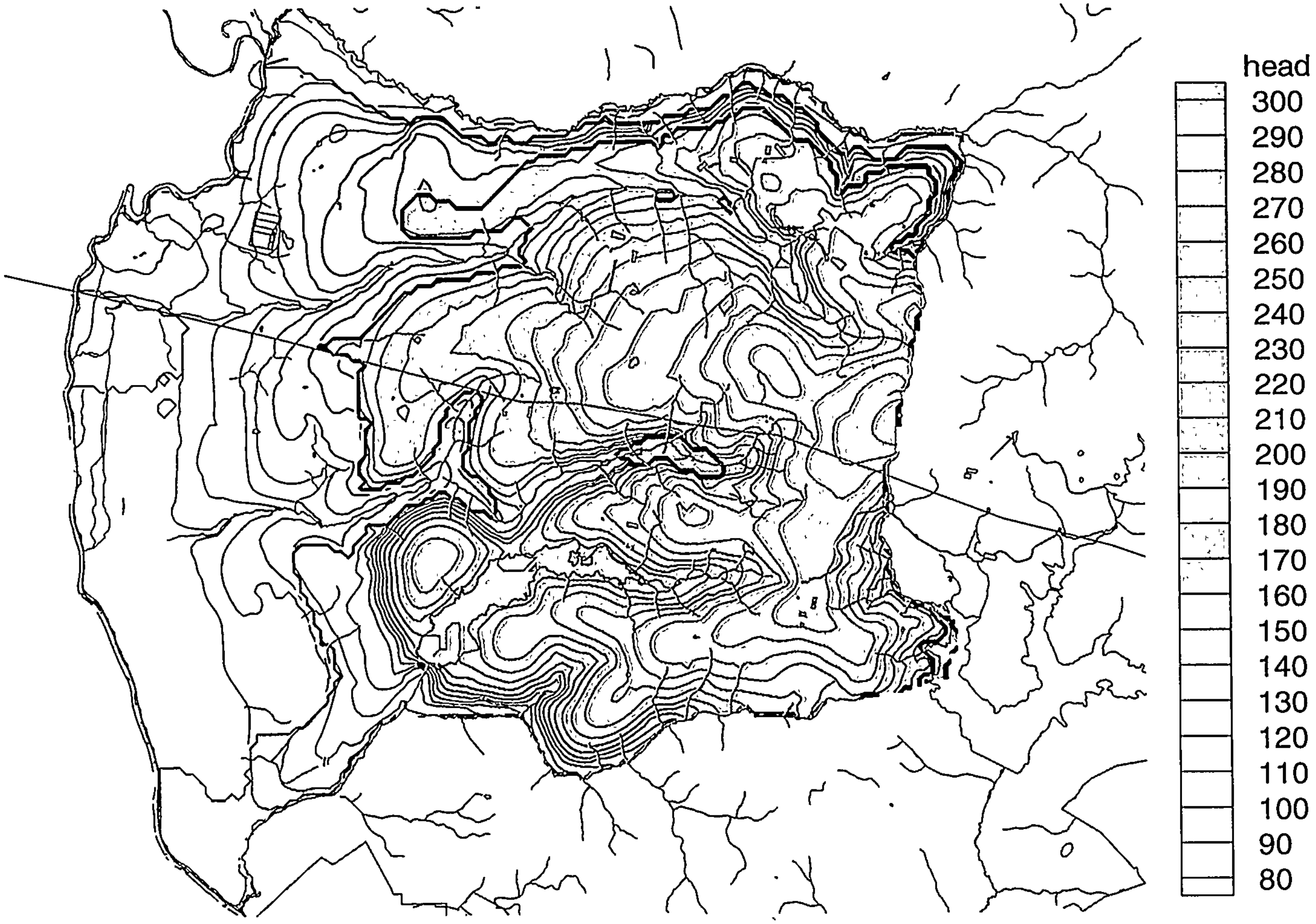


Figure G-3-16 (uncertainty case 3; compare to Figure 4-17)

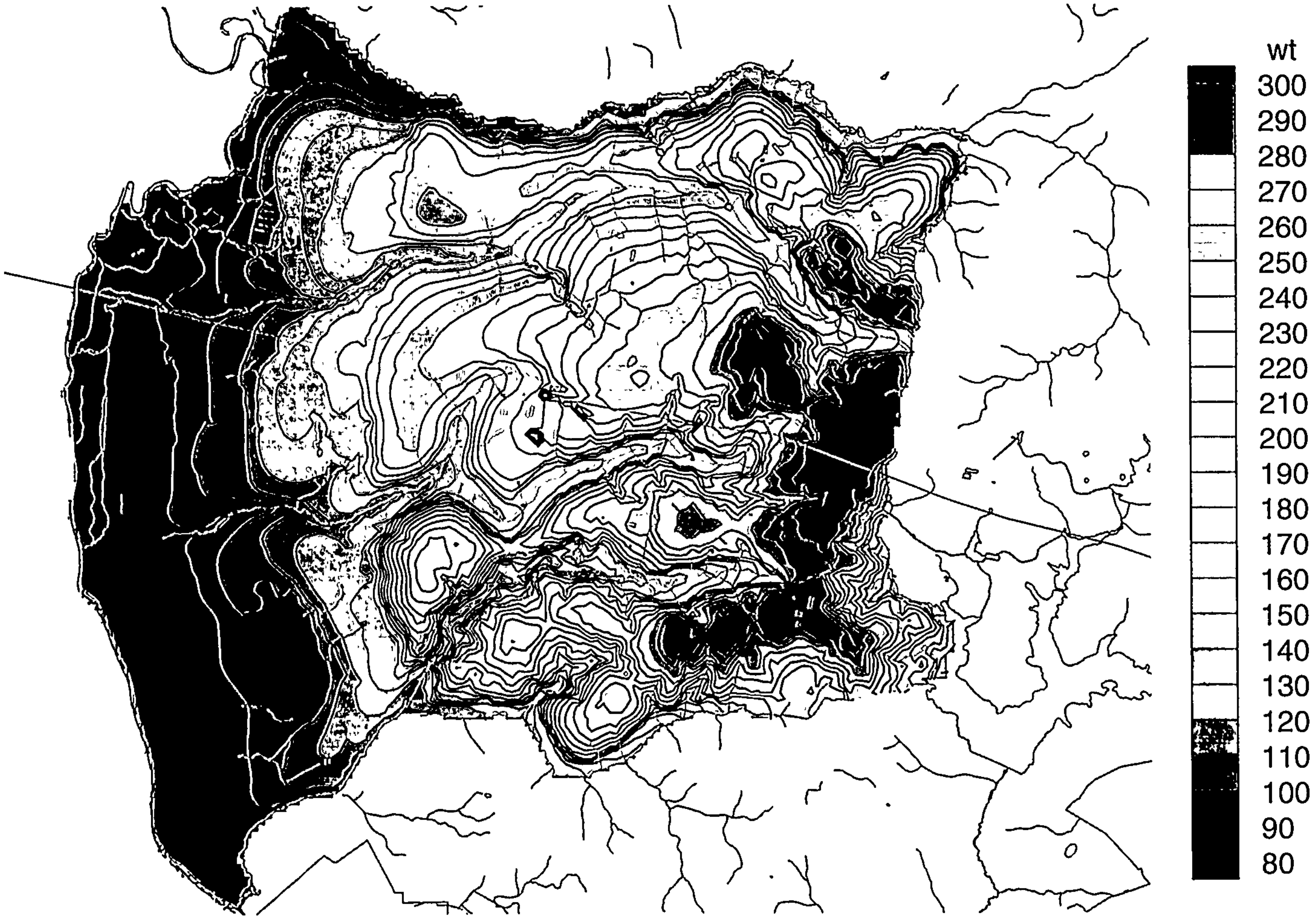

Simulated water table elevation

Figure G-3-17 (uncertainty case 3; compare to Figure 4-18)

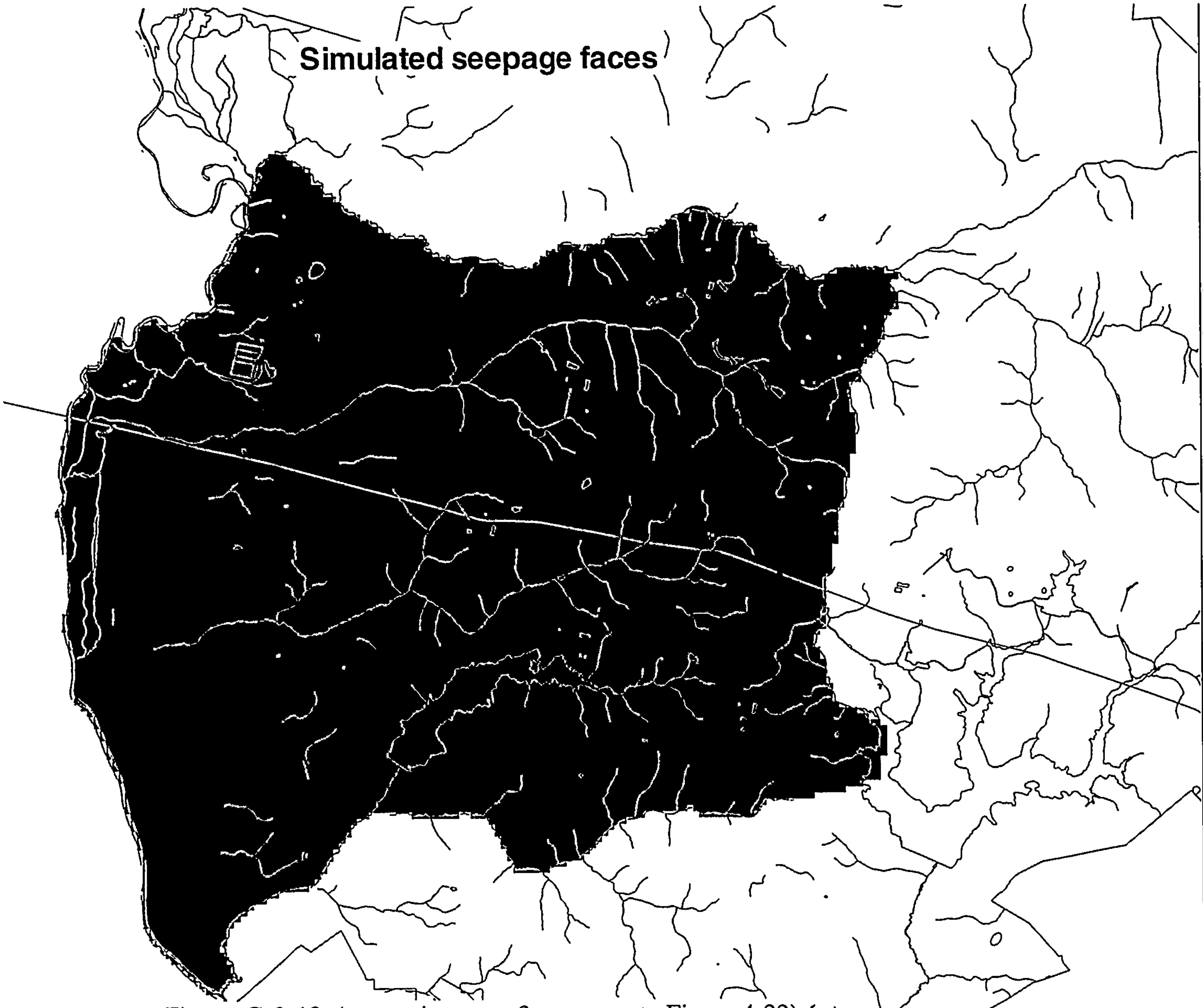


Figure G-3-18 (uncertainty case 3; compare to Figure 4-22)

Simulated groundwater recharge (discharge)

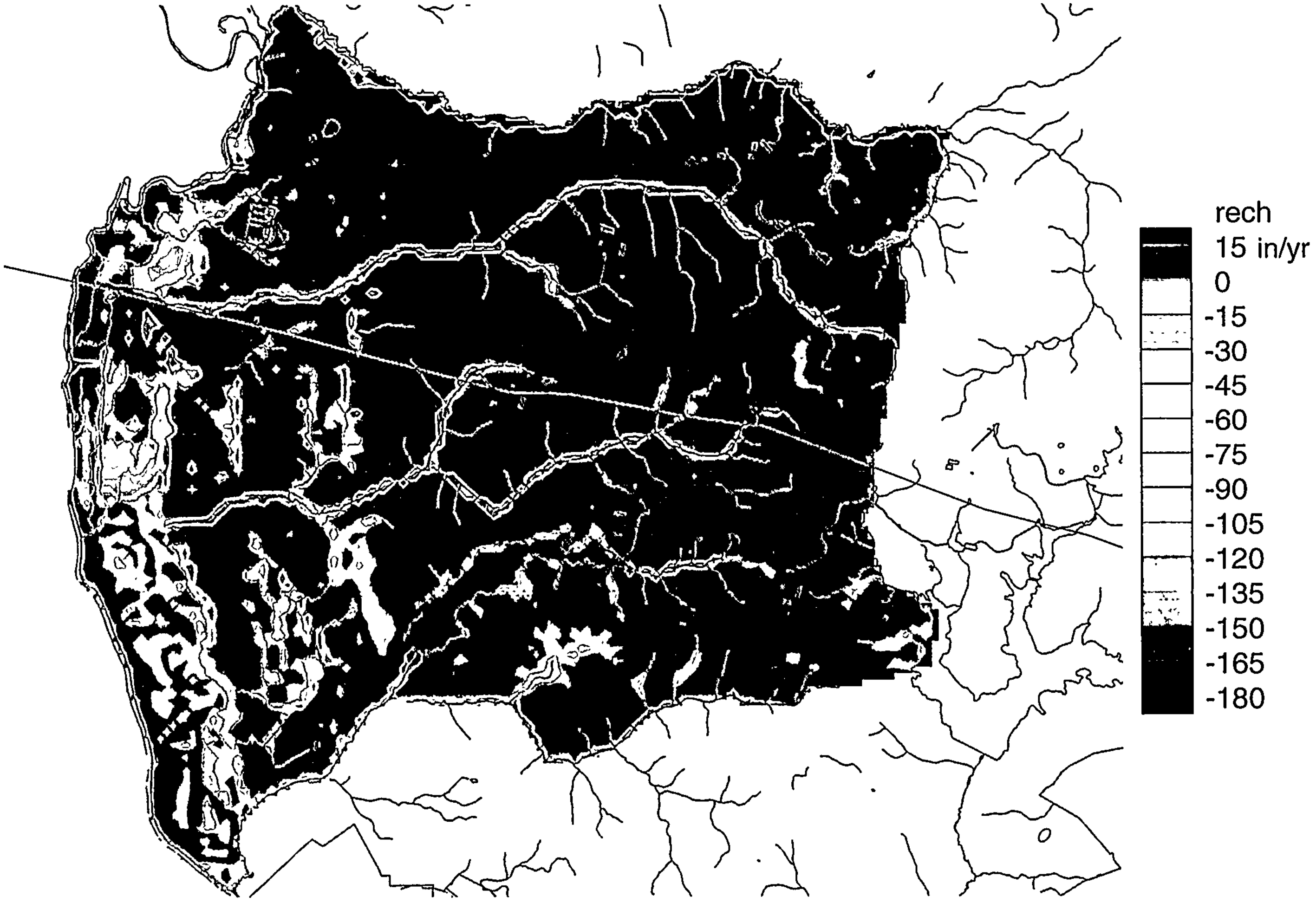


Figure G-3-19 (uncertainty case 3; compare to Figure 4-23)

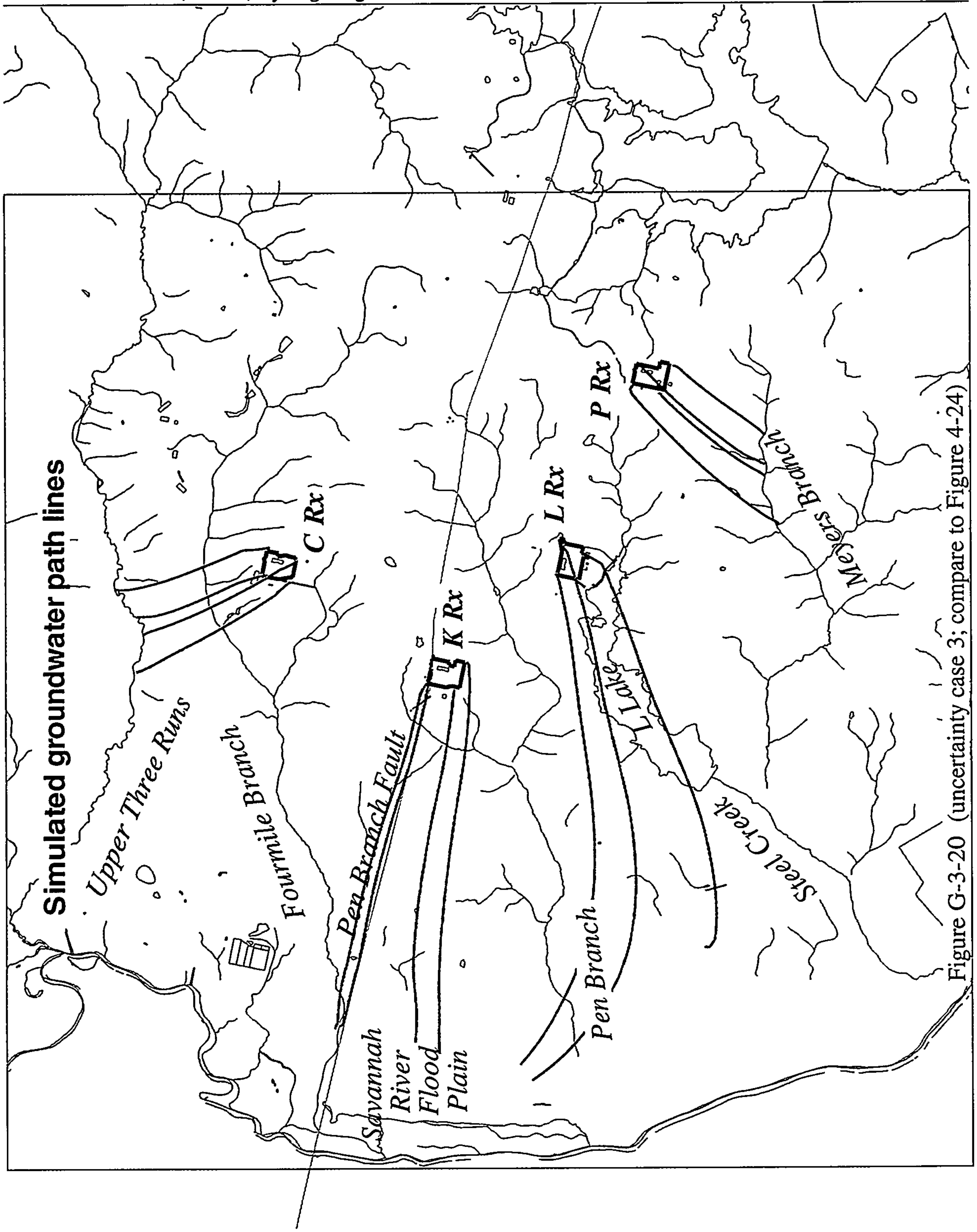


Figure G-3-20 (uncertainty case 3; compare to Figure 4-24)

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Simulation results for uncertainty case 4

Uncertainty case 4 involves a decrease in Gordon confining unit vertical conductivity by a factor of 5 to 2×10^{-5} ft/day (Table 4-4). Summary calibration results are provided in Table 4-5. This appendix presents detailed simulation results for uncertainty case 4 for comparison to the nominal results shown in figures in the main text. The correspondence between figures for the nominal and uncertainty case 4 is as follows:

Plot type	**Nominal case**	**Uncertainty case 4**
Head residual summary	Figure 4-1	Figure G-4-1
Head residuals in Gordon aquifer	Figure 4-2	Figure G-4-2
Head residuals in "lower" UTRA	Figure 4-3	Figure G-4-3
Head residuals in "upper" UTRA	Figure 4-4	Figure G-4-4
Kh in element layer 1	Figure 4-5	Figure G-4-5
Kv in element layer 2	Figure 4-6	Figure G-4-6
Kh in element layer 3	Figure 4-7	Figure G-4-7
Kh in element layer 4	Figure 4-8	Figure G-4-8
Kv in element layer 5	Figure 4-9	Figure G-4-9
Kh in element layer 6	Figure 4-10	Figure G-4-10
Kh in element layer 7	Figure 4-11	Figure G-4-11
Kh in element layer 8	Figure 4-12	Figure G-4-12
Gordon aquifer head	Figure 4-14	Figure G-4-13
"Lower" UTRA head	Figure 4-15	Figure G-4-14
"Upper" UTRA head	Figure 4-16	Figure G-4-15
Head in aquifer containing water table	Figure 4-17	Figure G-4-16
Water table	Figure 4-18	Figure G-4-17
Seepage faces	Figure 4-22	Figure G-4-18
Recharge/discharge	Figure 4-23	Figure G-4-19
Example particle tracing	Figure 4-24	Figure G-4-20

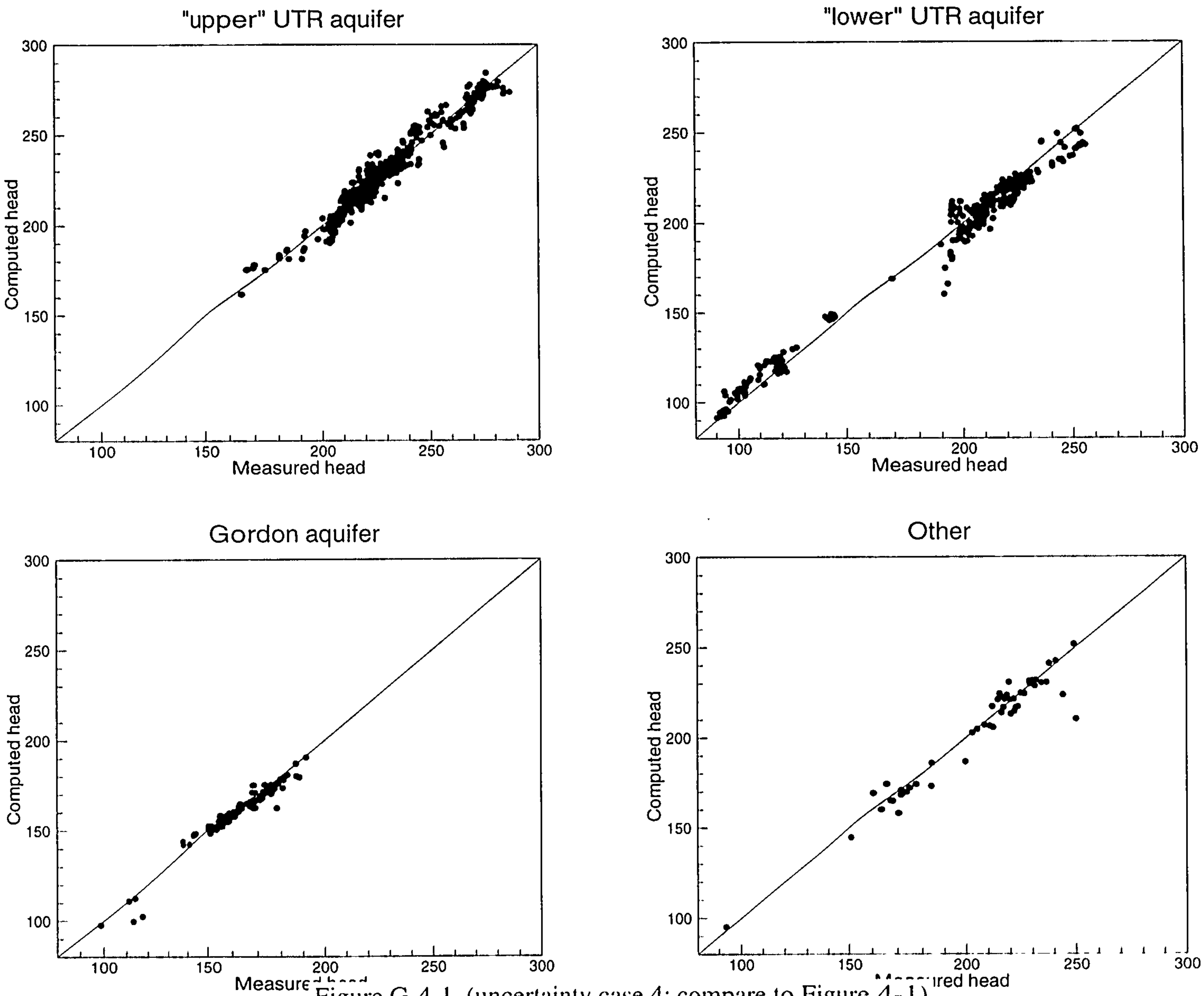

Figure G-4-1 (uncertainty case 4; compare to Figure 4-1)

Gordon aquifer head residuals

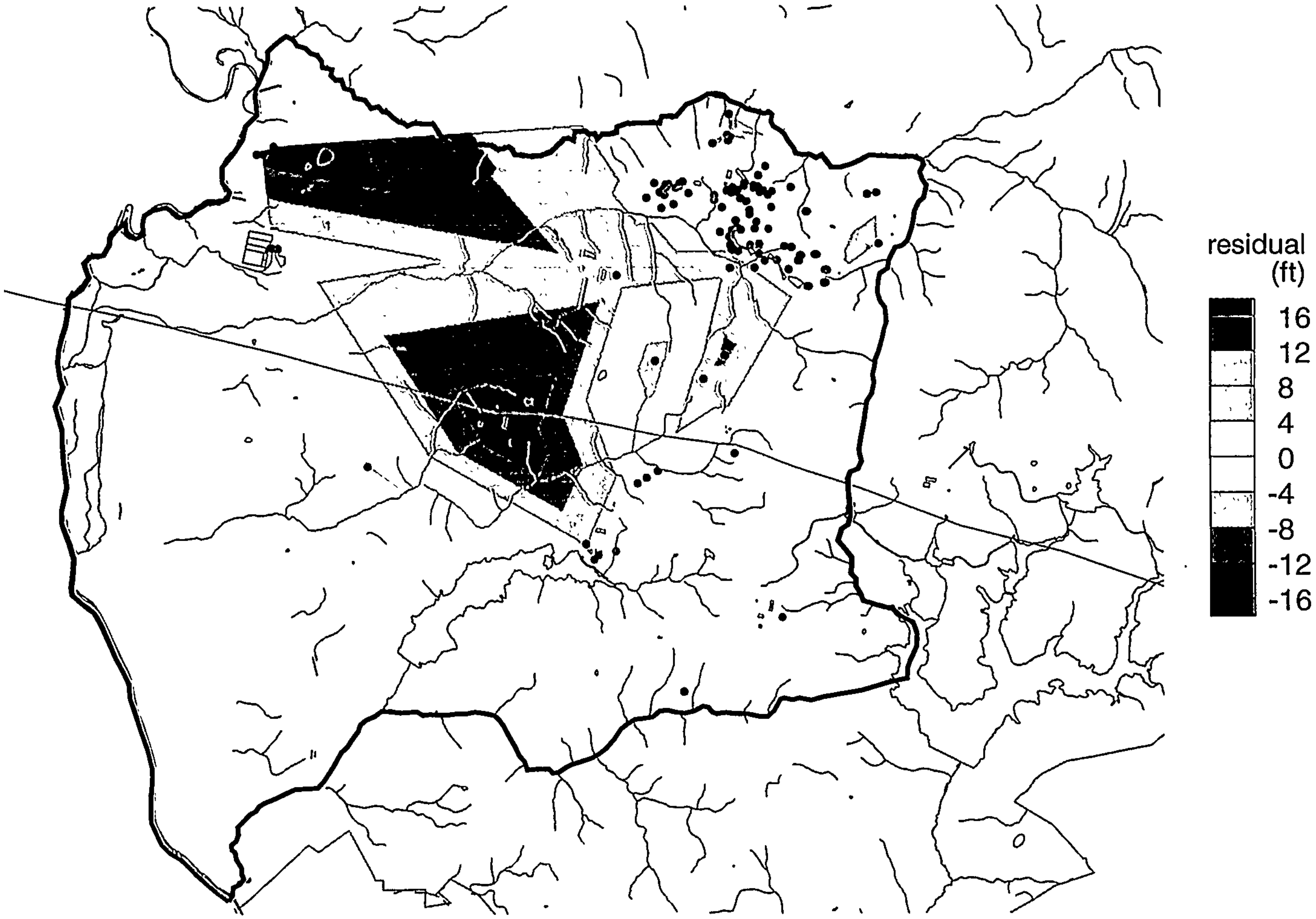

Figure G-4-2 (uncertainty case 4; compare to Figure 4-2)

"lower" UTR aquifer zone

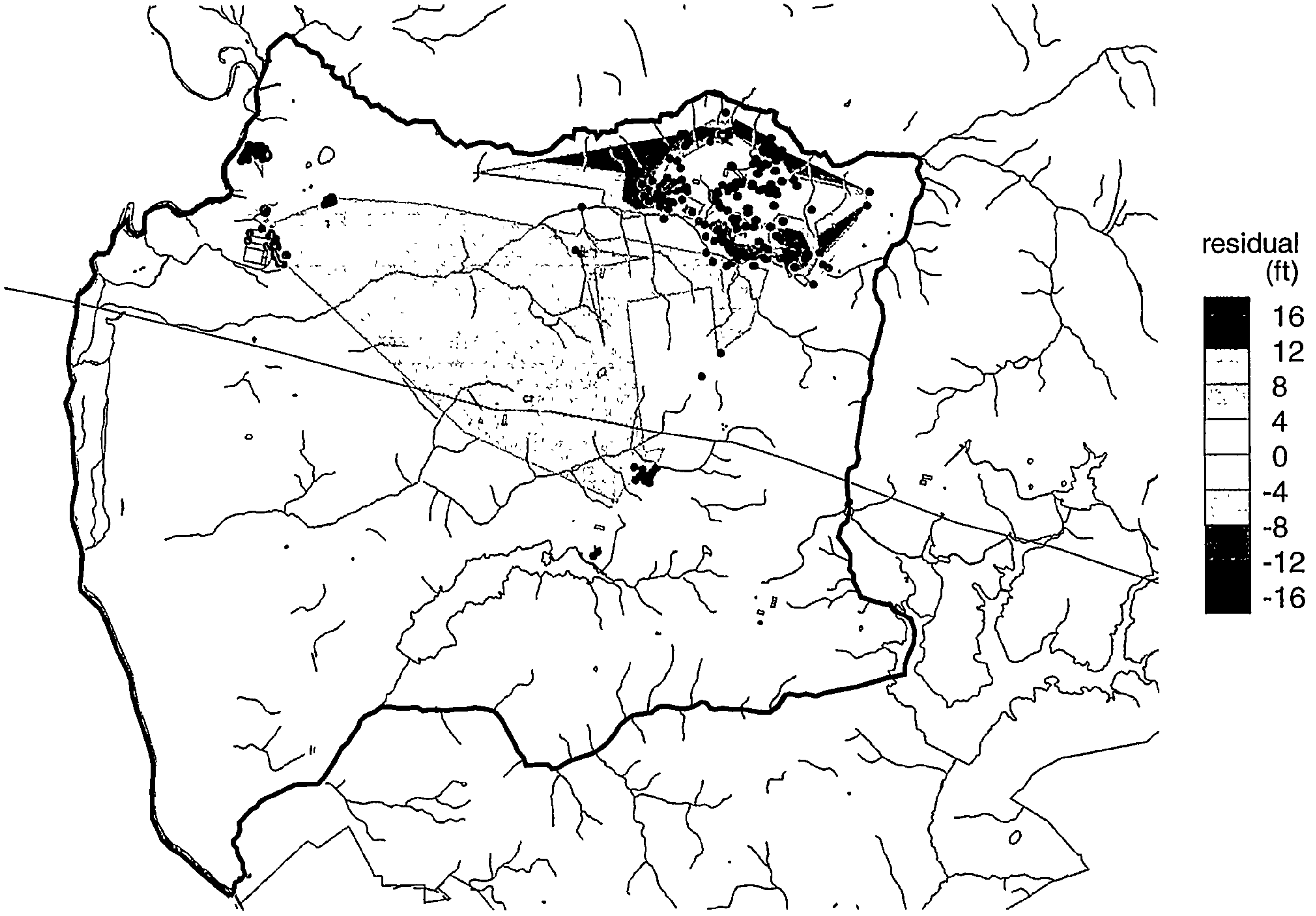

Figure G-4-3 (uncertainty case 4; compare to Figure 4-3)

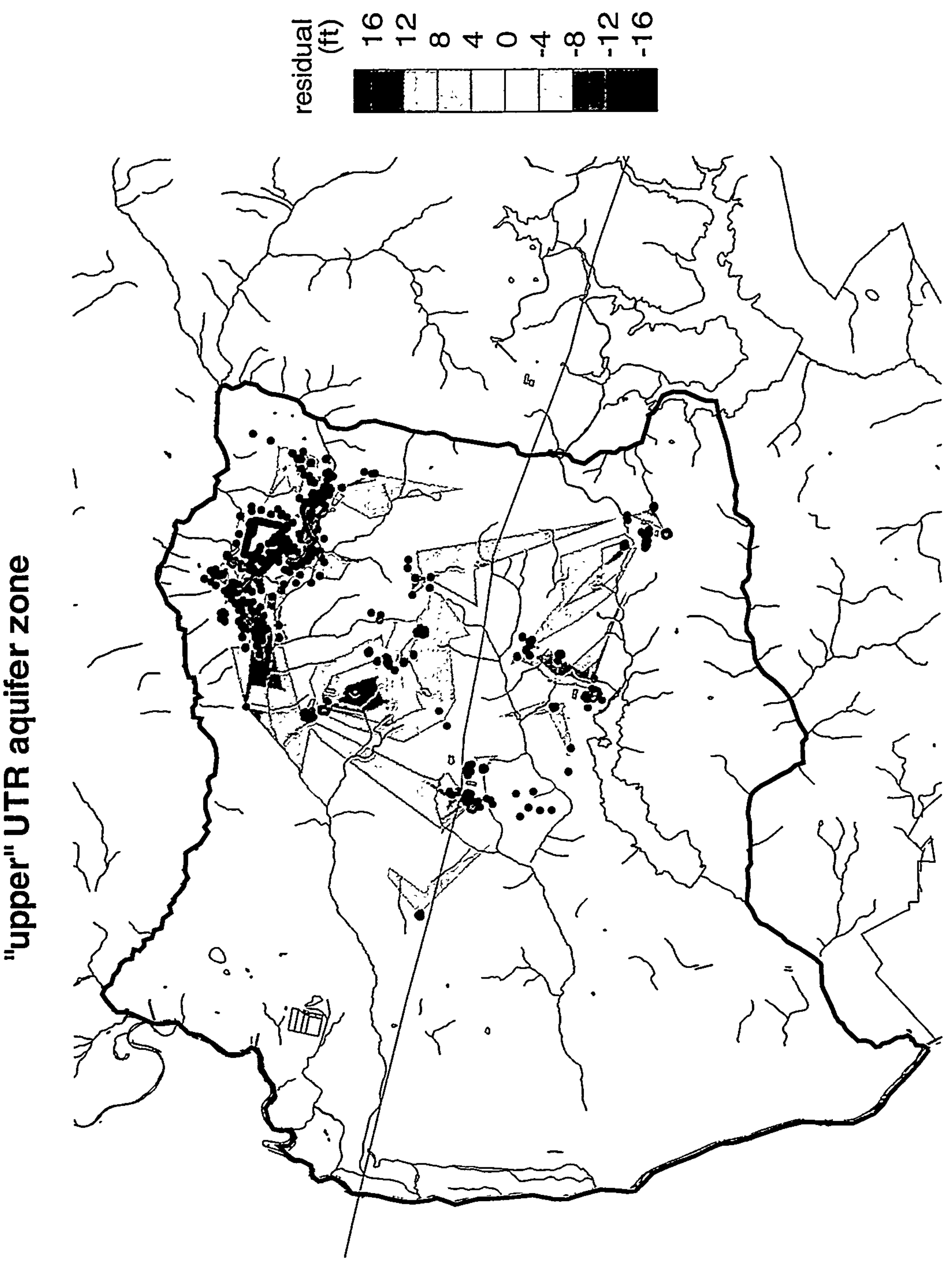

Figure G-4-4 (uncertainty case 4; compare to Figure 4-4)

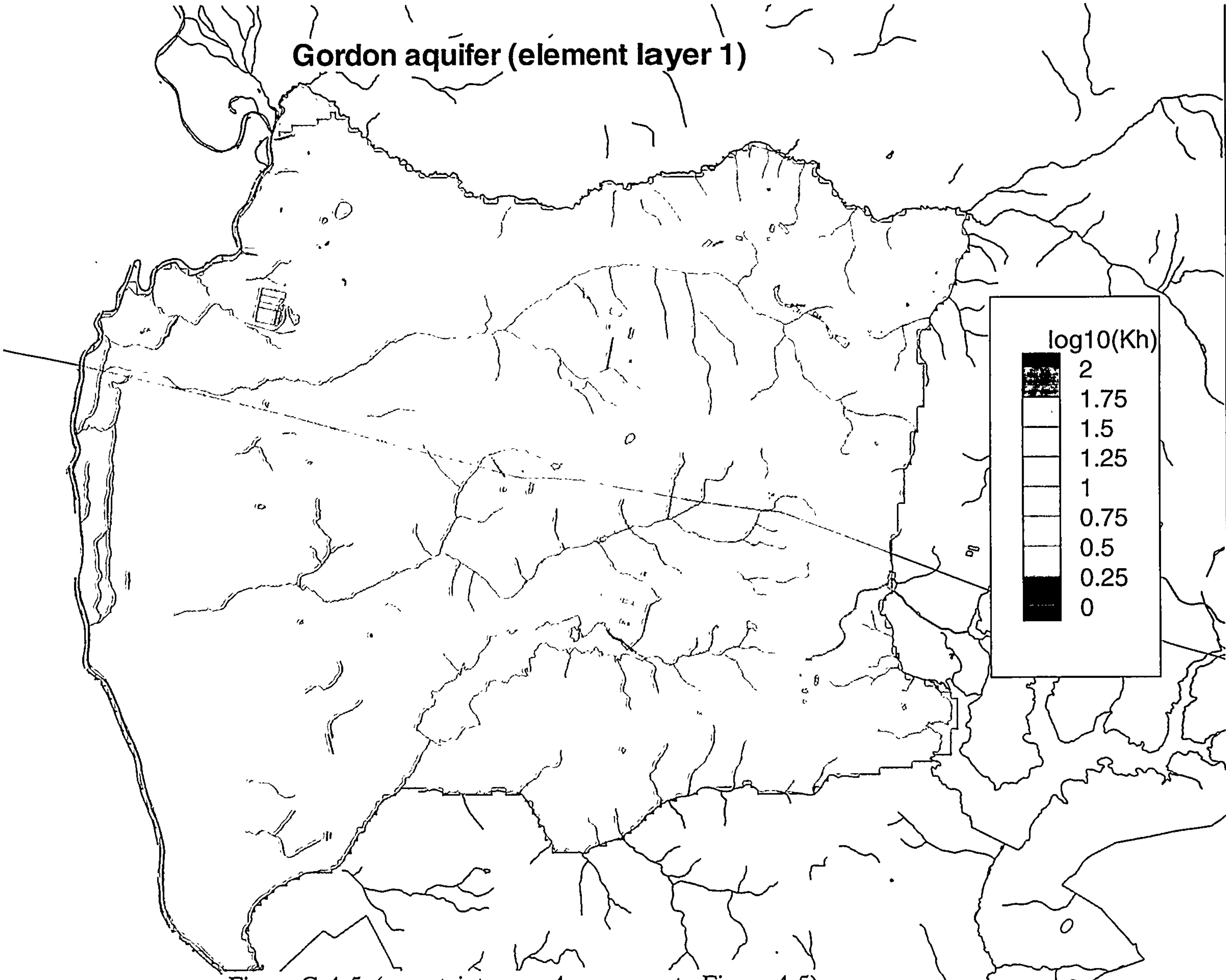

Figure G-4-5 (uncertainty case 4; compare to Figure 4-5)

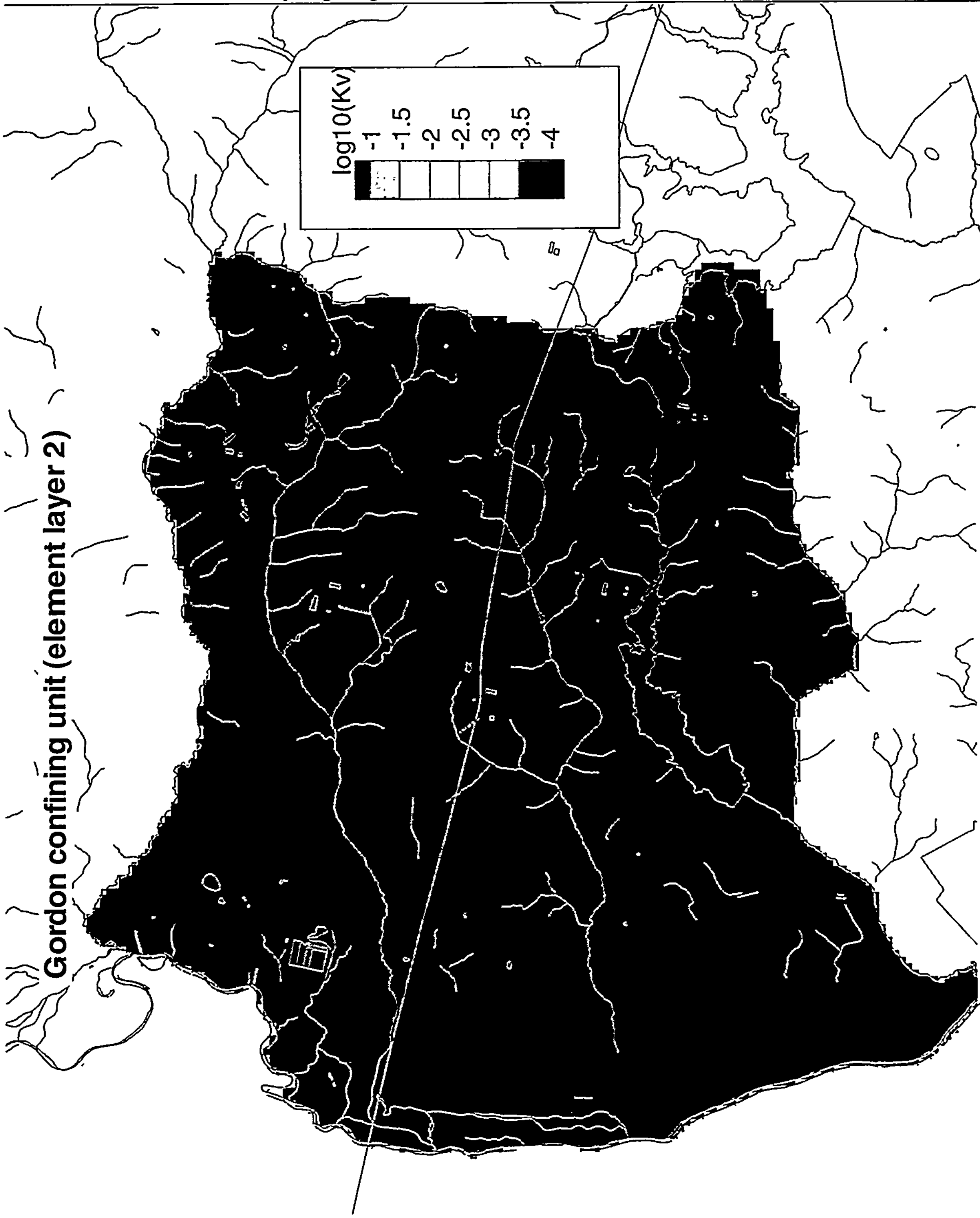
Gordon confining unit (element layer 2)

Figure G-4-6 (uncertainty case 4; compare to Figure 4-6)

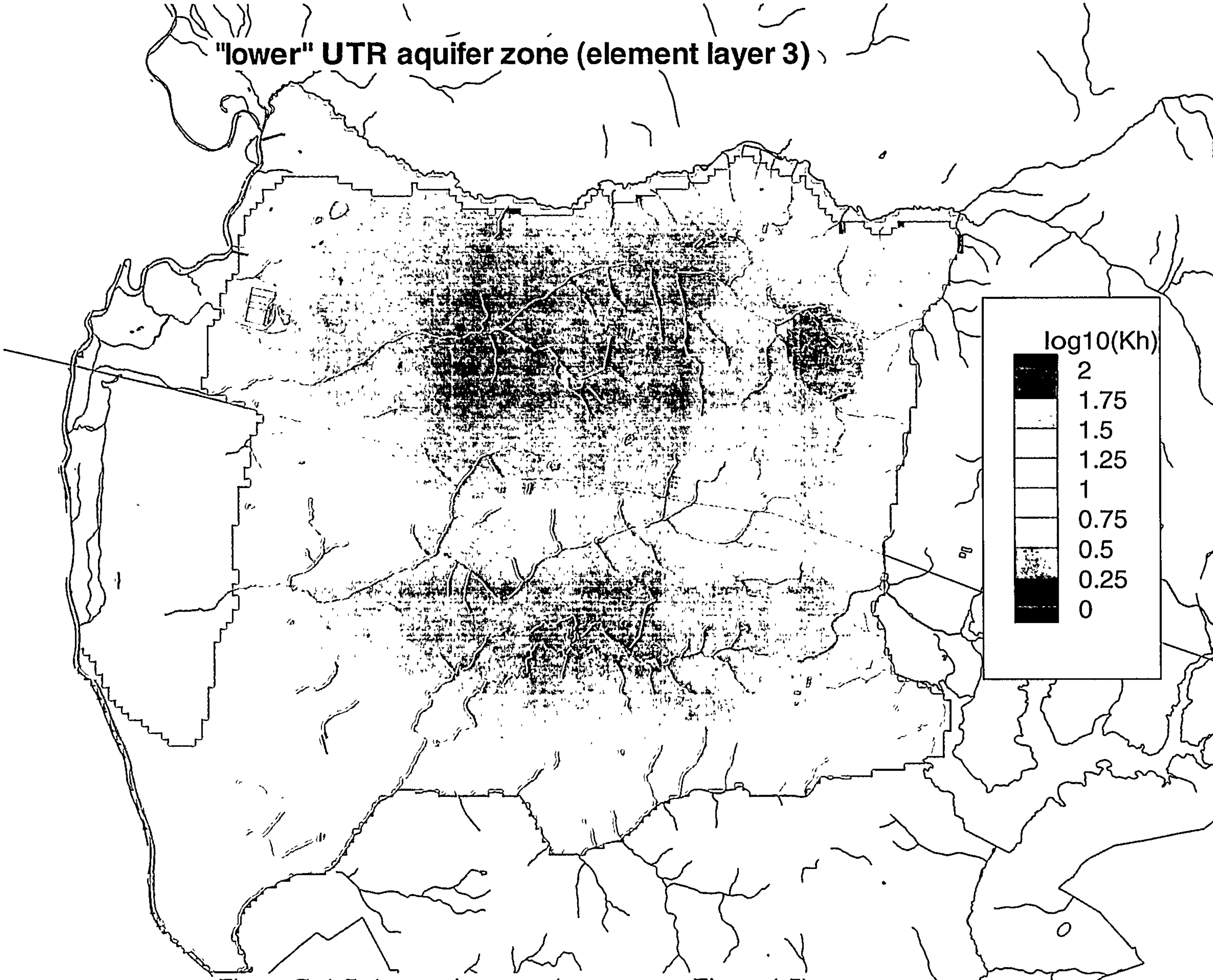
"lower" UTR aquifer zone (element layer 3)

Figure G-4-7 (uncertainty case 4; compare to Figure 4-7)

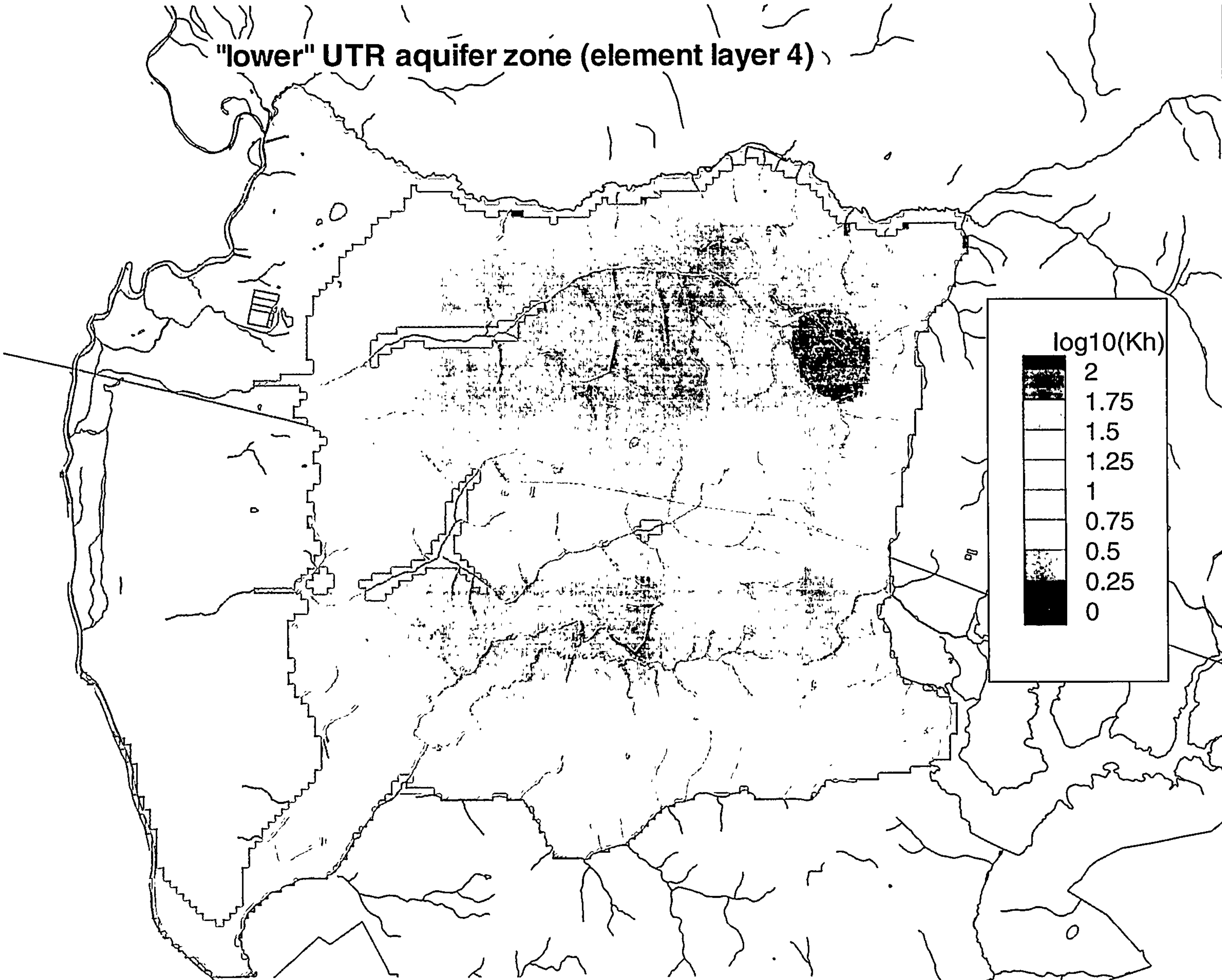
"lower" UTR aquifer zone (element layer 4)

Figure G-4-8 (uncertainty case 4; compare to Figure 4-8)

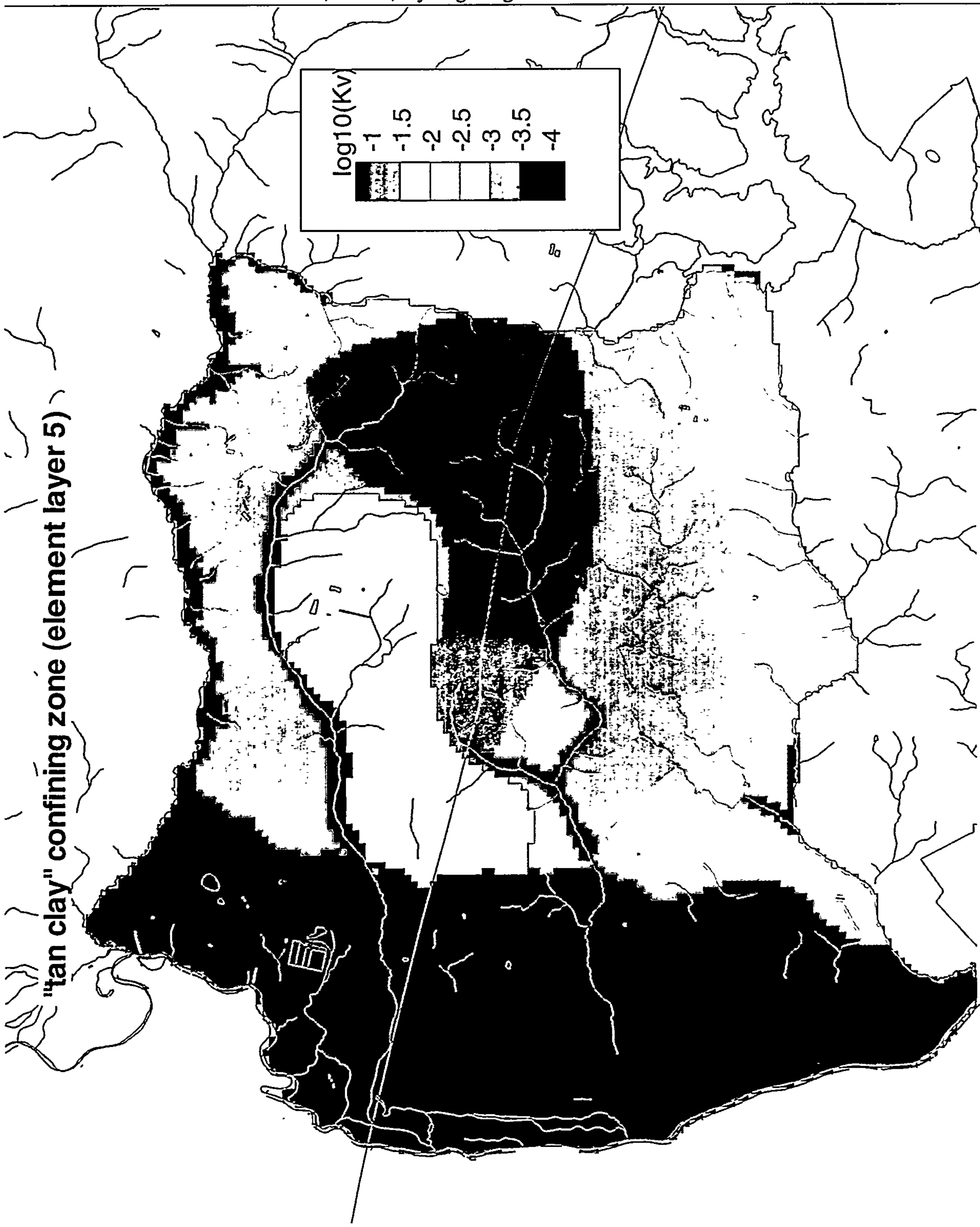

Figure G-4-9 (uncertainty case 4; compare to Figure 4-9)

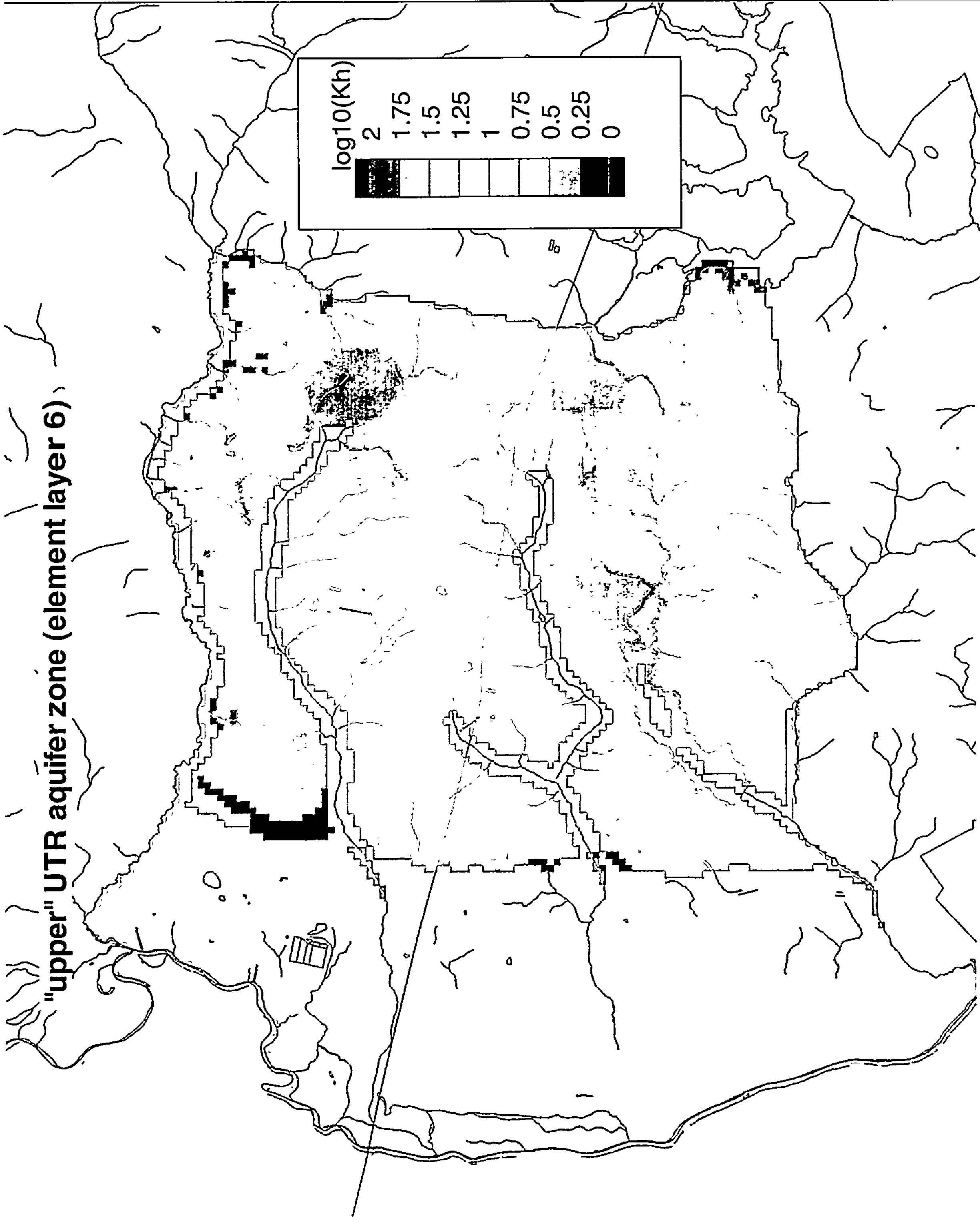

Figure G-4-10 (uncertainty case 4; compare to Figure 4-10)

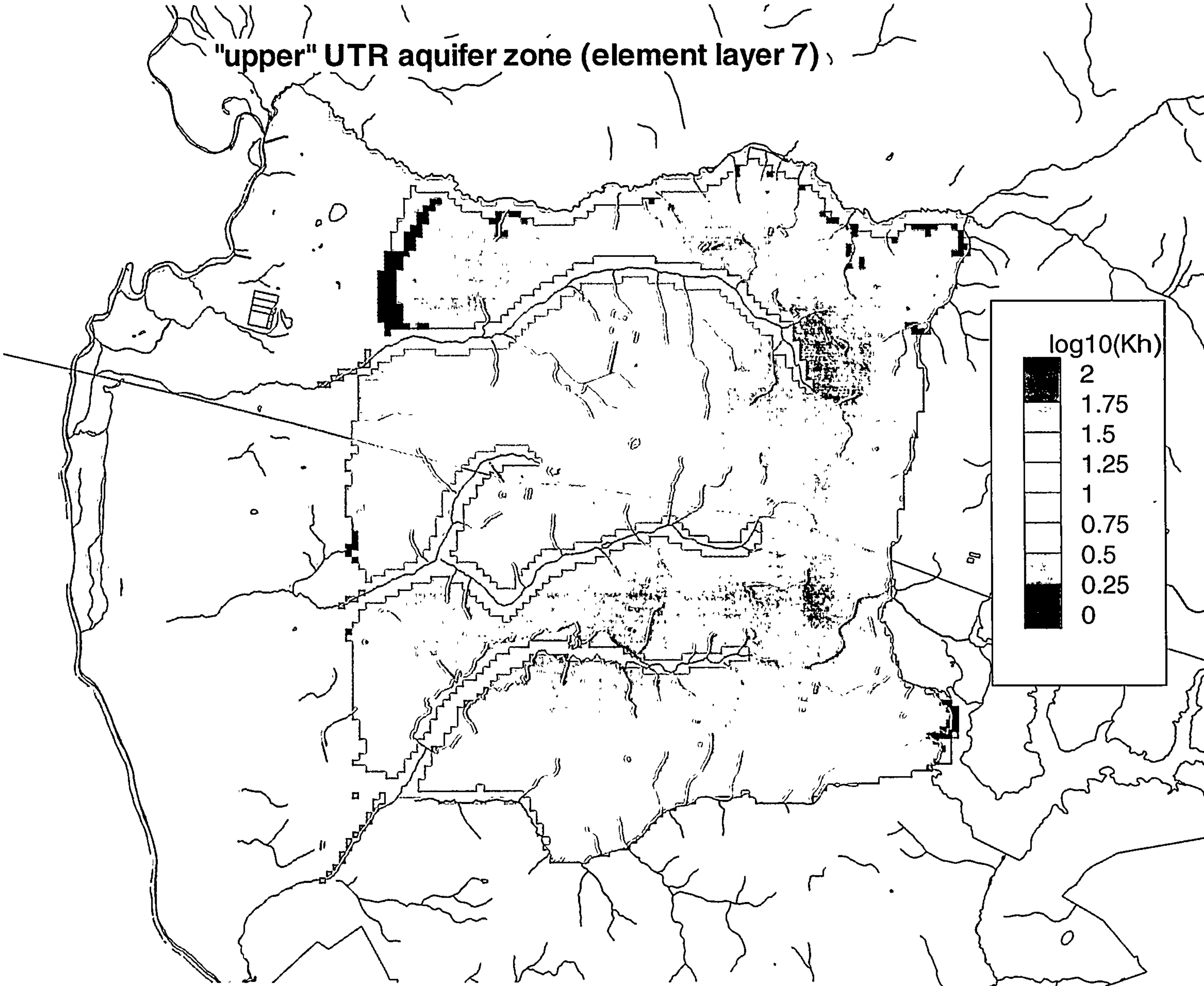
"upper" UTR aquifer zone (element layer 7)

Figure G-4-11 (uncertainty case 4; compare to Figure 4-11)

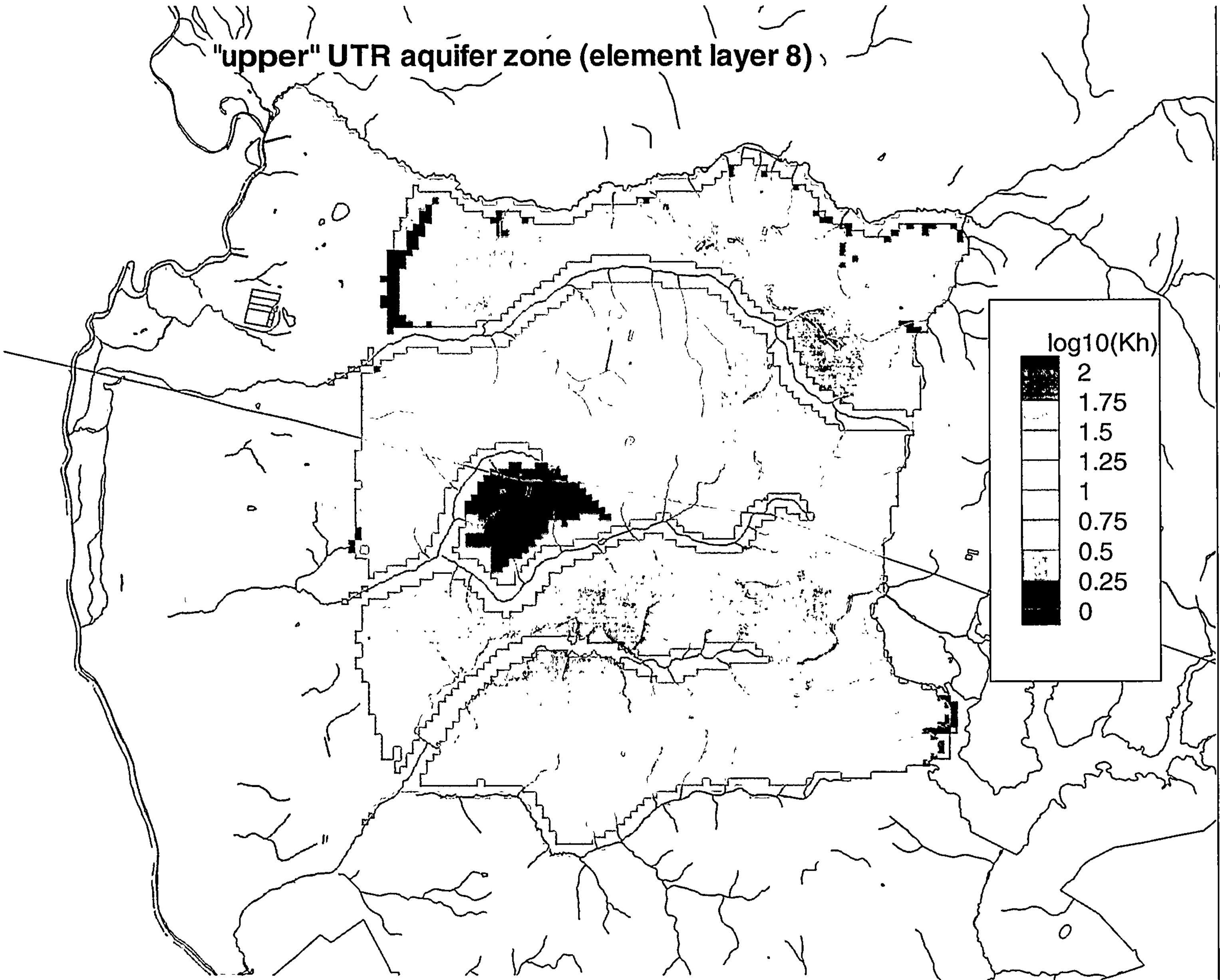

Figure G-4-12 (uncertainty case 4; compare to Figure 4-12)

Simulated hydraulic head in Gordon aquifer

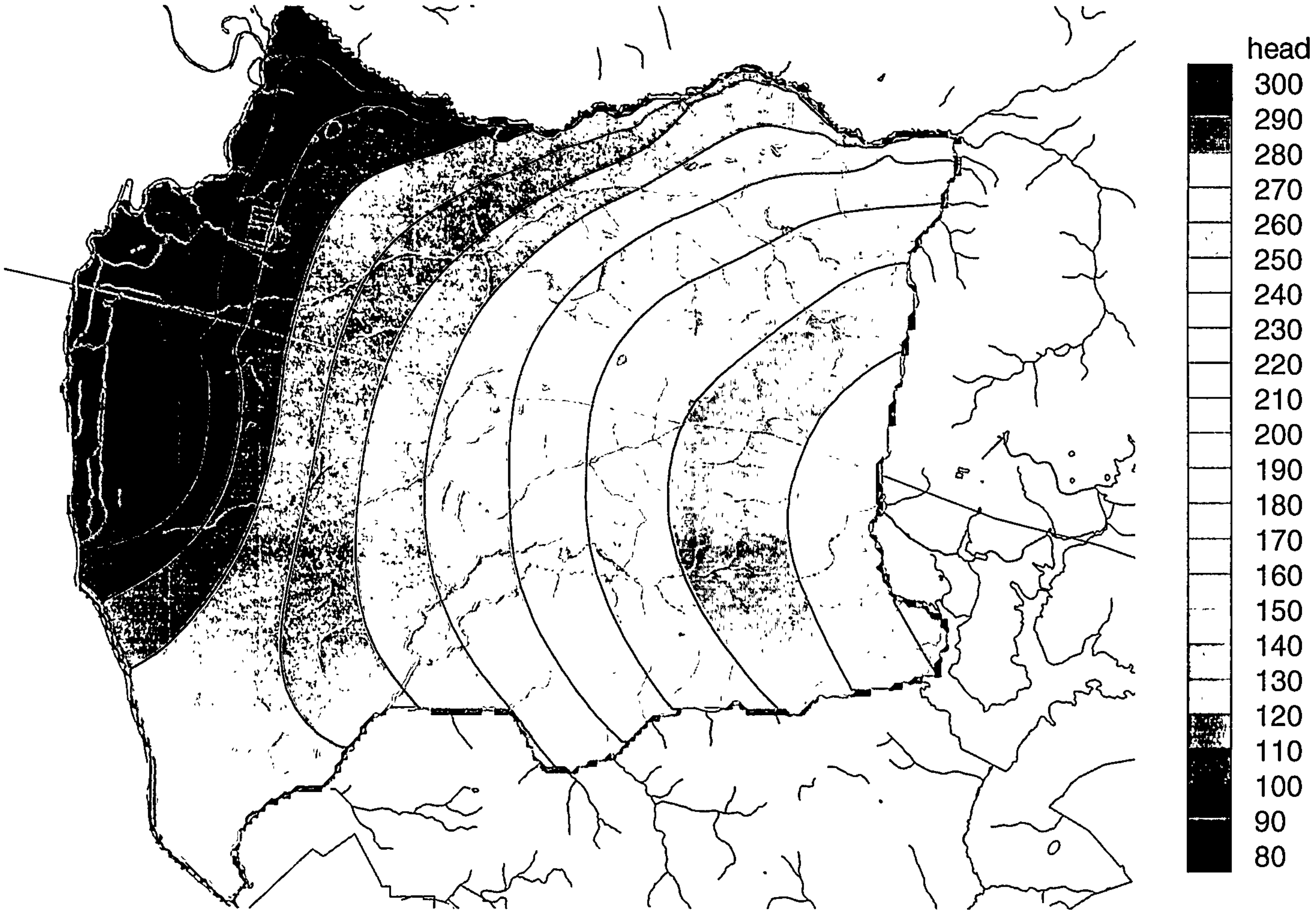

Figure G-4-13 (uncertainty case 4; compare to Figure 4-14)

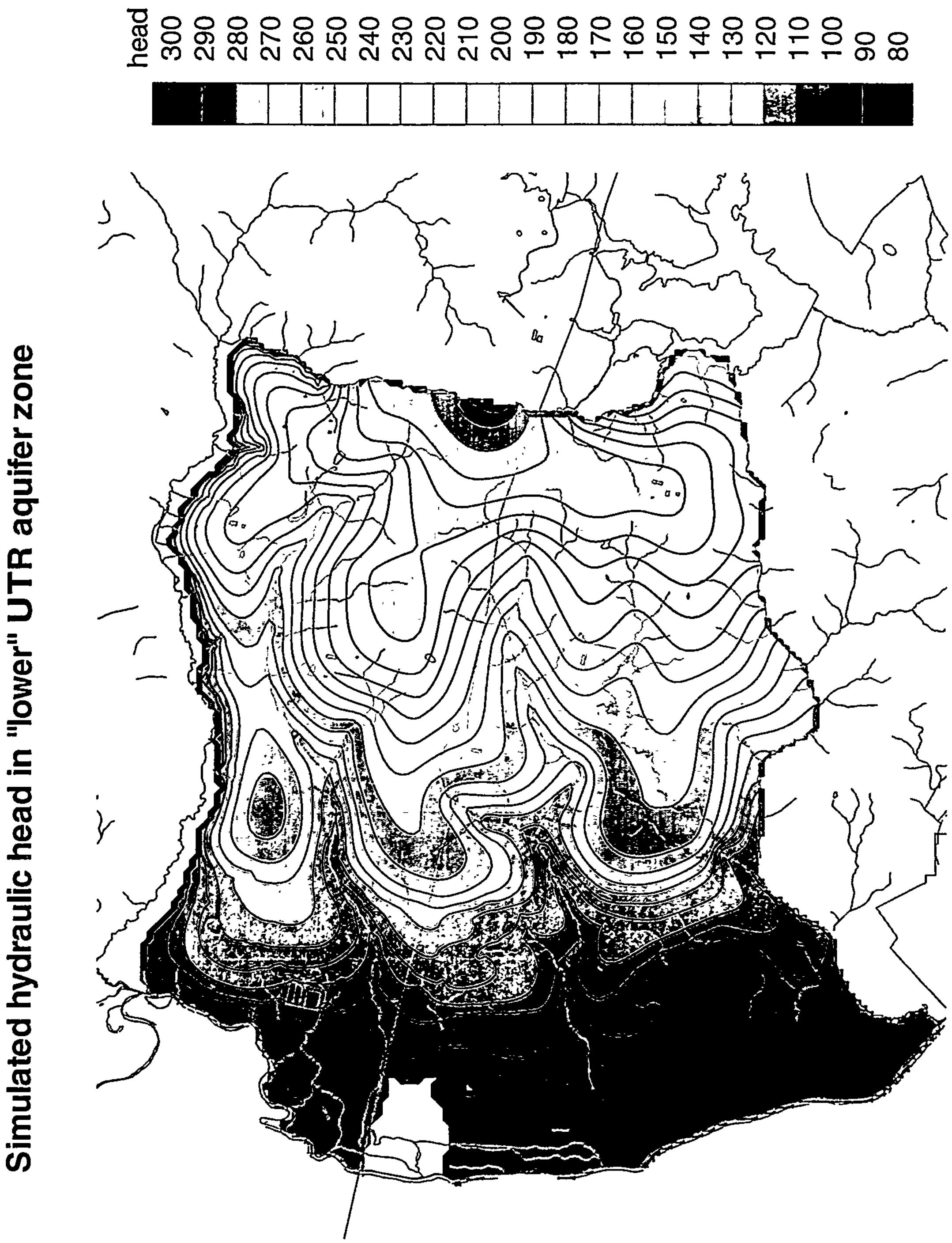

Figure G-4-14 (uncertainty case 4; compare to Figure 4-15)

Simulated hydraulic head in "upper" UTR aquifer zone

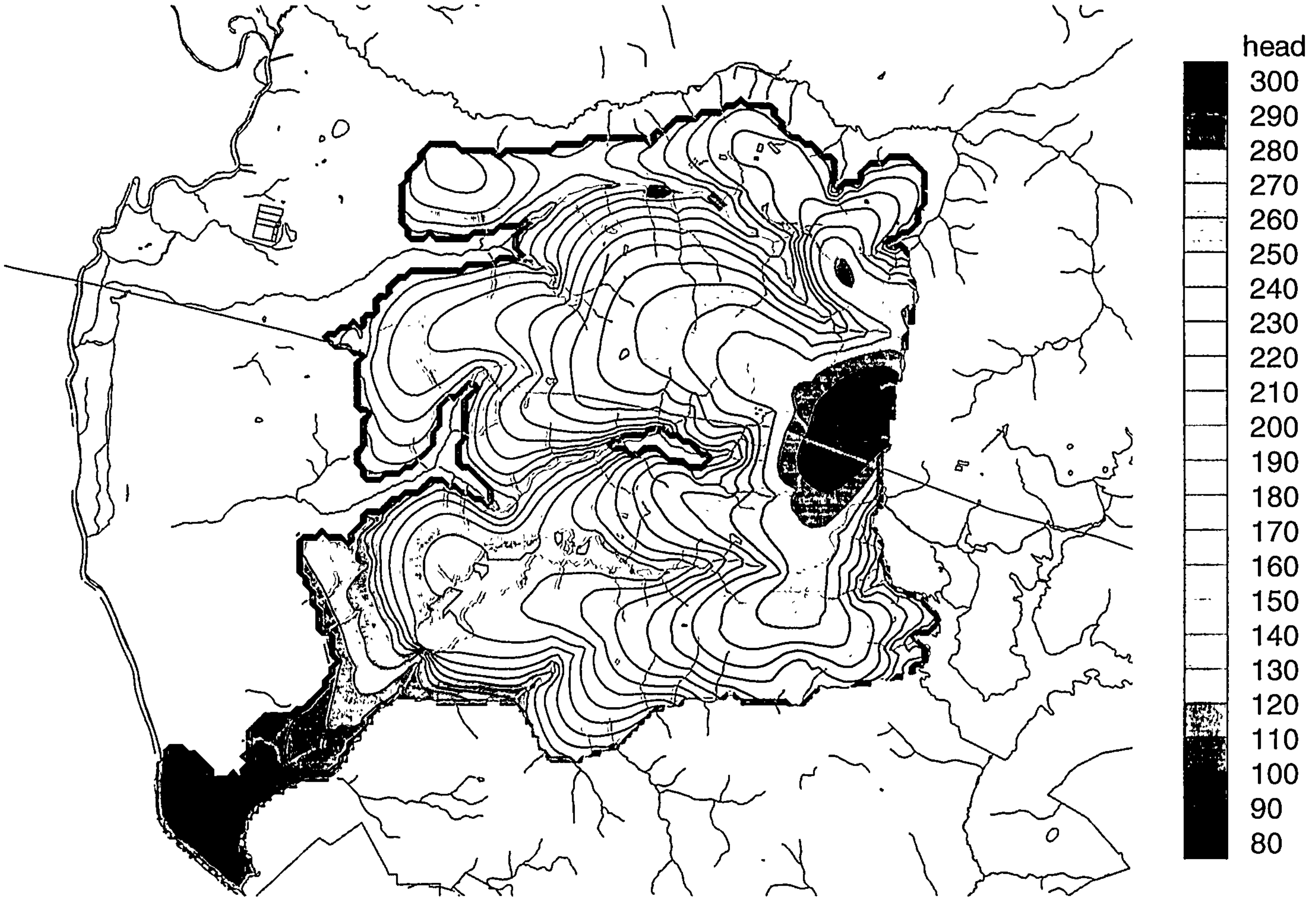

Figure G-4-15 (uncertainty case 4; compare to Figure 4-16)

Simulated hydraulic head in aquifer zone containing water table

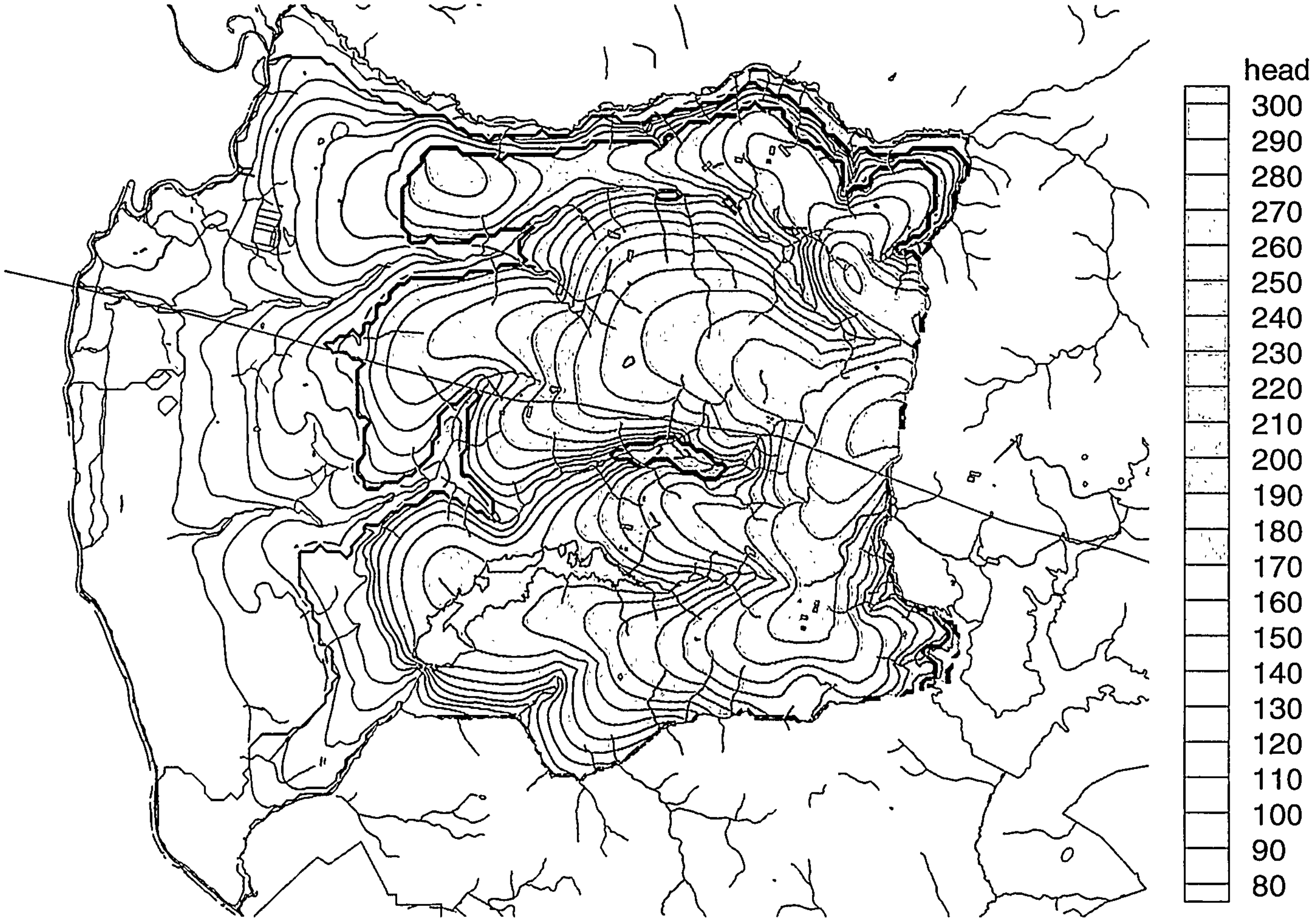

Figure G-4-16 (uncertainty case 4; compare to Figure 4-17)

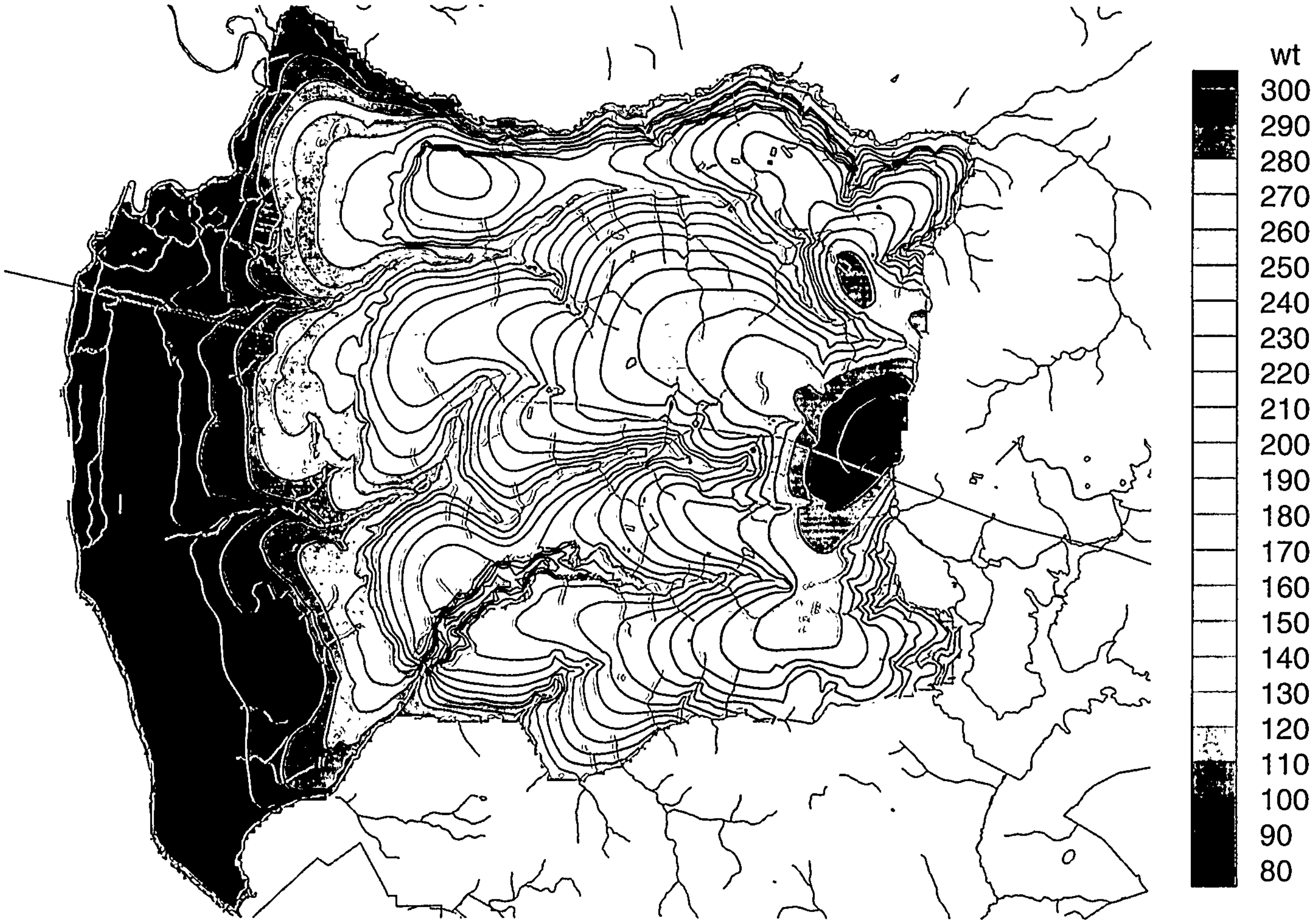
Simulated water table elevation

Figure G-4-17 (uncertainty case 4; compare to Figure 4-18)

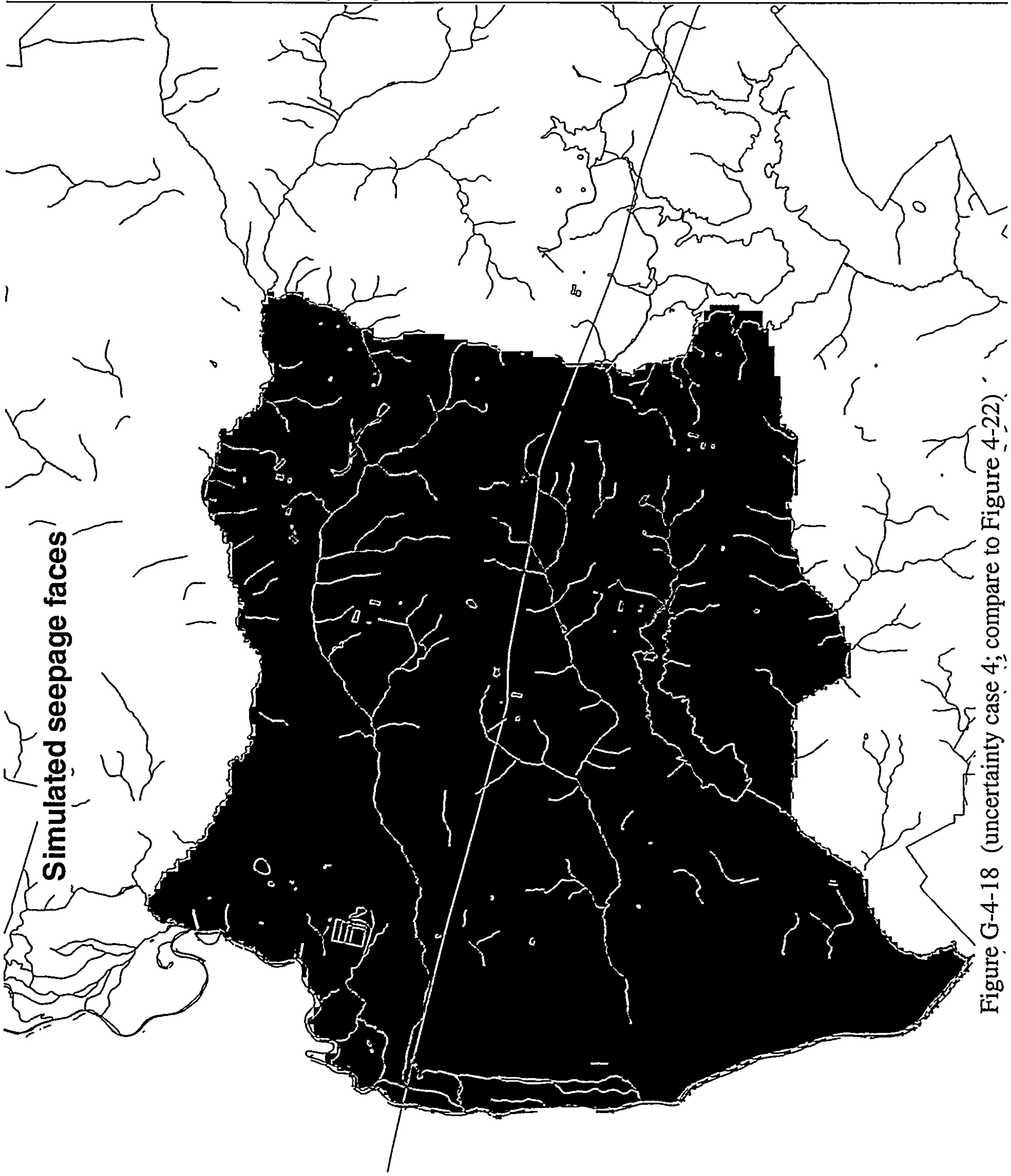

Figure G-4-18 (uncertainty case 4; compare to Figure 4-22)

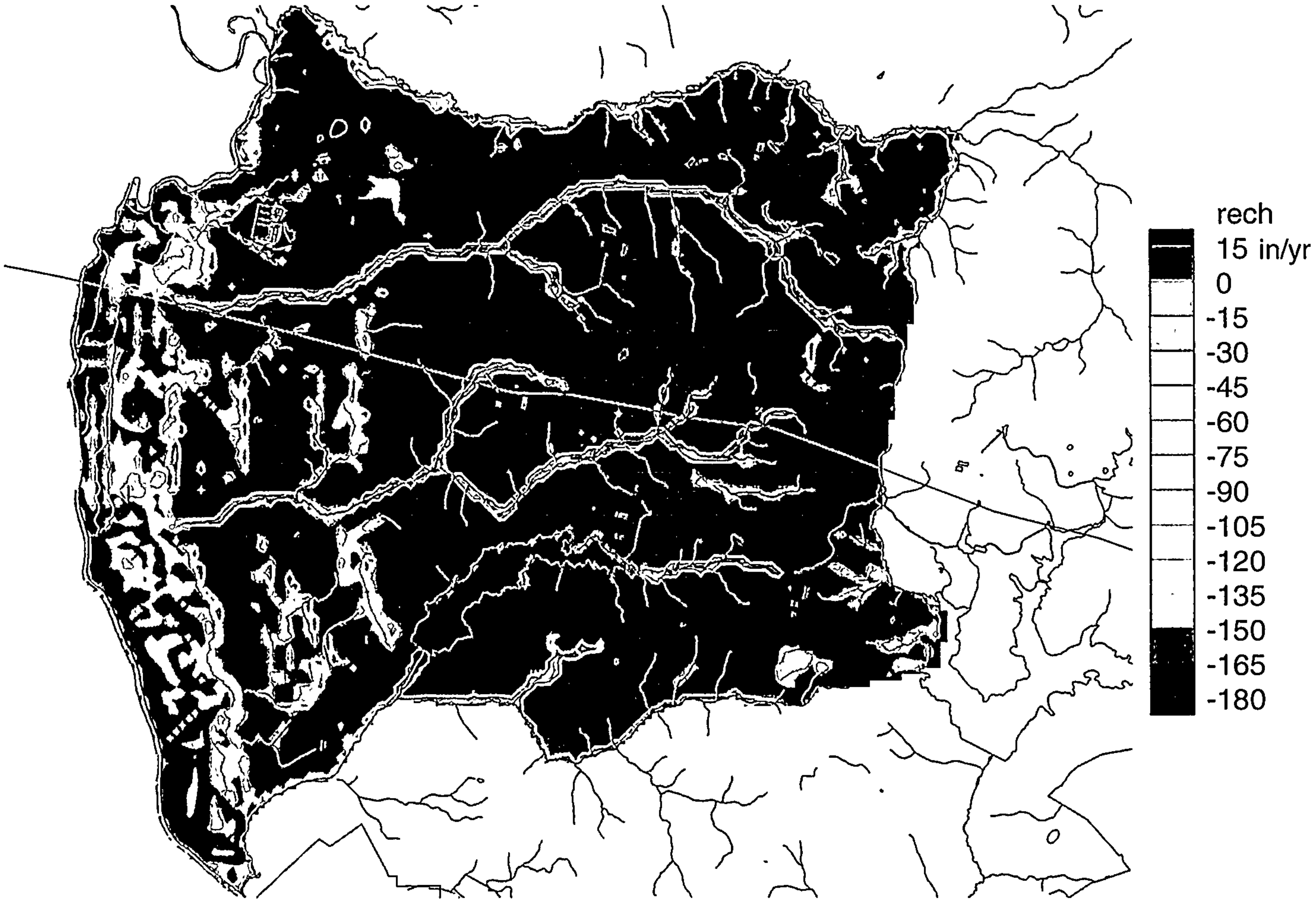
Simulated groundwater recharge (discharge)

Figure G-4-19 (uncertainty case 4; compare to Figure 4-23)

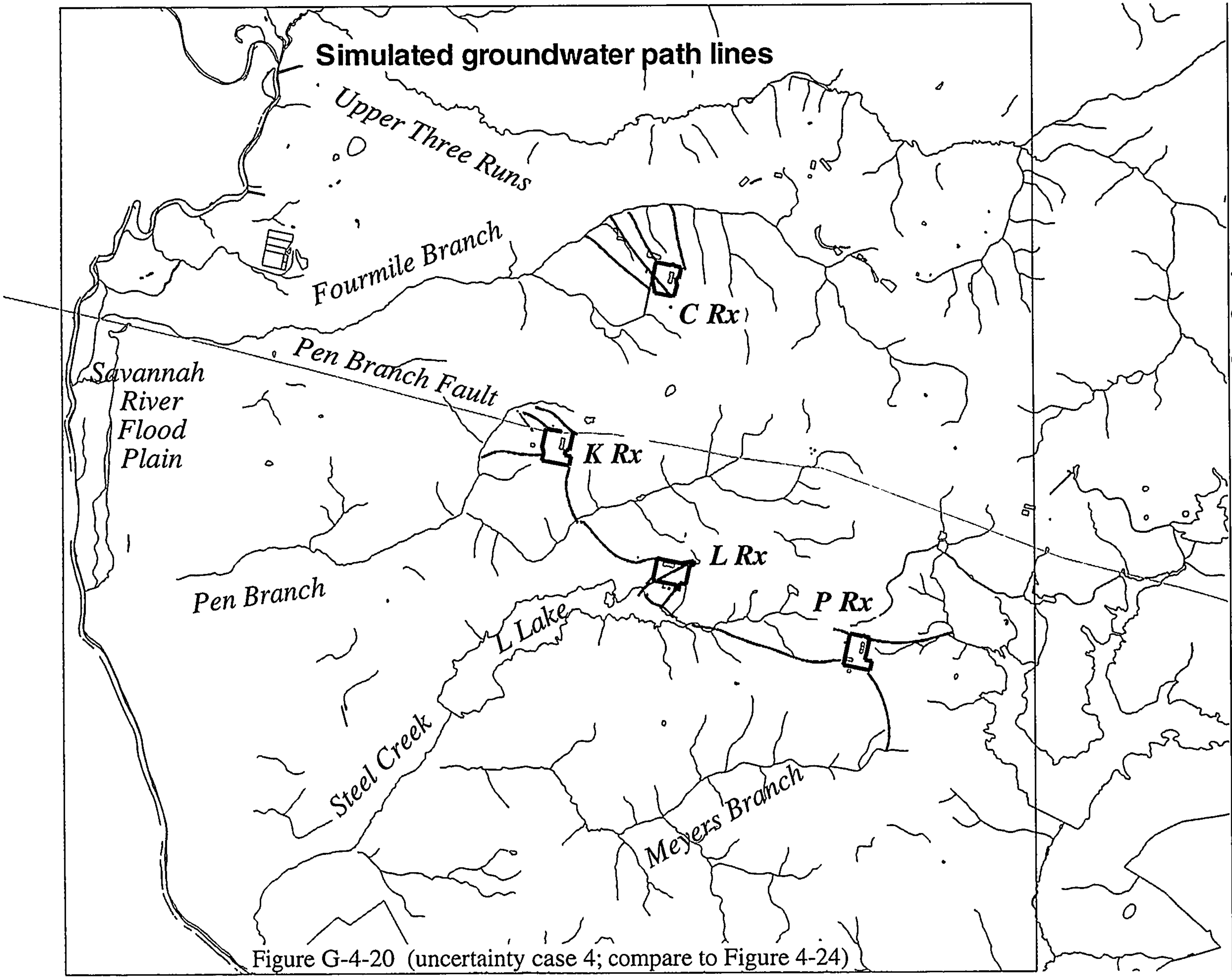

Figure G-4-20 (uncertainty case 4; compare to Figure 4-24)

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