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A THREE-DIMENSIONAL FINITE DIFFERENCE GROUND WATER FLOW MODEL OF THE SURFICIAL AQUIFER SYSTEM, BROWARD COUNTY, FLORIDA

by

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EXECUTIVE SUMMARY

Broward County, Florida is underlain by two aquifer systems: the Surficial Aquifer System and the deeper Floridan Aquifer System. This study focused upon the Surficial Aquifer System, which is widely used for potable and irrigation uses in the study area. The most productive zone of the Surficial Aquifer System is the Biscayne aquifer. The Biscayne aquifer is composed primarily of highly solutioned, extremely transmissive limestone. Most ground water in the study area is withdrawn from the Biscayne aquifer portion of the Surficial Aquifer System.

The Broward County ground water flow model was developed using the USGS three-dimensional finite difference flow code, MODFLOW. This code was chosen because it allows a detailed evaluation of ground water flow, is available in the public domain, is compatible with most computer systems, can be coupled with currently available solute transport models and contains many features which make it easy to use and modify. MODFLOW simulates ground water levels and flow using data describing aquifer characteristics and stresses to the aquifer, such as recharge, evapotranspiration, well withdrawals, and interactions with surface water bodies.

The Broward County model contains five vertical layers representing three different hydrogeologic zones within the Surficial Aquifer System. The horizontal model grid is divided into 100 rows and 134 columns. Each model cell is uniformly 1,000 feet in the east-west direction by 2,000 feet in the north-south direction.

Initial estimates of aquifer parameters were obtained from existing private consultant reports and from aquifer tests conducted by District staff. The model was calibrated by adjusting aquifer, canal, recharge and evapotranspiration parameters to better match computed ground water levels with observed historical ground water levels. Two calibration periods were selected: January 1983 through December 1985, and January 1989 through December 1989. Ground water withdrawal information for steady state and transient calibration was obtained from water use permits issued by the District and from public water supply information reported directly to the District.

The District's ARC/INFO geographic information system was used to create all time-independent information coverages for the county. The time-independent information was assembled with time-dependent information (such as precipitation data from the District's DBHYDRO database) through a series of pre-processing programs. These programs computed and formatted the data for input into MODFLOW. Graphic representations of model results were created with several post-processing programs. The final model files were subjected to a thorough quality assurance/quality control (QA/QC) procedure by staff from the Lower District Planning Division and the Hydrogeology Division.

To ensure the best possible accuracy for evaluative or predictive purposes, the model was tested for sensitivity to different aquifer parameters and stresses. The model appears to be most sensitive to hydraulic conductivity and canal conductance changes. Accordingly, the model is especially responsive to canal water levels and ground water pumping rates.

Recommendations

Eastern Broward County is experiencing a deficit of water to supply its needs during dry periods, and depends heavily on the availability of aquifer storage and on water brought into the area from adjacent areas. As demands increase, so will the need for additional water supplements into the area. Supplemental supply alternatives for the county could include management of demands through water conservation, wastewater reuse, backpumping, implementation of aquifer storage and recovery (ASR) facilities, development of new surface water reservoirs, and desalinization of salt water for public supply.

Careful management of withdrawals from the Biscayne aquifer is needed to reduce the risk of saline water intrusion in eastern Broward County. Maximum withdrawals, minimum head levels and/or minimum net yearly ground water flows to the ocean should be established in coastal areas to reduce or slow salt water migration. Future requests for large scale withdrawals should be closely examined to ensure that the criteria can be maintained.

It is recognized that both water quality and water quantity are important and interdependent aspects of water resources. Future modeling efforts should be extended to include solute transport models, which will provide the District with effective

tools in the management of such complex issues as ground water storage of wastewater, artificial recharge, aquifer storage and recovery, location of landfills and salt water intrusion.

The integrated surface water/ground water system that provides water supply in southeast Florida has evolved as a result of local needs rather than as a result of a single comprehensive regional plan. In spite of the fundamental understanding of ground water and surface water hydrologies and their interrelations, the two are often considered independently in south Florida.

A fully integrated surface, unsaturated and saturated flow model should be implemented with rigorous representation and conceptualization of the physical processes, water allocation, and surface water body operations involved in a canal-aquifer system such as Broward County. To a large extent, the model should incorporate the entire physical conceptualization of the hydrologic cycle on a time scale ranging from daily to monthly. For a realistic assessment of short-term impacts such as: 1) availability of water in canals, 2) the effects of precipitation in surface water bodies or in the unsaturated zone, or 3) water levels in aquifers near canals, the model should simulate the system using short stress periods. Similarly, for a realistic allocation of water based on agricultural or other needs, short simulation stress periods are desirable.

Interfaces should be developed with the existing Palm Beach County model, with the Dade County model currently under development, and with the regional surface water system model. This will result in a truly regional model that encompasses the entire flow regime for the Surficial Aquifer System in the Lower East Coast water supply planning area. This regional surface and ground water model would be particularly useful in evaluating the District's canal system, which maintains ground water levels and supplies many of the public water supply wellfields within the tri-county area.

The model can be used in the evaluation of water use permit applications for large uses. Where a finer scale or site-specific evaluation is required, the model can be used to provide boundary conditions. The model should continue to be improved and updated as additional information becomes available. Suggested improvements to the model include a finer grid spacing and shorter stress periods, ideally five days or less.

The Broward County model is sensitive to utility pumpage rates. Increased reporting and verification of public water supply pumpages and of large irrigation withdrawals on a well-by-well basis is recommended. Additional wells should be incorporated into the USGS monitoring well network in order to improve the regional ground water level information. Furthermore, additional aquifer testing should be required in areas where hydrogeologic information is lacking.

A new approach to computing evapotranspiration should be developed. Evapotranspiration values currently calculated are based on a modified Blaney-Criddle equation, which relies on temperature data. Errors due to the use of the Blaney-Criddle approach could be significant because it often results in the overestimation of irrigation demands.

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ABSTRACT

The Surficial Aquifer System is the primary source of potable and irrigation water in eastern Broward County. The most productive zone within the aquifer system is the Biscayne aquifer, which is present throughout most of the study area. A three-dimensional ground water flow model of the Surficial Aquifer System was developed using the U. S. Geological Survey MODFLOW code. The model is discretized into 100 rows, 134 columns, and five vertical layers. Initial aquifer parameters were obtained from private consultant reports and from aquifer tests conducted by District personnel. Two transient calibrations were performed (January 1983 through December 1985 and January 1989 through December 1989) by comparing simulated water levels to observed water levels. Two steady state calibrations were performed as well, using January 1983 and January 1989 conditions. Averaged 1989 conditions were also considered.

Based on the results of the calibration, adjustments were made to the aquifer parameters. Results of the sensitivity runs show that the Broward County model is most sensitive to hydraulic conductivity and canal conductance changes.

A fully integrated surface and ground water flow model should be implemented with rigorous representation and conceptualization of the hydrologic cycle. Regulatory criteria based on maximum withdrawals, minimum water levels or minimum net yearly ground water flows to the ocean should be established. A new approach to computing evapotranspiration should be developed.

INTRODUCTION

PURPOSE AND SCOPE

The purpose of this study was to develop a three-dimensional ground water flow model of the Surficial Aquifer System in eastern Broward County. The model is calibrated to recent data and will be used for predictive purposes, as a basis for ground water elements in the Broward County Water Supply Plan, and to assist in evaluating applications for water uses. Other possible applications of this model include:

1. Evaluation of short term drought management scenarios during declared water shortages,
2. Estimation of potential regional impacts of proposed new ground water uses, and
3. Conceptualization of regional effects of constructing new canals or changing the operational rules in existing canals.

LOCATION OF STUDY AREA

Broward County is located in southeast Florida. It is bounded on the north by Palm Beach County, on the east by the Atlantic Ocean, on the south by Dade County, and on the west by Collier and Hendry counties. Broward County encompasses approximately 1,200 square miles. The study area includes eastern Broward County and adjacent areas in Palm Beach and Dade counties. The buffer areas were chosen to provide suitable boundary conditions for the model; however, the primary study area is within Broward County (Figures 1 and 2).

HYDROGEOLOGY

Surficial Aquifer System

The Surficial Aquifer System is comprised of all saturated sediments from the water table down to the relatively impermeable sediments of the Intermediate Confining Unit overlying the Floridan Aquifer System. It is an unconfined aquifer system recharged by rainfall and by leakage from surface water bodies.

The Surficial Aquifer System is heterogeneous. In this study, the system was divided into three broad zones: the upper zone, the Biscayne aquifer, and the lower zone. The upper zone contains the sands, shells and silts of the water table sediments extending down to the top of the Biscayne aquifer. The Biscayne aquifer is made up of extremely permeable, massive biogenic limestone. The lower zone extends from the bottom of the Biscayne aquifer to the silts and clays of the Intermediate Confining Unit. Figures 3A and 3B show general conceptual cross-sections of the Surficial Aquifer System in the north-to-south direction as well as the west-to-east direction. The Surficial Aquifer System tends to thicken toward the east. The reader is referred to the USGS publication <u>Hydrogeology, Aquifer Characteristics, and Ground-Water Flow of the Surficial Aquifer System, Broward County, Florida</u>, by Johnnie E. Fish, for more detailed information on the Surficial Aquifer System.

Biscayne Aquifer

The Biscayne aquifer underlies the upper zone of the Surficial Aquifer System throughout most of the study area. It is composed primarily of solution-riddled biogenic limestone. Hydraulic conductivities in the Biscayne aquifer often exceed 10,000 ft/day (Fish, 1988). The aquifer thickens to the east and the south, and extends upward towards land surface in southern Broward and Dade counties. Water levels in the Biscayne are almost identical to local water table levels, suggesting an unconfined system. However, aquifer tests of extremely permeable zones of the Biscayne may exhibit semiconfined behavior due to significant stratification and wide variations in permeabilities of overlying sediments (Fish, 1988).

Drilling logs, well cuttings and well sample descriptions from consultant reports were examined to delineate the base of the Surficial Aquifer System and the top elevation and thickness of the Biscayne aquifer within it (Appendix A, Table A-1 and Figure A-1). Also, several wells from the hydrogeologic cross-sections in Fish (1988) were used. Well cuttings and cores from District test wells constructed as part of this study were also examined. The base of the Surficial Aquifer System was selected by the occurrence of hydraulic conductivities of less than 10 ft/day (Fish, 1988), by lithologic logs citing increased clay content or significant and vertically continuous low permeability, and by examination of cores and split-spoon samples. The Biscayne aquifer was identified as those zones having hydraulic conductivities of 1,000 ft/day or more (Fish, 1988), by sample descriptions of solutioned crystalline limestone or reports of lost circulation during rotary drilling, and by examination of cores and split spoon samples. Structure contours of the Surficial Aquifer System and the Biscayne aquifer can be found in Appendix A, Figures A-2 through A-4.

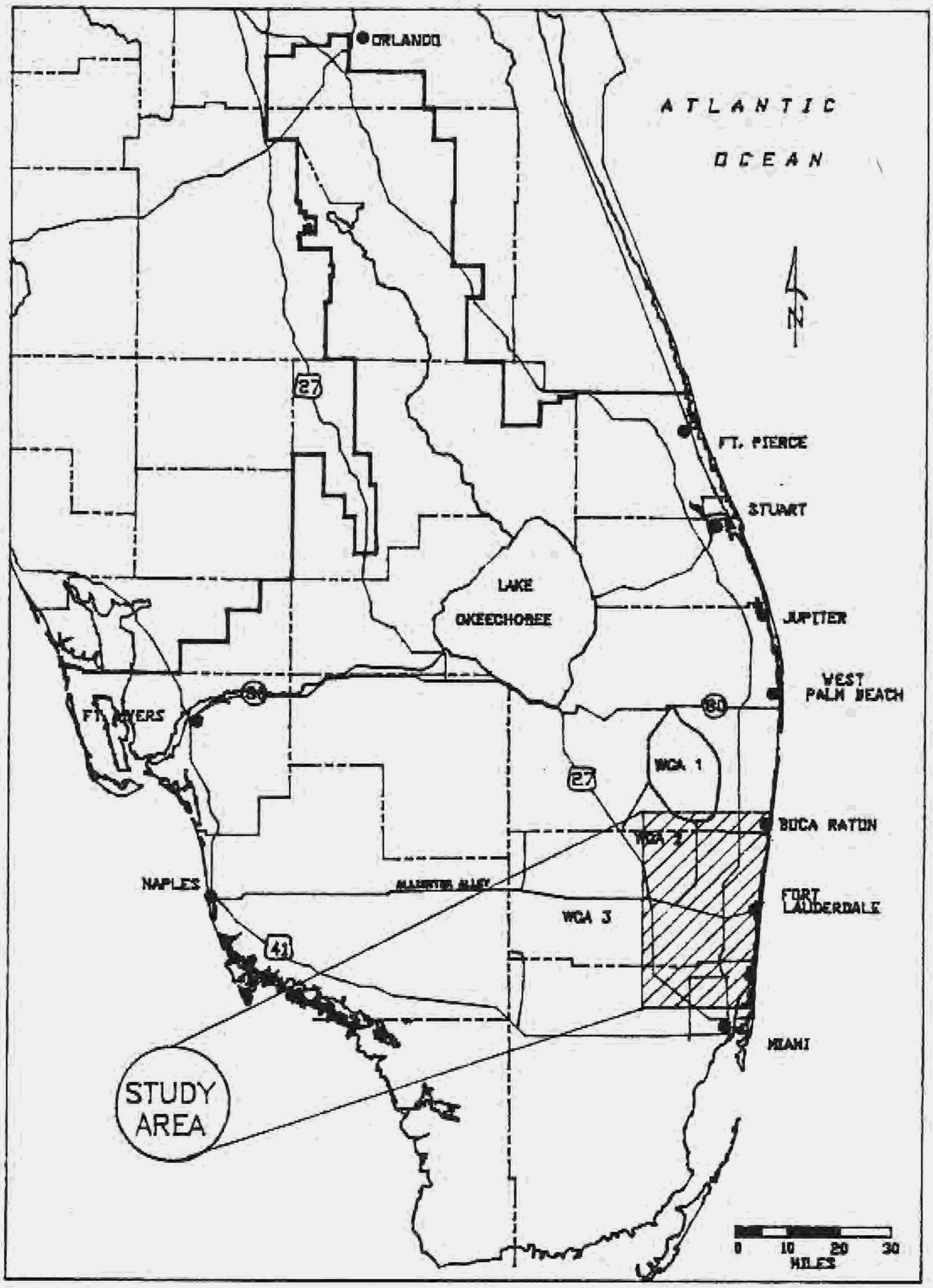


FIGURE 1. Study Area for Broward County Model

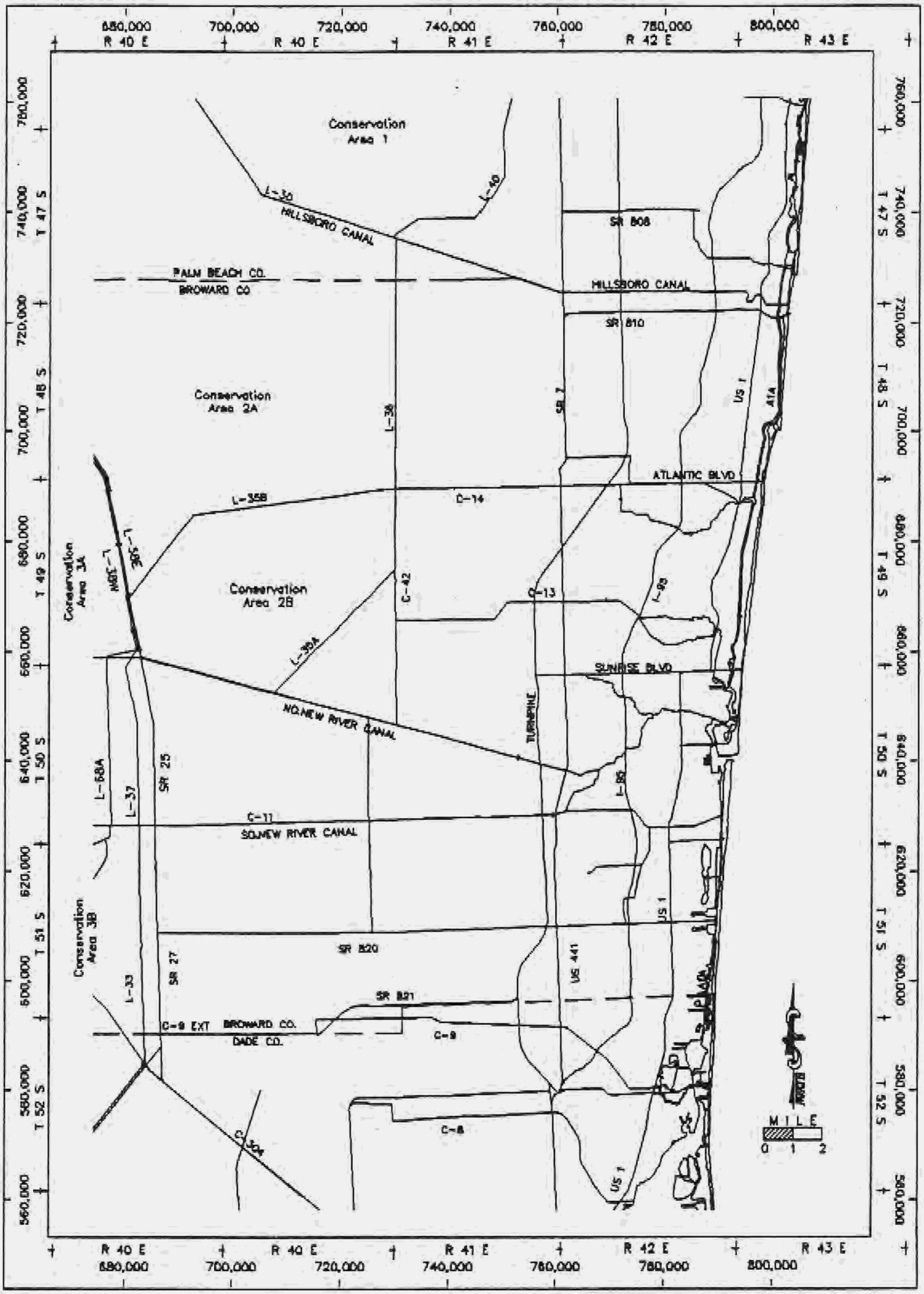


FIGURE 2. **Modeled Study Area**

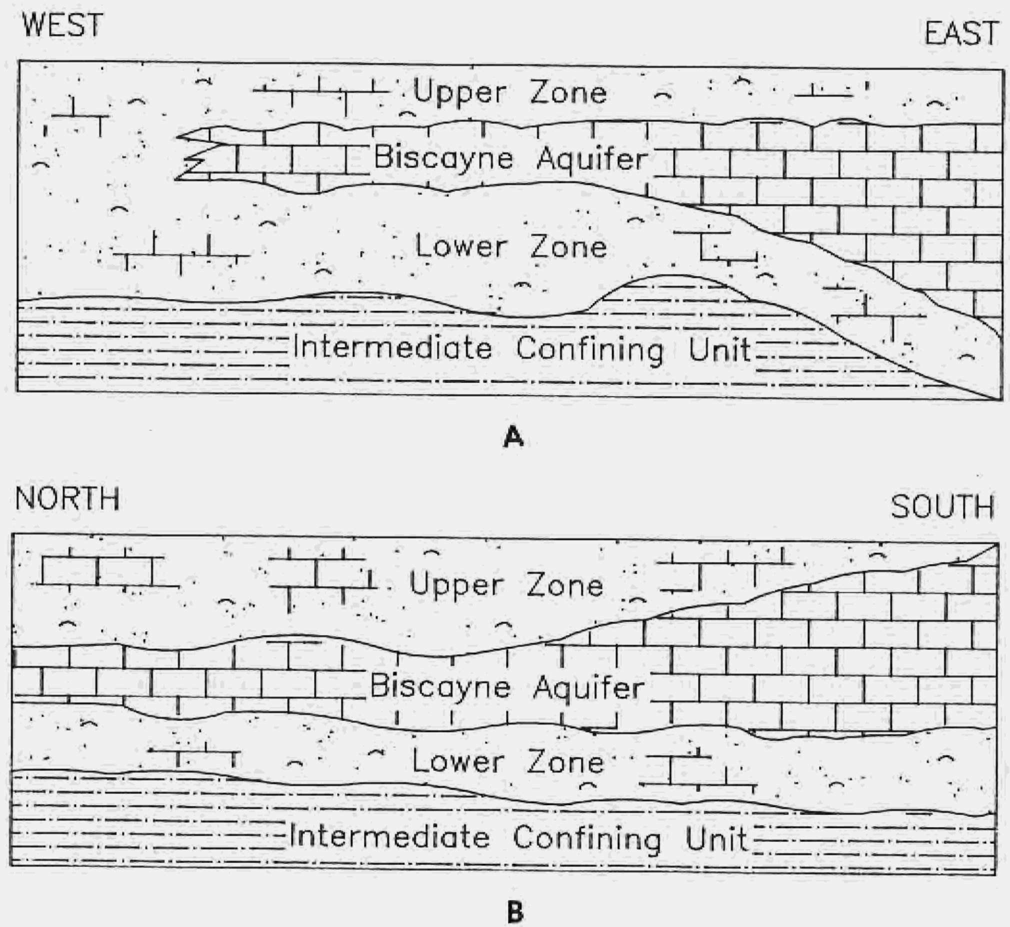


FIGURE 3. **Generalized Hydrogeologic Cross Section of the Surficial Aquifer System in Broward County (3A - West to East, 3B - North to South)**

MODELING FORMULATION AND APPLICATION

INTRODUCTION

The U. S. Geological Survey modular three-dimensional finite-difference ground water flow code, commonly known as MODFLOW (McDonald and Harbaugh, 1988), was used in this study to simulate the ground water flow and the interaction of ground water and surface water systems. MODFLOW is capable of simulating ground water flow in anisotropic, heterogeneous, layered aquifer systems. The finite-difference approach is block-centered, meaning that the head values are calculated at the center of the cells. Layers may be simulated as confined, unconfined or convertible (confined/unconfined). This model was selected for the following reasons:

1. It is available in the public domain,
2. It is compatible with most computers with only minor modification,
3. The modular structure of the code and its excellent documentation allow modification of the code and the addition of new modules for specialty applications,
4. MODFLOW allows flexibility of data file structure and management, which facilitates the employment of and interaction with other software for data manipulation,
5. The cell-by-cell flow feature of the code can be used to:
   A. evaluate in detail flow and head changes associated with various withdrawal scenarios, and
   B. generate boundary conditions for higher-resolution models within the regional flow model,
6. It can be coupled with currently available non-density dependent solute transport models, and
7. A stream package is available for MODFLOW.

The MODFLOW code is written in modular form. It consists of a main routine and a series of independent subroutines called modules. These modules are grouped into packages which address the general use of the model, specific features of the hydrologic system, or particular solution techniques. The hydrologic system packages simulate recharge, evapotranspiration from the saturated aquifer zone, rivers, drains, wells, and other sources and sinks of water external to the model (boundary conditions). Three solution technique packages are available for simulating flow problems: 1) slice-successive over relaxation (SSOR), 2) strongly implicit procedure (SIP), and 3) the preconditioned conjugate gradient (PCG) method. The SIP method was used in this study because it was fast and caused no convergence problems. Table 1 lists the packages used in this study.

Three types of boundary conditions are available for the model formulation: prescribed head, prescribed flux and head-dependent flux. A prescribed head boundary is defined when the head at the boundary is specified as a known function of position and time. Similarly, prescribed flux is defined when the flux is specified as a known function of time at the outer edges of boundaries. The head-dependent flux boundary is defined when the ratio between the head gradient and flux is known. Constant head boundaries, which are a particular case of prescribed head boundaries, maintain the same user-specified head levels throughout the simulation.

Prescribed flux boundaries can be simulated in MODFLOW through the use of external source terms in the model. No-flow boundaries are a type of prescribed flux boundary for which no flow is simulated between the inactive cell and any adjacent active cell. Head-dependent flux boundaries generate a flux dependent on the computed head in the cell and a user-defined head assigned to the external source. Head-dependent flux boundaries can be simulated in MODFLOW through the use of general-head boundaries as well as the river, drain or ET packages. Prescribed head can be represented in MODFLOW as a particular case of head-dependent flux, where the flux can become as large as needed. All types of boundary conditions can be set anywhere within a model grid. A no-flow boundary is implicit along the outer edges and bottom layer of a model grid.

DISCRETIZATION

Space Discretization. The model grid contains uniform cells covering a two million square foot area, as shown in Figure 4. The grid is composed of 100 rows and 134 columns. Grid spacing is 1,000 feet wide (west to east) by 2,000 feet long (north to south). The model is divided vertically into five layers of varying thickness. Vertical discretization

TABLE 1
MODFLOW PACKAGES USED IN THE BROWARD COUNTY MODEL

MODFLOW PACKAGE	FUNCTION	USE IN MODEL
Basic	Handles model administration.	Used
Block Centered Flow	Computes coefficients of finite difference equations for ground water flow, in an isolated aquifer system considering constant head cells.	Used to represent aquifer system without constant head cells.
Well	Simulates a source or sink to the aquifer at a specific rate not affected explicitly by heads and cell area.	Used to simulate pumpage and injection wells.
River	Simulates the effects of river leakage. River may act as recharge or discharge sources depending on the head gradient between the river stage and the ground water regime.	Used to simulate the interaction between a surface water body and the aquifer in cells with maintained SFWMD canals, secondary canals with recharge systems, or secondary canals having free flow with SFWMD canals.
Drain	Simulates the effects of drains, which remove water from the aquifer when the head in the aquifer is higher than the head in the drain.	Used to simulate water levels in unmaintained canals and some lakes which are not isolated.
Recharge	Simulates recharge to the aquifer from deep percolation due to precipitation.	Used
Evapotranspiration	Simulates the effects of evapotranspiration from a saturated aquifer system.	Used
General Head Boundary	Simulates a source/sink of water outside model area which provides or removes water to a model active cell at a rate proportional to the head gradient between the source and the cell.	Used to simulate General Head Boundary conditions and prescribed heads.
Strongly Implicit Procedure (SIP)	Solves the model's finite difference equations using the SIP method.	Used
Observation Nodes	Generates computed aquifer heads for selected model cells.	Used for calibration and comparison purposes.

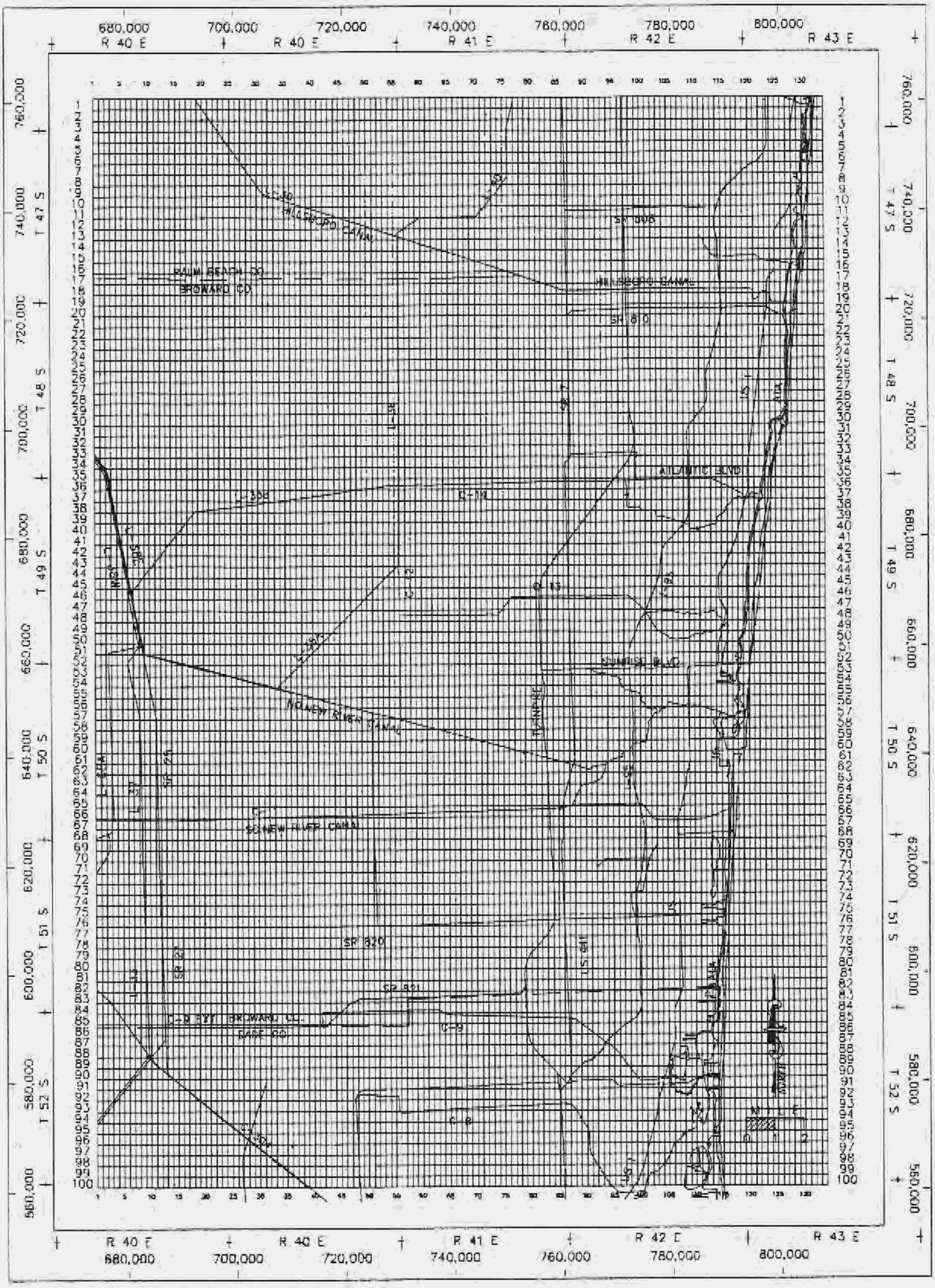


FIGURE 4. Broward County Model Grid

of the Surficial Aquifer System (Figure 5) was designed as follows:

1. Layer 1 contains all river, drain, recharge and evapotranspiration cells. Layer 1 extends from the water table to a maximum depth of -15 feet National Geodetic Vertical Datum (NGVD), subject to a minimum saturated thickness of 15 ft. A maximum thickness of 22.5 feet was chosen to prevent drying of cells. The maximum thickness and minimum saturated thickness were selected in order to portray soil conditions and lakes while avoiding drying of cells during model simulations. Where layer 1 is absent (e.g. where the Biscayne aquifer rises towards land surface), the thickness of the layer is set to 15 feet, with corresponding changes in hydraulic conductivity as discussed in the transient calibration section.

2. Layer 2 extends from the bottom of layer 1 to approximately the top of the highly permeable limestones of the Biscayne aquifer. Where layer 2 is missing (e.g. where the Biscayne aquifer rises close to land surface), the thickness of the layer is set to 5 feet, with corresponding changes in hydraulic conductivity as discussed in the transient calibration section.

3. Layers 3 and 4 generally represent the Biscayne aquifer. The top of layer 3 was assigned to the first occurrence of highly permeable limestone in examined cores and well logs, at the top of strata identified as having hydraulic conductivities of at least 1,000 ft/day in hydrogeologic sections illustrated in Fish (1988). The top of layer 4 (bottom of layer 3) is approximately the midpoint of the Biscayne aquifer. Where the Biscayne aquifer is missing, layers 3 and 4 are reduced to a minimum thickness of three feet (six feet total), with corresponding changes in hydraulic conductivity as discussed in the transient calibration section.

4. Layer 5 begins approximately at the bottom of the Biscayne aquifer, or when the highly permeable limestones found above give way to significantly less permeable sands, silts, and shell. The bottom of layer 5 generally coincides with the bottom of the Surficial Aquifer System and the appearance of the green silts and sandy clay of the Intermediate Confining Unit.

Although layers 3 and 4 could be modeled by a single layer, the discretization selected correlates with that used by Shine, et al., (1989) in a model of Palm Beach County. Figures A-5 through A-12 in Appendix A depict the elevation of the tops of layers 2 through 5 and their thicknesses.

Time Discretization. Transient discretization into 1-month stress periods was chosen because of the availability of monthly pumping reports from public water utilities and computer storage considerations at the beginning of the modeling effort. Two transient calibration periods were simulated; the first period was from January 1983 through December 1985, and the second was from January 1989 through December 1989. Initially, the 1989 period was used only to verify the estimated parameters used for the 1983 through 1985 period. However, significant changes in canal operating systems and the addition and removal of other canals between 1985 and 1989 necessitated a second calibration period. The steady state model, which is a single time step or stress period with no water taken into or released from aquifer storage, uses both January 1983 and January 1989 conditions independently, as well as averaged 1989 conditions.

BOUNDARY CONDITIONS

The function of boundaries is to impose the effects of the external regional flow system on the modeled area. Selecting the correct boundary type and appropriate values is an important consideration, since the response of the model can be greatly affected by the choice of boundary conditions. Boundary conditions are expressed in mathematical equations which represent the physical conditions as interpreted by the modeler. In many cases, true physical boundaries are unknown or are at a great distance from the region of interest; therefore, model boundaries must be defined on a practical basis. Whether a model's boundaries are true physical conditions or practical representations, boundary condition specification is extremely important and requires an understanding of the mathematical role of boundary conditions as well as the hydrogeological environment.

A combination of no-flow, general-head, and general-head acting as prescribed head boundaries were used in this model. Figure 6 shows which cells are active, which are inactive and which are considered general-head boundaries. No-flow boundaries are implicit along the edges of the model.

The general-head boundary package was used to generate head-dependent flux and prescribed head boundaries. According to McDonald and Harbaugh (1988), a general-head boundary consists of a water source outside the modeled area which supplies or removes water to a model cell at a rate proportional

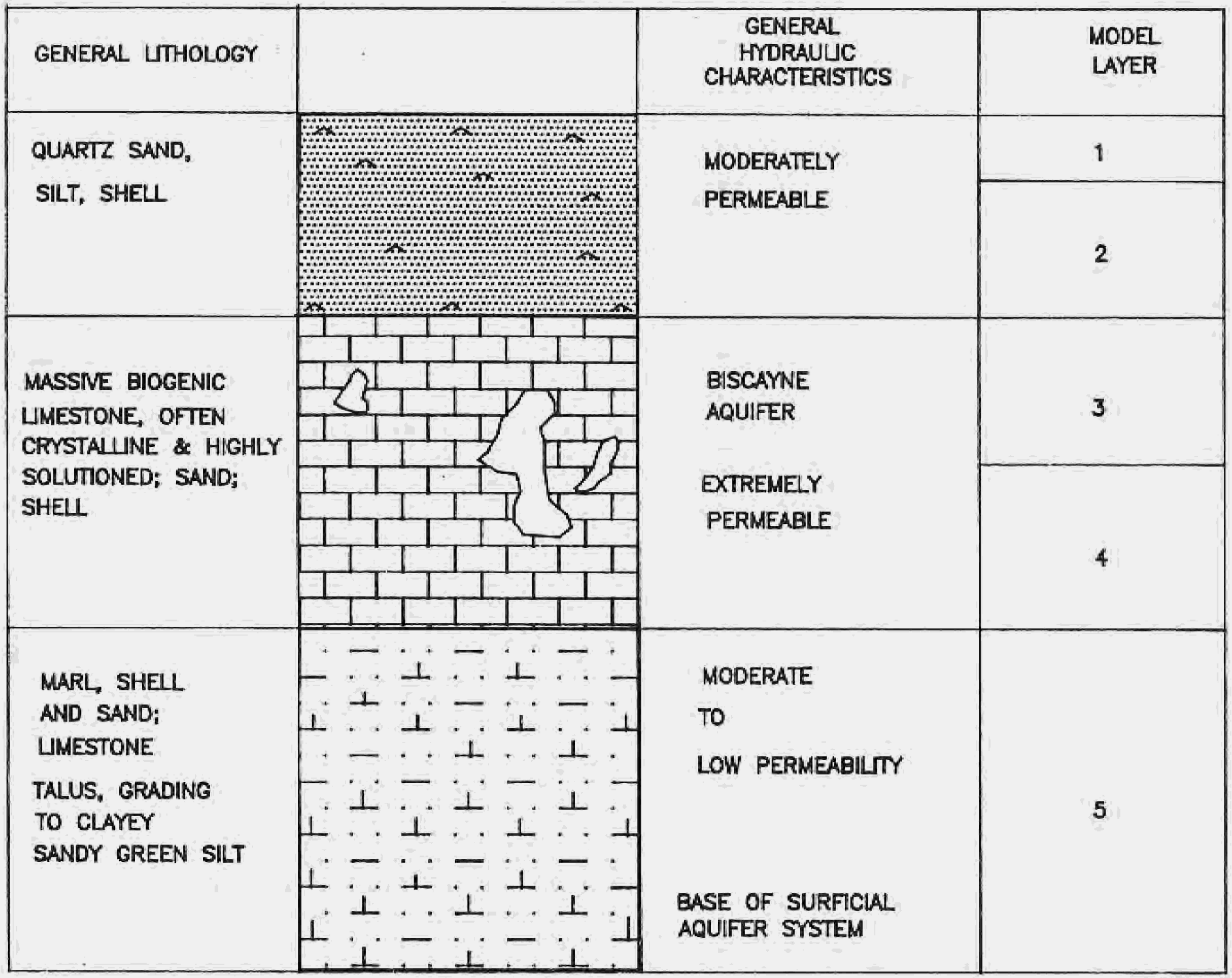


FIGURE 5. Generalized Hydrogeologic Column of the Surficial Aquifer System and Corresponding Model Layers

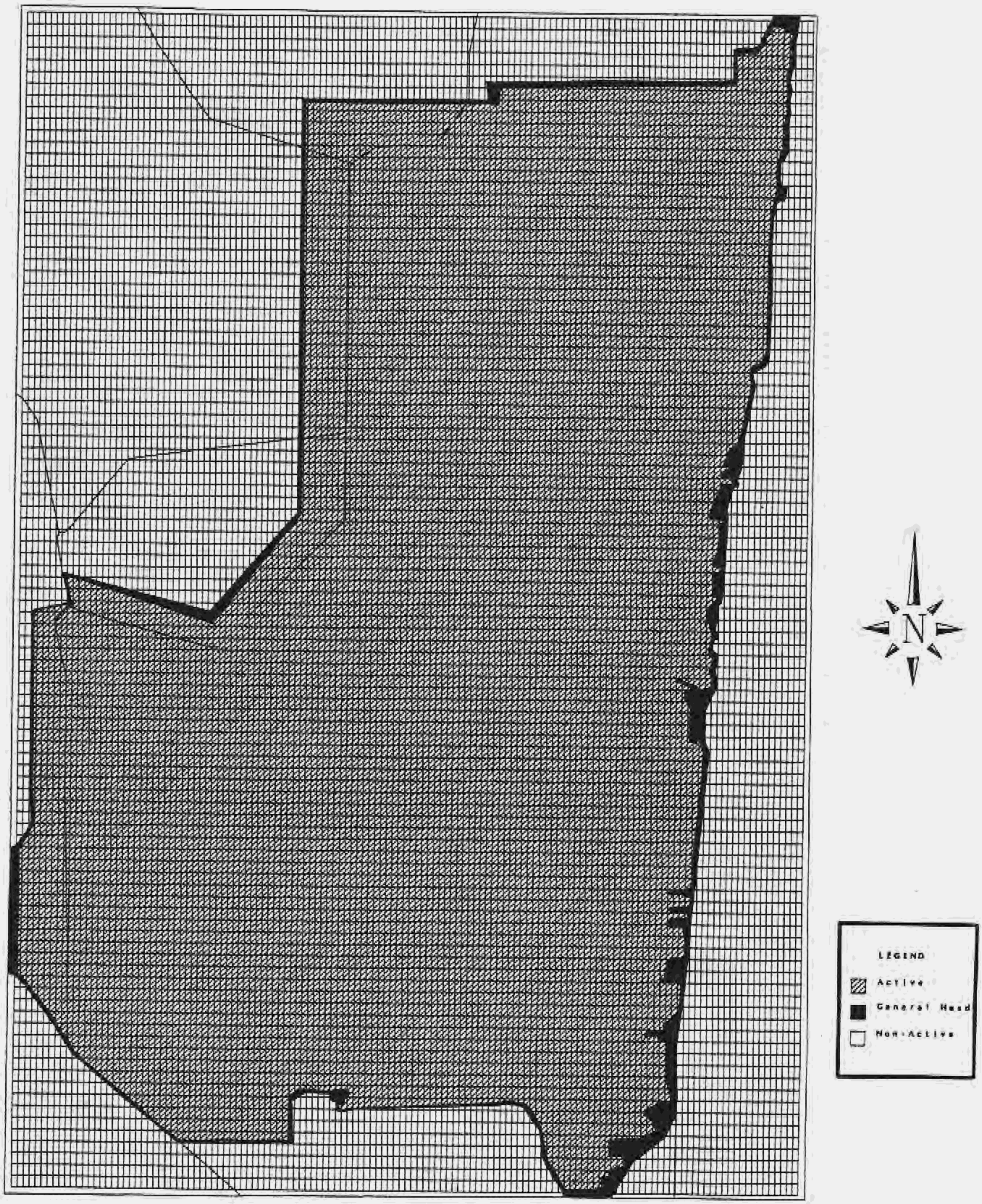


FIGURE 6. Broward County Model Boundaries

to the head difference between the source and the cell. The rate at which water is supplied to a cell is given by:

$$Q_m = C_m (H_m - h) \qquad (1)$$

where

Q_m is the flow rate to or from the cell from boundary m (ft^3/day),

C_m is the constant of proportionality for boundary m (ft^2/day),

H_m is the average head at the source boundary m (ft), and

h is the average head in the cell (ft).

The constant of proportionality for boundary m defined herein as the horizontal conductance, C_m, (ft^2/day) was calculated using equation 2:

$$C_m = \frac{K_h\, b\, W}{F_c\, L} \qquad (2)$$

where

K_h is the horizontal hydraulic conductivity of the cell (ft/day);

b is the average thickness of the layer (ft),

W is the width of the cell (ft),

F_c is a dimensionless calibration factor for general-head boundary representation; for prescribed heads, this value ranged between 1 x 10^{-3} to 1 x 10^{-5}, and

L is the length of the assumed flow path line (ft).

In order to simulate a constant head boundary around the active edges of the model, a large horizontal conductance value was assigned to the general-head cells, causing them to function as prescribed head cells. Prescribed head cells differ from constant head cells in that the head values can change between stress periods. The river package may also be used to create a prescribed head boundary; however, the disadvantage with utilizing the river package is that the actual physical system may not be well represented by vertical flow across an idealized streambed.

Several obvious boundaries were available for the Broward model: the Atlantic Ocean borders the entire eastern edge of the county, and Water Conservation Areas (1, 2A, 2B, 3A, and 3B) border the entire western edge (Figure 2). In the Water Conservation Areas, the boundaries were located far enough west of the levees to reduce any boundary impacts. Under current conditions, the C-15 canal and Lake Worth Drainage District (LWDD) canals in Palm Beach County provide a boundary along the northern edge of the model far enough from the political boundaries of Broward County to avoid boundary flow effects within the area of interest and to prevent stresses in the area of interest from affecting the boundary. In a similar fashion, the C-8 and C-304 canals in Dade County provide a boundary along the southern edge of the model. A detailed discussion of the boundary conditions used in the modeling domain follows.

Eastern Boundary. The Atlantic Ocean is utilized as the eastern boundary of the model. The ocean provides an infinite source of water (at a given head) which can be considered a head-dependent flow boundary at each of the aquifer layers. This boundary was represented using the general-head boundary package. Head elevations at the external source were set at the monthly mean sea level for all model layers. A conversion to equivalent fresh water head was not used. In layers 1 and 2, the eastern boundary cells are in direct contact with the ocean. Accordingly, horizontal conductance values were set large enough to provide an unlimited source/sink of water, thereby acting as a prescribed head boundary.

Layers 3, 4 and 5 were assumed not to be in direct contact with the ocean; therefore, a more restrictive general-head boundary was assigned, with a conductance closer to the actual inter-block transmissivity at the no-flow boundary. The horizontal conductance was decreased with depth in the three lower layers in order to simulate the increasing distance from the oceanic source/sink. Equation 2 was used to calculate the conductances. Conductances were reduced with depth by increasing the F_c calibration factor for each successive layer.

Western Boundary. Figure B-1 in Appendix B depicts the location of the Water Conservation Areas (WCAs) within the model area. The WCAs function as storage basins and their stages are generally controlled by the South Florida Water Management District. The WCAs have been divided into 5 pools and designated by number from north to south as WCAs 1, 2A, 2B, 3A, and 3B. Figures B-2 through B-6 in Appendix B illustrate the average monthly water levels from January 1989 through December 1989 for WCAs 1, 2A, 2B, 3A, and 3B, respectively. Information on the management of the WCAs can be found in An Atlas of Surface Water Management Basins in the Everglades: The Water Conservation Areas and Everglades National Park, by R. M. Cooper and J. Roy.

The WCAs provide a type of prescribed head boundary for the western edge of the model for the top layers. Since head elevations in the WCAs change significantly with time, the general-head package was used to simulate the boundaries. In layer 1, the cells were given large conductance values. The large conductance values allow the cells to function as prescribed head cells. In layers 2 through 5, equation 2 was used to calculate the conductance; conductance then was decreased through the layers with depth to the limit of the actual inter-block transmissivity at the no-flow boundary. This was accomplished by increasing the F_c calibration factor, as described in the discussion of the eastern boundary. As a result, the general-head cells in layers 2 through 5 may function more like general-head boundaries than prescribed head boundaries. The western model boundary extends far enough from the levees on the eastern side of the WCAs that stresses occurring within the developed areas of the county should not affect boundary flow conditions.

Northern Boundary. The northern boundary of the model was extended far enough north of the Broward County line to eliminate any boundary effects from the edges of the model. Water bodies near the northern edge of the study area used to simulate boundary conditions include C-15, WCA 1, WCA 2A, and canals within the Lake Worth Drainage District (LWDD). The water bodies were simulated with the general-head boundary package using the conductance term given in equation 2. Similar to the eastern and western boundaries, a large conductance was assumed in layer 1 to create a prescribed head boundary. The conductance was reduced with depth using the F_c calibration factor as previously explained.

Southern Boundary. The C-304 and C-8 Canals are located in the southern edge of the model. These canals are located far enough into Dade County that stresses occurring within Broward County should not effect the boundary flow conditions. General-head boundary conditions were assumed for all layers. A large conductance was assumed in layer 1 to establish a prescribed head boundary. The conductance in layers 2 through 5 was reduced with depth by increasing the F_c calibration factor in equation 2 as previously discussed.

HYDRAULIC CHARACTERISTICS

Transmissivity

Pre-calibration transmissivities for all layers in the model were initially based on estimates of hydraulic conductivity. Horizontal hydraulic conductivity of layer 1 was estimated to be twice the average vertical hydraulic conductivity of the soil profile, based on soil data obtained from the Soil Conservation Service soil surveys of Broward (1976) and Palm Beach (1978) counties, and on aquifer tests in the upper zone of the Surficial Aquifer System in Broward County. In cells containing lakes, the hydraulic conductivity was allowed to increase up to an additional 1,250 ft/day, depending on the size of the lakes. Since layer 1 is classified as unconfined, MODFLOW calculates the transmissivity of layer 1 by multiplying horizontal hydraulic conductivity by the elevation of the water table above the bottom of the layer.

Transmissivity of layers 2 and 5 were initially calculated as the product of layer thicknesses and a uniform horizontal hydraulic conductivity value of 50 ft/day. The 50 ft/day value was chosen to correspond with the hydraulic conductivity of non-Biscayne sediments used in the South Palm Beach County model (Shine, et al., 1989). As a result of the calibration process, final hydraulic conductivity values for layer 2 ranged between 30 and 1,130 feet per day. Transmissivity values ranged between 325 and 13,850 ft^2/day for layer 2 and between 540 and 15,180 ft^2/day for layer 5. These layers are classified as confined/unconfined, with the thicknesses of each layer remaining unchanged throughout the simulation. Storage coefficients may alternate between confined and unconfined values should the layers desaturate.

Initial transmissivity estimates for the Biscayne aquifer (layers 3 and 4) were based on a generalized transmissivity map of the Biscayne contained in a 1986 report by James M. Montgomery, Inc. Transmissivity value points along those contours as well as those from several aquifer performance tests (APTs) were kriged using Surfer (Version 4.12, Golden Software) and then converted to model cell values. The APT locations and transmissivity values used are shown in Table 2. The model cell transmissivity values were divided by the combined thickness of layers 3 and 4 to calculate hydraulic conductivity values. A value of 10,000 ft/day was set as a maximum limit for hydraulic conductivity of the Biscayne aquifer. Although this value can be exceeded in the Biscayne (Fish, 1988), the use of hydraulic conductivity values greater than 10,000 ft/day did not change model results. The thickness of the Biscayne then was multiplied by the hydraulic conductivity to regenerate transmissivity values. In areas where the Biscayne aquifer thins appreciably, yet is expected to conduct large volumes of water, a minimum thickness of 35 feet was used in recalculating the transmissivities. Where the Biscayne aquifer was absent, transmissivity was calculated by multiplying a minimum thickness of six feet (three feet each for layers 3 and 4) by the

TABLE 2 Summary of Aquifer Test Data Used to Establish the Transmissivity of the Biscayne Aquifer Within the Surficial Aquifer System

Location or Owner	Source of Information	Florida State Planar Coordinates[1]		Transmissivity (sq ft/day)
		X (east)	Y (north)	
USGS PB 1574	Shine, 1989	760734	759816	31,000
Morikami Park	Shine, 1989	776734	759816	140,000
USGS PB 1581	Shine, 1989	771734	739816	88,000
Wellfield 3B	JMM, 1989	763734	605816	400,000
Quiet Waters Park	SFWMD[2]	774734	721816	133,700
Tradewinds Park	SFWMD[2]	771734	701816	198,000
Prospect Wellfield	CDM, 1980	758734	669816	260,000
Coral Springs	CDM, 1986	743734	707816	37,000
North Springs Improvement Dist.	G & J, 1979	729734	709816	10,000
Dixie Wellfield	CDM, 1980	753734	641816	140,000
Deerfield Beach	G & J, 1980	785734	715816	46,800

Abbreviations: JMM - James M. Montgomery, Inc.
CDM - Camp Dresser & McKee, Inc.
G & J - Gee & Jenson, Inc.

[1]The coordinates represent the centers of model cells where the transmissivity values were applied rather than exact coordinates of the pumping test wells.

[2]Conducted by SFWMD as part of this study.

average of the hydraulic conductivities of the adjoining cells in layers 2 and 5. In all of the above calculations, the Biscayne aquifer was treated as a single unit; transmissivities were halved to separate layers 3 and 4. Transmissivity values for either layer 3 or 4 ranged from 180 to 595,000 ft^2/day. Hydraulic conductivity values for each layer were adjusted non-uniformly, to a maximum change of ±15 percent, during the calibration process.

The composite transmissivity (sum of all transmissivities in all layers) which approximates the transmissivity of the Surficial Aquifer System as a whole is shown in generalized transmissivity regions in Figure 7. Layer 1 transmissivities were based on the average water table elevation for the composite transmissivity calculations. Transmissivity contours for layers 2 through 5 may be found in Appendix A, Figures A-13 through A-15.

Specific Yield and Storage

Calibrated specific yield values in layer 1 range from 0.19 to 0.21, with an average value of 0.2, a typical value for unconfined aquifers (Walton, 1987). The specific yield was allowed to increase to a maximum value of 0.5 when large lakes were present in cells, depending on the size of the lakes.

Calibrated storage coefficients in layers 2 through 5 were set to a specific storage value of 5×10^{-6} ft^{-1} multiplied by the aquifer thickness (feet). Final storage coefficient values varied as follows:

LAYER	MINIMUM	MAXIMUM
2	2×10^{-4}	6×10^{-4}
3	4×10^{-5}	1×10^{-4}
4	4×10^{-5}	1×10^{-4}
5	2×10^{-4}	6×10^{-4}

Specific yield and storage coefficients were adjusted non-uniformly in space during the calibration process.

Vertical Conductance

Within the MODFLOW model, vertical flow between layers is controlled by the vertical conductance coefficients (V_{cont}). V_{cont} is a composite term which is input into the model. V_{cont} is expressed in units of day^{-1}. It is calculated for the two nodes located at vertically adjacent geohydrologic units using the following equation based on the Vcont equation in MODFLOW (McDonald and Harbaugh, 1988):

$$V_{cont} = \frac{1}{\dfrac{b_u}{2K_{hu}A_{vh}}} + \frac{1}{\dfrac{b_l}{2K_{hl}A_{vh}}} \qquad (3)$$

where

b_u and b_l are the thicknesses of the upper and lower layers (ft),

K_{hu} and K_{hl} are the horizontal hydraulic conductivities for the upper and lower layers (ft/day), and

A_{vh} is the ratio of vertical to horizontal hydraulic conductivity (the vertical anisotropy factor) for each layer in consideration (dimensionless).

The factor A_{vh} was adjusted non-uniformly in space during the calibration process.

The Surficial Aquifer System in the study area behaves as a semiconfined system. Calibrated values of the vertical anisotropy factor, A_{vh}, for the upper zone of the Surficial Aquifer System (layers 1 and 2) range from 0.02 to 0.08, with an average value of 0.055. The Biscayne aquifer (layers 3 and 4), when present, behaves as a single semiconfined unit. It is characterized by high values of hydraulic conductivity in any direction. The resulting high values of V_{cont} cause layer 3 to react to stress in a similar manner as layer 4. Vertical anisotropy values from 0.08 to 0.15 were used in the Biscayne, with an average value of 0.15. Although this value appears low, it was found to yield acceptable results. Where the Biscayne aquifer is absent, the averaged value for layers 2 and 5 is used. Values of vertical anisotropy for the lower zone (layer 5) range from 0.02 to 0.09, with an average value of 0.052.

SURFACE WATER INTERACTION

The canals function as a source of recharge to the aquifer and a recipient of discharge from the aquifer. Canal-aquifer interaction is dependent on several factors:

1. the degree of hydraulic connection between the canal and the aquifer,
2. the difference in water level between the aquifer and the canal (see Figure 8),
3. the shape of the flow lines in the aquifer surrounding the canal reach (for example, the flow lines may be more vertical or more horizontal),

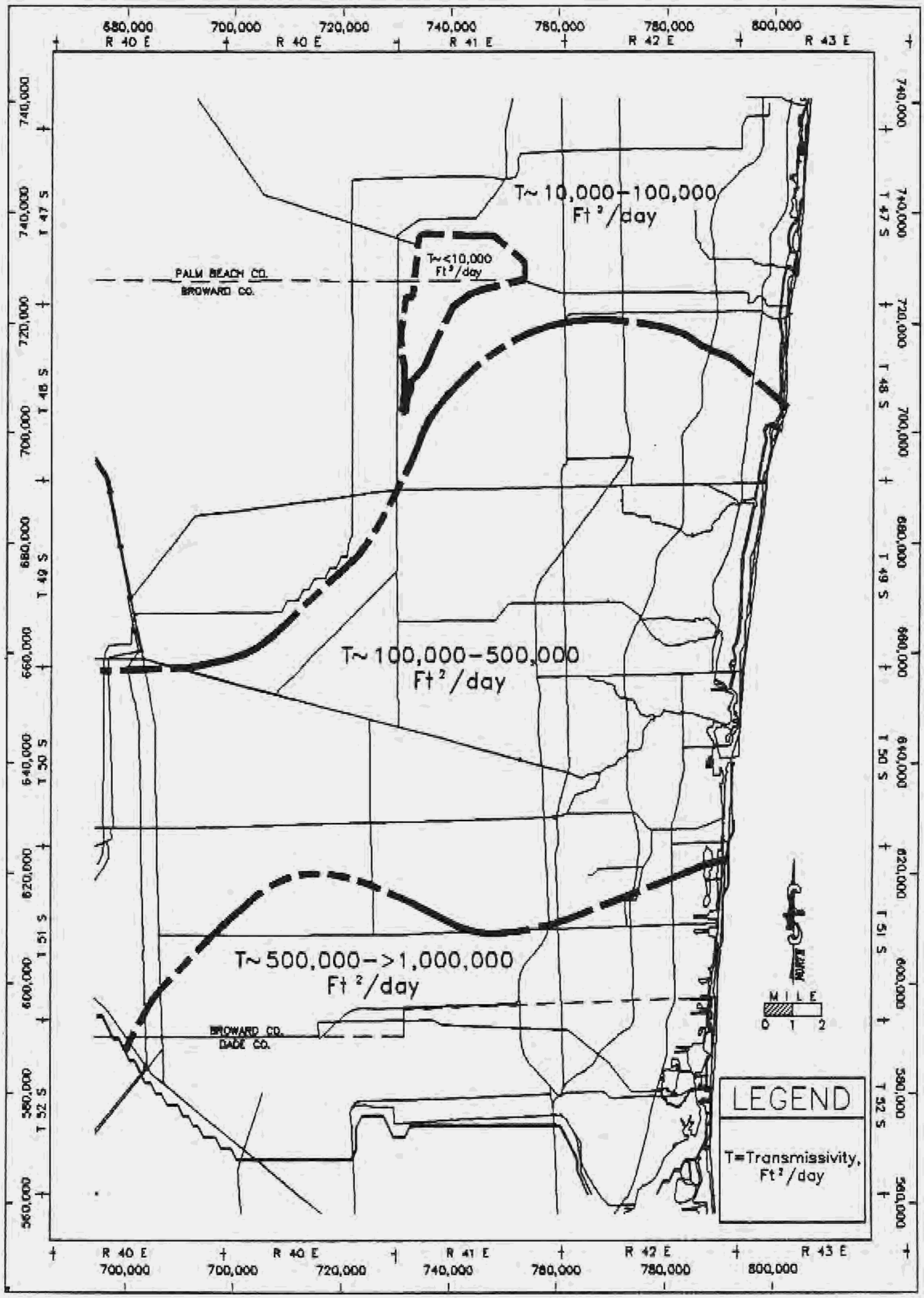
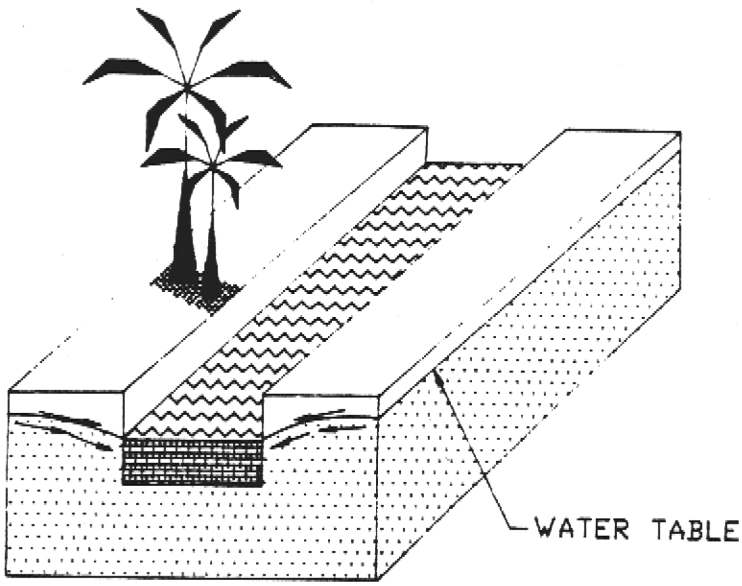
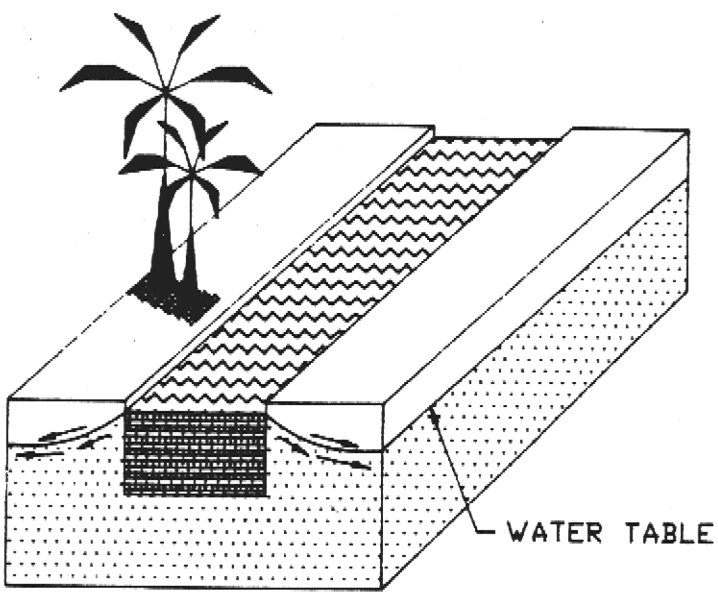


FIGURE 7. **Generalized Composite Transmissivity Map of the Surficial Aquifer System**



When the water level in an aquifer is higher than that in a canal that penetrates it, water moves toward the canal.



When the water level in a canal is higher than that in the aquifer it penetrates, water moves into the aquifer.

FIGURE 8. **Hydraulic Connection Between a Canal and an Aquifer (after Klein, *et al.*, 1975)**

4. the local aquifer hydraulic conductivity associated with the canal reach,

5. the geometric characteristics of the cross-section of the canal reach, and

6. restricted seepage rates due to clogging of the canal reach by fine sediments of significantly lower hydraulic conductivity than the underlying material.

McDonald and Harbaugh (1988) approximated vertical leakage through the canal bed by the following equation:

$$Q = \frac{K\,L\,W}{M}\,(H_c - h) \qquad (4)$$

where

Q is the leakage through the reach of the canal bead (ft^3/day),

K is the hydraulic conductivity of the canal bed (ft/day),

L is the length of the reach (ft),

W is the width of the canal (ft),

M is the thickness of the canal bed (ft),

H_c is the average monthly canal stage (ft), and

h is the average head in the aquifer cell containing the canal reach (ft).

Physical System Background

There are many major and minor canals within the study area. Understanding the function of these canals and their relation to the ground water levels is essential in developing an effective model for the study area.

Water levels in the major canals are maintained by the South Florida Water Management District (SFWMD) through the use of pump stations and control structures. Figure B-1 in Appendix B illustrates the location of SFWMD control structures and pump stations in the model area. Table B-1 in Appendix B lists the control elevations for SFWMD salinity control structures.

During dry periods, water is transported via canals from Lake Okeechobee and the Water Conservation Areas into the study area for water supply, to maintain adequate water levels in the canals, and to prevent salt water intrusion. During wet periods, water is either discharged to the ocean or pumped into the Water Conservation Areas in order to reduce the potential for flooding.

There are numerous secondary canals and lakes throughout the study area. Most of these canals are maintained by local water control districts (WCDs), drainage districts, or improvement districts. There are 26 drainage districts in Broward County. Figure B-7, Appendix B shows the location of the drainage districts in the model area and Table B-2 lists their permitted control elevations. Table B-2 also indicates if the district has a recharge system which allows it to bring water into the district.

The Hillsboro Basin of the LWDD was divided into subareas based on control elevations and the operational procedure of the LWDD. Figure B-7 shows how the subareas of the Hillsboro Basin were divided and Table B-2 lists the control elevations. The subareas were similarly divided as outlined in the report Ground Water Resource Assessment of Eastern Palm Beach County, Florida (Shine, et al., 1989).

As shown in Table B-2, several districts have ground water recharge systems. Recently, the county-operated WCD 2 and the Sunshine Drainage District obtained water use permits to withdraw water from SFWMD canals to maintain water levels and to supply water to wellfields within their respective drainage districts. Withdrawals did not commence, however, during the first calibration period from 1983 to 1985. Old Plantation WCD and Plantation Acres Improvement District have pumps which are capable of bringing water into their systems as well; however, these pumps have never been used for recharge. The LWDD withdraws water from the Hillsboro Canal via pumps on the E-2-W Canal in order to maintain the control elevations in the canals shown in Table B-2. In addition, the City of Boca Raton withdraws water from the Hillsboro Canal into the E-2-E Canal to recharge the aquifer within the vicinity of its Western Wellfield in the Hillsboro Basin. The recharge systems for other districts consist of free flow with SFWMD canals, with the flow direction being dependent upon the difference in water levels between the individual drainage districts and the SFWMD canals. In some cases, the drainage district canals are allowed free flow when SFWMD canal elevations are higher than their own.

In the past, there were several farms located within the Pinetree, Cocomar, and Turtle Run WCDs. These farmers were part of the Deerfield Irrigation Company Inc. (DICI) (December 1991 meeting with T. Butler, former director of DICI and also personal communication with D. Markwood, Water Resource Management Division, Broward County). These farmers utilized a pump on the

Hillsboro Canal and a canal that runs parallel to US 441 to supply water to the farm ditches. Figure B-9 in Appendix B, modified from Broward County (1990), is a map which shows the major secondary canals and structures within the DICI. Due to the interconnection of the canals in the area and the hydraulic connection between the canals and the aquifer, the pumpage from the farmers in DICI helped recharge the aquifer throughout most of north central Broward County. By agreement between the farmers and the local drainage districts, the average water level in the main canal is 11.6 feet NGVD. However, the water level in the main canal can rise as high as 12 feet NGVD during the growing season and can drop to 11 feet NGVD at other times. The farmers attempt to maintain the levels in the irrigation ditches between 12 and 14 feet NGVD. The growing season usually begins in November and ends in April, although it can begin as early as September and end as early as January. The highest water levels occur in November, at the beginning of the dry season. The farmers lower the water level an average of two feet during the remainder of the growing season in order to protect the crop roots. The irrigated acreage within the DICI has decreased from about 2,700 acres in 1982 to about 850 acres by 1989. Many of the farmers moved out between 1980 and 1985.

An analysis of Tables B-1 and B-2 indicates that canal seepage from the Hillsboro Basin within the LWDD may also help maintain ground water elevations in Broward County. As shown in Tables B-1 and B-2, the LWDD maintains the water levels in the Hillsboro Basin canals at a higher level than either the Hillsboro Canal or any of the adjacent drainage district canals in Broward County. This operational procedure by the LWDD allows for seepage from the LWDD area into the Hillsboro Canal and underneath into the drainage districts in northern Broward County.

Several areas which are not included within an existing drainage district were grouped into a drainage basin as part of this study. In most of these areas, drainage elevations were established for flood protection purposes (personal communication with Tony Waterhouse, SFWMD). Figure B-8, Appendix B shows the location of these areas.

Model Input

The canals within the study area were classified as either rivers, tidal rivers or drains. The river category consists of canals owned by the SFWMD, canals owned by the drainage districts which had active recharge systems during the calibration period and canals having free flow with SFWMD canals. Tidal rivers are those rivers or portions of rivers subject to tidal influences. The drain category consists of the remaining canals, which function as drains only and provide no recharge to the aquifer. The canal locations and widths were measured from aerial photos or obtained from SFWMD records. Canal bottom elevations were obtained from Corps of Engineers canal profile records or estimated when no other information was available. The data was digitized and put into ARC/INFO format. The model grid was superimposed on the river coverages, then each canal reach was placed in the appropriate cells using the ARC/INFO Geographic Information System. Figures 9 and 10 indicate which cells contain rivers or drains.

The canals classified as rivers and tidal rivers were simulated using the river package. Water may flow from the aquifer to the river or vice versa depending on the head gradient between the river and the aquifer. Average monthly canal stages were determined from the SFWMD data base and/or records. The remaining canals act as drains. Only layer 1 has river or drain cells. The difference between the river package and the drain package is that the drain package only allows flow from the aquifer to the drain.

Initial hydraulic conductivity values for both river and drain bottom sediments were estimated at 0.75 ft/day. Through the calibration process, these values subsequently were adjusted to a value of 1.1 ft/day, with tidal river bottom sediments given a value of 0.52 ft/day. The lower hydraulic conductivity value assigned to the tidal river sediments was based on the assumption that tidal channel bottoms probably contain a greater amount of fine-grained, low permeability mucks than do river or drain channel bottoms.

The thickness parameter M of equation 4 was varied during the calibration process after the above modifications to hydraulic conductivity were made. Beginning with an initial uniform bed thickness of one foot for all river and drain cells, thickness values were varied non-uniformly in space to achieve a satisfactory calibration. Final bed thickness values ranged from 0.7 to 1.25 feet.

RECHARGE

The average net recharge depth in a model cell resulting from precipitation, R_p, can be computed using the mass balance equation as:

$$R_p = P_n - Q_d - ET_u - ET_s \qquad (5)$$

where

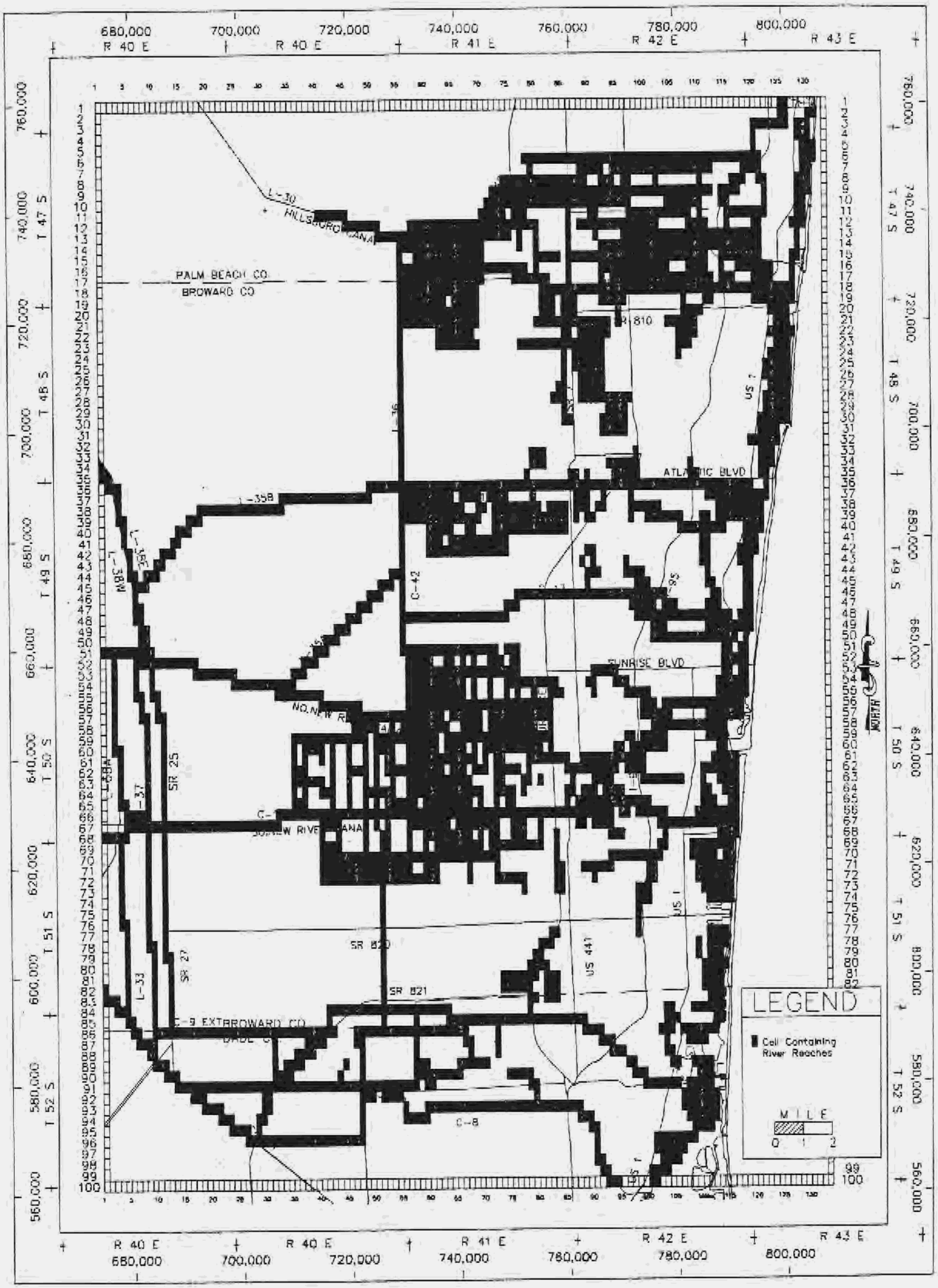


FIGURE 9. Layer 1 Cells Containing Rivers

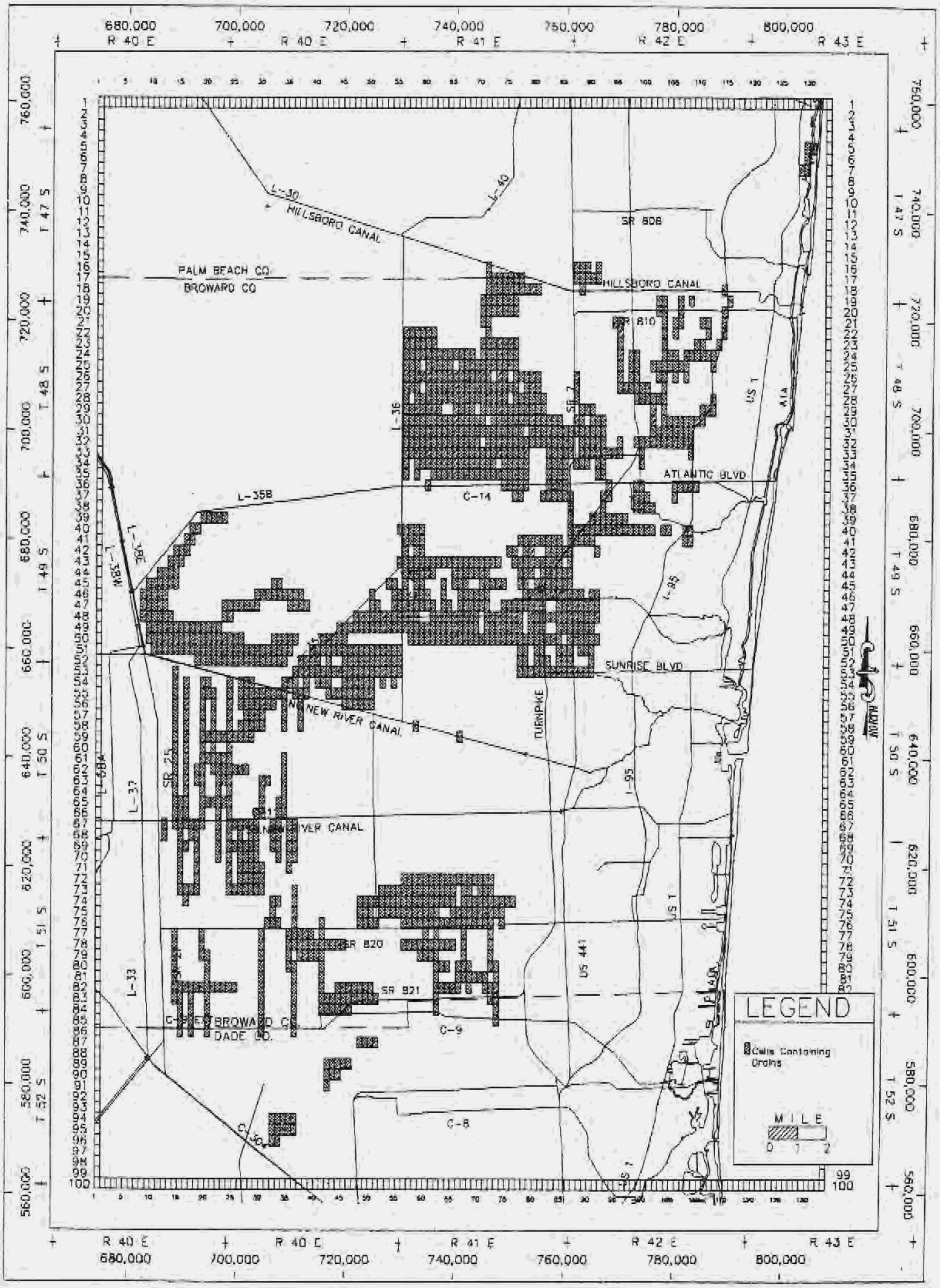


FIGURE 10. Layer 1 Cells Containing Drains

P_n is the average net precipitation depth over the cell not lost to interception or depressional storage,

Q_d is the average depth of water lost to surface drainage (not otherwise simulated using a MODFLOW package),

ET_u is the average evapotranspiration depth from the unsaturated zone (not calculated by the evapotranspiration package in MODFLOW), and

ET_s is the average evapotranspiration depth from the saturated zone (calculated by the evapotranspiration package in MODFLOW).

Units may be any consistent unit of length; this model uses feet.

The evapotranspiration depth from the unsaturated zone, ET_u, was not considered in this model. In areas where there is a significant unsaturated zone above the water table, however, the recharge calculations may become inaccurate without considering ET_u. A portion of the calculated recharge, R_p, never reaches the aquifer because it is trapped and used by plants at the unsaturated zone. This limitation will be resolved in the complete recharge package (currently under development). In some cases, an overly high recharge rate caused by this limitation can be drained away by canals.

Net Precipitation. The average monthly net precipitation depth, P_n, for a cell can be approximated from the total monthly precipitation depth over the cell, P_t, as:

$$P_n = MAX\{K_i P_t - \sum_{n=1}^{N} K_d(n)\ ,\ 0\} \qquad (6)$$

where

K_i is the interception coefficient,

$K_d(n)$ is the depth of daily depression storage loss (in feet, for this model), and

N is the total number of days in a given month.

Interception is that portion of gross precipitation which wets and adheres to above-ground objects until it returns to the atmosphere through evaporation (Bower, et al., 1990). The quantity of water intercepted depends upon the storm character, the season of the year, and the species, age, and density of the prevailing plants and trees. The total interception by an individual plant is directly related to the amount of foliage. For non-urban land uses, extreme values of K_i can be defined as (Viessman, et al., 1977):

$$K_i = \begin{cases} 1.00 & \text{for clear bare ground surface (0\% interception)} \\ 0.75 & \text{for dense closed forest (25 \& interception)} \end{cases}$$

Values for K_i in urban areas ranged from 1.0 to 0.5, depending upon the land use type. The value of K_i assigned to a model cell represented the weighted average of the K_i values for all land use types within the cell. Table C-2 in Appendix C lists land use codes and corresponding values for K_i.

Precipitation that reaches the ground surface may infiltrate, flow over the surface, or become trapped in numerous small depressions. The depression storage loss for impervious drainage areas varies from 0.05 inch, on a slope of 2.5 percent, up to 0.11 inch, on a slope of 1 percent (Bower, et al., 1990). The upper limit of 0.11 inch (0.009 feet) was assumed for the model. The model depression storage loss, K_d, was calculated as:

$$K_d = K_d^{max}\ \{MAX\{[1 - (\frac{K}{K_m})^{\frac{1}{2}}]\ ,\ 0\}\} \qquad (7)$$

where

K_d^{max} is the maximum daily depression storage losses for the stress period (an upper limit of 0.11 inches or 0.009 feet was assumed for each day),

K is the vertical hydraulic conductivity of the soil layer (in ft/day for this model), and

K_m is a calibration factor. It is the value of hydraulic conductivity at which infiltration is assumed to be nearly instantaneous, thus precluding evaporative losses from storage in depression (in ft/day for this model).

A (K/K_m) value of 0, signifying an impervious drainage area, implies a K_d value of 0.11 inch per single precipitation event; and a (K/K_m) value of 1, a highly pervious area, implies a K_d value of 0. Rainfall of less than the critical daily precipitation depth K_d evaporates and creates neither infiltration nor runoff drainage.

Only one precipitation event per rainy day of at least 0.11 inch was assumed. Interception storage capacity is usually reached early in a storm event. This implies that a larger fraction of rainfall is intercepted in depressions during numerous small storms than during one equivalent severe storm (Bower, et al., 1990).

The value of soil hydraulic conductivity, K, in a model cell was estimated by examination of the tables of saturated vertical permeability for applicable soil types found in Soil Conservation Service soil survey books (Pendleton, et al., 1976 and McCollum, et at., 1978). Soil permeability values ranged from 12 ft/day to 40 ft/day throughout the modeled area. The calibration factor, K_m, was set at 500 ft/day.

Surface Drainage. The net average depth of water lost to surface drainage, Q_d, can be estimated by:

$$Q_d = K_s\, K_a\, P_n \qquad (8)$$

where

K_s is a coefficient relating the potential for runoff to surface drainage, and

K_a is a coefficient relating the potential for aquifer recharge from surface drainage.

K_s varies between 0 and 1, depending on the potential of the land use type to generate surface drainage into a surface water body. K_s takes into account the effect of drainage systems which may recharge the unsaturated zone of the aquifer. The value of K_a is a function of the average hydraulic conductivity and the average slope of the land surface. Coefficient K_a has a value of 1 if there is no infiltration into the unsaturated zone, and has a value of 0 when rainfall completely recharges the unsaturated zone. Model values for K_s varied between 0.1 and 0.3, with most values being 0.1. Table C-2 in Appendix C shows land use codes and their assigned values for K_s. The value for K_a was defined as:

$$K_a = K_a^{max}(1 - K/K_{max}) \qquad (9)$$

where

K_a^{max} is the maximum value that K_a may take (less than or equal to 1),

K is the hydraulic conductivity of the soil layer, and

K_{max} is the maximum soil hydraulic conductivity in the study area.

The net direct surface runoff in southeastern Florida is assumed to be relatively small. However, the effective recharge into the aquifer depends on the ground water storage available. In many cases, the ground water flow into the canals due to precipitation may be quite large, depending on the availability of stored ground water. At the same time, the amount of water released into the ocean due to a given precipitation event depends on the storage available in the surface water bodies and on flood protection criteria imposed on canal systems. The lack of an integrated surface and ground water model in the current application is a shortcoming when generating global mass balance for the system.

Rainfall stations from which total precipitation data were obtained are shown in Figure C-2, Appendix C. Precipitation was distributed throughout the model by the Theissen polygon method, which entails applying rainfall from the nearest active rainfall station to each model cell. Total precipitation polygons are shown in Figures C-3 and C-4 for January and July of 1989. Net recharge to the Surficial Aquifer System in Broward County is somewhat dependent upon land use type. For cells containing 50 percent or greater urban land uses, the ratio of net recharge to total precipitation was about 41 percent for January 1989 and about 55 percent for July 1989. In predominantly non-urban areas, the ratio of net recharge to total precipitation was approximately 55 percent in January 1989 and about 71 percent in July 1989. The effect of land use on net recharge to ground water should be explored further. A general land use map of Broward County is shown in Figure C-1, Appendix C.

EVAPOTRANSPIRATION

Water loss through direct evaporation and through transpiration from the saturated zone by plants is simulated in the model by the evapotranspiration (ET) package of MODFLOW. The following assumptions are applied (McDonald and Harbaugh, 1988):

1. When the water table is at or above a specified elevation, termed "ET surface", ET loss from the water table occurs at a specified maximum rate,
2. When the depth of the water table below the ET surface exceeds a specified value, termed the "extinction depth" or "root zone", ET from the water table ceases, and
3. ET from the water table varies linearly between the above limits.

ET surface. The ET surface elevation is represented by the land surface elevation of the modeled area minus any significant capillary zone height. Initial land surface values were taken from the most recently available USGS 7.5 minute topographic quadrangle maps and from additional control points such as land surface elevation from USGS monitor wells. These points were then contoured and smoothed using SURFER (Golden Software). Where water bodies such as lakes or borrow pits were present, the free water surface was used as the base elevation. The ET surface elevation was altered ±1.5 feet for specific cells during the calibration process.

Maximum ET rate. The monthly potential evapotranspiration depth, ET, was estimated using the modified Blaney-Criddle equation. The basic form of the equation is:

$$U = k\,k_t\,\frac{p_m t_m}{100} \qquad (10)$$

where

U is the crop ET for a given month in inches per day from layer 1,

k is a consumptive use coefficient which varies according to the crop type and growth stage,

k_t is a climatic coefficient which is related to the mean monthly air temperature (It is defined as $k_t = .0173t - .314$, where $_t$ is Fahrenheit temperature),

p_m is the percent of daytime hours of the year which occurred during the month, and

t_m is the mean temperature for the month, in degrees Fahrenheit.

The consumptive use coefficient is defined as:

$$k = k_c\,k_f \qquad (11)$$

where

k_c is a crop coefficient reflecting the growth state of the crop (Table C-3, Appendix C), and

k_f is a coefficient reflecting the fraction of land surface which is covered with a specific type of vegetation (also Table C-3). Values for K_f vary between 0.05 and 1.0.

Temperature data was used from rainfall stations in Pompano Beach and Fort Lauderdale. Crop coefficients for each land use type (k_c) were either taken directly from or inferred from values presented in Table C-1 and C-2, SFWMD's Permit Information Manual Volume III. Values of k_f for urban land uses were determined for each land use type by examination of appropriate surface water permit data for ratios of pervious to impervious area. A k_f value of 1 was assigned to all land use types except urban.

Extinction Depth. Extinction depth represents the depth of the water table below the ET surface elevation beyond which evapotranspiration from the water table ceases. It physically represents the depth to which the roots of plants extend below land surface. Extinction depths in the model are related to land use and are based upon estimated root depths for various kinds of vegetation (memorandum with list of vegetation types and root depths, dated April 26, 1990, from Thomas Teets to Michael Bennett, SFWMD). Land use codes and their assigned extinction depth values are shown in Table C-4, Appendix C.

Water Table and Capillary Fringe. The variation of evapotranspiration with the water table depth depends on the ground cover conditions. It is apparent that the deeper the roots, the greater the depth at which water losses occur. Even with relatively deep water tables, evapotranspiration does not necessarily cease because upward transport by capillary action can still occur. Capillary rise is a function of soil grain size and can vary from 0.3 feet in a coarse gravel to six feet in clay (Fetter, 1980). Since MODFLOW does not address ET occurring when the water table drops below the root zone, capillary fringe ET can be represented by reducing the original ET surface (land surface) by an amount equal to the capillary fringe height. To be physically accurate, however, the capillary zone height should be added to the water table level. Since the elevation of the water table changes with time, this raising of the available water level would need to be incorporated within the MODFLOW program. Therefore, in order to simplify the representation of the capillary fringe ET, the ET surface elevation can be lowered by an amount equal to the capillary zone height. In the current model, the capillary zone height was ignored, since the model is insensitive to changes in ET surface elevation or extinction depth. It is expected that the actual ET removed from the saturated ground water zone will be close to zero when a crop is well irrigated. This is because the water lost to ET comes from the irrigation system. The model indirectly simulates this effect, particularly in cases where grove canals keep ground water levels below the root zone.

GROUND WATER USE

Introduction

Data from individual water use permits issued by the SFWMD and user pumpage reports were used to prepare the well package of the model. All users of water are required to obtain a water use permit (SFWMD, 1985). There are two types of water use permits; individual and general. Individual permits are required from a user if the demand equals or exceeds 100,000 GPD. General permits are issued for uses under 100,000 GPD. The exceptions to the permitting requirement are single family homes, duplexes, and water used strictly for fire-fighting (SFWMD, 1985). The general permit and exempted uses were considered insignificant for a regional study and therefore were not included in the well package. The individual permits were divided into two categories: public water supply and non-public water supply.

Public Water Supply Use

At present there are 33 individual public water supply permits in Broward County. The permit files for each utility were reviewed for well locations and well construction data. Individual well locations were digitized and located on the model grid. Well construction data was used to determine in which model layers the withdrawals were occurring. Each utility was contacted concerning its wellfield operation schedule for each specific well. The wellfield operation schedules were used to accurately simulate the withdrawals. Public water supply wellfields in Palm Beach County and Dade County that are within the study area also were incorporated into the model. Figures C-5 and C-6 in Appendix C show the locations of all cells with public water supply uses within the study area. Table C-5 in Appendix C provides information on the utilities within Broward County.

Non-Public Water Supply Use

Most other uses of water within the study area consist of mining-dewatering, industrial, and agriculture uses. Table C-7 in Appendix C shows the locations of all cells containing non-public water supply water uses incorporated within the model.

Mining-dewatering is a short-term use. In most cases, the users are required to store the water on-site. The only water losses from this type of water use are due to evaporation, which is already accounted for in the ET package. In addition, water levels during mining-dewatering are lowered within a relatively small area, producing an insignificant impact in the context of a regional model with a coarse grid. For all of these reasons, mining-dewatering uses were not incorporated into the model.

There are few industrial users of ground water in Broward County. The most significant ground water industrial withdrawal is from the Florida Power & Light plant, permit #06-00503-W. The SFWMD also classifies commercial, recreational, air-conditioning and various other types of water uses as industrial (SFWMD, 1985).

The largest non-public water supply use in Broward County is agricultural irrigation use. This category includes all farming, golf, recreational, landscaping and nursery uses. Since most agricultural users are not required to submit pumpage reports to the District, the withdrawals were estimated. The irrigation water requirements of different crops were calculated using a method described by the U. S. Soil Conservation Service (USDA, 1970). This method uses the modified Blaney-Criddle formula to approximate the water requirements of various crops. Factors such as crop type, soil type, air temperature, daylight hours, effective rainfall, and irrigation system efficiency are used to calculate the irrigation requirements of different crops found throughout the modeled area.

The irrigation requirements for each permitted use were estimated for each month of the two calibration periods (January 1983 through December 1985 and the calendar year of 1989). The monthly irrigation requirement for each permitted use was distributed among the withdrawal facilities in proportion to their pump capacities. Individual wells were then assigned to the proper model cell.

CALIBRATION

"Steady state" can be viewed as an average condition achieved over a long period of time, and assumes that no major changes in stress rates occur during that time. Assuming constant stress rates into and out of the aquifer, the period of time required to reach steady state depends on the aquifer properties. When the stresses that drive ground water flow change very slowly in time relative to the rate of change within the aquifer system, steady state assumptions are justified. In many cases, however, the steady state condition is hypothetical due to the artificially rapid changes applied to the aquifer system, and transient calibration processes need to be emphasized.

Before significant pumping or drainage of a system begins, a state of approximate equilibrium prevails in the undeveloped ground water reservoir. Under pre-development conditions, recharge to the system equals discharge from the system over time; hence, no net change in ground water storage occurs. Some type of pre-development condition for Broward County was present at the beginning of this century, for which little or no data exists. At the present time, the aquifer system is in a dynamic transient process. However, it can be said that the Broward model, on a monthly basis, behaves in "quasi-steady-state" manner due to the very high hydraulic conductivity of the Biscayne aquifer. As a result, the "memory" of the system is short. Memory of an aquifer system can be described as the length of time that a stress applied to a system continues to significantly affect the rate of change in water levels within that system. In general, the Broward model exhibits a system memory of less than two months.

Both steady state and transient conditions were taken into account in the model calibration process. Figure E-1 in Appendix E shows the locations of the observation wells used in this process. For calibration and verification purposes, two periods were considered. The first calibration period was from January 1983 through December 1985, and the second was from January 1989 through December 1989. The first multi-year period was chosen so that the effect of annual variations in canal stages, evapotranspiration, irrigation and seasonal rainfall could be explored. The second period was chosen because it encompassed a period of significantly below normal rainfall, and because of changes in canal operating schedules and addition or removal of canals in the time since the first calibration period. USGS observation well water levels used in the calibration process are published in the annual USGS Water Resources Data reports for water years 1983 to 1986 and 1989 to 1990.

The calibrations were completed by a trial and error process. Small simulation periods were used in the transient simulations until relatively stable conditions in the aquifer systems were achieved (i.e. head levels were realistic and showed reasonable variation over time). Adjustments to parameters were made as necessary to adequately match computed and observed values.

STEADY STATE CALIBRATION

The steady state runs served six purposes:

1. to detect obvious errors in the input data sets to MODFLOW,
2. to make the initial adjustments to the aquifer parameters used in the model,
3. to generate starting heads for the transient runs,
4. to monitor parameter modifications in each transient calibration run,
5. to act as the base case for most of the sensitivity analyses, and
6. to act as the base case for predictive simulations.

The pumpage applied in the steady state runs comprises both estimated irrigation water use and reported public water supply pumpage for 1983 or 1989 runs. Data from January 1983 and January 1989 were applied to two separate sets of steady state runs. January 1983 represents a wet month and January 1989 represents a very dry month. The computed average conditions taken over the year 1989 were also used for comparative purposes. The January 1983 and 1989 values of recharge, evapotranspiration, and average surface water stage elevations were used and behaved as a "quasi-steady-state" condition. January conditions were found to be close to average input conditions for the system, with the exception of January 1989 rainfall conditions, which were exceptionally low. The model calibration is non-unique since different sets of parameters can give similar results. The final steady state runs provided much of the information used to describe the ground water flow regime in the study area.

Calibrated steady state heads in layer 1 representing end-of-month values are shown in Figure D-1, Appendix D. Since canal operating systems significantly changed from 1983 to 1989, calibration results from 1989 only are presented, as those more closely reflect current conditions. Simulated heads in other layers are not shown since the differences between layer heads are insignificant, except near surface water bodies and boundaries. Figure D-2 compares computed water levels to estimated observed water levels. The observed water levels used for interpretation during calibration are based on end-of-month field observations in wells and averaged monthly canal stages for the same month. The estimated errors in model water levels in all active cells are generally within the range of ± one foot. The average canal stage elevation and the ground water heads were assumed to approximate steady state conditions under monthly average conditions for January 1983 and 1989.

TRANSIENT CALIBRATION

A series of transient runs were made to calibrate the model to observed water levels using historical meteorological conditions and either reported or estimated water use. The transient calibration simulates the periods of January 1983 through December 1985, and January 1989 through December 1989. The transient runs comprised 36 and 12 stress periods of one month each, respectively. Each month was simulated by a stress period comprising five time steps; the reader is referred to the MODFLOW definition of time steps and stress periods (McDonald and Harbaugh, 1988). The accuracy of the model is enhanced by using more time steps per stress period; however, sometimes the increased computer run time required for more time steps is prohibitive. In the case of the Broward County model, CPU run time did not change significantly with one or five time steps.

Starting heads for each calibration period were calculated from water level data obtained from USGS monitor wells and the average canal stage elevations and boundary head values for January 1983 and January 1989. The data was regionalized using a kriging interpolation technique, which provides a head value for every model cell. The kriged heads were used as starting heads for two one-stress periods runs (January 1983 and January 1989) without application of recharge or pumping stresses, and with observation well head levels applied as constant head values in order to force the computed water levels near observation wells. The model head values generated from these runs were used as starting heads for the transient runs.

Comparative hydrographs for observed and simulated water levels were generated for those cells that correspond to the location of USGS monitoring wells. These were used to aid in the interpretation of several MODFLOW runs, particularly with regard to how the simulated heads changed over time in response to varying stresses. The hydrographs are presented in Appendix E.

The goal of the calibration process was to reduce the difference between observed water levels in monitor wells and calculated water levels in the cells to within the tolerance of ± one standard deviation of the fluctuation for a particular month. Standard deviations were determined from well water levels for all individual months, for the available online period of record. When water level data was not available for a given month for an observation well, the standard deviation was determined from water levels for all available months for that well. As stated previously, observation well water levels represent end-of-month values.

A satisfactory calibration was obtained. In most cases, average absolute errors were less than 0.75 feet. The average standard error for all observation wells is about 0.45 ft. Figures in Appendix E compare hydrographs of computed and observed water levels at the end of each stress period in 1989. The pattern match between simulated and historical water heads was acceptable. The absolute difference between computed and observed values was less than one foot or one standard deviation of the historical values for each month for most stress periods.

The acceptability of the matching varies somewhat based on discretization considerations such as distance of monitor wells from the center of a model cell, proximity to surface water bodies and the presence of pumping wells in a cell. Differences in computed and observed levels could be explained as follows:

1. The computed water levels represent the average water level over a model cell. If actual levels vary significantly across the 1,000 by 2,000 feet rectangular cell, monitor well levels may not closely match the computed levels. This is especially true where wells are located within public water supply wellfields and stresses on the aquifer cause steep gradients or where wells are located near surface water streams where strong natural gradients occur. In most cases, the gradient across a cell is sufficiently small that the monitor well represents the cell conditions. Cell-wide averaging effects are

evident in comparing observed and computed levels in the cells containing wells G2395 and G820A, where Fort Lauderdale's Prospect Wellfield is located.

2. Rainfall in the study area tends to occur as intense short-term events over relatively small areas. In many cases, ground water levels respond almost immediately to these events. Similarly, canal water levels respond with a small time lag to these intense storms. The precipitation is applied to the model as a total depth occurring over the month, whereas observation well heads represent end-of-month values. An end-of-month storm can result in locally high water levels in some wells and canals not well represented by the monthly time discretization in the model.

Modifications to achieve calibration are discussed in the following sections. As a general rule, changes to the model parameters during calibration were made in the following order:

1. river and drain conductances,
2. horizontal hydraulic conductivity,
3. vertical anisotropy of the layers,
4. ET surface elevation, and
5. storage coefficients.

These changes were made in conjunction with the application of recharge and evapotranspiration stresses. Recharge and evapotranspiration coefficients were adjusted slightly during calibration. The sensitivity of measured water levels to rainfall and changes in surface water levels complicates the calibration. Modifications made to aquifer characteristics during calibration process were relatively insignificant.

Layers 1 and 2, upper zone of Surficial Aquifer System: In the areas where this zone is present, the transmissivities were initially set as discussed in the section on hydraulic characteristics. Where layer 1 or 2 is absent, the transmissivity for missing layer is represented by the hydraulic conductivity of the subjacent cell multiplied by a minimum thickness (15 feet for layer 1 and five feet for layer 2). The best calibration for layers 1 and 2 was obtained by varying the vertical anisotropy within the range between 0.02 and 0.08, as discussed previously. Similarly, the specific yield in layer 1 and the storage coefficient in layer 2 were changed non-uniformly in space. Hydraulic conductivity also was adjusted non-uniformly in these layers, to a maximum change of ± 15 percent. The agreement between observed and computed water levels is shown in the calibration hydrographs in Appendix E.

Layers 3 and 4, the Biscayne Aquifer: The initial transmissivity of these layers was set as discussed in the section on hydraulic characteristics. In areas where the Biscayne aquifer is missing, a transmissivity was assigned which represented a minimum thickness of three feet for layers 3 and 4 (six feet total) multiplied by the averaged hydraulic conductivity of the nearest cells in layers 2 and 5. Based on the calibration runs, V_{cont} was lowered to 25 percent of its original assigned value. Storage was set to 1.9×10^{-4} and remained essentially constant in space. During calibration, unusually small drawdowns were noted in the area of Prospect Wellfield. Localized adjustments to hydraulic conductivity within acceptable ranges (± 15 percent) succeeded in correcting the problem. Inspection of pumping records from this wellfield suggested that the problem was an underestimation of water use for water supply and injection. Based on discussions with utility personnel (personal communication between Steve Krupa, SFWMD, and Charles Petrone, City of Fort Lauderdale, July 8, 1991), well pumpages in the model were increased an additional 20 percent. After re-calibration and adjustment of hydraulic conductivities in layers 3 and 4, all observed and computed water levels were within the acceptable tolerances. This case also illustrates how cell-wide averaging effects in cells with steep head gradients can influence computed water levels and calibration.

Layer 5, lower zone of Surficial Aquifer System: Compared to the overlying aquifers, relatively little is known about the hydraulic characteristics of the lower zone. In calibrating the fifth layer, hydraulic conductivities were varied from 30 to 100 ft/day, which represent the usual range of transmissivities for this type of aquifer. There are no observation wells in layer 5. Heads in layer 5 are relatively insensitive to changes in hydraulic conductivity. Since observed and computed heads matched best in the lithologically similar layer 2 at a relatively uniform hydraulic conductivity of 50 ft/day, this value was applied to layer 5. Agreement of computed and observed heads was tested by varying vertical conductance. Lacking information of the degree of confinement between the Biscayne aquifer and layer 5, uniform values of vertical conductance for this boundary were tested. Observed and computed levels matched a little closer when the vertical conductance was varied up to ± 30 percent of the original values, particularly in the vicinity of some wellfields. Accordingly, a variable vertical conductance for the boundary between layers 4 and 5 was developed.

CALIBRATION RESULTS

As already noted, the initial model is based on existing interpretations of the hydrogeology of Broward County to the extent possible. Calibration results are presented in the following paragraphs.

Steady State Calibration Results

Steady state calibration was used to detect data errors, poor assumptions, or poorly calibrated areas. Initial heads used in steady state calibration are representative of the end of January 1983 or 1989, depending on the calibration period. These values were chosen as a convenience in computing drawdowns, because the steady state solution is independent of initial head values. As previously stated, January water levels and stresses generally approximate average conditions. Horizontal and vertical flow components referred to in the following sections are depicted in Appendix D, Figures D-5 through D-13. Steady state results using averaged 1989 conditions are similar to those using January 1989 conditions, as the entire year was dry.

Horizontal flow in layers 1 and 2, upper zone of the Surficial Aquifer System. Horizontal flow in layers 1 and 2 is similar; however, Layer 1 shows a large flow component near major canal structures. In general, LWDD canals near the county line are draining into the Hillsboro Canal. Flows in northeast Broward (east of the Florida Turnpike) are parallel to the Hillsboro Canal. An essentially stagnant flow zone occurs west of the intersection of the county line and the Hillsboro Canal. Water from WCA 2A is moving east; however, it is largely intercepted by the L-36 canal. Greater flows are moving east out of WCA 2B, but again are intercepted for the most part by a canal, in this case the L-35A canal. North of the C-11 canal, between the North and South New rivers, eastward flow is intercepted by the L-37 canal. Between the C-11 and C-304 (Miami Canal) canals, ground water moves east and is only minimally intercepted by L-33. A small regional flow trends to the south in the southern part of study area. In general, no clear regional flow exists, except in the vicinity of canals and wellfields. A ground water mound exists just south of the intersection of State Road 7 and the Hillsboro Canal. This may be due to agricultural irrigation, relatively minimal stresses in this area or indirectly due to high water levels maintained in LWDD canals. Flow west out of the mound is intercepted by local drainage district canals. Flow east out of the mound goes to wellfields (Deerfield Beach, Broward County 2A, etc).

General statements about the potential for salt water intrusion can be made based on the magnitude and direction of ground water flow calculated by the model. Horizontal flow vectors along the coast which point west (Appendix D, Figures D-5 and D-6) may indicate the potential for salt water intrusion along the coast. The very small to non-existent flow vectors along the coast south of Atlantic Boulevard can be interpreted as a stationary salt water front. South of the Hillsboro Canal, in the area of the Deerfield Beach, Broward County 2A and Pompano Beach wellfields, the salt water front appears to be actively moving inland, as shown by the large westward flow vectors.

Horizontal flow in layers 3 and 4, the Biscayne Aquifer. Flow vectors in these layers are very similar to those in layers 1 and 2. For the most part, water in the WCAs moves to the east or southeast and is intercepted by canals as in the upper layers. The exceptions are that an underflow is present out of WCAs 2A and 2B and that much less flow moves eastward out of WCA 2A. Ground water flows from Palm Beach County into Broward County under the Hillsboro Canal east of Powerline Road.

In order to examine the effects of development on this underflow and to test the validity of the model boundaries, a hypothetical wellfield was simulated just south of the Hillsboro Canal and east of Powerline Road (Figure 11). The hypothetical wells were assigned a cumulative pumping rate of 3 million ft^3/day. A significant flow from LWDD canals under the Hillsboro Canal was induced as these wells pumped (Figure 12A). Horizontal flows from Palm Beach County into Broward County increased by about 23 percent. At the Conservation Areas on the western boundary, the horizontal flow was unaffected. At the eastern boundary, westward horizontal flows into Broward County increased by about one percent. When the hypothetical wellfield was activated and recharge from agricultural irrigation was removed (as would be the case if the wellfield truly existed), flows out of LWDD canals at the county line increased about 32 percent. In the area bounding the hypothetical wells (approximately between columns 82 and 108 in the model), flows from Palm Beach County increased by about 250 percent. Outside of that area, northern boundary flows were unaffected.

Regional flow in layers 3 and 4 is more or less defined by the wellfields. A very small regional trend to the east exists.

Active salt water intrusion can be interpreted in these layers near the Deerfield Beach, Broward County 2A and Pompano Beach wellfields (Figures D-7 and D-8) based on large westward horizontal

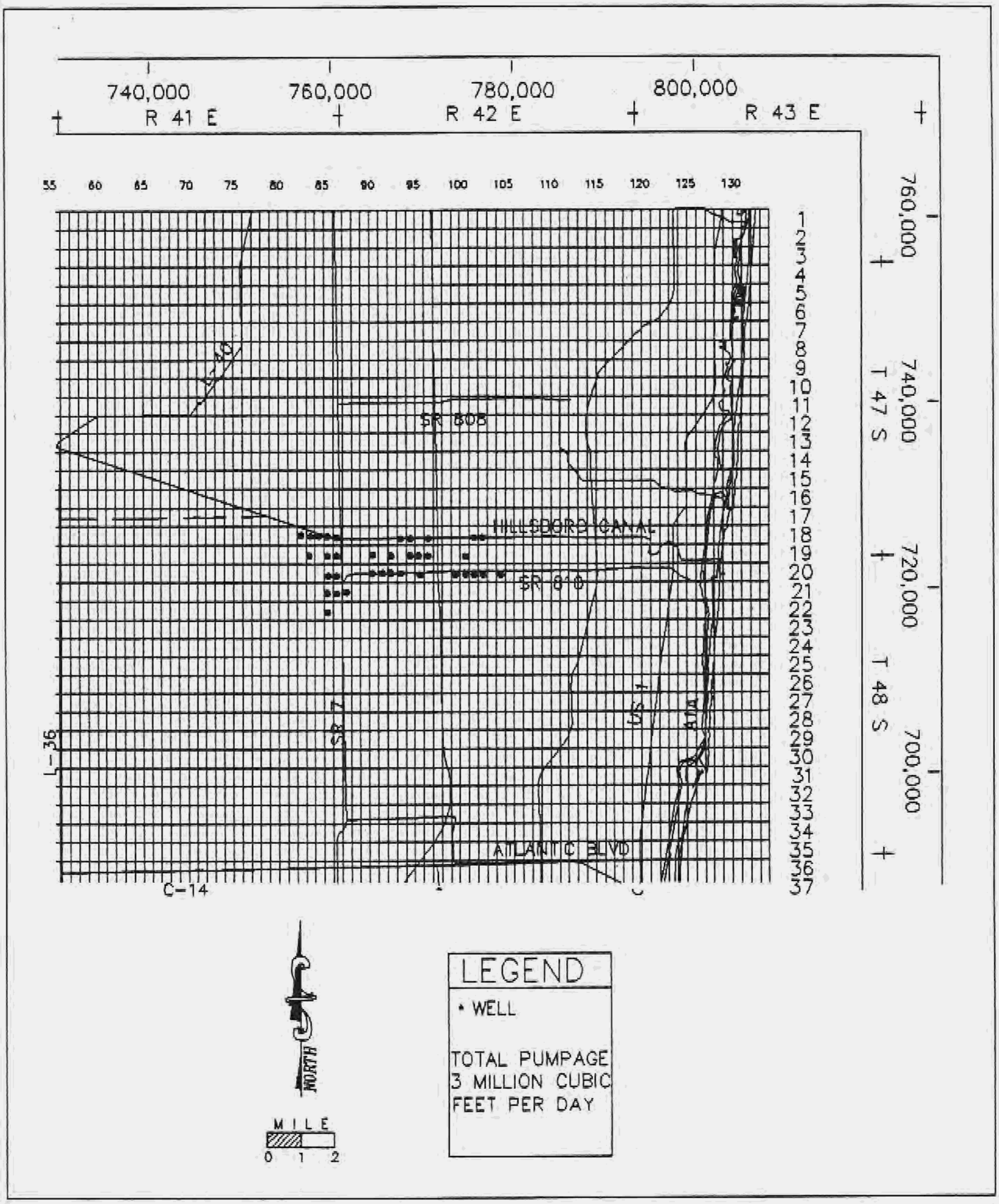


FIGURE 11. **Hypothetical Wellfield in Northern Broward County**

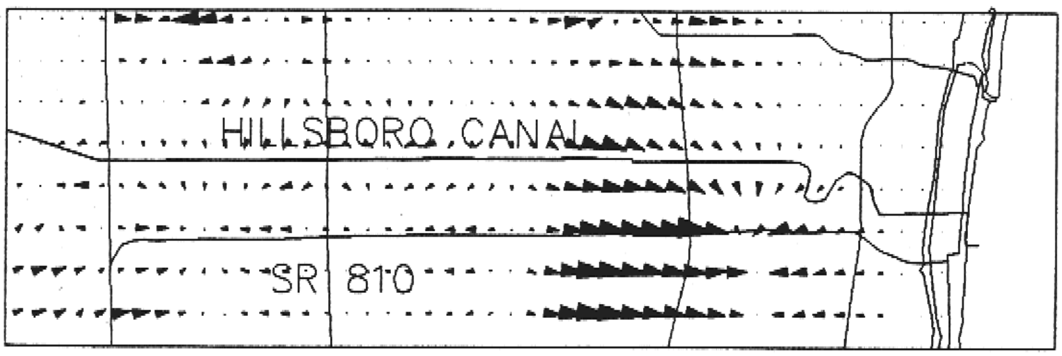


FIGURE 12A. Horizontal Flow in Layer 3 Around Hypothetical Wellfield (Without Recharge due to Agricultural Irrigation)

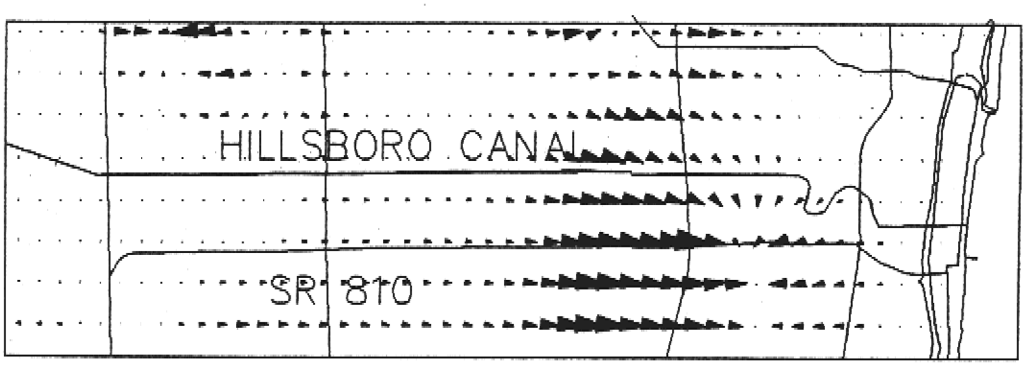


FIGURE 12B. Calibrated Horizontal Flow in Layer 3 in Area Around Hypothetical Wellfield flow vectors computed in the model. The salt water front also appears to be moving westward near the Hollywood wellfield.

Horizontal flow in layer 5, lower zone of the Surficial Aquifer System. No clear regional ground water flow trend is evident in this layer. Compared to upper layers, flows toward wellfields are reduced in most areas, although still significant near the Prospect Wellfield in Fort Lauderdale. Flows eastward out of WCAs 2A, 2B, 3A and 3B are smaller than in the upper layers and are of similar magnitude to each other.

Salt water intrusion is suggested by westward flow in layer 5 along the coast near the Deerfield Beach, Broward County 2A and Pompano Beach wellfields, although to a lesser degree than in the upper layers. This can be seen in the computed horizontal flow vectors shown in Figure D-9.

The Surficial Aquifer System in the area of the Deerfield Beach, Broward 2A, and Pompano Beach wellfields should receive careful attention with regard to management of the saline intrusion problem. Model results imply that the salt water interface may be moving inland in the production zone of these wellfields.

Vertical flow. Vertical ground water flows in layers 1 through 4 are similar in direction, yet consistently decrease in magnitude as the layers descend (Figure D-10 through D-13). In general, vertical flows are in the downward direction. Layers 1, 2 and 3 (to a lesser degree) show large downward flows near and upstream of canal structures. Layers 1 and 2 show significantly larger downward flows in the area east of U.S. 1 between the Hillsboro Canal and Atlantic Boulevard than in other areas along the coast; this is probably due to stresses from wellfields.

Upward vertical flows occur in the Conservation Areas along the L-35A and North New River canals. Similar flows are observed along the eastern edges of WCAs 3A and 3B. This is presumably due to interception by levee canals.

Transient Calibration Results

Examples of Results. Figures 13 and 14 show the net rate change in different model parameters for each month of 1989 in that portion of the study area lying within Broward County. The Water Conservation Areas and tidal region are not included. Figure D-3 in Appendix D shows the simulated heads in layer 1 for the end of the dry season in January 1989. The computed layer 1 heads for the end of the wet season in September 1986 are shown in Figure D-4.

In every stress period simulated for 1989, westward horizontal flows occurred along the coast, suggesting potential salt water intrusion. Ground water gradients in all model layers present serious concerns for wellfields along the coast, particularly those between the Hillsboro Canal and Atlantic Boulevard. The magnitude of this westward flow varied between 0.5 and 0.75 million ft^3/day (for all layers combined) from month to month during 1989.

Along the western model boundary, eastward horizontal flows occurred out of the Conservation Areas and along the eastern side of the levee canals during each stress period of 1989. The magnitude of these flows varies between 6.0 and 7.7 million ft^3/day for each stress period.

Horizontal flows from Palm Beach County into Broward County occurred during each stress period simulated in 1989 and in the steady state simulation as well. The magnitude of this southerly flow varied between 2.4 and 3.2 million ft^3/day. Similarly, horizontal flows occurred from Broward County into Dade County during each stress period of 1989. The magnitude of the flows out of Broward County into Dade County varied between 3.3 and 3.9 million ft^3/day.

On the average, water was provided to the Biscayne aquifer in Broward County from the following sources during 1989:

1. the upper zone of the Surficial Aquifer System contributed about 74 percent,
2. lateral boundary flow contributed an estimated 25 percent, and
3. the bottom zone of the Surficial Aquifer System provided about one percent.

Water entering the Biscayne aquifer from the upper layers came from recharge due to precipitation and, in some areas, from canal leakage. Lateral boundary inflows occurred primarily from the north and the west. Water from the Biscayne aquifer in Broward County flows out laterally into Dade County and, in some areas, into the ocean. These losses are equivalent to about 10 percent of the total inflow to the Biscayne aquifer.

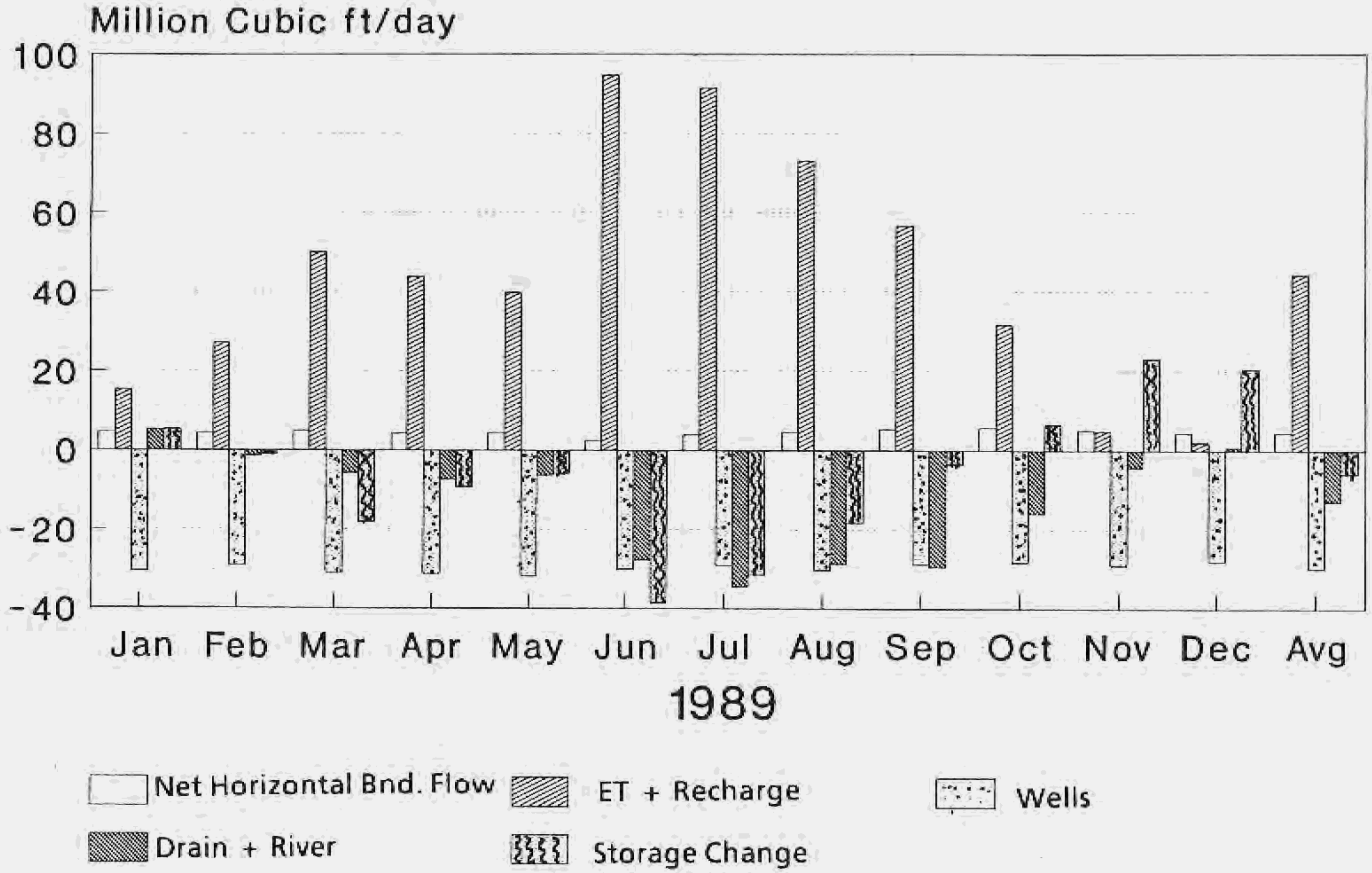


FIGURE 13. **Mass Balance for Modeled Area Within Broward County (Excluding Water Conservation Areas)**

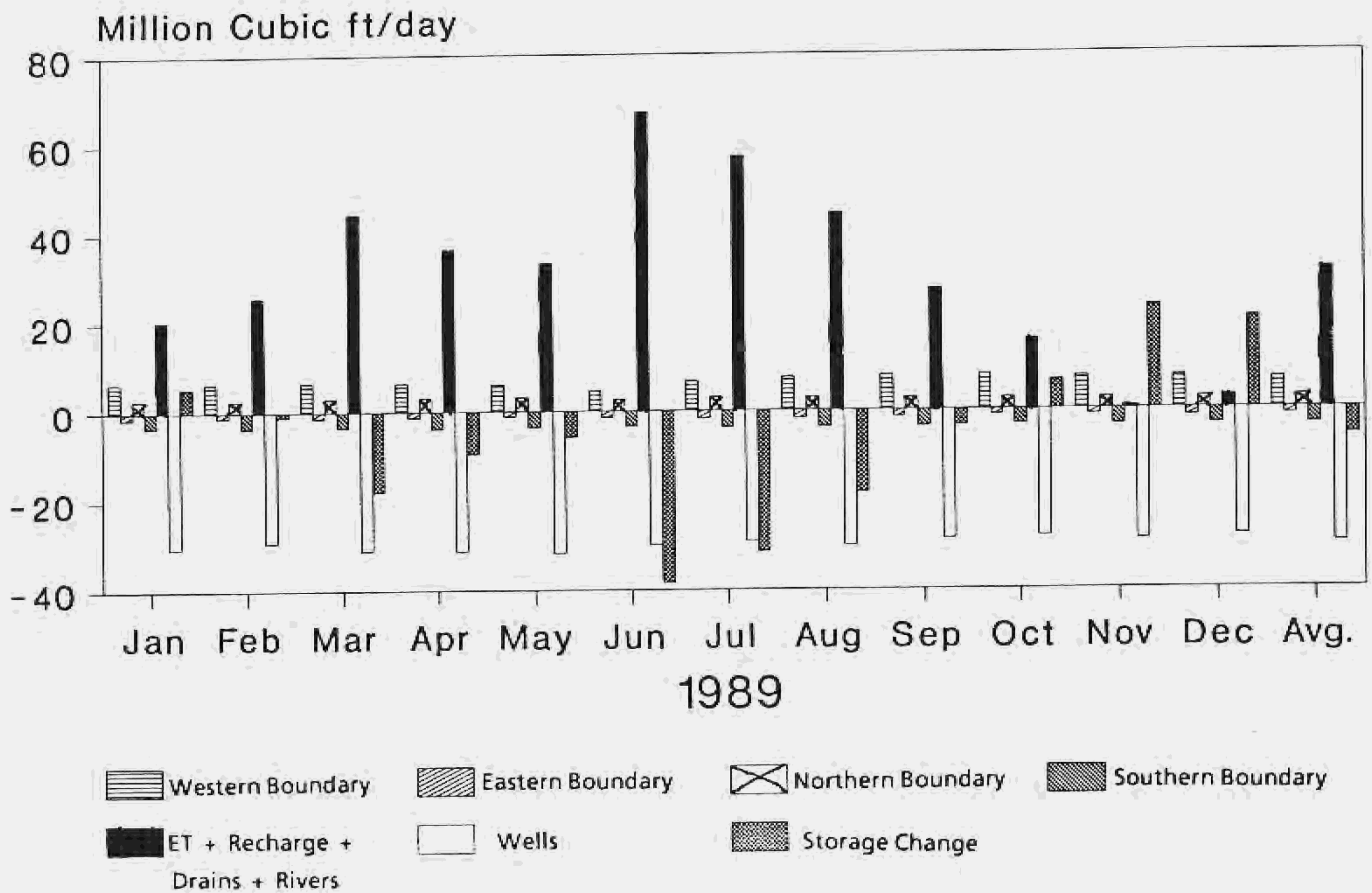


FIGURE 14. Mass Balance for Modeled Area Within Broward County (Excluding Water Conservation Areas) Showing Net Flow at Each Boundary

SENSITIVITY TESTING

An important process in data collection is the determination of the data that are necessary to improve the reliability of the model. The Broward model was tested through sensitivity analyses in a effort to discover which data and processes most affect the model on a daily and a monthly basis.

To test the certainty of the parameter estimates used in the steady state model, sensitivity tests were performed. For example, the sensitivity of the model was tested first by varying the calibrated hydraulic conductivity upwards and downwards by an order of magnitude. Because layers 3 and 4 each exhibited sensitivity to one or more of these changes, a second set of sensitivity tests were conducted by doubling then halving hydraulic conductivity for each of the hydrogeologic zones in the Surficial System.

Other parameters examined in the sensitivity analyses were changes in recharge rate, ET rate, ET surface elevation, ET extinction depth, river and drain conductances, and vertical conductance. Sensitivity to changes in storage and starting heads were examined in the transient model. The model appears to be most sensitive to hydraulic conductivity and canal conductance changes. Accordingly, the model is sensitive to pumpage from the aquifer and water levels in canals. The role of canals in providing recharge to the aquifer can be seen clearly in the sensitivity run where recharge from precipitation was eliminated. The results of the sensitivity analyses are presented in Appendix F.

A sensitivity analysis of initial water levels was carried out under both calibrated transient 1989 conditions and on non-stressed transient 1989 conditions (without recharge, ET, wells, river and drains). The water table elevation was increased and decreased by two feet in these simulations. In both the stressed and non-stressed cases, the model results became practically independent of initial conditions after two months of simulation. However, in some areas, particularly those with relatively low hydraulic conductivity, the effects of initial conditions continue for a significantly longer period.

Model sensitivity to general head boundary conductances was tested by both multiplying and dividing steady state conductance values by 2, 10 and 100. Doubling and halving the general head conductances had virtually no effect on the model. Multiplying and dividing by a factor of 10 showed only slight ($\pm$ 0.1 feet) head variations in localized regions along the coast. The model was fairly insensitive along the coast to a reduction in conductance by a factor of 100, and was more sensitive in the WCA boundaries at this level. Sensitivity to conductance multiplied by 100 increased with descending layers along the coast, and also caused a 0.23 percent discrepancy in the mass balance at the end of the simulation.

CONCLUSIONS

The Biscayne aquifer is the most productive zone of the Surficial Aquifer System. Yields in the Biscayne aquifer increase significantly towards southern Broward County. Under current conditions, the most important sources of recharge to the Surficial Aquifer system are deep percolation from precipitation, leakage from canals, leakage from the Water Conservation Areas and leakage across the northern county line from Palm Beach County. Of the total net ground water recharge occurring during 1989 for the study area represented in Figures 13 and 14, rainfall provided approximately 84 percent of the total recharge, the western boundary contributed about 11 percent, with the remaining five percent coming from the northern boundary. In some areas, canals provide recharge to the aquifer; however, a net loss of ground water to canals occurs over the study area as a whole.

The largest ground water withdrawals in the Broward County area occur in the public water supply wellfields. Public water supply withdrawals account for approximately 54 percent of the total annual ground water losses in the study area represented in Figures 13 and 14. Leakage from the aquifer into canals accounts for an additional 24 percent of the total net ground water loss. Evapotranspiration from the saturated zone accounts for approximately 13 percent, and the southern and eastern boundaries contribute the remaining six percent and three percent, respectively.

Regional ground water flow in eastern Broward County is largely affected by the location of major wellfields and to some extent by the location of surface water bodies. Ground water flow from Water Conservation Areas 1, 2A and 2B is intercepted by the levee canals. This water then moves via canals to wellfields, leaks out into the aquifer, or enters the ocean as runoff. Ground water flow out of Conservation Areas 3A and 3B provides an important source of water to urban areas in southern Broward County.

Sensitivity simulations indicate that if canal water levels can be maintained during severe droughts (as in January 1989), significant decreases in ground water levels can be mitigated. The ground water regime in Broward County is driven by the surface water system and/or by deep percolation due to precipitation. The interrelation of the two conveys the urgency of developing a fully-coupled surface and ground water model.

Model simulations indicate that salt water intrusion may be taking place along the Atlantic coast. Westward horizontal flows in all model layers along coastal areas can be interpreted as a moving salt water/fresh water interface. These westward flows are largest in the area between the Hillsboro Canal and Atlantic Boulevard in northern Broward County.

RECOMMENDATIONS

Eastern Broward County is experiencing a deficit of water to supply its needs during dry periods, and depends heavily on the aquifer storage availability and on water brought into the area from adjacent zones. As demands increase, so will the need for additional water supplements.

Careful management of withdrawals from the Biscayne aquifer is needed to reduce the potential for saline water intrusion in eastern Broward County. Maximum withdrawals, minimum head levels and/or minimum net yearly ground water flows to the ocean should be established in coastal areas to reduce or slow salt water migration and to deter upconing of saline water into pumping wells. Future requests for large scale withdrawals should be closely examined to ensure that the criteria can be maintained.

Additional attention should be devoted to the management of water quality. It is recognized that both water quality and water quantity are important and interdependent aspects of water resources. Effective analysis of the aquifer with regard to storage of wastewater, artificial recharge, aquifer storage and recovery, and salt water intrusion requires a better understanding of solute transport within it.

The integrated surface water/ground water system that provides water supply in southeast Florida has evolved as a result of local needs rather than as a result of a single comprehensive regional plan. In spite of the fundamental understanding of ground water and surface water hydrologies and their interrelations, the two are often considered as being physically disconnected. Accordingly, an integrated model is a fundamental need in Broward County.

A fully integrated surface, unsaturated and saturated flow model should be developed for Broward County. Such a model should be rigorous in the representation and conceptualization of the water allocation and surface water body operations and other physical processes involved in a canal-aquifer system such as the one in place in Broward County. The model should incorporate, to a large extent, the entire physical conceptualization of the hydrologic cycle on a daily basis. The description of the complex process of infiltration and redistribution of water in the unsaturated and saturated soil should be given special attention. In order to provide a realistic assessment of short-term impacts such as: 1) availability of water in canals, 2) the effects of precipitation in surface water bodies or in the unsaturated zone, or 3) water levels in aquifers near canals, the model should simulate the system using short stress periods. Similarly, for a realistic allocation of water based on agricultural or other needs, short simulation stress periods are desirable. However, shorter stress periods do not require similarly shorter changes in ground water heads, except in areas close to canals. The concept of reach transmissivity to simulate canal-aquifer interaction should be explored as an alternative to the canal conductance approach currently used in MODFLOW when horizontal flow is predominant.

Interfaces should be developed with the existing Palm Beach County model, with the Dade County model currently under development, and with the regional surface water system. This will result in a truly regional model that encompasses the entire flow regime for the Surficial Aquifer System in the lower east coast water supply planning area. This regional surface and ground water model would be particularly useful in evaluating the District's canal system, which maintains ground water levels and supplies many of the public water supply wellfields within the tri-county area.

The Broward model can be used in the evaluation of water use permit applications for large uses. Where a finer scale or site-specific evaluation is required, the model can be used to provide boundary conditions. The model should continue to be refined and updated as additional information becomes available. Suggested refinements to the model include a finer grid spacing and smaller stress periods, ideally five days or less.

The difficulties involved in estimating parameters are closely related to the more general issue of data collection for surface-ground water models. A model can be developed with any amount of real data. However, the amount and quality of available data directly affects the credibility of the model application. The District's responsibility in collecting an optimal amount of dependable data for models implies the necessity of:

1. re-specifying data collection procedures,
2. improving data collection networks,
3. identification of critical data, and
4. accurate storage of data.

The Broward model is sensitive to utility pumpage rates. Increased reporting and verification of public water supply pumpages on a well-by-well basis, as well as the reporting of large agricultural withdrawals, is recommended. Additional wells in the USGS monitoring well network are needed in order to improve the regional information available. Furthermore, additional aquifer testing should be required in areas where hydrogeological information is lacking.

Problems arise in using MODFLOW to simulate free-surface bodies (e.g. wetlands) or large wellfields. During the course of a simulation or during the iterative determination of the water levels, cell heads may drop below the bottom elevation of an active cell or rise above the bottom elevation of an inactive cell. A cell may change from active to inactive in the standard version of MODFLOW. However, the inverse process - reactivation of an inactive cell submerged during a simulation - is not possible with the current version of MODFLOW. It is recommended that this problem be addressed through the recently released USGS module called BCF2.

Calibration is a laborious and inaccurate task if carried out by trial and error. A semi-automatic calibration procedure should be adopted. The surface water system and the aquifer system should be calibrated separately first, then together.

A new approach to computing evapotranspiration should be delineated. The ET rates currently calculated are based on a modified Blaney-Criddle equation, which relies on temperature to calculate monthly rates. Numerous studies, however, show that ET is dependent on solar radiation and that temperature approaches alone are the least accurate of ET estimation methods. Errors due to use of a temperature-dependent approach become apparent in the ground water model calibration process through the excessive ground water pumping rates for agricultural demands created by use of the Blaney-Criddle equation. It is recommended that the Penman-Monteith or modified Penman methods be explored. These methods require solar radiation, air temperature, humidity and wind speed data, some of which is already being collected by the District for some stations. Any new approach should be used consistently with any mathematical model or in any agricultural water use decision made in the District.

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APPENDIX A

HYDROGEOLOGY AND STRUCTURE CONTOUR DATA

LIST OF FIGURES - APPENDIX A

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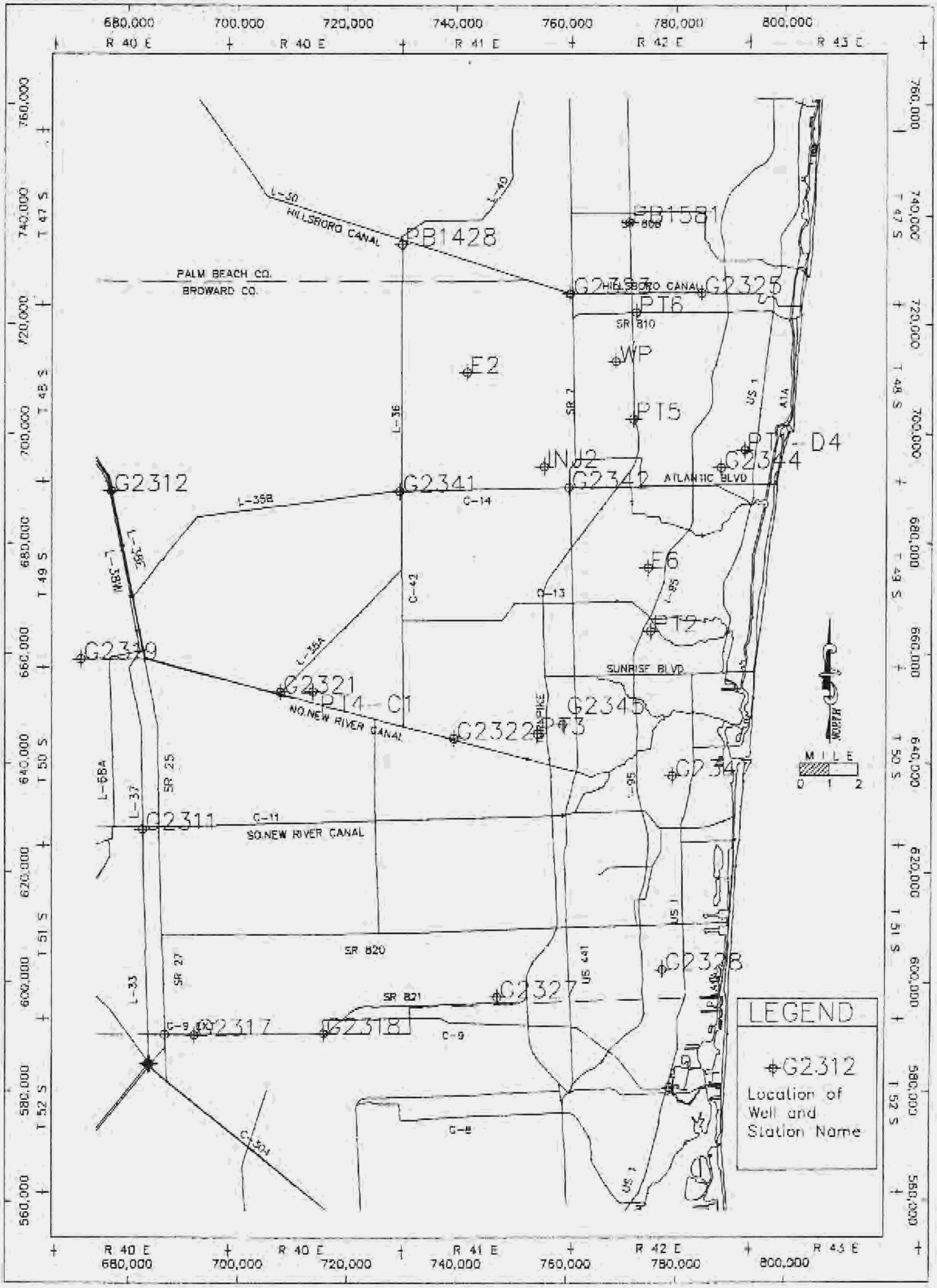

FIGURE A-1. Location of Wells Used for Lithological Data

WELL NAME	FLORIDA PLANARS X(EAST)	Y(NORTH)	TOTAL DEPTH	BASE OF SAS	TOP OF BA	BOTTOM OF BA	THICKNESS OF BA	COMMENTS
PB1581	771417	738488	-303	-283	-70	-163	93	Shine, 1989.
PB1428	730051	734406	-204	-177	NP	NP	NP	Fish, 1988.
G2323	760673	725395	-278	-262	-85	-145	60	Fish, 1988.
PT6	772708	721937	-145	BTD	-79	-135	56	Quiet Waters Pk, SFWMD well.
G2325	784603	725550	-311	-260	-65	-110	45	Fish, 1988.
WP	768942	712927	-135	BTD	-80	BTD	>55	Winston Park, JMM/Dames & Moore, 1986.
E2	742000*	710900*	-176.5	-165	-102	-125	23	N.Springs Imp. Dist. Gee & Jenson, 1979.
PT5	772135	702448	-279	-229	-57	-152	95	Tradewinds Park, SFWMD well.
INJ2	755950	693864	**	-228	-38	-138	100	Samples from Margate injection well #2.
PT1-D4	792481	696927	-134.5	BTD	-31	BTD	>103	Pompano Airfield, SFWMD well.
G2344	788186	693768	-461	-320	-45	-112	67	Fish, 1988.
G2342	760435	690055	-291	-275	-90	-140	50	Fish, 1988.
G2341	729658	689372	-189	-125	NP	NP	NP	Fish, 1988.
PT2	775357	663896	-171	BTD	-70	BTD	>101	Mills Pond Park, SFWMD well.
G2345	758331	646935	-320	-285	-50	-125	75	Fish, 1988.
G2347	779357	637570	-471	-330	-35	-140	105	Fish, 1988.
PT3	754800	645200	-136	BTD	-70	BTD	>66	Heritage Park, SFWMD well.
G2322	739564	644396	-229	-195	-50	-122	72	Fish, 1988.
PT4-C1	713743	652942	-117	-107	-32	-87	55	Markham Park, SFWMD well.
G2321	707798	652812	-279	-113	-47	-83	36	Fish, 1988.
E6	774900*	675400*	-103	BTD	-47	BTD	>56	Prospect Wellfield MW7, CDM, 1980.
G2317	692129	590142	-135	-90	-10	-60	50	Fish, 1988.
G2318	715768	590456	-205	-130	-20	-107	87	Fish, 1988.
G2327	747494	597190	-275	-260	-45	-120	75	Fish, 1988.
G2328	777579	602321	-290	-260	-20	-140	120	Fish, 1988.
G2311	682659	627759	-195	-183	-11	-64	53	Fish, 1988.
G2319	671408	658809	-208	-200	-20	-36	16	Fish, 1988.
G2312	676930	689524	-208	-200	NP	NP	NP	Fish, 1988.

SAS - Surficial Aquifer System
BA - Biscayne aquifer
NP - Not present
BTD - Below total depth
* - Location estimated
** - Observed only 300 ft of samples

Total depth, base of Surficial Aquifer System, and Biscayne aquifer elevations reported in feet NGVD. Total depths of wells from Fish, 1988, were estimated from hydrogeological cross-sections.

TABLE A-1. Wells Used to Develop Structure Contours of the Surficial Aquifer System, Broward County

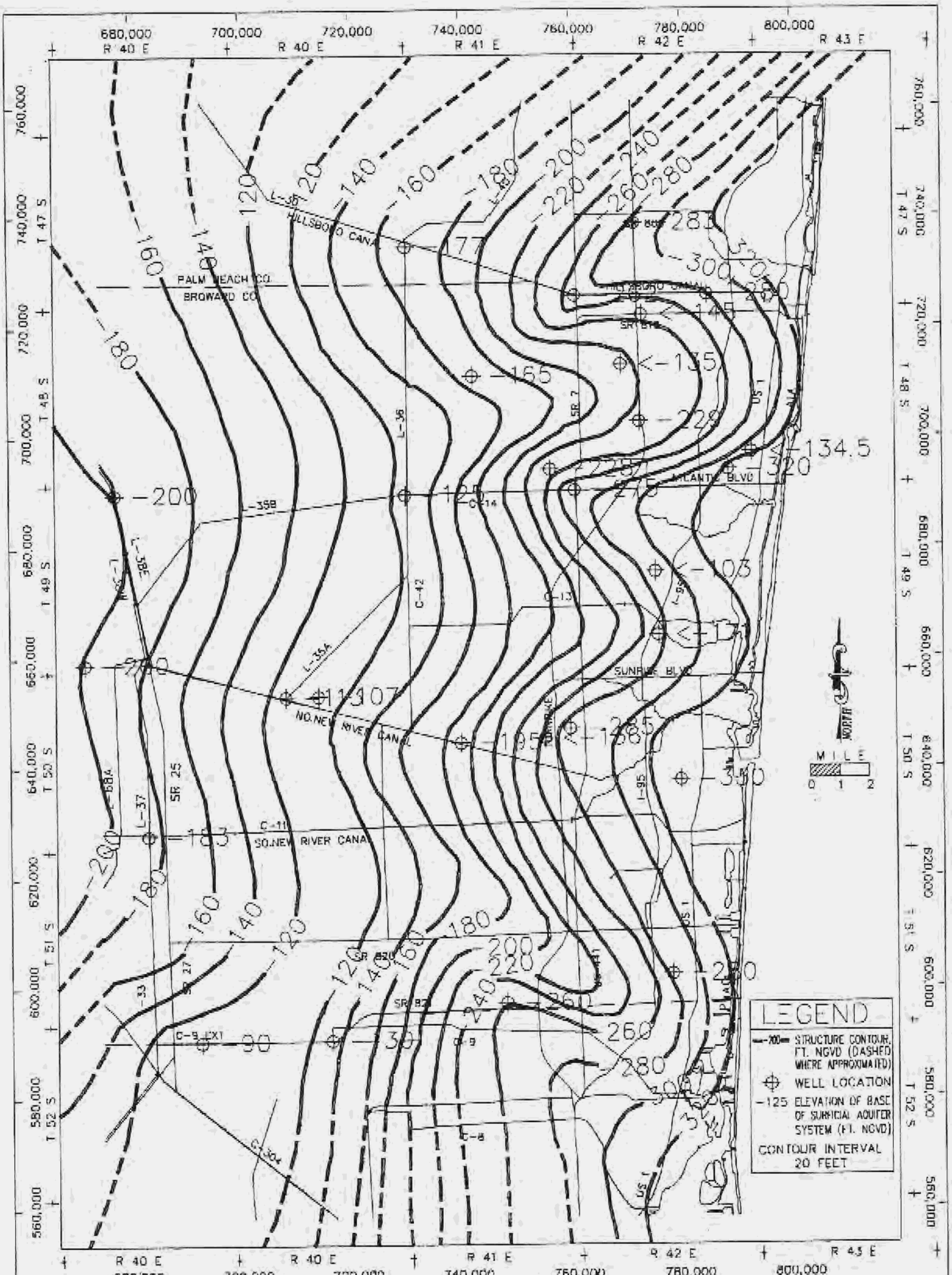

FIGURE A-2. Elevation of the Base of the Surficial Aquifer System

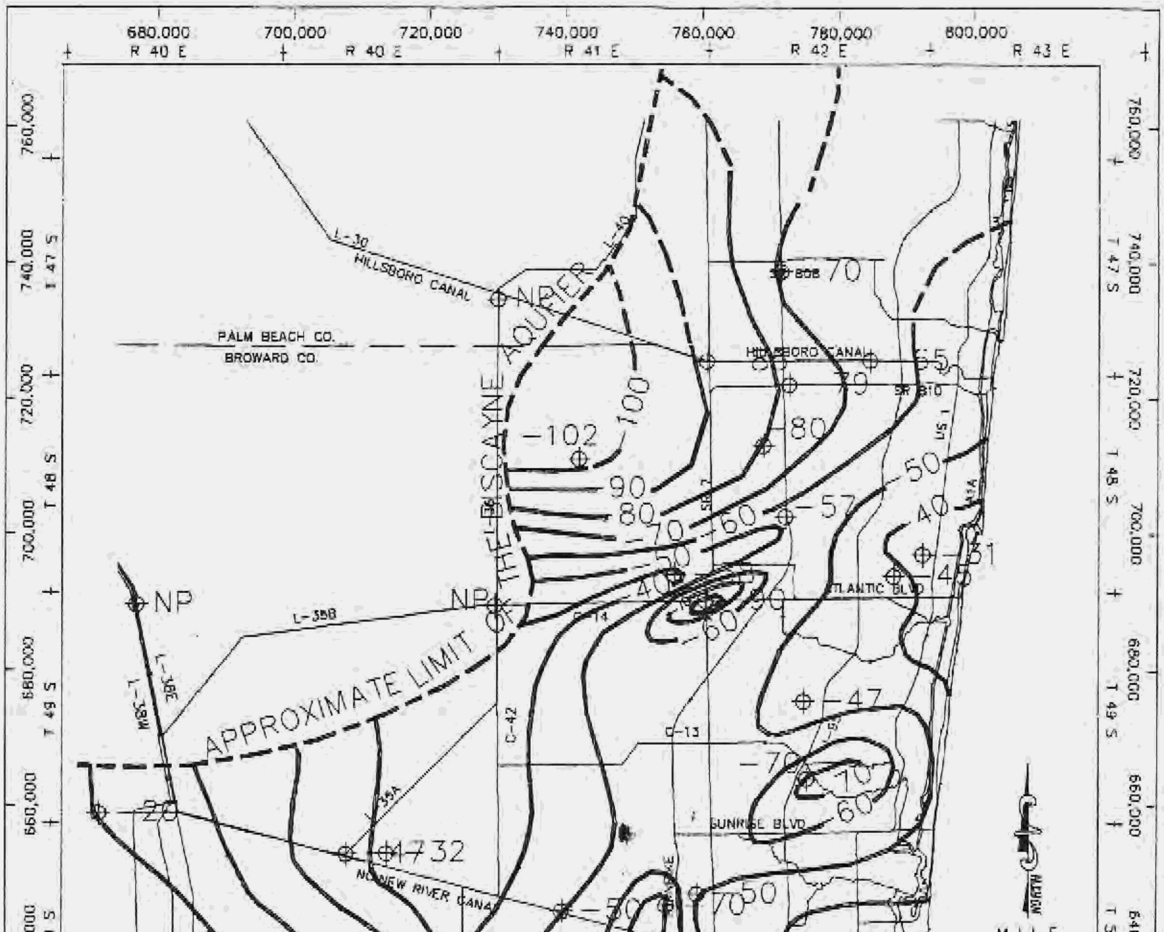

FIGURE A-3. Elevation of the Top of the Biscayne Aquifer

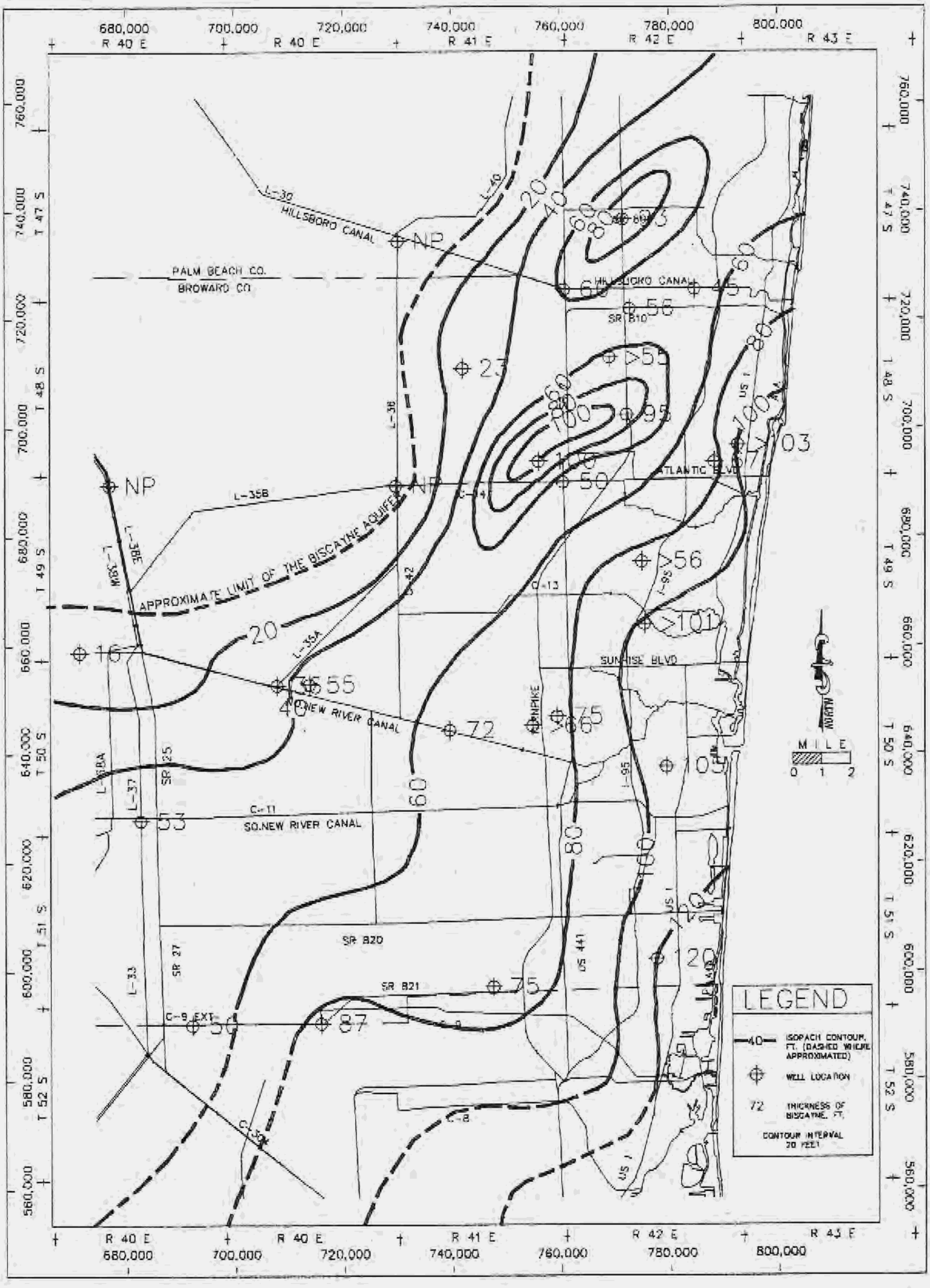

FIGURE A-4. Thickness of the Biscayne Aquifer

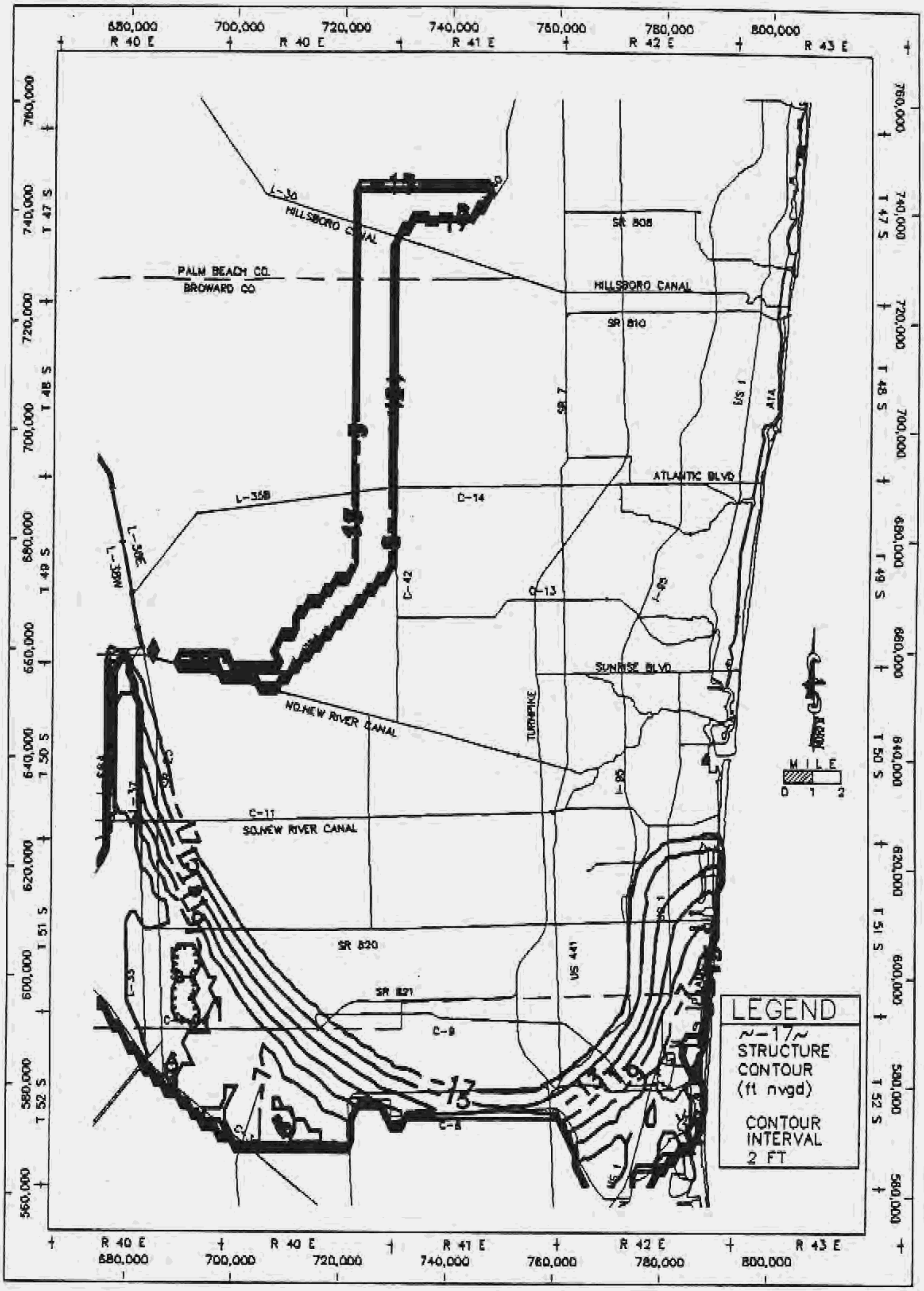

FIGURE A-5. Elevation of the Top of Layer 2

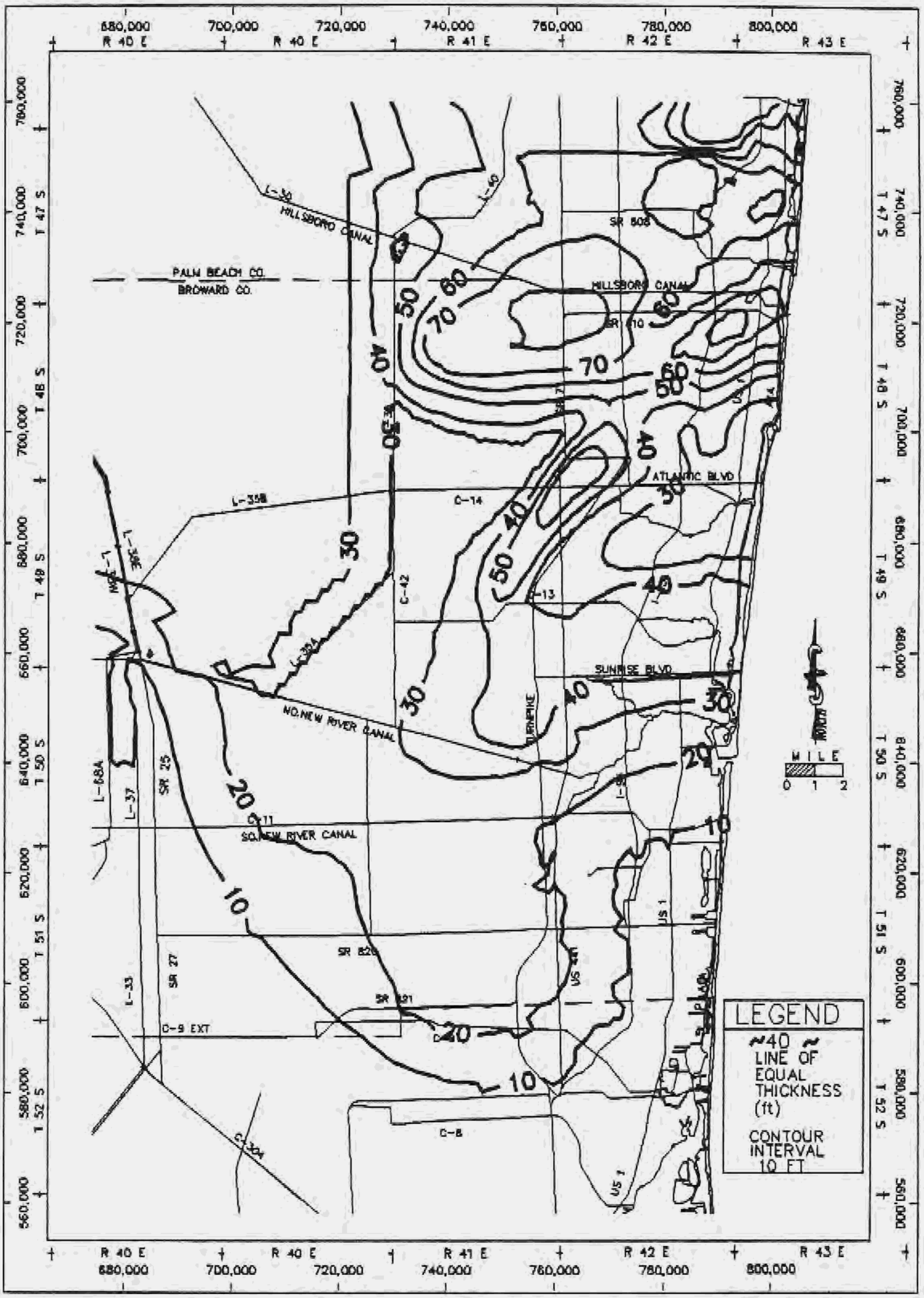

FIGURE A-6. Thickness of Layer 2

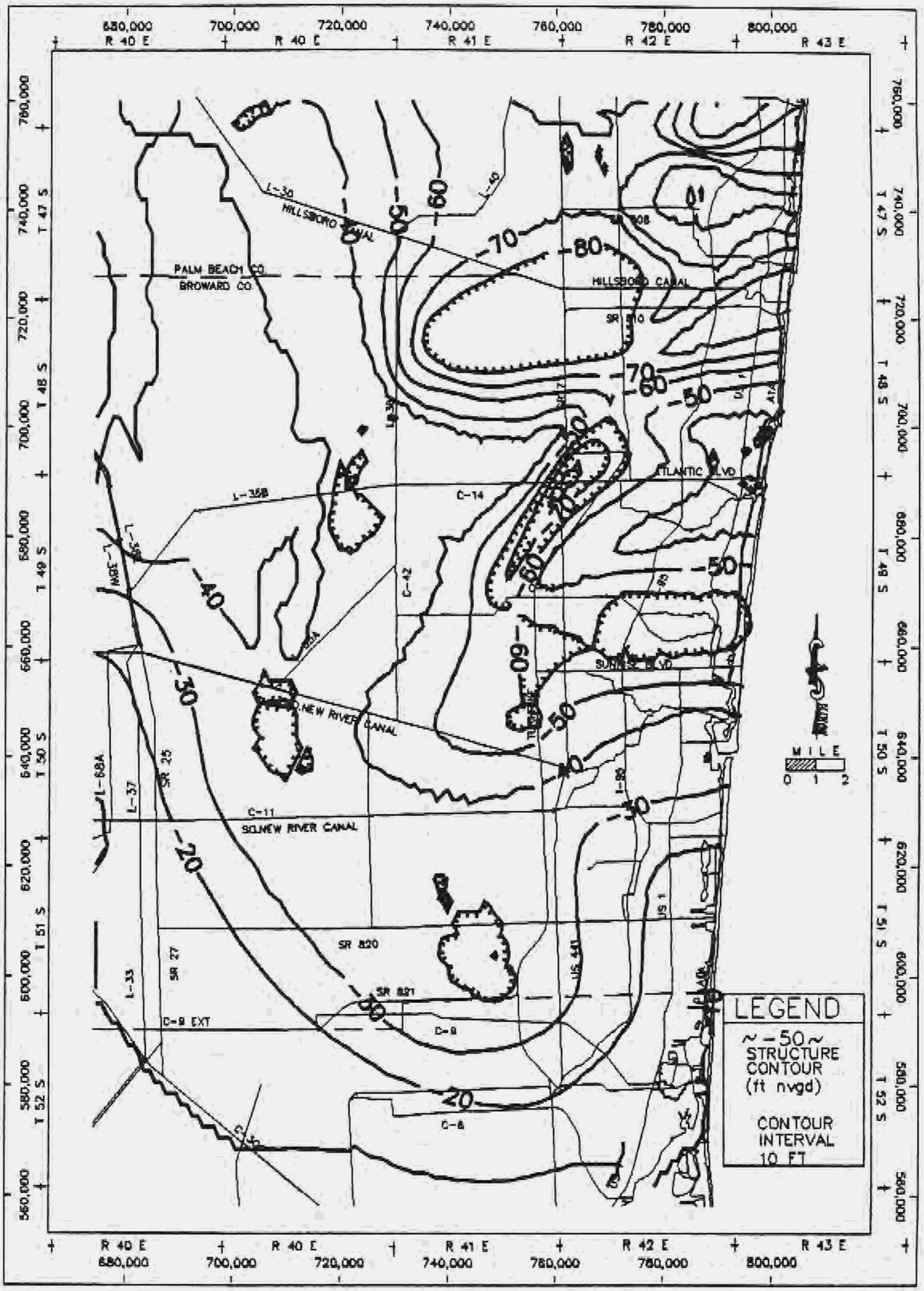

FIGURE A-7. Elevation of the Top of Layer 3

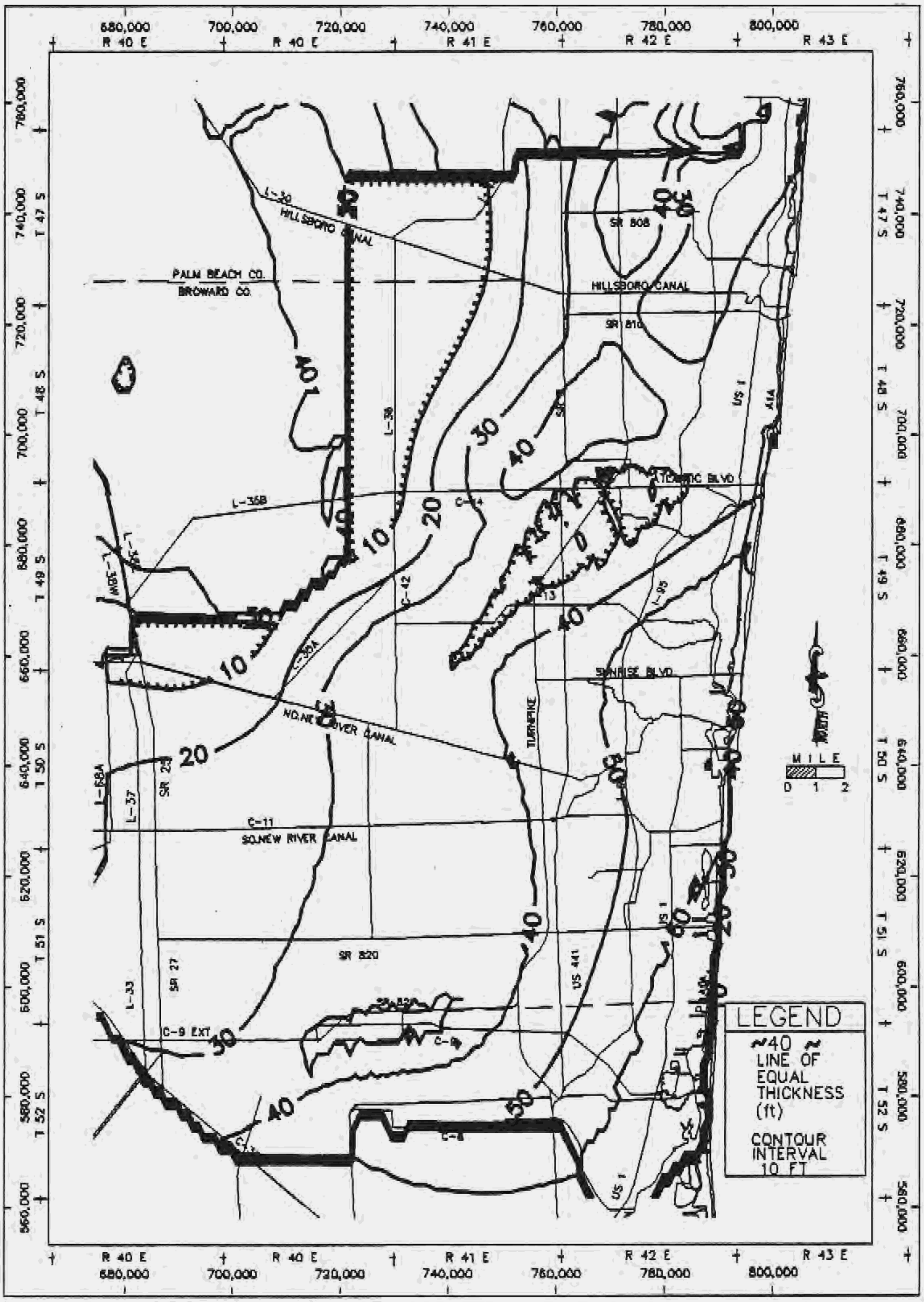

FIGURE A-8. Thickness of Layer 3

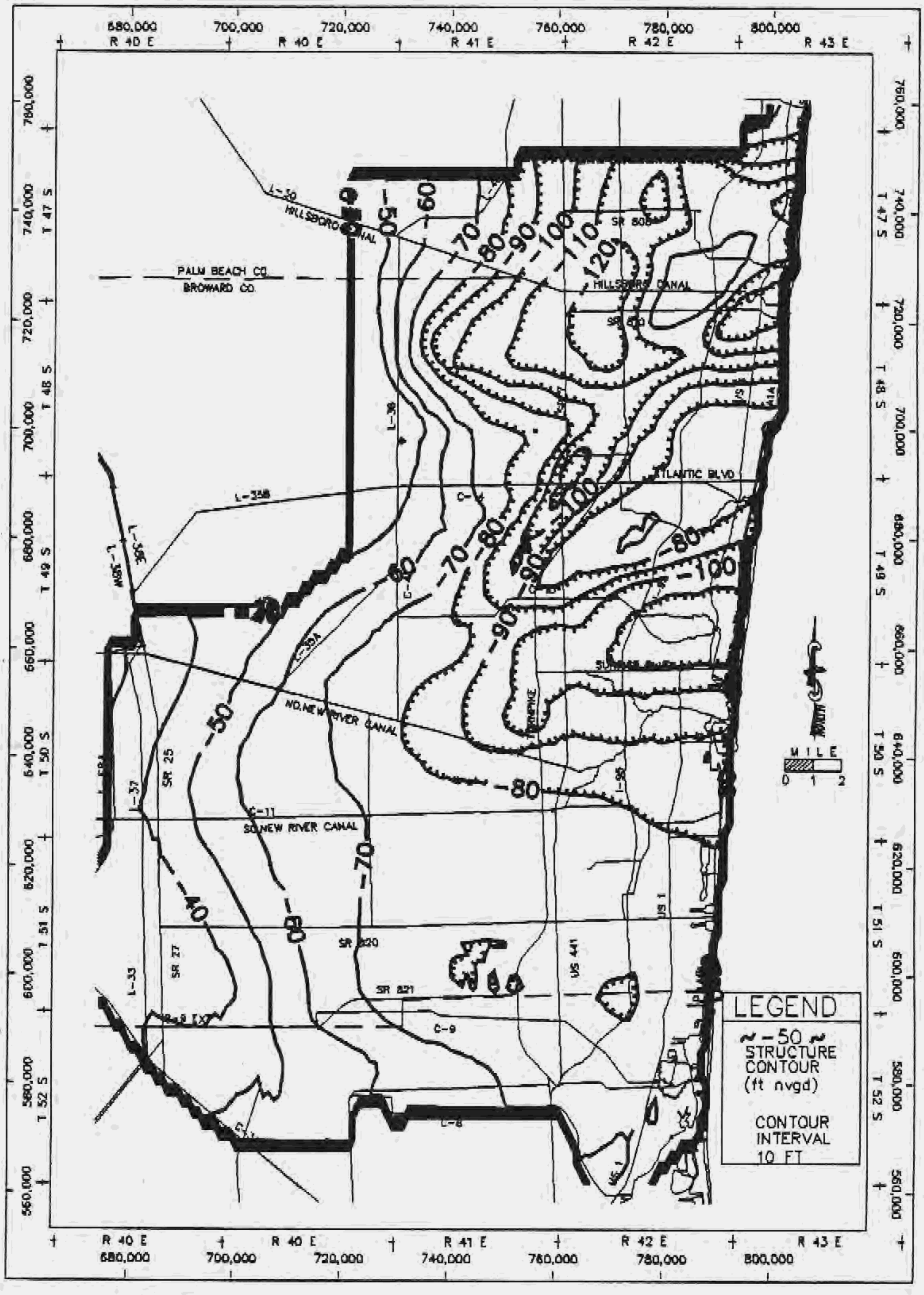

FIGURE A-9. Elevation of the Top of Layer 4

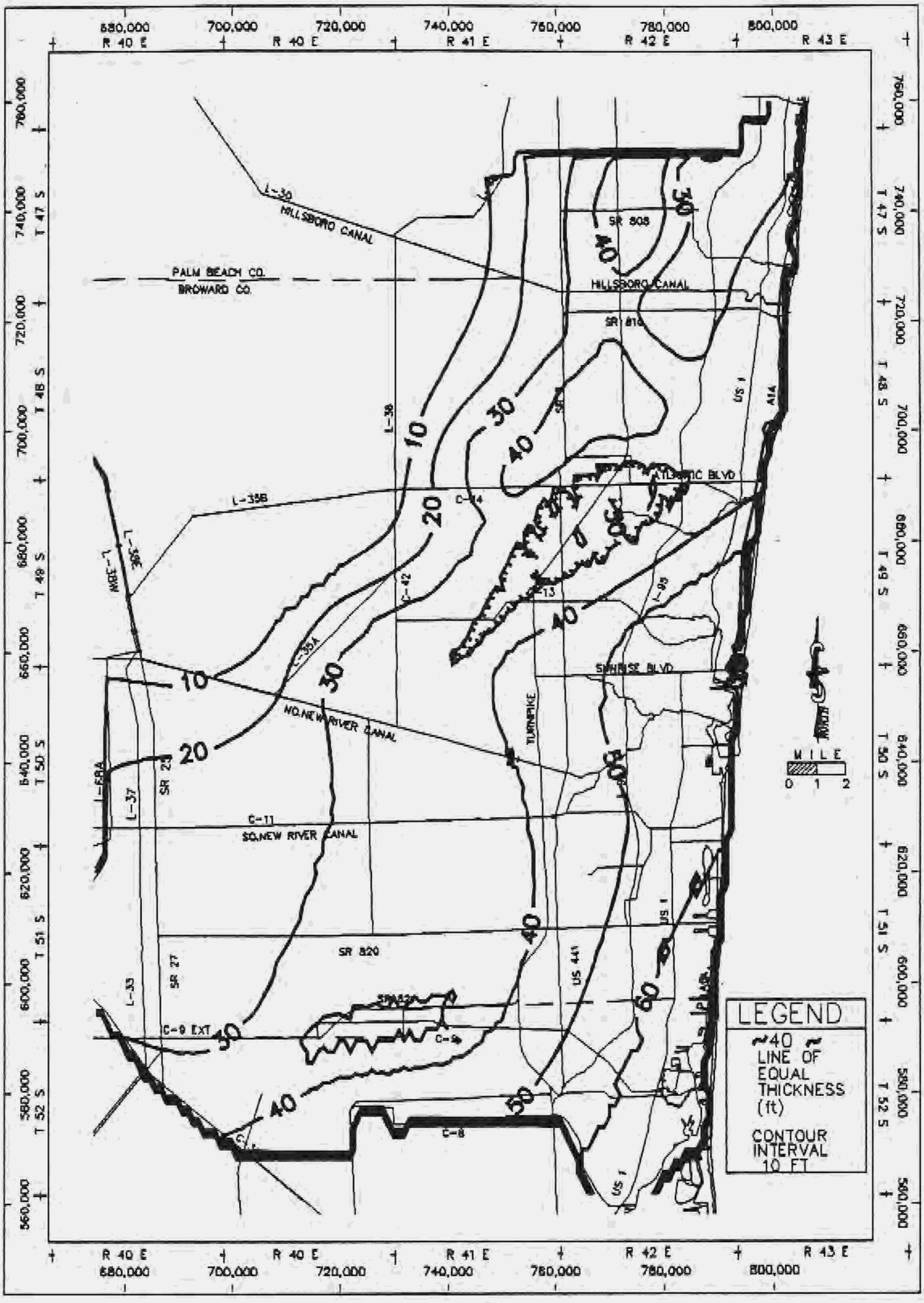

FIGURE A-10. Thickness of Layer 4

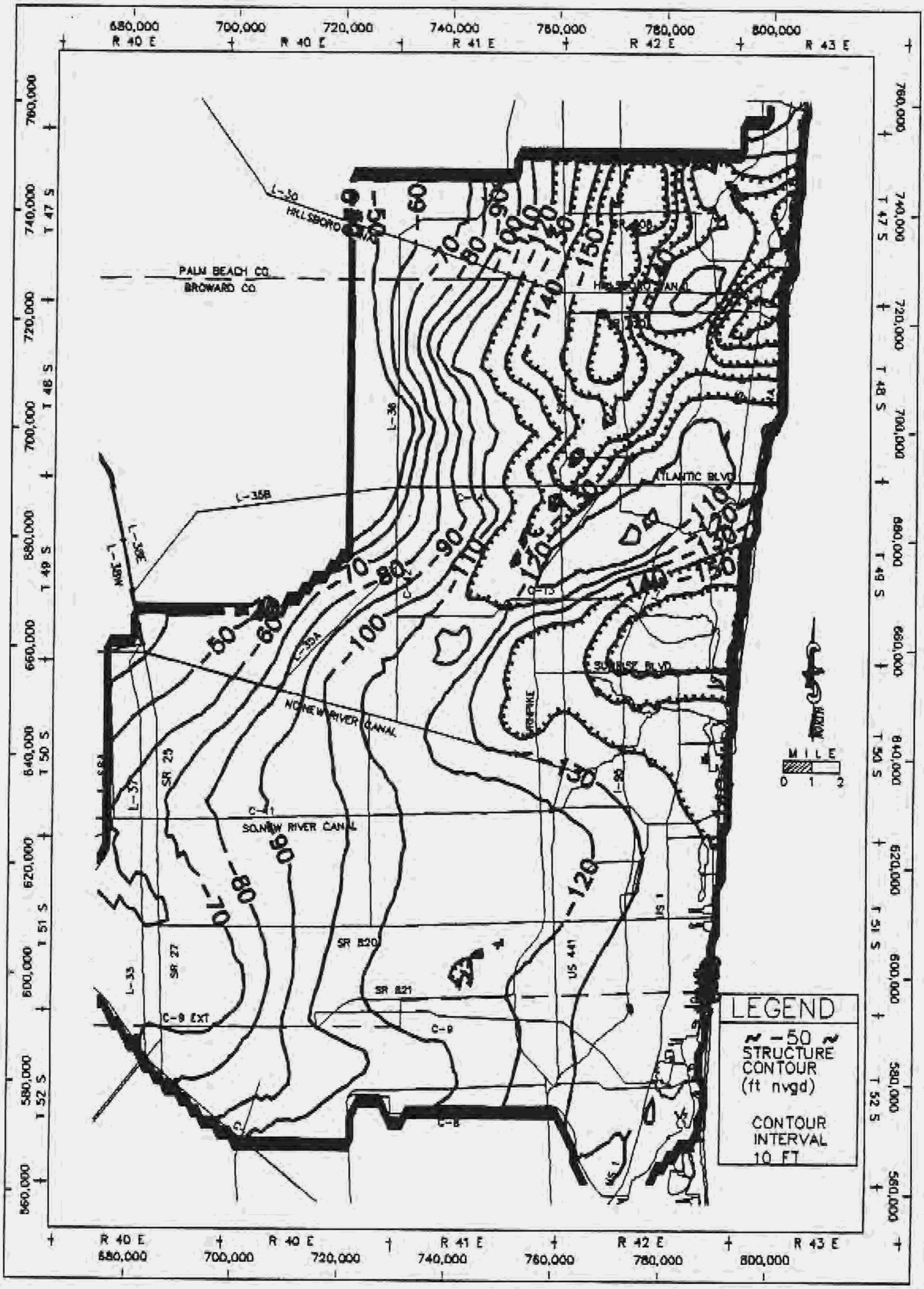

FIGURE A-11. Elevation of the Top of Layer 5

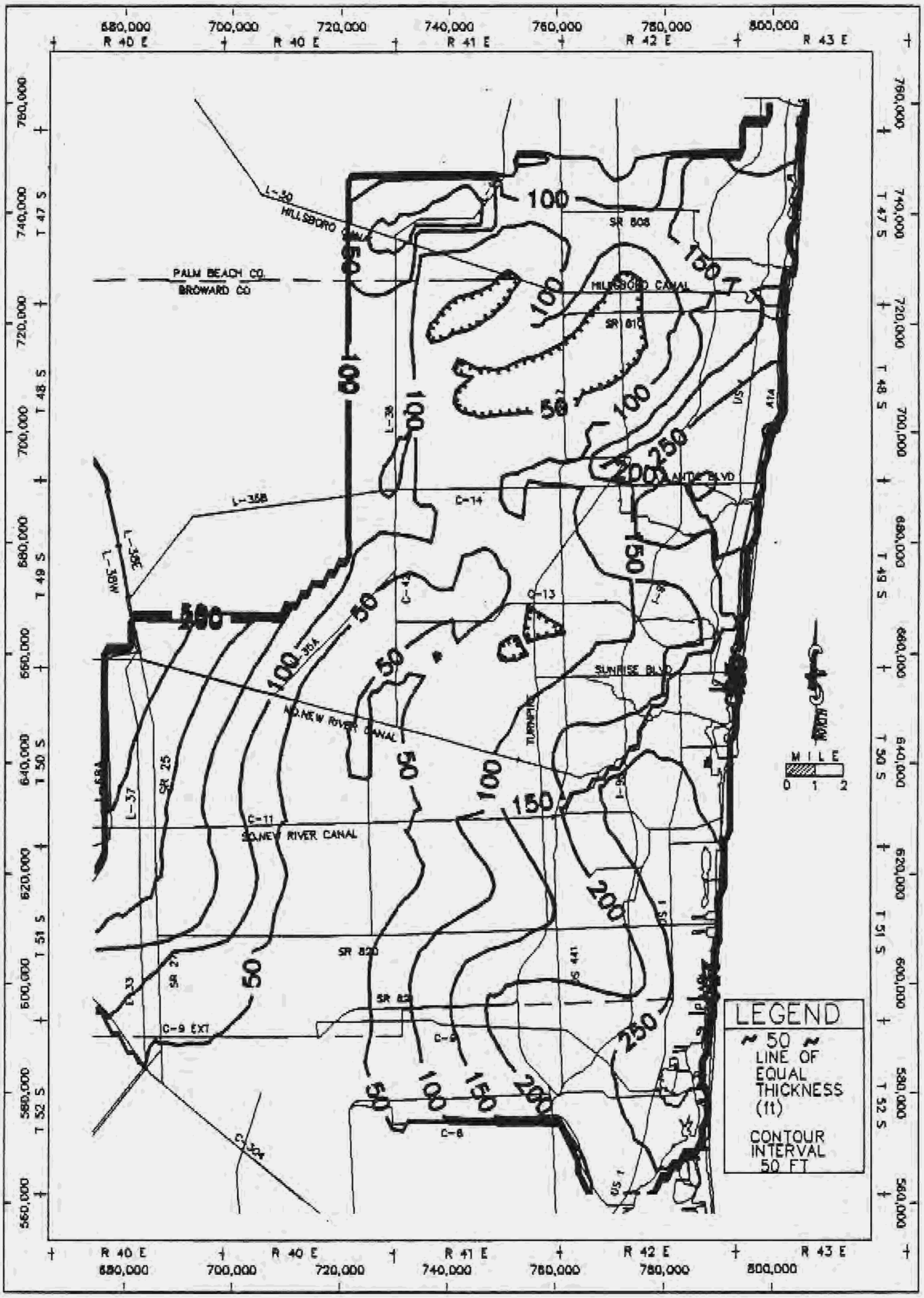

FIGURE A-12. Thickness of Layer 5

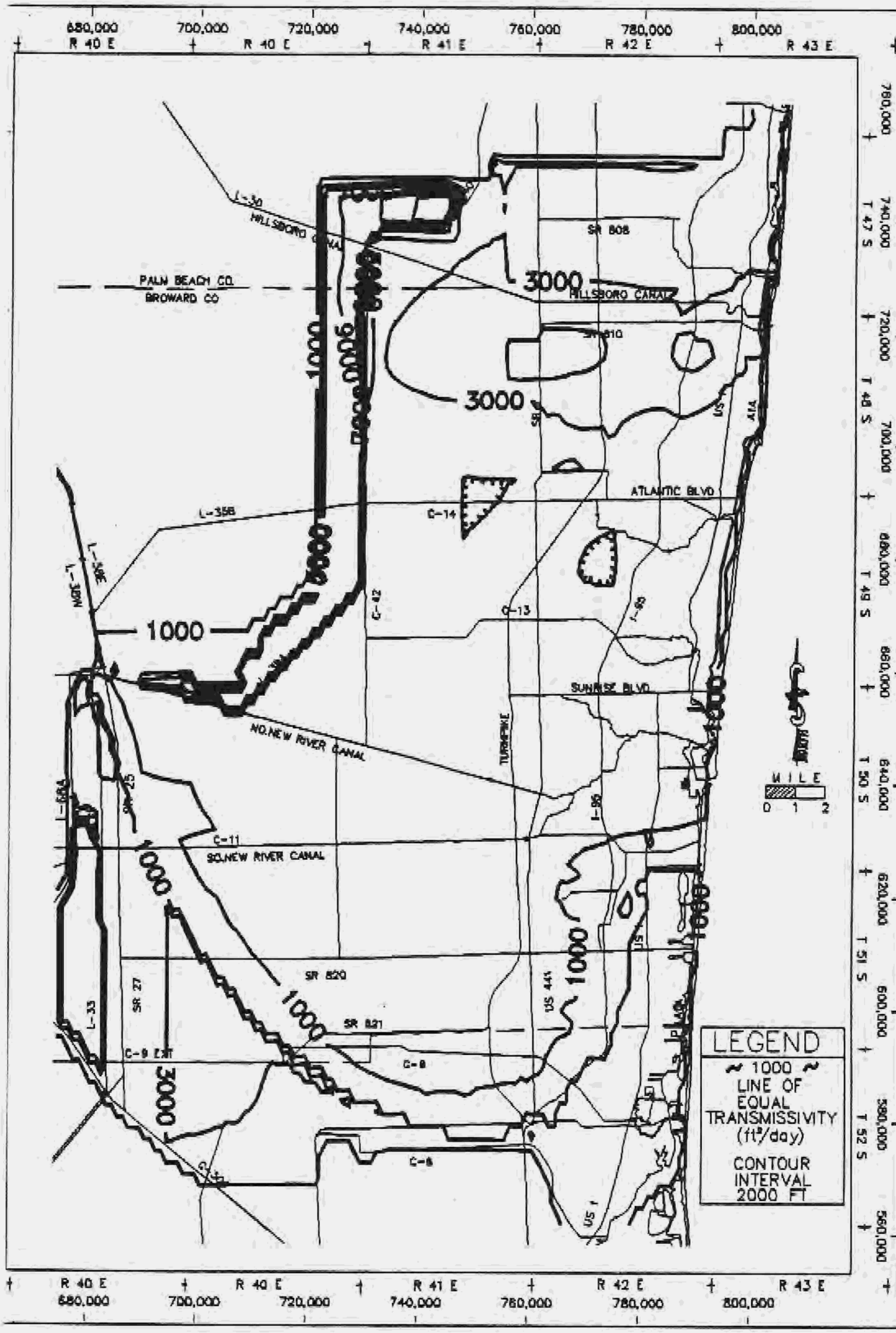

FIGURE A-13. Transmissivity of Layer 2

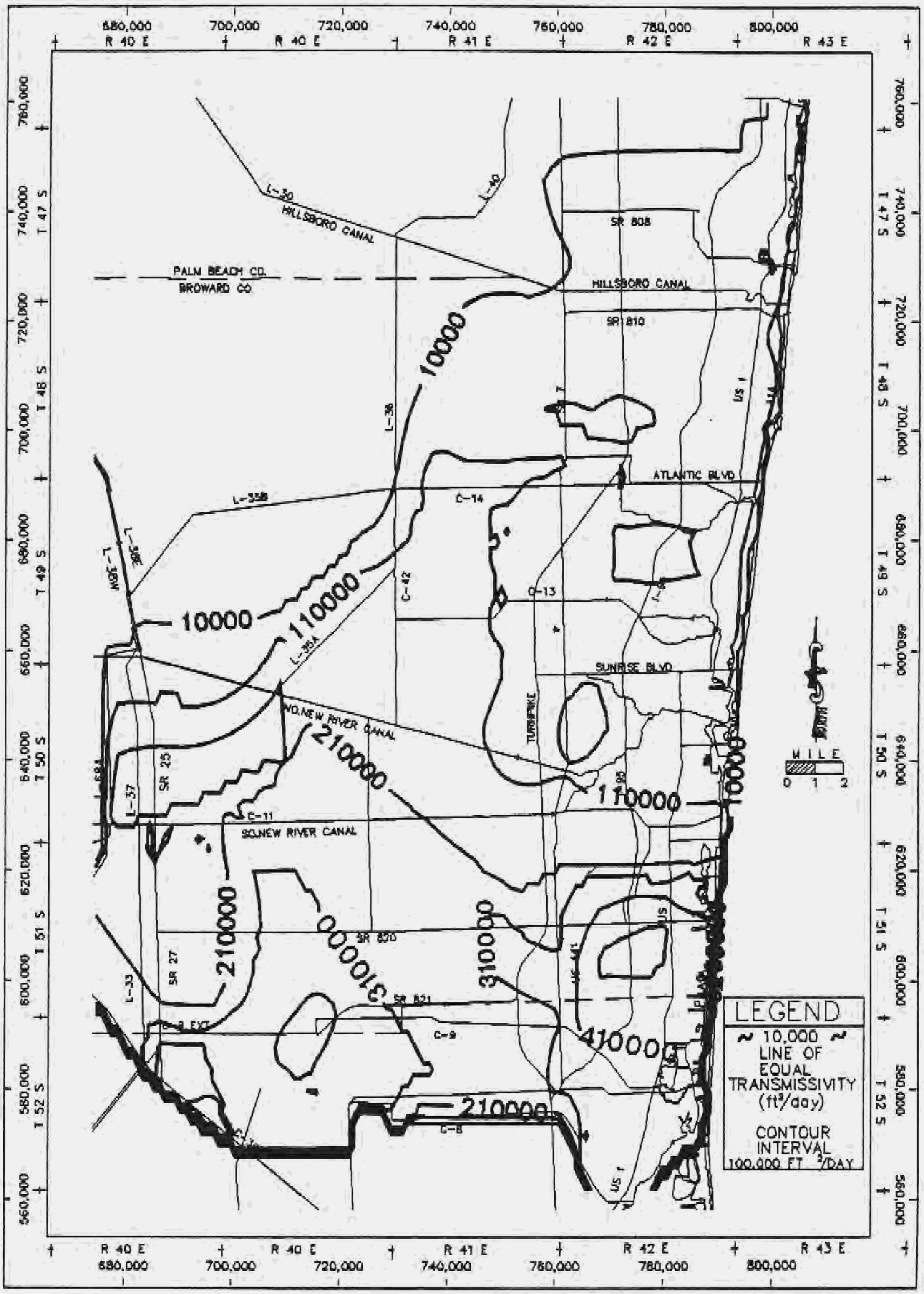

FIGURE A-14. Transmissivity of Layer 3

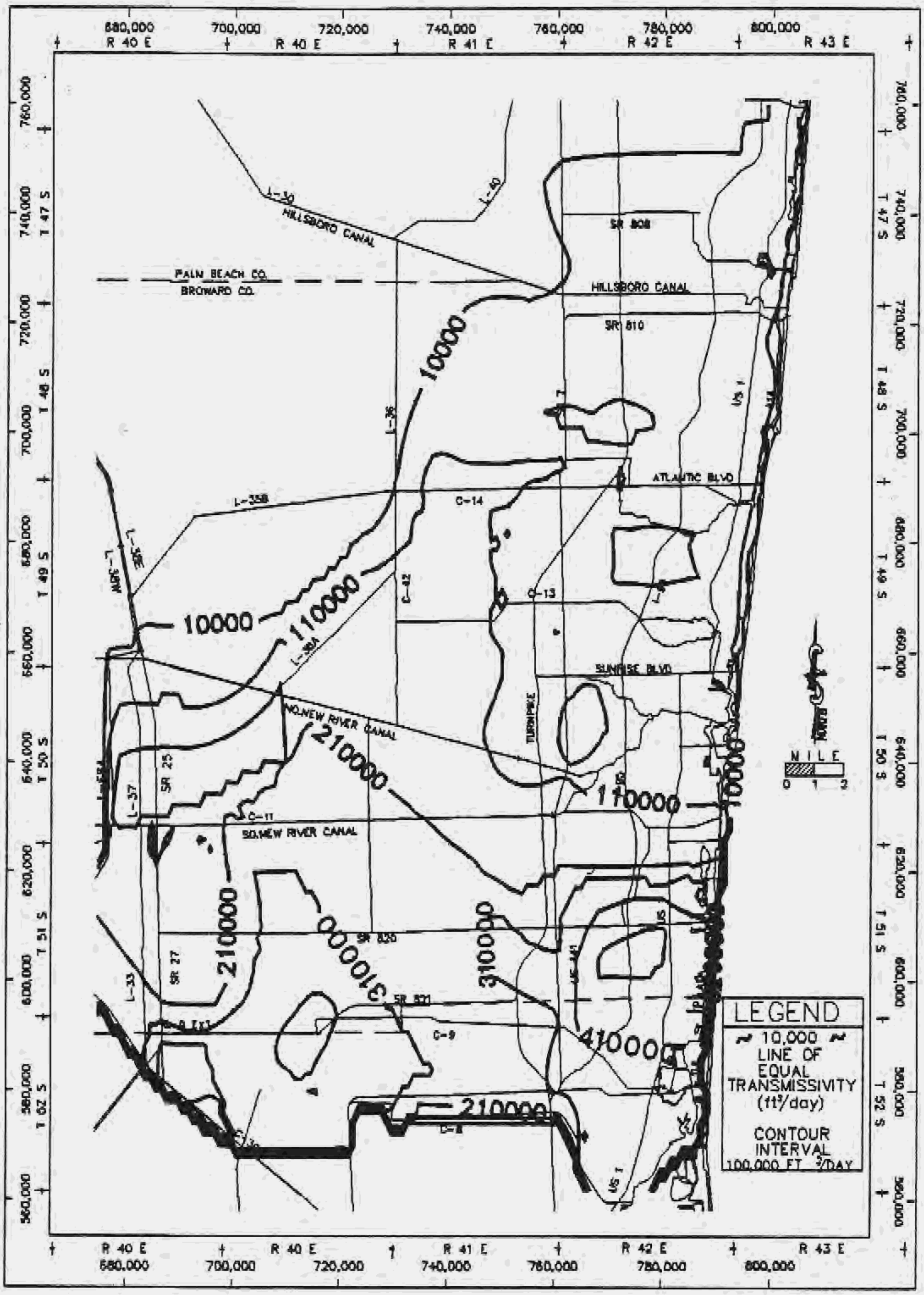

FIGURE A-15. Transmissivity of Layer 4

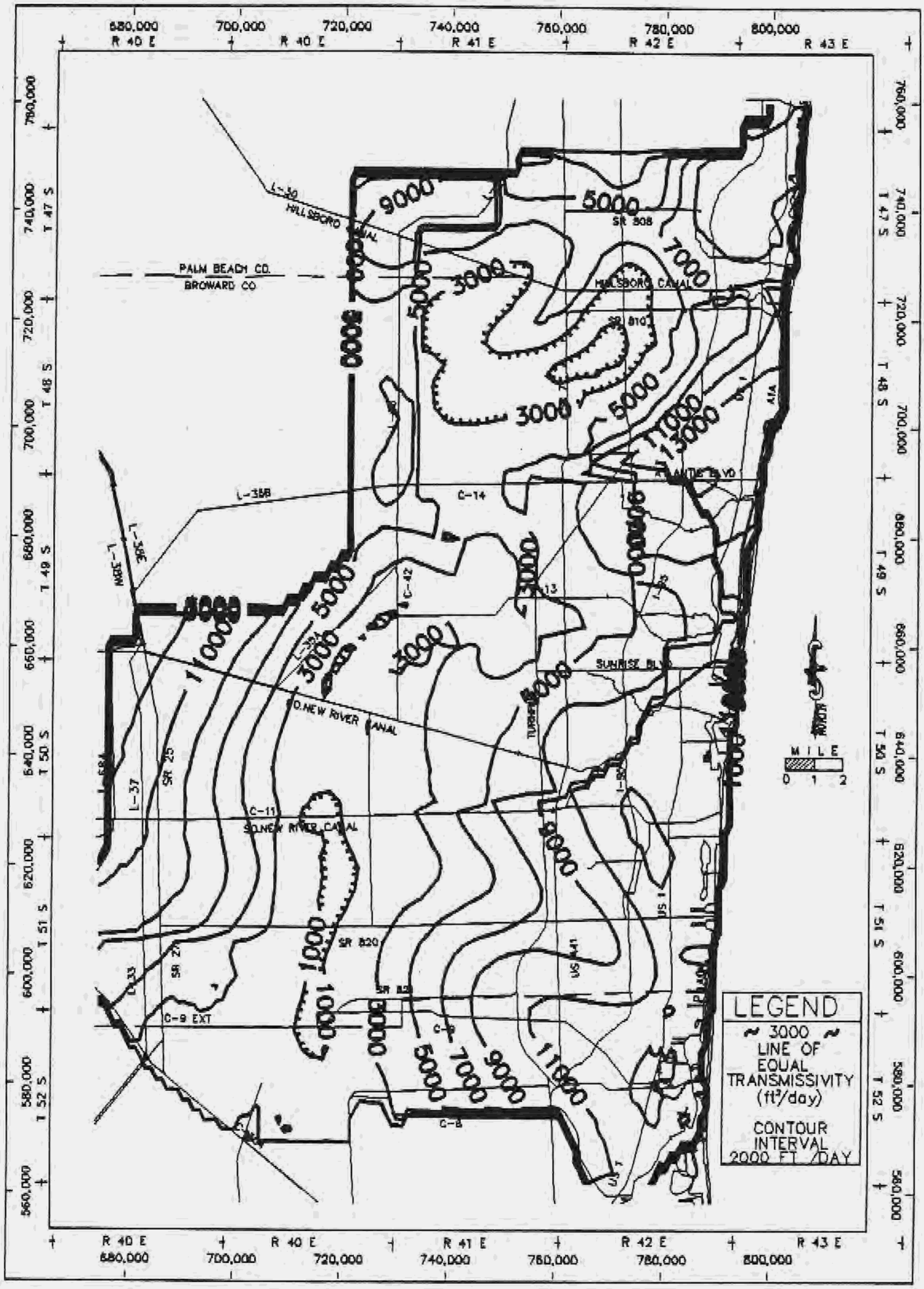

FIGURE A-16. Transmissivity of Layer 5

APPENDIX B

SURFACE WATER DATA AND FIGURES

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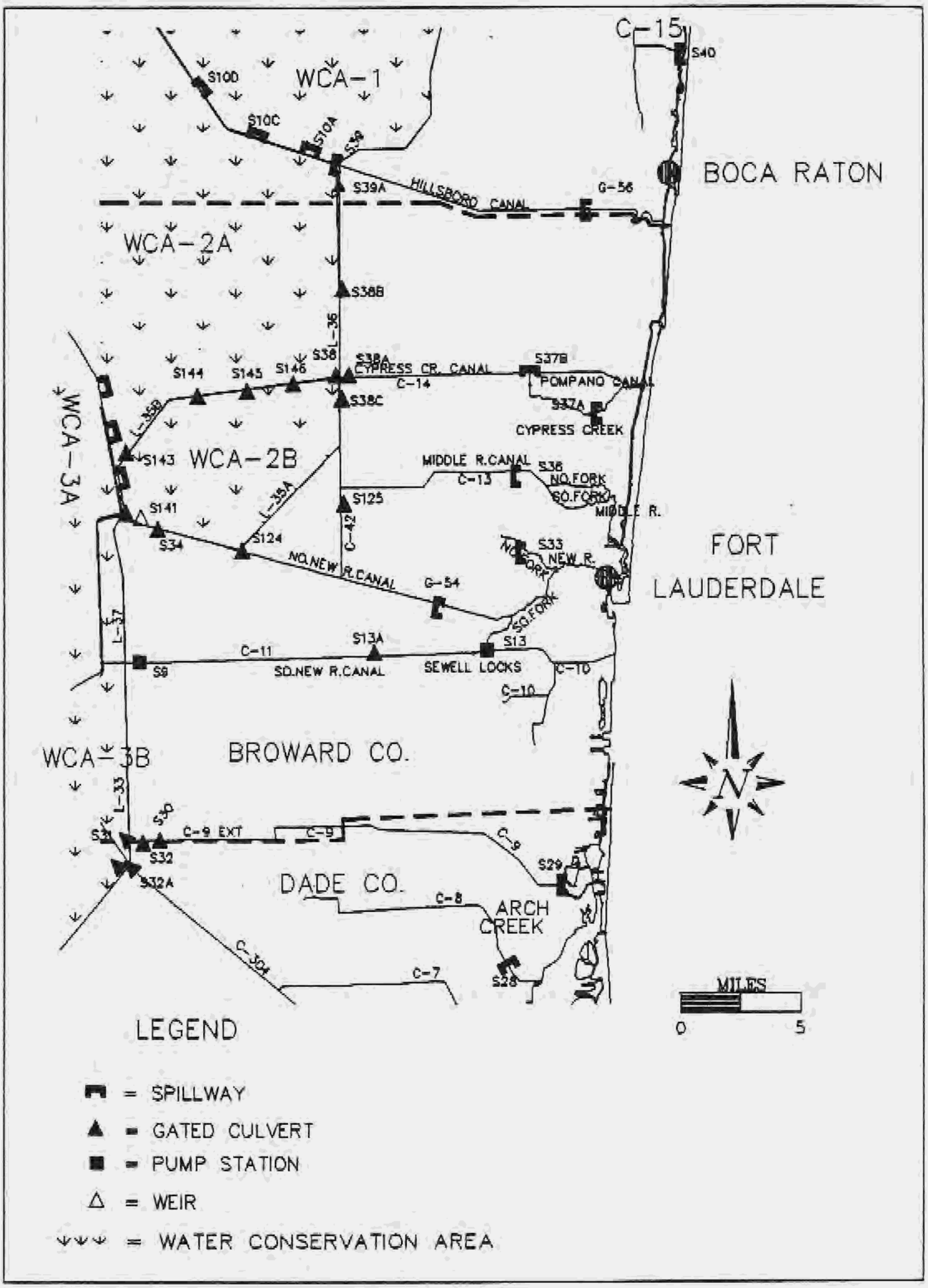

FIGURE B-1. **Major Water Bodies Within Study Area**

CANAL NAME	STRUCTURE NAME	WET SEASON CONTROL ELEVATION	DRY SEASON CONTROL ELEVATION
C-15 Canal	S-40	8.2	8.2
Hillsboro	G-56	7.5	8.0
Cypress Creek	S-37A	3.5	3.5
Cypress Creek	S-37B	7.5	7.5
Old Pompano	G-57	4.5	4.5
Middle River	S-36	4.5	4.5
C-12	S-33	3.5	3.5
North New River	G-54	3.5	3.5
South New River	S-13	1.6	1.6
Snake Creek	S-29	2.0	2.0
Arch Creek	G-58	1.8	1.8
C-8	S-28	1.8	1.8
Miami Canal	S-26	2.5	2.5

TABLE B-1. **SFWMD Canals With Control Elevations**

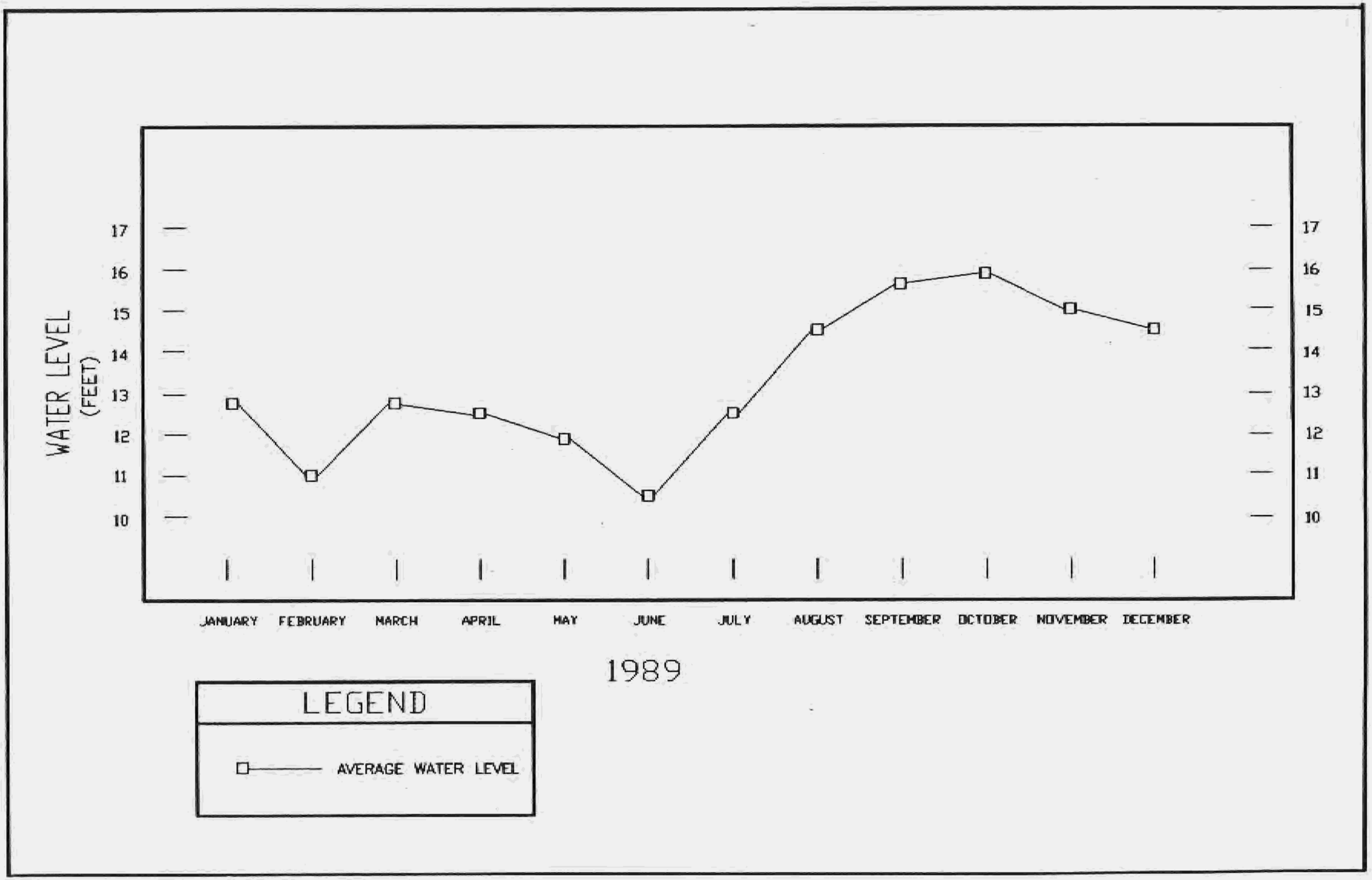

FIGURE B-2. **Average Monthly Water Level for WCA 1**

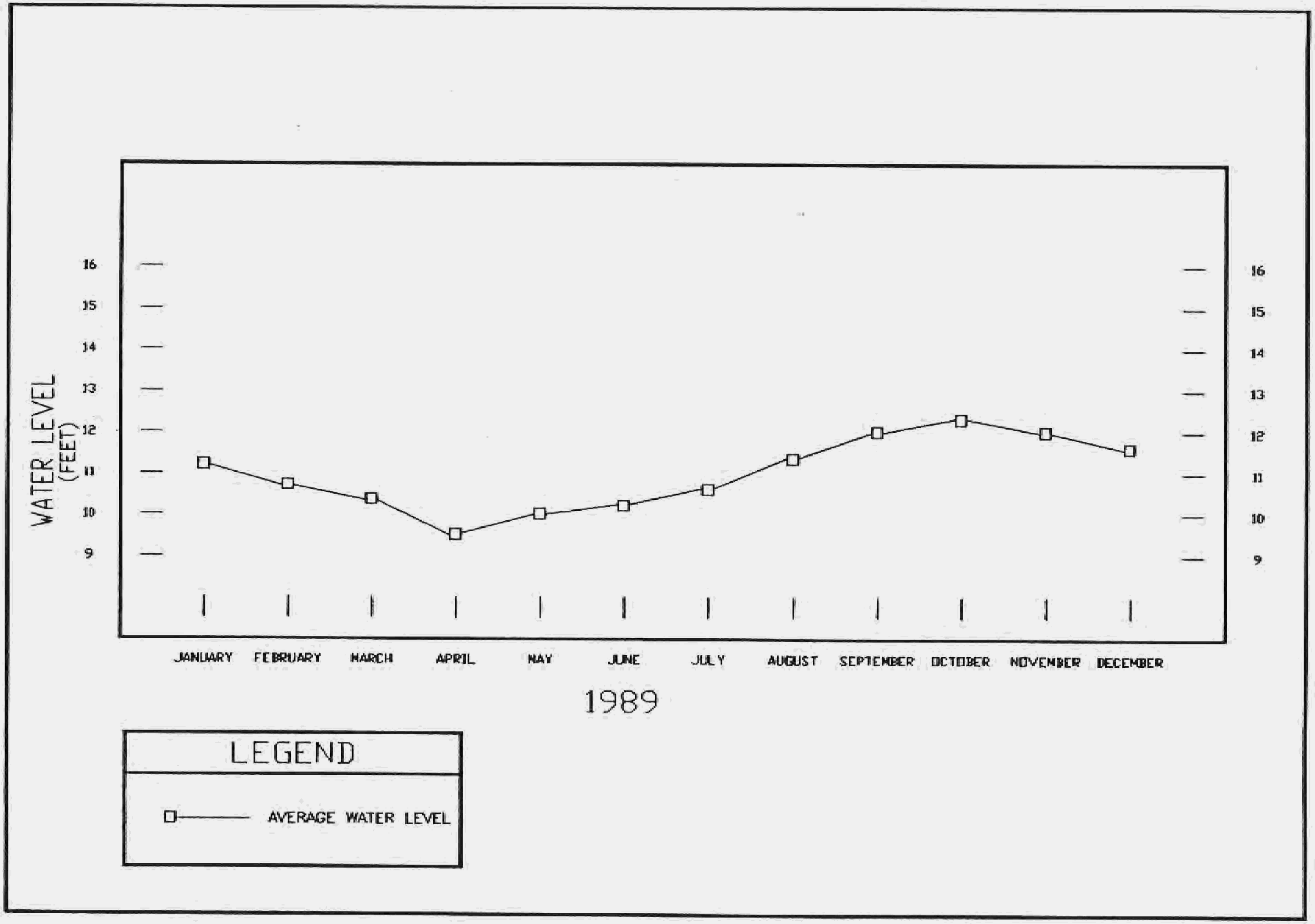

FIGURE B-3. **Average Monthly Water Level for WCA 2A**

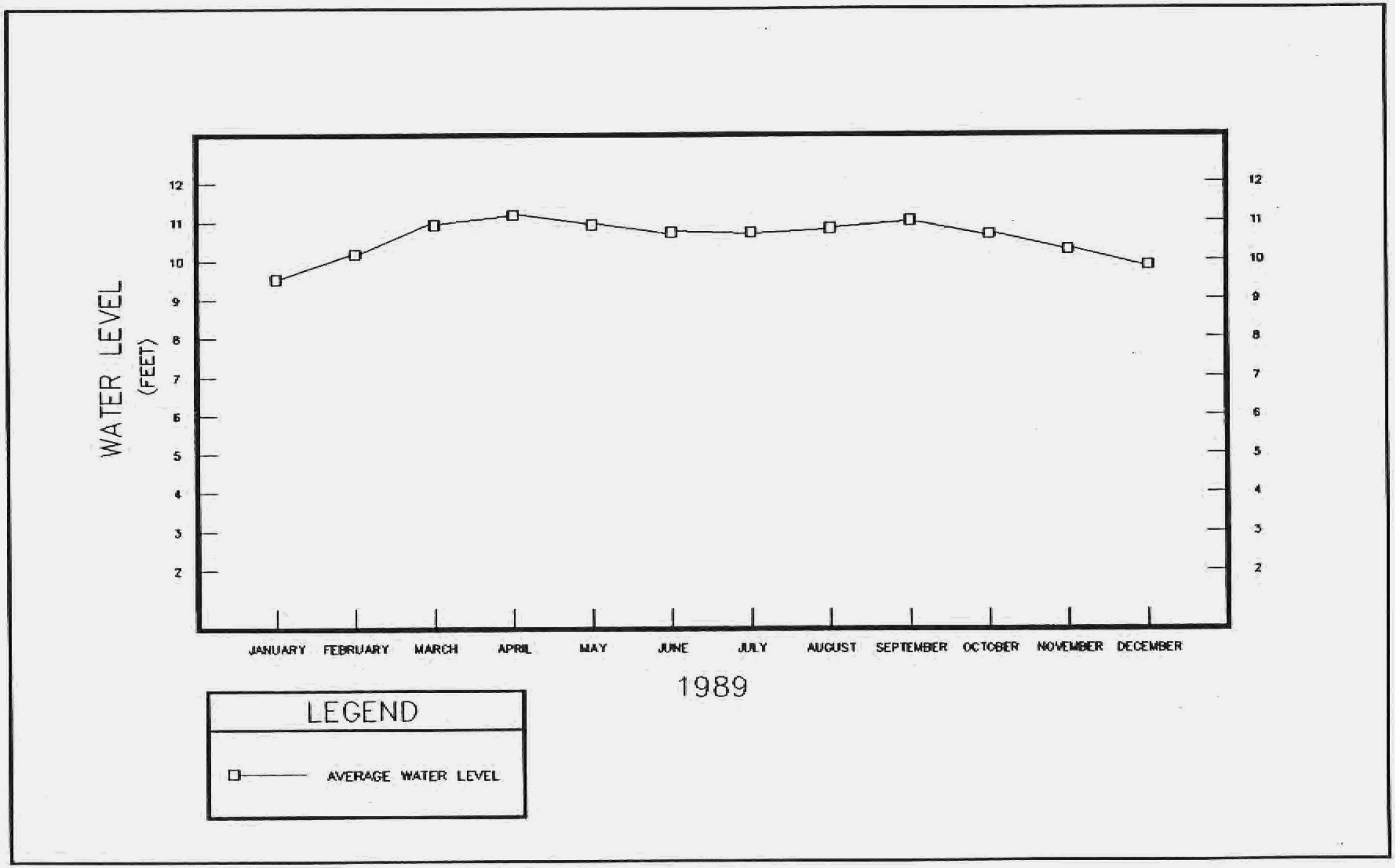

FIGURE B-4. Average Monthly Water Level for WCA 2B

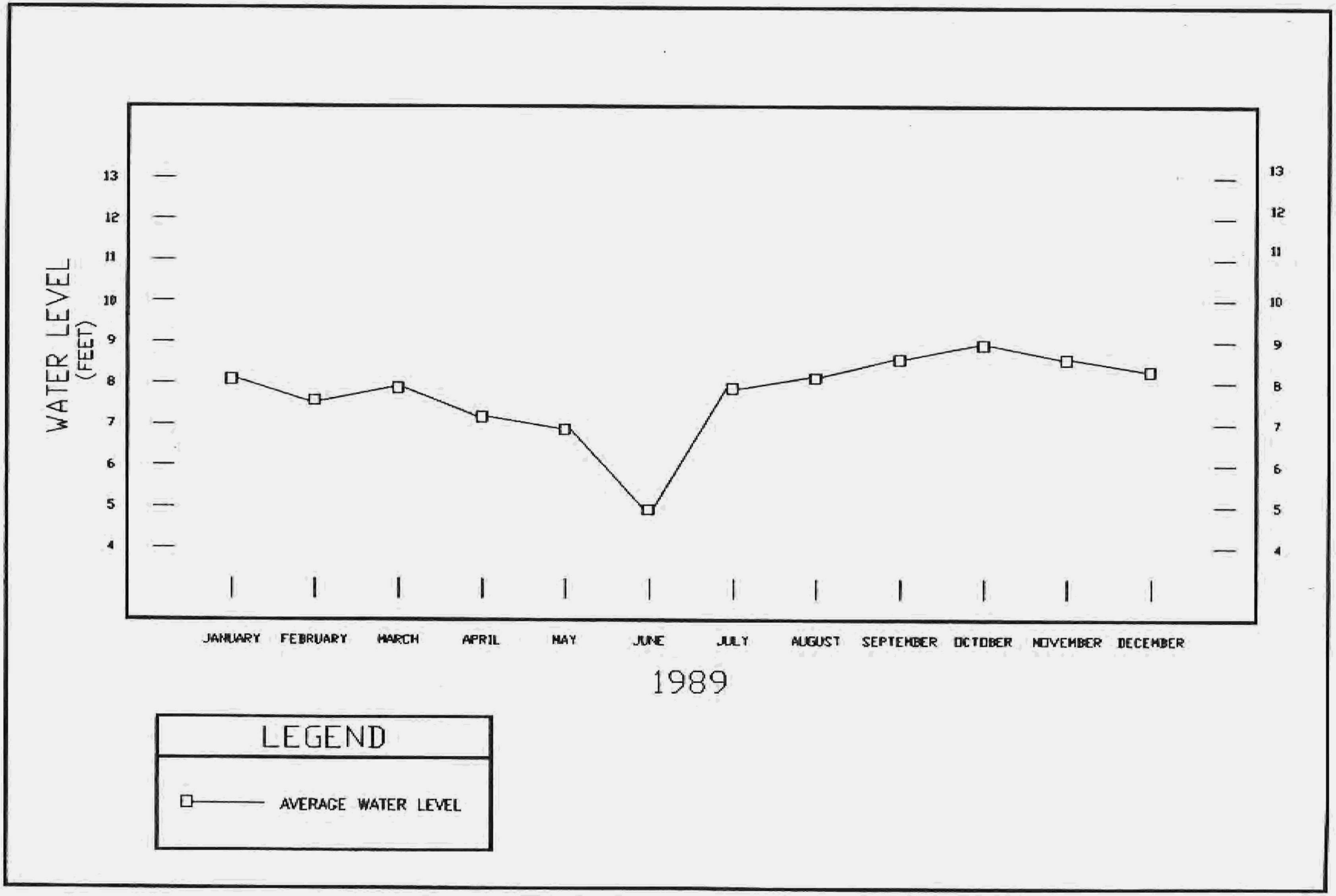

FIGURE B-5. **Average Monthly Water Level for WCA 3A**

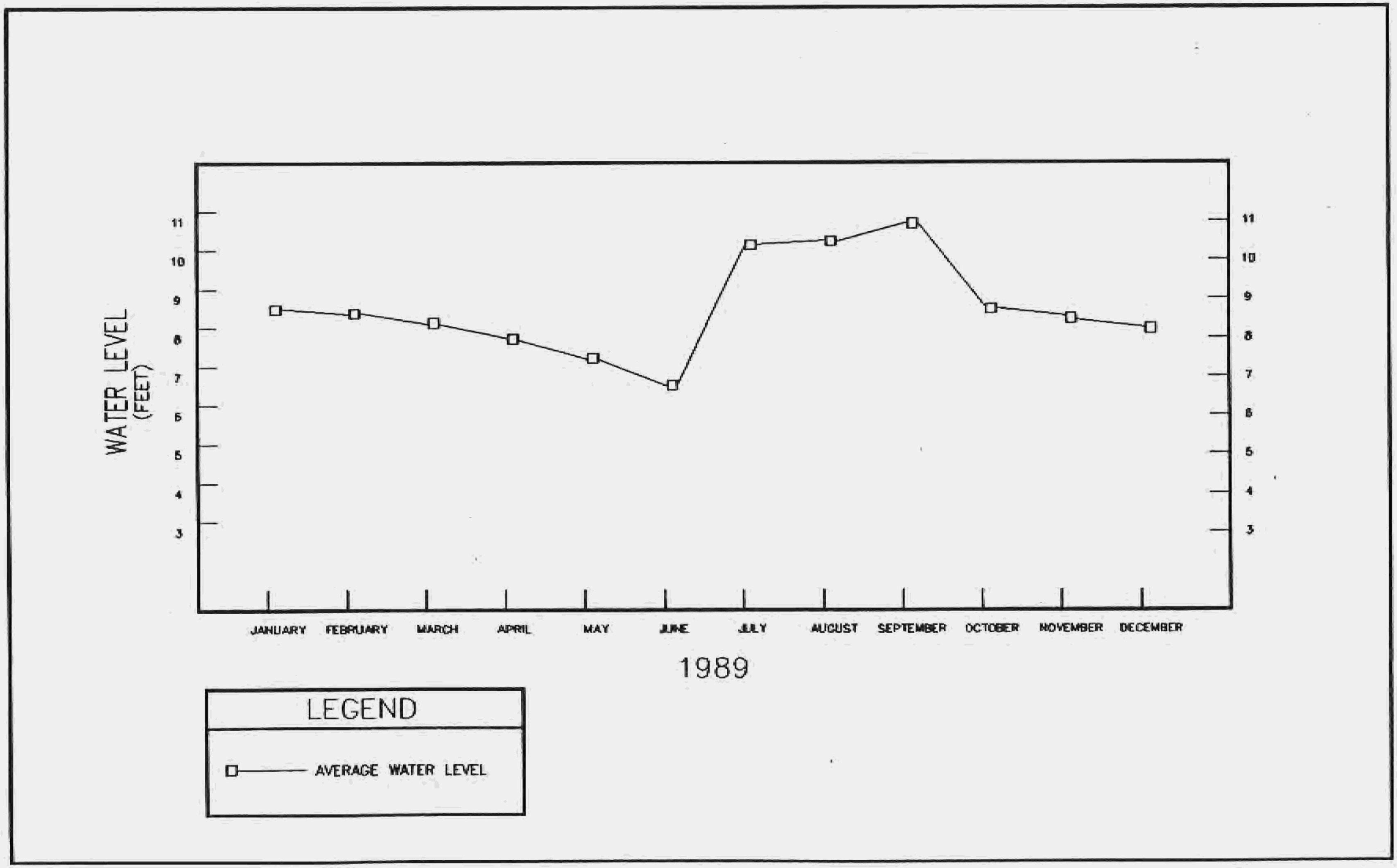

FIGURE B-6. **Average Monthly Water Level for WCA 3B**

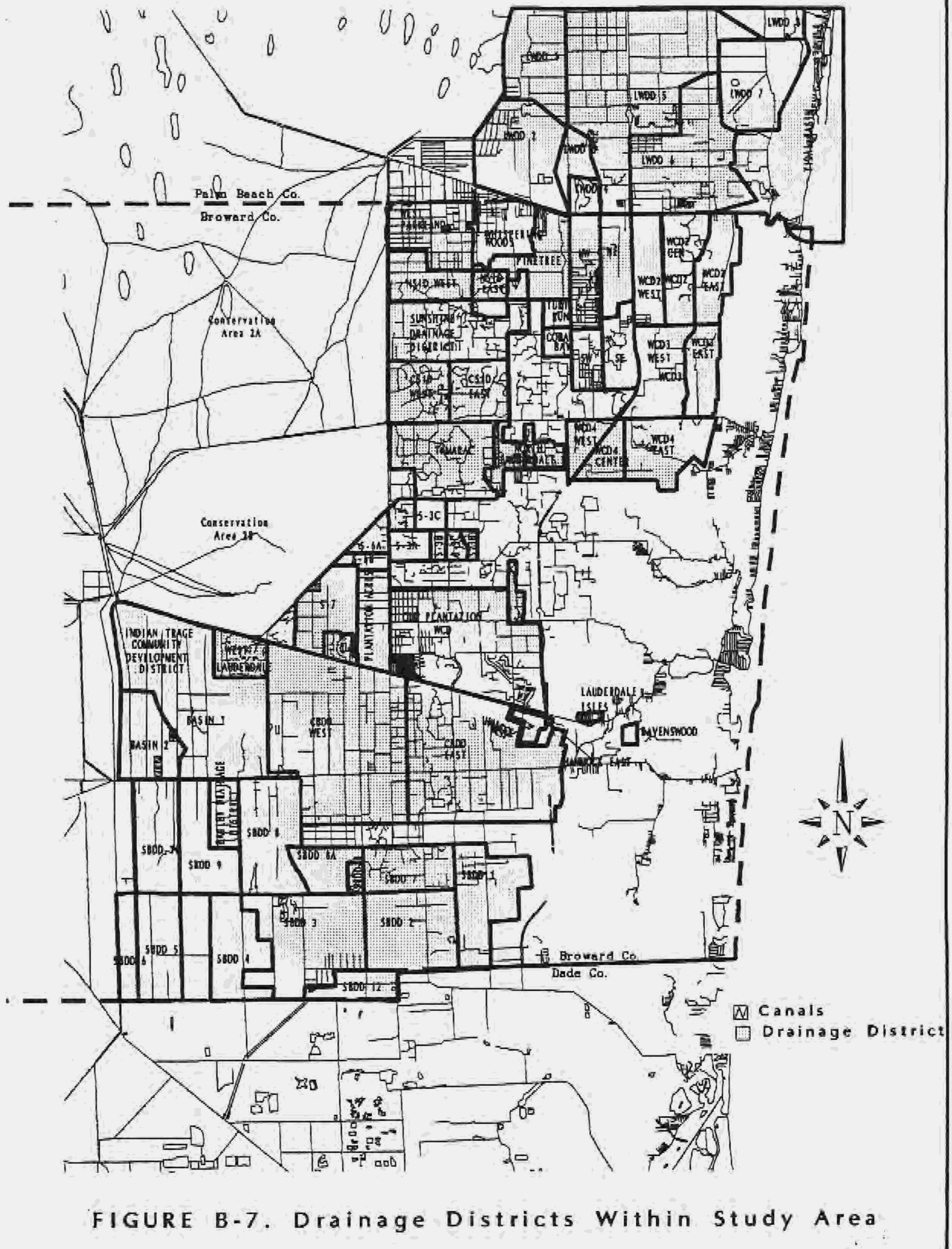

FIGURE B-7. Drainage Districts Within Study Area

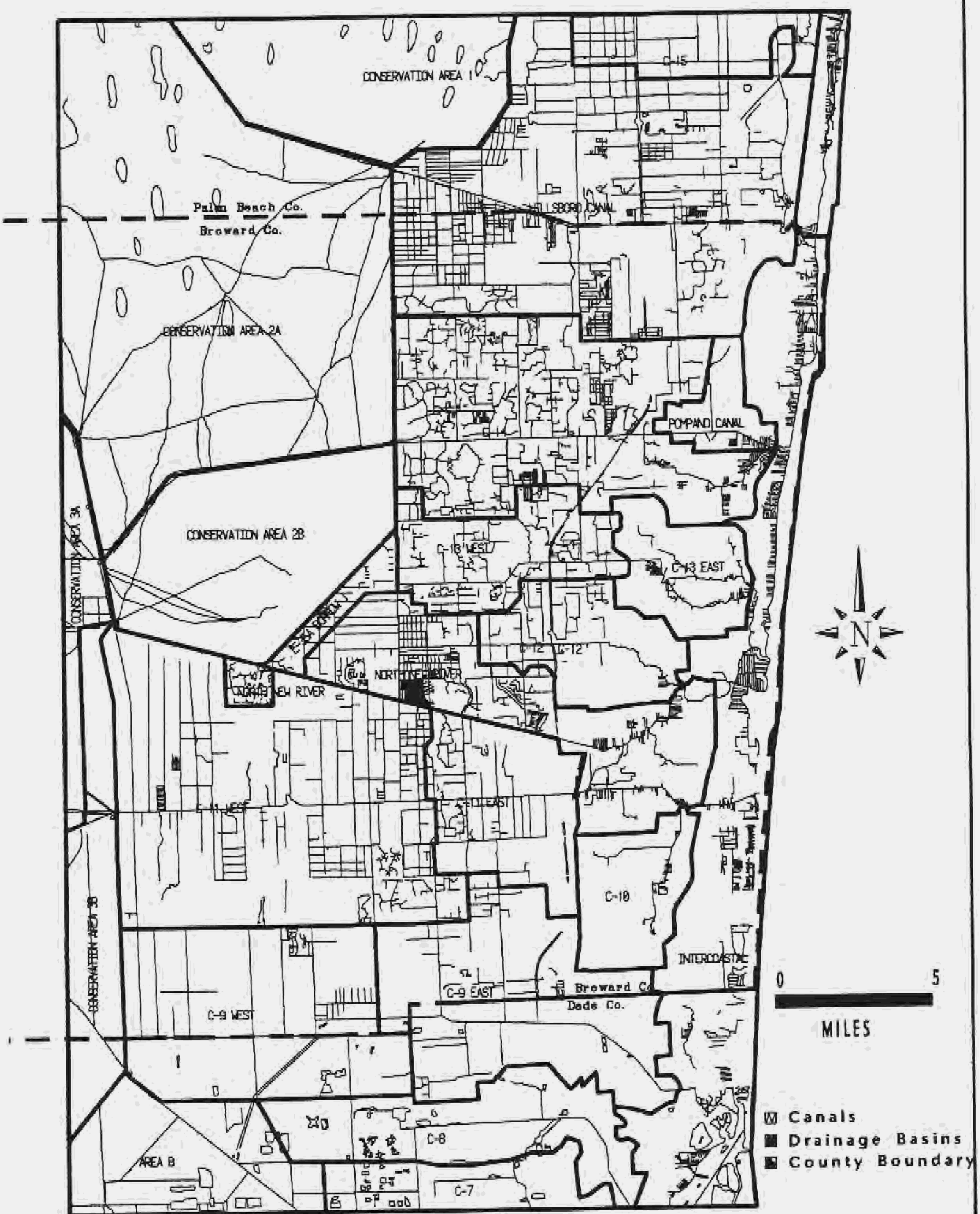

FIGURE B-8. Broward Model Drainage Basins

TABLE B-2
DRAINAGE DISTRICT CONTROL ELEVATIONS

DRAINAGE DISTRICTS	WET SEASON TARGET CONTROL ELEVATION	DRY SEASON TARGET CONTROL ELEVATION	RECHARGE SYSTEM
Bailey Drainage	4.0	4.0	N
Central Broward East	3.0	3.0	Y(1)
Central Broward West	4.0	4.0	Y(1)
Cocomar NE	11.0	11.0	Y(2)
Cocomar NW	11.0	11.0	Y(2)
Cocomar SE	9.5	9.5	Y(2)
Cocomar SW	8.5	9.5	Y(2)
Coral Bay	9.5	9.5	Y(2)
CSID East	6.5	7.0	N
CSID West	6.5	7.0	N
Indian Trace Basin 1	4.0	4.0	N
Indian Trace Basin 2	4.0	4.0	N
Lauderdale Isles	Tidal	Tidal	N
LWDD 1	9.3	9.3	Y(2)
LWDD 2	7.5	7.5	N
LWDD 3	14.5	14.5	Y(2)
LWDD 4	8.0	8.0	N
LWDD 5	16.0	16.0	Y(2)
LWDD 6	13.0	13.0	Y(2)
LWDD 7	4.3	4.3	N
LWDD 8	8.5	8.5	Y(2)
North Lauderdale	7.5	7.5	Y(3)
NSID East	9.0	10.0	N
NSID West	8.0	7.0	N
Old Plantation	4.0	4.0	Y(4,5)
Pinetree	11.0	12.0	Y(2)
Plantation Acres	3.5	4.5	Y(5)
Ravenswood	2.0	2.0	N
South Broward Basin 1	2.5	2.5	N
South Broward Basin 2	2.7	2.7	N
South Broward Basin 3	3.0	3.0	N
South Broward Basin 4	3.5	3.5	Y(6)
South Broward Basin 5	4.0	4.0	Y(6)
South Broward Basin 6	4.0	4.0	Y(6)

TABLE B-2 (Continued)
DRAINAGE DISTRICT CONTROL ELEVATIONS

DRAINAGE DISTRICTS	WET SEASON TARGET CONTROL ELEVATION	DRY SEASON TARGET CONTROL ELEVATION	RECHARGE SYSTEM
South Broward Basin 7	2.7	2.7	N
South Broward Basin 8	3.5	3.5	Y(6)
South Broward Basin 8A	2.7	2.7	Y(6)
South Broward Basin 9	4.0	4.0	Y(6)
South Broward Basin 10	4.0	4.0	Y(6)
South Broward Basin 12	3.5	3.5	Y(6)
Sunrise 1	4.1	4.1	Y(7)
Sunrise 3A	5.5	5.5	Y(7)
Sunrise 3B	5.0	5.0	Y(7)
Sunrise 3C	6.5	6.5	Y(7)
Sunrise 3D	5.0	5.0	Y(7)
Sunrise 5	5.5	5.5	Y(7)
Sunrise 6A	5.5	5.5	Y(7)
Sunrise 6B	5.5	5.5	Y(7)
Sunrise 7	4.5	4.5	Y(7)
Sunshine	7.5	7.5	Y(8)
Tamarac, City of	6.3	6.3	Y(3)
Tindall Hammock East	Tidal	Tidal	N/A
Tindall Hammock West	3.5	3.5	Y(4)
Turtle Run	9.5	9.5	Y(2)
Twin Lakes	N/A	N/A	N
WCD1	N/A	N/A	N/A
WCD2 Central	10.0	10.0	Y(9)
WCD2 East	8.5	8.5	Y(9)
WCD2 West	10.0	10.0	Y(9)
WCD3 East	8.5	8.5	N
WCD3 West	9.0	9.0	N
WCD4 Central	6.0	6.0	N
WCD4 East	3.5	4.5	N
WCD4 West	7.5	7.5	Y(3)
West Lauderdale	4.0	4,0	N
West Parkland	8.0	8.0	N
Whispering Woods	11.5	11.5	Y(2)

TABLE B-2 (Continued)

Key to Table B-2

1. The recharge system consists of free flow between the CBDD canals and the C-11 Canal.

2. The water levels in the drainage district are maintained by the diversion of water from the Hillsboro Canal into the canals of the drainage district.

3. The recharge system consists of free flow with the C-14 Canal.

4. The recharge system consists of free flow with the North New River Canal.

5. Pumps are present to recharge the drainage district.

6. The recharge system consists of free flow between the SBDD canals and either the C-9 or C-11 canal.

7. The recharge system consists of free flow between the City of Sunrise's canals and the C-13 Canal.

8. The Sunshine Drainage District received a consumptive use permit to withdraw water from the C-42 Canal in order to maintain the water levels within the drainage district.

9. Broward County received a consumptive use permit to withdraw water from the Hillsboro Canal to maintain water levels within the drainage district. The water is pumped into the C-2 Canal of WCD2.

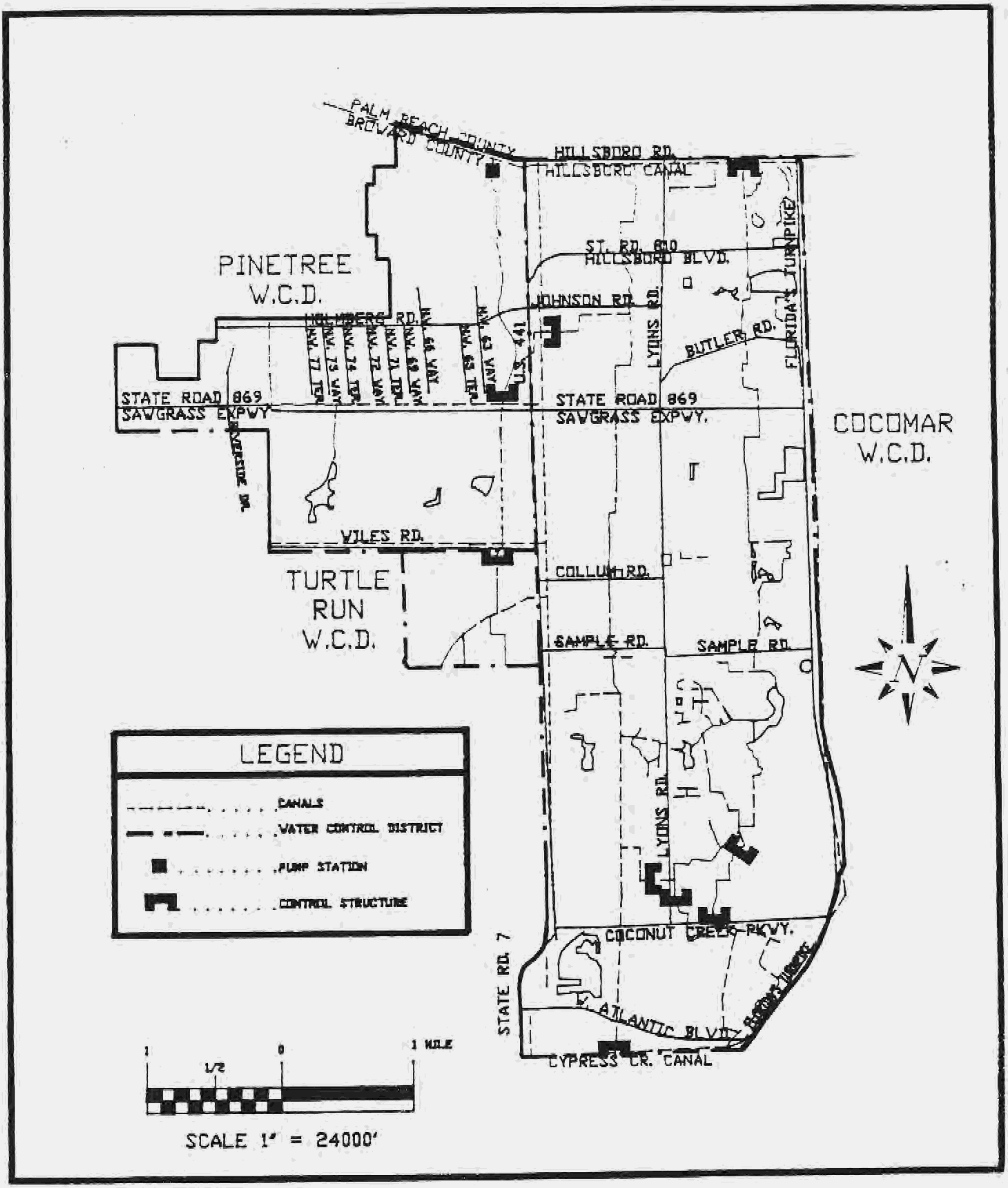

FIGURE B-9. Primary Canals Within the Deerfield Irrigation Company Area

APPENDIX C

DATA AND FIGURES RELATING TO LAND USE, RECHARGE, EVAPOTRANSPIRATION AND WATER USE

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FIGURE C-1. General Land Use, Level 1, Broward County, 1988

TABLE C-1. S.F.W.M.D. LAND USE AND LAND COVER CLASSIFICATION CODE

LEVEL I LEVEL II LEVEL III

(U) Urban and built-up land

(UR) Residential

- (URSL) Single-family, Low Density (under 2 D.U./gross acre)
- (URSM) Single-family, Medium Density (2 to 5 D.U./gross acre)
- (URSH) Single-family, High Density (over 5 D.U./gross acre)
- (URMF) Multi-family building
- (URMH) Mobile homes

(UC) Commercial and Services

- (UCPL) Parking lot
- (UCSC) Shopping center
- (UCSS) Sales and services
- (UCCE) Cultural and Entertainment
- (UCMC) Marine commercial (Marinas)
- (UCHM) Hotel-Motel

(UI) Industrial

- (UIJK) Junkyard
- (UILT) Other light industrial
- (UIHV) Other heavy industrial

(US) Institutional

- (USED) Educational
- (USMD) Medical
- (USRL) Religious
- (USMF) Military
- (USCF) Correctional
- (USGF) Governmental (other than military or correctional)
- (USSS) Social services (Elks, Moose, Eagles)

(UT) Transportation

- (UTAP) Airports
- (UTAG) Small grass airports
- (UTRR) Railroad yards and terminals
- (UTPF) Port facilities
- (UTEP) Electrical power facilities
- (UTTL) Major transmission lines
- (UTHW) Major highway and rights-of-way
- (UTWS) Water supply plants
- (UTSP) Sewerage treatment plants
- (UTSW) Solid waste disposal

TABLE C-1. SFWMD Land Use and Land Cover Classification Code (Continued)

(UTRS) Antenna arrays
(UTOG) Oil and gas storage

(UO) Open and others

(UORC) Recreational facilities
(UOGC) Golf courses
(UOPK) Parks
(UOCM) Cemeteries
(UORV) Recreational vehicle parks
(UOUD) Open under development
(UOUN) Open and undeveloped within urban area

(A) Agriculture

(AC) Cropland

(ACSC) Sugar cane
(ACTC) Truck crops
(ACRF) Rice fields

(AP) Pasture

(APIM) Improved pasture
(APUN) Unimproved pasture

(AM) Groves, Ornamentals, Nurseries, Tropical fruits

(AMCT) Citrus
(AMTF) Tropical fruits
(AMSF) Sod farms
(AMOR) Ornamentals

(AF) Confined feeding operations

(AFFL) Cattle feed lots
(AFDF) Dairy farms
(AFFF) Fish farms
(AFHT) Horse training and stables
(AFPY) Poultry

(R) Rangeland

(RG) Grassland

(RS) Scrub and brushland

(RSPP) Palmetto prairies
(RSSB) Brushland

(F) Forested uplands

TABLE C-1. SFWMD Land Use and Land Cover Classification Code (Continued)

(FE) Coniferous

- (FEPF) Pine flatwoods
- (FESP) Sand pine scrub
- (FECF) Commercial forest (pine)

(FO) Non-coniferous

- (FOAP) Australian pine
- (FOBP) Brazilian pepper
- (FOPA) Palms
- (FOSO) Scrub oak
- (FOOK) Oak
- (FOCF) Commercial forest

(FM) Mixed forested

- (FMTW) Temperate hardwoods
- (FMCM) Cabbage palms/Melaleuca
- (FMCO) Cabbage palms/Oaks
- (FMPM) Pine/Melaleuca
- (FMPO) Pine/Oak
- (FMTH) Tropical hammocks
- (FMOF) Old fields forested
- (FMCD) Coastal dunes
- (FMPC) Pine/Cabbage palms

(W) Wetlands

(WF) Forested fresh

- (WFCM) Cypress/Melaleuca
- (WFCY) Cypress
- (WFWL) Willow
- (WFME) Melaleuca
- (WFSB) Scrub and brushland
- (WFMX) Mixed forested

(WN) Non-forested fresh

- (WNSG) Sawgrass
- (WNCT) Cattail
- (WNBR) Bullrush
- (WNWC) Wire cordgrass
- (WNAG) Mixed aquatic grass
- (WNWL) Sloughs

(WS) Forested salt

- (WSRM) Red mangrove
- (WSBW) Black and White mangrove

(WM) Non-forested salt

TABLE C-1. SFWMD Land Use and Land Cover Classification Code (Continued)

(**WX**) Mixed forested and non-forested fresh

- (**WXPP**) Pine and wet prairies
- (**WXCP**) Cypress domes and wet prairies
- (**WXHM**) Hardwood marsh

(H) Water

(B) Barren land

- (**BB**) Beaches
- (**BP**) Extractive
  (strip mines, quarries, and
  gravel pits)
- (**BS**) Spoil areas
- (**BL**) Levees

* Documentation of major codes from "LAND USE, COVER AND FORMS CLASSIFICATION SYSTEM, A TECHNICAL MANUAL", Department of Transportation, State Topographic Office Remote Sensing Center, Kuyper, Becker and Shopmyer, February 1981

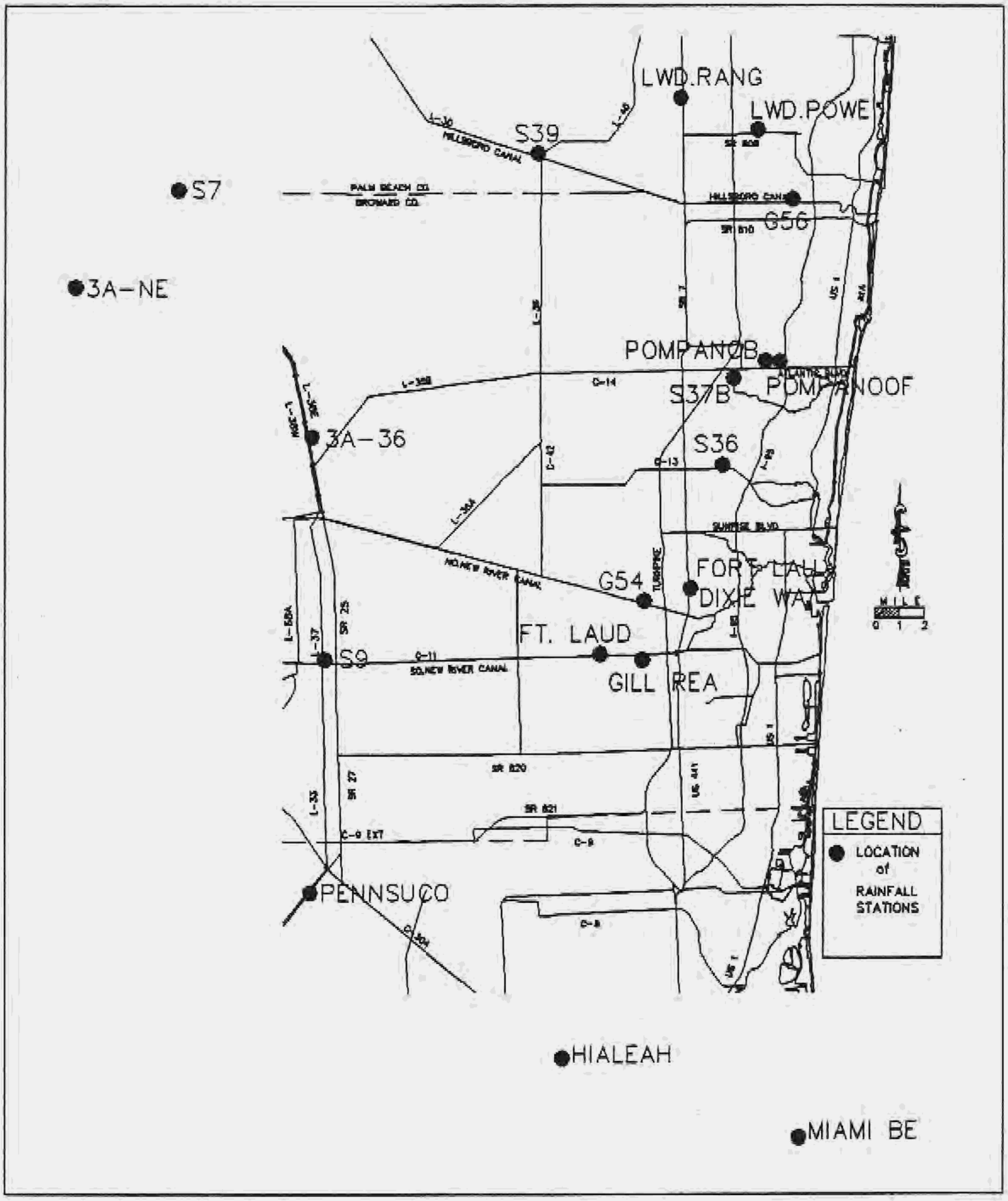

FIGURE C-2. Location of Rainfall Stations Used in Recharge Package

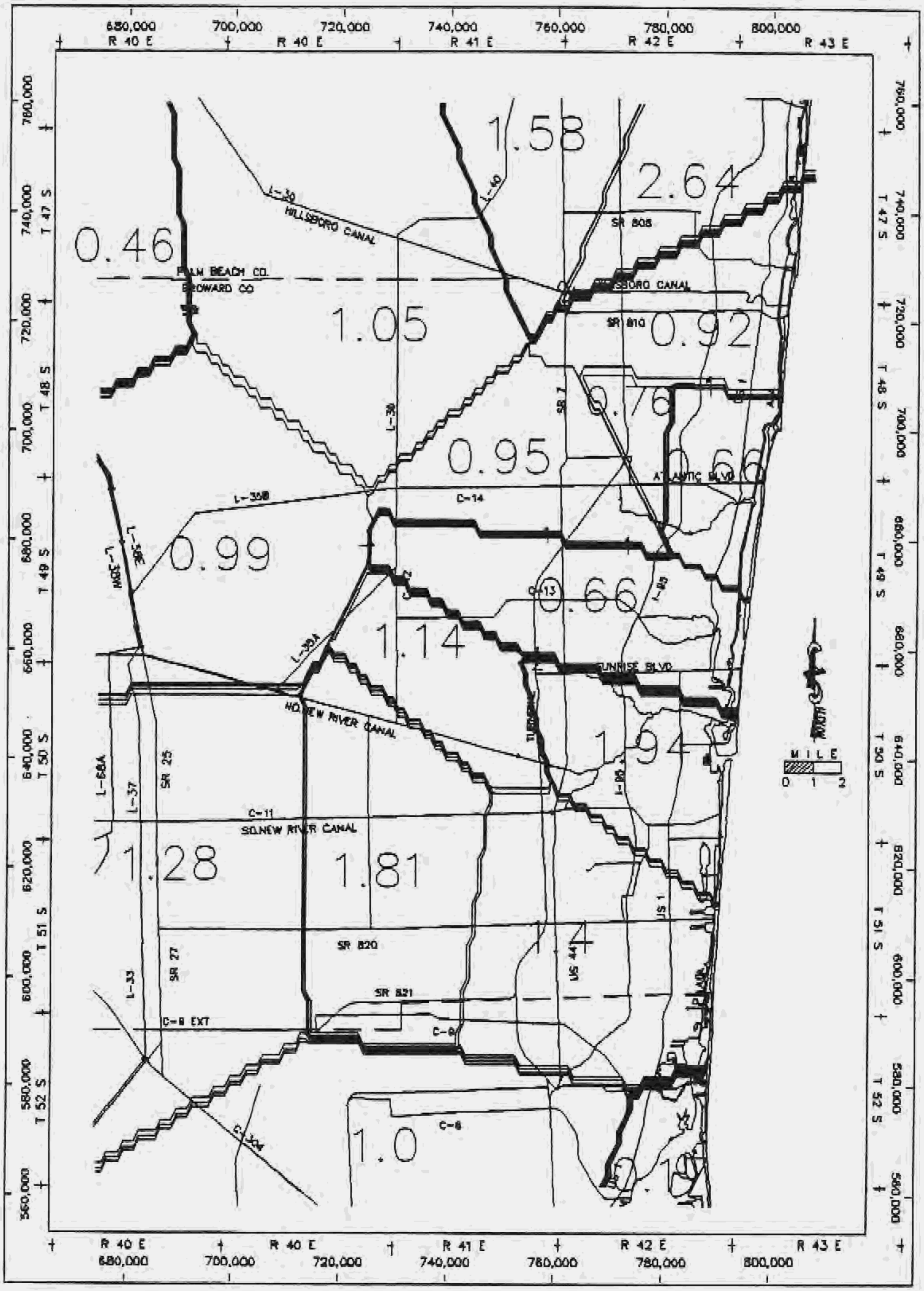

FIGURE C-3. Total Precipitation (inches) in Study Area, January 1989

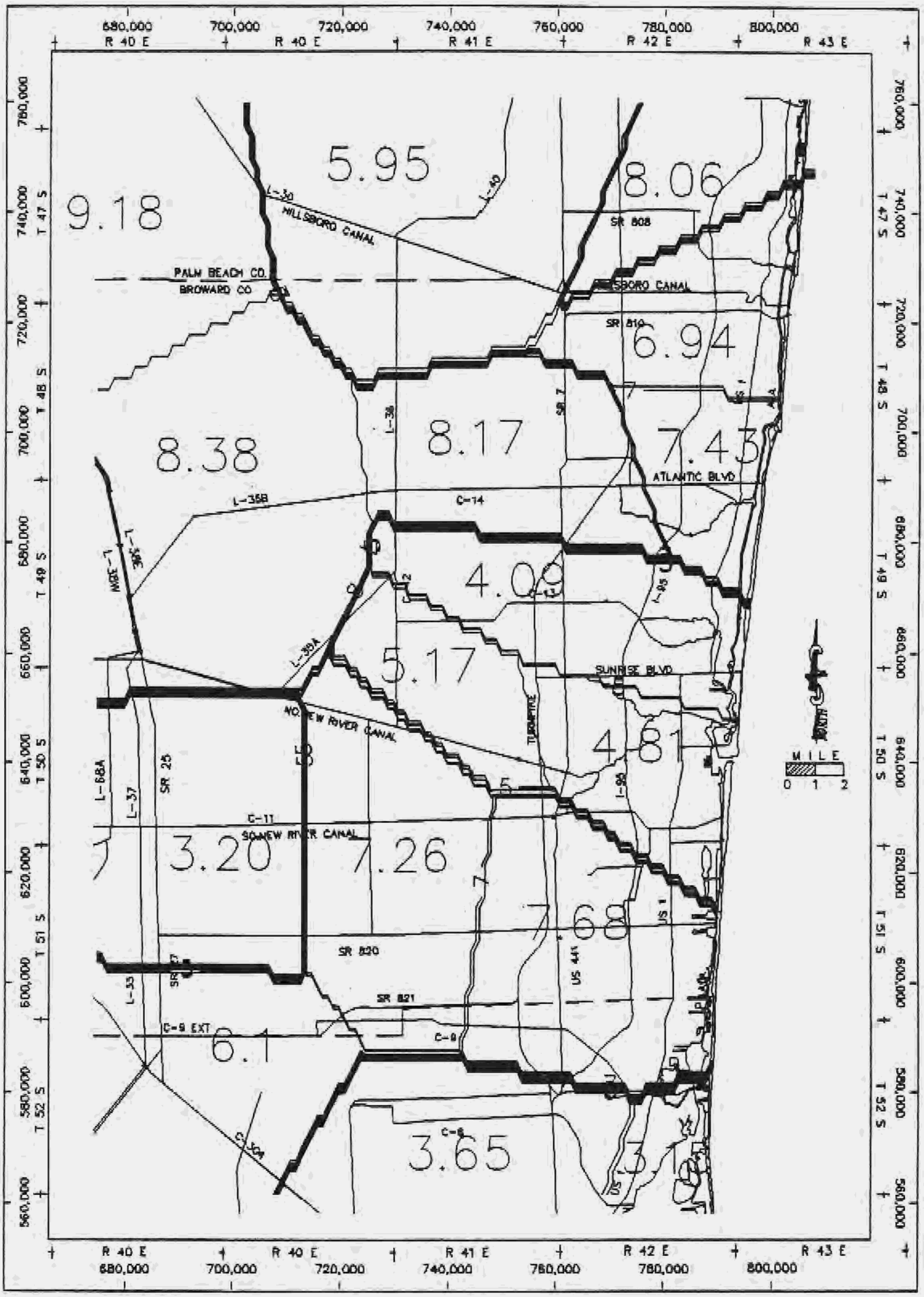

FIGURE C-4. **Total Precipitation (inches) in Study Area, July 1989**

TABLE C-2. **Coefficients Used in Recharge Preprocessing**

Land Use	Ki	Ks	Ka
U	.75	.10	.10
UR	.70	.10	.10
URSL	.80	.10	.10
URSM	.75	.10	.10
URSH	.70	.10	.10
URMF	.65	.10	.10
URMH	.60	.10	.10
UC	.50	.30	.10
UCPL	.50	.30	.10
UCSC	.50	.30	.10
UCSS	.50	.30	.10
UCCE	.60	.20	.10
UCMC	.50	.20	.10
UCHM	.50	.20	.10
UI	.50	.30	.10
UIJK	.50	.30	.10
UILT	.50	.20	.10
UIHV	.50	.30	.10
US	.50	.20	.10
USED	.60	.20	.10
USMD	.50	.30	.10
USRL	.50	.20	.10
USMF	.50	.20	.10
USCF	.50	.20	.10
USGF	.50	.20	.10
USSS	.50	.20	.10
UT	.60	.20	.10
UTAP	.60	.20	.10
UTAG	.70	.10	.10

Land Use	Ki	Ks	Ka
AMOR	.70	.10	.10
AF	.90	.10	.10
AFFL	.90	.10	.10
AFDF	.90	.10	.10
AFFF	.90	.10	.10
AFHT	.90	.10	.10
AFPY	.90	.10	.10
R	.75	.10	.10
RG	1.00	.10	.10
RS	.80	.10	.10
RSPP	.75	.10	.10
RSSB	.80	.10	.10
F	.85	.10	.10
FE	.85	.10	.10
FEPF	.85	.10	.10
FESP	.85	.10	.10
FECP	.85	.10	.10
FO	.85	.10	.10
FOAP	.85	.10	.10
FOBP	.85	.10	.10
FOPA	.85	.10	.10
FOSO	.85	.10	.10
FOOK	.85	.10	.10
FOCF	.85	.10	.10
FM	.85	.10	.10
FMTW	.85	.10	.10
FMCM	.85	.10	.10
FMCO	.85	.10	.10
FMPM	.85	.10	.10

TABLE C-2. Coefficients Used in Recharge Preprocessing (Continued)

Land Use	Ki	Ks	Ka
UTRR	.60	.10	.10
UTPF	.60	.20	.10
UTEP	.60	.10	.10
UTTL	.60	.10	.10
UTHW	.60	.10	.10
UTWS	.60	.10	.10
UTSP	.60	.20	.10
UTSW	.60	.10	.10
UTRS	.60	.10	.10
UTOG	.60	.20	.10
UO	.98	.10	.10
UORC	.90	.10	.10
UOGC	.75	.10	.10
UOPK	.90	.10	.10
UOCM	.90	.10	.10
UORV	.80	.20	.10
UOUD	.98	.10	.10
UOUN	.75	.10	.10
A	.80	.10	.10
AC	.95	.10	.10
ACSC	.83	.10	.10
ACTC	.95	.10	.10
ACRF	.86	.10	.10
AP	.83	.10	.10
APIM	.83	.10	.10
APUN	.83	.10	.10
AM	.85	.10	.10
AMCT	.85	.10	.10
AMTF	.85	.10	.10
AMSF	.90	.10	.10

Land Use	Ki	Ks	Ka
FMPO	.85	.10	.10
FMTH	.85	.10	.10
FMOF	.85	.10	.10
FMCD	.85	.10	.10
FMPC	.85	.10	.10
W	.90	.10	.10
WF	.85	.10	.10
WFCM	.85	.10	.10
WFCY	.85	.10	.10
WFWL	.85	.10	.10
WFME	.87	.10	.10
WFSB	.80	.10	.10
WFMX	.80	.10	.10
WN	.90	.10	.10
WNSG	.90	.10	.10
WNCT	.90	.10	.10
WNBR	.90	.10	.10
WNWC	.90	.10	.10
WNAG	.90	.10	.10
WNWL	.90	.10	.10
WS	.85	.10	.10
WSRM	.85	.10	.10
WSBW	.85	.10	.10
WM	.90	.10	.10
WX	.90	.10	.10
WXPP	.90	.10	.10
WXCP	.90	.10	.10
WXHM	.90	.10	.10
H	1.00	.10	.10

TABLE C-3. Crop Coefficients Used in ET Preprocessing

Land Use	Covered	Month											
	%	1	2	3	4	5	6	7	8	9	10	11	12
U	.50	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UR	.48	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
URSL	.67	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
URSM	.53	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
URSH	.45	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
URMF	.33	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
URMH	.40	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UC	.20	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UCPL	.25	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UCSC	.20	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UCSS	.20	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UCCE	.20	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UCMC	.20	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UCHM	.20	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UI	.20	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UIJK	.20	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UILT	.20	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UIHV	.05	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
US	.70	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
USED	.70	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
USMD	.60	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
USRL	.70	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
USMF	.60	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
USCF	.70	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
USGF	.70	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
USSS	.70	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UT	.50	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UTAP	.10	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80

TABLE C-3. Crop Coefficients Used in ET Preprocessing (Continued)

Land Use	Covered	Month											
	%	1	2	3	4	5	6	7	8	9	10	11	12
UTAG	.20	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UTRR	.50	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UTPF	.05	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UTEP	.50	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UTTL	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UTHW	.50	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UTWS	.50	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UTSP	.50	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UTSW	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UTRS	.50	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UTOG	.50	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UO	.90	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UORC	.90	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UOGC	.90	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UOPK	.90	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UOCM	.90	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UORV	.90	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UOUD	.90	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
UOUN	.90	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
AC	.90	.41	.44	.63	.67	.64	.69	.72	.71	.72	.86	.74	.64
ACSC	.90	.39	.30	.53	.61	.70	.79	.79	.84	.73	.88	.72	.69
ACTC	.85	.44	.71	.82	.78	.53	.49	.57	.44	.71	.82	.78	.53
ACRF	.90	.39	.30	.53	.61	.70	.79	.79	.84	.73	.88	.72	.69
AP	.90	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55
APIM	.90	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55
APUN	.90	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55
AM	.85	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55
AMCT	.85	.63	.66	.68	.70	.71	.71	.71	.71	.7	.68	.67	.64
AMTF	.85	.27	.42	.58	.70	.78	.81	.77	.71	.63	.54	.43	.3
AMSF	.90	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55

TABLE C-3. Crop Coefficients Used in ET Preprocessing (Continued)

Land Use	Covered	Month											
	%	1	2	3	4	5	6	7	8	9	10	11	12
AMOR	.85	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55
AF	.76	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55
AFFL	.75	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55
AFDF	.80	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55
AFFF	.75	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55
AFHT	.75	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55
AFPY	.75	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55
R	1.0	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55
RG	1.0	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55
RS	1.0	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55
RSPP	1.0	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55
RSSB	1.0	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55
F	.80	.61	.71	.91	1.06	1.13	1.15	1.15	1.14	1.08	.98	.84	.69
FE	.80	.61	.71	.91	1.06	1.13	1.15	1.15	1.14	1.08	.98	.84	.69
FEPF	.80	.61	.71	.91	1.06	1.13	1.15	1.15	1.14	1.08	.98	.84	.69
FESP	.80	.61	.71	.91	1.06	1.13	1.15	1.15	1.14	1.08	.98	.84	.69
FECF	.80	.61	.71	.91	1.06	1.13	1.15	1.15	1.14	1.08	.98	.84	.69
FO	.80	.61	.71	.91	1.06	1.13	1.15	1.15	1.14	1.08	.98	.84	.69
FOAP	.80	.61	.71	.91	1.06	1.13	1.15	1.15	1.14	1.08	.98	.84	.69
FOBP	.80	.61	.71	.91	1.06	1.13	1.15	1.15	1.14	1.08	.98	.84	.69
FOPA	.80	.61	.71	.91	1.06	1.13	1.15	1.15	1.14	1.08	.98	.84	.69
FOSO	.80	.61	.71	.91	1.06	1.13	1.15	1.15	1.14	1.08	.98	.84	.69
FOOK	.80	.61	.71	.91	1.06	1.13	1.15	1.15	1.14	1.08	.98	.84	.69
FOCF	.80	.61	.71	.91	1.06	1.13	1.15	1.15	1.14	1.08	.98	.84	.69
FM	.80	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55
FMTW	.80	.49	.57	.73	.87	.67	.92	.92	.91	.87	.79	.67	.55
FMCM	.80	.49	.57	.73	.87	.67	.92	.92	.91	.87	.79	.67	.55
FMCO	.80	.49	.57	.73	.87	.67	.92	.92	.91	.87	.79	.67	.55
FMPM	.80	.49	.57	.73	.87	.67	.92	.92	.91	.87	.79	.67	.55
FMPO	.80	.49	.57	.73	.87	.67	.92	.92	.91	.87	.79	.67	.55

TABLE C-3. Crop Coefficients Used in ET Preprocessing (Continued)

Land Use	Covered	Month											
	%	1	2	3	4	5	6	7	8	9	10	11	12
FMTH	.80	.49	.57	.73	.87	.67	.92	.92	.91	.87	.79	.67	.55
FMOF	.80	.49	.57	.73	.87	.67	.92	.92	.91	.87	.79	.67	.55
FMCD	.80	.49	.57	.73	.87	.67	.92	.92	.91	.87	.79	.67	.55
FMPC	.80	.49	.57	.73	.85	.67	.92	.92	.91	.87	.79	.67	.55
W	.80	.62	.71	.76	.97	1.05	1.11	1.09	1.04	.97	.89	.77	.64
WF	.80	.62	.71	.76	.97	1.05	1.11	1.09	1.04	.97	.89	.77	.64
WFCM	.80	.62	.71	.76	.97	1.05	1.11	1.09	1.04	.97	.89	.77	.64
WFCY	.80	.62	.71	.76	.97	1.05	1.11	1.09	1.04	.97	.89	.77	.64
WFWL	.80	.62	.71	.76	.97	1.05	1.11	1.09	1.04	.97	.89	.77	.64
WFME	.80	.73	.84	.99	1.14	1.24	1.30	1.28	1.22	1.14	1.05	.90	.75
WFSB	.80	.62	.71	.76	.97	1.05	1.11	1.09	1.04	.97	.89	.77	.64
WFMX	.80	.62	.71	.76	.97	1.05	1.11	1.09	1.04	.97	.89	.77	.64
WN	.80	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55
WNSG	.80	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55
WNCT	.80	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55
WNBR	.80	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55
WNWC	.80	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55
WNAG	.80	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55
WNWL	.80	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55
WS	.80	.62	.71	.76	.97	1.05	1.11	1.09	1.04	.97	.89	.77	.64
WSRM	.80	.62	.71	.76	.97	1.05	1.11	1.09	1.04	.97	.89	.77	.64
WSBW	.80	.62	.71	.76	.97	1.05	1.11	1.09	1.04	.97	.89	.77	.64
WM	.80	.62	.71	.76	.97	1.05	1.11	1.09	1.04	.97	.89	.77	.64
WX	.80	.62	.71	.76	.97	1.05	1.11	1.09	1.04	.97	.89	.77	.64
WXPP	.80	.62	.71	.76	.97	1.05	1.11	1.09	1.04	.97	.89	.77	.64
WXCP	.80	.62	.71	.76	.97	1.05	1.11	1.09	1.04	.97	.89	.77	.64
WXHM	.80	.62	.71	.76	.97	1.05	1.11	1.09	1.04	.97	.89	.77	.64
H	1.0	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55
B	1.0	.49	.57	.73	.85	.90	.92	.92	.91	.87	.79	.67	.55

TABLE C-4. Extinction Depths Used in ET Preprocessing

Land Use Code	Extinction Depth (feet)	Land Use Code	Extinction Depth (feet)	Land Use Code	Extinction Depth (feet)
U	1.0	UOGC	1.0	FOCF	2.0
UR	1.0	UOPK	1.25	FM	2.40
URSL	1.0	UOCM	1.0	FMTW	5.0
URSM	1.0	UORV	1.25	FMCM	1.5
URSH	1.0	UOUD	1.0	FMCO	1.5
URMF	1.0	UOUN	1.25	FMPM	2.0
URMH	1.0	A	1.4	FMPO	3.0
UC	1.0	AC	1.65	FMTH	1.5
UCPL	1.0	ACSC	3.0	FMOF	2.0
UCSC	1.0	ACTC	1.0	FMCD	3.0
UCSS	1.0	ACRF	1.0	FMPC	2.0
UCCE	1.0	AP	2.5	W	2.25
UCMC	1.0	APIM	2.5	WF	3.35
UCHM	1.0	APUN	2.5	WFCM	5.0
UI	1.0	AM	2.25	WFCY	6.0
UIJK	1.0	AMCT	3.0	WFWL	1.0
UILT	1.0	AMTF	3.0	WFME	1.5
UIHV	1.0	AMSF	1.25	WFSB	1.5
US	1.0	AMOR	1.5	WFMX	2.5
USED	1.0	AF	1.0	WN	1.5
USMD	1.0	AFFL	1.0	WNSG	2.5
USRL	1.0	AFDF	1.0	WNCT	2.5
USMF	1.0	AFFF	1.0	WNBR	1.0
USCF	1.0	AFHT	1.0	WNWC	1.0
USGF	1.0	AFPY	1.0	WNAG	1.0
USSS	1.0	R	2.0	WNWL	1.0
UT	1.0	RG	2.0	WS	3.0
UTAP	1.0	RS	2.0	WSRM	3.0
UTAG	1.0	RSPP	2.0	WSBW	3.0
UTRR	1.0	RSSB	2.0	WM	1.25
UTPF	1.0	F	2.30	WX	4.0
UTEP	1.0	FE	2.65	WXPP	2.5
UTTL	1.0	FEPF	2.0	WXCP	4.5
UTHW	1.0	FESP	5.0	WXHM	4.5
UTWS	1.0	FECP	1.0	H	6.0
UTSP	1.0	FO	2.0	B	.50
UTSW	1.0	FOAP	1.0		
UTRS	1.0	FOBP	1.0		
UTOG	1.0	FOPA	1.5		
UO	1.10	FOSO	1.5		
UORC	1.0	FOOK	5.0		

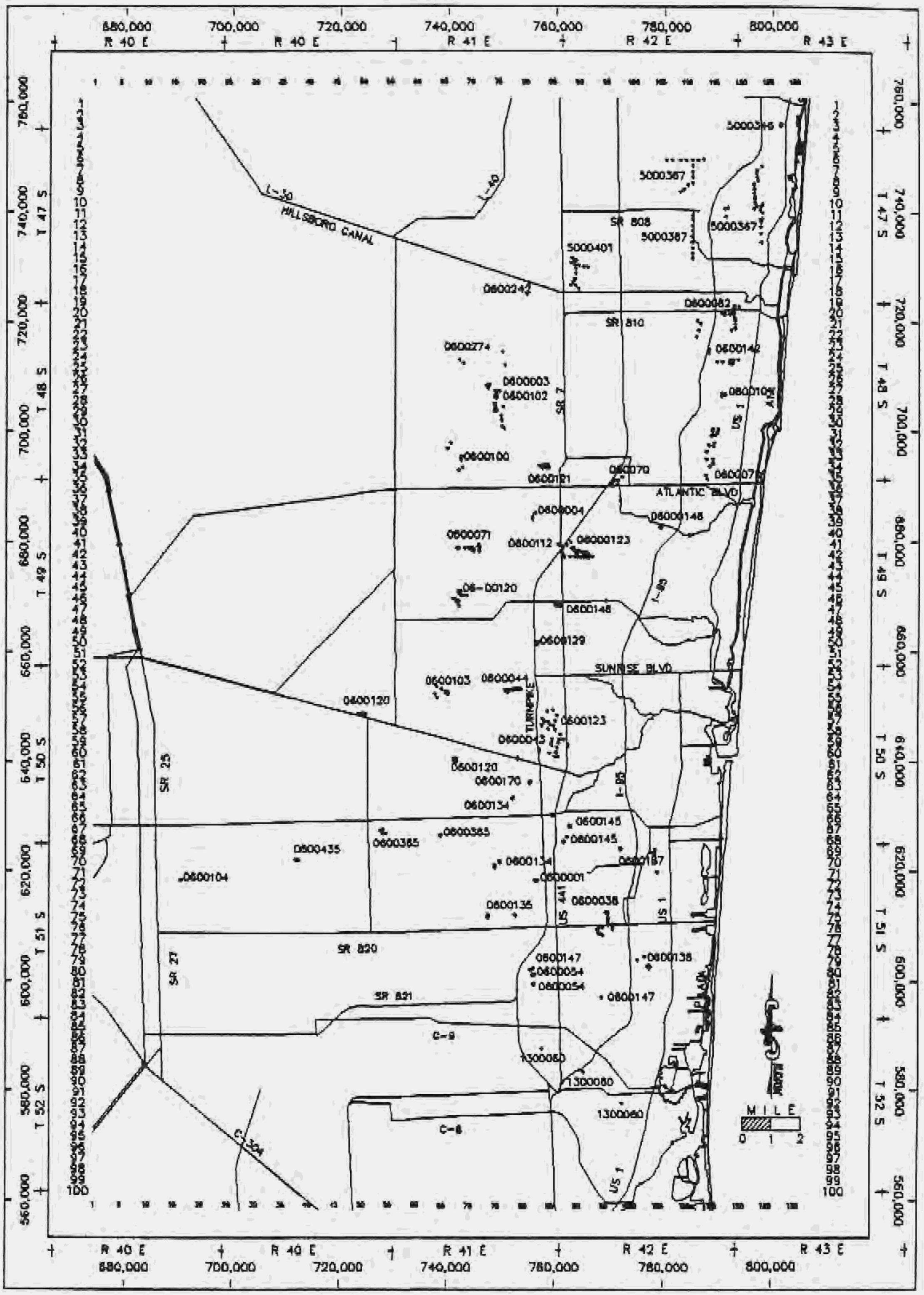

FIGURE C-5. Location of Public Water Supply Permits in Study Area

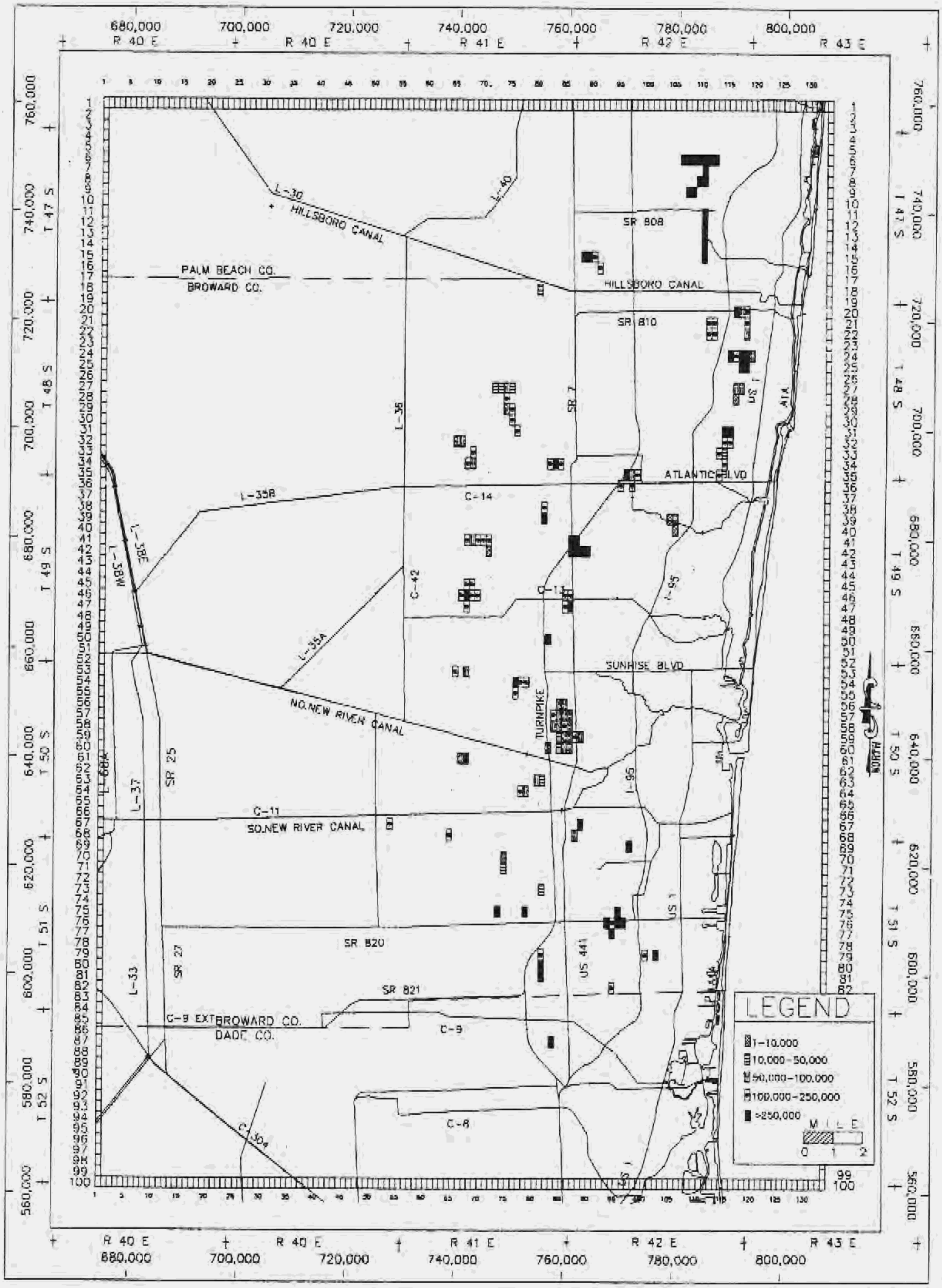

FIGURE C-6. **Location of Public Water Supply Wells and Pumping Rates (Cubic Ft/day)**

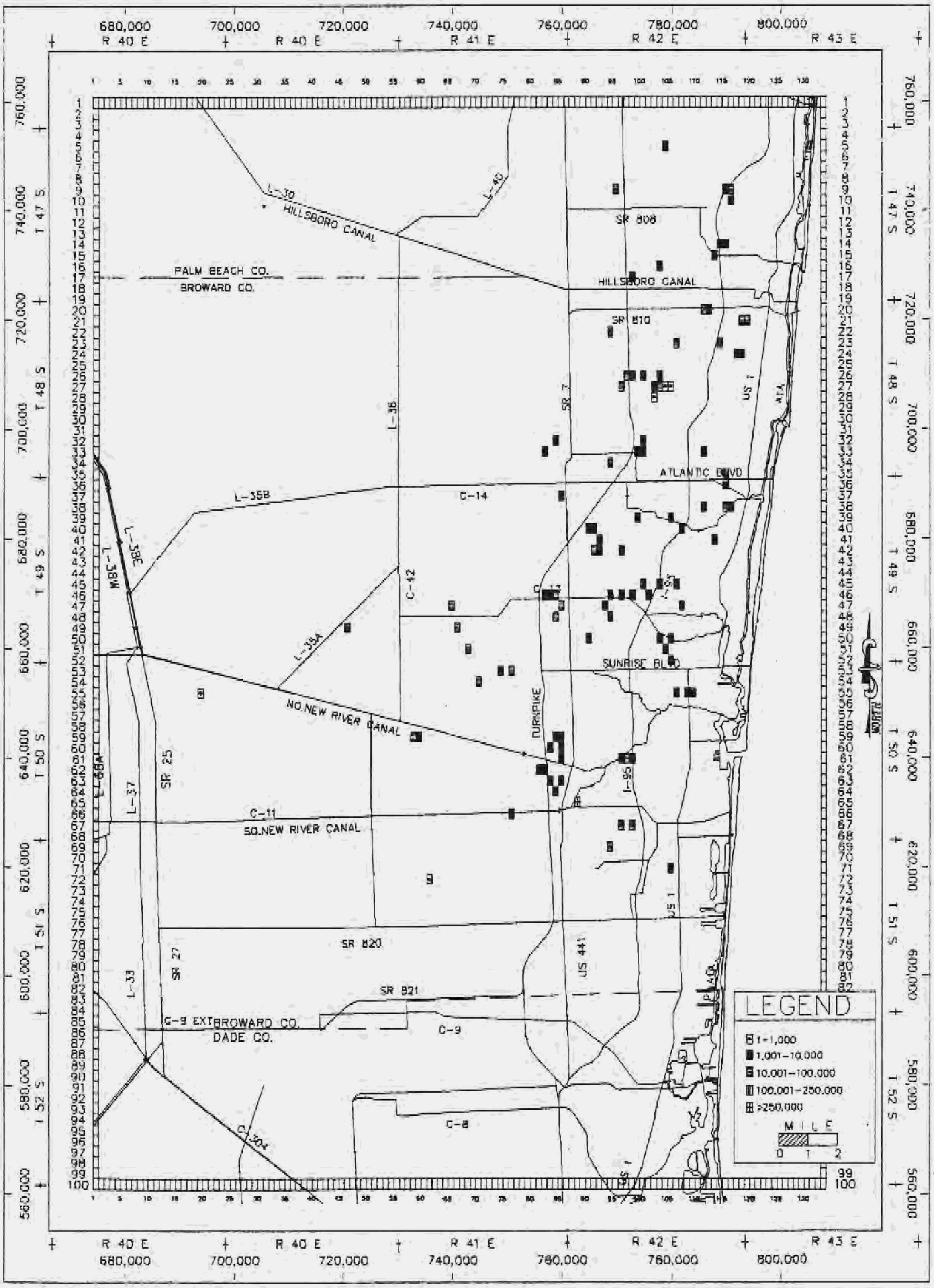

FIGURE C-7. **Location of Non-Public Water Supply Wells and Pumping Rates (Cubic Ft/day)**

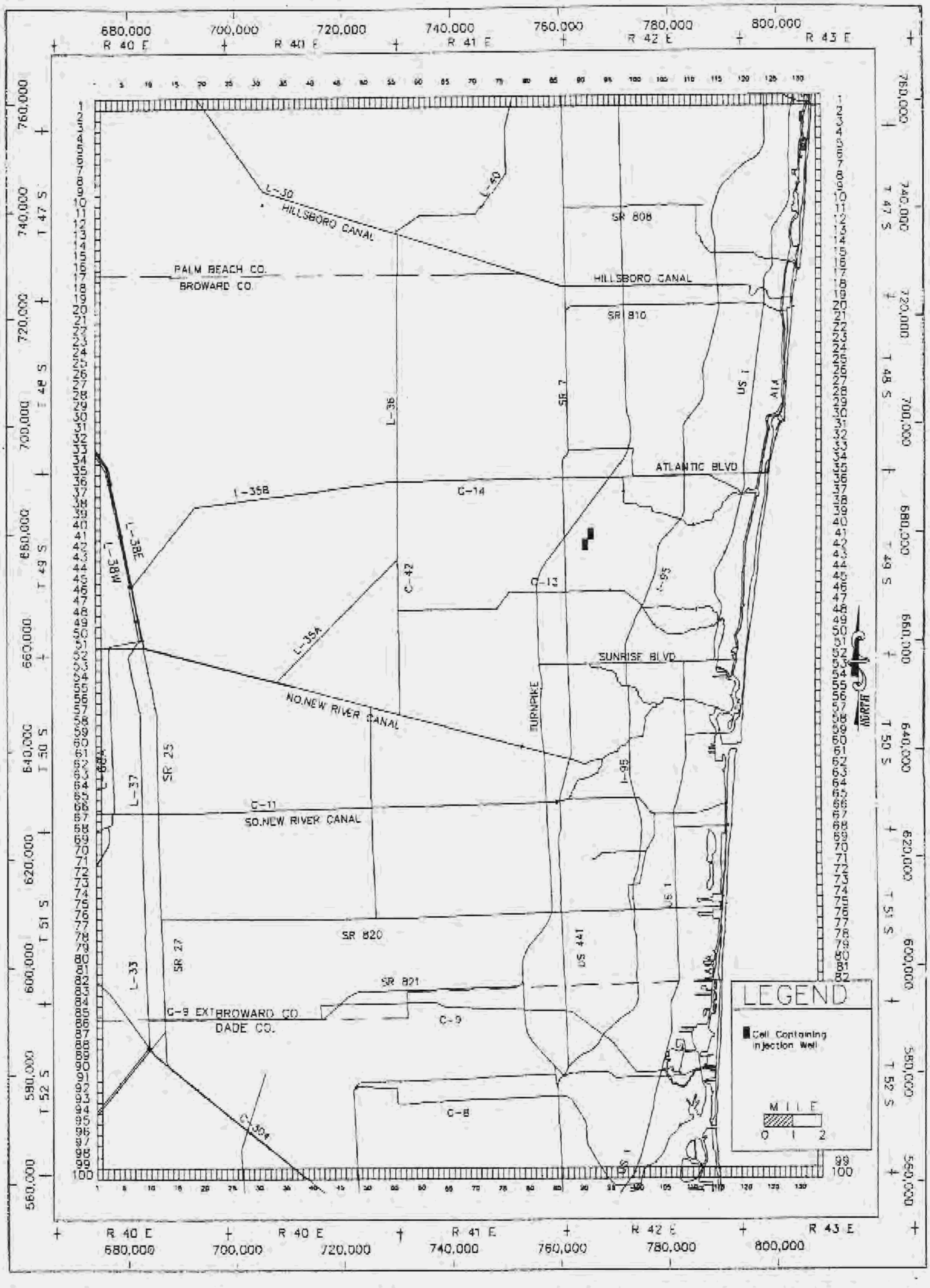

FIGURE C-8. Cells Containing Wells Injecting to the Surficial Aquifer System

TABLE C-5. Legend for Public and Non-Public Water Supply Spreadsheets

AN.ALL. = Annual Permitted Allocation
ALL.UNT. = Annual Allocation Units
- 01 = MGD
- 02 = MGM
- 03 = MGY
- 04 = AC-FT

MAX DAY = Maximum Daily Permitted Allocation
DAY UTS. = Daily Allocation Units

MAXMO = Maximum Monthly Permitted Allocation
- 01 = MGD
- 02 = MGM
- 03 = AC-FT

CO = County Code (from permit number)
DATE ISS = Date Permit Issued (mo/yr)
USE TYPE = AG,IND,GLF,PWS,COM,REC
SRC = Source (SW,GW, BOTH)
NO.WLS. = Number of ACTIVE permitted wells
SWPMPS = Number of Surface Water Pumps
AQ. = Aquifer
- 01 = Water Table
- 02 = Surficial (Semi-confined)
- 03 = Lower Tamiami
- 04 = Sandstone
- 05 = mid-Hawthorn
- 06 = lower Hawthorn
- 07 = Suwannee
- 08 = Floridan
- 09 = Biscayne

CROP TYPE = Blaney-Criddle Code
- 11 = Alfalfa
- 12 = Avacado
- 13 = Citrus
- 14 = Grapes
- 15 = Turf
- 16 = Suger Beet
- 20 = Pasture
- 51 = Dry Beans
- 52 = Green Beans
- 53 = Grain Corn
- 54 = Silage Corn
- 55 = Sweet Corn
- 56 = Melons
- 57 = Peas
- 58 = Potato
- 59 = Soybeans
- 60 = Tomato
- 61 = Small Vegetables
- 5 or 70 = Nursery

RAINST = Rain Station Code Number
- 1 = NAPLES
- 2 = FT. MYERS
- 3 = WEST PALM BEACH

TABLE C-5. Legend for Public and Non-Public Water Supply Spreadsheets (Continued)

4 = STUART
5 = FT. LAUDERDALE
6 = KISSIMMEE
7 = MELBOURNE
8 = ORLANDO
9 = TITUSVILLE
10 = FELLSMERE
11 = FT. PIERCE
12 = OKEECHOBEE
13 = AVON PARK
14 = MOORE HAVEN
15 = LABELLE
16 = BELLE GLADE
17 = LOXAHATCHEE
18 = JUPITER
21 = TAMIAMI 4
22 = HOMESTEAD
23 = POMPANO BEACH
24 = INDIANTOWN
25 = HYPOLUXO
26 = BIG CYPRESS
27 = EVERGLADES
28 = HIALEAH
29 = LAKE PLACID
30 = MERRIT ISLAND
31 = VERO BEACH

IRR ACRES = Number of irrigated acres
IRR EFF = Irrigation system efficiency
STS = Status

01 = Existing
02 = Proposed
03 = Stand By/Backup
04 = To Be Plugged

DPTH CODE = Datum for Elevations

01 = NGVD
02 = Land Surface

PMPINT = Depth to Pump Intake (Wells Only)
PUMP TYPE

01 = Centrifical (suction)
02 = Lift (turbine, jet, submersible)
03 = Unknown

PUMP CAP. = Capacity in GPM (SW & GW Facilities)

01 = Unknown

MTR? = Is use Metered by Volume or Power Consumption and Reported to the District?

Y = Yes
N = No

YPLNR = North Planar Coordinate
XPLNR = East Planar Coordinate

TABLE C-6. Public Water Supply Spreadsheet

```
BROWARD COUNTY PUBLIC WATER SUPPLY PERMITS
=====================================
THROUGH 10/89

==================================================================================================================
LINE 1 HEADINGS
==================================================================================================================
PERMIT   AN.           ALL.  MAX   DAY     DATE  USE SRC.NO.   SW
NO.      ALL.          UNT.  DAY   UTS. CO ISS.  TYPE    WLS.  PMPS   OWNER                             CO  PERMIT NO.SAID LAD  HAD   LMMD  HMMD AQ
==================================================================================================================

LINE 2 HEADINGS
==================================================================================================================
PERMIT   FACILITY           WELL    DPTH              PMP PUMP PUMP
NO.      NUMBER         STS DIA.    CODE   TD   CD   INT TYPE CAP. MTR?  XPLNR   YPLNR     COMMENTS
==================================================================================================================
==================================================================================================================

0600001         173.74 03     0.81 01   06  2/89  PWS GW       3     SEMINOLE TRIBE OF FLORIDA       06  06-00001-W                         09
         0600001-16    01    12.00 02  105     96   30 02    1100 N    756751   618409 THIS PROJECT IS NOT A PERMIT ; BUT RATHER A WORK PLAN.
         0600001-17    03    12.00 02   72     58   30 02    1200 N    756289   618339 THE PLAN WAS SIGNED BY DISTRICT STAFF IN FEBRUARY 1989.
         0600001-19    01    12.00 02   72     58   30 02     800 N    756079   618351 THE PWS PROJECTIONS ARE FOR THE YEAR 1998.
                                                                                     FACILITIES 1 THROUGH 15 ARE IRRIGATION FACILITIES AT THE
                                                                                     HOLLYWOOD RESERVATION.  WELL 17 IS USED FOR STANDBY
                                                                                     AND WELL 18 IS A MONITORING WELL.  THIS DISCUSSION ONLY
                                                                                     COVERS THE WELLS AT THE HOLLYWOOD RESERVATION.

0600003         157.00 03     0.73 01   06  2/85  PWS GW       3     ROYAL UTILITIES COMPANY         06  06-00003-W                         09
         0600003-1     01     8.00 02  140    127      02    1350 Y    747602   708623 PERMIT # 06-00003-W WAS ORIGINALLY ISSUED TO UNIVERSITY
         0600003-2     01    12.00 02  165    140      02    1350 Y    747130   708326 UTILITIES ON SEPTEMBER 13, 1974.  IT WAS TRANSFERRED TO
         0600003-3     01    12.00 02  138    132      02    1350 Y    747375   707978 ROYAL UTILITIES IN SEPTEMBER 1988.

0600004        1600.00 03     7.00 01   06  2/84  PWS GW       3     CITY OF NORTH LAUDERDALE        06  06-00004-W                         09
         0600004-1     01    24.00 02  129    106      02    2500 Y    756069   685379 THE ORIGINAL PERMIT WAS ISSUED TO THE CITY IN SEPTEMBER 1974.
         0600004-2     01    24.00 02  128    105      02    2500 Y    755546   684744 THE PERMIT WAS REISSUED IN MAY 1979 AND FEBRUARY 1984.
         0600004-3     01    24.00 02  128    103      02    2500 Y    755553   684259 A RENEWAL APPLICATION IN HOUSE.

0600038        8202.00 03    27.45 01   06  6/89  PWS GW      28     CITY OF HOLLYWOOD               06  06-00038-W                         09
         0600038-1     01    12.00 02   67     55      01     700 N    769751   610284
         0600038-2     01    12.00 02   65     53      02    1000 N    769771   610504 IN ACCORDANCE WITH THE LIMITING CONDITIONS OF THE PERMIT,
         0600038-3     01    12.00 02   65     53      02    1000 N    769776   610645 THE CITY IS ATTEMPTING TO SHIFT ITS PUMPAGE TO THE WEST IN
         0600038-4     01    12.00 02   70     53      02    1000 N    769713   610736 ORDER TO REDUCE THE POTENTIAL FOR SALINE WATER INTRUSION.
         0600038-5     01    12.00 02   70     53      02    1000 N    769786   610852 LIMITING CONDITION 26 REQUIRES THAT WELLS 16 AND 17 BE
         0600038-6     01    12.00 02   65     52      02    1000 N    769770   611111 PLACED ON STANDBY ONCE WELLS 28 AND 29 ARE IN SERVICE.
         0600038-7     01    12.00 02   68     52      01    1000 N    769781   611245 LIMITING  CONDITION 27 REQUIRES THE CITY SUBMIT THE WELL
         0600038-8     01    12.00 02  125    110      01    1000 N    769761   611340 DESCRIPTIONS WITHIN 30 DAYS OF COMPLETION.
         0600038-9     01    12.00 02   67     54      01    1000 N    769750   611432
         0600038-10    01    12.00 02   65     52      01    1000 N    769710   610395
         0600038-12    01    10.00 02  152    128      01     900 N    770655   610089
         0600038-13    01    10.00 02  143    121      01     900 N    770656   609775
```

TABLE C-6. Public Water Supply Spreadsheet (Continued)

	0600038-14	01	10.00	02	152	143		01	900 N	770667	609427		
	0600038-15	01	10.00	02	120	111		01	1000 N	770683	610473		
	0600038-16	01	14.00	02	123	70		02	1200 N	770521	610334		
	0600038-17	01	14.00	02	118	58		02	1200 N	769703	612480		
	0600038-18	01	14.00	02	70	58		02	1200 N	769697	612208		
	0600038-19	01	14.00	02	69	65		02	1200 N	769746	611727		
	0600038-20	01	14.00	02	65	60		02	2300 N	769754	611593		
	0600038-21	01	14.00	02	65	60		02	2300 N	769316	612564		
	0600038-22	01	20.00	02	75	70		02	2400 N	769514	612668		
	0600038-23	01	20.00	02	138	110		02	2400 N	767983	609596		
	0600038-24	01	20.00	02	70	59		02	2400 N	768779	609905		
	0600038-25	01	20.00	02	85	66		02	2400 N	768466	608714		
	0600038-26	01	20.00	02	80	59		02	2400 N	767703	609452		
	0600038-27	01	20.00	02	80	62		02	2400 N	768673	608448		
	0600038-28	02								767970	608770		
	0600038-29	02											
0600043	278.80	03	0.99	01	06	4/86	PWS	GW	3	BROADVIEW PARK WATER COMPANY	06	06-00043-W	09
	0600043-1	01	10.00	02	94	84		02	450 N	757043	642618	BROADVIEW RECEIVED ITS ORIGINAL PERMIT IN JULY, 1975.	
	0600043-2	01	10.00	02	108	98		02	450 N	757011	641994	THE PERMIT WAS REISSUED AGAIN IN APRIL 1986 AND WILL EXPIRE	
	0600043-3	01	12.00	02	120	107		02	650 N	757003	642384	IN APRIL 1991.	
0600044	3100.00	03	13.94	01	06	8/75	PWS	GW	13	CITY OF PLANTATION	06	06-00044-W	09
	0600044-1	01	8.00	02					858	751214	652760	THE CITY RECEIVED IT ORIGINAL PERMIT ON AUGUST 15, 1975.	
	0600044-2	01	8.00	02					850	750587	653256	THE PERMIT WILL EXPIRE NON AUGUST 15, 1995.	
	0600044-3	01	8.00	02	58	50			850	751177	653279	ON OCTOBER 11, 1989, MR. ENTUS INDICATED THAT 11 WELLS WERE	
	0600044-4	01	8.00	02	90	86			935	750942	652743	CONSTRUCTED.	
	0600044-5	01	12.00	02	74	68			960	751810	653281		
	0600044-6	01	8.00	02	95	86			706	750913	653104		
	0600044-7	01	8.00	02	85	75			816	751198	652998		
	0600044-8	01	12.00	02	74	70			960	752093	653297		
	0600044-9	01	12.00	02	75				960	752393	653299		
	0600044-10	01	12.00	02	75				960	752663	653324		
	0600044-11	01	12.00	02	75				960	752860	653332		
	0600044-12	02	12.00	02	75				960	753165	653383		
	0600044-13	02	12.00	02	75				960	753457	653340		
0600054	1241.00	03	5.30	01	06	6/86	PWS	GW	9	CITY OF MIRAMAR	06	06-00054-W	09
	0600054-1	01	8.00	02	110	100		02	550 N	756217	601389	THE CITY RECEIVED ITS ORIGINAL PERMIT IN SEPTEMBER 1975. THE	
	0600054-2	01	6.00	02	110	100		02	400 N	755947	601135	PERMIT WAS REISSUED IN 1984 AND AGAIN IN 1986. THE PERMIT	
	0600054-3	01	8.00	02	110	100		02	550 N	755682	601078	EXPIRED IN JUNE 1988. THE APPLICANT HAS A RENEWAL APPLICATION	
	0600054-4	01	8.00	02	110	100		02	500 N	755789	601164	IN HOUSE.	
	0600054-5	01	10.00	02	120	110		02	500 N	756126	601277		
	0600054-6	01	12.00	02	110	100		02	1100 N	755961	599625		
	0600054-7	01	12.00	02	110	100		02	1100 N	756042	599341		
	0600054-8	01	8.00	02	110	100		02	800 N	755911	599327		
	0600054-9	01	8.00	02	110	100		02	450 N	756147	599659		
0600070	7612.00	03	25.50	01	06	5/87	PWS	GW	22	CITY OF POMPANO BEACH	06	06-00070-W	09
	0600070-1	04								788053	691575		
	0600070-2	02	16.00	02	136			02	1500 N	787808	692317	WELLS 1 THROUGH 16 ARE LOCATED AT THE AIRPORT WELLFIELD.	
	0600070-3	01	16.00	02	107			02	1500 N	788415	693873	WELL ONE IS ABANDONED. DUE TO SALINE WATER INTRUSION PROBLEMS,	

TABLE C-6. Public Water Supply Spreadsheet (Continued)

	0600070-4	01	16.00	02	140			02	1800	N	789099	694418	WELLS 2 AND 8 ARE USED ONLY WHEN NECESSARY.	
	0600070-5	01	16.00	02	108	97		02	1500	N	789041	695138	WELLS 17 TO 22 ARE LOCATED AT THE PALM AIRE WELLFIELD.	
	0600070-6	01	14.00	02	156	100		02	2200	N	787883	695229	DUE TO POTENTIAL IMPACTS ON THE GOLF COURSE, THE PALM AIRE	
	0600070-7	01	16.00	02	90	90		02	1500	N	787944	696496	WAS LIMITED TO 6 MGD. THE CITY HAS AN APPLICATION	
	0600070-8	02	16.00	02	90	90		02	1500	N	789248	697522	IN HOUSE IN ORDER TO INCREASE THE ALLOCATION.	
	0600070-9	01	16.00	02	131	97		02	1500	N	788318	697725		
	0600070-10	01	16.00	02	113	93		02	1800	N	789281	698133		
	0600070-11	01	16.00	02	127	88		02	1500	N	788774	699453		
	0600070-12	01	16.00	02	123	90		02	1500	N	789532	699557		
	0600070-13	01	16.00	02	115	115		02	1800	N	789964	700082		
	0600070-14	01	16.00	02	114	114		02	1500	N	788961	700263		
	0600070-15	01	18.00	02	140	115		02	2000	N	789057	700646		
	0600070-16	01	18.00	02	130	113		02	2000	N	790021	700569		
	0600070-17	01	16.00	02	150	76		02	2400	N	770085	690516		
	0600070-18	01	16.00	02	130	72		02	2400	N	770383	690944		
	0600070-19	01	16.00	02	158	78		02	2100	N	770719	691468		
	0600070-20	01	16.00	02	154	80		02	2100	N	771377	690705		
	0600070-21	01	16.00	02	153	80		02	1600	N	771531	691381		
	0600070-22	01	16.00	02	153	79		02	2100	N	772252	691959		
0600071	2700.00	03	10.40	01	06	1/87	PWS	GW	19		CITY OF TAMARAC		06 06-00071-W	09
	0600071-1	01	12.00	02	126	112		02	550	N	744764	678886	TAMARAC WAS ISSUED A PERMIT IN 1976 WITH AN ANNUAL ALLOCATION	
	0600071-2	01	12.00	02	111	101		02	550	N	743859	678904	OF 3831 MGY.	
	0600071-3	01	12.00	02	115	109		02	700	N	744354	678910	THE PERMIT WAS REISSUED IN 1986 FOR AN ANNUAL ALLOCATION	
	0600071-4	01	12.00	02	110	101		02	550	N	743065	679035	OF 2510 MGY.	
	0600071-5	01	12.00	02	117	102		02	500	N	742065	679034	WELLS 1 THROUGH 9 WERE IN EXISTENCE WHEN THE PERMIT WAS ISSUED	
	0600071-6	01	12.00	02	109	102		02	225	N	741610	679030	IN 1976. THE OTHER WELLS WERE ADDED LATER.	
	0600071-7	01	12.00	02	125	111		02	425	N	744539	679036	THE WITHDRAWAL CAPACITIES OF WELLS 1 THROUGH 9 HAS DECLINED	
	0600071-8	01	12.00	02	123	105		02	525	N	744102	678894	THROUGH OUT THE YEARS.	
	0600071-9	01	12.00	02	115	108		02	425	N	743888	679129		
	0600071-10	01	12.00	02	145	106		02	660	N	745850	678256		
	0600071-11	01	12.00	02	145	108		02	675	N	745831	678577		
	0600071-12	01	12.00	02	160	112		02	600	N	745879	678977		
	0600071-13	01	12.00	02	160	111		02	650	N	745895	679219		
	0600071-14	02	12.00	02	160	111		02	800	N	745781	679276		
	0600071-15	02	12.00	02	160	111		02	800	N	745601	679298		
	0600071-16	02	12.00	02	160	111		02	800	N	745728	679506		
	0600071-17	02	12.00	02	160	111		02	800	N	745741	679745		
	0600071-18	02	12.00	02	160	111		02	800	N	744793	678649		
	0600071-19	02	12.00	02	160	111		02	800	N	744787	678387		
0600082	4270.00	03	19.00	01	06	5/85	PWS	GW	20		CITY OF DEERFIELD		06 06-00082-W	09
	0600082-1	04	8.00	02	92		40	02		N	792883	722667	WELL # 1 HAS BEEN CAPPED AND ABANDONED.	
	0600082-2	03	12.00	02	96		40	02	700	N	793056	722647	WELLS # 2, 3, AND 9 ARE USED ONLY TO MEET PEEK DEMANDS.	
	0600082-3	03	12.00	02	110		40	02	700	N	793869	723015	WELLS # 17 THROUGH 20 ARE I THE WESTERN WELLFIELD.	
	0600082-4	01	12.00	02	112		40	02	700	N	792087	721518	DUE TO POLLUTION PROBLEMS, THE WESTERN WELLFIELD WAS	
	0600082-5	01	12.00	02	100		40	02	1000	N	791198	721508	USED SPARINGLY IN THE PAST.	
	0600082-6	01	12.00	02	87	66	40	02	700	N	791140	721821		
	0600082-7	01	12.00	02	100	67	40	02	700	N	791022	721452		
	0600082-8	01	12.00	02	100	64	40	02	700	N	790602	721729		
	0600082-9	03	12.00	02	100		40	02	700	Y	793062	723182		
	0600082-10	01	14.00	02	90	60	40	02	700	N	792911	722007		

TABLE C-6. Public Water Supply Spreadsheet (Continued)

	0600082-11	01	14.00	02	85	60	40	02	700	N	792777	721556				
	0600082-12	01	14.00	02	83	60	40	02	700	N	793074	720876				
	0600082-13	01	14.00	02	85	60	40	02	700	N	793091	720360				
	0600082-14	01	14.00	02	96	60	40	02	700	N	793100	719711				
	0600082-15	01	14.00	02	96	60	40	02	700	N	793104	718986				
	0600082-16	01	14.00	02	96	60	40	02	700	N	792485	718651				
	0600082-17	01	14.00	02	180	60	46	02	2800	Y	786737	719849				
	0600082-18	01	14.00	02	180	60	46	02	2800	Y	785966	717474				
	0600082-19	01	20.00	02	101	75		02	2800	N	786355	718623				
	0600082-20	01	20.00	02	103	80		02	2800	N	786124	720426				
0600100	1300.00	03	5.59	01	06	9/87	PWS	GW	7		CSID			06	06-00100-W	09
	0600100-1	01	8.00	02	105	60	30	02	700	Y	742401	694954	PERMIT 06-00100-W WAS ORIGINALLY ISSUED ON MARCH 10, 1987.			
	0600100-2	01	8.00	02	105	60	30	02	700	Y	742429	695262	WELLS 6 AND 7 WERE COMPLETED IN AUGUST 1988.			
	0600100-3	01	8.00	02	105	60	30	02	700	Y	742395	695571	WELLS 1 THROUGH 5 WERE INSTALLED PRIOR TO 1980.			
	0600100-4	01	8.00	02	120	60	25	02	800	Y	742727	693614	THE X AND Y COORDINATES WERE TAKEN FROM PERMIT FILE.			
	0600100-5	01	16.00	02	140	60	30	02	1700	Y	742005	693081				
	0600100-6	01	16.00	02	120	60	30	02	1200	Y	739918	696908				
	0600100-7	01	16.00	02	120	60	30	02	1200	Y	740491	697933				
0600101	409.00	03	1.90	01	06	11/81	PWS	GW	4		TOWN OF HILLSBORO BEACH			06	06-00101-W	09
	0600101-1	01	8.00	02	71	61			250	N	791441	706948	PERMIT 06-00101-W WAS ORIGINALLY ISSUED IN MARCH, 1977.			
	0600101-2	01	8.00	02	73	64			250	N	791142	706889	THE PERMIT WAS REISSUED IN 1980 AND IN 1981. THE PERMIT			
	0600101-3	01	12.00	02	104	90			1200	N	790796	707250	EXPIRED ON NOVEMBER 12, 1986. THE TOWN HAS A RENEWAL			
	060010104	01	12.00	02	138	128			1200	N	790618	706669	APPLICATION IN HOUSE.			
0600102	2120.00	03	9.55	01	06	10/87	PWS	GW	17		CITY OF CORAL SPRINGS			06	06-00102-W	
	0600102-1	01	10.00	02	134	81	69	02	226	Y	748852	706913				
	0600102-2	01	10.00	02	130	77	65	02	310	Y	748868	706782				
	0600102-3	01	12.00	02	165	53	41	02	385	Y	748856	706614				
	0600102-4	01	12.00	02	175	58	46	02	345	Y	748687	706551				
	0600102-5	01	16.00	02	155	67	55	02	300	Y	748866	706378				
	0600102-6	01	16.00	02	175	57	45	02	350	Y	748743	706172				
	0600102-7	01	16.00	02	175	58	46	02	430	Y	748720	707447				
	0600102-8	01	16.00	02	156	48	36	02	265	Y	749422	707462				
	0600102-9	01	16.00	02	150	77	65	02	495	Y	748608	705151				
	0600102-10	01	16.00	02	155	77	65	02	353	Y	748613	704571				
	0600102-11	01	16.00	02	150	68	56	02	350	Y	748918	703916				
	0600102-12	01	16.00	02	150	75	63	02	496	Y	748477	703846				
	0600102-13	01	20.00	02	165	110		02	900	N	750137	704619				
	0600102-14	01	20.00	02	165	110		02	900	N	749631	702947				
	0600102-15	01	20.00	02	165	110		02	900	N	749838	702161				
	0600102-16	01	20.00	02	152	87		02	900	N	749821	701009				
	0600102-17	01	20.00	02	145	85		02	900	N	750269	700568				
0600103	1650.00	03	6.41	01	06	6/87	PWS	GW	8		CITY OF PLANTATION			06	06-00103-W	09
	0600103-1	01	14.00	02	130	100		02	1400	N	737730	652510	ACCORDING TO THE FILE, THE INDIVIDUAL WELLS ARE NOT METERED.			
	0600103-2	01	14.00	02	130	100		02	1400	N	737971	653796	HOWEVER, THE FLOW INTO AND FROM THE PLANT IS METERED.			
	0600103-3	01	14.00	02	130	100		02	1400	N	738938	653346	PERMIT # 06-00103-W WAS ORIGINALLY ISSUED ON MARCH 10,1977.			
	0600103-4	01	14.00	02	130	100		02	1400	N	738091	651740	THE PERMIT WAS REISSUED ON MARCH 13, 1986 FOR AN ALLOCATION			
	0600103-5	01	14.00	02	130	100		02	1400	N	740118	652515	OF 1650 MGY AND 4 ADDITIONAL WELLS. ON JUNE 11, 1987,			

TABLE C-6. Public Water Supply Spreadsheet (Continued)

	0600103-6		01	14.00 02	130	100		02	1400 N	739821	652464	THE APPLICANT RECEIVED APPROVAL FOR 4 ADDITIONAL WELLS AND	
	0600103-7		01	14.00 02	130	100		02	1400 N	740023	652881	WELLS AND PERMISSION TO ABANDON THE 4 ORIGINAL WELLS.	
	0600103-8		01	14.00 02	130	100		02	1400 N	739712	652898	ON JANUARY 9, 1989, THE CITY OF PLANTATION	
												RECEIVED A PERMIT TO ABANDON ITS ORIGINAL 4 PRODUCTION WELLS.	
0600104		43.50	03	0.14 01	06	10/81	PWS	GW	2	BROWARD COUNTY CORRECTIONAL 06 06-00104-W			09
	0600104-1		01	12.00 02	80	60		03	120 N	690555	618368	THE PERMIT EXPIRED ON JULY 9, 1986. THE FACILITY RECEIVES	
	0600104-2		01	12.00 02	86	56		03	125 N	690402	618453	DRINKING WATER FROM THE COUNTY.	
0600112		268.60	03	1.02 01	06	3/88	PWS	GW	3	BROWARD COUNTY UTILITIES 06 06-00112-W			09
	0600112-1		01	12.00 02	112	100		02	400 Y	760607	679723	THE PERMIT WAS ORIGINALLY ISSUED TO BROADVIEW UTILITIES	
	0600112-2		01	12.00 02	113	100		02	1000 Y	760424	679761	ON MAY 12, 1977. THE PERMIT WAS TRANSFERRED TO THE COUNTY	
	0600112-3		01	12.00 02	115	105		02	1050 Y	760498	679639	AND REISSUED ON MARCH 10, 1988.	
06-00120		6290.00	03	23.77 01	06	10/88	PWS	GW	35	CITY OF SUNRISE 06 06-00120-W			09
	0600120-2A		01	18.00 02	115	110	20	02	1000 N	742304	671117	WELLS LABELED "A" ARE LOCATED AT PLANT 1; WELLS	
	0600120-3A		01	18.00 02	106	70	20	02	1000 N	742068	671161	LABELED "B" ARE AT PLANT 2; WELLS LABELED C ARE AT	
	0600120-4A		01	18.00 02	104	91	20	02	1000 N	742043	670899	PLANT 3. THE OTHER PLANTS DO NOT HAVE WELLS.	
	0600120-5A		01	18.00 02	112	93	20	02	1000 N	742146	670573	THE APPLICANT HAS PROPOSED TO EXPAND PLANT 1 BY ADDING	
	0600120-6A		01	18.00 02	76	69	20	02	1000 N	742459	670279	THREE NEW WELLS. IN ADDITION, WELLS 6A AND 9A WILL BE	
	0600120-7A		01	18.00 02	76	68	20	02	1000 N	742820	670290	ABANDONED DUE TO POTENTIAL POLLUTION PROBLEMS.	
	0600120-8A		01	18.00 02	72	67	20	02	1000 N	743240	670330	THE CITY WILL BASE THE NEW WELL LOCATIONS ON THE	
	0600120-9A		01	18.00 02	72	65	20	02	1000 N	743590	670321	RESULTS OF A HYDROLOGIC STUDY.	
	0600120-10A		01	18.00 02	84	80	20	02	1000 N	740954	669804	ON AUGUST 12, 1982, THE CITY RECEIVED A PERMIT FROM THE	
	0600120-11A		01	18.00 02	91	84	20	02	1000 N	741337	669664	DISTRICT FOR AN ANNUAL ALLOCATION OF 4950 MGY. THE PERMIT	
	0600120-12A		01	18.00 02	91	84	20	02	1000 N	741637	669475	WAS REISSUED WITH A REDUCED ALLOCATION OF 4970 MG ON	
	0600120-13A		01	18.00 02	84	80	20	02	1000 N	741857	669037	DECEMBER 10, 1987. THE PERMIT WAS REISSUED AGAIN ON	
	0600120-14A		01	18.00 02	90	84	20	02	1000 N	742111	669255	OCTOBER 6, 1988 WITH AN INCREASED ALLOCATION OF 6290 MG.	
	0600120-15A		01	18.00 02	87	83	20	02	1000 N	742124	668652		
	0600120-16A		01	18.00 02	88	84	20	02	1000 N	742152	668406		
	0600120-17A		02	18.00 02	90	80	20	02	1000 N				
	0600120-18A		02	18.00 02	90	80	20	02	1000 N				
	0600120-19A		02	18.00 02	90	80	20	02	1000 N				
	0600120-20A		02	18.00 02	90	80	20	02	1000 N				
	0600120-21A		02	18.00 02	90	80	20	02	1000 N				
	0600120-1B		02	10.00 02	60		23	02	350 N	741200	640850		
	0600120-2B		02	12.00 02	102	102	23	02	700 Y	741350	640250		
	0600120-3B		02	12.00 02	102	102	23	02	700 Y	741350	640550		
	0600120-4B		02	12.00 02	102	102	23	02	700 Y	741450	640750		
	0600120-5B		02	12.00 02	102	102	23	02	700 Y	741200	640400		
	0600120-6B		02	12.00 02	102	102	23	02	700 Y	741750	640750		
	0600120-7B		02	12.00 02	102	102	23	02	700 Y	741750	640250		
	0600120-1C		02	8.00 02	30		22	02	700 N	723450	648800		
	0600120-2C		02	8.00 02	30		22	02	700 N	723700	648750		
	0600120-3C		02	10.00 02	100		22	02	1200 N	724000	648800		
	0600120-4C		02	10.00 02	100		22	02	1200 N	724250	648800		
	0600120-5C		02	10.00 02	100		22	02	1200 N	724450	648800		
	0600120-6C		02	10.00 02	100		22	02	1200 N	724650	648800		
	0600120-7C		02	10.00 02	100		22	02	1200 N	724890	648800		

TABLE C-6. Public Water Supply Spreadsheet (Continued)

0600121	3600.00	03	13.30 01	06	8/77	PWS	GW	12				CITY OF MARGATE 06 06-00121-W
	0600121-1	01	8.00 02	100	90			800	Y	758000	694027	WELL CONSTRUCTION DATA TAKEN FROM THE PACKAGE MR. VAN ACKER
	0600121-2	01	12.00 02	100	100			1000	Y	758557	693659	SENT ME ON 12-19-89.
	0600121-3	01	12.00 02	100	100			1000	Y	758081	693629	THERE ARE ONLY 13 WELLS. DUE TO MIS-NUMBERING, THE THREE NEW
	0600121-4	01	12.00 02	105	1000			1000	Y	758209	693647	WELLS WERE INITIALLY LABELED 12, 12, AND 14. THIS MISTAKE WAS
	0600121-5	01	12.00 02	105	100			1000	Y	757699	694047	CORRECTED HERE. SEE PAGE 4 OF 1977 STAFF REPORT.
	0600121-6	01	12.00 02	105	100			1000	Y	757900	693867	VERY LITTLE DATA WAS GIVEN FOR THE EXISTING 10 WELLS
	0600121-7	01	18.00 02	105	95			1500	Y	757461	693935	
	0600121-8	01	18.00 02	105	95			1500	Y	757146	693912	
	0600121-9	01	18.00 02	105	88			2100	Y	756838	693903	
	0600121-10	01	18.00 02	105	88			2100	Y	758436	694028	
	0600121-11	01	18.00 02	105	88			2100	Y	757506	693593	
	0600121-12	01	18.00 02	105	88			2100	Y	757249	693518	
0600123	1916.00	03	69.30 01	06	2/89	PWS	GW	75				CITY OF FORT LAUDERDALE 06 06-00123-W 09
	0600123-1D	01								758922	646904	
	0600123-2D	01	12.00 02	125	110		02	600	N	759883	647490	THE CITY OF FORT LAUDERDALE HAS TWO WELLFIELDS. THE WELLS AT
	0600123-3D	01	12.00 02	125	110		02	600	N	760277	648503	THE DIXIE WELLFIELD ARE LABELED WITH A "D" AND THE WELLS AT
	0600123-4D	01	12.00 02	125	110		02	600	N	759884	645834	THE PROSPECT WELLFIELD ARE LABELED WITH A "P". THE
	0600123-5D	01	12.00 02	99	87		02	600	N	758625	646084	TOTAL NUMBER OF WELLS IS 75; 26 WELLS ARE LOCATED AT THE
	0600123-6D	01	12.00 02	189	181		02	600	N	758546	647417	DIXIE WELLFIELD AND 49 WELLS (ONLY 26 ACTIVE WELLS) ARE
	0600123-7D	01	12.00 02	125	110		02	600	N	757470	646708	LOCATED AT THE PROSPECT WELLFIELD. THE DIXIE
	0600123-8D	01	12.00 02	104	89		02	600	N	757603	647924	WELLFIELD IS LIMITED TO A MAXIMUM WITHDRAWAL OF 20
	0600123-9D	01	12.00 02	117	104		02	600	N	758424	649235	MGD DUE TO POTENTIAL SALINE WATER INTRUSION PROBLEMS. AT
	0600123-10D	01	12.00 02	148	82		02	600	N	759562	649497	THE PROSPECT WELLFIELD, THE CITY DOES NOT USE WELLS 1
	0600123-11D	01	12.00 02	126	110		02	600	N	762228	643278	THROUGH.24 DUE TO CONTAMINATION AND SALINE WATER INTRUSION
	0600123-12D	01	12.00 02	126	110		02	600	N	762262	642928	PROBLEMS. THE CITY RECEIVED THE ORIGINAL PERMIT ON
	0600123-13D	01	12.00 02	125	110		02	600	N	761447	644160	AUGUST 11, 1977.
	0600123-14D	01	12.00 02	125	110		02	400	N	760639	644073	
	0600123-15D	01	12.00 02	125	110		02	400	N	760506	643574	
	0600123-16D	01	12.00 02	125	110		02	400	N	760286	642694	
	0600123-17D	01	12.00 02	125	110		02	400	N	760063	641800	
	0600123-18D	01	12.00 02	125	110		02	400	N	759854	641027	
	0600123-19D	01	12.00 02	125	110		02	400	N	760356	641019	
	0600123-20D	01	12.00 02	114	89		02	500	N	759310	644223	
	0600123-21D	01	12.00 02	114	87		02	500	N	759242	643585	
	0600123-22D	01	10.00 02	115	89		02	500	N	759210	643135	
	0600123-23D	01	10.00 02	114	87		02	500	N	758842	641694	
	0600123-24D	01	10.00 02	115	89		02	500	N	759629	646654	
	0600123-25D	01	10.00 02	115	89		02	500	N	757877	647402	
	0600123-26D	01	12.00 02	118	93		02	600	N	760895	645053	
	0600123-25P	01	17.00 02	150	112	50	02	2100	N	763499	677447	
	0600123-26P	01	17.00 02	144	105	50	02	2100	N	762581	677462	
	0600123-27P	01	17.00 02	103	100	50	02	2100	N	763456	678445	
	0600123-28P	01	17.00 02	116	81	50	02	2100	N	762917	678911	
	0600123-29P	01	17.00 02	109	86	50	02	2100	N	763236	679063	
	0600123-30P	01	17.00 02	109	90	50	02	2100	N	762698	680096	
	0600123-31P	01	17.00 02	100	80	50	02	2100	N	761920	679504	
	0600123-32P	01	17.00 02	103	82	50	02	2100	N	761255	679091	
	0600123-33P	01	17.00 02	101	80	50	02	2100	N	761180	678064	
	0600123-34P	01	17.00 02	90	75	50	02	2100	N	761563	677432	

TABLE C-6. Public Water Supply Spreadsheet (Continued)

	0600123-35P	01	17.00	02	96	70	50	02	2100	N	766801	677553				
	0600123-36P	01	17.00	02	99	81		02	2100	N	766039	677380				
	0600123-37P	01	17.00	02	98	82		02	2100	N	765045	677376				
	0600123-38P	01	17.00	02	102	82		02	2100	N	763860	677428				
	0600123-39P	01	17.00	02	98	82		02	2100	N	765598	677737				
	0600123-40P	01	17.00	02	90	62		02	2100	N	765938	678053				
	0600123-41P	01	17.00	02	95	82		02	2100	N	765123	678376				
	0600123-42P	01	17.00	02	91	82		02	2100	N	763972	678645				
	0600123-43P	01	17.00	02	90	66		02	2100	N	764500	677382				
	0600123-44P	01	17.00	02	90	68		02	2100	N	763824	677947				
	0600123-45P	01	17.00	02	95	71	50	02	2100	N	765698	677392				
	0600123-46P	01	17.00	02	98	72	50	02	2100	N	766120	677740				
	0600123-47P	01	17.00	02	96	73	50	02	2100	N	765094	678019				
	0600123-48P	01	17.00	02	96	48	50	02	2100	N	765585	678314				
	0600123-49P	01	17.00	02	95	69	50	02	2100	N	764555	678333				
0600129	2510.00	03	10.06	01	06	6/86	PWS	GW	7		CITY OF LAUDERHILL			06	06-00129-W	09
	0600129-1	01	8.00	02	111	80		02	500		756639	661643				
	0600129-2	01	12.00	02	111	80		02	1000		756489	661458				
	0600129-3	01	12.00	02	154	80		02	1500		756461	661832				
	0600129-4	01	12.00	02	154	80		02	1000		756627	661509				
	0600129-5	01	24.00	02	115	80		02	2800		756700	661833				
	0600129-6	01	24.00	02	121	80		02	2800		756282	661428				
	0600129-7	01	24.00	02	142	80		02	2800		756973	661938				
0600134	1124.20	03	4.31	01	06	4/85	PWS	GW	9		CITY OF DAVIE			06	06-00134-W	09
	0600134-1	01	10.00	02	110	100	100	02	550	Y	752008	633264	WELLS 5 AND 6 ARE LOCATED AT SYSTEM 2. THESE WELLS ARE			
	0600134-2	01	10.00	02	110	100	100	02	550	Y	751973	633428	FOR EMERGENCY USE. WELLS 7, 8, AND 9 ARE THE NEW WELLS			
	0600134-3	01	12.00	02	150	133	133	02	1050	Y	752249	633618	AT SYSTEM 2. ON NOVEMBER 17, 1977, THE CITY RECEIVED			
	0600134-4	01	12.00	02	140	125	125	02	1050	Y	752150	633420	A WATER USE PERMIT FOR AN ANNUAL			
	0600134-5	03	12.00	02	115	100	100	02	700		749739	621925	ALLOCATION OF 572 MGY. THE PERMIT WAS REISSUED			
	0600134-6	03	12.00	02	150	131	131	02	700		749749	621659	IN 1979 FOR AN ANNUAL ALLOCATION OF 923 MGY.			
	0600134-7	01	20.00	02	110	100		02	1400	Y	748774	621198				
	0600134-8	01	20.00	02	110	100		02	1400	Y	748830	620952				
	0600134-9	01	20.00	02	125	100		02	1400	Y	748778	620667				
0600135	2847.00	03	10.14	01	06	8/89	PWS	GW	8		CITY OF PEMBROKE PINES			06	06-00135-W	09
	0600135-1	03	12.00	02	112	109	40	02	2000	Y	747700	612200	ON NOVEMBER 17, 1977, THE APPLICANT RECEIVED A WATER USE			
	0600135-2	03	12.00	02	112	109	40	02	1000	Y	747700	611950	PERMIT. THE PERMIT WAS RENEWED IN 1981, 1987 AND 1989.			
	0600135-3	03	12.00	02	111	109	40	02	1000	Y	747700	611685	WELLS 6, 7, AND 8 ARE THE PRIMARY WELLS. THE OTHER WELL			
	0600135-4	03	16.00	02	144	114	40	02	2100	Y	747460	611685	ARE STANDBY.			
	0600135-5	03	16.00	02	115	103	40	02	2800	Y	747460	611855				
	0600135-6	01	10.00	02	94	90	40	02	1500	Y	752500	612100				
	0600135-7	01	10.00	02	107	102	40	02	1500	Y	752650	612100				
	0600135-8	01	10.00	02	112	106	40	02	1500	Y	752650	611900				
0600138	1227.00	03	3.50	01	06	8/87	PWS	GW	8		CITY OF HALLANDALE			06	06-00138-W	09
	0600138-1	03	20.00	02	83	58	35	02	791	Y	777324	602487	ON AUGUST 13, 1987 THE DISTRICT RESTRICTED THE			
	0600138-2	03	20.00	02	82	60	35	02	1000	Y	777415	602655	CITY OF HALLANDALE TO 3.5 MGD. WELLS 1 THROUGH 6			
	0600138-3	03	20.00	02	81	61	35	02	1529	Y	777443	602809	WERE PLACED ON STANDBY.			
	0600138-4	03	20.00	02	68	40	40	02	1041	Y	777282	602821				

TABLE C-6. Public Water Supply Spreadsheet (Continued)

	0600138-5	03	20.00	02	68	40	40	02	1041	Y	777141	602866		
	0600138-6	03	20.00	02	68	40	40	02	1041	Y	777116	602689		
	0600138-7	01	20.00	02	97	66	42	02	2083	Y	776431	604495		
	0600138-8	01	20.00	02	107	101	42	02	2431	Y	775109	603867		
0600142	4860.00	03	19.98	01	06	9/88	PWS	GW	9		BROWARD	COUNTY 2A	06 06-00142-W	09
	0600142-1	01	8.00	02	178			02	600	N	792872	713259	THE PERMITTED 13.31 MGD IS A REDUCTION FROM THE PREVIOUSLY	
	0600142-2	01	12.00	02	180	154		02	2100	N	792714	713212	PERMITTED 15.07 MGD WHICH WAS PERMITTED ON JUNE 12, 1986.	
	0600142-3	01	8.00	02	143			02	800	N	793774	713295	FUTURE PLANS INCLUDE JOINING THE REGIONAL WELLFIELD SYSTEM.	
	0600142-4	01	18.00	02	120	107		02	3000	Y	792220	713251		
	0600142-5	01	12.00	02	142	125		02	1800	N	792770	712644		
	0600142-6	01	18.00	02	133	125		02	2100	N	792478	712646		
	0600142-7	01	20.00	02	176	156		02	4000	Y	792134	712649		
	0600142-8	01	24.00	02	150	80		02	3100	Y	789828	712933		
	0600142-9	01	24.00	02	155	85		02	2400	Y	790750	712959		
	0600142-10	02	24.00	02	110			02	2500	N	788267	714517		
	0600142-11	02	24.00	02	110			02	2500	N	788252	715130		
0600145	1565.00	03	5.43	01	06	4/87	PWS	GW	6		BROWARD	COUNTY UTILITIES	06 06-00145	09
	0600145-1	01	12.00	02	65	55	25	01	540	Y	762545	628436	WELL 1 WILL BE PLACED ON STANDBY WHEN WELLS 5 AND 6 ARE	
	0600145-2	01	10.00	02	65	55	25	01	610	Y	762548	628177	BROUGHT ON LINE. THE COUNTY HAS AN APPLICATION IN HOUSE.	
	0600145-3	01	12.00	02	65	55	25	01	815	N	762892	628199	IN THE APPLICATION, THE CITY INTENDS TO PROVIDE DANIA WITH	
	0600145-4	01	14.00	02	180	116	30	01	750	N	762101	626240	1.0 MGD. ACCORDING TO PAGE 2 OF THE APPLICATION, WELLS	
	0600145-5	02	20.00	02	110	75	30	02	1100	N	761522	625612	1 AND 2 HAVE FLOWMETERS.	
	0600145-6	02	20.00	02	110	75	30	02	1100	N	761502	625307	FUTURE PLANS INCLUDE JOINING THE REGIONAL WELLFIELD.	
0600146	3310.00	03	11.80	01	06	9/88	PWS	GW	14		BROWARD	COUNTY 1A AND 1B		09
	0600146-1A	01	12.00	02	100	72		02	1200	N	761085	669064	WELLFIELD 1A IS THE PRIMARY WELLFIELD FOR BOTH SERVICE	
	0600146-2A	01	12.00	02	100	70		02	1150	N	761002	668495	AREAS. WELLFIELD 1B (WELLS 1B-5B) IS USED FOR STANDBY.	
	0600146-3A	01	12.00	02	100	89		02	1100	N	760668	669050	PERMIT # 06-00146-W WAS ORIGINALLY ISSUED IN JANUARY 1978	
	0600146-4A	01	12.00	02	100	76		02	1150	N	760701	668521	FOR AN ANNUAL ALLOCATION OF 2140 MGY. THE PERMIT WAS	
	0600146-5A	01	20.00	02	94	84		02	2100	N	759941	668593	REISSUED IN JULY 1980 WITH AN ANNUAL ALLOCATION OF 3420	
	0600146-6A	01	20.00	02	100	69		02	2100	N	759957	668881	MGY AND JUNE 1986 WITH AN ANNUAL ALLOCATION OF 3382 MGY.	
	0600146-7A	01	20.00	02	100	75		02	2100	N	760684	668774		
	0600146-8A	02	20.00	02	100	75		02	2100	N	760223	668593		
	0600146-9A	02	20.00	02	100	75		02	2100	N	760388	668925		
	0600146-1B	03	6.00	02	110	103		02	225	N	779257	682739		
	0600146-2B	03	6.00	02	110	103		02	225	N	779233	682857		
	0600146-3B	03	8.00	02	115	102		02	650	N	779260	683075		
	0600146-4B	03	8.00	02	115	102		02	640	N	779388	682976		
	0600146-5B	03	8.00	02	110	103		02	650	N	779408	682818		
0600147	1690.00	03	6.30	01	06	2/86	PWS	GW	9		BROWARD	COUNTY	06 06-000147	09
	0600147-A	01	6.00	02	100			02	850	N	755640	602237	WELLS A THROUGH F ARE AT THE 3B WELLFIELD; WELLS 1	
	0600147-B	01	8.00	02	100			01	930	N	755764	602307	THROUGH 3 ARE AT THE 3C WELLFIELD. THE COUNTY HAS	
	0600147-C	01	10.00	02	130			02	1200	N	755881	602429	A RENEWAL APPLICATION IN HOUSE TO SUPPLY HALLANDALE WITH	
	0600147-D	01	18.00	02	140	102		02	1200	N	768548	597123	WATER. EVENTUALLY, THE 3B SERVICE AREA WILL BE SUPPLIED	
	0600147-E	02	24.00	02	150	100		02	2100	N	768548	597123	WITH WATER FROM THE REGIONAL WELLFIELD; AND THE 3B	
	0600147-F	02	24.00	02	150	100		02	2100	N	768548	597123	WELLFIELD WILL BE SOLD. THE 3C SERVICE AREA WILL BE	
	0600147-1	01	4.00	02	80			02	100	Y	768548	597123	SOLD TO A NEIGHBORING UTILITY.	
	0600147-2	01	6.00	02	57	50		02	350	Y	755313	602182		

TABLE C-6. Public Water Supply Spreadsheet (Continued)

	0600147-3	01	10.00	02	80	73		02	500 Y	755313	602182				
0600170	340.00	03	1.20	01	06	8/88	PWS	GW	4	FERNCREST UTILITIES			06	06-00170-W	09
	0600170-1	01	6.00	02	89	89		02	550 Y	755136	636227				
	0600170-2	01	4.00	02	87	87		02	200 Y	755151	636401				
	0600170-3	01	8.00	02	89	89		02	700 Y	755205	636582				
	0600170-4	01	8.00	02	90	90		02	700 Y	755376	636495				
0600187	770.00	03	3.00	01	06	9/82	PWS	GW	7	CITY OF DANIA			06	06-00187-W	09
	0600187-A	01	12.00			93			1000	778335	623904	WELLS G AND H ARE THE PRIMARY WELLS AND ARE LOCATED IN			
	0600187-B									777856	623382	THE WESTERN WELLFIELD. THE OTHER WELLS ARE USED AS NEEDED.			
	0600187-C	01	12.00			100			500	778365	623287	ON DECEMBER 9, 1982, THE CITY RECEIVED A WATER USE PERMIT			
	0600187-D	01	12.00			120			500	778298	623067	FOR AN ANNUAL ALLOCATION OF 770 MGY. THE PERMIT EXPIRED ON			
	0600187-E	01	12.00			88			700	778880	619915	DECEMBER 9, 1987. THE CITY HAS A RENEWAL APPLICATION IN			
	0600187-F	01	12.00			100			700	778617	619916	HOUSE. FUTURE PLANS FOR DANIA ARE UNCERTAIN.			
	0600187-G	01	18.00			65			2100	771885	623988				
	0600187-H	01	18.00			69			1050	771890	624241				
0600242	186.10	03	0.76	01	06	3/85	PWS	GW	2	PARKLAND UTILITIES			06	06-00242-W	09
	0600242-1	01	10.00	02	140	140	30	02	400 Y	754679	726750	ON MAY 17, 1979, PARKLAND UTILITIES WAS ISSUED A PERMIT			
	0600242-2	01	10.00	02	140	140	30	02	400 Y	754391	725139	WITH AN ANNUAL ALLOCATION OF 198 MGY. THE PERMIT WAS			
												REISSUED IN 1985.			
0600274	259.00	03	1.41	01	06	10/88	PWS	GW	5	NSID			06	06-00274-W	09
	0600274-2	01	24.00	02	130	70	46	02	700 N			NSID HAS 3 EXISTING WELLS AND PROPOSES TO INSTALL 10			
	0600274-2A	01	24.00	02	130	70	46	02	750 N			ADDITIONAL WELLS. ONLY WELLS 2 AND 2A ARE CURRENTLY ACTIVE.			
	0600274-7	01	24.00	02	120	70	40	02	650 N			ACCORDING TO MR. PERRON, ONLY 2 WELLS ARE ACTIVE.			
0600365	1190.00	03	5.22	01	06	8/89	PWS	GW	10	COOPER CITY			06	06-00365-W	09
	0600365-1E	01	10.00	02	114	110	112	02	700	738890	626615	WELLS AT THE EAST WELLFIELD ARE LABELED WITH AN "E" AND			
	0600365-2E	01	10.00	02	89	80	85	02	600	738693	626633	WELLS AT THE WESTERN WELLFIELD ARE LABELED WITH A "W".			
	0600365-3E	01	12.00	02	85	75	80	02	1000	738787	626475	WELL 2 AT THE WEST WELLFIELD HAS BEEN ABANDONED. WELLS 5,			
	0600365-1W	01	12.00	02	80	70	75	02	600	727948	627528	6, AND 7 AT THE WEST WELLFIELD ARE PROPOSED. PERMIT			
	0600365-3W	01	12.00	02	80	70	75	02	1100	728051	627708	06-00365-W WAS ORIGINALLY ISSUED TO COOPER CITY IN			
	0600365-4W	01	12.00	02	80	70	75	02	1100	728014	627619	NOVEMBER 1981. THE PERMIT WAS REISSUED IN 1986 AND 1989.			
	0600365-5W	02	12.00	02	80	70	75	02		727538	627494	PERMIT 06-00137-W IS INCORPORATED INTO PERMIT 06-00365-W.			
	0600365-6W	02	12.00	02	80	70	75	02		727993	626885				
	0600365-7W	02	12.00	02	80	70	75	02		728603	626885				
										728970	626909				
0600435	239.44	03	1.05	01	06	9/87	PWS	GW	3	SOUTH BROWARD UTILITIES INC.			06	06-00435-W	09
	0600435-1	01	12.00	02	60	40	32	02	700 Y	712357	622017	SOUTH BROWARD UTILITIES RECEIVED ITS ORIGINAL PERMIT IN			
	0600435-2	01	12.00	02	60	42	34	02	700 Y	712101	622020	SEPTEMBER 1982. THE PERMIT WAS REISSUED IN 1987. THE			
	0600435-3	01	12.00	02	60	40	32	02	700 Y	711747	622012	UTILITY HAS A RENEWAL APPLICATION IN HOUSE.			

TABLE C-7. Non-Public Water Supply Spreadsheet

BROWARD COUNTY NON PWS WATER USE

THROUGH 11/89

LINE 1 HEADINGS (EXISTING WATER USE PERMITS)

PERMIT NO.	AN. ALL.	ALL. UNT.	MAX MO.	MO. UTS.	CO	DATE ISS.	USE TYPE	SRC. TYPE	NO. WLS.	SW PMPS	OWNER	CO	AQ	CROP TYPE	SOIL TYPE	RAIN ST	IRR ACRES	IRR EFF
0600001			14.90	02	06	2/89	AG	BOTH	17	1	SEMINOLE TRIBE OF FLORIDA	06	09	15	0.4	5	78.90	0.75
0600007	22.20	03	0.14	01	06	9/74	AG	GW	2	0	CITY OF POMPANO, HOUSING AUTHORITY	06	09	15	0.8	23	44.50	0.75
0600021	125.40	03	18.72	02	06	4/89	GLF	SW	0	2	VALASSIS GOLF PROPERTIES INC.	06	09	15	0.2	23	100.00	0.75
0600024	778.74	03	118.63	02	06	10/87	GLF	BOTH	7	8	FPA CORPORATION	06	09	15	0.4	23	662.00	0.75

LINE 2 HEADINGS (FACILITIES INFORMATION FOR EACH PERMIT)

PERMIT NO.	FACILITY NUMBER	STS	WELL DIA.	DPTH CODE	TD	CD	PMP INT	PUMP TYPE	PUMP CAP.	MTR?	XPLNR	YPLNR	SRC	COMMENTS
0600001	0600001-1	01	3.00					01	150	N	759477	624101	SW	THIS PROJECT IS NOT A PERMIT; BUT RATHER A WORK PLAN
	0600001-2	01	2.00	02	60		20	01	60	N	759568	623865	GW	BETWEEN THE DISTRICT AND THE SEMINOLE INDIAN TRIBE.
	0600001-3	01	2.00	02	60		20	01	60	N	759270	623807	GW	NO ANNUAL ALLOCATION WAS GIVEN FOR THE AGRICULTURAL
	0600001-4	01	2.00	02	60		20	01	60	N	759256	623652	GW	USE. THERE ARE OTHER TRIBE LOCATIONS WITHIN THE
	0600001-5	01	2.00	02	60		20	01	60	N	758999	623407	GW	DISTRICT. HOWEVER, THIS DISCUSSION ONLY COVERS THE
	0600001-6	01	2.00	02	60		20	01	60	N	759297	623078	GW	HOLLYWOOD RESERVATION.
	0600001-7	01	2.00	02	60		20	01	60	N	759275	622173	GW	WELLS 19 AND 20 ARE FOR SEMINOLE ESTATES AND
	0600001-8	01	2.00	02	60		20	01	60	N	759281	622058	GW	HOLLYWOOD MOBILE ESTATES, RESPECTIVELY.
	0600001-9	01	2.00	02	60		20	01	60	N	759864	621719	GW	
	0600001-10	01	2.00	02	60		20	01	60	N	759889	621489	GW	
	0600001-11	01	2.00	02	60		20	01	60	N	757711	621410	GW	
	0600001-12	01	2.00	02	60		20	01	60	N	757644	620944	GW	
	0600001-13	01	2.00	02	60		20	01	60	N	757710	620905	GW	
	0600001-14	01	2.00	02	60		20	01	60	N	759996	619898	GW	
	0600001-15	01	2.00	02	60		20	01	60	N	759618	619440	GW	
	0600001-19	01	2.00	02	50		10	01	35	N	756129	618430	GW	
	0600001-20	01	1.50	02	50		10	01	60	N	756808	618451	GW	
0600007	0600007-1	01	8.00	02	40			03	600	Y	780529	695674	GW	THE IRRIGATION EFFICIENCY WAS NOT GIVEN; HOWEVER,
	0600007-2	01	8.00	02	40			03	600	Y	780610	695654	GW	IT SHOULD BE 75%. THE PERMIT EXPIRED IN 1984.
0600021	0600021-1	01	6.00					02	750	N	752867	702690	SW	THE SOURCE OF SURFACE WATER IS AN ON-SITE LAKE.
	0600021-2	01	6.00					02	750	N	752883	702601	SW	
0600024	0600024-5A	01	6.00	02	75			03	50	N	774497	690232	GW	SURFACE WATER PUMP 4 HAS BEEN ABANDONED.
	0600024-5B	01	12.00	02	75			03	400	N	772033	690459	GW	MOST OF THE WELL AND PUMP INFORMATION WAS MISSING
	0600024-6A	01	6.00	02	75			03	133	N	772354	690446	GW	FROM THE PERMIT ISSUED 10-8-87.
	0600024-6B	01	12.00	02	75			03	133	N	770539	688340	GW	ACCORDING TO THE PERMITTEE, THE WITHDRAWALS WILL BE

TABLE C-7. Non-Public Water Supply Spreadsheet (Continued)

	0600024-7		01	10.00	02	127				03	133	N		770519	688291	GW	EQUALLY DISTRIBUTED BETWEEN THE BISCAYNE AQUIFER,					
	0600024-8		01	10.00	02	100				03	400	N		770710	688067	GW	ON-SITE LAKES, AND CANAL C-14. THE INFORMATION					
	0600024-11		01	10.00	02	100				03	400	N		770723	688089	GW	GIVEN HERE IS BASED ON THE 1987 PERMIT.					
	0600024-1		01							03	450			773275	686073	SW						
	0600024-2		01							03	450			773320	686033	SW						
	0600024-3		01							03	200			769154	684835	SW						
	0600024-9A1		01							03	600			769216	684857	SW						
	0600024-9A2		01							03	600			769225	684745	SW						
	0600024-9B		01							03	50			771940	687958	SW						
	0600024-10		01							03	400					SW						
	0600024-12		01							03	150			769102	686620	SW						
0600025		30.00	03	1.00	01	06	4/15	GLF	GW		4		0	CITY OF POMPANO BEACH			06 09	15	0.4	23	350.95	0.75
	0600025-1		01	8.00	02	40				03	600	N		792437	698916	GW	THIS AREA HAS EXPERIENCED SALINE WATER ENCROACHMENT.					
	0600025-2		01	8.00	02	40				03	600	N		792616	698873	GW	TO ALLEVIATE THIS PROBLEM, THE DISTRICT REQUIRED					
	0600025-3		01	8.00	02	40				03	600	N		793419	699312	GW	THE PERMITTEE TO UTILIZE WASTE WATER FOR GOLF					
	0600025-4		01	8.00	02	40				03	600	N		793915	698843	GW	COURSE IRRIGATION.					
0600026		51.13	03	10.65	02	06	3/89	GLF	SW		0		2	CITY OF PEMBROKE PINES			06 09	15	3.6	5	80.00	0.75
	0600026		01								650			735712	613714	SW	THE DIAMETERS AND PUMP TYPE ARE UNKNOWN. THE					
	0600026		01								650			735712	613714	SW	APPLICANT ALSO HAS A 200 GPM JOCKEY PUMP.					
0600034		73.76	03	11.24	02	06	7/89	GLF	GW		4		0	DEERFIELD COUNTRY CLUB			06 09	15	0.4	23	62.70	0.75
	0600034-1		01	6.00	02	100	90			02	320	N		790344	724733	GW						
	0600034-2		01	6.00	02	100	90			02	320	N		790929	722887	GW						
	0600034-3		01	6.00	02	100	90			02	320	N		790282	722680	GW						
	0600034-4		01	6.00	02	100	90			02	320	N		789752	724368	GW						
0600039		352.00	04	34.90	02	06	9/78	GLF	GW		1		0	WYNMOOR LIMITED PARTNERSHIP			06 09	15	0.2	23	130.00	0.50
	0600039-1		01	10.00	02	350				03	1750			768524	697663	GW	THE 350-FOOT WELL DEPTH SEEMS ANOMALOUS.					
0600048		17.65	03	2.69	02	06	5/89	AG	SW		0		2	HIGHLAND MEADOWS EST. ASSOCIATION W			06 09	15	0.4	23	15.00	0.75
	0600048-1		01	8.00						01	500			785768	713255	SW						
0600052		72.34	03			06	5/89	GLF	GW		3		0	CITY OF HOLLYWOOD			06 09	15	0.8	5	229.00	0.50
	0600052-1		01	12.00		70				02	1100	N		771478	605050	GW	DUE TO POTENTIAL PROBLEMS WITH SALINE WATER					
	0600052-2		01	12.00		100	92			02	750	N		771177	607965	GW	ENCROACHMENT WITHIN THE AREA, THE PERMITTEE WAS					
	0600052-3		01	12.00		83	78			02	750	N		773028	607620	GW	GIVEN AN ALLOCATION OF 72.34 MGY BASED ON A BASIN					
																	YIELD OF 13 INCHES/ACRE.					
0600055		477.46	03	98.54	02	06	7/89	AG	SW		0		4	MECCA FARMS INC			06 09	63	0.2	23	488.00	0.50
	0600055-1		01	18.00						01	18000			759479	725722	SW	FACILITIES 3 AND 4 ARE WITHDRAWAL CULVERTS.					
	0600055-2		01	18.00						01	18000			756273	726809	SW	BOTH CULVERTS ARE 66 INCHES BY 222 FEET. THE					
	0600055-3		01	66.00							0			759571	725767	SW	APPLICANT ALSO HAS A DRAINAGE CULVERT.					
	0600055-4		01	66.00							0			756355	726828	SW	THE HILLSBORO CANAL IS THE SURFACE WATER SOURCE.					
0600056		335.26	03	53.05	02	06	6/89	GLF	GW		6		0	FT.LAUDERDALE COUNTRY CLUB			06 09	15	0.4	5	280.00	0.75
	0600056-1		01	12.00	02	90	30			02	600	Y		759437	646874	GW	THERE IS NO WELL LABELED AS # 6.					
	0600056-2		01	12.00	02	90	30			02	600	Y		758905	646797	GW						
	0600056-3		01	4.00	02	90	30			02	150	N		756974	649341	GW						
	0600056-4		01	6.00	02	90	30			02	600	Y		759022	649847	GW						
	0600056-5		01	6.00	02	90	30			02	600	Y		759125	649125	GW						

TABLE C-7. Non-Public Water Supply Spreadsheet (Continued)

0600056-7	01	12.00 02	90	30		02	150 Y		757394	649363 GW			
0600059	23.53 03	3.58 02	06	1/89	AG	GW	1	0			WILLOW LAKES ESTATES, INC	06 09 15 0.4 23	20.00 0.75
0600059-1	01	8.00 02	90	90	15	02	690 N		788216	711958 GW			
0600061	207.38 03	32.81 02	06	6/89	GLF	SW	0	3			EMERALD HILLS COUNTRY CLUB, INC	06 09 15 0.4 5	173.20 0.75
0600061-1	01					03	700		767655	619676 SW	PERMIT # 06-00062-W IS INCLUDED IN THIS PERMIT.		
0600061-2	01					03	700		767684	619637 SW			
0600061-3	01					03	700		767684	619601 SW			
0600062	70.10 04		06	9/78	GLF	SW	0	1			EMERALD HILLS COUNTRY CLUB, INC.	06 09 15 0.4 5	64.70 0.50
0600062-1	01	12.00				03	390		766168	619562 SW	THE SURFACE WATER SOURCE IS AN ON-SITE LAKE.		
0600063	32.11 03	5.08 02	06	4/89	AG	GW	6	0			FRED HUNTER MEMORIAL SERVICES INC	06 09 15 0.4 5	26.82 0.75
0600063-1	01	8.00 02	103	103	10	02	500 N		757661	615247 GW			
0600063-2	01	4.00 02	60	60	10	01	160 N		757658	615211 GW			
0600063-3	01	2.00 02	60	60	10	01	20 N		757654	615113 GW			
0600063-4	01	8.00 02	60	60	10	02	500 N		758509	614799 GW			
0600063-5	01	4.00 02	60	60	10	01	240 N		759806	615110 GW			
0600063-6	01	2.00 02	60	60	10	01	20 N		759868	615241 GW			
0600068	43.30 04	10.80 02	06	9/78	AG	GW	2	0			FOREST LAWN MEMORIAL GARDENS	06 09 15 0.4 23	40.00 0.50
0600068-1	01	6.00 02	100			03	500 N		785969	701045 GW	THE PERMIT EXPIRED ON 4/89 AND HAS NOT BEEN RENEWED.		
0600068-2	01	6.00 02	100			03	300 N		787223	701102 GW	THE ANNUAL ALLOCATION WAS 43.3 ACRE FEET (14.1 MG).		
0600069	96.22 03	17.64 02	06	4/89	AG	SW	0	6			NATIONAL NURSERY	06 09 15 0.8 5	30.00 0.20
0600069-1	01	6.00				01	1960		732063	625104 SW	THE PERMITTEE GROWS POTTED NURSERY PLANTS.		
0600069-2	01	8.00				01	1960		731606	625037 SW	PURSUANT TO CURRENT PERMITTING CRITERIA, POTTED		
0600069-3	01	6.00				01	1400		731095	625040 SW	PLANTS RECEIVE A 20% IRRIGATION EFFICIENCY. A FIELD		
0600069-4	01	2.00				01	150		732827	625678 SW	INSPECTION ON 7-27-89 INDICATED THAT THE PROPERTY		
0600069-5	01	2.00				01	150		731594	625604 SW	HAS BEEN SOLD AND THE WATER USE PERMIT IS NO		
0600069-6	01	2.00				01	150		731438	625015 SW	LONGER APPLICABLE.		
0600074	91.40 03	15.44 02	06	5/89	AG	BOTH	3	11			KEVIN KRAFT	06 09 15 0.8 23	27.00 0.20
0600074												09 15 0.8 23	7.00 0.85
0600074-1W	01	8.00 02	170		10	01	800 N		778238	718473 GW	THE CROP TYPE IS NURSERY STOCK. PURSUANT TO SFWMD		
0600074-2W	02	5.00 02	170		10	01	400 N		779268	718192 GW	POLICY NURSERY STOCK RECEIVES THE SAME ALLOCATION		
0600074-3W	02	5.00 02	170		10	01	400 N		778723	717771 GW	AS GRASS. THE SURFACE WATER SOURCE IS ON-SITE		
0600074-#2	01	5.00				01	1250		778248	718444 SW	PONDS. ACCORDING TO EXHIBIT 4, WELL 1 AND		
0600074-E1	01	2.00				01	100		778729	717801 SW	PUMPS #2, E1, E2, AND E3 ARE LOCATED ON LAKE 1;		
0600074-E2	01	2.00				01	100		779241	718189 SW	WELL 2 AND PUMPS 3, 4, E4, AND E5 ARE		
0600074-E3	01	2.00				01	100		779297	718176 SW	LOCATED ON LAKE 2; AND WELL 3 AND		
0600074-#3	01	5.00				01	1250		778755	717827 SW	PUMPS 5, E6, AND E7 ARE LOCATED ON LAKE 3.		
0600074-E4	01	2.00				01	100			SW			
0600074-E5	01	2.50				01	250			SW			
0600074-#4	01	5.00				01	1250			SW			
0600074-E6	02	2.00				01	100			SW			
0600074-E7	02	2.50				01	200			SW			
0600074-#5	02	5.00				01	1250			SW			
0600075	22.45 03	3.65 02	06	4/89	AG	SW	0	2			FRED HUNTER MEMORIAL SERVICES INC	06 09 15 0.4 5	18.75 0.75
0600075-1	01	3.00			5	01	265		752706	618961 SW	THE SURFACE WATER SOURCE IS CANAL N-9		

TABLE C-7. Non-Public Water Supply Spreadsheet (Continued)

	0600075-2		01	2.00					5	01	30			752679	618787	SW								
0600076		549.14	03	87.13	02	06	4/89	GLF		SW	0		22	CENTURY VILLAGE EAST				06	09	15	0.8	23	530.00	0.75
	0600076-1		01							01	1050			780603	721539	SW	THE SURFACE WATER SOURCE IS THE ON-SITE LAKE SYSTEM.							
	0600076-2		01							01	950			781875	721814	SW								
	0600076-3		01							01	820			781649	720849	SW								
	0600076-4		01							01	820			783301	721763	SW								
	0600076-5		01							01	410			783395	720962	SW								
	0600076-6		01							01	410			784512	721206	SW								
	0600076-7		01							01	410			783313	719490	SW								
	0600076-8		01							01	410			783473	719433	SW								
	0600076-9		01							01	410			784205	719418	SW								
	0600076-10		01							01	410			783940	718257	SW								
	0600076-11		01							01	410			783458	717629	SW								
	0600076-12		01							01	410			782469	717761	SW								
	0600076-13		01							01	410			782170	717472	SW								
	0600076-14		01							01	410			783797	717799	SW								
	0600076-15		01							01	410			785385	718740	SW								
	0600076-16		01							01	410			784927	719447	SW								
	0600076-17		01							01	410			784533	720736	SW								
	0600076-18		01							01	200			781535	720329	SW								
	0600076-19		01							01	200			780841	719234	SW								
	0600076-20		01							01	150			780095	718766	SW								
	0600076-21		01							01	150			780593	718109	SW								
	0600076-22		01							01	150			780104	721151	SW								
0600081		15.90	03	0.04	01	06	7/89	AG		GW	2		0	CITY OF POMPANO BEACH				06	09	15	0.8	23	44.00	0.75
	0600081-1		01	6.00	02	90				02	400	N		792774	693839	GW	SALINE WATER INTRUSION IS A PROBLEM IN THIS AREA.							
	0600081-2		01	6.00	02	90				02	370	N		792088	693761	GW								
0600083		144.21	03	21.53	02	06	3/89	GLF		BOTH	2		1	SABAL PALMS, LTD				06	09	15	0.2	23	115.00	0.75
	0600083-1		01	10.00	02	70				02	750	N		756608	676491	GW	THE SURFACE WATER SOURCE IS THE TURNPIKE CANAL.							
	0600083-2		01	10.00	02	80				02	750	N		758983	677418	GW								
	0600083-3		01							03	4500			757647	675071	SW								
0600087		26.94	03	4.26	02	06	4/89	AG		SW	0		1	FORMANS DAIRY PALM NURSERY				06	09	15	0.4	5	15.00	0.50
	0600087-1		01	12.00					0		5000			752207	639606	SW								
	0600087-2		01	36.00					1					753341	639337	SW								
0600089		529.00	03	79.00	02	06	2/82	GLF		SW	0		6	MONTWOOD, INCORPORATED				06	09	15	0.2	23	281.00	0.50
	0600089-1		01	6.00						03	750			740710	686171	SW	THE SURFACE WATER SOURCE IS THE ON-SITE LAKE SYSTEM.							
	0600089-2		01	6.00						03	750			740827	686247	SW	CURRENT DISTRICT CRITERIA WOULD ASSIGN ONLY A 75%							
	0600089-3		01	6.00						03	750			740909	686329	SW	IRRIGATION EFFICIENCY.							
	0600089-4		01	6.00						03	750			741088	686500	SW	THE ANNUAL ALLOCATION WAS ESTIMATED. IT IS NOT							
	0600089-5		01	6.00						03	750			741014	686369	SW	PART OF THE LIMITING CONDITIONS OF THE PERMIT.							
	0600089-6		01	6.00						03	750			740909	686201	SW	THE PERMIT EXPIRED ON 4-15-89.							
0600090		71.84	03	11.37	02	06	5/89	AG		SW	0		2	RICHARD C.NAUGLE				06	09	15	0.4	5	16.00	0.20
	0600090-1		01	6.00						03	1500			743250	627560	SW								
	0600090-2		01	6.00						03	1500			743480	627577	SW								
0600094		307.22	03	45.87	02	06	1/90	GLF		SW	0		8	WOODLANDS GOLF ASSOCIATION				06	09	15	0.2	23	245.00	0.75

TABLE C-7. Non-Public Water Supply Spreadsheet (Continued)

0600094-1	01	4.00 02			02	02	300	751670 675445 SW						THE SURFACE WATER SOURCES ARE ON-SITE LAKES
0600094-2	01	4.00 02			02	02	300	753647 676180 SW						AND CANALS.
0600094-3	01	4.00 02			02	02	300	754939 676320 SW						
0600094-4	01	4.00 02			02	02	300	752524 673579 SW						
0600094-5	01	4.00 02			02	02	300	751468 672221 SW						
0600094-6	01	4.00 02			02	02	300	752865 672697 SW						
0600094-7	01	4.00 02			02	02	300	753523 672094 SW						
0600094-8	01	4.00 02			02	02	300	755161 672419 SW						
0600096	90.61 03	20.09 02	06	4/89	AG	SW	0	1 MCJUNKIN W.S.	06 09	63	0.2	23	100.00 0.50	
0600096-1	01	14.00 02			12		4000	754577 727308 SW						THE SURFACE WATER SOURCE IS THE HILLSBORO CANAL.
0600098	73.69 03	0.21 01	06	6/85	IND	GW	1	0 GARDEN POINT, INC.	06 09					
0600098-1	01	6.00 02	74	65	65	01	140 N	789883 689954 GW						THIS PERMIT IS FOR AIR CONDITIONING (INDUSTRIAL WATER USE).
0600099	179.61 03	28.42 02	06	5/89	GLF	SW	0	4 JAFFEE ISIDORE	06 09	15	0.4	5	150.00 0.75	
0600099-1	01	6.00 02			5	02	700	766800 605115 SW						THE SURFACE WATER SOURCE ARE THE ON-SITE LAKES.
0600099-2	01	6.00 02			5	02	700	766974 605132 SW						
0600099-3	01	2.00 02			5	01	250	767151 605126 SW						
0600099-4	01	4.00 02			5	02	500	764982 607162 SW						
0600105	230.00 04		06	9/78	GLF	GW	3	0 CORAL RIDGE COUNTRY CLUB	06 09	15	0.8	5	212.00 0.50	
0600105-1	01	12.00 02	85	85		02	450 N	789656 670706 GW						THE PERMIT EXPIRED ON 4-15-89 AND THE PERMITTEE IS
0600105-2	01	12.00 02	85	85		02	450 N	789384 670693 GW						WORKING TO RENEW THE PERMIT. THE PERMITTEE IS
0600105-3	01	12.00 02	85	85		02	450 N	789505 670888 GW						CURRENTLY EXPERIENCING A WATER INTRUSION PROBLEM.
0600106	43.89 03	6.55 02	06	12/88	AG	SW	0	3 CATHOLIC CEMETERIES	06 09	15	0.2	23	35.00 0.75	
0600108	01	3.00 02			3	03	352	761758 682126 SW						THE SURFACE WATER SOURCE IS ON-SITE LAKES
0600108	01	3.00 02			3	03	352	761782 682287 SW						
0600108	01	3.00 02			3	03	250	761764 682408 SW						
0600107	1470.00 04	1183.00 02	06	4/77	AG	SW	0	2 J. H. W. FARMS	06 09	57	0.2	5	1360.00 0.50	
0600107-1	01					03	24000	737676 657103 SW						THE PERMITTEE GROWS SWEET CORN.
0600107-2	01					03	16000	730295 658795 SW						
0600107-3	01	24.00						SW						
0600108	309.85 03	47.84 02	06	5/89	GLF	SW	0	6 BONAVENTURE RESORT & SPA	06 09	15	0.2	5	243.00 0.75	
0600108-1	01	9.00 02			3	01	600	706358 652160 SW						THE SURFACE WATER SOURCES ARE THE ON-SITE LAKES.
0600108-2	01	6.00 02			3	01	250	706552 652141 SW						
0600108-3	01	02			3	01	600	708191 647438 SW						
0600108-4	01	6.00 02			3	02	600	706120 649800 SW						
0600108-5	01	6.00 02			3	02	600	706120 649799 SW						
0600108-6	01	6.00 02			3	02	250	706120 649798 SW						
0600110	20.73 03	3.29 02	06	2/89	AG	SW	0	6 ORIOLE GARDENS CONDO ASSOC., INC.	06 09	15	0.8	23	20.00 0.75	
0600110-1	01	3.00				03	3500	754626 691766 SW						THE SURFACE WATER SOURCE IS THE C-14 CANAL.
0600110-2	01	3.00				03	3500	754770 691761 SW						
0600110-3	01	3.00				03	3500	755248 691733 SW						
0600110-4	01	3.00				03	3500	755366 691742 SW						
0600110-5	01	3.00				03	3500	755923 691749 SW						
0600110-6	01	3.00				03	3500	756067 691754 SW						

TABLE C-7. Non-Public Water Supply Spreadsheet (Continued)

0600122		208.08	03	57.12	02	06	3/89	AG	GW	39	0	CITY OF FORT LAUDERDALE				06 09	15	0.4	5	301.50	0.75
	0600122-1		01	3.00	02	65			02	80	N	774959	677830	GW	THESE WELLS ARE USED TO IRRIGATE PARKS AND OTHER						
	0600122-2		01	8.00	02				02	300	N	775018	677259	GW	FACILITIES THROUGHOUT THE CITY. WELLS 24 THROUGH						
	0600122-3		01	4.00	02				02	300	N	775027	676299	GW	30 ARE LOCATED ADJACENT TO THE TIDAL PORTION OF THE						
	0600122-4		01	3.00	02				02	80	N	773498	674931	GW	NORTH FORK OF THE NEW RIVER CANAL. THE CITY WILL						
	0600122-5		01	4.00	02				02	150	N	785471	676242	GW	EVENTUALLY USE CITY WATER TO IRRIGATE THESE AREAS.						
	0600122-6		01	6.00	02	75			02	400	N	765096	661314	GW	THEREFORE, THE POTENTIAL FOR SALINE WATER INTRUSION						
	0600122-7		01	10.00	02	90			02	400	N	766135	661368	GW	WILL BE REDUCED. WELL 15 HAS BEEN INCLUDED IN						
	0600122-8		01	12.00	02	75			03	0	N	766915	659027	GW	THE CITY'S SALT PROGRAM. THE WELL CONSTRUCTION						
	0600122-9		01	12.00	02	80			03	0	N	766917	658657	GW	DETAILS FOR MANY OF THE WELLS WERE NOT						
	0600122-10		01	12.00	02	84			03	0	N	766897	658342	GW	GIVEN AT TIME OF PERMIT REISSUANCE.						
	0600122-11		01	12.00	02	98			03	0	N	765816	657382	GW							
	0600122-12		01	12.00	02	105			03	0	N	765836	657175	GW							
	0600122-13		01	12.00	02	133			03	0	N	765821	656995	GW							
	0600122-14		01	4.00	02				02	150	N	775296	658677	GW							
	0600122-15		01	4.00	02	60	56		02	150	N	780761	656624	GW							
	0600122-16		01	4.00	02				02	150	N	775350	655425	GW							
	0600122-17		01	4.00	02				02	150	N	783935	655709	GW							
	0600122-18		01	4.00	02				02	400	N	784284	655088	GW							
	0600122-19		01	4.00	02				02	300	N	783693	654487	GW							
	0600122-20		01	4.00	02				02	300	N	776654	652728	GW							
	0600122-21		01	10.00	02	84			02	400	N	790095	665084	GW							
	0600122-22		01	4.00	02				02	150	N	782205	661138	GW							
	0600122-23		01	4.00	02				02	150	N	774583	651344	GW							
	0600122-24		01	3.00	02	74			02	80	N	768594	650397	GW							
	0600122-25		01	3.00	02	76			02	80	N	770907	650459	GW							
	0600122-26		01	3.00	02	74			02	0	N	773145	650755	GW							
	0600122-27		01	3.00	02	63			02	80	N	775995	650661	GW							
	0600122-28		01	3.00	02	63			02	80	N	777625	650903	GW							
	0600122-29		01	3.00	02	63			02	80	N	780742	651066	GW							
	0600122-30		01	3.00	02	63			02	0	N	781097	651117	GW							
	0600122-31		01	4.00	02				02	150	N	768062	646849	GW							
	0600122-32		01	4.00	02				03	0	N	781297	647475	GW							
	0600122-33		01	4.00	02				02	150	N	768745	646057	GW							
	0600122-34		01	4.00	02				02	150	N	764990	641224	GW							
	0600122-35		01	6.00	02				02	150	N	780111	642289	GW							
	0600122-36		01	10.00	02				02	500	N	778122	641248	GW							
	0600122-37		01	10.00	02	101			02	500	N	779469	641297	GW							
	0600122-38		01	10.00	02	75			02	500	N	778720	640325	GW							
	0600122-39		01	4.00	02				02	0	N	779265	638108	GW							
0600126		32.50	04	5.21	02	06	10/77	AG	SW	0	3	EAST MARSH NURSERY NORTH, INC.				06 09	15	0.2	23	26.00	0.50
	0600126-1		01						03	2500		752596	727579	SW	THE PERMITTEE GROWS NURSERY STOCK IN CONTAINERS.						
	0600126-2		01						03	2500		751705	727726	SW	THE PERMIT EXPIRED ON APRIL 15, 1989 AND HAS NOT						
	0600126-3		01						03	2500		751775	727555	SW	BEEN RENEWED.						
0600130		119.74	03	18.94	02	06	5/88	AG	BOTH	4	2	SOUTH BROWARD PARK DISTRICT				06 09	15	0.4	5	100.00	0.75
	0600130-1		01	6.00	02		65		02	400	N	772139	619916	GW	THE SURFACE WATER SOURCE IS AN ON-SITE LAKE.						
	0600130-2		01	3.00	02		65		01	200	N	772061	620280	GW							
	0600130-3		01	3.00	02		65		01	200	N	772625	618928	GW							
	0600130-4		01	2.00	02		65		01		N	771062	619657	GW							
	0600130-5		01	4.00					02	200		771204	618758	SW							

TABLE C-7. Non-Public Water Supply Spreadsheet (Continued)

	0600130-6		01	4.00					02	200		772178	619719	SW								
0600131		28.87	03	5.29	02	06	4/89	AG	SW	0		2 NATIONAL NURSERIES				06	09	15	0.8	5	9.00	0.20
	0600131-1		01	6.00					01	200		733564	623452	SW	THE SURFACE WATER SOURCE IS AN ON-SITE LAKE.							
	0600131-2		01	6.00					01	200		733525	623352	SW								
0600149		287.37	03	45.47	02	06	5/89	GLF	BOTH	1		4 JACARANDA COUNTRY CLUB				06	09	15	0.4	5	240.00	0.75
	0600149-1		01	10.00	02	125	40	40	02	800	Y	740413	644677	GW	THE SOURCE OF SURFACE WATER IS THE ON-SITE LAKE							
	0600149-2		01	10.00	02	125	40	40	02	800	Y	739284	648786	GW	SYSTEM.							
	0600149-3		01	6.00					02	300		738763	647331	SW								
	0600149-4		01	10.00					02	600		737974	646207	SW								
	0600149-5		01	10.00					02	600		738107	646397	SW								
	0600149-6		01	6.00					02	250		738271	646272	SW								
0600155		545.31	03	115.56	02	06	7/89	AG	SW	0		2 HENDRIX, CHARLES W.				06	09	63	0.2	23	700.00	0.50
	0600155-1		01	18.00	02					7500		747232	729649	SW	THE SURFACE WATER SOURCE IS THE HILLSBORO CANAL.							
	0600155-2		01	28.00	02					14000		750452	728635	SW								
0600181		3.52	03	1.57	02	06	7/89	AG	GW	1		0 CITY OF LAUDERDALE LAKES				06	09	15	0.2	5	8.00	0.75
	0600181-1		01	10.00	02	115	80	22	02	500	Y	760152	668807	GW								
0600185				1858.70	02	06	10/86	AG	SW	0		9 OLD PLANTATION WCD				06	09	57	0.4	5	2400.00	0.50
0600185																	09	15	0.4	5	3616.00	0.50
	0600185-1		01	48.00	01			-2		0		730267	660524	SW	THE SURFACE WATER SOURCES ARE THE NORTH NEW RIVER							
	0600185-2		01	48.00	01			-2		0		730345	655408	SW	CANAL AND THE C-42 CANAL.							
	0600185-3		01						03	45000		751400	642108	SW	FACILITIES 1 AND 2 ARE CULVERTS.							
	0600185-4		01						03	45000		751508	642013	SW	THE EXISTING PERMIT EXPIRED ON 4-15-89.							
	0600185-5		01						03	45000		740723	644214	SW								
	0600185-6		01						03	45000		740799	644117	SW								
	0600185-7		01						03	45000		740712	644060	SW								
	0600185-8		01						03	45000		740632	644134	SW								
	0600185-9		01						03	45000		735507	645571	SW								
	0600185-10		01						03	45000		735609	645464	SW								
	0600185-11		01						03	45000		735492	645381	SW								
	0600185-12		01						03	45000		735413	645514	SW								
	0600185-13		01						03	45000		751095	655511	SW								
	0600185-14		01						03	45000		751140	655416	SW								
	0600185-15		01						03	45000		750996	655431	SW								
0600193		106.22	03	12.99	02	06	8/87	GLF	BOTH	12		3 POMPANO PARK RACEWAY				06	09	15	0.4	23	90.30	0.75
	0600193-1		01	4.00	02	80	80	80	01	200	N	776830	688568	GW	THE SOURCES FOR SURFACE WATER ARE THE ON-SITE							
	0600193-2		01	2.00	02	80	80	80	01	36	N	777532	688610	GW	LAKE SYSTEM AND THE C-14 CANAL.							
	0600193-3		01	2.00	02	80	80	80	01	36	N	777566	688138	GW	THERE ARE TWO TYPES OF WATER USES; GOLF							
	0600193-4		01	2.00	02	80	80	80	01	36	N	777722	688650	GW	COURSE AND RECREATIONAL.							
	0600193-5		01	2.00	02	80	80	80	01	36	N	777755	688119	GW								
	0600193-6		01	8.00	02			1	01	800		778868	688336	SW								
	0600193-7		01	4.00	02			1	01	200		778689	688459	SW								
	0600193-8		01	4.00	02	80	80	80	01	500	N	778024	689246	GW								
	0600193-9		01	3.00	02			1	01	30		778596	690399	SW								
	0600193-10		01	2.00	02	80	80	80	01	100	N	779931	688177	GW								
	0600193-11		01	3.00	02	80	80	80	01	28	N	779073	687269	GW								
	0600193-12		01	4.00	02	80	80	80	01	1000	N	777909	686863	GW								

TABLE C-7. Non-Public Water Supply Spreadsheet (Continued)

	0600193-13		01	8.00	02	80	80	80	01	1800	N		777397	686826	GW							
	0600193-14		01	2.00	02	80	80	80	01	36	N		776729	686218	GW							
	0600193-15		01	2.00	02	80	80	80	01	36	N		776737	686034	GW							
0600244		190.60	03	28.46	02	06	4/89	GLF	SW	0		4	GEORGE VALASSIS				06 09	15	0.2	23	152.00	0.75
	0600244-1		01	8.00					03	1900			781509	724078	SW	THE SURFACE WATER SOURCE IS THE C-2 CANAL.						
	0600244-2		01	8.00					03	150			781395	723243	SW							
	0600244-3		01	8.00					03	150			779846	722836	SW							
	0600244-4		01	8.00					03	75			779987	722825	SW							
0600245		28.20		7.10	02	06	6/79	AG	BOTH	1		1	HIGH SCHOOL CCC, BROWARD COUNTY				06 09	15	0.4	5	25.00	0.50
	0600245-1		01	10.00					03	700			720428	643483	GW	THE SURFACE WATER SOURCE IS A COUNTY CANAL.						
	0600245-2		01						03	200			719823	643931	SW	THE TD AND CD DEPTH OF THE WELL ARE UNKNOWN.						
0600253		89.80	03	14.21	02	06	5/89	AG	SW	0		1	RICHARD C. NAUGLE				06 09	15	0.4	5	20.00	0.20
	0600253-1		01	6.00					03	1500			748333	623395	SW	THE SURFACE WATER SOURCE IS AN ON-SITE POND.						
0600307		153.00	03	48.30	02	06	2/81	AG	SW	0		2	OAKRIDGE COUNTRY CLUB				06 09	15	0.4	5	170.00	0.50
	0600307-1		01						03	600			765068	626070	SW	THE SURFACE WATER SOURCES ARE THE ON-SITE LAKES.						
	0600307-2		01						03	600			767052	627022	SW	THE ANNUAL ALLOCATION IS ONLY AN ESTIMATE.						
0600310		113.88	03	0.75	01	06	9/85	IND	GW	1		0	BROWARD COUNTY PARKS				06 09					
	0600310-1		01	12.00	02	140	140		02	520	N		776009	717911	GW	THIS PERMIT IS FOR RECREATIONAL WATER USE.						
0600336		29.41	03	4.48	02	06	3/89	AG	GW	1		0	RICHARD DANIELS				06 09	15	0.4	23	25.00	0.75
	0600336-1		01	6.00	02	100	60		02	200	N		788334	695821	GW							
0600344		359.21	03	56.83	02	06	3/89	AG	SW	0		10	INVERRARY COUNTRY CLUB				06 09	15	0.4	5	300.00	0.75
	0600344-1		01	4.00					01	90			752363	670570	SW	THE SURFACE WATER SOURCE IS CANAL C-13.						
	0600344-2		01	12.00					02	100			752362	670515	SW							
	0600344-3		01	18.00					02	800			752358	670433	SW							
	0600344-4		01	18.00					02	800			754931	669091	SW							
	0600344-5		01	12.00					02	100			754956	669006	SW							
	0600344-6		01	18.00					02	800			754939	668953	SW							
	0600344-7		01	18.00					02	800			748794	666811	SW							
	0600344-8		01	12.00					02	100			748793	666732	SW							
	0600344-9		01	18.00					02	800			748802	666657	SW							
	0600344-10		01	18.00					02	800			750326	667069	SW							
0600345		86.96	03	13.43	02	06	9/88	AG	SW	0		6	STILES CORPORATION				06 09	15	0.2	5	68.20	0.75
	0600345-1		01	7.50					01	225			718911	651219	SW	THE SURFACE WATER SOURCE IS THE ON-SITE LAKE AND CANAL SYSTEM.						
	0600345-2		01	7.50					01	225					SW							
	0600345-3		01	7.50					01	225			716885	653452	SW							
	0600345-4		01	7.50					01	225			716885	653452	SW							
	0600345-5		01	7.50					01	225			716804	655411	SW							
	0600345-6		01	7.50					01	225			716804	655411	SW							
0600347		144.21	03	21.53	02	06	4/89	AG	SW	0		2	BROWARD COUNTY PARKS				06 09	15	0.2	23	115.00	0.75
	0600347-1		01	6.00	01			3	02	1000			769632	704191	SW	THE SURFACE WATER SYSTEM IS THE ON-SITE LAKE SYSTEM.						
	0600347-2		01	6.00	01			2	02	275			770125	708626	SW							

TABLE C-7. Non-Public Water Supply Spreadsheet (Continued)

0600354		26.19	03	4.14	02	06		12/88	AG		BOTH	1		2	BROWARD COMMUNITY COLLEGE				06	09	15	0.4	5	21.87	0.75
	0600354-1		01	4.00	02	45					01	150	N		750915	609566	GW	THE SURFACE WATER SOURCE IS THE ON-SITE LAKE SYSTEM							
	0600354-2		01	2.50							01	150			751105	609457	SW								
	0600354-3		01	3.00							01	125			751275	609552	SW								
0600357		22.35	03	3.40	02	06		3/89	AG		SW	0		4	PALM AIRE COUNTRY CLUB APARTMENTS				06	09	15	0.4	23	19.00	0.75
	0600357-1		01	4.00	01					4	02	350			774542	688050	SW	THE SURFACE WATER SOURCE IS THE ON-SITE LAKE SYSTEM.							
	0600357-2		01	4.00	01					4	02	350			774642	687947	SW	THE PROJECT SITE IS LOCATED UPSTREAM OF THE SALINITY CONTROL							
	0600357-3		01	4.00	01					4	02	100			774550	687932	SW	STRUCTURES ON THE POMPANO AND CYPRESS CREEK CANALS.							
	0600357-4		02									300			774505	687995	SW	PUMP # 4 IS PROPOSED.							
0600371				54.09	02	06		1/82	AG		BOTH	1		2	CRYSTAL LAKE FARM #1				06	09	63	0.4	23	70.00	0.50
	0600371-1		01	12.00	02	130					03	2500	N		777268	708878	GW	THE SURFACE WATER SOURCE IS A CANAL.							
	0600371-2		01								03	7500			774920	710153	SW	THE PERMITTEE ALSO RECEIVED 20 INCHES/ACRE FOR FLOOD CREDIT.							
	0600371-3		01								03	6000			774929	709464	SW	NO ANNUAL ALLOCATION WAS GIVEN.							
0600374		17.90	03	3.73	02	06		7/89	AG		BOTH	2		1	HOME GARDENS ASSOCIATES, INC.				06	09	15	3.6	5	28.00	0.75
	0600374-1		01	4.00	02	60					01	100	N		693399	632442	GW	THE SURFACE WATER SOURCE IS AN INDIAN TRACE DRAINAGE							
	0600374-2		01	2.00	02	60					01	100	N		693398	632265	GW	DISTRICT CANAL.							
	0600374-3		01								03	4500	N		693437	631667	SW								
0600375		126.66	03	19.98	02	06		2/88	AG		BOTH	1		8	UNIVERSITY OF FLORIDA				06	09	15	0.4	5	25.00	0.75
0600375																				09	15	0.4	5	20.00	0.20
	0600375-1		01								02	300	N		749575	639171	SW	THE SURFACE WATER SOURCE IS THE ON-SITE LAKE AND CANAL SYSTEM.							
	0600375-2		01								01	0	N		749951	636428	SW	THE PERMITTEE IS GROWING 25 ACRES OF GRASS AND 20 ACRES							
	0600375-3		01								01	0	N		749954	637343	SW	OF POTTED NURSERY STOCK. HOWEVER, PURSUANT TO DISTRICT							
	0600375-4		01								01	50	N		749525	638988	SW	POLICY NURSERY STOCK RECEIVES THE SAME ALLOCATION AS GRASS.							
	0600375-5		01								01	275	N		749607	636573	SW	POTTED NURSERY STOCK IS ASSIGNED AN IRRIGATION EFFICIENCY 20%.							
	0600375-6		01	2.50	02	30					03	100	N		748564	636671	GW	IN ADDITION, THE PERMITTEE HAS A 5-ACRE FISH FARM.							
	0600375-7		01								01	0	N		748584	636763	SW	THE ALLOCATION FOR THE FISH FARM WAS BASED ON							
	0600375-8		01								01	0	N		748653	636842	SW	EVAPOTRANSPIRATION RATES.							
	0600375-9		01								01	0	N		748653	636842	SW								
0600376		56.43	03	8.43	02	06		2/89	GLF		SW	0		2	BROKEN WOODS COUNTRY CLUB				06	09	15	0.2	23	45.00	0.75
	0600376-1		01	4.00							01	275			747196	706147	SW	THE SURFACE WATER SOURCES ARE ON-SITE LAKES AND CANALS.							
	0600376-2		01	4.00							02	325			748092	707125	SW								
0600377		106.77	03	16.97	02	06		6/89	GLF		SW	0		1	COUNTRY CLUB OF CORAL SPRINGS				06	09	15	0.8	23	103.00	0.75
	0600377-1		01	10.00							02	1200			737504	701735	SW	THE SURFACE WATER SOURCE IS AN ON-SITE LAKE.							
0600380		27.59	03	8.93	02	06		4/89	AG		BOTH	1		1	FRED SPEAR INC				06	09	63	0.8	23	60.00	0.50
	0600380-1		01	12.00	02	130					03	2500	N		772927	706835	GW	FACILITY # 1 IS A WELL; FACILITY # 2 IS A PUMP.							
	0600380-2		01								03	4500			774897	708041	SW	THIS PERMIT EXPIRED ON 6-1-89.							
0600382		54.33	03	11.31	02	06		4/89	AG		SW	0		3	BROWARD COUNTY PARKS AND RECREATION				06	09	15	0.4	5	113.60	0.75
	0600382-1		01	6.00	01					-3	02	400			739336	619219	SW	THE SURFACE WATER SOURCE IS AN ON-SITE LAKE.							
	0600382-2		01	6.00	01					-3	02	400			739336	619219	SW	THE PERMITTEE HAS A MODIFICATION IN HOUSE AT THE							
	0600382-3		01	6.00	01					-3	02	275			739336	619219	SW	PRESENT TIME.							
0600383		94.11	03	14.34	02	06		4/89	GLF		BOTH	1		1	HS RH LW & BJ BROUD				06	09	15	0.4	23	80.00	0.75
	0600383-1		01	12.00	02	80	60				02	975	N		768332	673331	GW	THE SURFACE WATER SOURCE IS AN ON-SITE LAKE.							
	0600383-2		01	9.50							02	720			768333	673482	SW								

TABLE C-7. Non-Public Water Supply Spreadsheet (Continued)

0600384		118.50	03	17.69	02	06	4/89	GLF	SW	0		2	TAM O'SHANTER GOLF CLUB				06	09	15	0.2	23	94.50	0.75
	0600384-1		01	6.00	02			12	02	750			779993	710676	SW	THE SURFACE WATER SOURCES ARE ON-SITE LAKES.							
	0600384-2		01	6.00	02			12	02	750			782561	710443	SW								
0600385		18.14	03	2.88	02	06	2/89	AG	GW	4		0	DEERFIELD BEACH HIGH SCHOOL				06	09	15	0.8	23	17.50	0.75
	0600385		01	6.00	02	60	60		02	500	N		788826	714153	GW								
	0600385		01	6.00	02	60	60		02	350	N		789296	713716	GW								
	0600385		01	6.00	02	60	60		02	350	N		789310	714198	GW								
	0600385		01	6.00	02	60	60		02	90	N		788883	713558	GW								
0600388				1296.00	02	06	2/82	AG	SW	0		1	D. S. BEATY FARMS, INC.				06	09	15	0.2	23	3000.00	0.50
0600388																		09	57	0.2	23	1000.00	0.50
	0600388-1		01	30.00					03	30000			730284	732951	SW	THE SURFACE WATER SOURCE IS THE HILLSBORO CANAL.							
0600393		191.58	03	30.31	02	06	10/89	GLF	BOTH	3		3	ROLLING HILLS GOLF RESORT				06	09	15	0.4	5	160.00	0.75
	0600393-1		01	4.00	02			12	02	90			742061	635404	SW	THE SURFACE WATER SOURCE IS AN ON-SITE LAKE.							
	0600393-2		01	6.00	02			12	02	250			742343	635538	SW								
	0600393-3		01	6.00	02			12	02	250			742099	635599	SW								
	0600393-2A		01	8.00	02	90	90		02	400	N		745052	634047	GW								
	0600393-2B		01	8.00	02	90	90		02	400	N		745052	634047	GW								
	0600393-2C		01	6.00	02	90	90		02	400	N		745052	634047	GW								
0600394		137.63	03	20.97	02	06	3/89	GLF	SW	0		4	A. HAROLD ANDERSON				06	09	15	0.4	23	117.00	0.75
	0600394-1		01	8.00					02	200			780218	708414	SW	THE SURFACE WATER SOURCE IS THE ON-SITE LAKE SYSTEM.							
	0600394-2		01	10.00					02	600			781555	708598	SW	THE PUMP # 4 IS A JOCKEY PUMP.							
	0600394-3		01	10.00					02	600			781597	708535	SW								
	0600394-4		01	6.00					01	120			781653	708600	SW								
0600395		1080.00	03	120.00	02	06	12/89	AG	SW	0		1	WILES FARM				06	09	63	0.8	23	102.00	0.50
	0600395-1		01	20.00	01			6	03	10000			761522	711046	SW								
0600396		9250.00	03	950.40	02	06	3/89	AG	SW	0		2	DEERFIELD IRRIGATION CO. INC. (DIC)				06	09	63	0.8	23	150.00	0.50
0600396																		09	62	0.8	23	675.00	0.50
	0600396-1		01	36.00					03	22000			761151	725368	SW	THE SURFACE WATER SOURCE IS THE HILLSBORO CANAL VIA							
	0600396-2		01	36.00					03	22000			766073	719797	SW	THE PINETREE WATER CONTROL DISTRICT A-4 CANAL.							
0600397		23.32	03	11.20	02	06	4/89	AG	SW	0		1	BUTLER PROPERTIES, LTD				06	09	15	0.8	23	72.00	0.50
	0600397-1		01	24.00	01			4	02	10000			769373	716574	SW	THIS PROJECT IS PART OF THE DICI.							
0600398		34.37	03	7.63	02	06	4/89	AG	SW	0		2	FLAMINGO GARDENS				06	09	15	0.4	5	20.00	0.75
0600398																		09	13	0.4	5	20.00	0.75
	0600398-1		01	4.00					03	200			726819	637780	SW	THE PERMITTEE IS GROWING 20 ACRES OF CITRUS AND 20 ACRES							
	0600398-2		01	4.00					03	200			727299	632894	SW	OF NURSERY STOCK.							
0600401		26.90	03	27.50	02	06	3/82	AG	SW	0		1	SMITTY "K" FARM, INC.				06	09	63	0.2	23	115.00	0.50
	0600401-1		01	16.00					03	8000			765932	700170	SW	THE SURFACE WATER SOURCE IS THE TARTON MINTO CANAL.							
0600402		39.80	03	41.00	02	06	3/82	AG	SW	0		1	SMITTY "K" FARM, INC.				06	09	63	0.2	23	170.00	0.50
	0600401-1		01	16.00					03	10000			763830	719705	SW	THE PERMIT EXPIRED ON 4-15-89.							
0600406		203.55	03	32.21	02	06	1/89	GLF	SW	0		8	HOLLYBROOK GOLF & TENNIS CLUB				06	09	15	0.4	5	170.00	0.75
	0600406-1		01	4.00					03	180			740340	608186	SW	THE SURFACE WATER SOURCES ARE ON-SITE LAKES AND PONDS.							

TABLE C-7. Non-Public Water Supply Spreadsheet (Continued)

	0600406-2	01	6.00						03	400		740993	607825	SW								
	0600406-3	01	2.00						03	100		741324	606153	SW								
	0600406-4	01	3.00						03	120		740134	605620	SW								
	0600406-5	01	3.00						03	120		739409	605495	SW								
	0600406-6	01	3.00						03	120		739428	605085	SW								
	0600406-7	01	3.00						03	120		740271	604614	SW								
	0600406-8	01	8.00						03	650		740316	605285	SW								
0600407		53.88	03	8.53	02	06	3/89	GLF	GW	1	0	COOPER CITY GOLF COURSE, INC.				06	09	15	0.4	5	45.00	0.75
	0600407	01	8.00	02	240				02	600 N		739449	627808	GW	THE TOTAL DEPTH GIVEN IN TABLE A SHOULD BE VERIFIED.							
0600408		38.32	03	6.06	02	06	4/89	GLF	SW	0	9	THOMAS N. KEARNS				06	09	15	0.4	5	32.00	0.75
	0600408-1	01	2.00						01	100		750951	645504	SW	THE SURFACE WATER SOURCE IS THE INTERNAL CANAL SYSTEM.							
	0600408-2	01	2.00						01	100		750497	647273	SW								
	0600408-3	01	2.00						01	100		750363	647638	SW								
	0600408-4	01	2.00						01	100		748894	647622	SW								
	0600408-5	01	2.00						01	100		748023	648323	SW								
	0600408-6	01	2.00						01	100		748388	648683	SW								
	0600408-7	01	2.00						01	100		749806	648823	SW								
	0600408-8	01	2.00						01	100		749115	649209	SW								
	0600408-9	01	2.00						01	100		748529	649644	SW								
0600412		65.17	03	12.16	02	06	3/89	GLF	SW	0	4	TOURNAMENT PLAYERS CLUB AT EAGLE TR				06	09	15	3.6	23	102.00	0.75
	0600412-1	01	4.00	01					02	265		732242	699139	SW	THE SURFACE WATER SOURCE IS AN ON-SITE LAKE.							
	0600412-2	01	6.00	01					02	400		732250	699230	SW								
	0600412-3	01	6.00	01					02	620		732384	699198	SW								
	0600412-4	01	8.00	01					02	1040		732369	699077	SW								
0600414		152.00	03	186.00	02	06	5/82	AG	SW	0	1	E.R. CROSSMAN FARMS				06	09	57	0.2	23	210.00	0.75
	0600414-1	01							03	15000				SW	THE SURFACE WATER SOURCE IS THE HILLSBORO CANAL.							
0600416		79.65	03	25.30	02	06	5/82	GLF	BOTH	1	2	WILLIAM LEONARD				06	09	15	0.8	23	102.42	0.50
	0600416-1	01	8.00	02	60				03	900 N		769767	724558	GW	THE SURFACE WATER SOURCES ARE ON-SITE LAKES.							
	0600416-2	01							03	900 N		769477	724489	SW	THE ESTIMATED ANNUAL ALLOCATION IS 79.65 MG. IT IS NOT PART OF							
	0600416-3	01							03	900 N		769863	724347	SW	THE PERMIT.							
0600431		65.26	03	10.32	02	06	3/89	AG	GW	3	0	BROWARD COUNTY AVIATION DEPT.				06	09	15	0.4	5	54.50	0.75
	0600431-1	01	6.00	02	80	25			01	300 Y		783412	632788	GW	THE WELLS ARE LABELED 4, 5, AND 6 IN TABLE A OF THE							
	0600431-2	01	4.00	02	80	25			01	300 Y		781124	632105	GW	CORRESPONDING STAFF REPORT.							
	0600431-3	01	6.00	02	80	25			01	300 N		782336	631462	GW								
0600483		42.33	03	6.54	02	06	3/89	AG	SW	0	2	RACAL MILGO, INC.				06	09	15	0.2	5	33.20	0.75
	0600483-1	01	3.00	01				2	01	180		717753	658178	SW	THE SURFACE WATER SOURCE IS AN ON-SITE LAKE SYSTEM.							
	0600483-2	01	3.00	01				2	01	180		719114	658418	SW								
0600496		113.75	03	18.00	02	06	3/89	AG	SW	0	3	AMACORP, INC.				06	09	15	0.4	5	95.00	0.75
	0600496-1	01	6.00						02	565		729931	606162	SW	THE SURFACE WATER SOURCE IS A ON-SITE LAKE.							
	0600496-2	01	6.00						02	565		729970	606126	SW								
	0600496-3	01	4.00						02	265		730036	606181	SW								
0600503		135.16	03	0.43	01	06	12/83	IND	BOTH	2	8	FLORIDA POWER & LIGHT COMPANY				06						
	0600503-4BW	01	20.00	02	55	55	-23		02	3000 N		762086	629365	GW	THE SURFACE WATER SOURCE IS THE DAINA CUTOFF CANAL; A							

TABLE C-7. Non-Public Water Supply Spreadsheet (Continued)

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         0600503-5BW  01    20.00 02   55     55 -23 02   3000 N      762211  629364 GW  BRACKISH WATER BODY.
         0600503-4A   01                             02  58000        762698  631052 SW  WATER WITHDRAWN FROM THE CANAL IS RETURNED TO THE CANAL.
         0600503-4B   01                             02  58000        762650  631547 SW  THIS PERMIT IS FOR INDUSTRIAL WATER USE.  THE APPLICANT REQUESTS
         0600503-4    01     7.13                    02    600        762801  631396 SW  TO INCREASE THE WITHDRAWALS FROM THE WELLS FROM 0.432 MGD
         0600503-4A1  01    12.88                    02   3000        762643  631292 SW  TO 8.64 MGD WITHIN THE IN-HOUSE MODIFICATION.
         0600503-5A   01                             02  58000        762924  631019 SW  THIS INCREASE IN WITHDRAWALS MAY INDUCE SALINE WATER INTRUSION
         0600503-5B   01                             02  58000        763073  631487 SW  WITHIN THE ADJACENT AREA.
         0600503-5    01     7.13                    02    600        762866  631334 SW  FP&L ALSO HAS A GENERAL PERMIT FOR IRRIGATION AT THE SITE.
         0600503-5A1  01    12.88                    02   3000        762590  631148 SW

0600515          58.34 03   12.13 02   06   2/89   GLF SW       0   2 FWCD INC.                            06 09   15   3.6    5    91.28 0.75
         0600515-1    01     4.00 01             -3 02     750        721210  607079 SW  THE SURFACE WATER SOURCE IS THE ON-SITE LAKE SYSTEM.
         0600515-2    01     4.00 01             -3 02     750        724133 6059011 SW

0600533         163.62 03   34.07 02   06   2/89   AG  SW       0   6 FWDC INC.                            06 09   15   3.6    5   256.00 0.75
         0600533-1    01          01             -3 02     655        720862  605562 SW  THE SURFACE WATER SYSTEM IS THE ON-SITE LAKE SYSTEM.
         0600533-2    01          01             -3 02     655        722469  606044 SW
         0600533-3    01          01             -3 02     655        723849  604500 SW
         0600533-4    01          01             -3 02     180        721902  603895 SW
         0600533-1A   01          01             -3 02     655        719477  606559 SW
         0600533-2A   01          01             -3 02     655        719796  603951 SW

0600652                      8.03 02   06   5/85   AG  SW       0   1 ROBERT M. DUGAN                      06 09   15   0.2    5    40.80 0.75
         0600652-1    01                             02   1100        719332  656968 SW  THE SURFACE WATER SOURCE IS AN ON-SITE LAKE.

0600667          92.00 03   15.32 02   06  12/88   AG  BOTH     3-  2 BROWARD COMMUNITY COLLEGE (CENTRAL) 06 09   15   0.8    5    87.00 0.75
         0600667-1W   01     6.00 02   70     70     02    400 N      750628  635947 GW  THE SURFACE WATER SOURCE IS THE ON-SITE LAKE SYSTEM.
         0600667-2W   01     6.00 02   70     70     02    400 N      751153  635860 GW  WELLS ARE LABELED WITH A "W"; PUMPS ARE LABELED WITH AN "S".
         0600667-3W   01     6.00 02   70     70     01    500 N      750701  634881 GW  I AM NOT SURE IF THE INTAKE DEPTH ON THE PUMPS IS RELATIVE TO
         0600667-1S   01     8.00                    01    200        751117  636884 SW  NGVD OR DEPTH BELOW WATER.
         0600667-2S   01     8.00                    01    225        751874  634376 SW

0600686          59.13 03    0.18 01   06   9/85   IND GW       2   0 CENVILL PROPERTIES, INC              06 09
         0600686-1    01    12.00 02   60     40  60 01    400 N      721448  605112 GW  WELL DESCRIPTIONS TAKEN FROM WELL COMPLETION REPORTS
         0600686-2    01    12.00 02   60     40  60 01    400 N      721467  605010 GW  THIS PROJECT IS FOR INDUSTRIAL WATER USE, AIR-CONDITIONING.

0600687         105.00 03    0.29 01   06   9/85   IND GW       6   0 EXXON COMPANY U.S.A.                 06 09
         0600687-RW24 01    36.00 02   16      1            50 N      769357  610606 GW  THIS IS AN INDUSTRIAL WATER USE PERMIT, HYDROCARBON RECOVERY
         0600687-RW25 01    36.00 02   18      1            50 N      769930  610850 GW  OF A GASOLINE SPILL.  THE PERMIT WAS ACTIVE FROM 9/85 TO 9/86
         0600687-MW27 01     4.00 02   25      5            50 N      770050  610450 GW  SINCE THERE IS NO CORRESPONDENCE PAST SEPTEMBER 1985,
         0600687-MW28 01     4.00 02   25      5            50 N      770100  610600 GW  I PRESUME THE PROJECT WAS COMPLETED SUCCESSFULLY.
         0600687-MW34 01     4.00 02   25      5            50 N      770210  610942 GW
         0600687-MW37 01     4.00 02   25      5            50 N      770271  610471 GW

0600696         150.87 03   23.87 02   06   1/89   GLF BOTH     1   1 GOLF, INC.                           06 09   15   0.4    5   126.00 0.75
         0600696-1    01     8.00 02   58     52     02    800 N      743330  638301 GW  THE SURFACE WATER SOURCE IS AN ON-SITE LAKE.
         0600696-2    01     8.00                    02    800 N      743580  639393 SW

0600711         140.20 03    0.58 01   06  12/85   IND GW       2   0 ROLLING HILLS HOTEL & RESTAURANT, I 06 09
         0600711-1    01    10.00 02   90     80   0 01    300 N      745638  636251 GW  THIS PROJECT IS FOR INDUSTRIAL WATER USE, AIR CONDITIONING.
         0600711-2    02    12.00 02   60     50   6 01    300 N      745648  636158 GW  DATA FOR WELL #1 WAS TAKEN FROM THE WELL COMPLETION REPROT;
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TABLE C-7. Non-Public Water Supply Spreadsheet (Continued)

0600741		99.99 03	15.23 02	06	8/89	AG	SW	0	5	WYNMOOR LTD.			06 09 15 0.4 23 85.00 0.75
	0600741-1	01	3.00				03	40		770063	699772	SW	THE SURFACE WATER SOURCE IS THE ON-SITE LAKE SYSTEM.
	0600741-2	01	4.00				03	100		770395	699205	SW	
	0600741-3	01	3.00				03	655		771550	699859	SW	
	0600741-4	01	3.00				03	655		771314	700554	SW	
	0600741-5	01	3.00				03	655		771630	699334	SW	
0600763	36.5	03	0.12 01	06	5/86	IND	GW	2	0	BUD GOOD			06 09
	0600763-1	01	8.00 02	25	25		02	40 N		746620	612789	GW	THIS PERMIT IS FOR INDUSTRIAL WATER USE, HYDROCARBON RECOVERY.
	0600763-2	01	8.00 02	25	25		02	40 N		746617	612868	GW	PLANAR COORDINATES WERE GIVEN
0600786		118.00 03	0.35 01	06	8/86	IND	GW	3	0	AMERICAN V. MUELLER			06 09
	0600786-1	01	8.00 02	50	5	30	01	150 N		773243	674629	GW	THIS IS AN INDUSTRIAL WATER USE PERMIT FOR A CONTAMINATION CLEANUP.
	0600786-2	01	8.00 02	50	5	30	01	150 N		773155	674129	GW	AFTER PASSING THROUGH AN AIR-STRIPPER, THE WATER IS DISCHARGED
	0600786-3	01	8.00 02	50	5	30	01	150 N		773183	673952	GW	INTO A FRENCH DRAIN.
0600814		10.37 03	0.86 02	06	4/89	AG	SW	0	1	PARKWOOD HOME OWNERS ASSOC.			06 09 15 0.2 5 11.98 0.75
	0600814-1	01	2.00				03	20		737365	672762	SW	THE SURFACE WATER SOURCE IS AN ON-SITE LAKE.
0600837		9.70 01	9.70 01	06	3/87	REC	SW	0	2	BROWARD COUNTY WRMD			06
	0600837-1	02	24.00 01			4	03	6750 Y		782807	725535	SW	THE SURFACE WATER SOURCE IS THE HILLSBORO CANAL.
	0600837-2	02	24.00 01			4	03	6750 Y		782873	725534	SW	THE COUNTY DESIRES TO PLACE PUMPS ON THREE NORTH-SOUTH CANALS
0600862		2630.00 03	7.20 01	06	7/87	IND	SW	0	2	TURTLE RUN JOINT VENTURE			06 09
	0600862-1	01	8.00 01			-14	03	2500		757040	708783	SW	THIS IS A DEWATERING OPERATION. EVEN THOUGH SURFACE WATER PUMPS
	0600862-2	01	8.00 01			-14	03	2500		758097	707134	SW	ARE USED, THE PERMITTEE IS WITHDRAWING GROUND WATER.
0600888		3.60 01	8.64 01	06	10/87	IND	GW	800	0	WASTE MANAGEMENT OF NORTH AMERICA			06 09
	0600888-1	01	2.00 02	8		5	03	6000 N				GW	THE DEWATERING OPERATION CEASED OPERATION IN MAY 1988.
0600889		169.38 03	35.27 02	06	10/87	AG	BOTH	30	36	CHAPEL TRAIL, LTD			06 09 15 3.6 5 265.00 0.75
	0600889-1	02	2.00 02	60	60	60	01	50 N				GW	ALL FACILITIES WERE PROPOSED AT TIME OF PERMIT ISSUANCE.
	0600889-2	02	2.00 02	60	60	60	01	50 N				GW	MORE ACCURATE WELL LOCATIONS MAY BE FOUND IN THE WELL
	0600889-3	02	2.00 02	60	60	60	01	50 N				GW	COMPLETION REPORTS WHICH THE PERMITTEE IS REQUIRED TO SUBMIT.
	0600889-4	02	2.00 02	60	60	60	01	50 N				GW	FACILITIES 1 THROUGH 30 ARE WELLS; 31-66 ARE SURFACE WATER PUMPS.
	0600889-5	02	2.00 02	60	60	60	01	50 N				GW	NONE OF THE WELLS WERE CONSTRUCTED AS OF 11-14-89.
	0600889-6	02	2.00 02	60	60	60	01	50 N				GW	
	0600889-7	02	2.00 02	60	60	60	01	50 N				GW	
	0600889-8	02	2.00 02	60	60	60	01	50 N				GW	
	0600889-9	02	2.00 02	60	60	60	01	50 N				GW	
	0600889-10	02	2.00 02	60	60	60	01	50 N				GW	
	0600889-11	02	2.00 02	60	60	60	01	50 N				GW	
	0600889-12	02	2.00 02	60	60	60	01	50 N				GW	
	0600889-13	02	2.00 02	60	60	60	01	50 N				GW	
	0600889-14	02	2.00 02	60	60	60	01	50 N				GW	
	0600889-15	02	2.00 02	60	60	60	01	50 N				GW	
	0600889-16	02	2.00 02	60	60	60	01	50 N				GW	
	0600889-17	02	2.00 02	60	60	60	01	50 N				GW	
	0600889-18	02	2.00 02	60	60	60	01	50 N				GW	
	0600889-19	02	2.00 02	60	60	60	01	50 N				GW	
	0600889-20	02	2.00 02	60	60	60	01	50 N				GW	
	0600889-21	02	2.00 02	60	60	60	01	50 N				GW	

TABLE C-7. Non-Public Water Supply Spreadsheet (Continued)

	0600889-22	02	2.00	02	60	60	60	01	50	N			GW						
	0600889-23	02	2.00	02	60	60	60	01	50	N			GW						
	0600889-24	02	2.00	02	60	60	60	01	50	N			GW						
	0600889-25	02	2.00	02	60	60	60	01	50	N			GW						
	0600889-26	02	2.00	02	60	60	60	01	50	N			GW						
	0600889-27	02	2.00	02	60	60	60	01	50	N			GW						
	0600889-28	02	2.00	02	60	60	60	01	50	N			GW						
	0600889-29	02	2.00	02	60	60	60	01	50	N			GW						
	0600889-30	02	2.00	02	60	60	60	01	50	N			GW						
	0600889-31	02	2.00					01	50				SW						
	0600889-32	02	2.00					01	50				SW						
	0600889-33	02	2.00					01	50				SW						
	0600889-34	02	2.00					01	50				SW						
	0600889-35	02	2.00					01	50				SW						
	0600889-36	02	2.00					01	50				SW						
	0600889-37	02	2.00					01	50				SW						
	0600889-38	02	2.00					01	50				SW						
	0600889-39	02	2.00					01	50				SW						
	0600889-40	02	2.00					01	50				SW						
	0600889-41	02	2.00					01	50				SW						
	0600889-42	02	2.00					01	50				SW						
	0600889-43	02	2.00					01	50				SW						
	0600889-44	02	2.00					01	50				SW						
	0600889-45	02	2.00					01	50				SW						
	0600889-46	02	2.00					01	50				SW						
	0600889-47	02	2.00					01	50				SW						
	0600889-48	02	2.00					01	50				SW						
	0600889-49	02	2.00					01	50				SW						
	0600889-50	02	2.00					01	50				SW						
	0600889-51	02	2.00					01	50				SW						
	0600889-52	02	2.00					01	50				SW						
	0600889-53	02	2.00					01	50				SW						
	0600889-54	02	2.00					01	50				SW						
	0600889-55	02	2.00					01	50				SW						
	0600889-56	02	2.00					01	50				SW						
	0600889-57	02	2.00					01	50				SW						
	0600889-58	02	2.00					01	50				SW						
	0600889-59	02	2.00					01	50				SW						
	0600889-60	02	2.00					01	50				SW						
	0600889-61	02	2.00					01	50				SW						
	0600889-62	02	2.00					01	50				SW						
	0600889-63	02	2.00					01	50				SW						
	0600889-64	02	2.00					01	50				SW						
	0600889-65	02	2.00					01	50				SW						
	0600889-66	02	3.00					01	90				SW						
0600908	160.45	03	25.39	02	06	3/88	GLF	SW	0		4	PINE ISLAND RIDGE COUNTRY CLUB INC		06	15	0.4	5	134.00	0.75
	0600908-1	01	6.00					03	900		737033	642144	SW	THE SURFACE WATER SOURCE IS THE ON-SITE LAKE SYSTEM.					
	0600908-2	01	6.00					03	3600		738277	642637	SW	THE PERMITTEE INDICATED THAT THERE ARE 82 OTHER SURFACE WATER					
	0600908-3	01	6.00					03	3600		738359	642625	SW	PUMPS. THESE PUMPS ARE USED BY ADJACENT HOME OWNERS AND					
	0600908-4	01	6.00					03	180		738502	642595	SW	WITHDRAW WATER FROM THE ON-SITE LAKE SYSTEM AND THE NORTH NEW RIVER.					

TABLE C-7. Non-Public Water Supply Spreadsheet (Continued)

0600914	13.41	03	2.12	02	06	4/88	AG	SW	0		1	ALFRED L. SIMPSON				06 09	15	0.4	5	11.20	0.75
0600914-1		02	3.00					03	250			744626	643821	SW	THE SURFACE WATER SOURCE IS AN ON SITE LAKE.						
0600915	183.96	03	0.50	01	06	4/8	IND	GW	3		0	RICK CASE ACURA				06 09			5		
0600915-1		01	6.00		90	80		01	200	N		760600	655375	GW	THIS IS AN INDUSTRIAL PERMIT.						
0600915-2			4.00		25			01	50	N		760601	655375	GW	IT WAS CANCELED ON SEPTEMBER 20TH, 1989.						
0600915-3			4.00		25			01	100	N		760602	655375	GW							
0600921	31.35	03	4.68	02	06	5/88	AG	SW	0		1	STAR OF DAVID MEMORIAL GARDENS				06 09	15	0.2	23	25.00	0.75
0600921-1		01	6.00					03	600			755352	681890	SW	THE SURFACE WATER SOURCE IS AN ON-SITE POND.						
0600937	531.00	03	5.90	01	06	7/88	IND	SW	0		1	WINSTON PARK, LTD				06					
0600937-1		01	12.00					02	4100					SW	THIS IS A DEWATERING OPERATION.						
0600945	89.80	03	14.21	02	06	9/88	AG	GW	3		0	NATIONAL NURSERIES LIMITED				06 09	15	0.4	5	20.00	0.20
0600945-1		01	12.00	02	60	50		01	1000	N		732706	624142	GW	THE ACTUAL CROP TYPE IS NURSERY STOCK, POTTED FOLIAGE PLANTS.						
0600945-2		01	16.00	02	60	50		01	2000	N		733034	624137	GW	ACCORDING TO DISTRICT POLICY, NURSERY STOCK RECEIVES THE SAME						
0600945-3		01	12.00	02	60	50		01	1000	N		733355	624162	GW	SUPPLEMENTAL CROP REQUIREMENT AS GRASS.						
0600949	30.60	03	4.72	02	06	9/88	AG	SW	0		2	SHELL OIL COMPANY				06 09	15	0.2	5	24.00	0.75
0600949-1		02	7.50					01	225			717247	655291	SW	THE SURFACE WATER SOURCE IS THE AN ON-SITE LAKE.						
0600949-2		02	7.50					01	225			717270	655170	SW	ONLY PUMP STATION # 4 IS COVERED UNDER THE PERMIT.						
0600950	102.26	03	21.30	02	06	9/88	AG	SW	0		6	BROWARD COUNTY (C.B. SMITH PARK)				06 09	15	3.6	5	160.00	0.75
0600950-1		01	4.00	02			10	02	250			724943	610108	SW	THE SURFACE WATER SOURCE IS THE ON-SITE LAKE SYSTEM.						
0600950-2		01	6.00	02			10	02	500			724997	610198	SW							
0600950-3		01	6.00	02			10	02	500			725074	610108	SW							
0600950-4		01	4.00	02			10	02	275			723681	611001	SW							
0600950-5		01	6.00	02			10	02	500			724499	610954	SW							
0600950-6		01	4.00	02			10	02	500			724568	611097	SW							
0600951	5.29	03	0.81	02	06	9/88	AG	GW	1		0	TIVOLI VENTURES, LIMITED				06 09	15	0.4	23	4.50	0.75
0600951-1		02	3.00	02	84	82		03	100	N		789426	719844	GW	THE PROJECT SITE IS LOCATED IN AN AREA WHERE SALINE WATER						
															INTRUSION IS A POTENTIAL PROBLEM.						
0600954	43.45	03	5.56	02	06	8/88	AG	GW	2		0	GULFSTREAM PARK RACING ASSOC.				06 09	15	0.8	5	16.50	0.75
0600954-1		01	12.00	02	43	16		02	500	Y		781667	600450	GW	IN ADDITION TO IRRIGATING 16.5 ACRES OF GRASS, THE PERMITTEE						
0600954-2		01	10.00	02	45	16		02	400	Y		781585	600588	GW	ALSO UTILIZES WATER TO MAINTAIN A 15.2 ACRE DIRT TRACK.						
0600960	1830.00	03	155.00	02	06	11/88	IND	SW	0		1	BROWARD COUNTY PARKS & RECREATION				06					
0600960-1		01	24.00	01			-1	03	10000	Y		765796	690037	SW	FACILITY # 2 IS A CULVERT.						
0600960-2		01	42.00	01			-4		0			765946	689050								
0600964	29.65	03	4.69	02	06	12/88	AG	BOTH	1		7	SUNBEAM PROPERTIES, INC.				06 09	15	0.4	5	24.76	0.75
0600964-1		01	5.00					01	120			736072	597225	SW	THE SURFACE WATER SOURCES ARE THE ON-SITE LAKES AND THE PALM CANAL.						
0600964-2		01	5.00					01	120			736790	598300	SW	PUMP # 4 IS AN EMERGENCY FIRE PUMP. IT IS ONLY USED IN THE						
0600964-3		01	3.00					01	120			735019	597553	SW	EVENT OF A FIRE OR INSUFFICIENT SUPPLY OF POTABLE WATER.						
0600964-4		01	8.00					01	1500			734970	597743	SW							
0600964-5		01	5.00	02	45	42	6	01	70	N		735478	597813	GW							
0600964-6		01	5.00					01	120			736147	597211	SW							
0600964-7		02	5.00					01	120			734667	597168	SW							
0600964-8		01	4.50					01	75			734907	598238	SW							

TABLE C-7. Non-Public Water Supply Spreadsheet (Continued)

0600969		45.27	03	6.99	02	06	1/89	AG	SW	0		2	AMERIFIRST DEVELOPMENT CORPORATION				06	09	15	0.2	5	35.50	0.75
	0600969-1		02	6.00					01	325			722347	656328	SW	THE SURFACE WATER SOURCE IS AN ON-SITE LAKE.							
	0600969-2		02	6.00					01	325			724851	656643	SW	THE PROJECT SITE IS COVERED UNDER DEVELOPMENT ORDER 732-X.							
0601009		15.57	03	2.46	02	06	3/89	AG	GW	1		0	E D C ASSOCIATES, LTD.				06	09	15	0.4	5	13.00	0.75
	0601009-1		02	4.00	02	100	40	10	01	100	Y		763014	666125	GW	THE PLANAR COORDINATES WERE GIVEN IN THE STAFF REPORT.							
0601038		31.70	03	6.60	02	06	4/89	AG	SW	0		4	NOJOSY CORPORATION				06	09	15	3.6	5	25.60	0.75
0601038																		09	15	3.6	5	6.40	0.20
	0601038-1		02	5.00					01	1400			688678	627382	SW	THE SURFACE WATER SOURCES ARE ON-SITE PONDS.							
	0601038-2		02	5.00					01	1400			688682	626664	SW	THE PLANAR COORDINATES WERE GIVEN IN THE STAFF REPORT.							
	0601038-3		02	5.00					01	1400			688703	625998	SW	THE PERMITTEE OWNS A NURSERY AND GROWS ORNAMENTAL PLANTS.							
	0601038-4		02	5.00					01	1400			688771	625095	SW								
0601047		91.74	03	14.16	02	06	5/89	AG	SW	0		4	C.M.D. DEVELOPMENT INC.				06	09	15	0.2	5	71.95	0.75
	0601047-1		02	6.00					01	90			707213	637608	SW	THE SURFACE WATER SOURCE IS THE ON-SITE LAKE SYSTEM.							
	0601047-2		02	6.00					01	90			707315	637632	SW								
	0601047-3		02	6.00					01	200			707879	634645	SW								
	0601047-4		02	6.00					01	200			708026	634628	SW								

APPENDIX D

CALIBRATION STEADY STATE WATER LEVELS, HORIZONTAL AND VERTICAL FLOW

LIST OF FIGURES - APPENDIX D

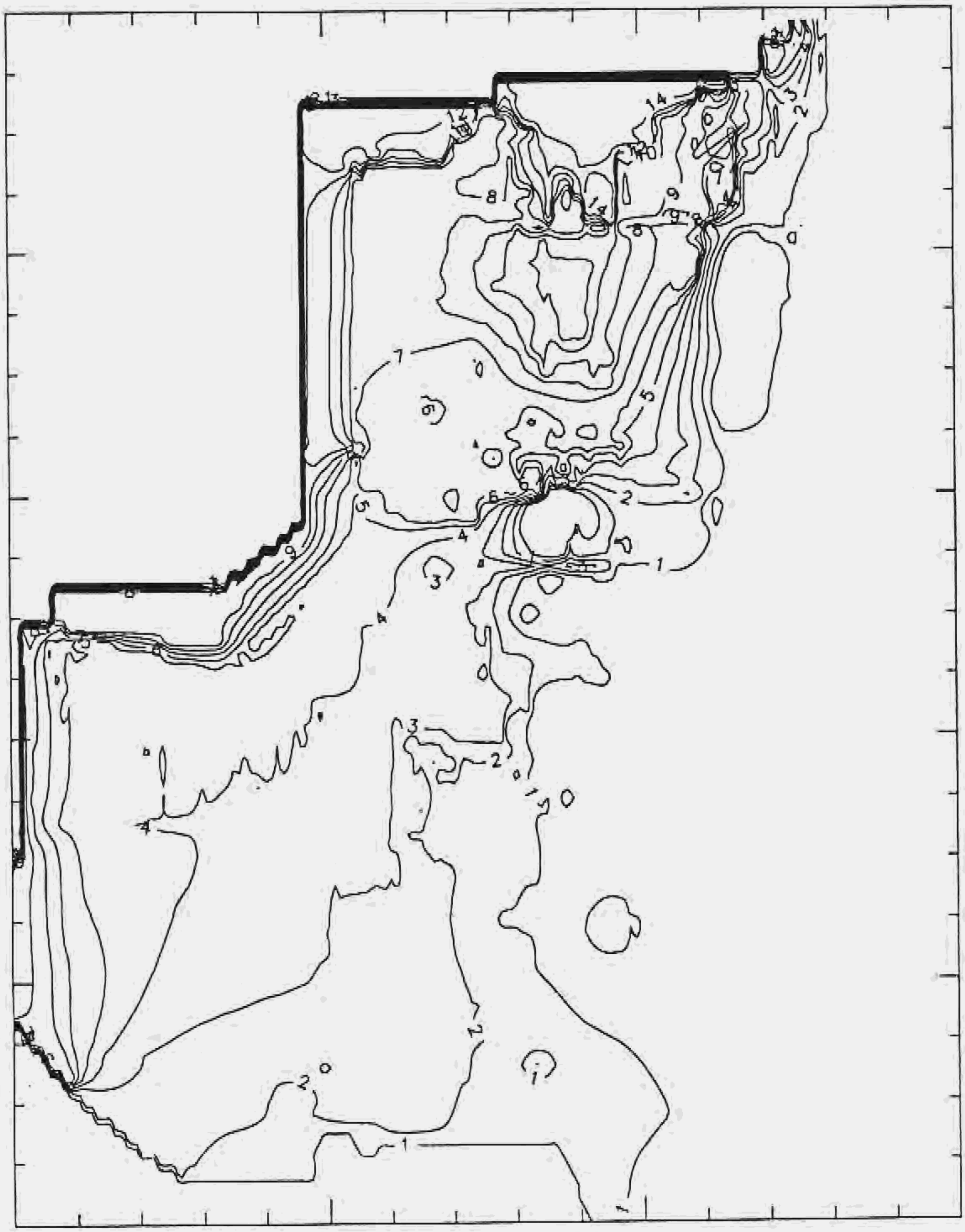


FIGURE D-1. Calibrated Steady State Water Levels (Ft) in Layer 1

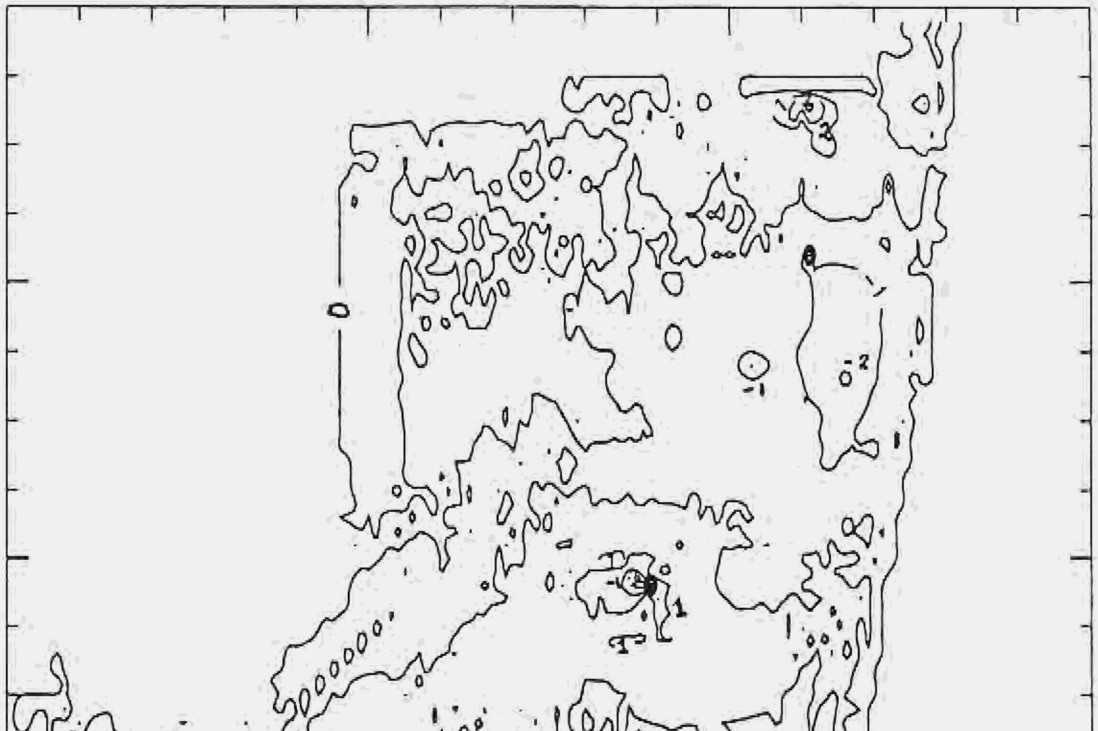


FIGURE D-2. Difference Between Steady State Observed and Computed Water Levels (Ft) in Layer 1

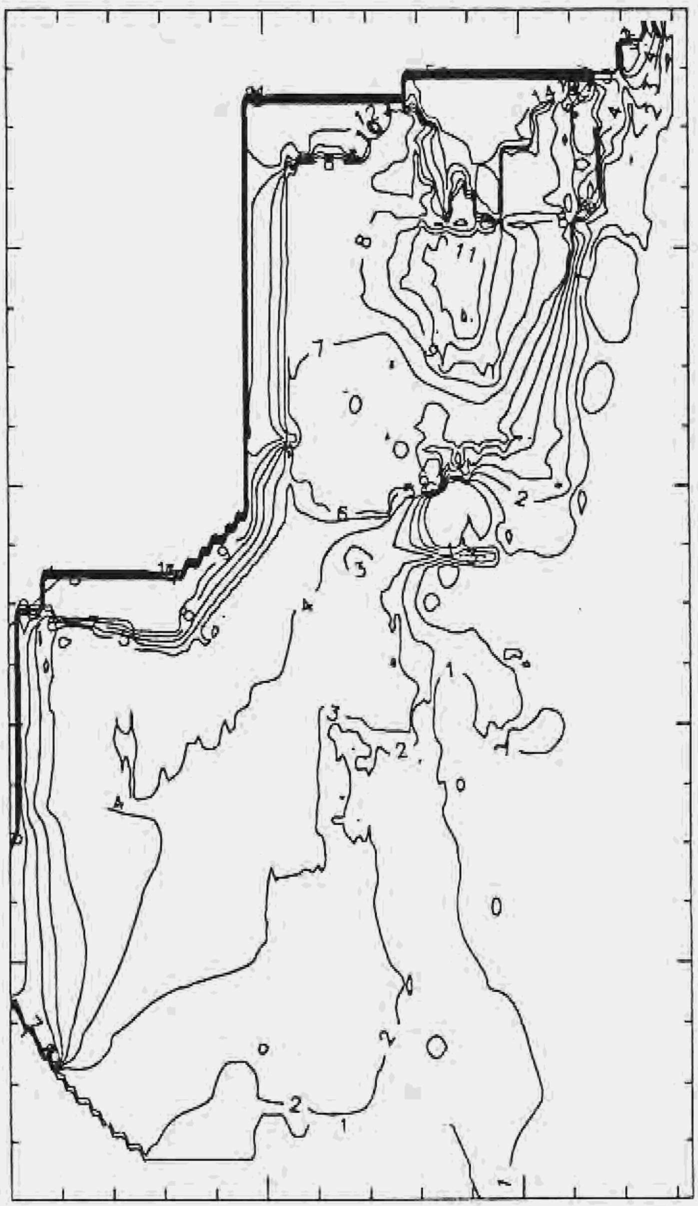


FIGURE D-3. Transient Simulated Water Levels (Ft) for January 1989, Layer 1

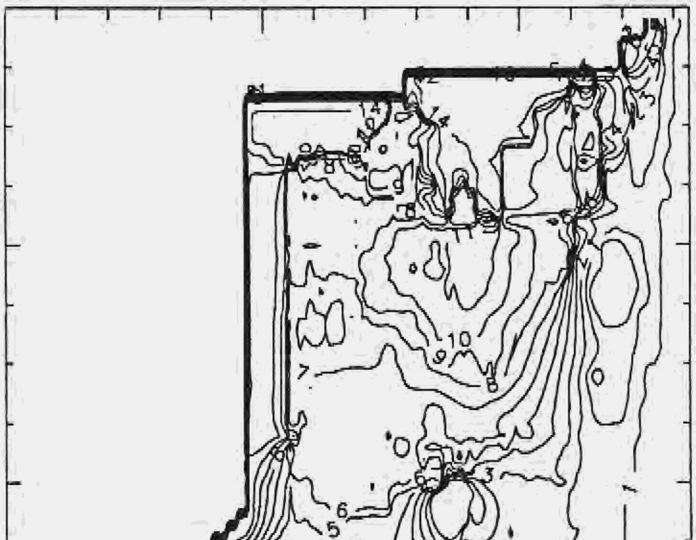


FIGURE D-4. Transient Simulated Water Levels (Ft) for September 1989, Layer 1

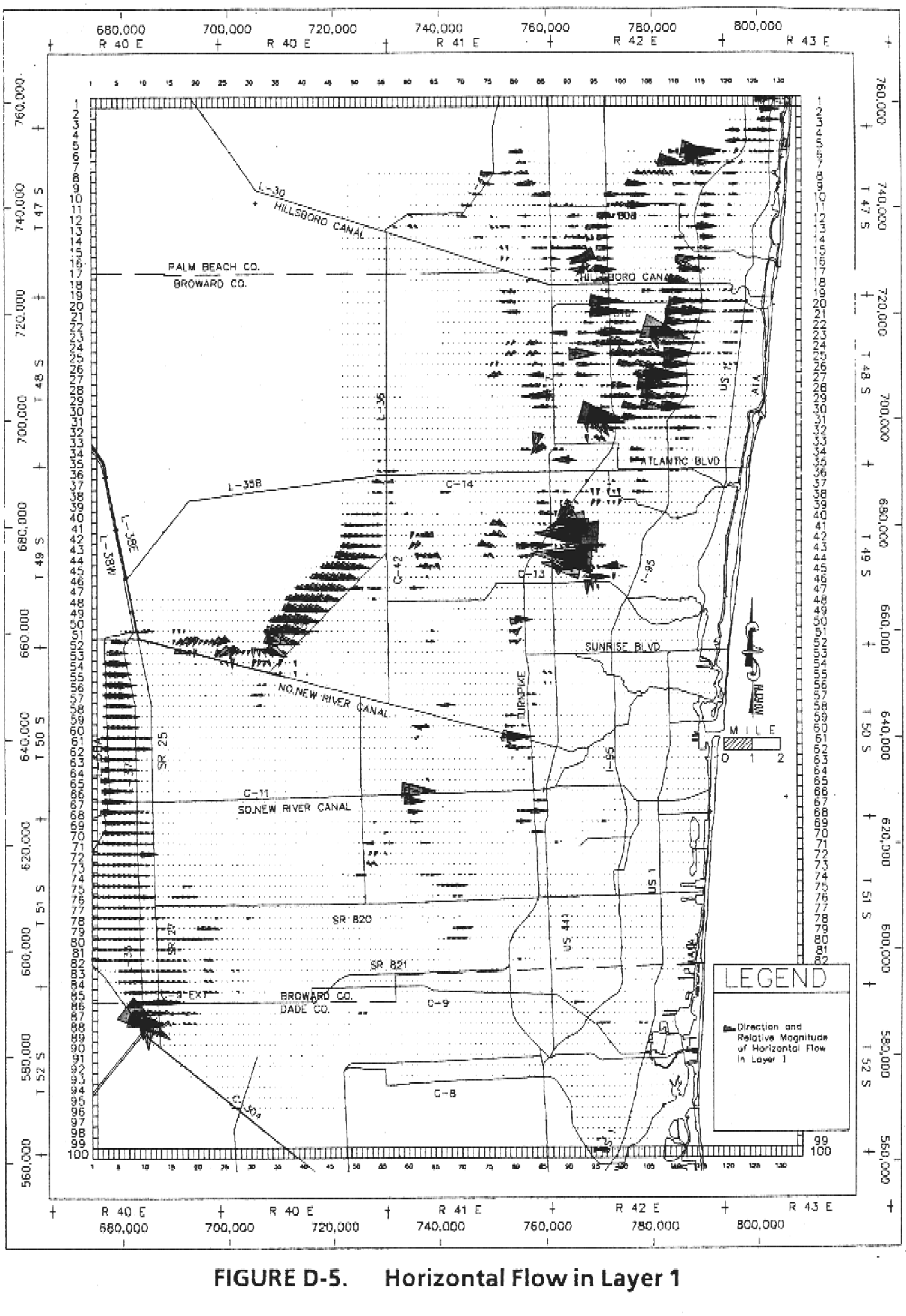


FIGURE D-5. Horizontal Flow in Layer 1

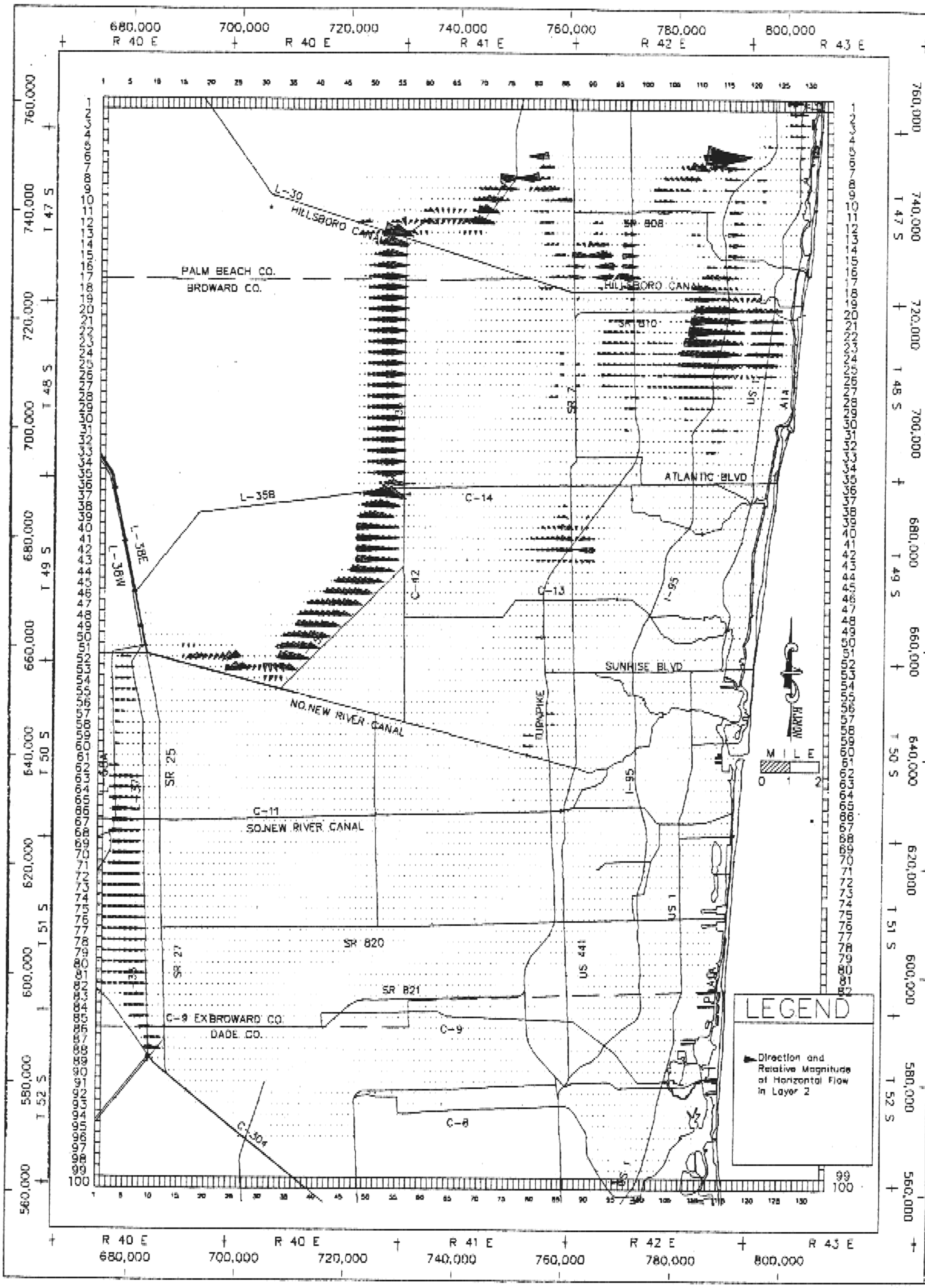


FIGURE D-6. Horizontal Flow in Layer 2

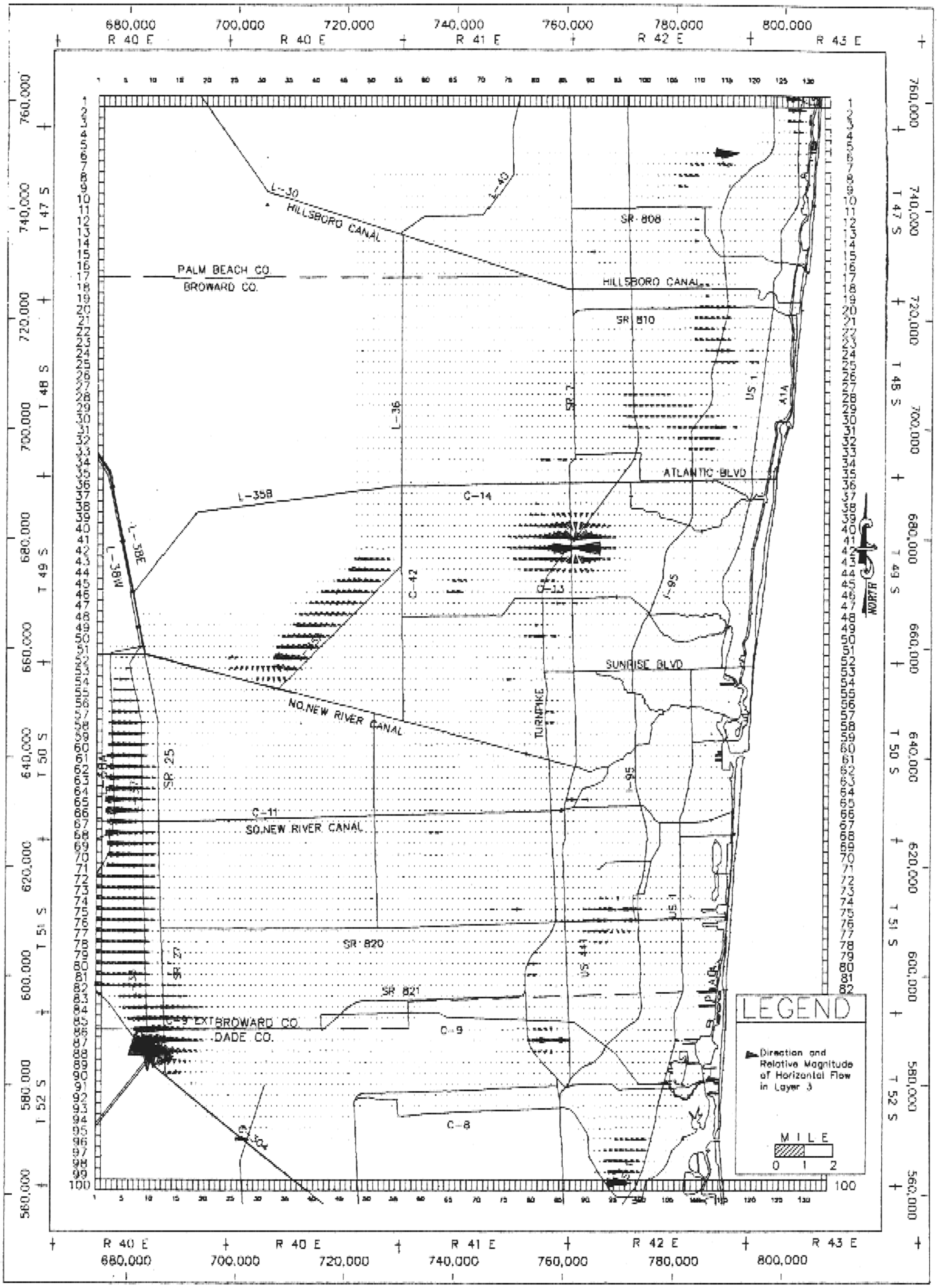


FIGURE D-7. Horizontal Flow in Layer 3

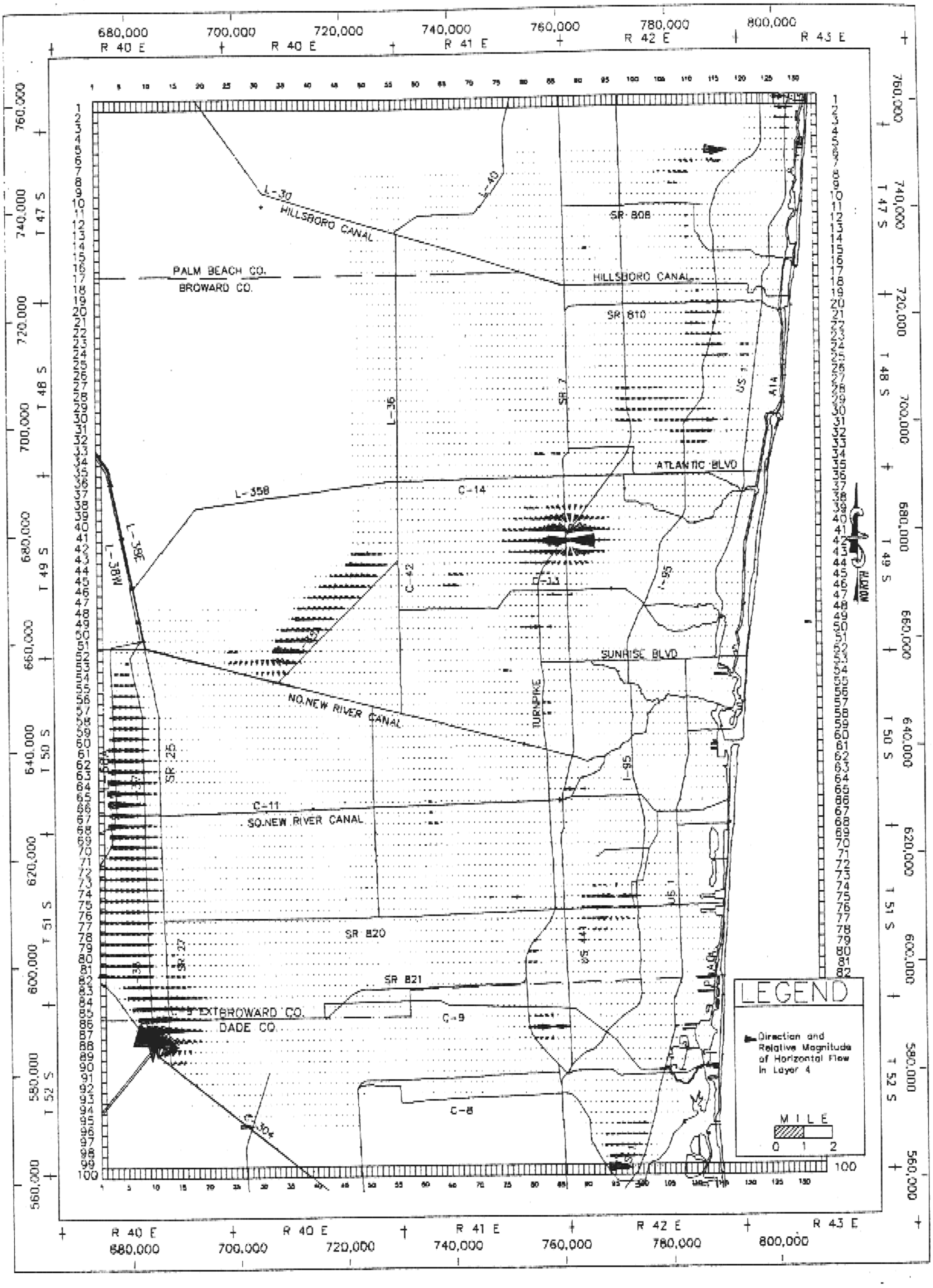


FIGURE D-8. Horizontal Flow in Layer 4

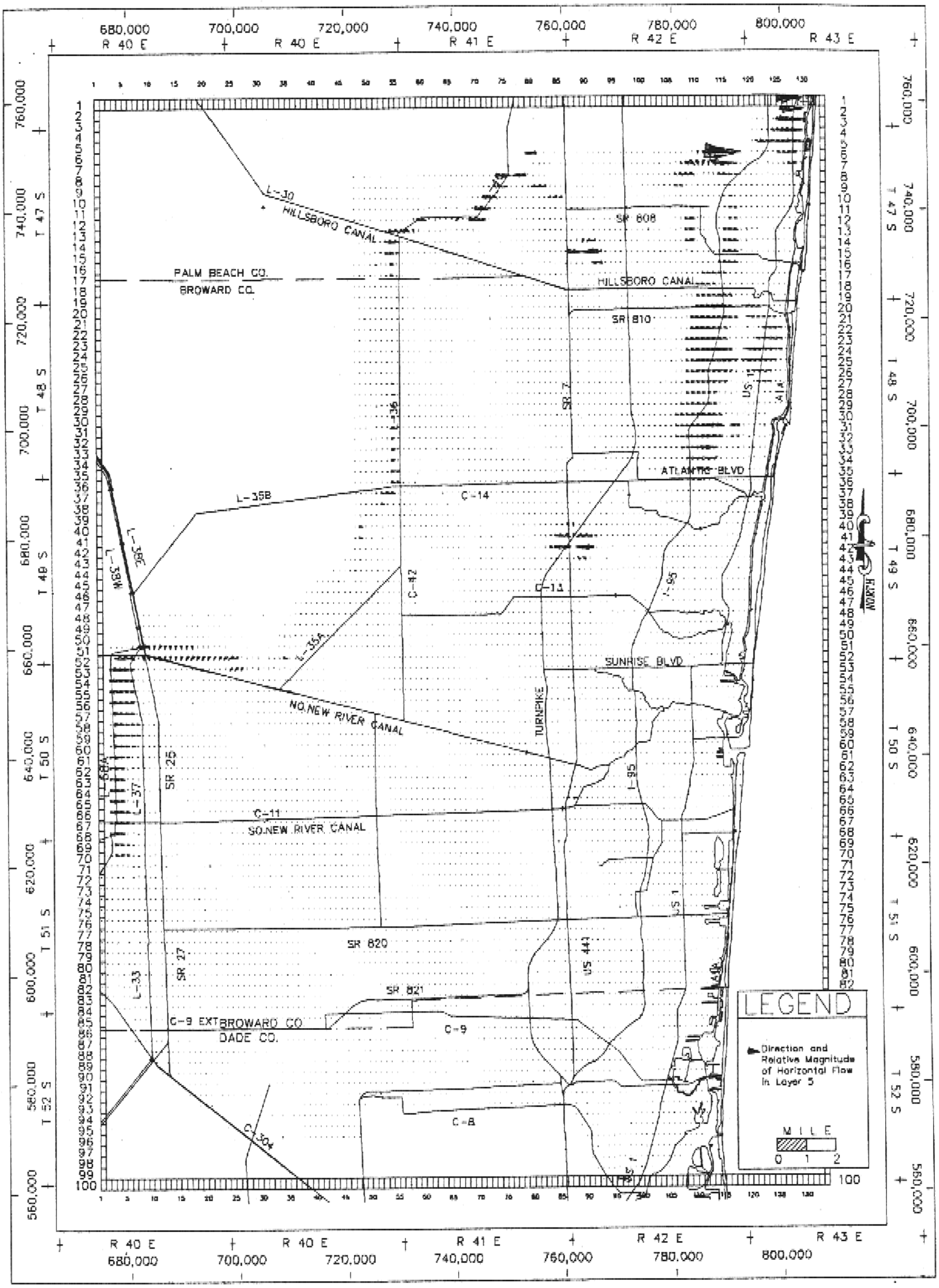


FIGURE D-9. Horizontal Flow in Layer 5

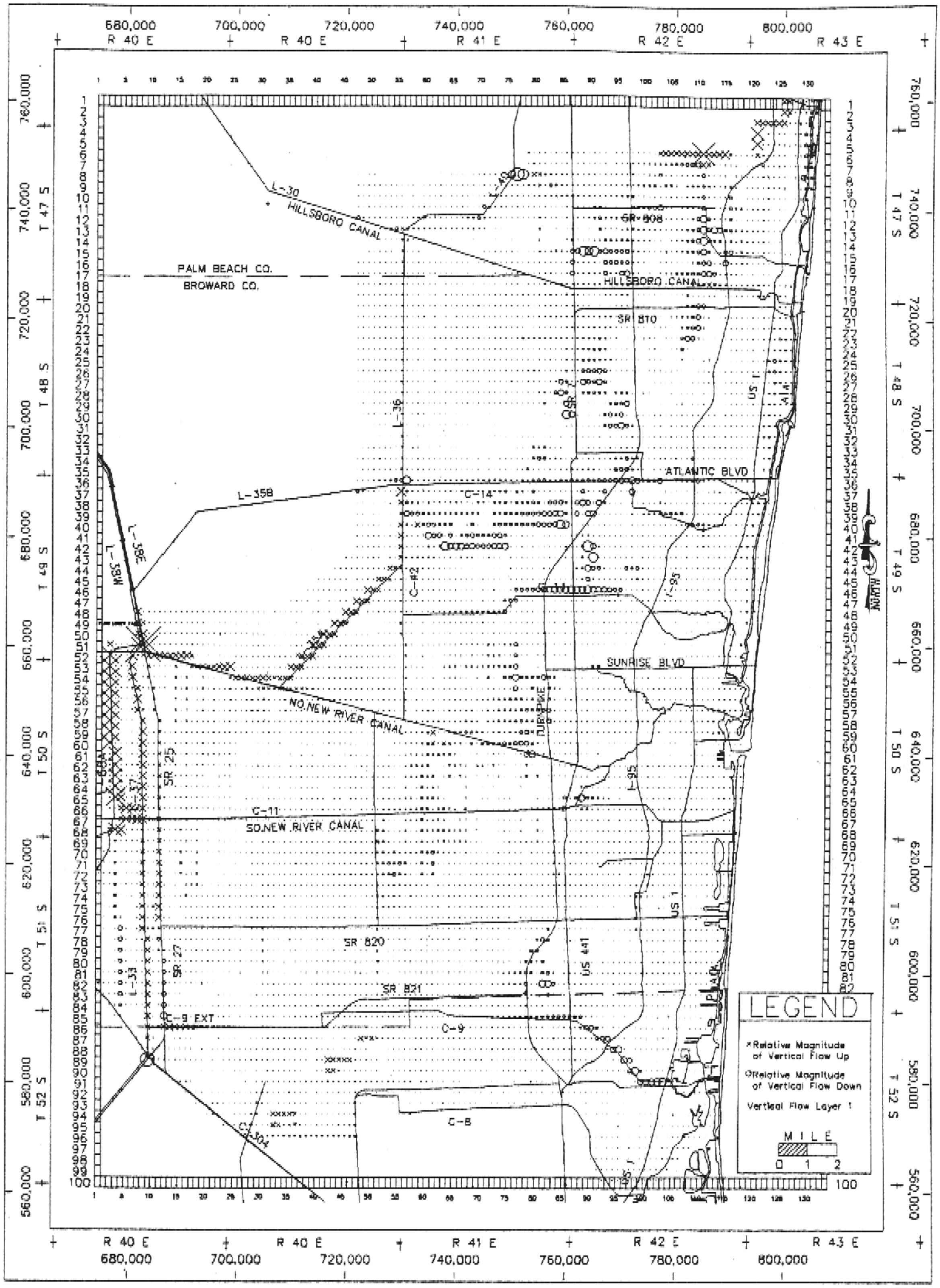


FIGURE D-10. Vertical Flow in Layer 1

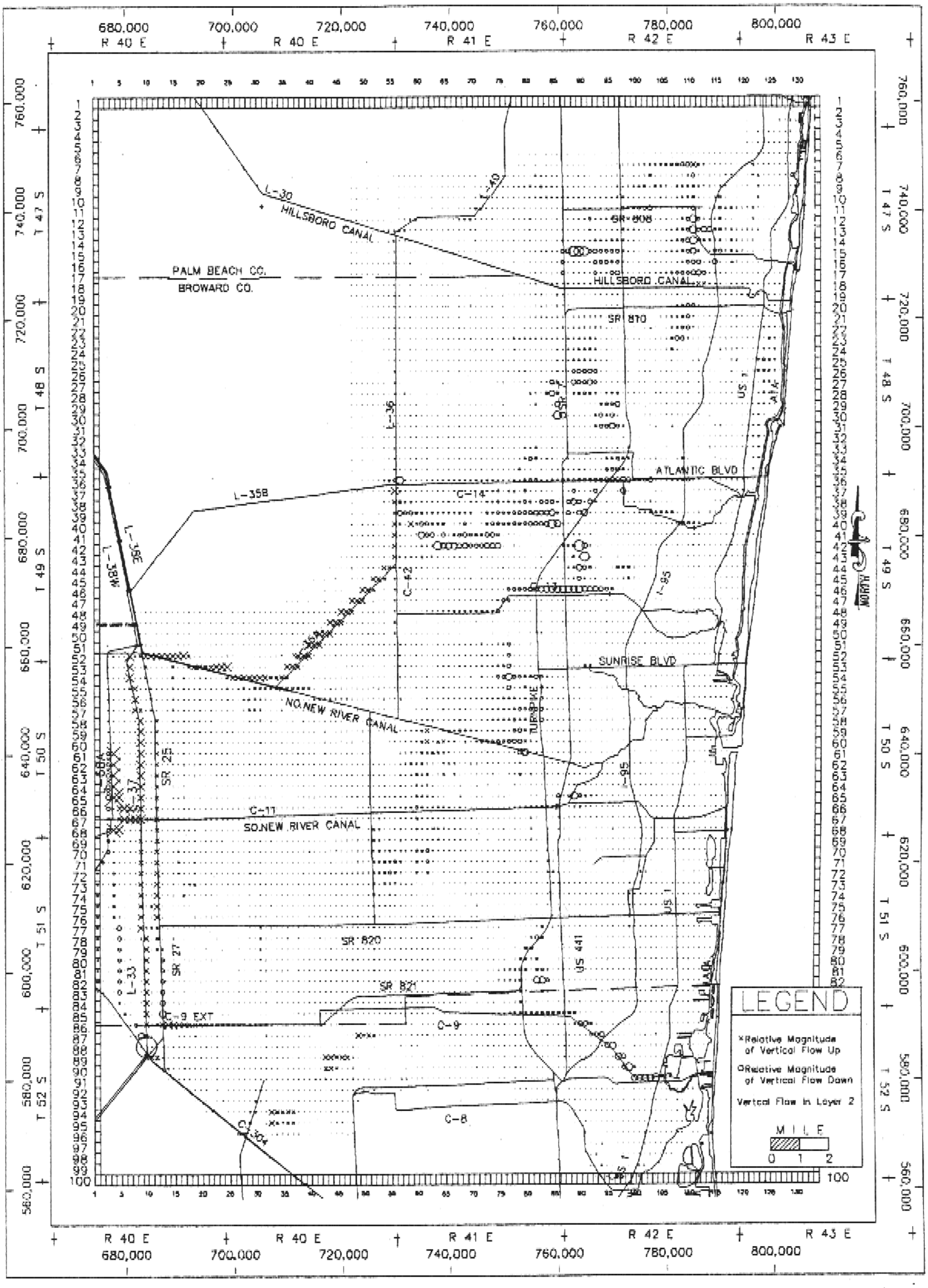


FIGURE D-11. Vertical Flow in Layer 2

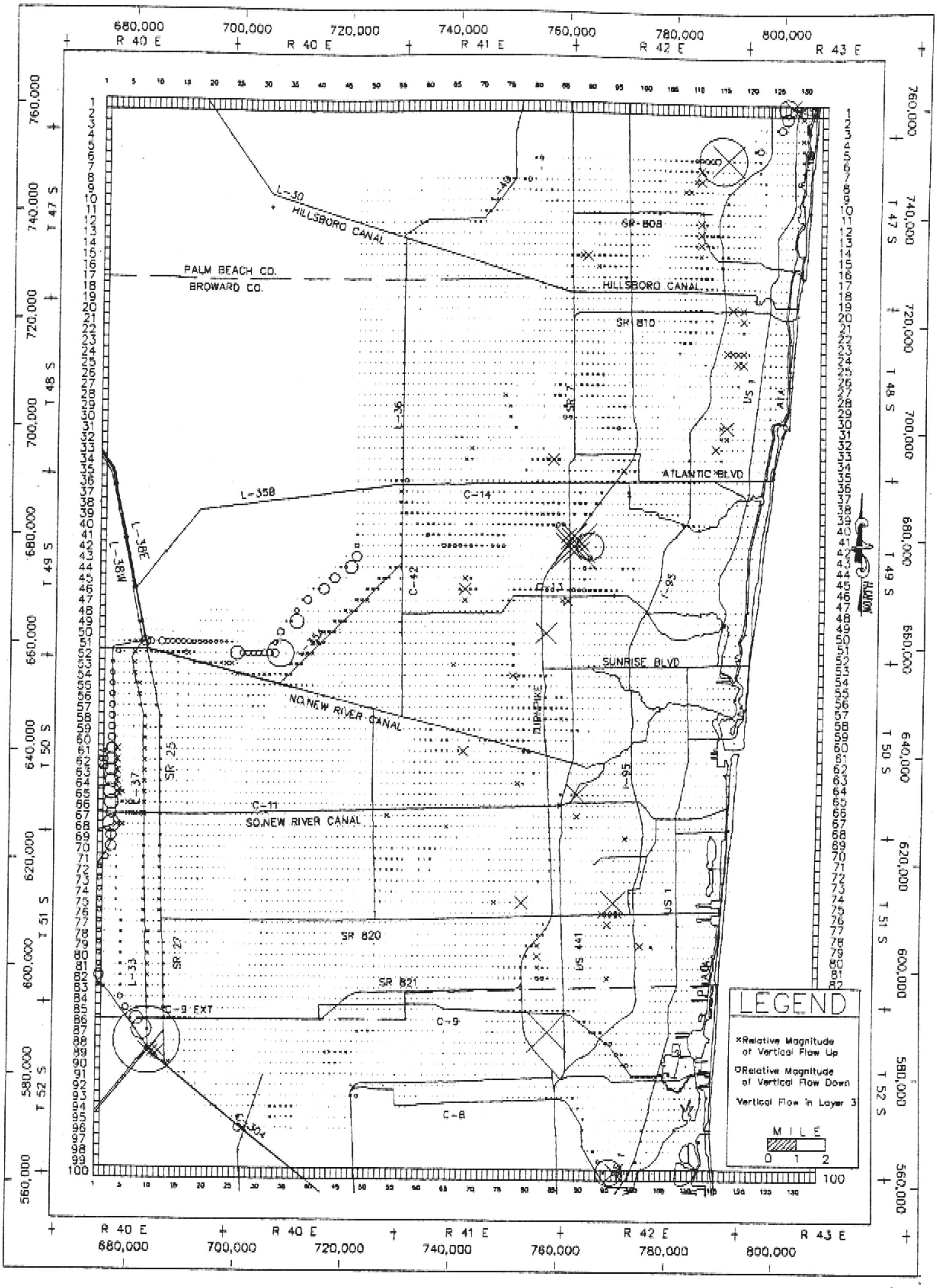


FIGURE D-12. Vertical Flow in Layer 3

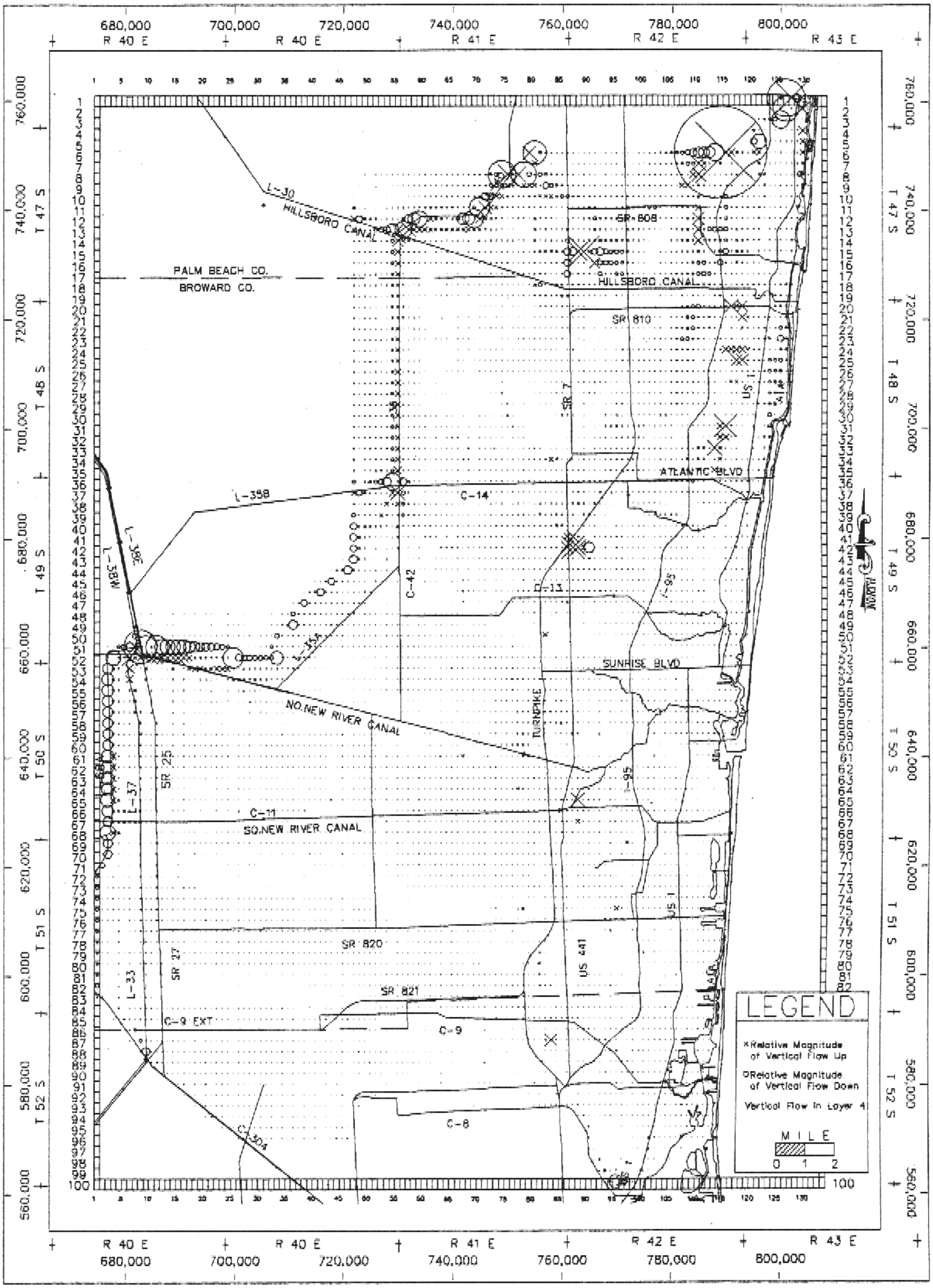


FIGURE D-13. Vertical Flow in Layer 4

APPENDIX E

CALIBRATION HYDROGRAPHS

LIST OF FIGURES - APPENDIX E

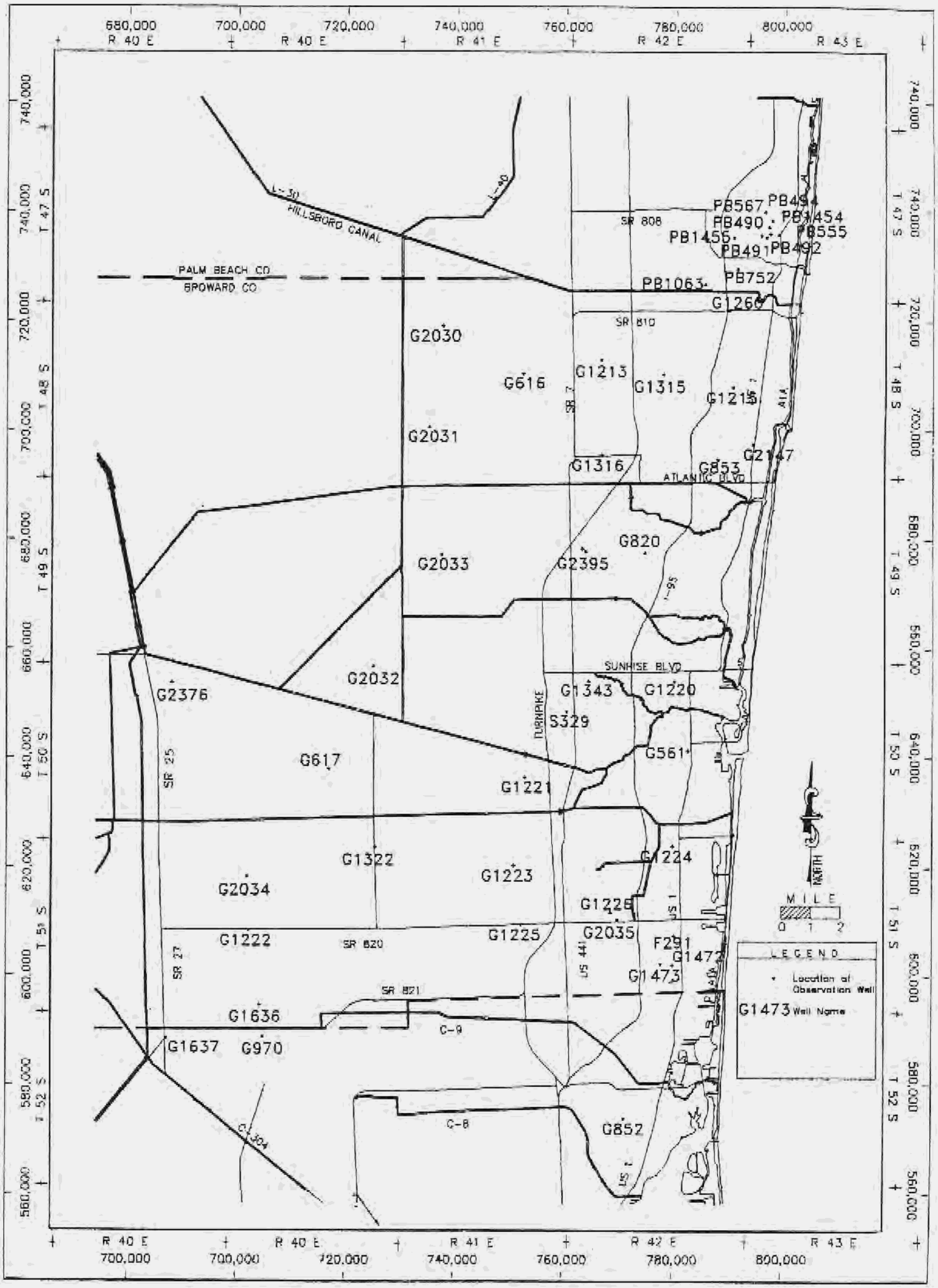
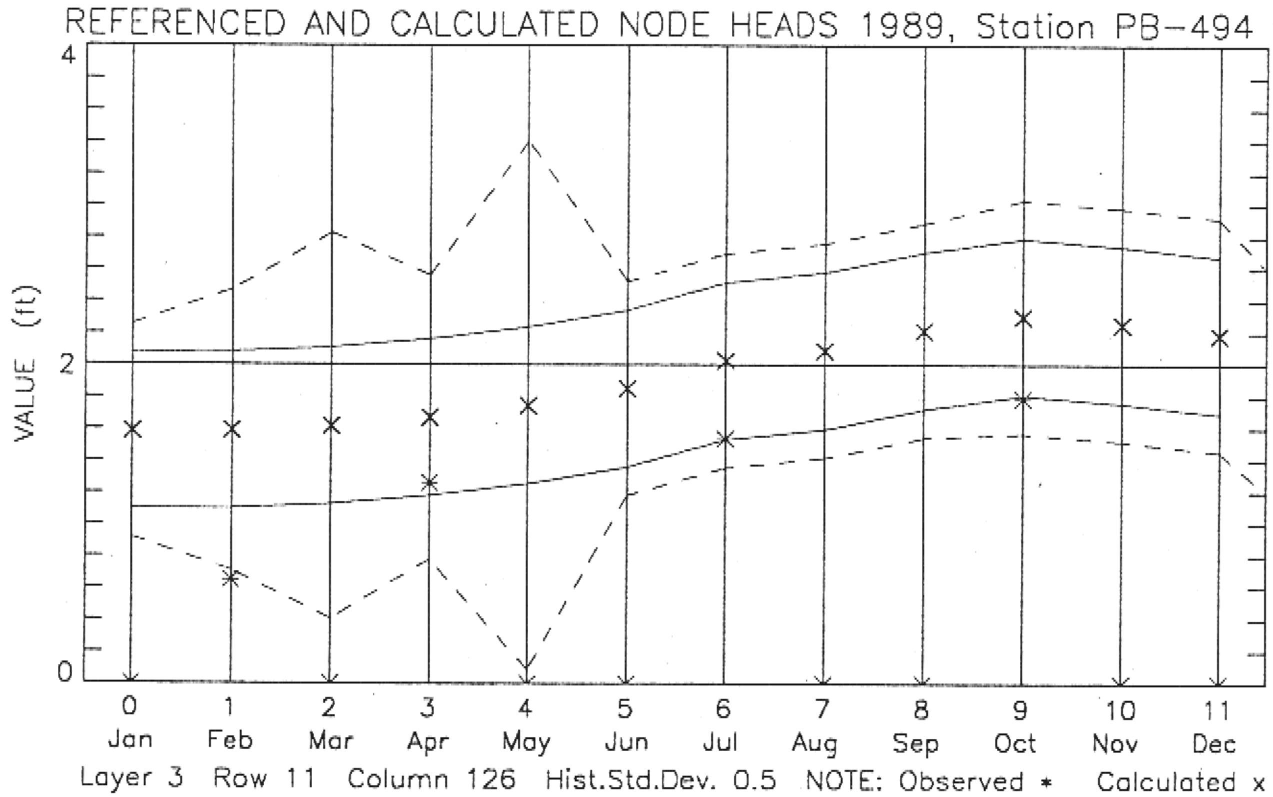
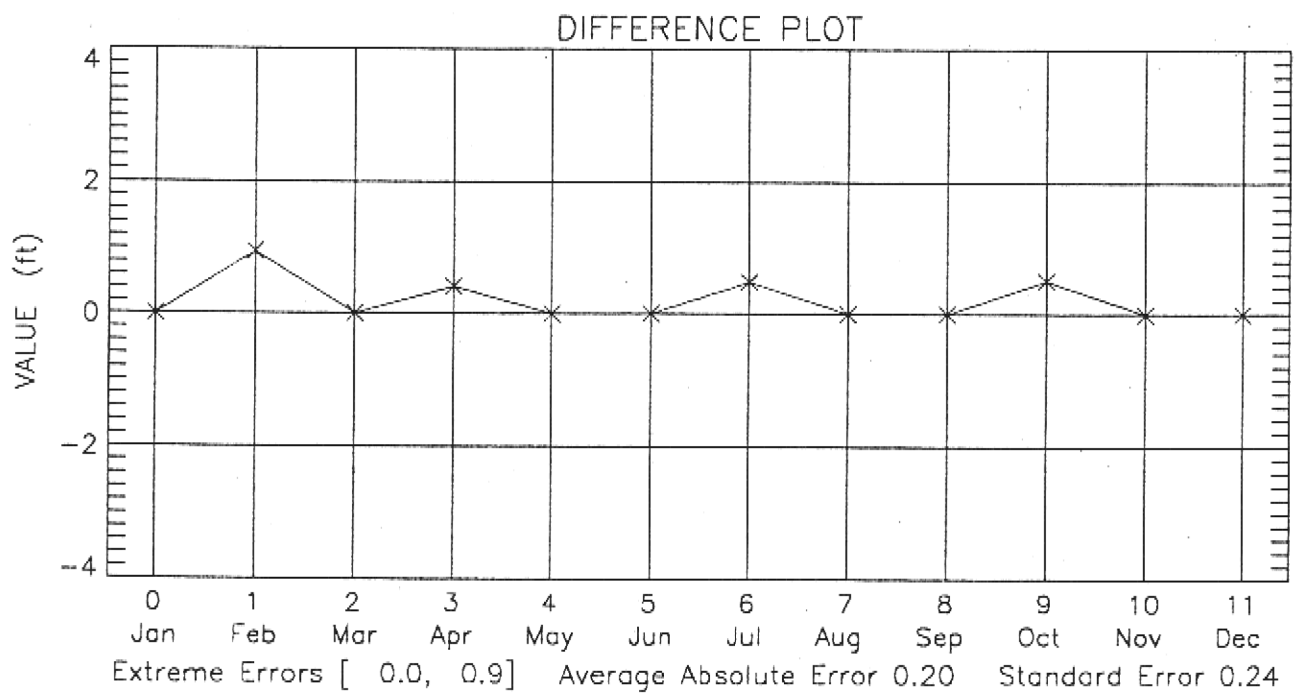


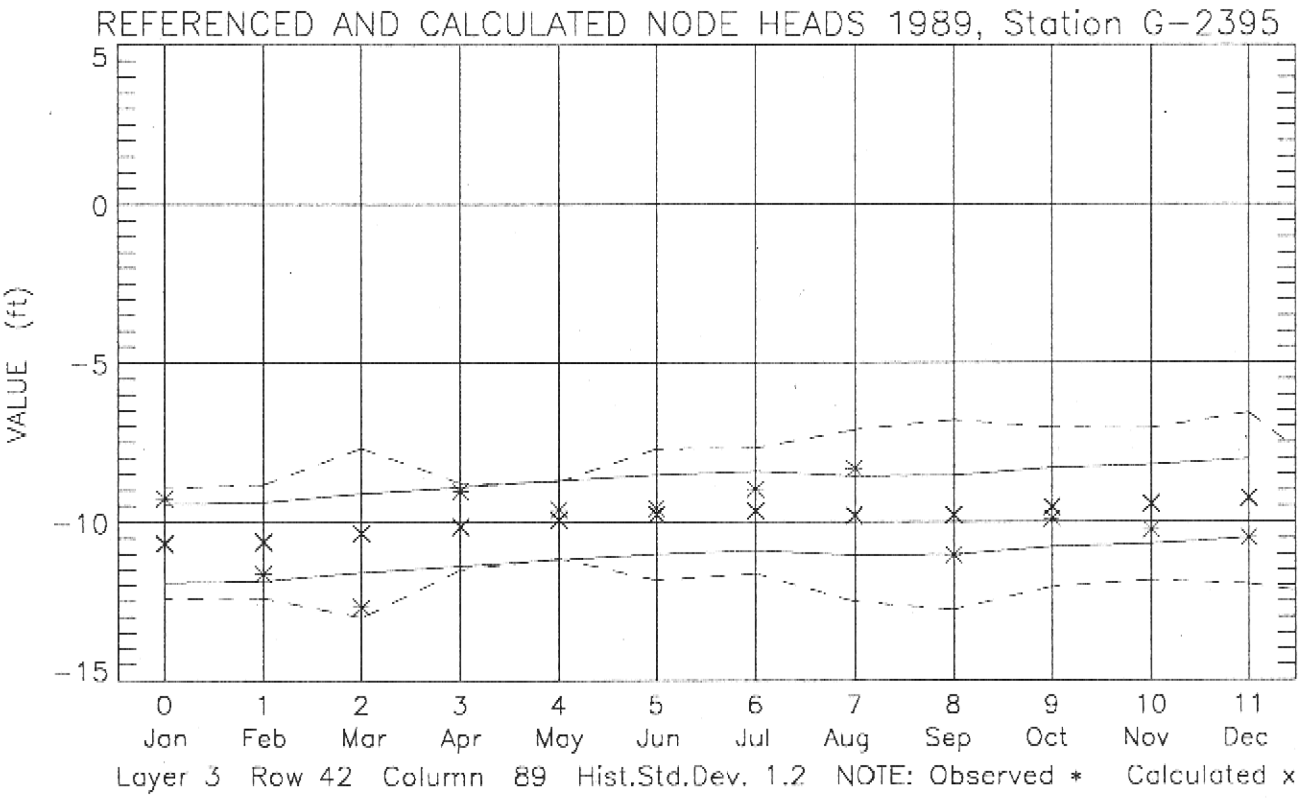
FIGURE E-1. Observation Wells Used in Model Calibration

Figure E-2. Calibration Hydrographs

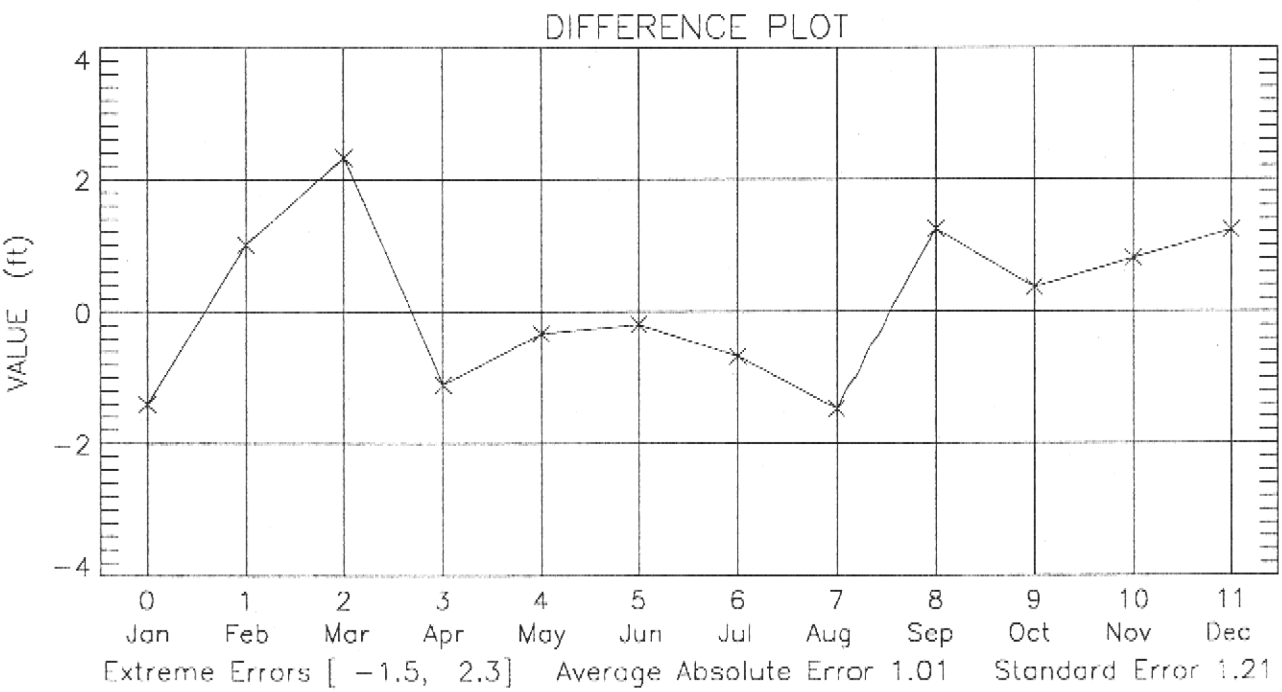
For each observation well, two graphs are shown. The first graph shows head values in feet for referenced and calculated values in the applicable cell. The second graph plots the difference between the two. The solid parallel lines seen in the first graph represent +/- one standard deviation taken over all historical water level records available for that station. The dashed lines represent +/- one standard deviation taken over historical records available for the particular month for that station.


REFERENCED AND CALCULATED NODE HEADS 1989, Station PB-494
VALUE (ft)
4
2
0
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Layer 3 Row 11 Column 126 Hist.Std.Dev. 0.5 NOTE: Observed * Calculated x

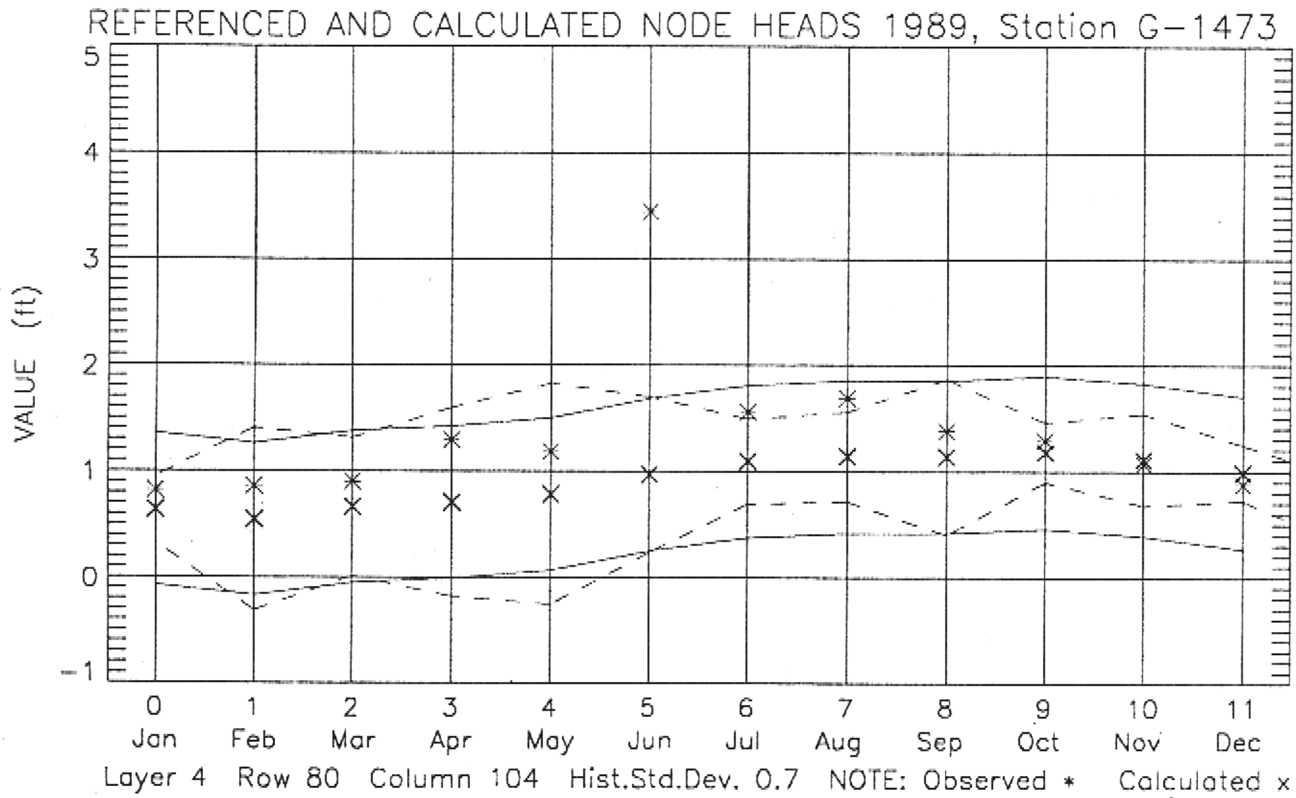

DIFFERENCE PLOT
VALUE (ft)
4
2
0
-2
-4
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Extreme Errors [0.0, 0.9] Average Absolute Error 0.20 Standard Error 0.24

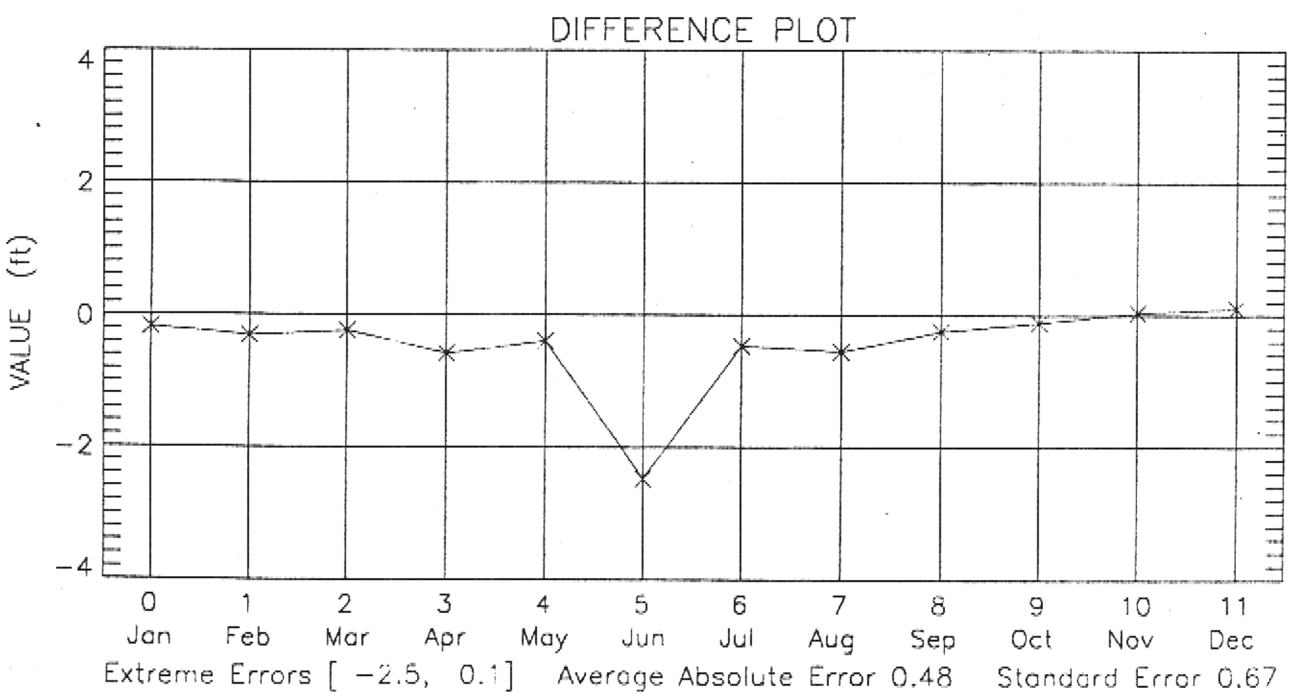


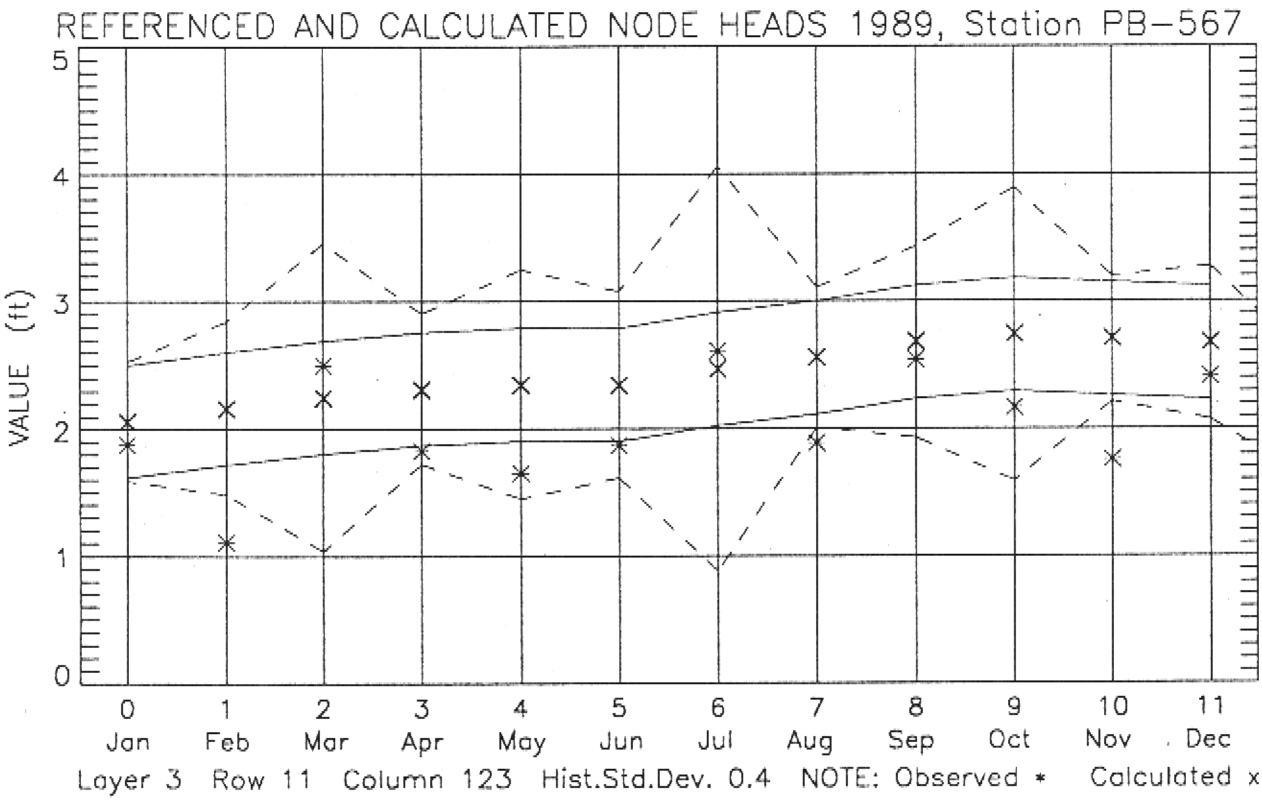
REFERENCED AND CALCULATED NODE HEADS 1989, Station G-2395
VALUE (ft)
5
0
-5
-10
-15
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Layer 3 Row 42 Column 89 Hist.Std.Dev. 1.2 NOTE: Observed * Calculated x

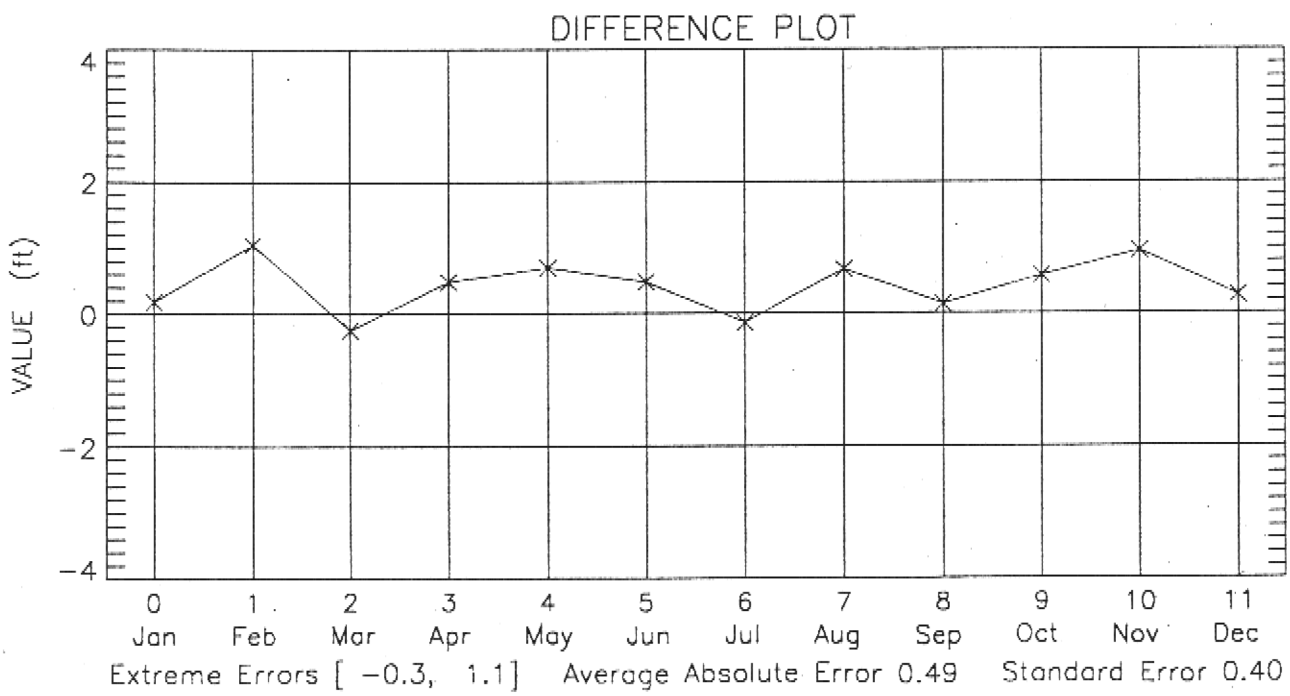


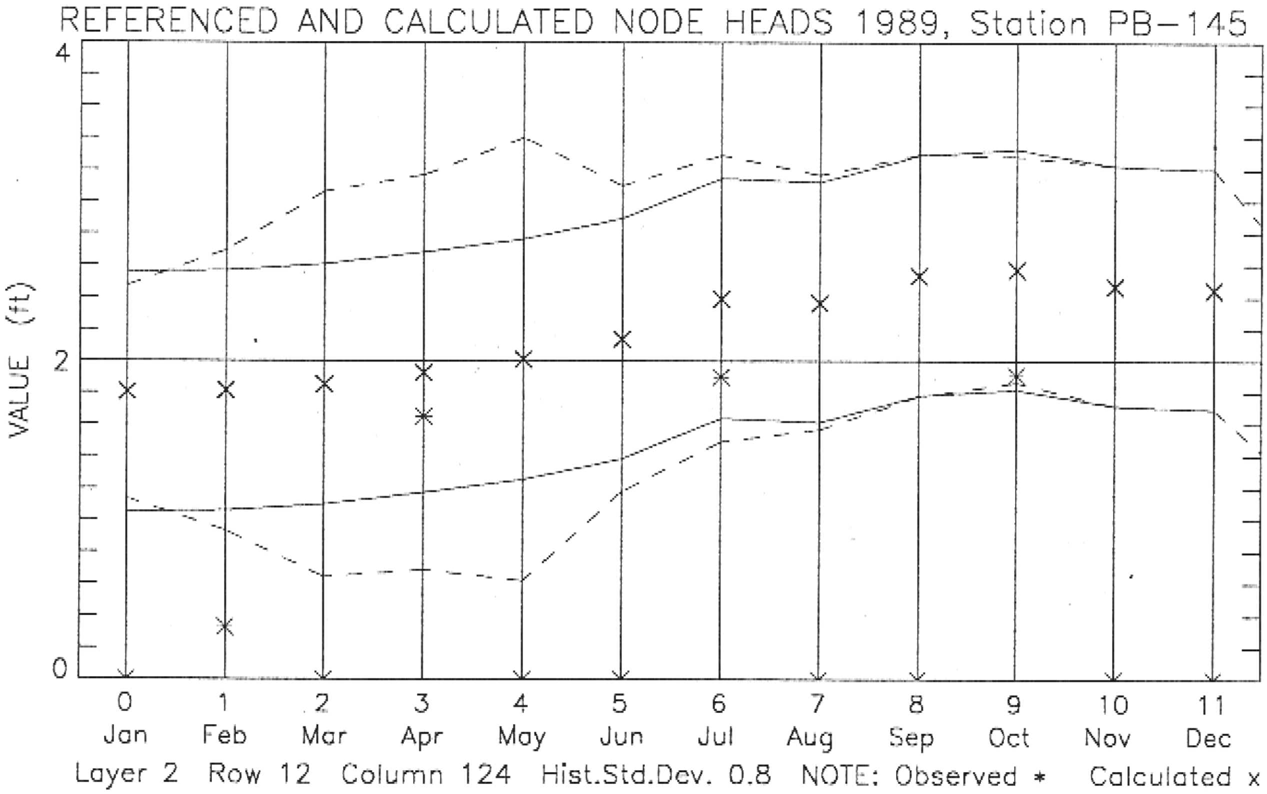
DIFFERENCE PLOT
VALUE (ft)
4
2
0
-2
-4
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Extreme Errors [-1.5, 2.3] Average Absolute Error 1.01 Standard Error 1.21

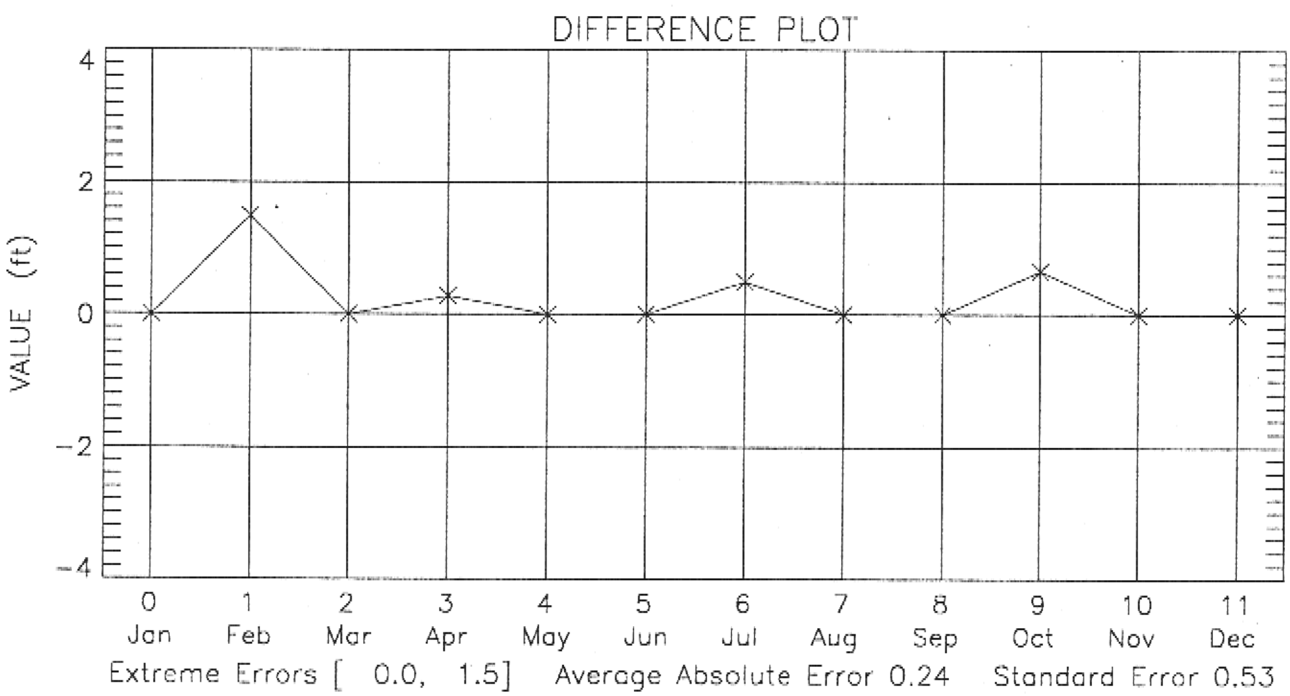

REFERENCED AND CALCULATED NODE HEADS 1989, Station G-1473
VALUE (ft)
5
4
3
2
1
0
-1
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Layer 4 Row 80 Column 104 Hist.Std.Dev. 0.7 NOTE: Observed * Calculated x

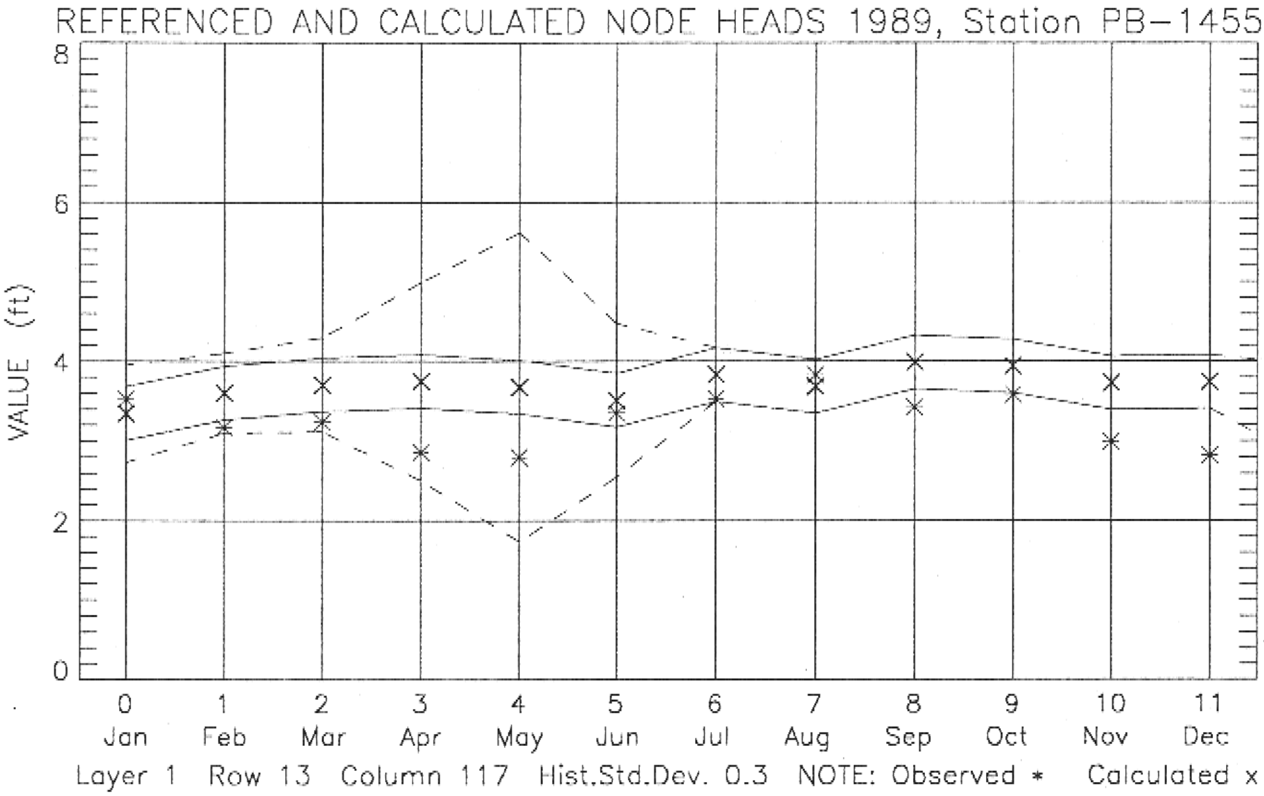

DIFFERENCE PLOT
VALUE (ft)
4
2
0
-2
-4
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Extreme Errors [-2.5, 0.1] Average Absolute Error 0.48 Standard Error 0.67

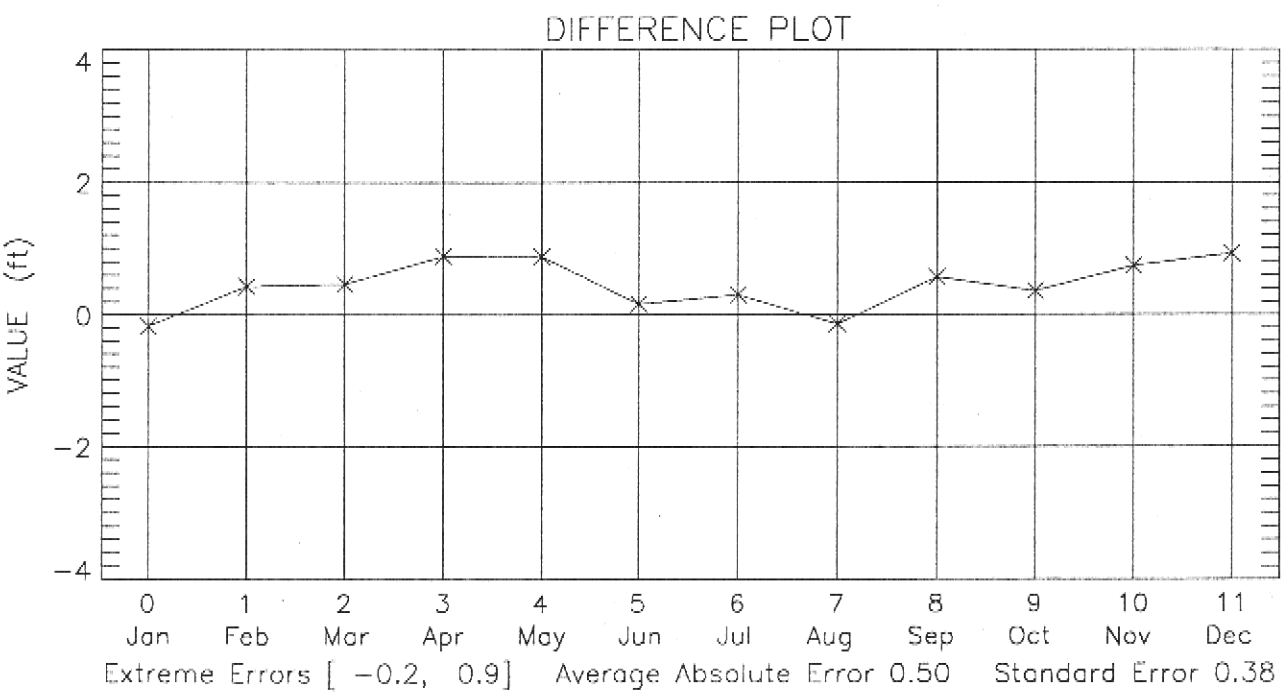

REFERENCED AND CALCULATED NODE HEADS 1989, Station PB-567
VALUE (ft)
5
4
3
2
1
0
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Layer 3 Row 11 Column 123 Hist.Std.Dev. 0.4 NOTE: Observed * Calculated x

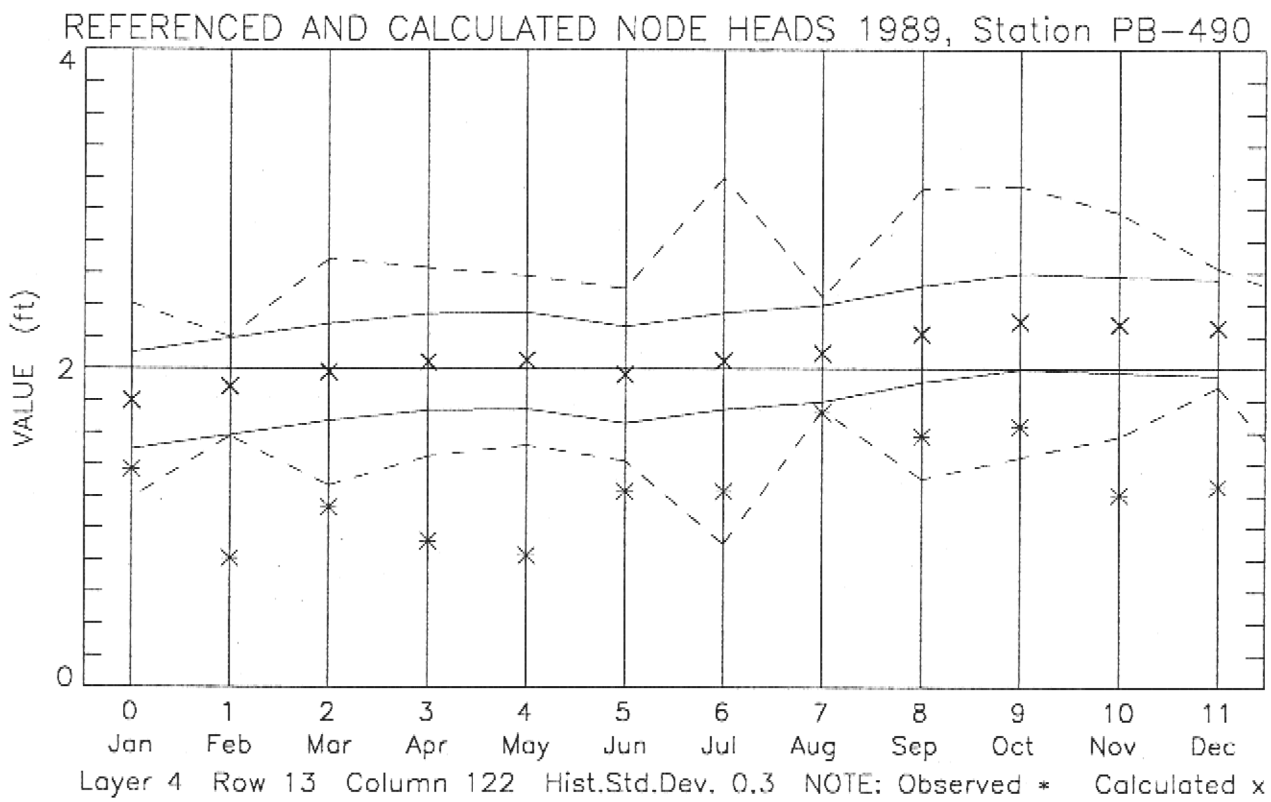

DIFFERENCE PLOT
VALUE (ft)
4
2
0
-2
-4
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Extreme Errors [-0.3, 1.1] Average Absolute Error 0.49 Standard Error 0.40


REFERENCED AND CALCULATED NODE HEADS 1989, Station PB-145
VALUE (ft)
4
2
0
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Layer 2 Row 12 Column 124 Hist.Std.Dev. 0.8 NOTE: Observed * Calculated x

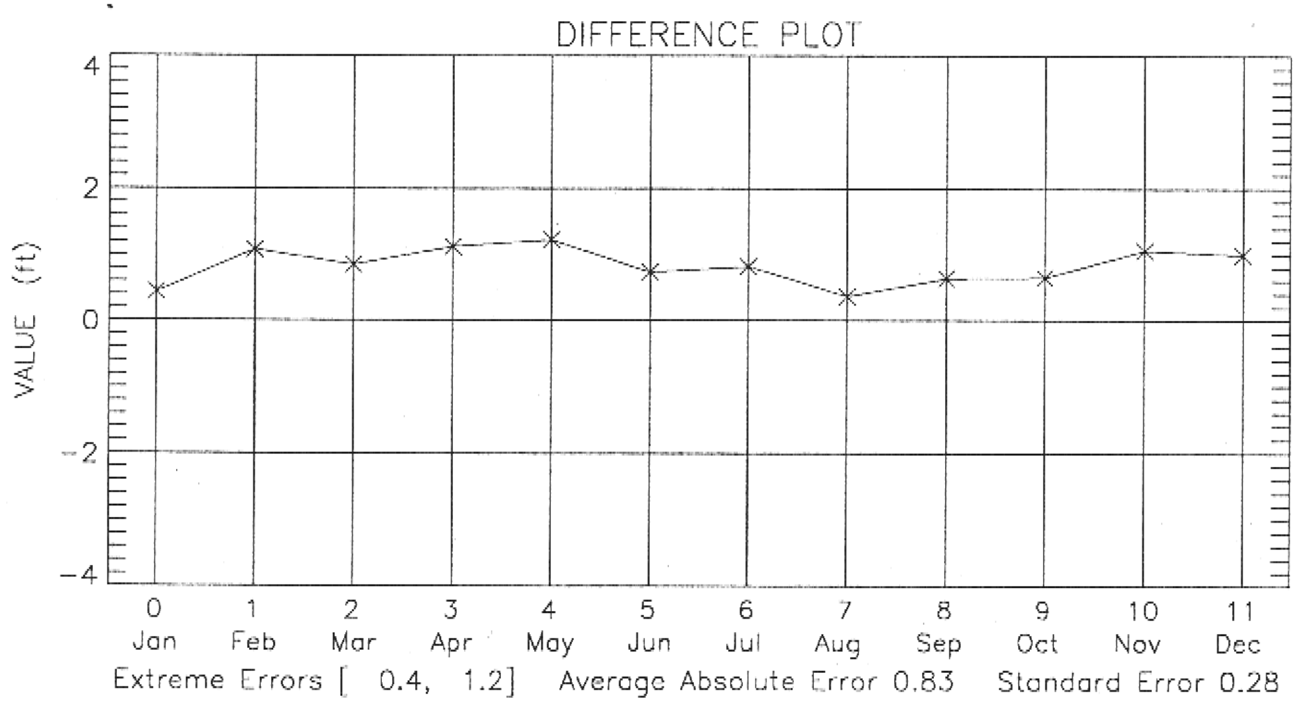

DIFFERENCE PLOT
VALUE (ft)
4
2
0
-2
-4
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Extreme Errors [0.0, 1.5] Average Absolute Error 0.24 Standard Error 0.53


REFERENCED AND CALCULATED NODE HEADS 1989, Station PB-1455
VALUE (ft)
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Layer 1 Row 13 Column 117 Hist.Std.Dev. 0.3 NOTE: Observed * Calculated x

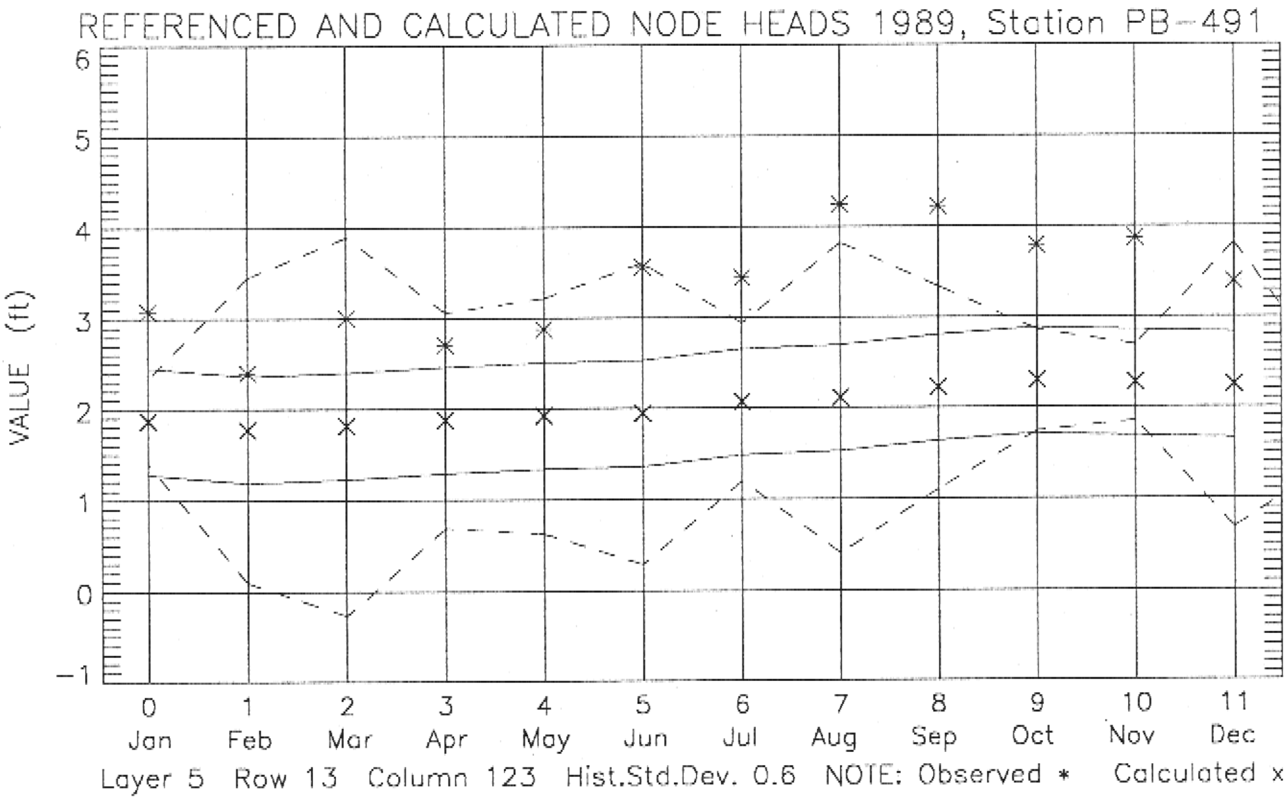

DIFFERENCE PLOT
VALUE (ft)
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Extreme Errors [-0.2, 0.9] Average Absolute Error 0.50 Standard Error 0.38



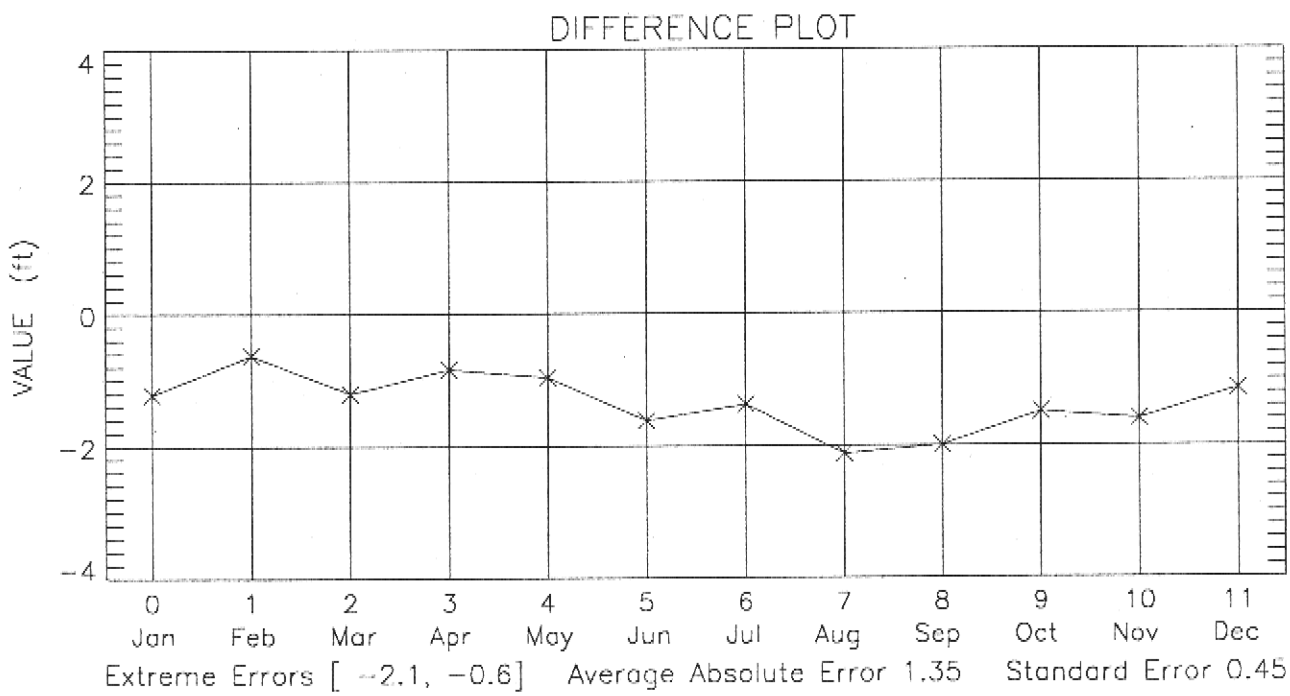
REFERENCED AND CALCULATED NODE HEADS 1989, Station PB-490
VALUE (ft)
4
2
0
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Layer 4 Row 13 Column 122 Hist.Std.Dev. 0.3 NOTE: Observed * Calculated x



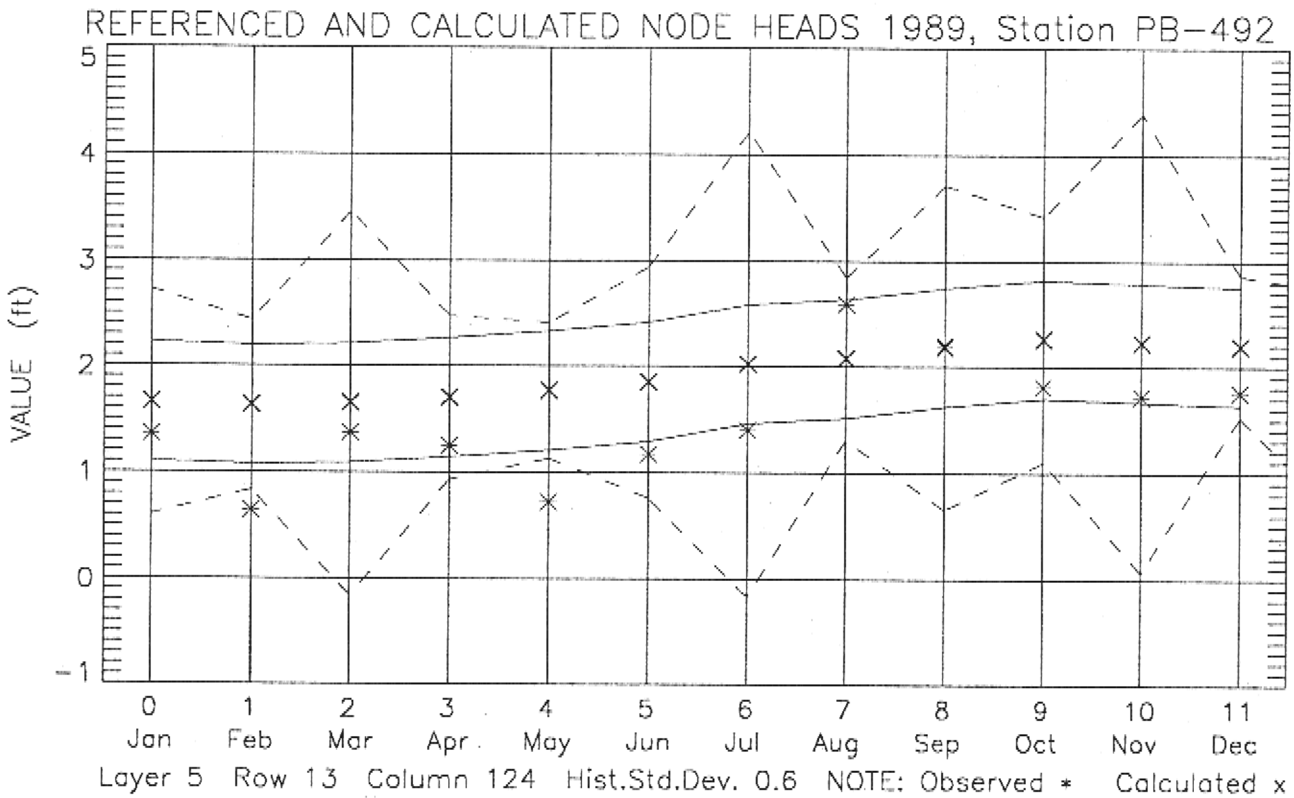
DIFFERENCE PLOT
VALUE (ft)
4
2
0
-2
-4
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Extreme Errors [0.4, 1.2] Average Absolute Error 0.83 Standard Error 0.28

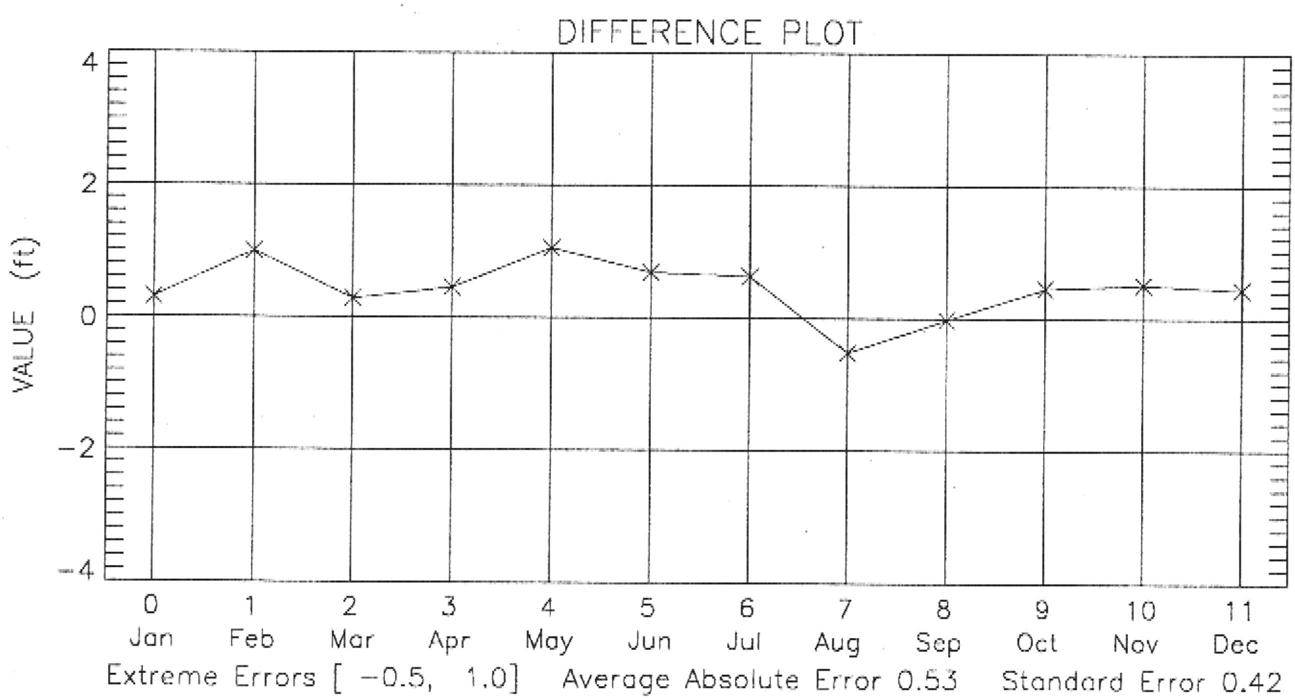


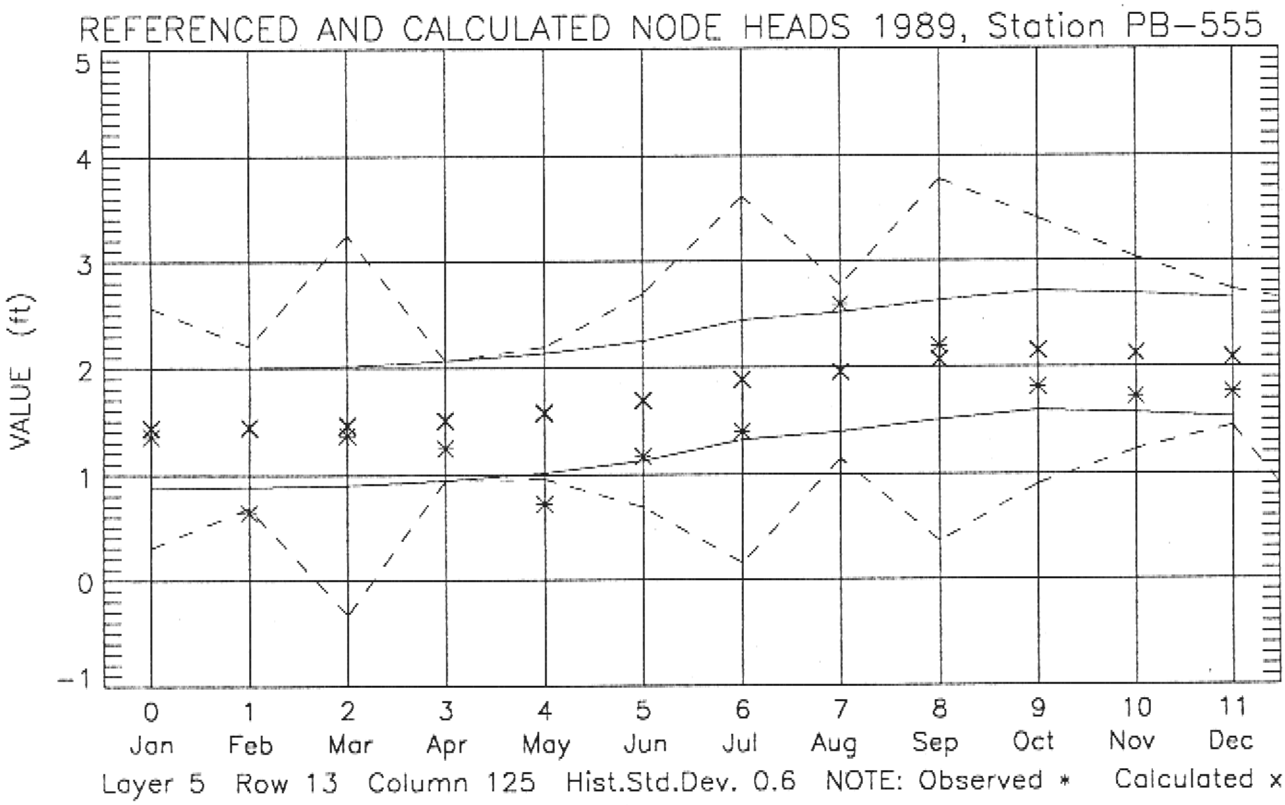
REFERENCED AND CALCULATED NODE HEADS 1989, Station PB-491
VALUE (ft)
6
5
4
3
2
1
0
-1
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Layer 5 Row 13 Column 123 Hist.Std.Dev. 0.6 NOTE: Observed * Calculated x



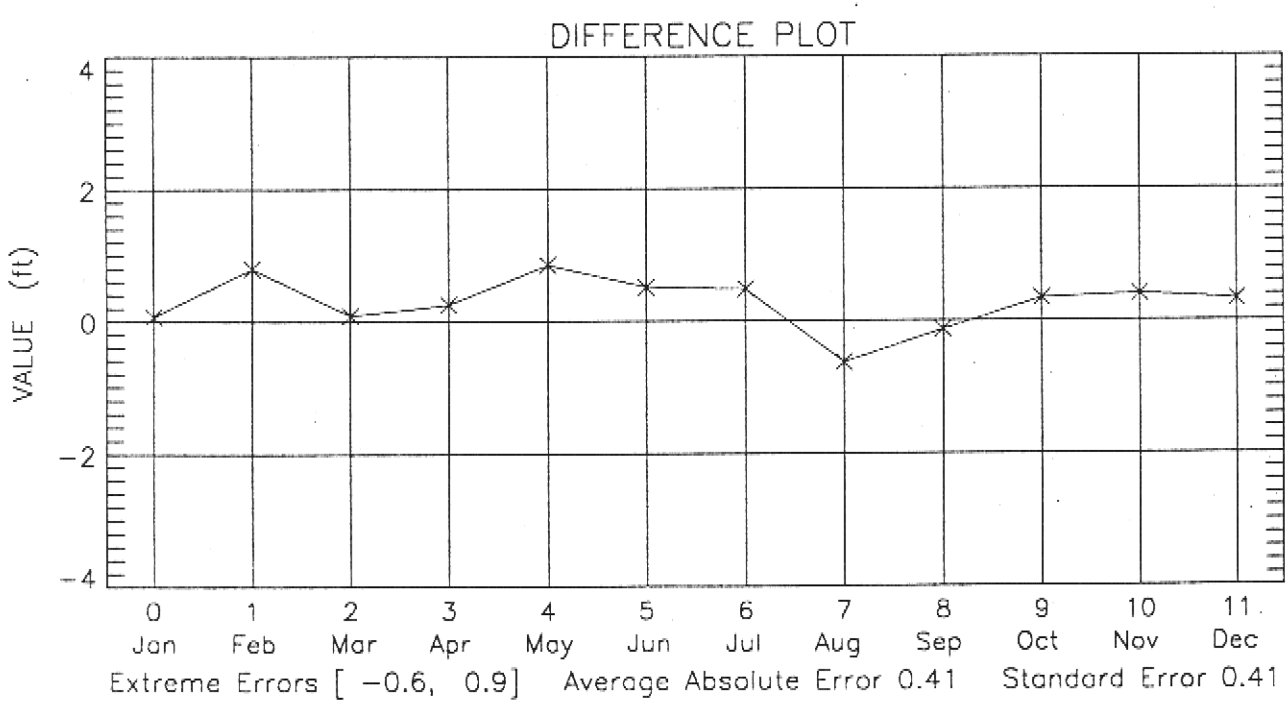
DIFFERENCE PLOT
VALUE (ft)
4
2
0
-2
-4
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Extreme Errors [-2.1, -0.6] Average Absolute Error 1.35 Standard Error 0.45


REFERENCED AND CALCULATED NODE HEADS 1989, Station PB-492
VALUE (ft)
5
4
3
2
1
0
-1
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Layer 5 Row 13 Column 124 Hist.Std.Dev. 0.6 NOTE: Observed * Calculated x

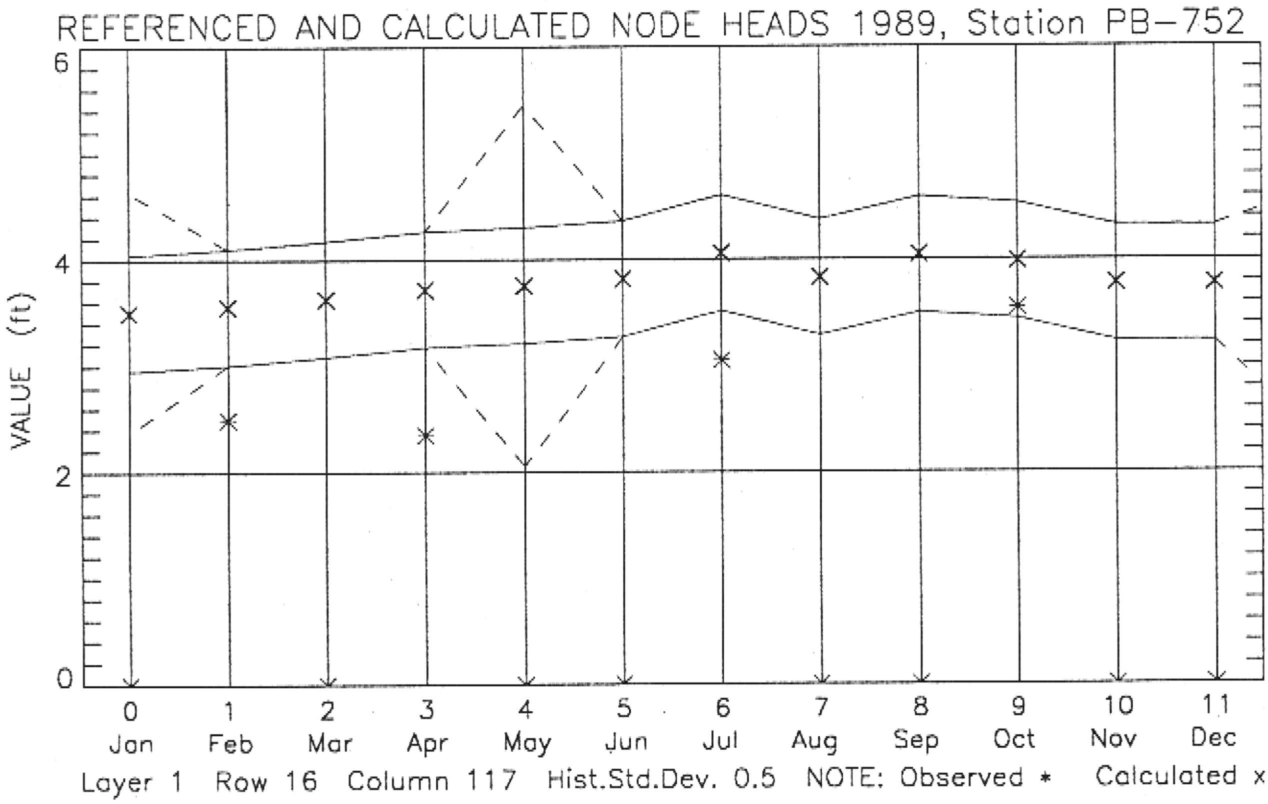

DIFFERENCE PLOT
VALUE (ft)
4
2
0
-2
-4
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Extreme Errors [-0.5, 1.0] Average Absolute Error 0.53 Standard Error 0.42

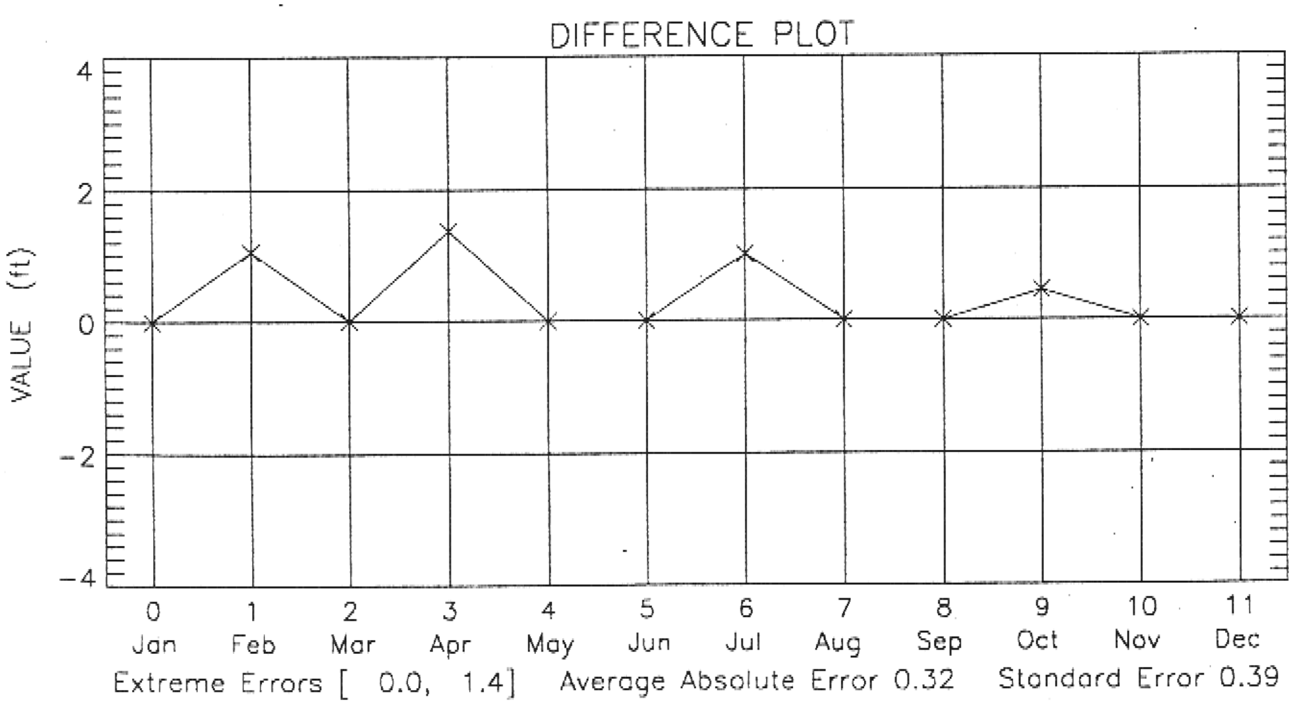


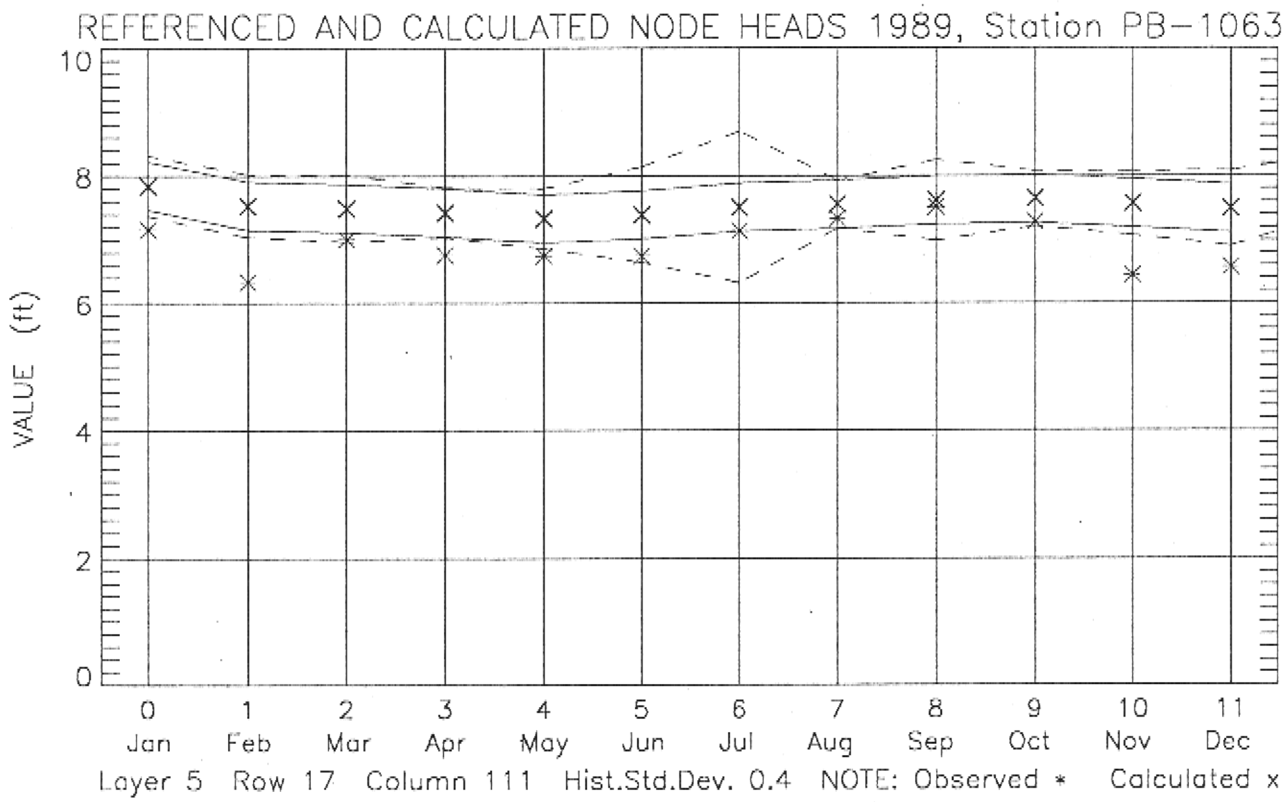
REFERENCED AND CALCULATED NODE HEADS 1989, Station PB-555
VALUE (ft)
0 Jan 1 Feb 2 Mar 3 Apr 4 May 5 Jun 6 Jul 7 Aug 8 Sep 9 Oct 10 Nov 11 Dec
Layer 5 Row 13 Column 125 Hist.Std.Dev. 0.6 NOTE: Observed * Calculated x

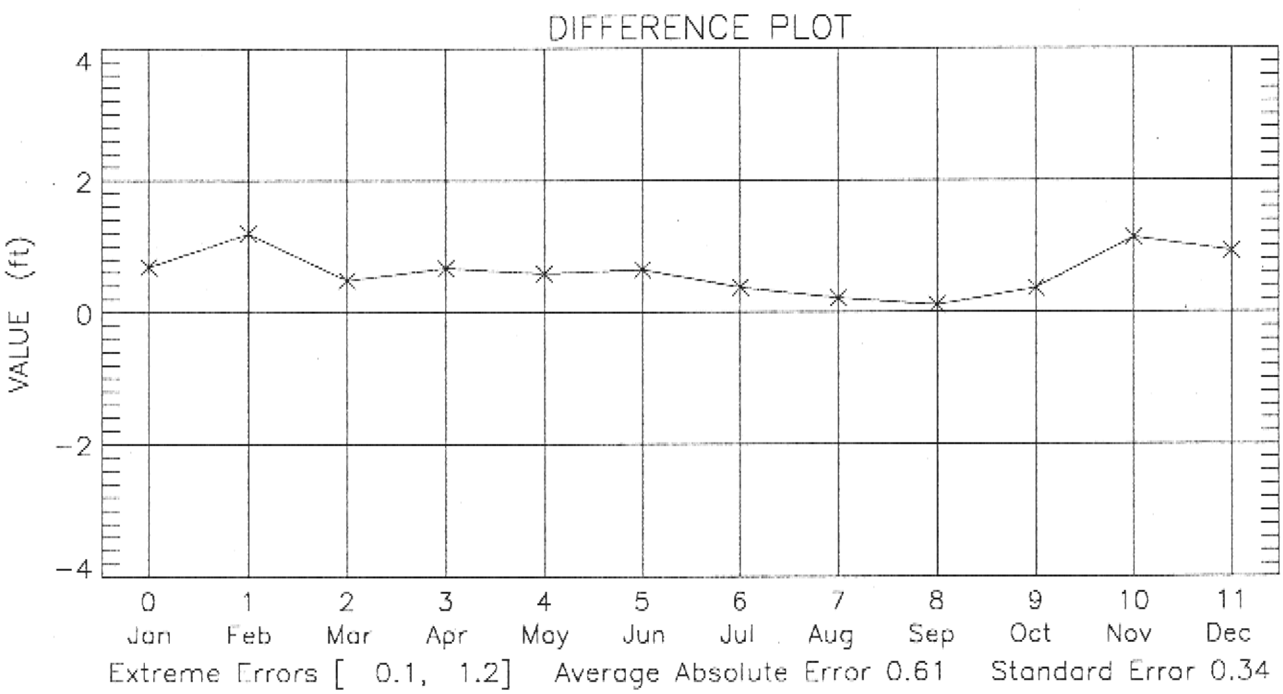


DIFFERENCE PLOT
VALUE (ft)
0 Jan 1 Feb 2 Mar 3 Apr 4 May 5 Jun 6 Jul 7 Aug 8 Sep 9 Oct 10 Nov 11 Dec
Extreme Errors [-0.6, 0.9] Average Absolute Error 0.41 Standard Error 0.41

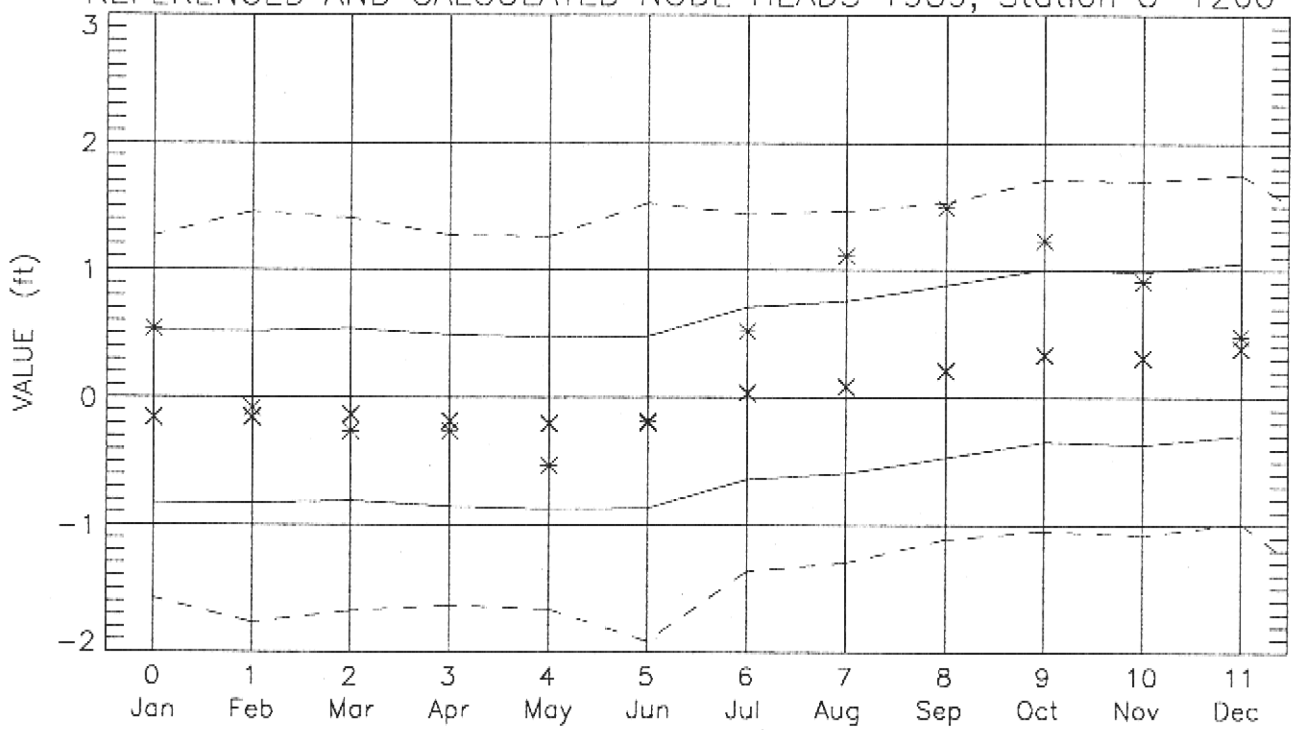

REFERENCED AND CALCULATED NODE HEADS 1989, Station PB-752
VALUE (ft)
0
2
4
6
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Layer 1 Row 16 Column 117 Hist.Std.Dev. 0.5 NOTE: Observed * Calculated x


DIFFERENCE PLOT
VALUE (ft)
4
2
0
-2
-4
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Extreme Errors [0.0, 1.4] Average Absolute Error 0.32 Standard Error 0.39


REFERENCED AND CALCULATED NODE HEADS 1989, Station PB-1063
VALUE (ft)
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Layer 5 Row 17 Column 111 Hist.Std.Dev. 0.4 NOTE: Observed * Calculated x

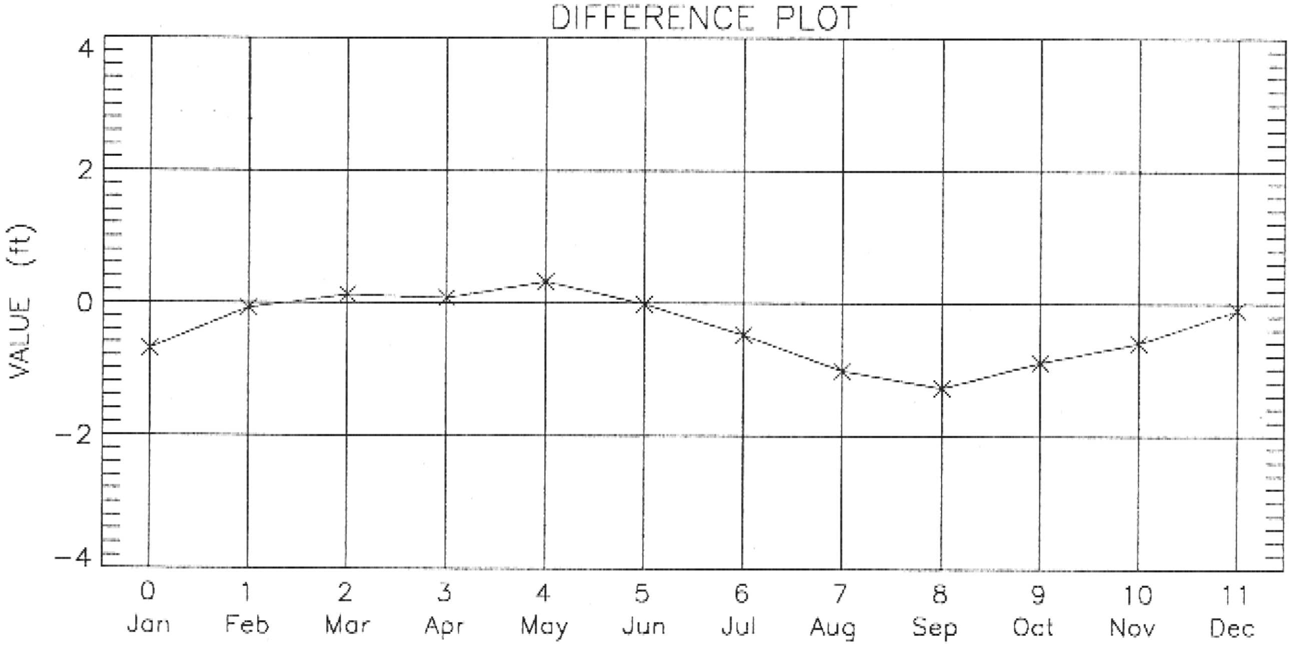

DIFFERENCE PLOT
VALUE (ft)
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Extreme Errors [0.1, 1.2] Average Absolute Error 0.61 Standard Error 0.34

REFERENCED AND CALCULATED NODE HEADS 1989, Station G-1260

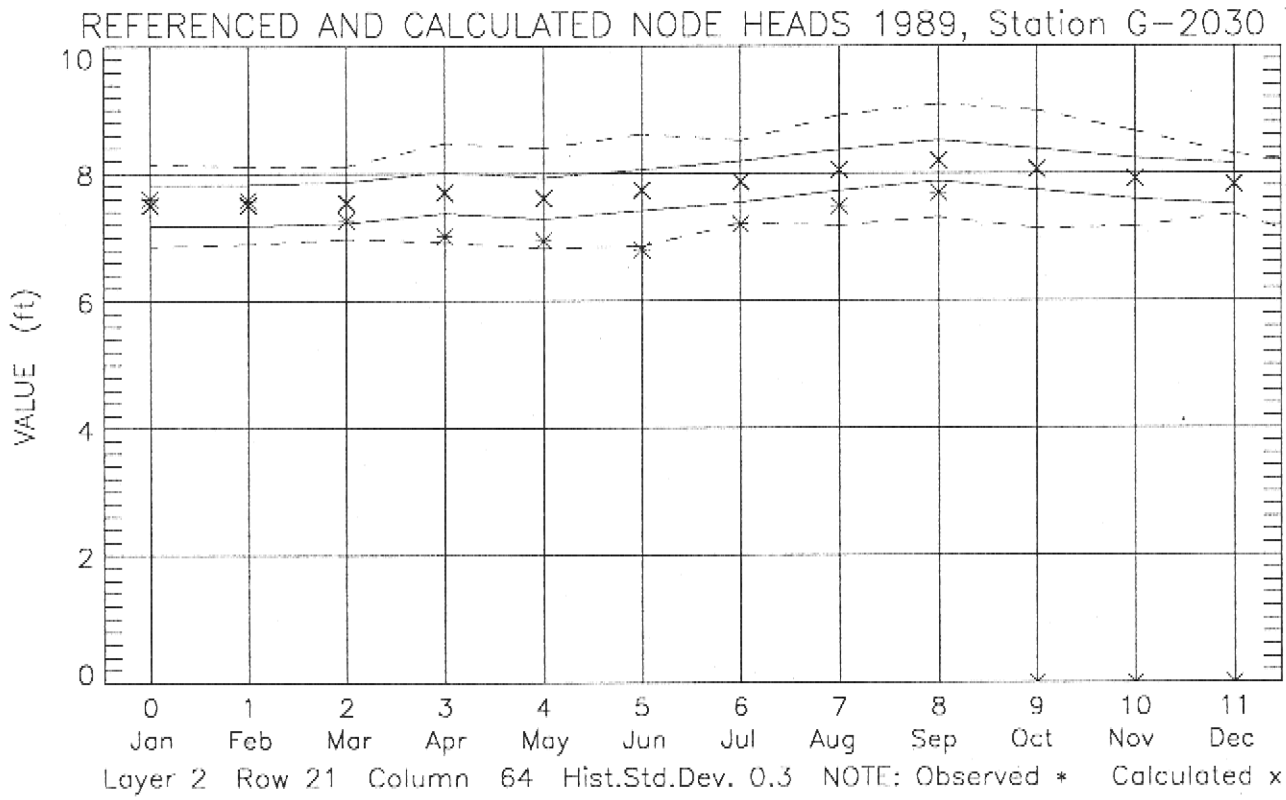


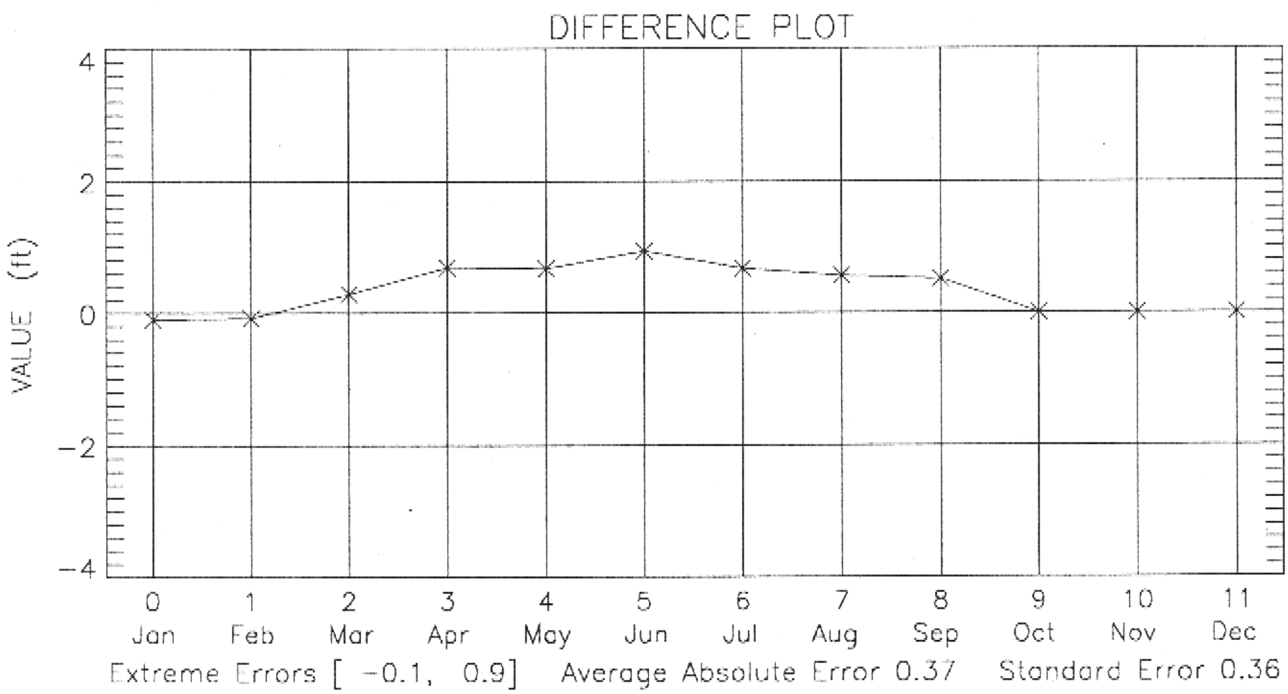
Layer 3 Row 20 Column 116 Hist.Std.Dev. 0.7 NOTE: Observed * Calculated x

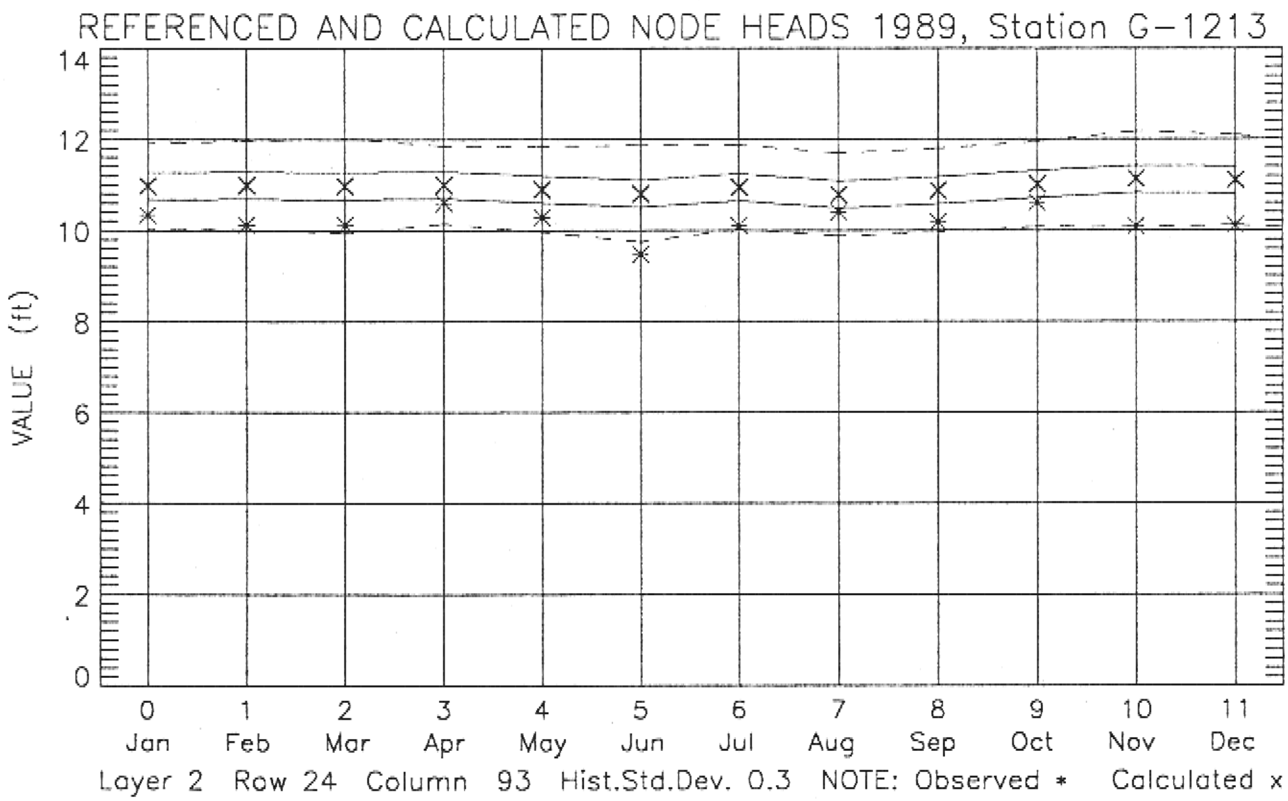
DIFFERENCE PLOT

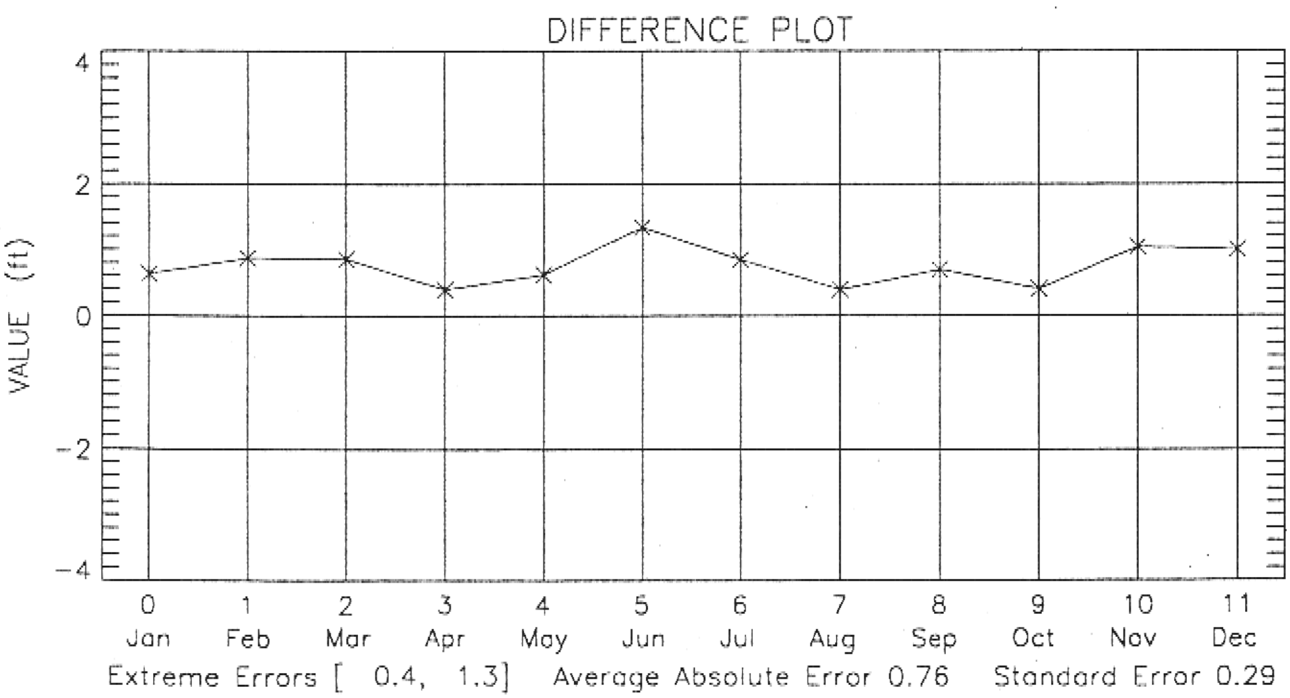


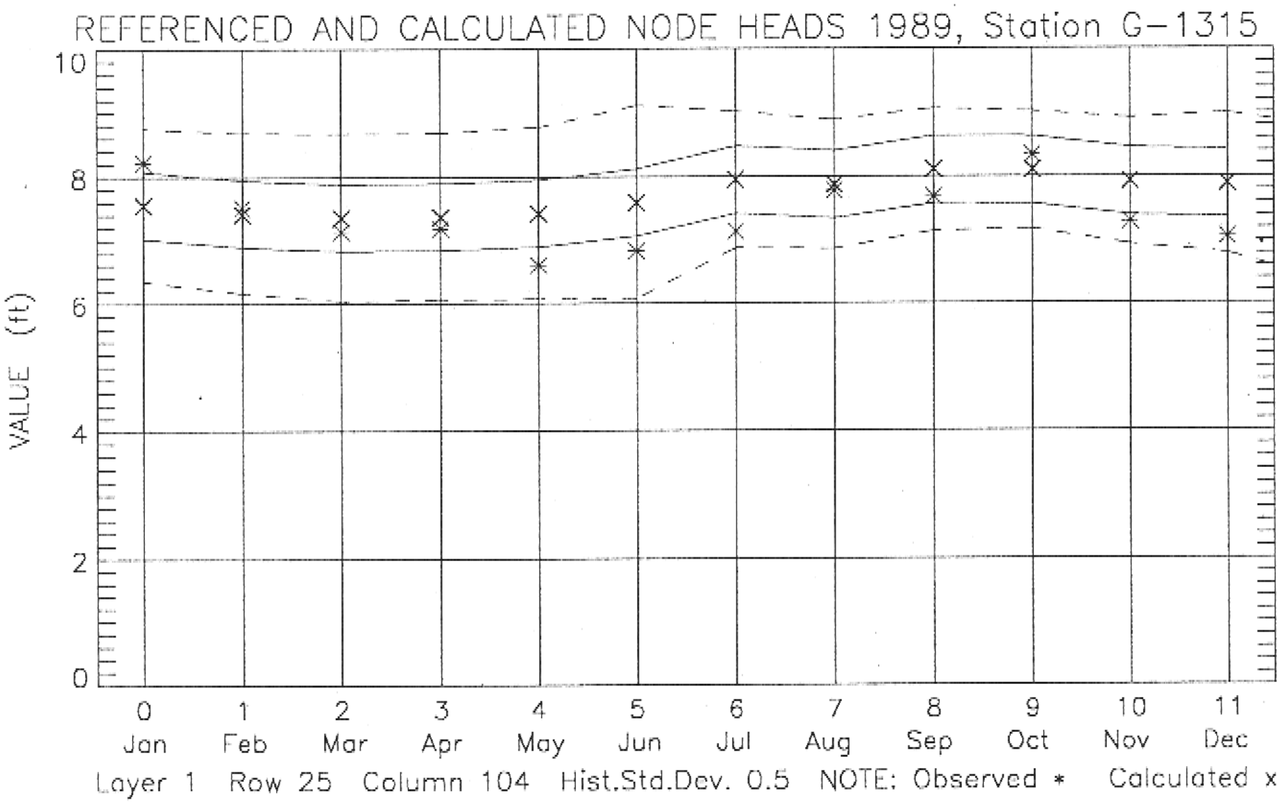
Extreme Errors [-1.3, 0.3] Average Absolute Error 0.47 Standard Error 0.52

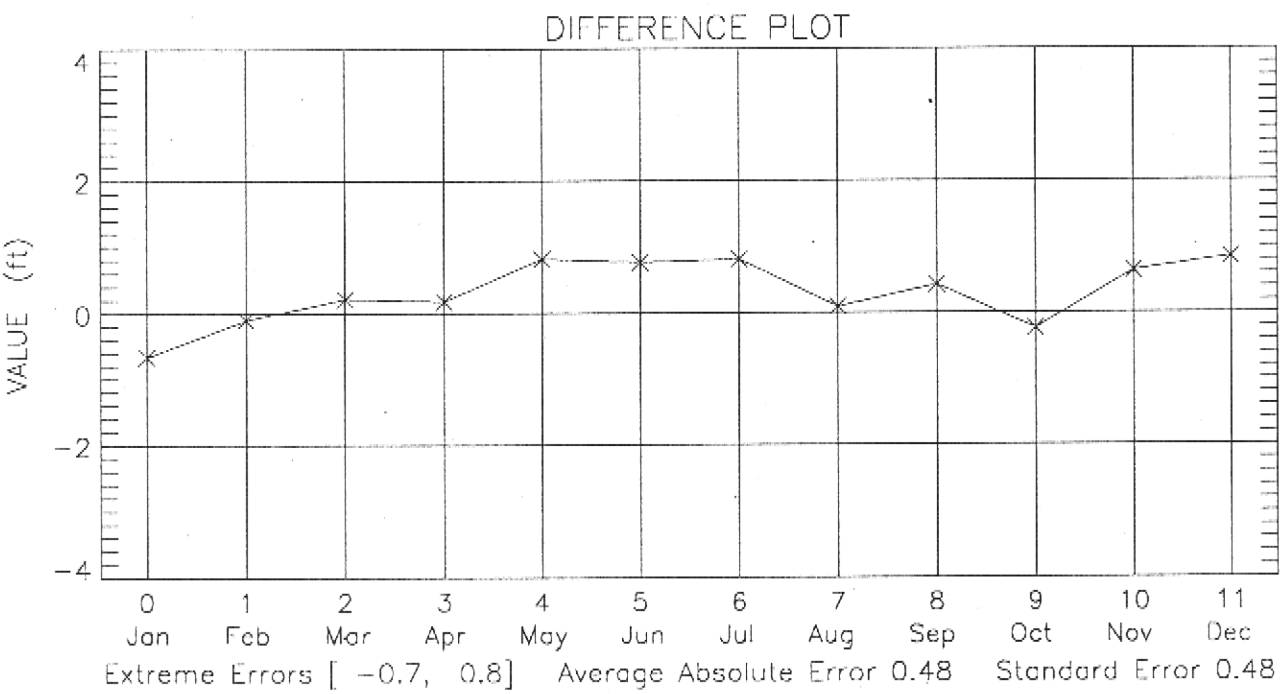

REFERENCED AND CALCULATED NODE HEADS 1989, Station G-2030
VALUE (ft)
10
8
6
4
2
0
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Layer 2 Row 21 Column 64 Hist.Std.Dev. 0.3 NOTE: Observed * Calculated x

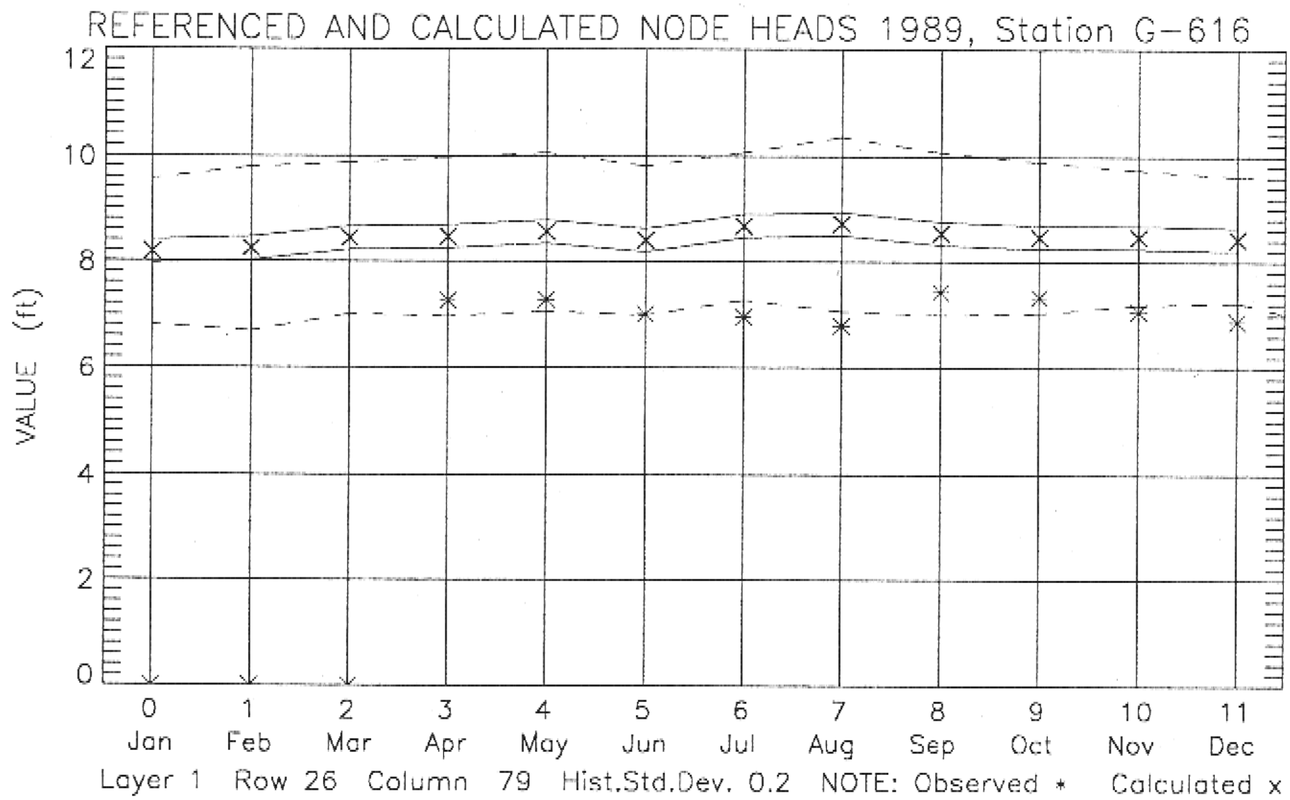

DIFFERENCE PLOT
VALUE (ft)
4
2
0
-2
-4
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Extreme Errors [-0.1, 0.9] Average Absolute Error 0.37 Standard Error 0.36

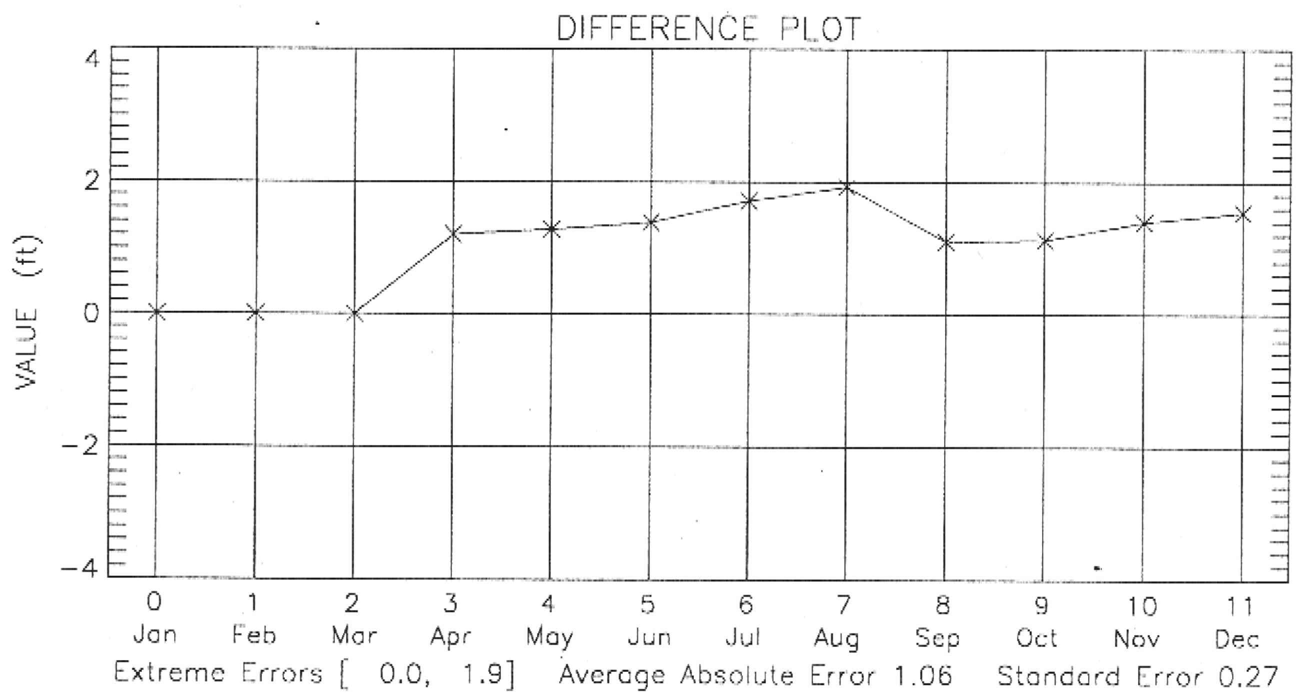

REFERENCED AND CALCULATED NODE HEADS 1989, Station G-1213
VALUE (ft)
0
2
4
6
8
10
12
14
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Layer 2 Row 24 Column 93 Hist.Std.Dev. 0.3 NOTE: Observed * Calculated x

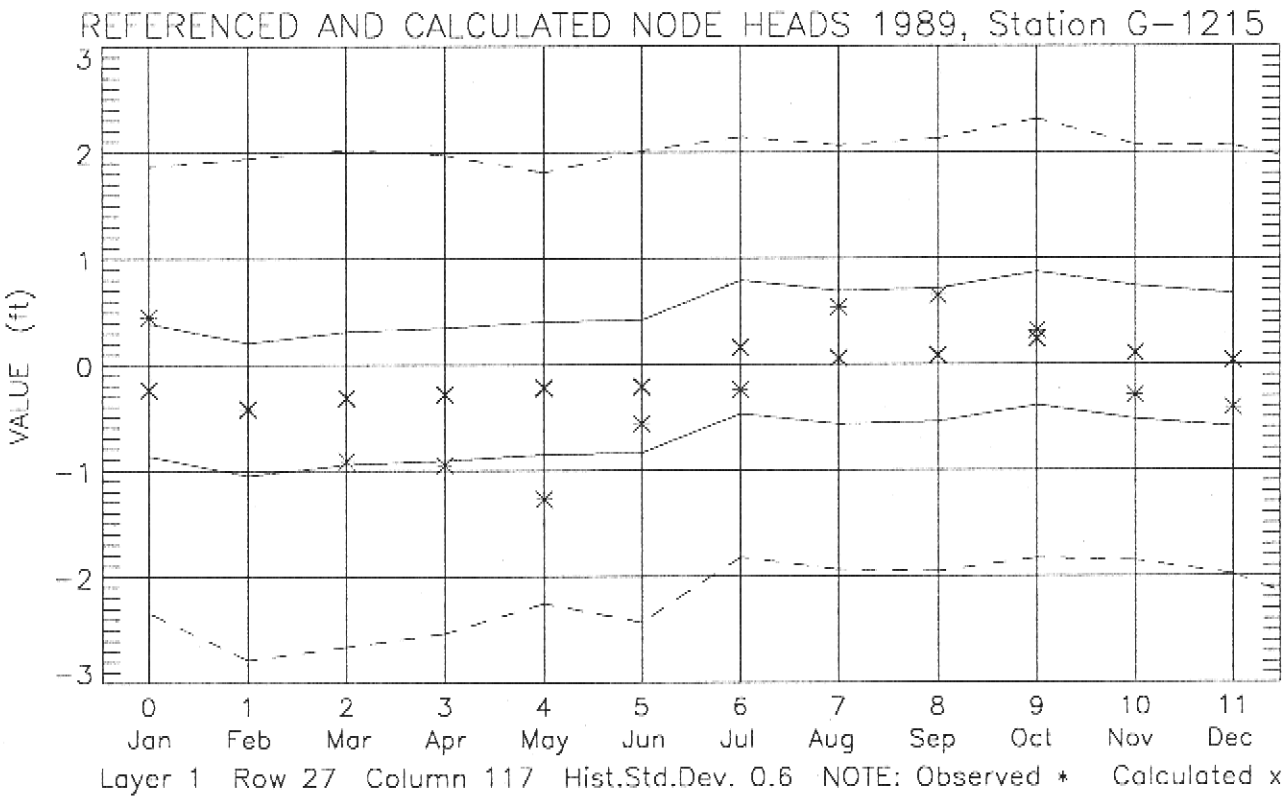

DIFFERENCE PLOT
VALUE (ft)
-4
-2
0
2
4
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Extreme Errors [0.4, 1.3] Average Absolute Error 0.76 Standard Error 0.29


REFERENCED AND CALCULATED NODE HEADS 1989, Station G-1315
VALUE (ft)
10
8
6
4
2
0
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Layer 1 Row 25 Column 104 Hist.Std.Dev. 0.5 NOTE: Observed * Calculated x

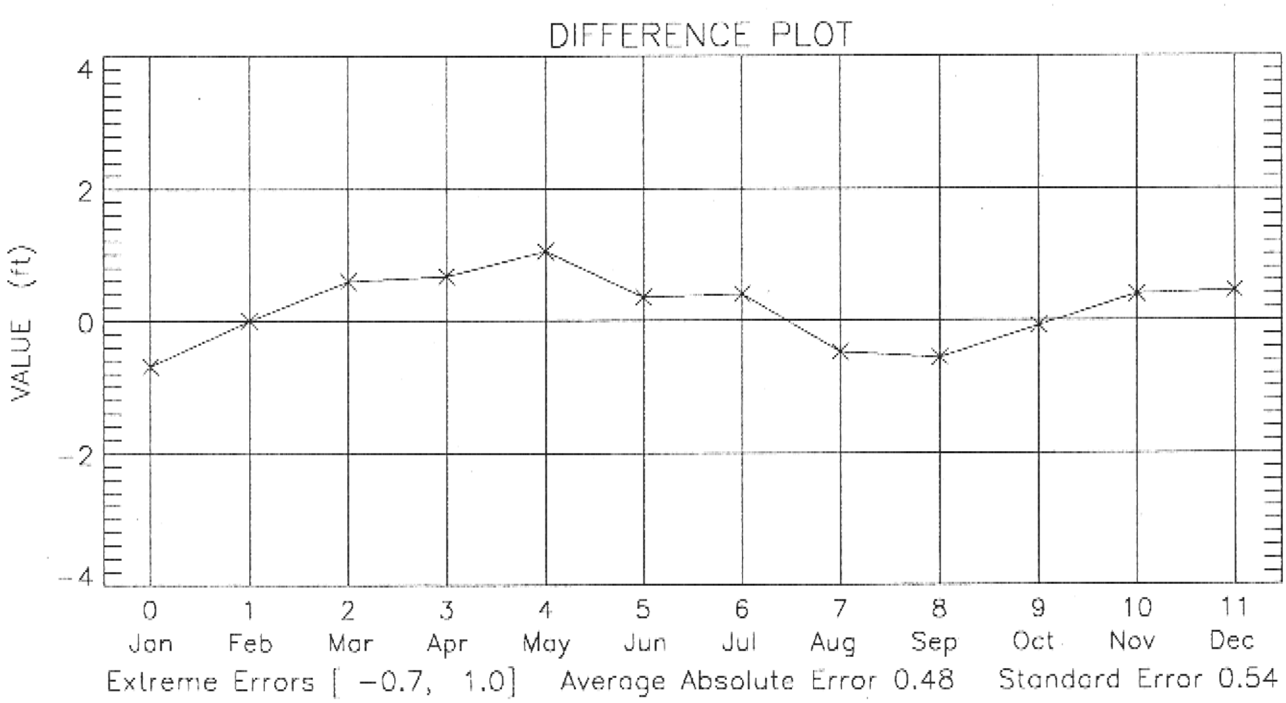

DIFFERENCE PLOT
VALUE (ft)
4
2
0
-2
-4
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Extreme Errors [-0.7, 0.8] Average Absolute Error 0.48 Standard Error 0.48


REFERENCED AND CALCULATED NODE HEADS 1989, Station G-616
VALUE (ft)
0 2 4 6 8 10 12
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Layer 1 Row 26 Column 79 Hist.Std.Dev. 0.2 NOTE: Observed * Calculated x

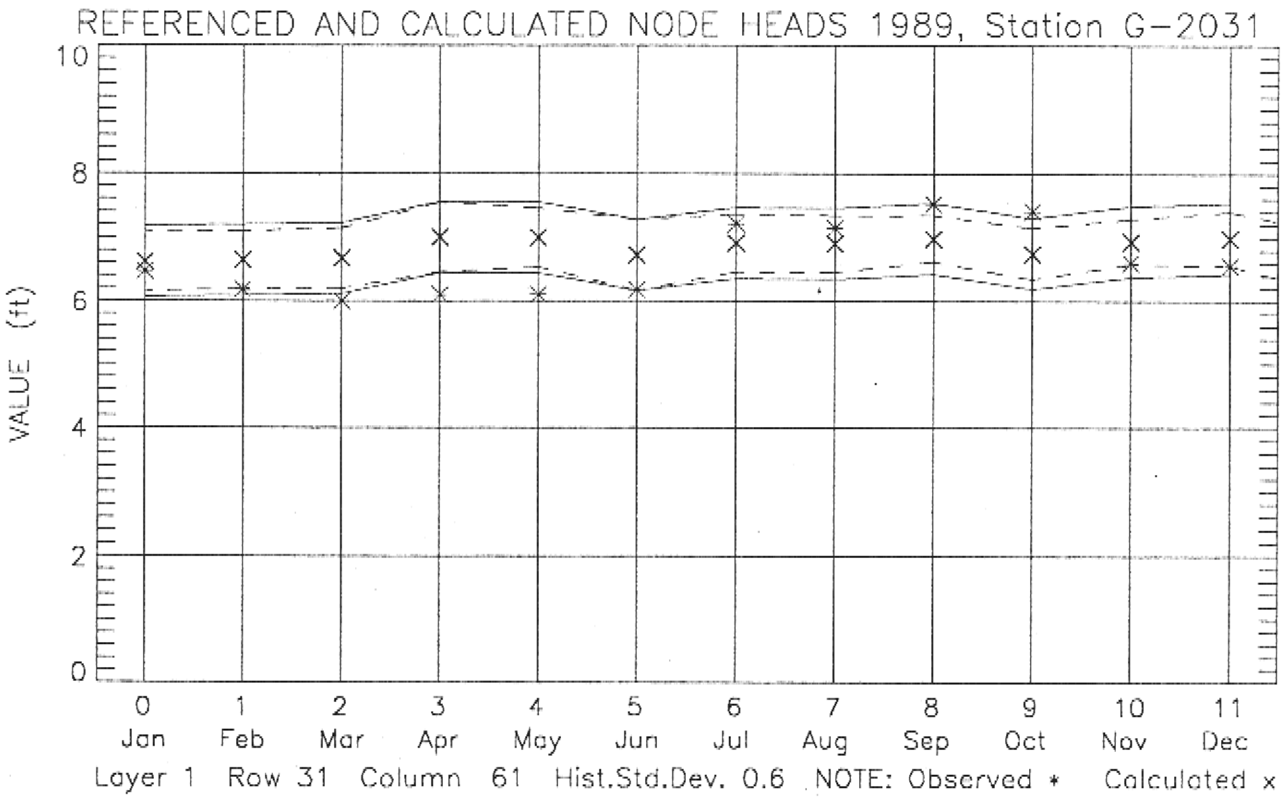

DIFFERENCE PLOT
VALUE (ft)
4 2 0 −2 −4
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Extreme Errors [0.0, 1.9] Average Absolute Error 1.06 Standard Error 0.27

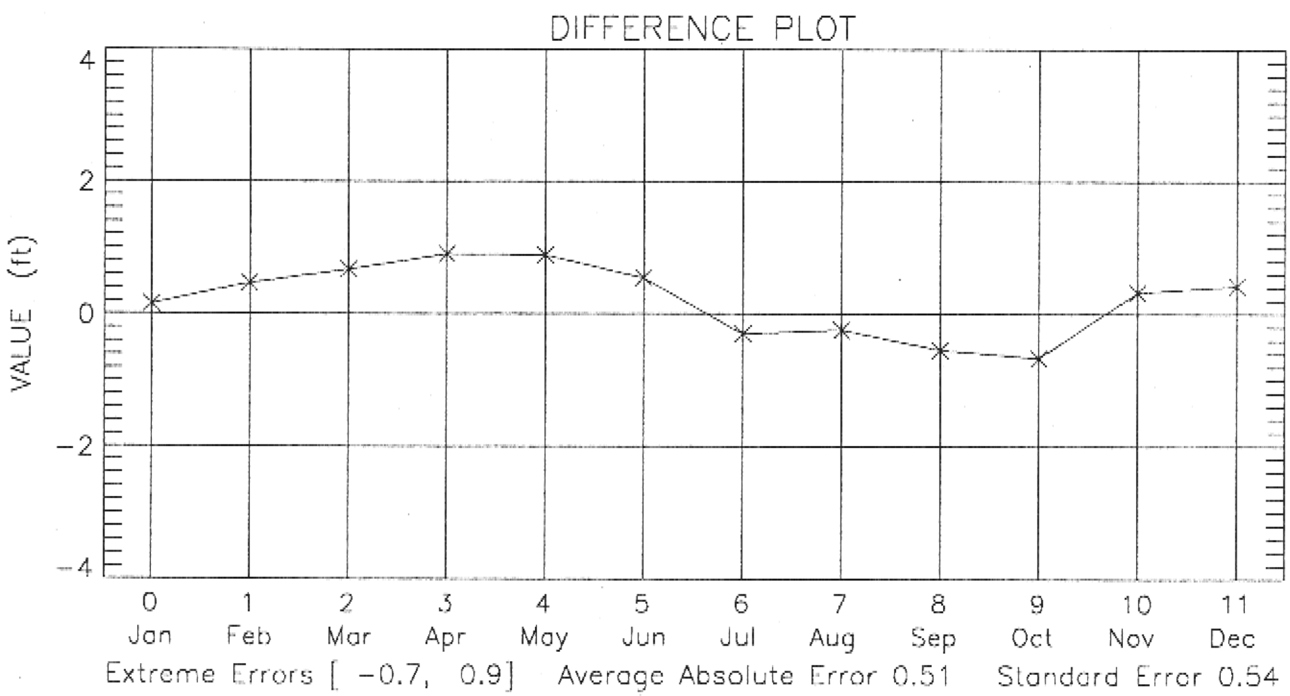


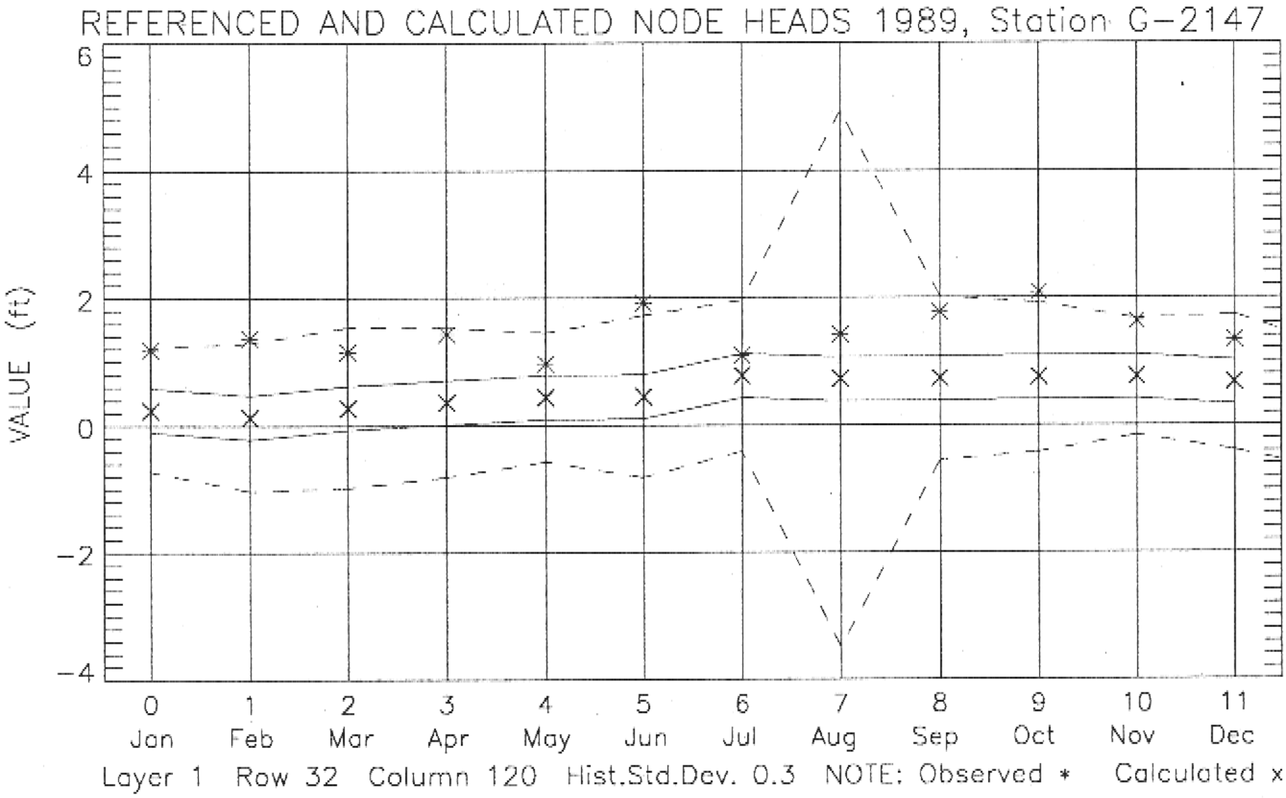
REFERENCED AND CALCULATED NODE HEADS 1989, Station G-1215
VALUE (ft)
3
2
1
0
-1
-2
-3
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Layer 1 Row 27 Column 117 Hist.Std.Dev. 0.6 NOTE: Observed * Calculated x

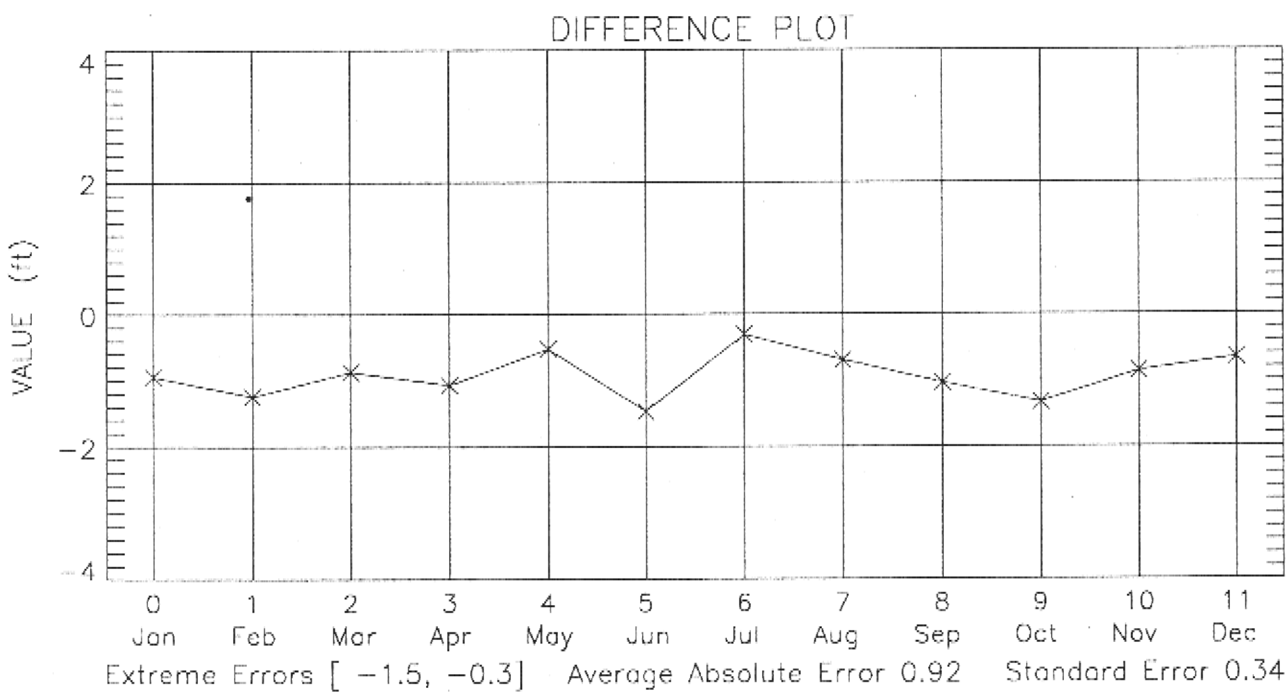


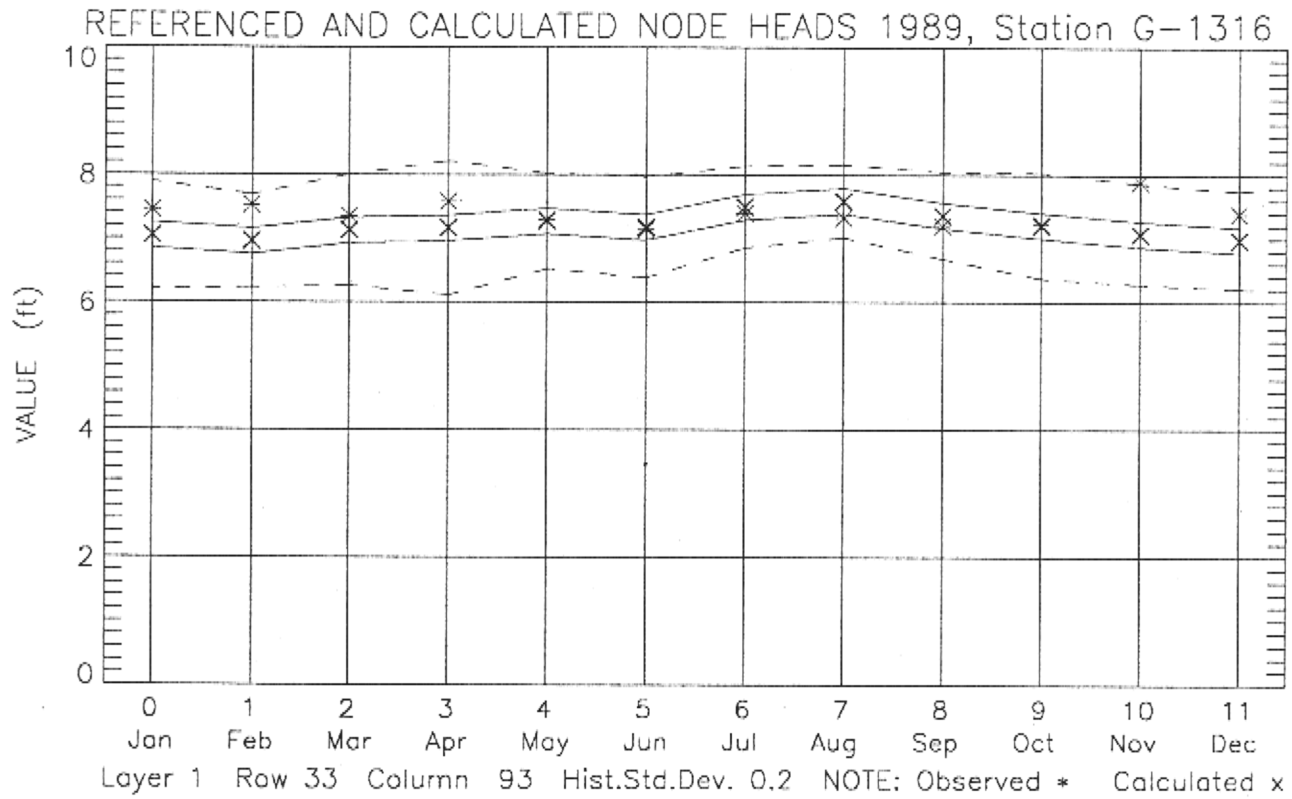
DIFFERENCE PLOT
VALUE (ft)
4
2
0
-2
-4
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Extreme Errors [-0.7, 1.0] Average Absolute Error 0.48 Standard Error 0.54

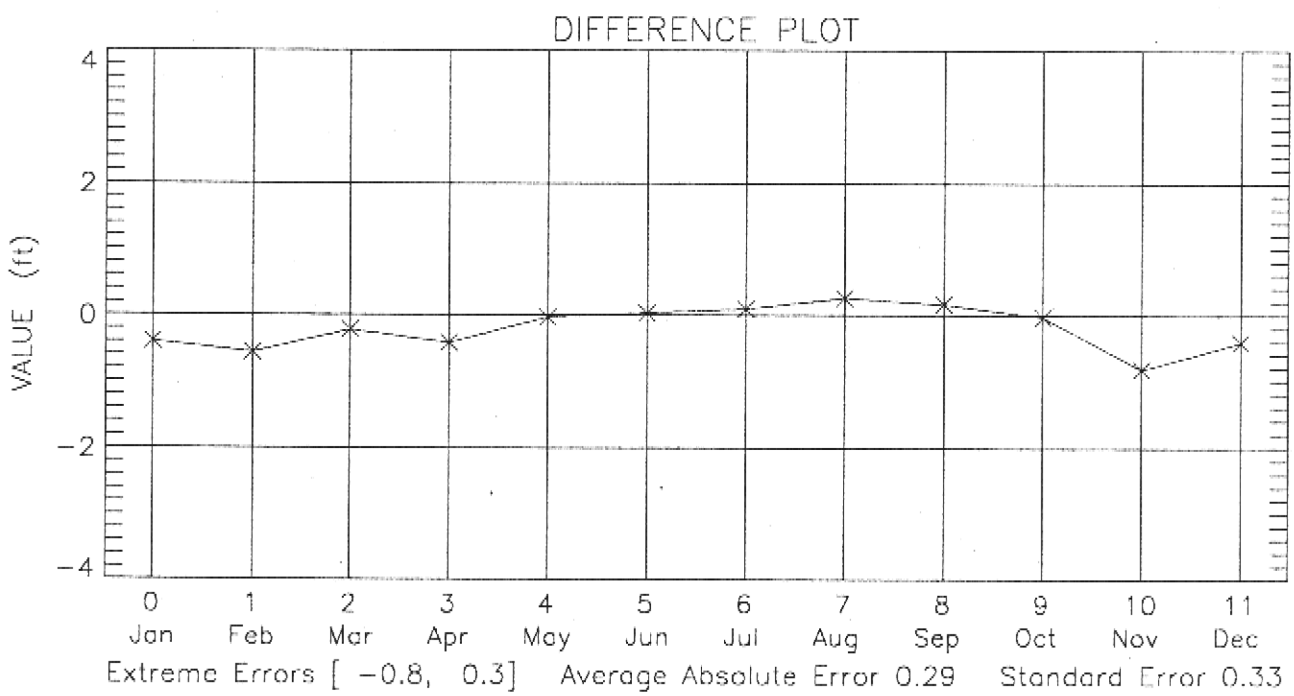

REFERENCED AND CALCULATED NODE HEADS 1989, Station G-2031
VALUE (ft)
10
8
6
4
2
0
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Layer 1 Row 31 Column 61 Hist.Std.Dev. 0.6 NOTE: Observed * Calculated x

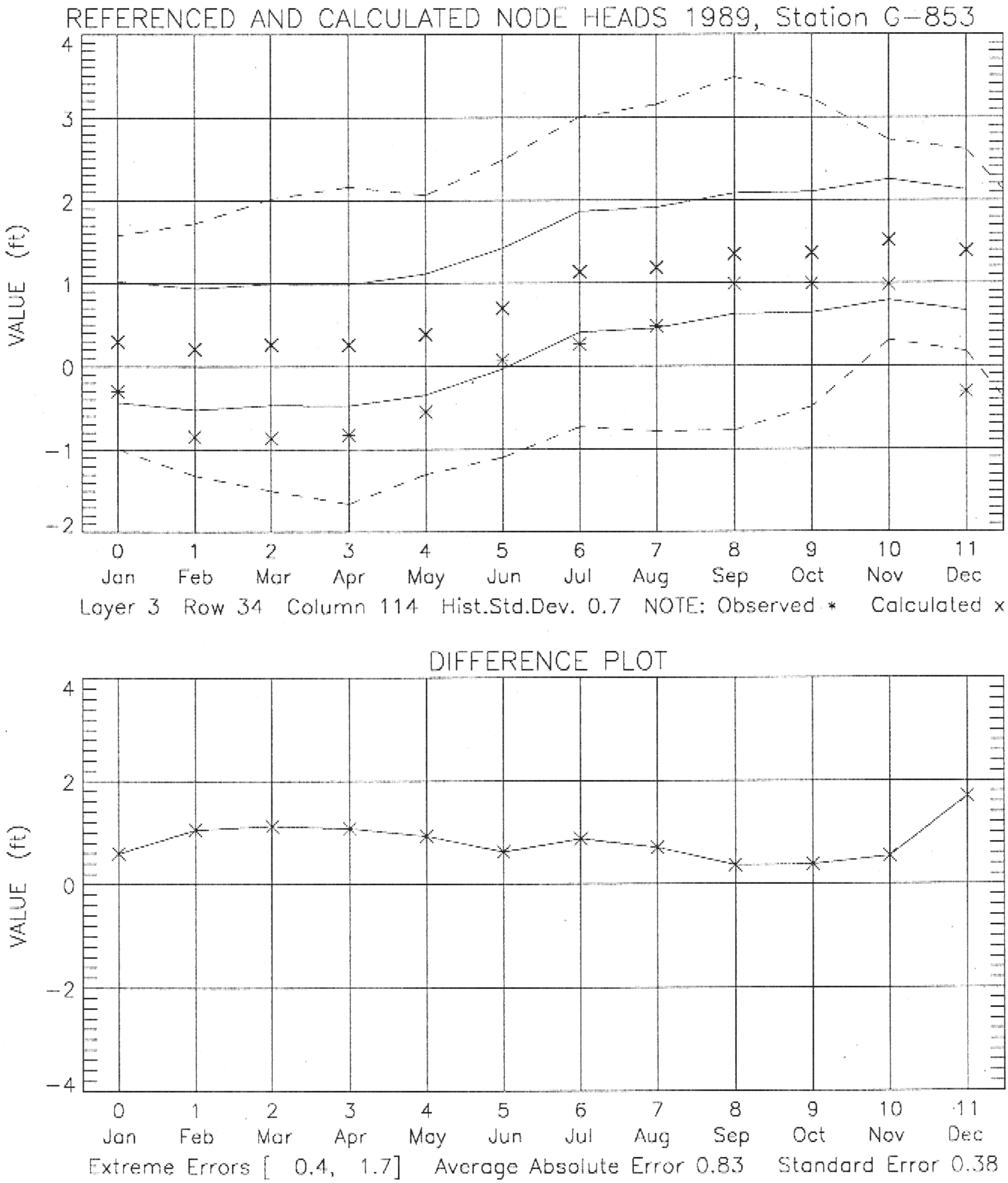

DIFFERENCE PLOT
VALUE (ft)
4
2
0
−2
−4
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Extreme Errors [−0.7, 0.9] Average Absolute Error 0.51 Standard Error 0.54

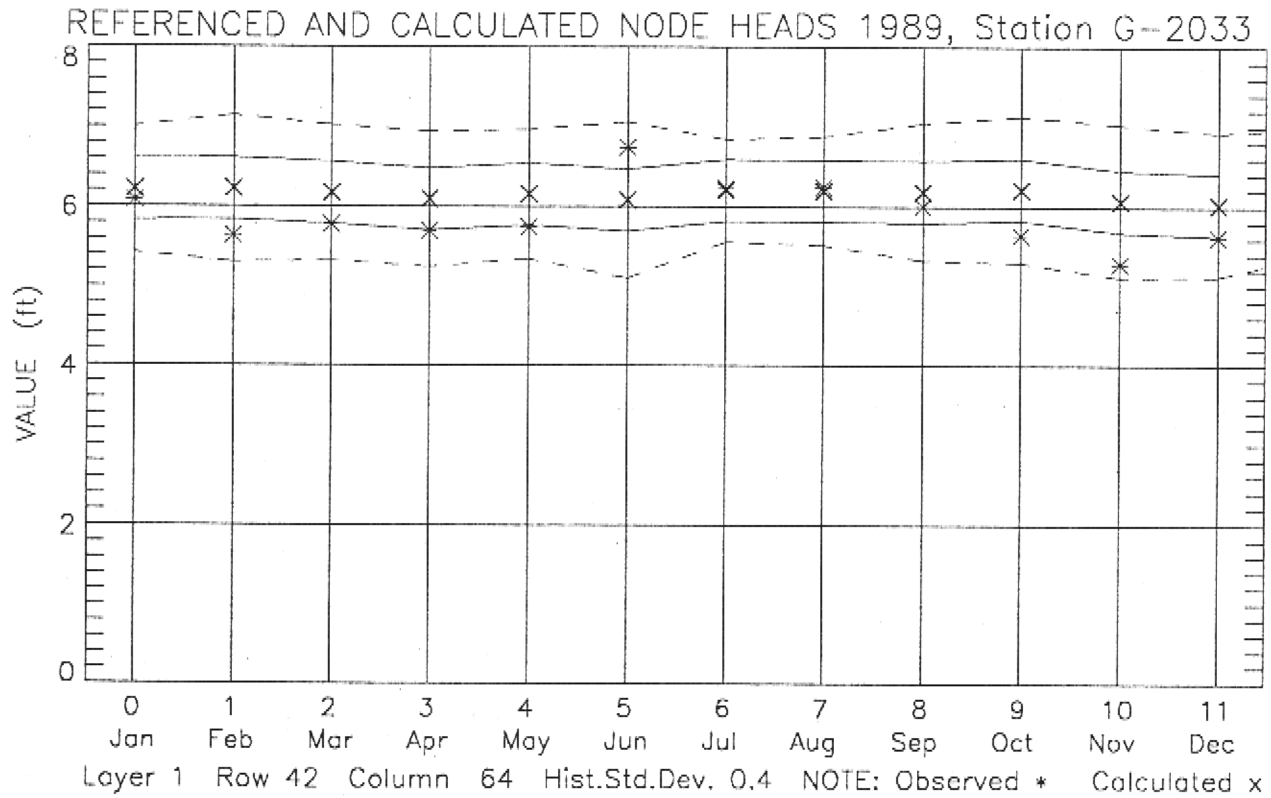

REFERENCED AND CALCULATED NODE HEADS 1989, Station G-2147
VALUE (ft)
6
4
2
0
-2
-4
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Layer 1 Row 32 Column 120 Hist.Std.Dev. 0.3 NOTE: Observed * Calculated x

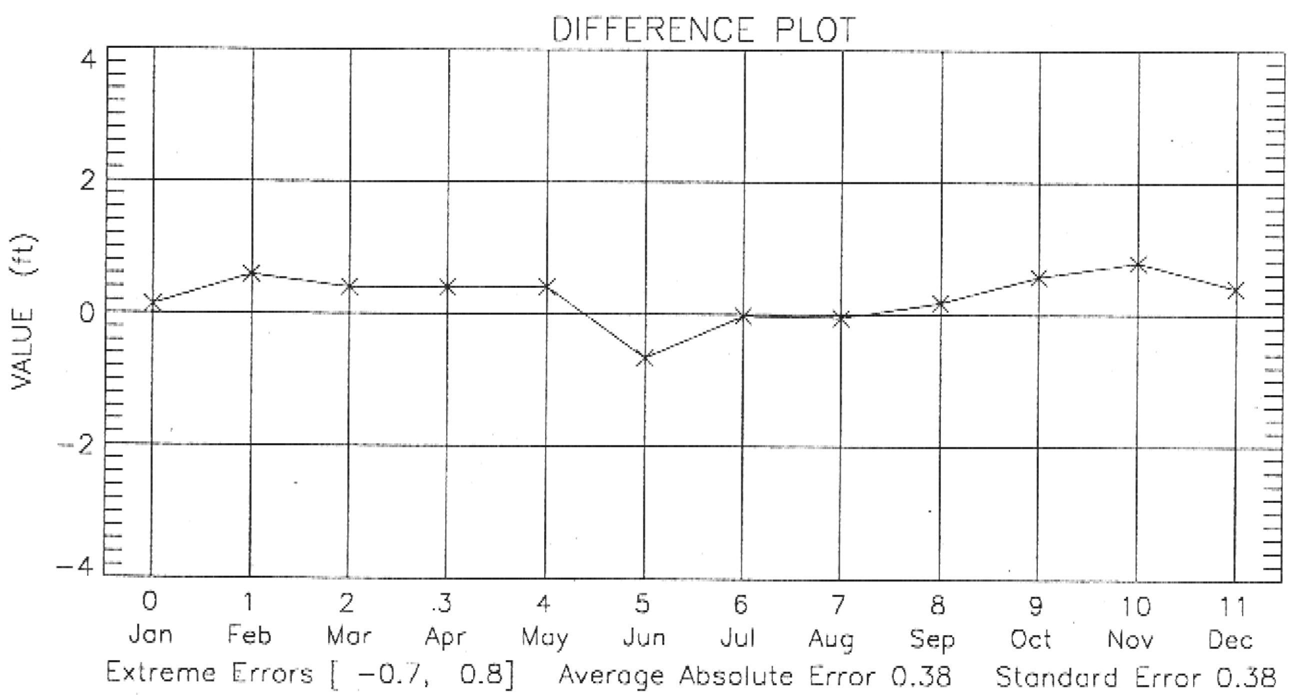

DIFFERENCE PLOT
VALUE (ft)
4
2
0
-2
-4
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Extreme Errors [-1.5, -0.3] Average Absolute Error 0.92 Standard Error 0.34

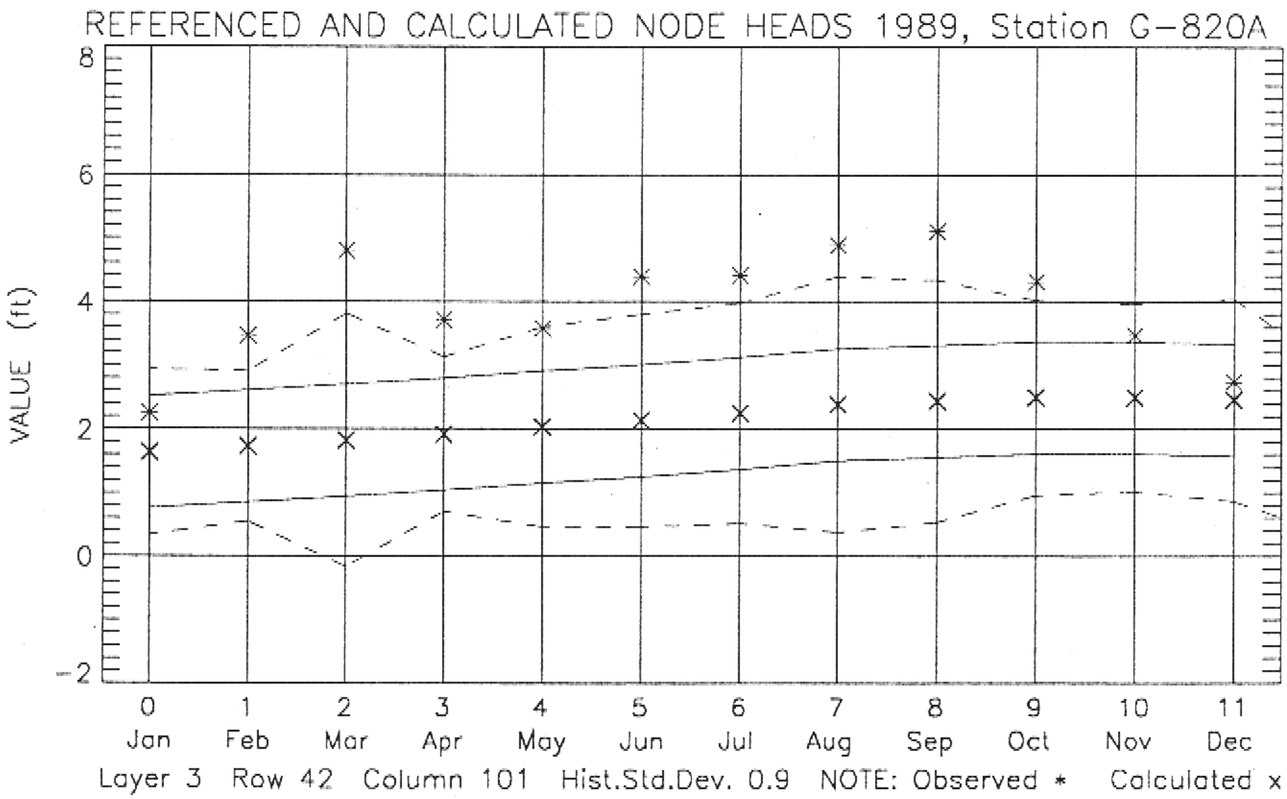

REFERENCED AND CALCULATED NODE HEADS 1989, Station G−1316
VALUE (ft)
10
8
6
4
2
0
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Layer 1 Row 33 Column 93 Hist.Std.Dev. 0.2 NOTE: Observed * Calculated x


DIFFERENCE PLOT
VALUE (ft)
4
2
0
−2
−4
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Extreme Errors [−0.8, 0.3] Average Absolute Error 0.29 Standard Error 0.33

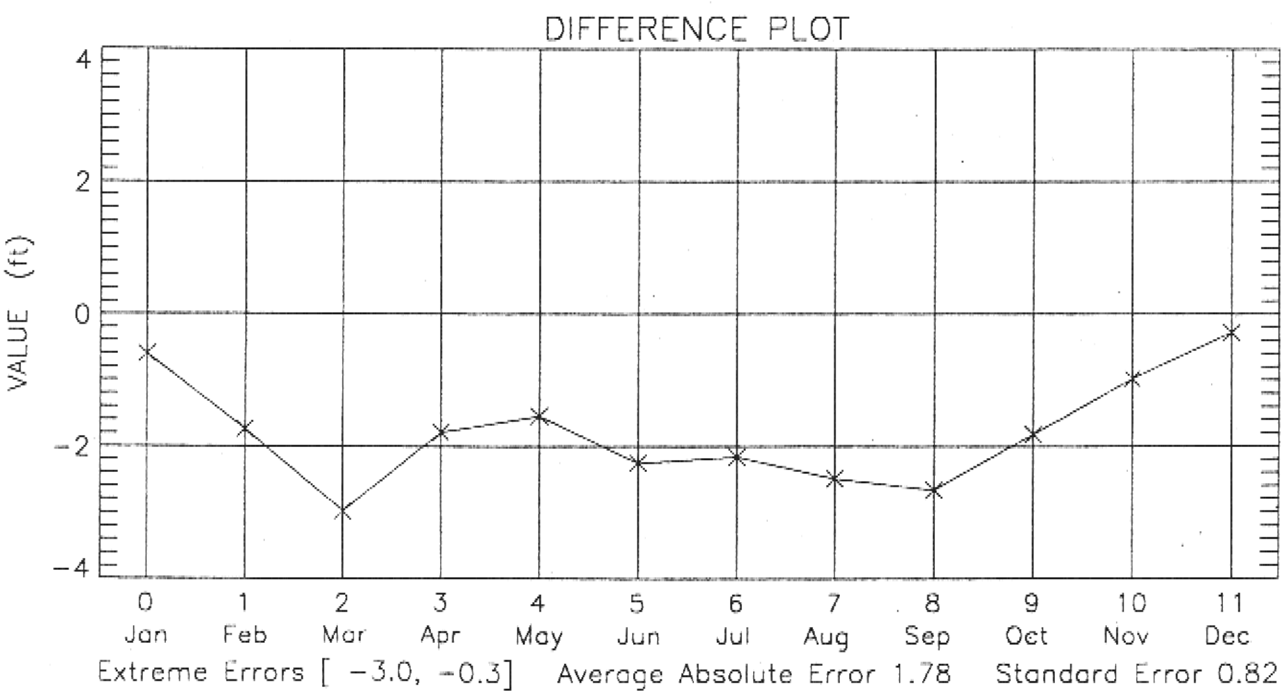

REFERENCED AND CALCULATED NODE HEADS 1989, Station G-853
VALUE (ft)
4
3
2
1
0
-1
-2
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Layer 3 Row 34 Column 114 Hist.Std.Dev. 0.7 NOTE: Observed * Calculated x
DIFFERENCE PLOT
VALUE (ft)
4
2
0
-2
-4
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Extreme Errors [0.4, 1.7] Average Absolute Error 0.83 Standard Error 0.38


REFERENCED AND CALCULATED NODE HEADS 1989, Station G-2033
VALUE (ft)
0
2
4
6
8
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Layer 1 Row 42 Column 64 Hist.Std.Dev. 0.4 NOTE: Observed * Calculated x

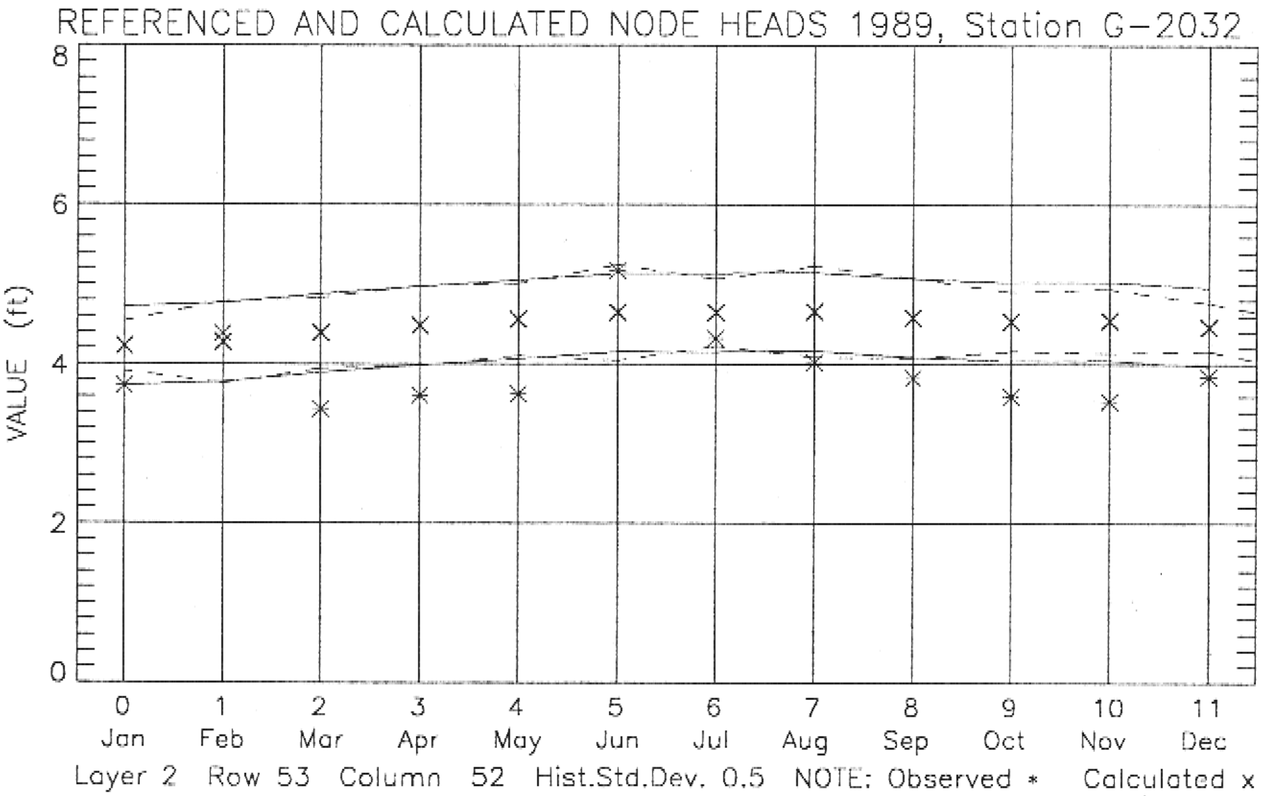

DIFFERENCE PLOT
VALUE (ft)
4
2
0
-2
-4
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Extreme Errors [-0.7, 0.8] Average Absolute Error 0.38 Standard Error 0.38

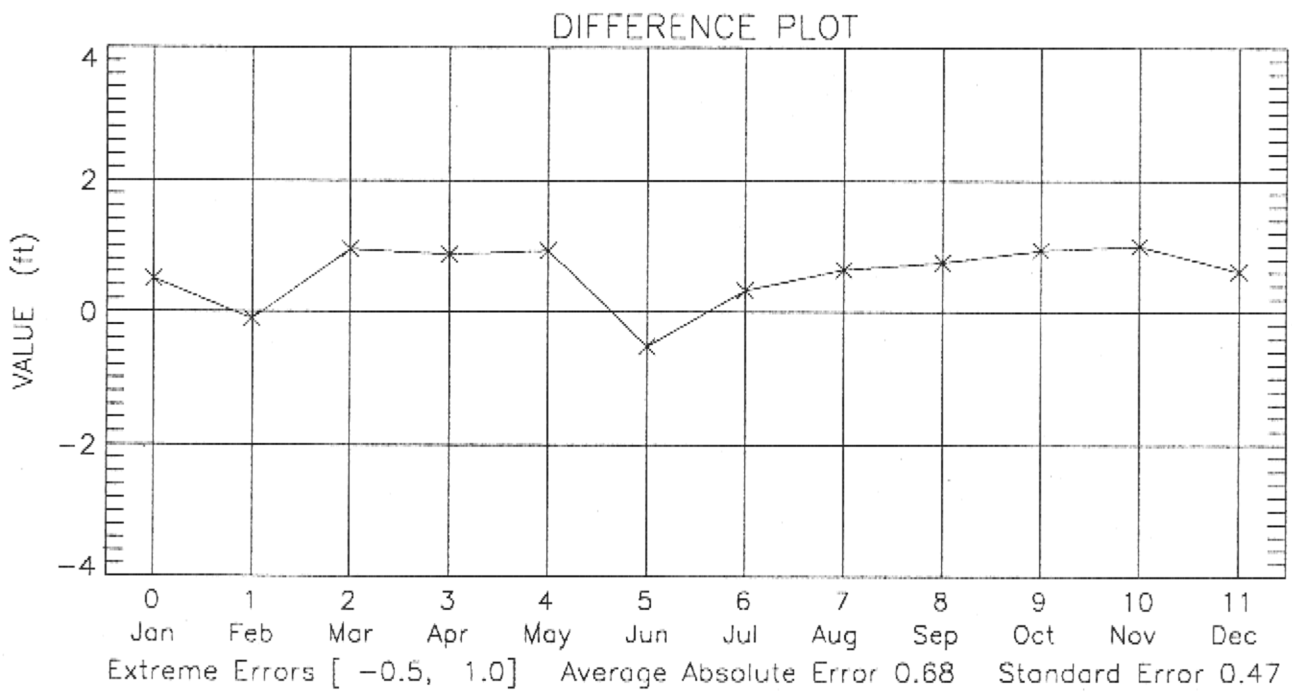


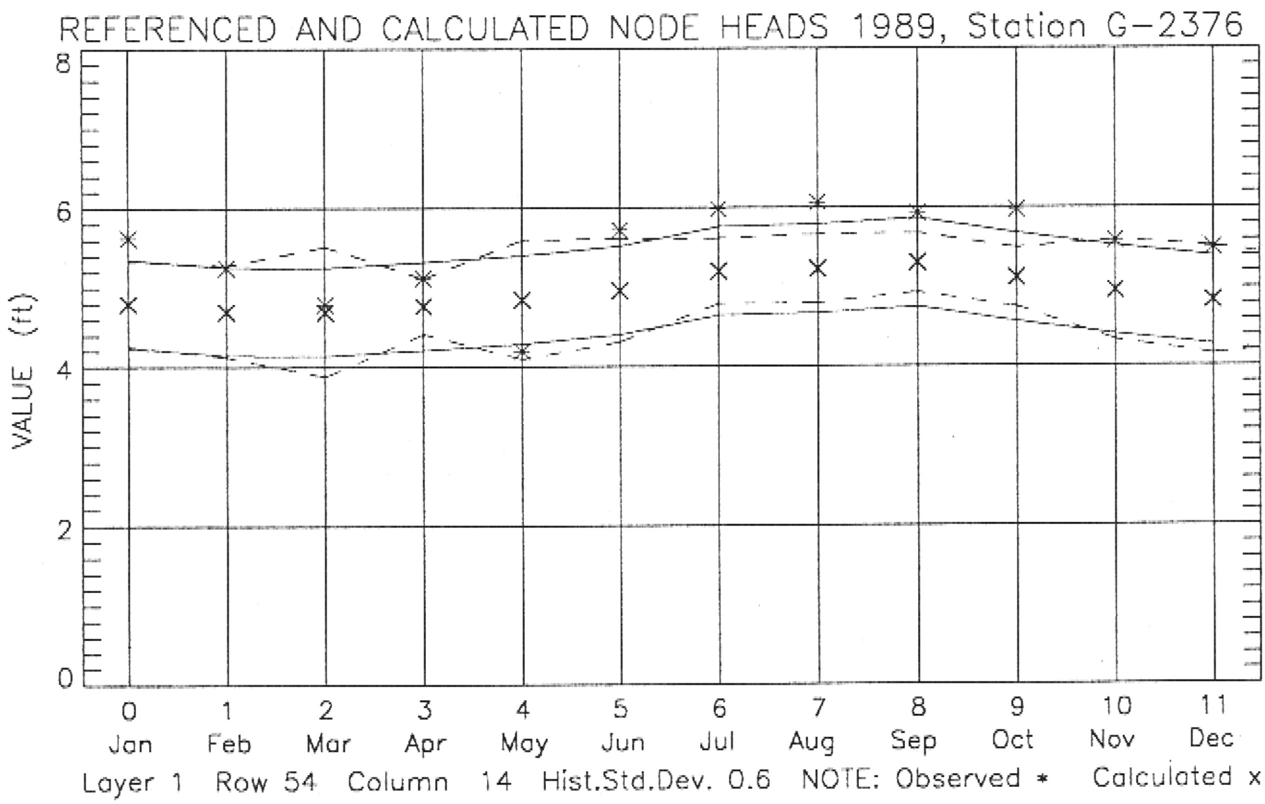
REFERENCED AND CALCULATED NODE HEADS 1989, Station G-820A
VALUE (ft)
8
6
4
2
0
-2
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Layer 3 Row 42 Column 101 Hist.Std.Dev. 0.9 NOTE: Observed * Calculated x

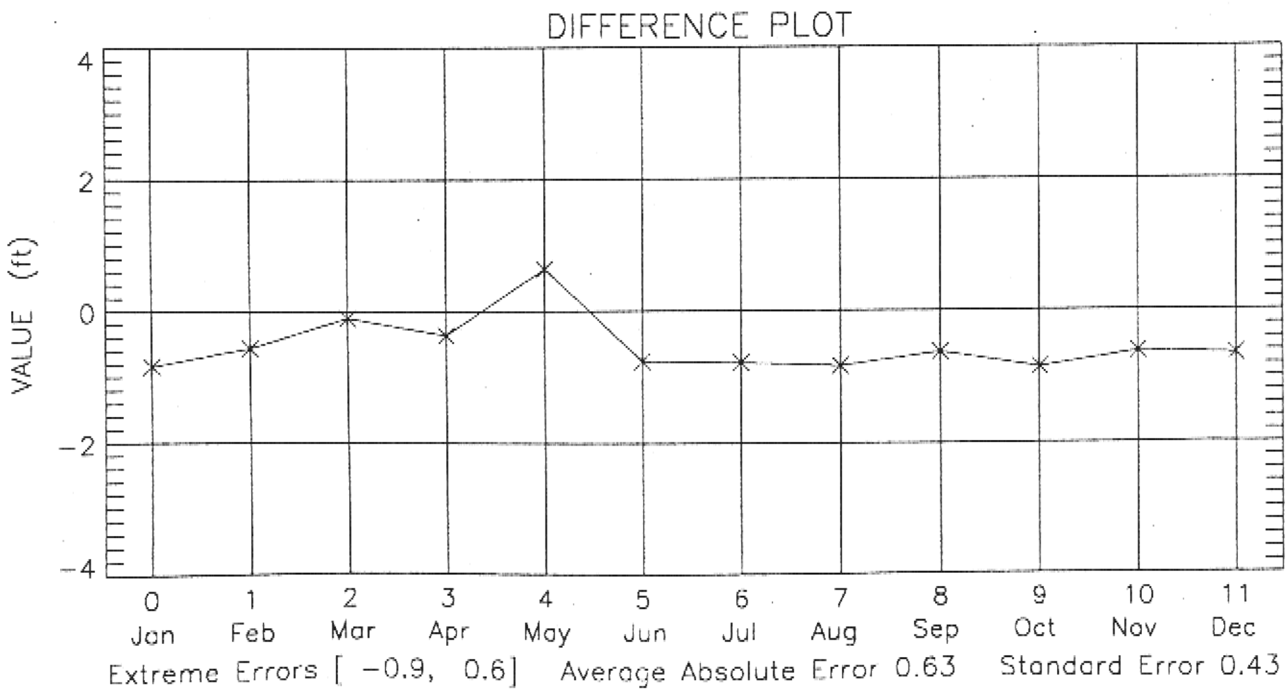


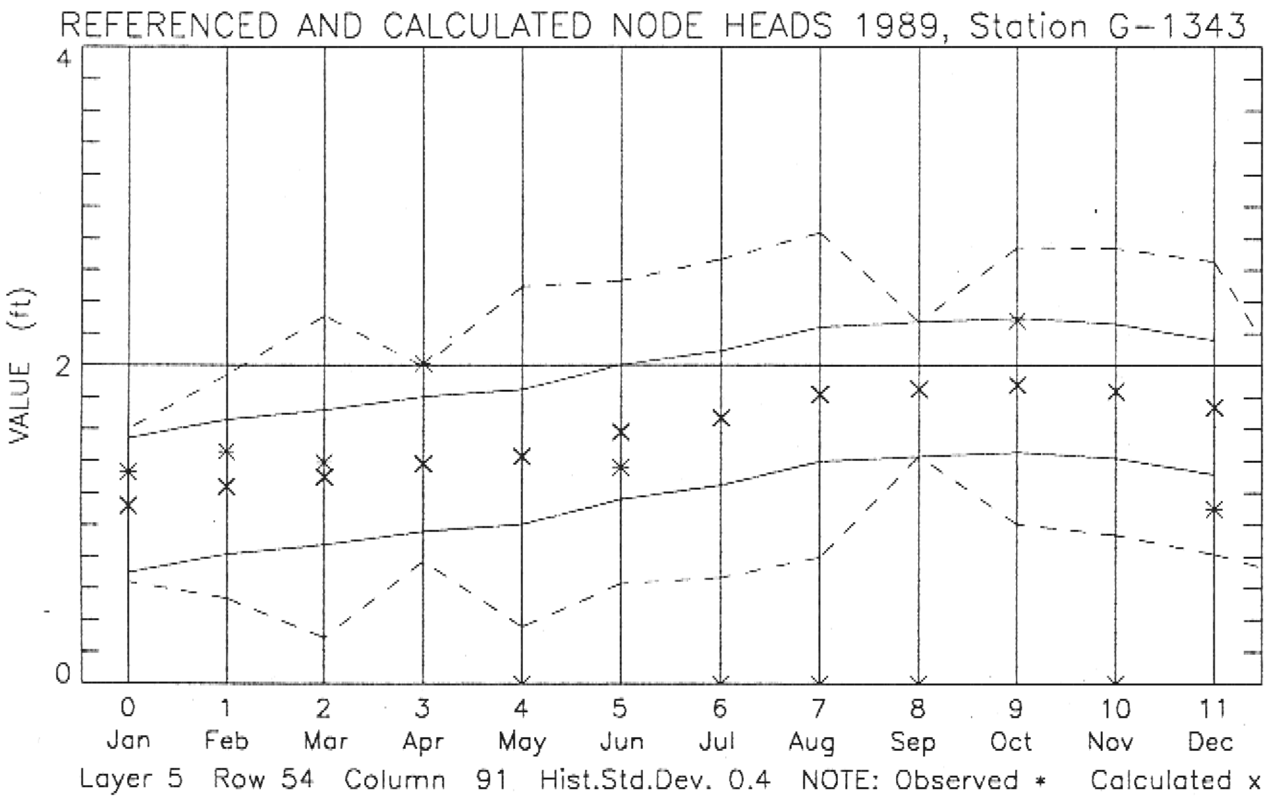
DIFFERENCE PLOT
VALUE (ft)
4
2
0
-2
-4
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Extreme Errors [-3.0, -0.3] Average Absolute Error 1.78 Standard Error 0.82

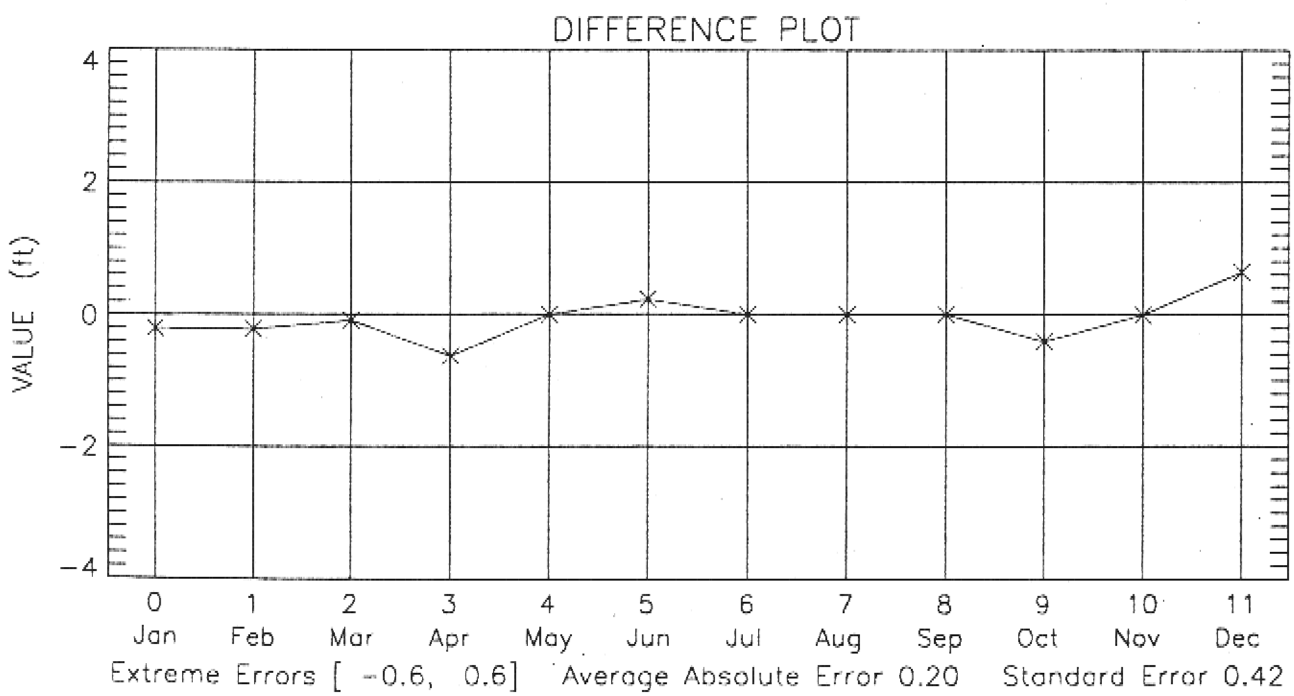

REFERENCED AND CALCULATED NODE HEADS 1989, Station G-2032
VALUE (ft)
0
2
4
6
8
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Layer 2 Row 53 Column 52 Hist.Std.Dev. 0.5 NOTE: Observed * Calculated x

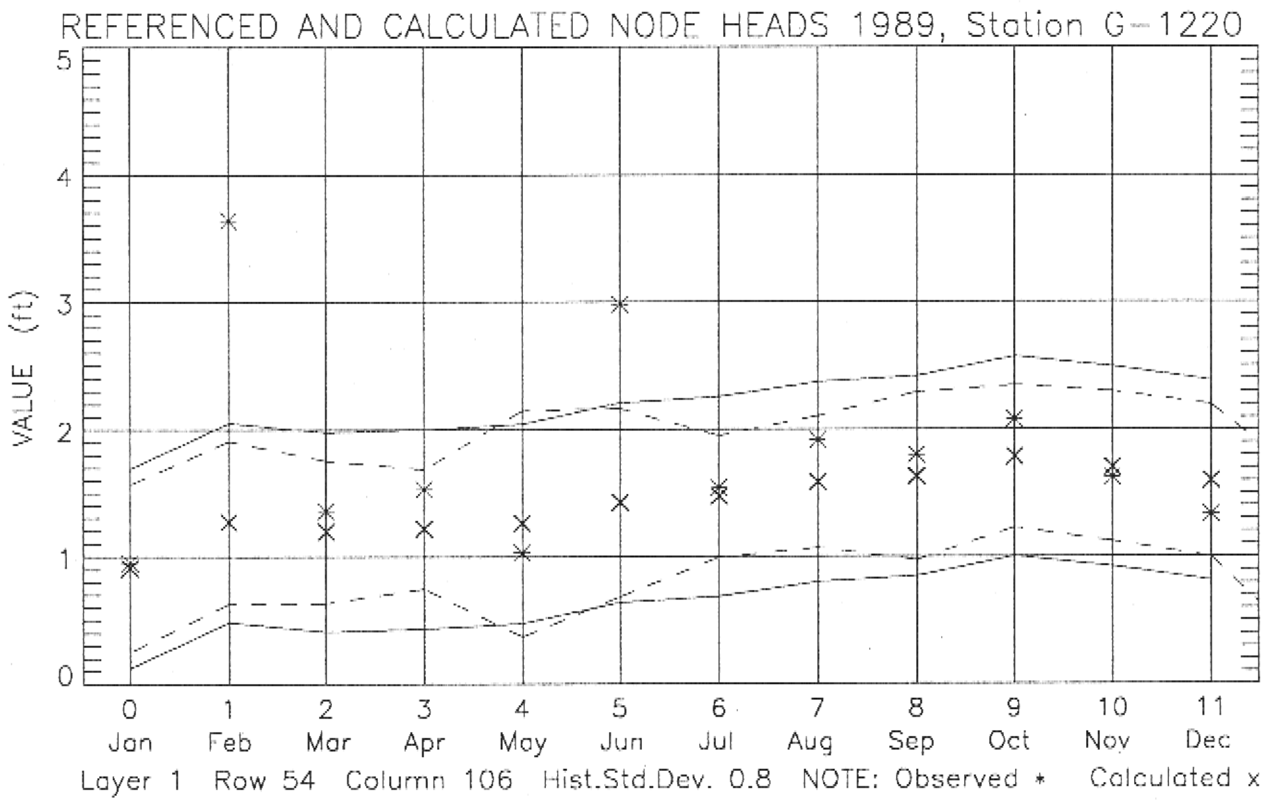

DIFFERENCE PLOT
VALUE (ft)
-4
-2
0
2
4
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Extreme Errors [-0.5, 1.0] Average Absolute Error 0.68 Standard Error 0.47

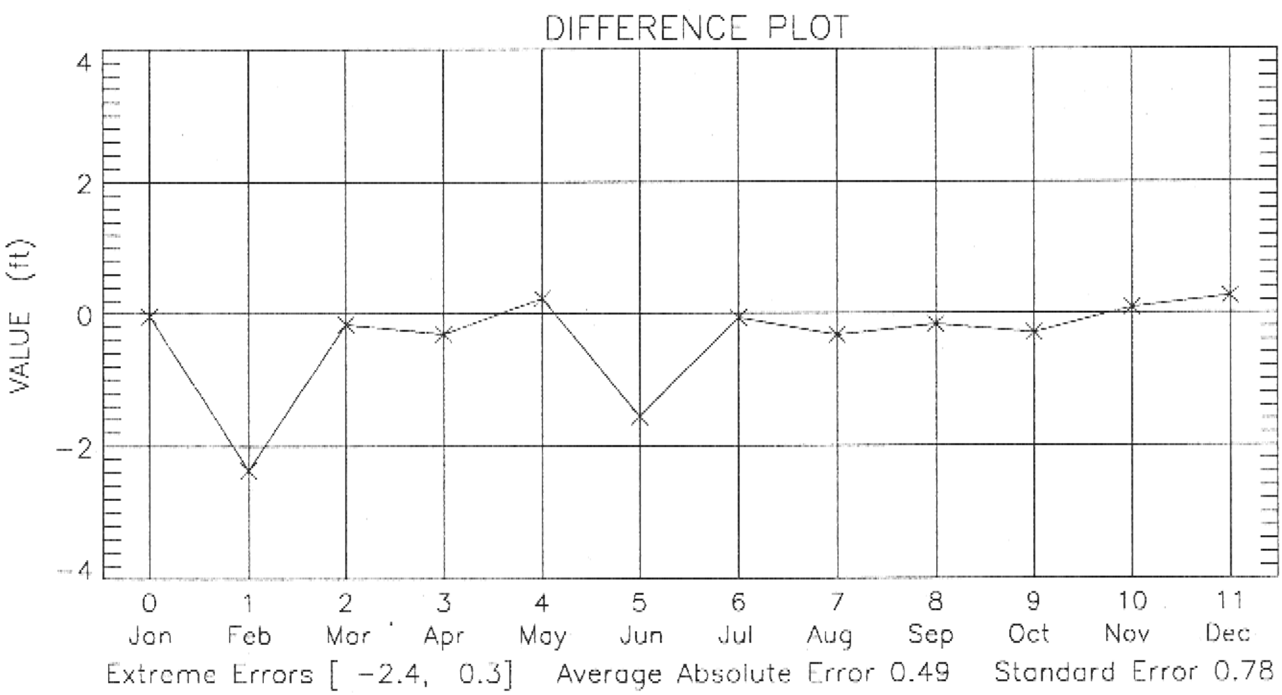

REFERENCED AND CALCULATED NODE HEADS 1989, Station G-2376
VALUE (ft)
8
6
4
2
0
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Layer 1 Row 54 Column 14 Hist.Std.Dev. 0.6 NOTE: Observed * Calculated x


DIFFERENCE PLOT
VALUE (ft)
4
2
0
-2
-4
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Extreme Errors [-0.9, 0.6] Average Absolute Error 0.63 Standard Error 0.43

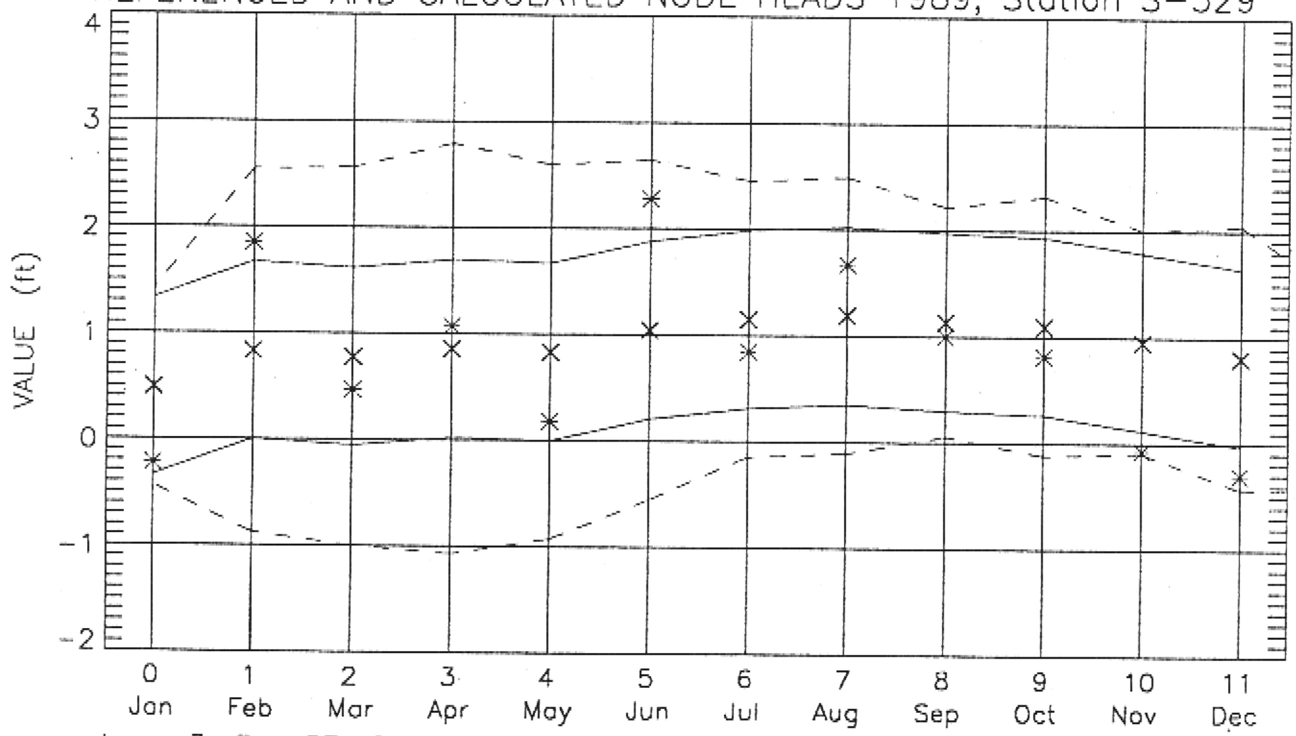

REFERENCED AND CALCULATED NODE HEADS 1989, Station G-1343
VALUE (ft)
4
2
0
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Layer 5 Row 54 Column 91 Hist.Std.Dev. 0.4 NOTE: Observed * Calculated x


DIFFERENCE PLOT
VALUE (ft)
4
2
0
-2
-4
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Extreme Errors [-0.6, 0.6] Average Absolute Error 0.20 Standard Error 0.42


REFERENCED AND CALCULATED NODE HEADS 1989, Station G-1220
VALUE (ft)
0 1 2 3 4 5
0 Jan 1 Feb 2 Mar 3 Apr 4 May 5 Jun 6 Jul 7 Aug 8 Sep 9 Oct 10 Nov 11 Dec
Layer 1 Row 54 Column 106 Hist.Std.Dev. 0.8 NOTE: Observed * Calculated x

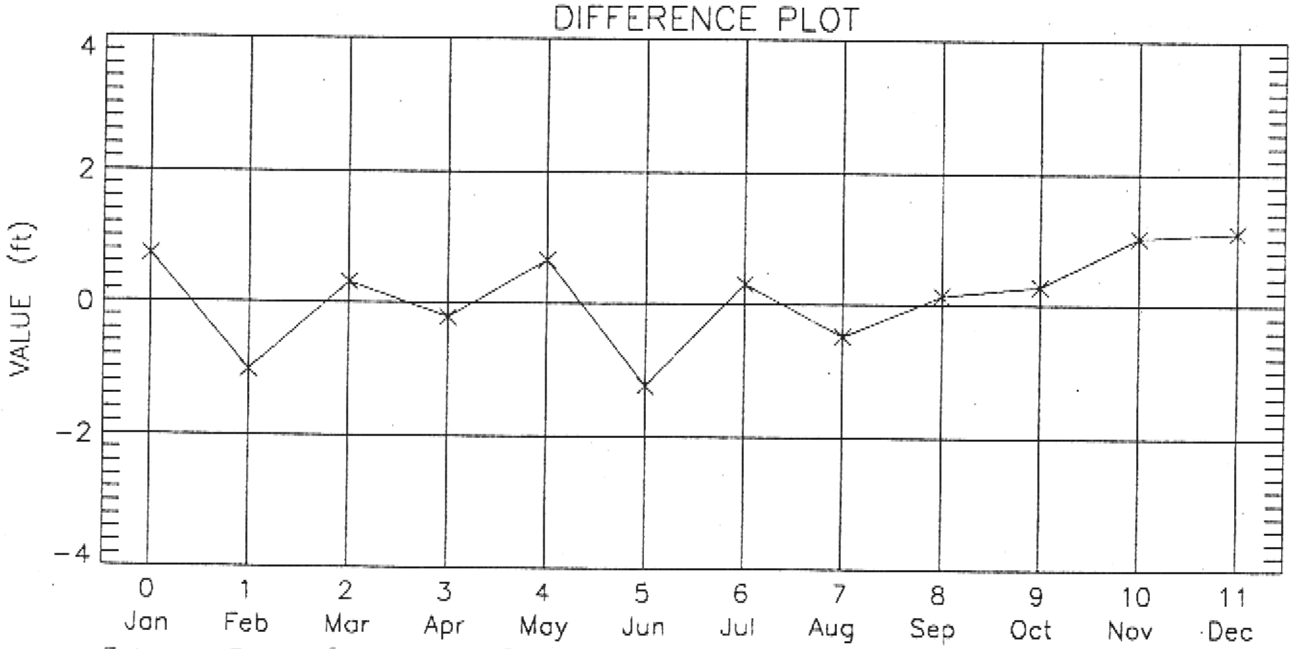

DIFFERENCE PLOT
VALUE (ft)
-4 -2 0 2 4
0 Jan 1 Feb 2 Mar 3 Apr 4 May 5 Jun 6 Jul 7 Aug 8 Sep 9 Oct 10 Nov 11 Dec
Extreme Errors [-2.4, 0.3] Average Absolute Error 0.49 Standard Error 0.78

REFERENCED AND CALCULATED NODE HEADS 1989, Station S-329



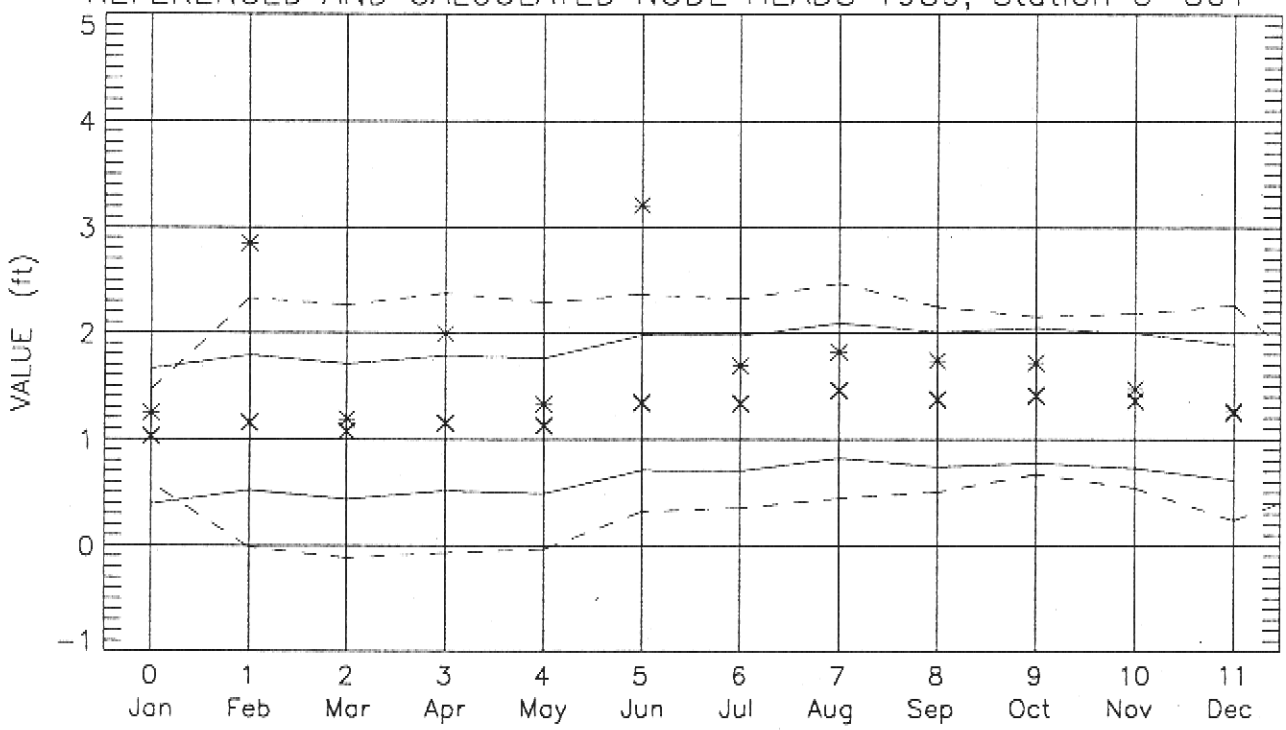
Layer 3 Row 57 Column 86 Hist.Std.Dev. 0.8 NOTE: Observed * Calculated x

DIFFERENCE PLOT



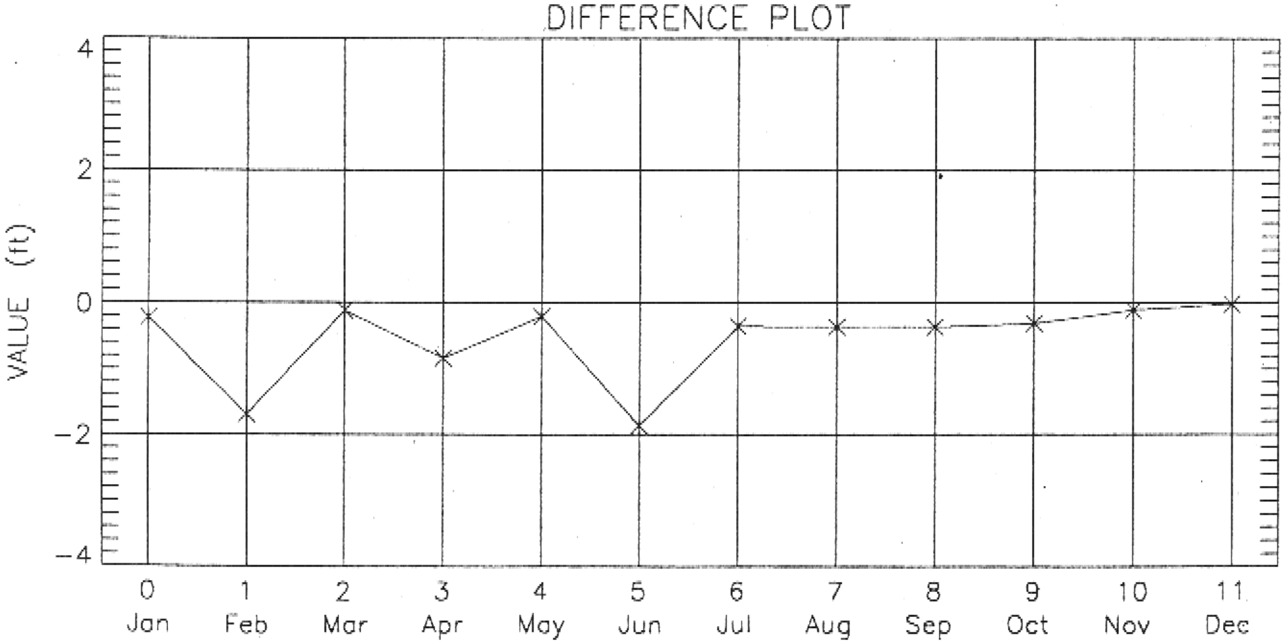
Extreme Errors [-1.2, 1.1] Average Absolute Error 0.62 Standard Error 0.75

REFERENCED AND CALCULATED NODE HEADS 1989, Station G-561

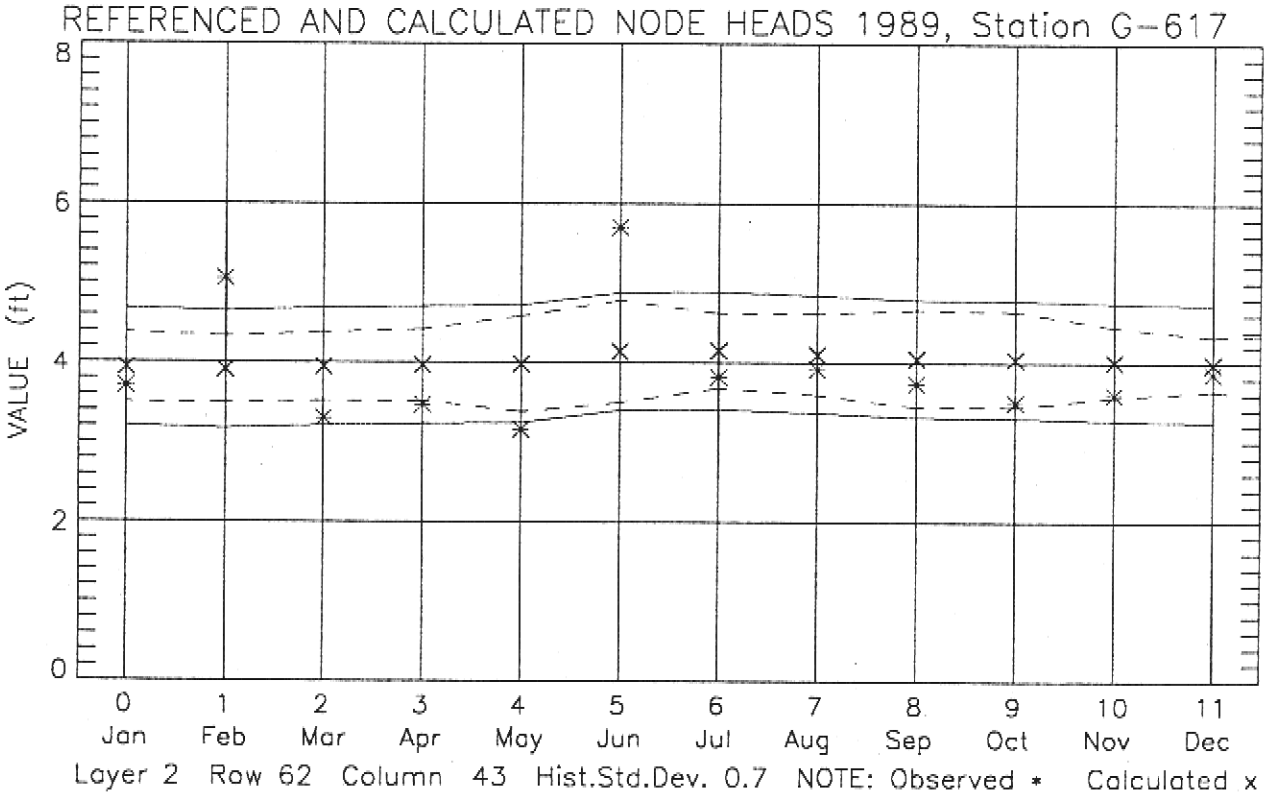


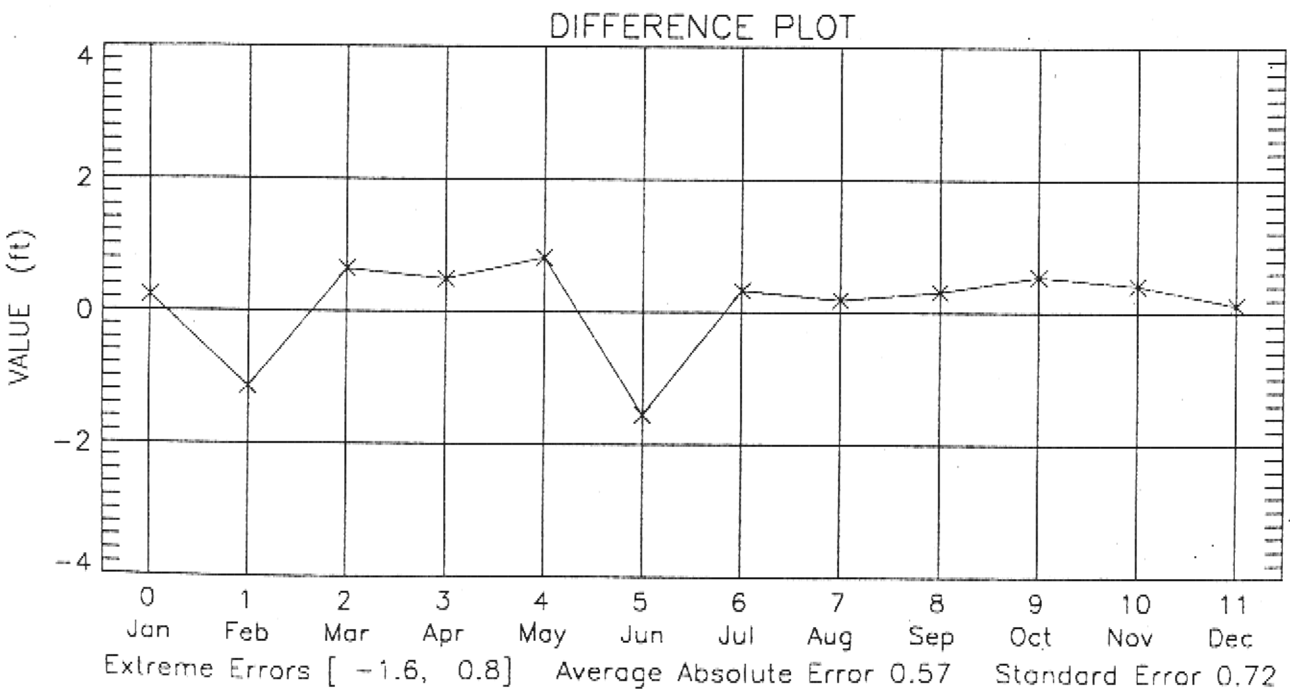
Layer 1 Row 60 Column 109 Hist.Std.Dev. 0.6 NOTE: Observed * Calculated x

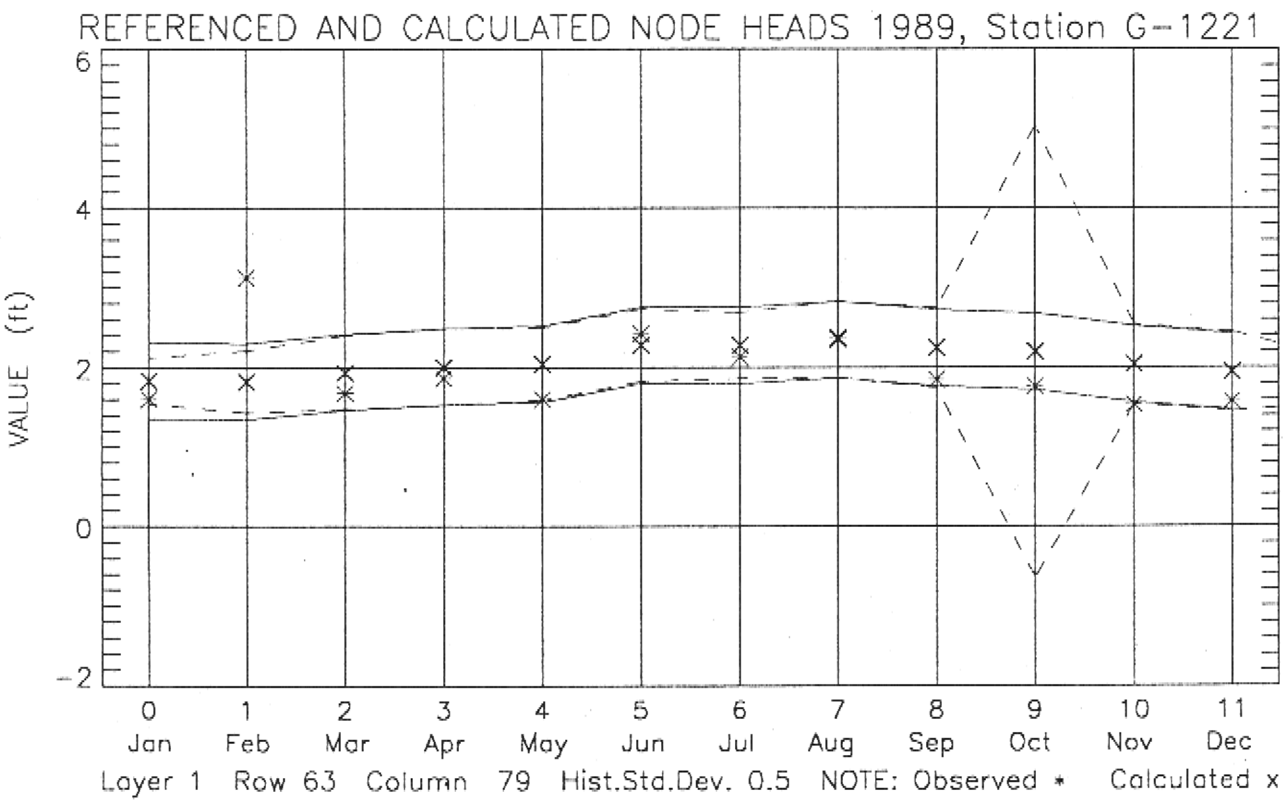
DIFFERENCE PLOT

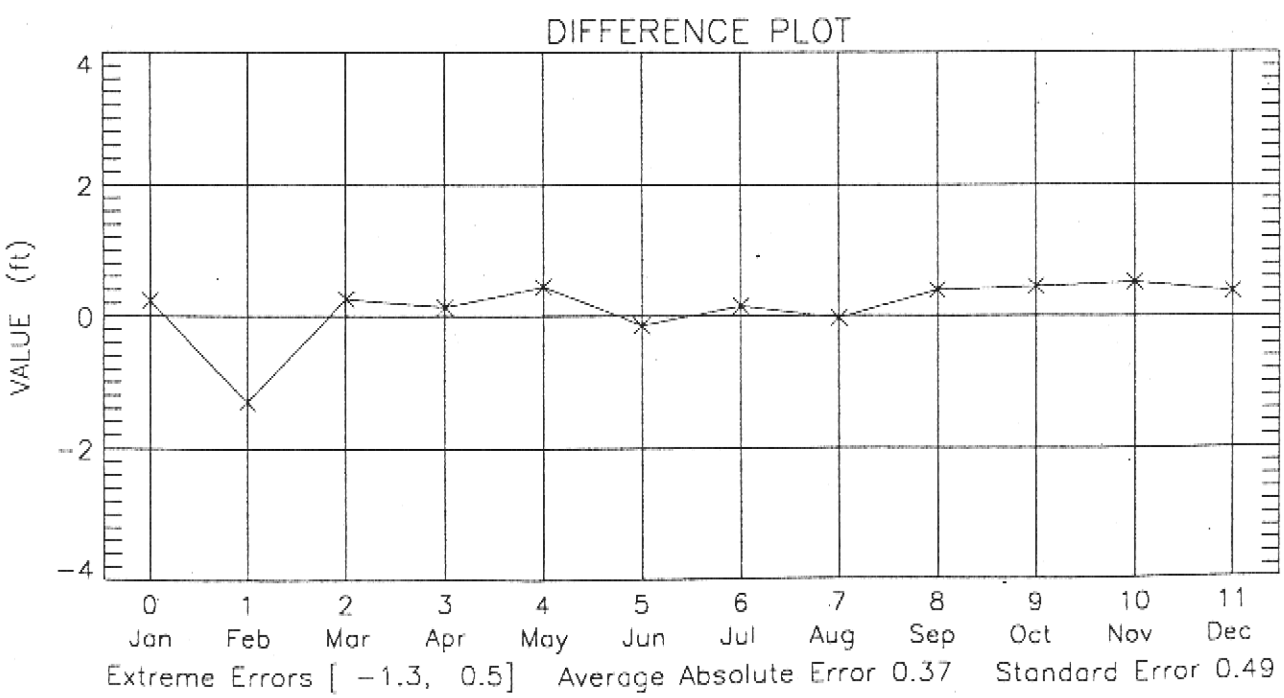


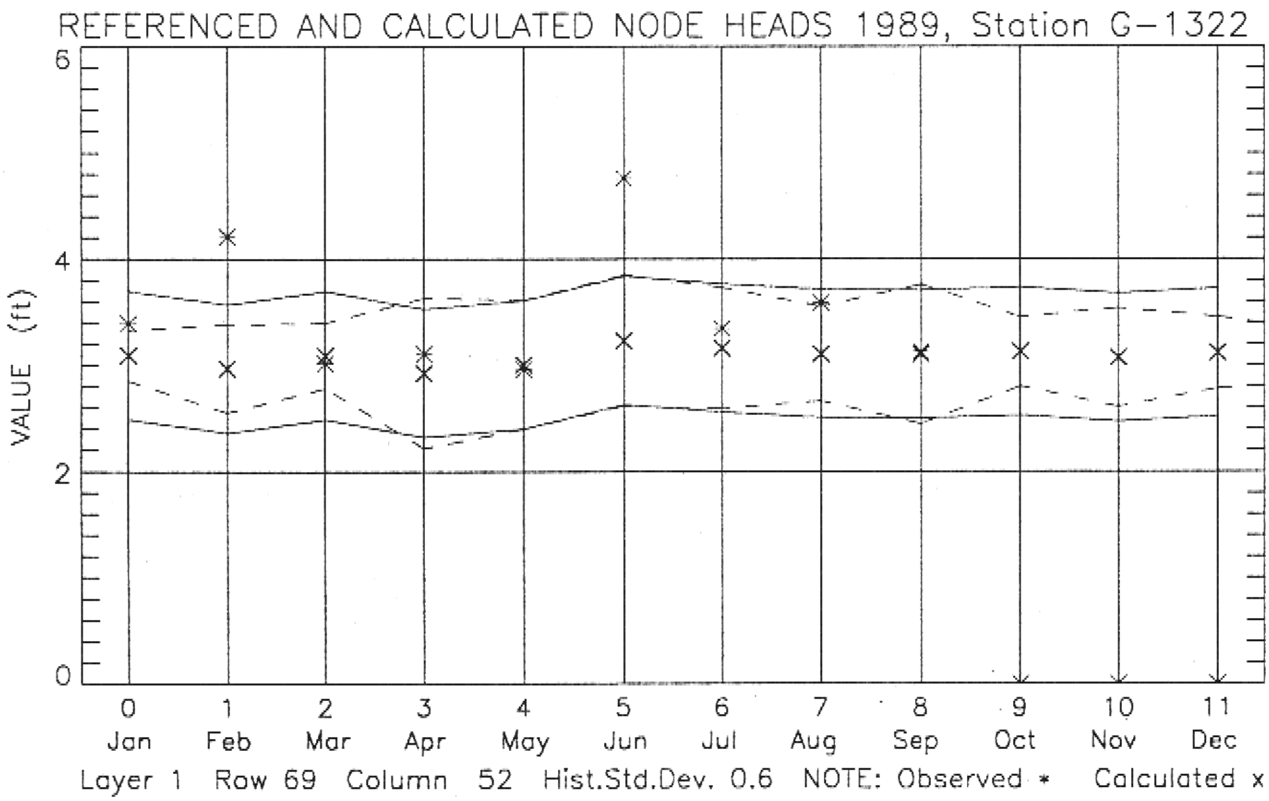
Extreme Errors [-1.9, 0.0] Average Absolute Error 0.54 Standard Error 0.62


REFERENCED AND CALCULATED NODE HEADS 1989, Station G-617
VALUE (ft)
8
6
4
2
0
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Layer 2 Row 62 Column 43 Hist.Std.Dev. 0.7 NOTE: Observed * Calculated x

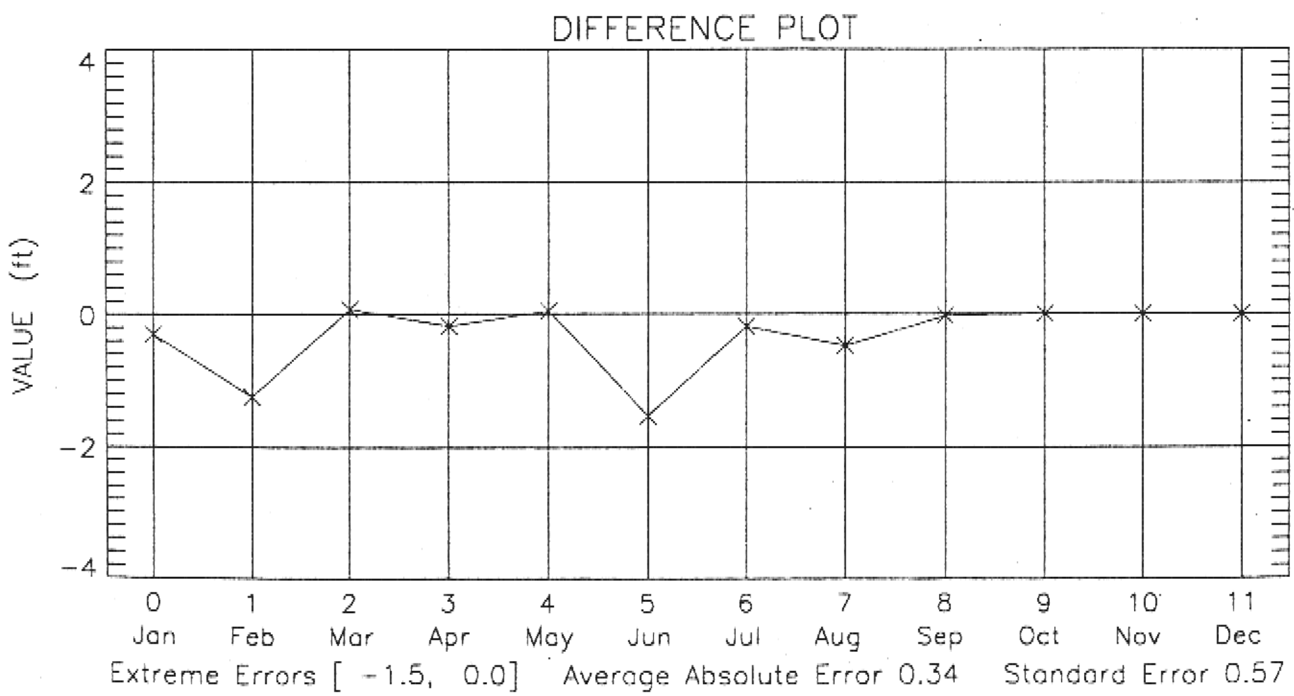

DIFFERENCE PLOT
VALUE (ft)
4
2
0
−2
−4
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Extreme Errors [−1.6, 0.8] Average Absolute Error 0.57 Standard Error 0.72


REFERENCED AND CALCULATED NODE HEADS 1989, Station G-1221
VALUE (ft)
6
4
2
0
-2
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Layer 1 Row 63 Column 79 Hist.Std.Dev. 0.5 NOTE: Observed * Calculated x

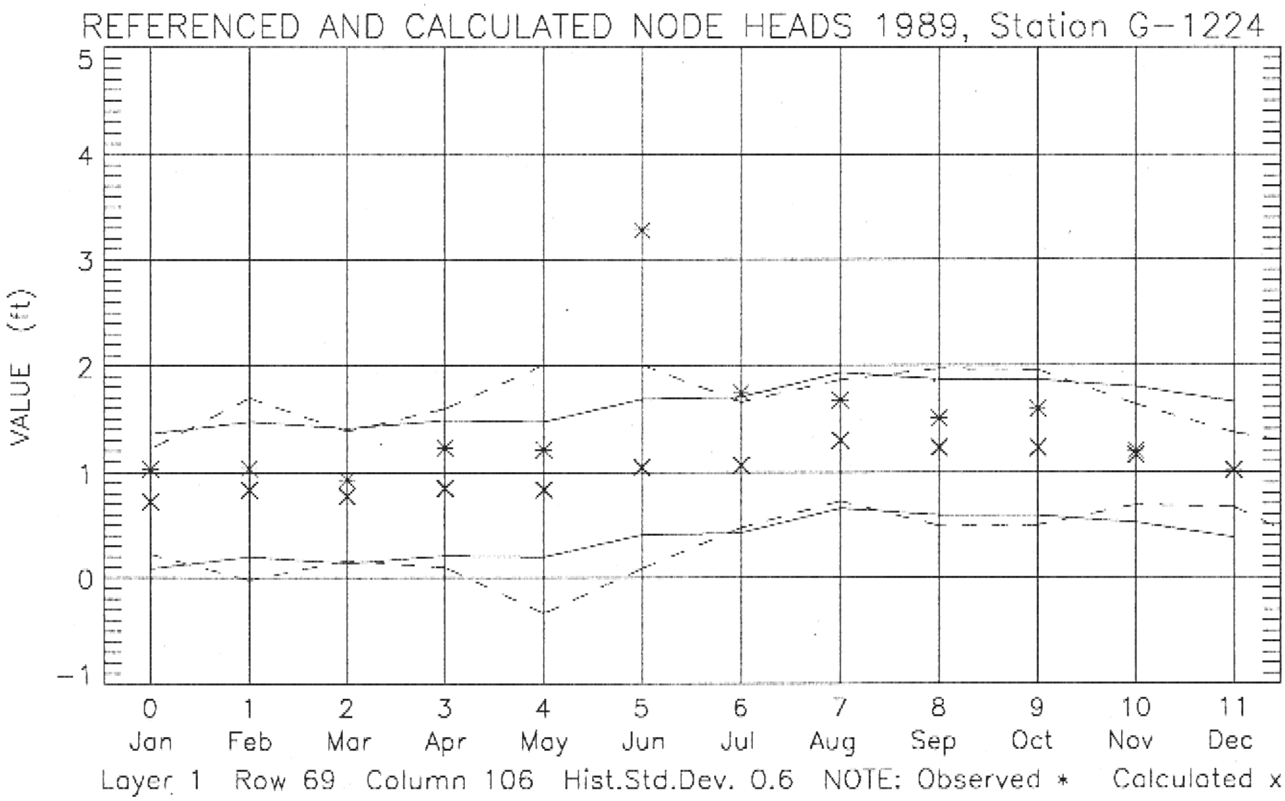

DIFFERENCE PLOT
VALUE (ft)
4
2
0
-2
-4
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Extreme Errors [-1.3, 0.5] Average Absolute Error 0.37 Standard Error 0.49

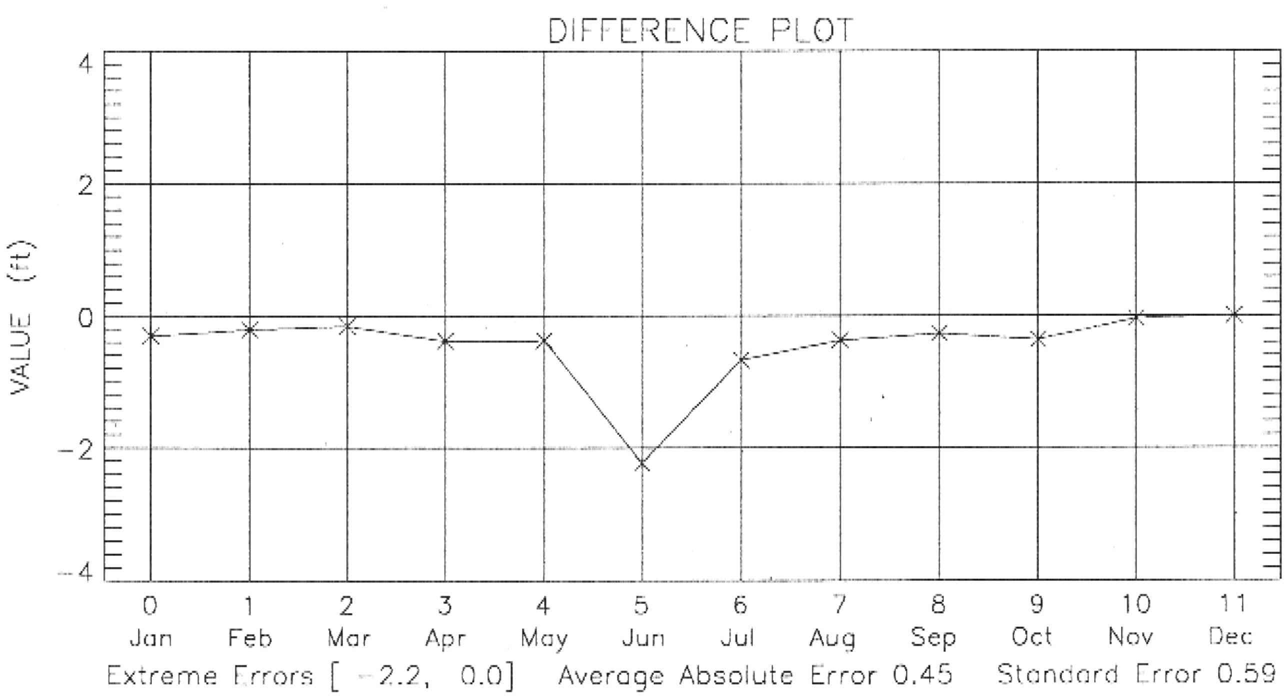


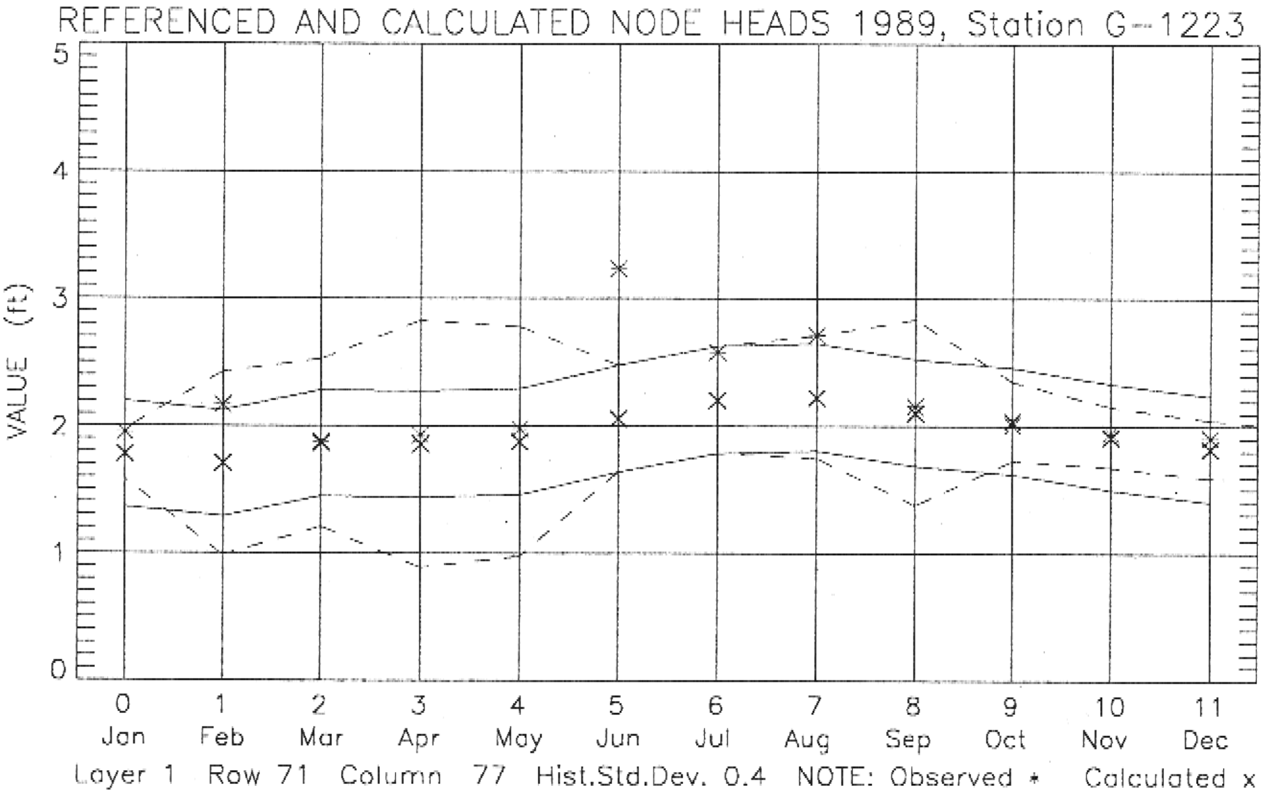
REFERENCED AND CALCULATED NODE HEADS 1989, Station G-1322
VALUE (ft)
0
2
4
6
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Layer 1 Row 69 Column 52 Hist.Std.Dev. 0.6 NOTE: Observed * Calculated x

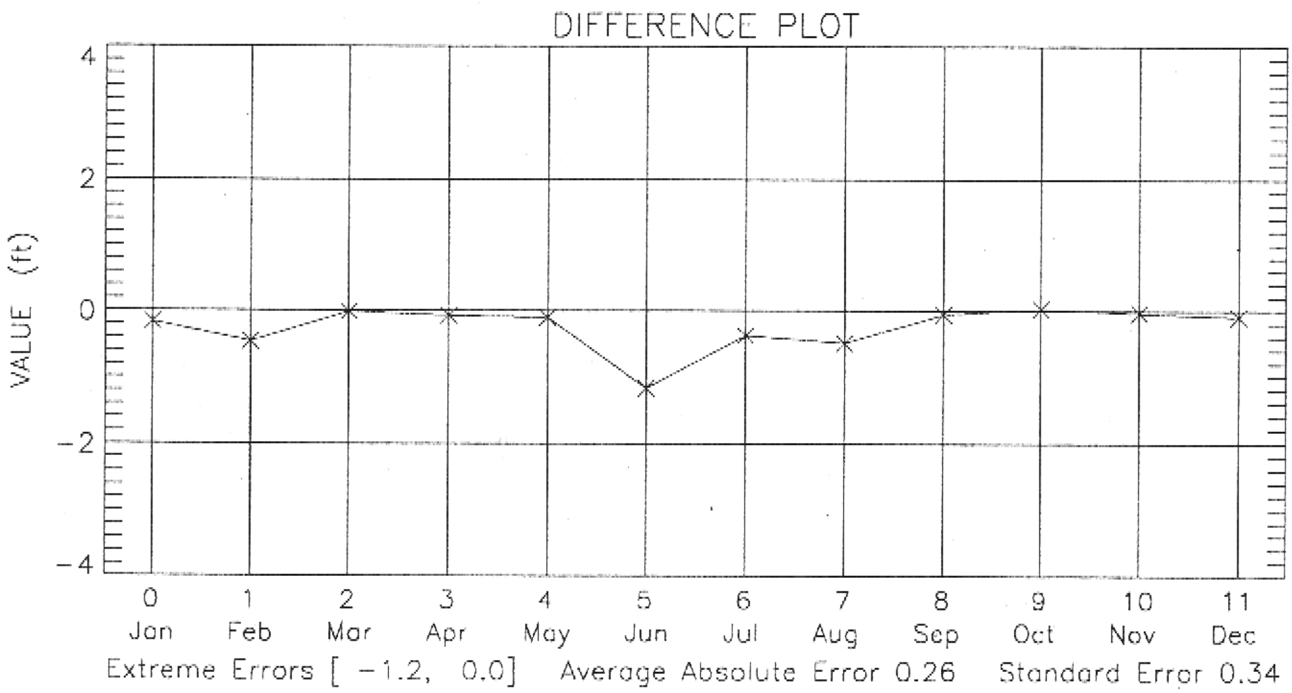


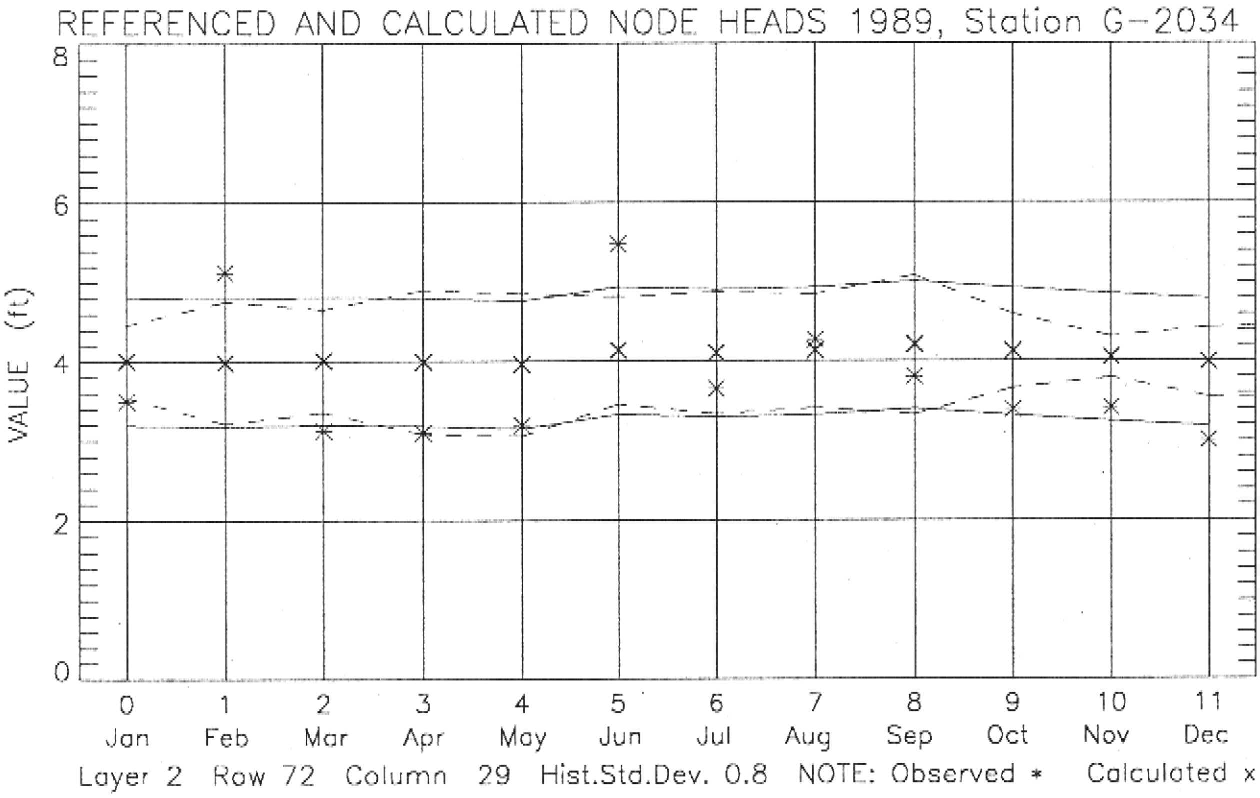
DIFFERENCE PLOT
VALUE (ft)
4
2
0
−2
−4
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Extreme Errors [−1.5, 0.0] Average Absolute Error 0.34 Standard Error 0.57

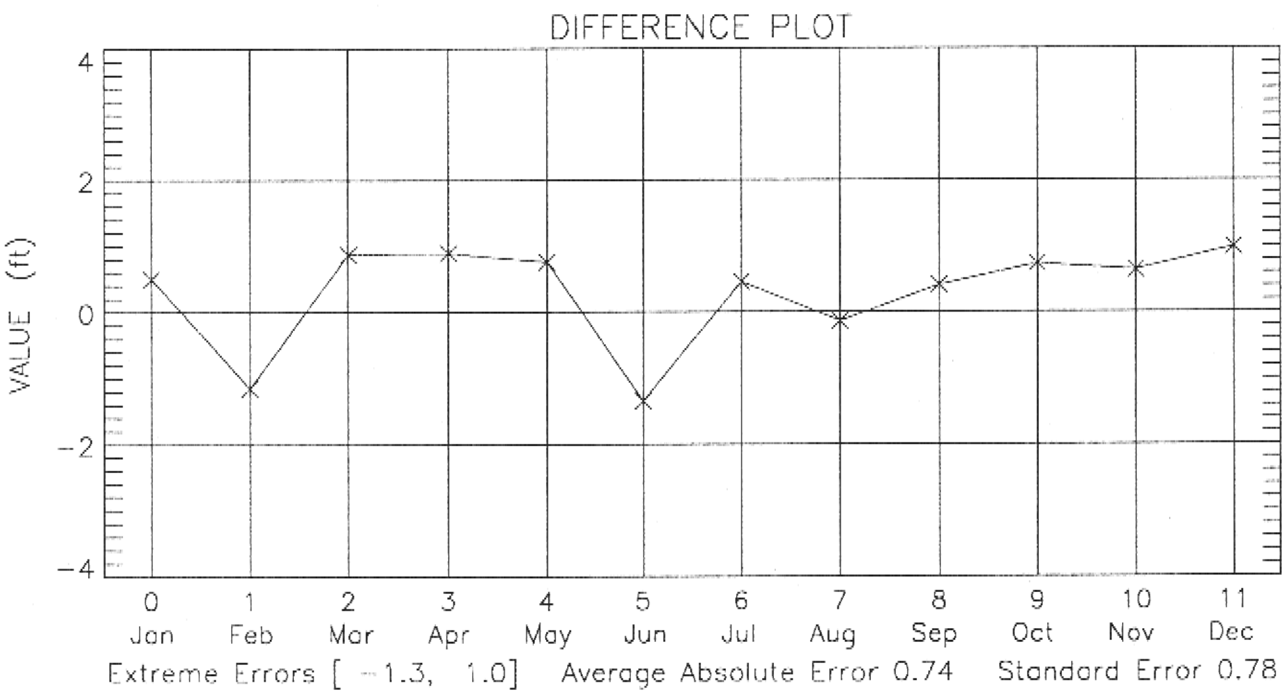

REFERENCED AND CALCULATED NODE HEADS 1989, Station G-1224
VALUE (ft)
5
4
3
2
1
0
-1
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Layer 1 Row 69 Column 106 Hist.Std.Dev. 0.6 NOTE: Observed * Calculated x

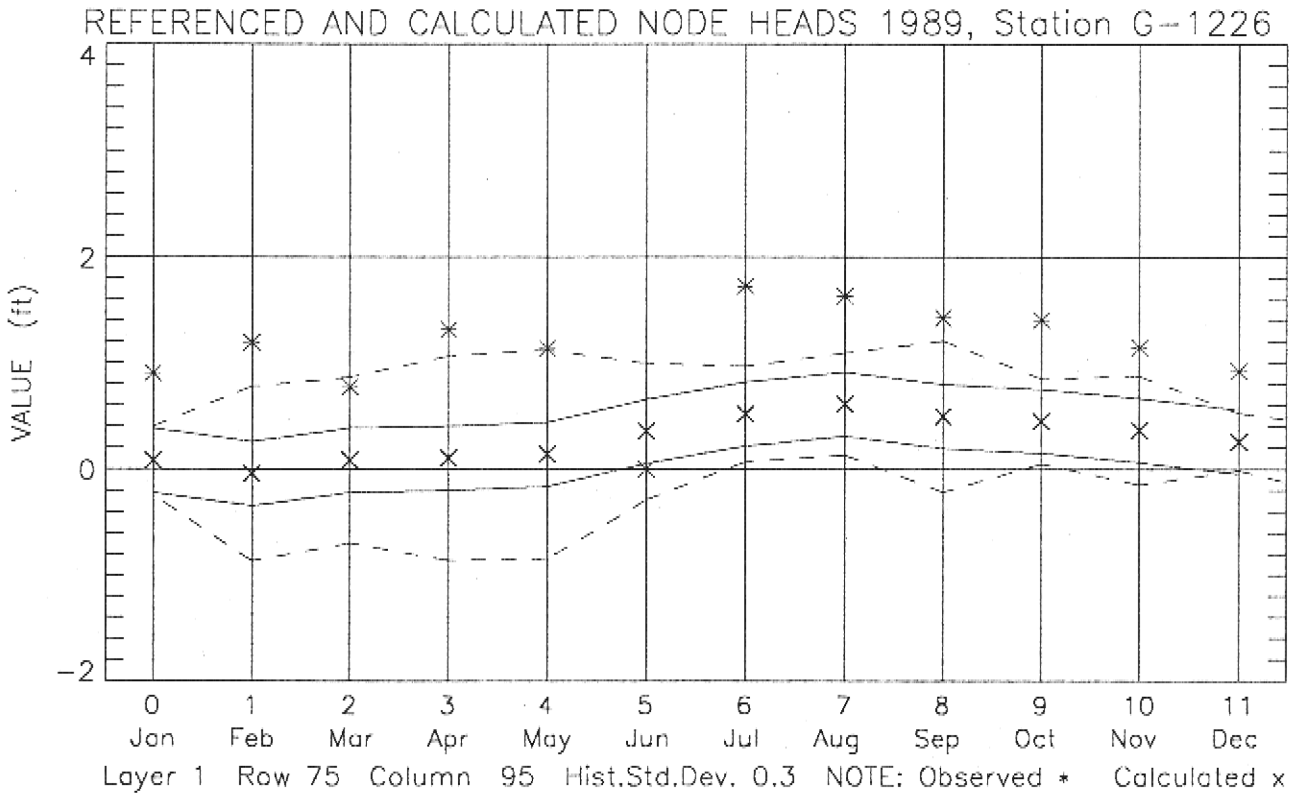

DIFFERENCE PLOT
VALUE (ft)
4
2
0
-2
-4
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Extreme Errors [-2.2, 0.0] Average Absolute Error 0.45 Standard Error 0.59

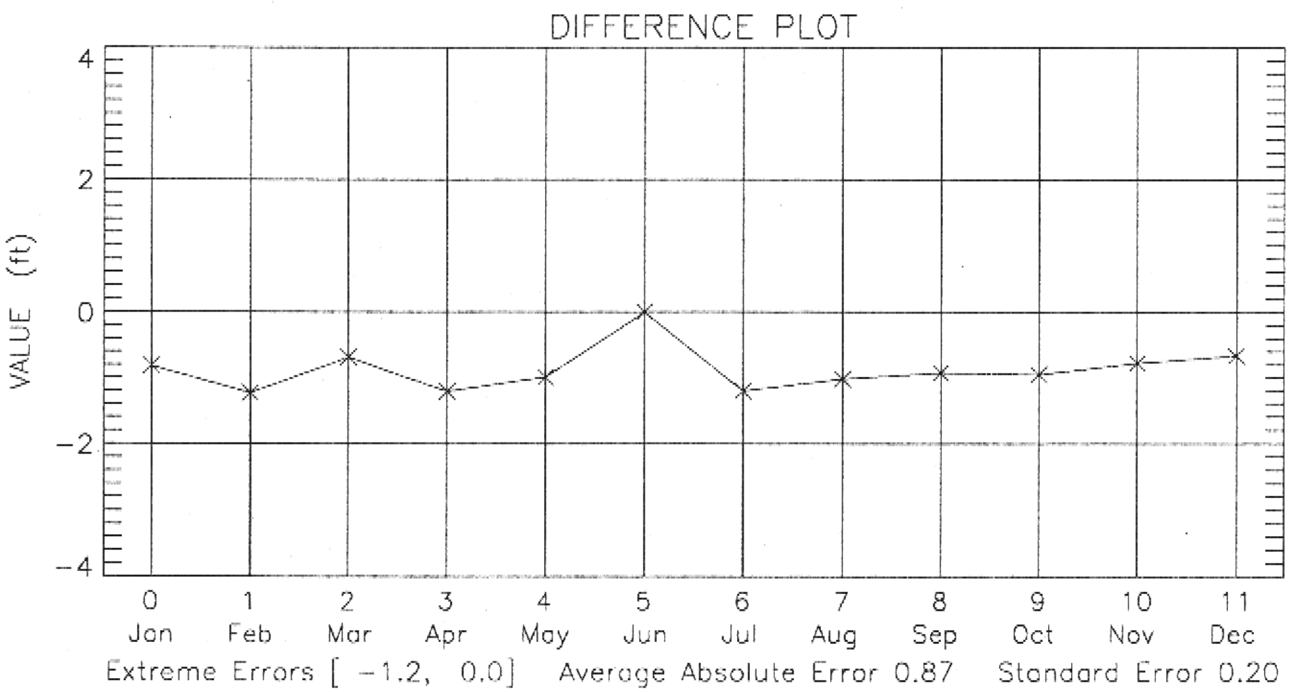

REFERENCED AND CALCULATED NODE HEADS 1989, Station G-1223
VALUE (ft)
0 1 2 3 4 5
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Layer 1 Row 71 Column 77 Hist.Std.Dev. 0.4 NOTE: Observed * Calculated x

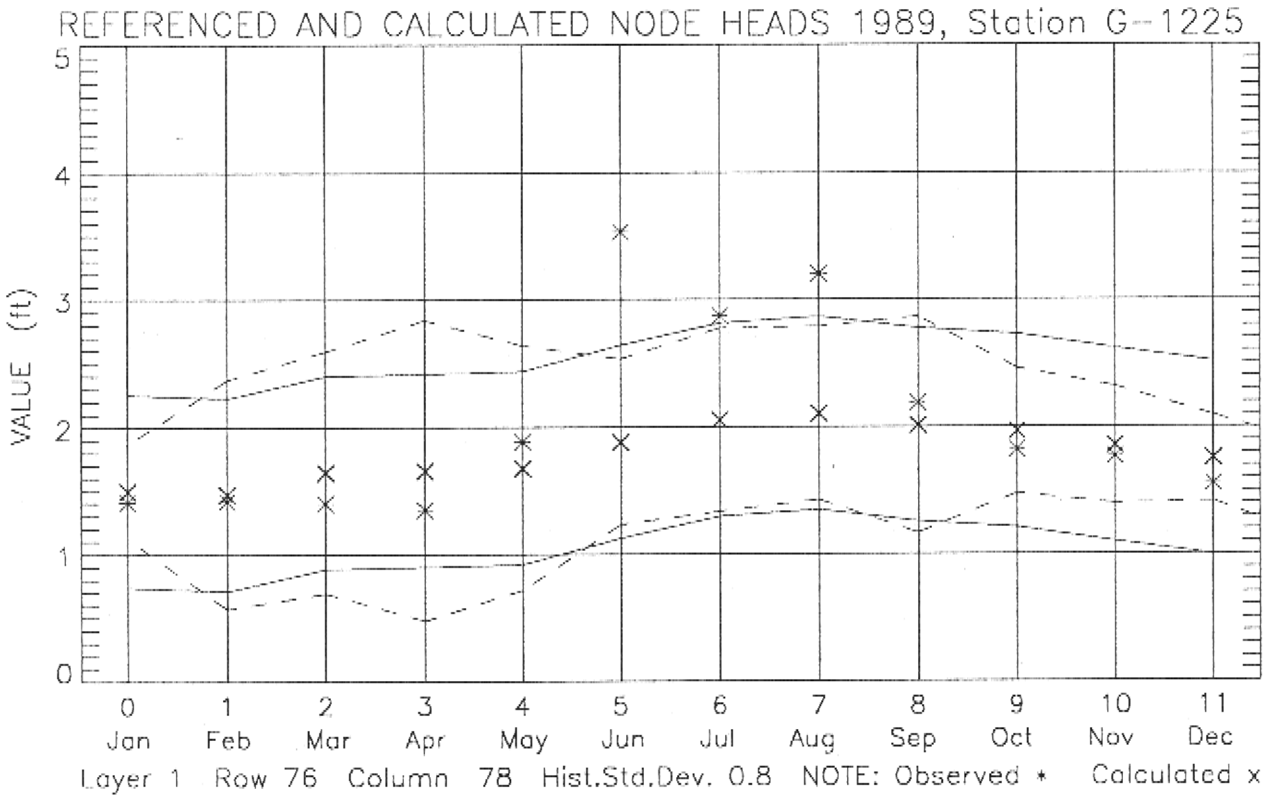

DIFFERENCE PLOT
VALUE (ft)
4 2 0 -2 -4
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Extreme Errors [-1.2, 0.0] Average Absolute Error 0.26 Standard Error 0.34

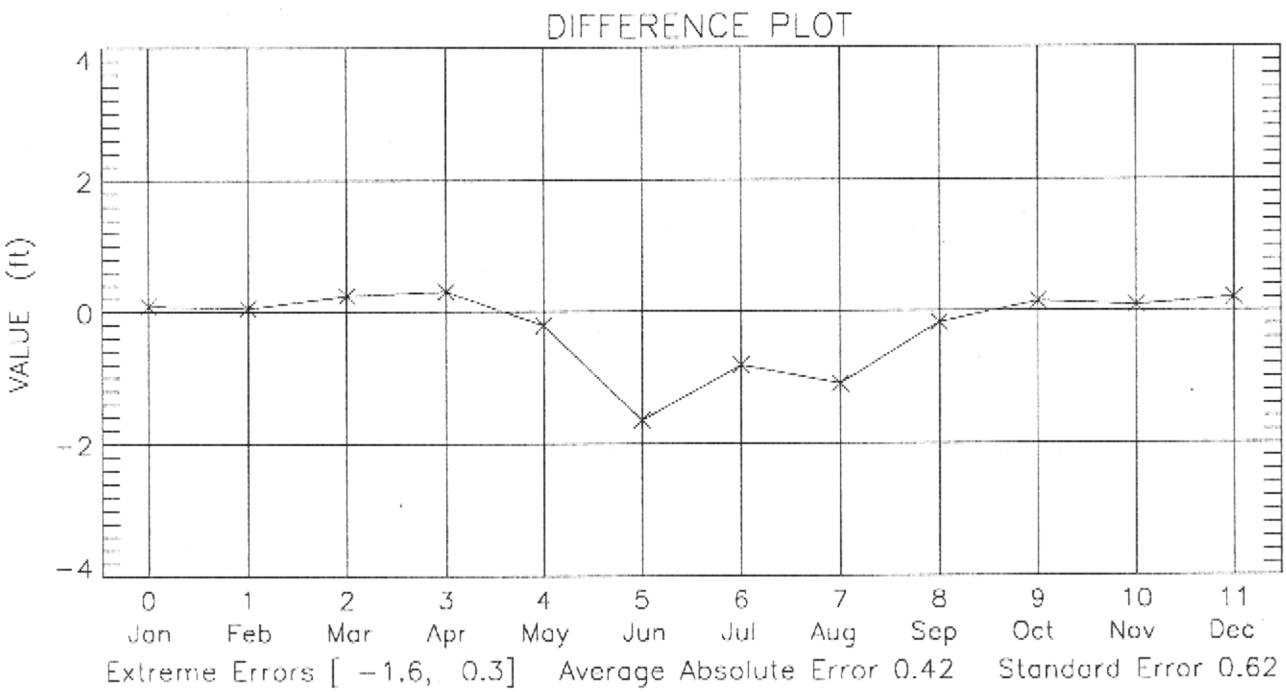

REFERENCED AND CALCULATED NODE HEADS 1989, Station G-2034
VALUE (ft)
8
6
4
2
0
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Layer 2 Row 72 Column 29 Hist.Std.Dev. 0.8 NOTE: Observed * Calculated x

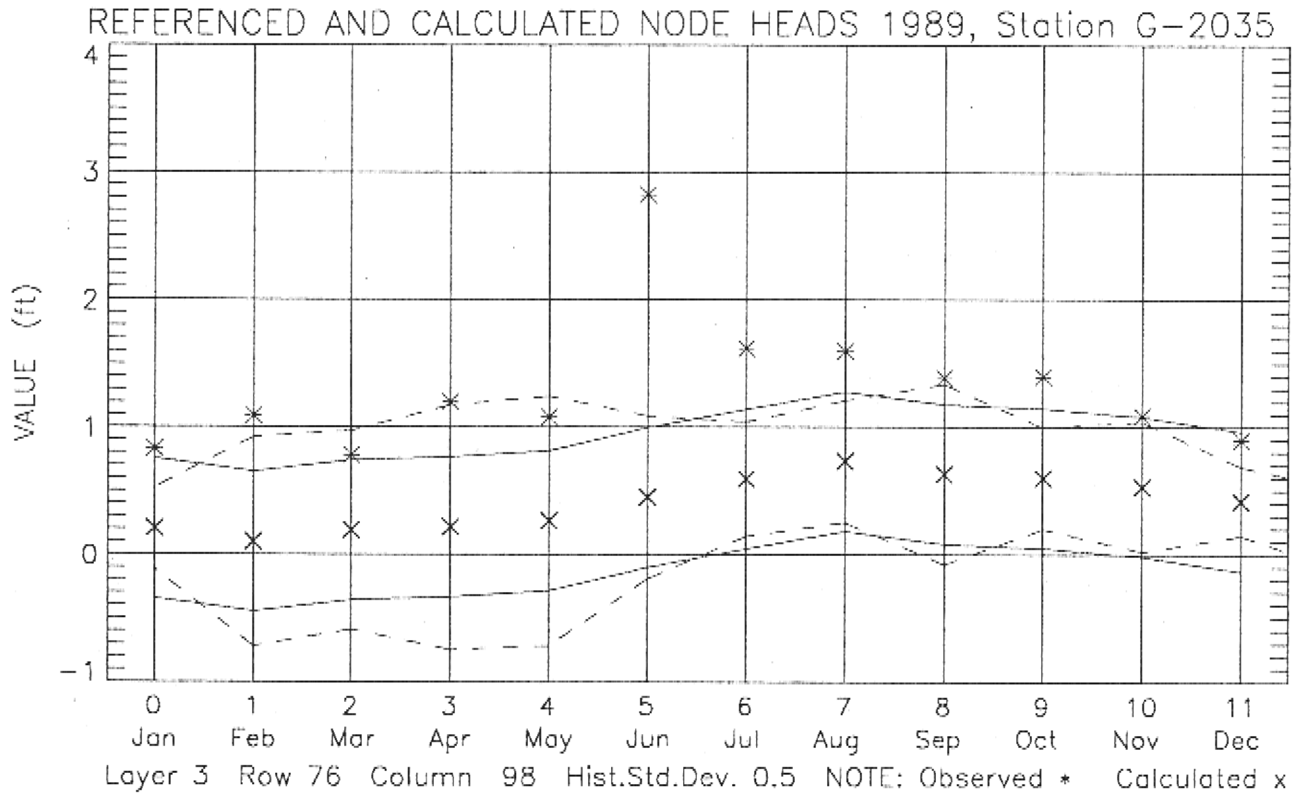

DIFFERENCE PLOT
VALUE (ft)
4
2
0
-2
-4
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Extreme Errors [-1.3, 1.0] Average Absolute Error 0.74 Standard Error 0.78

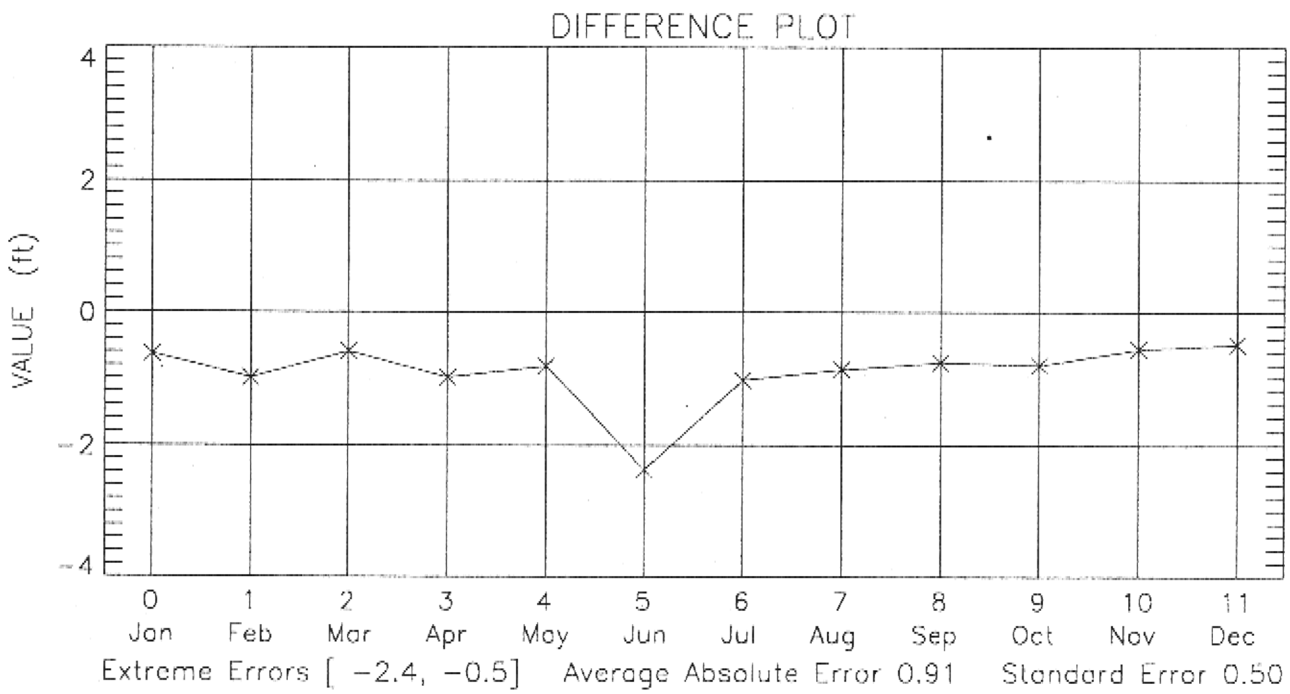

REFERENCED AND CALCULATED NODE HEADS 1989, Station G-1226
VALUE (ft)
4
2
0
-2
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Layer 1 Row 75 Column 95 Hist.Std.Dev. 0.3 NOTE: Observed * Calculated x

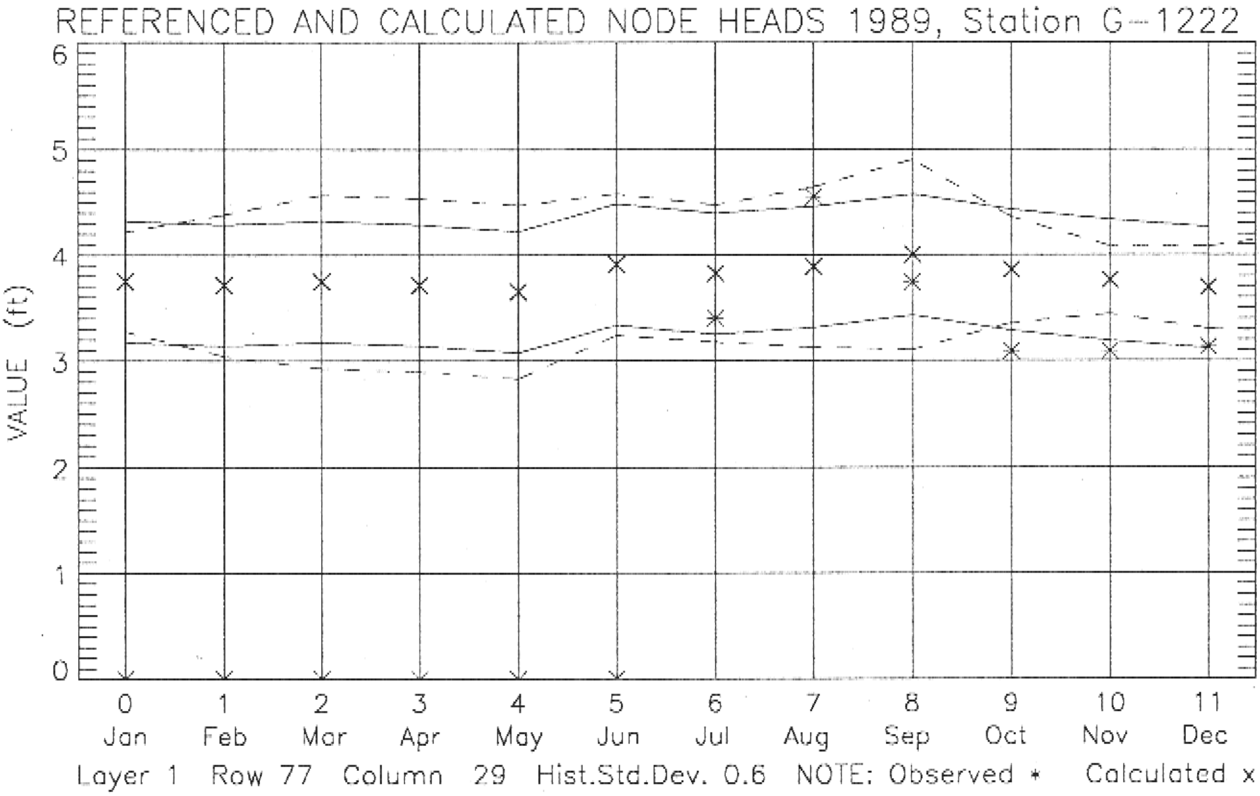

DIFFERENCE PLOT
VALUE (ft)
4
2
0
-2
-4
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Extreme Errors [-1.2, 0.0] Average Absolute Error 0.87 Standard Error 0.20

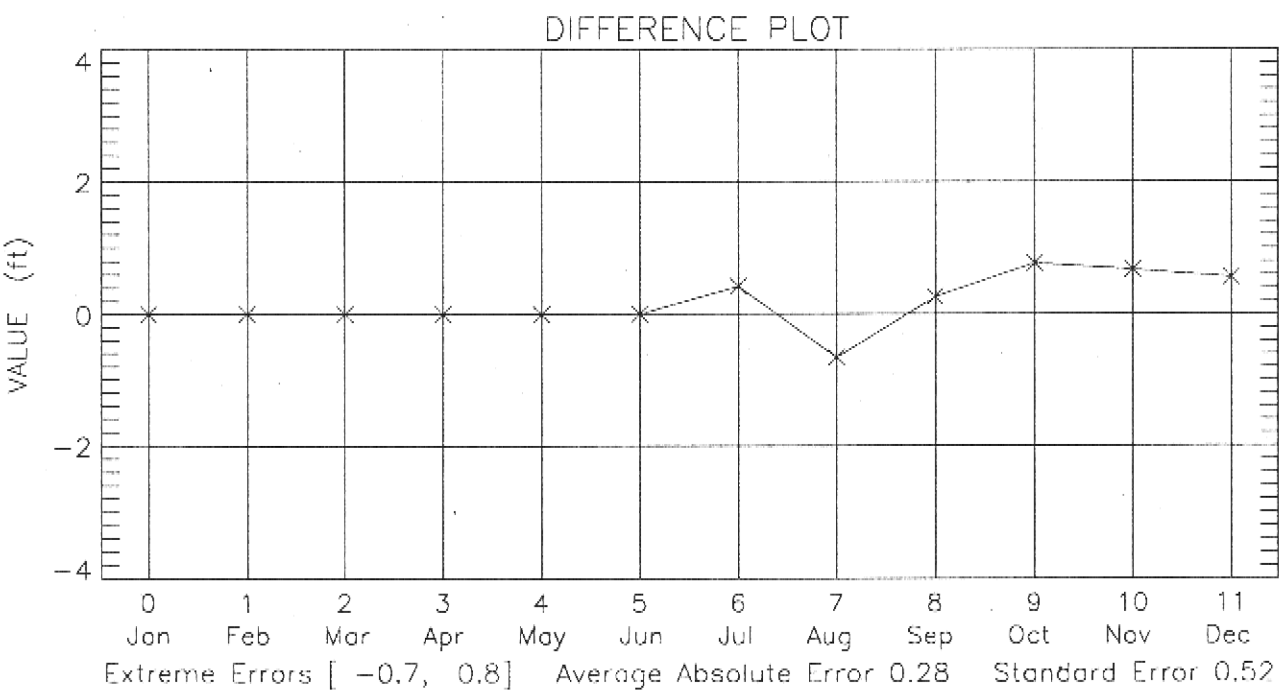

REFERENCED AND CALCULATED NODE HEADS 1989, Station G-1225
VALUE (ft)
0 1 2 3 4 5
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Layer 1 Row 76 Column 78 Hist.Std.Dev. 0.8 NOTE: Observed * Calculated x

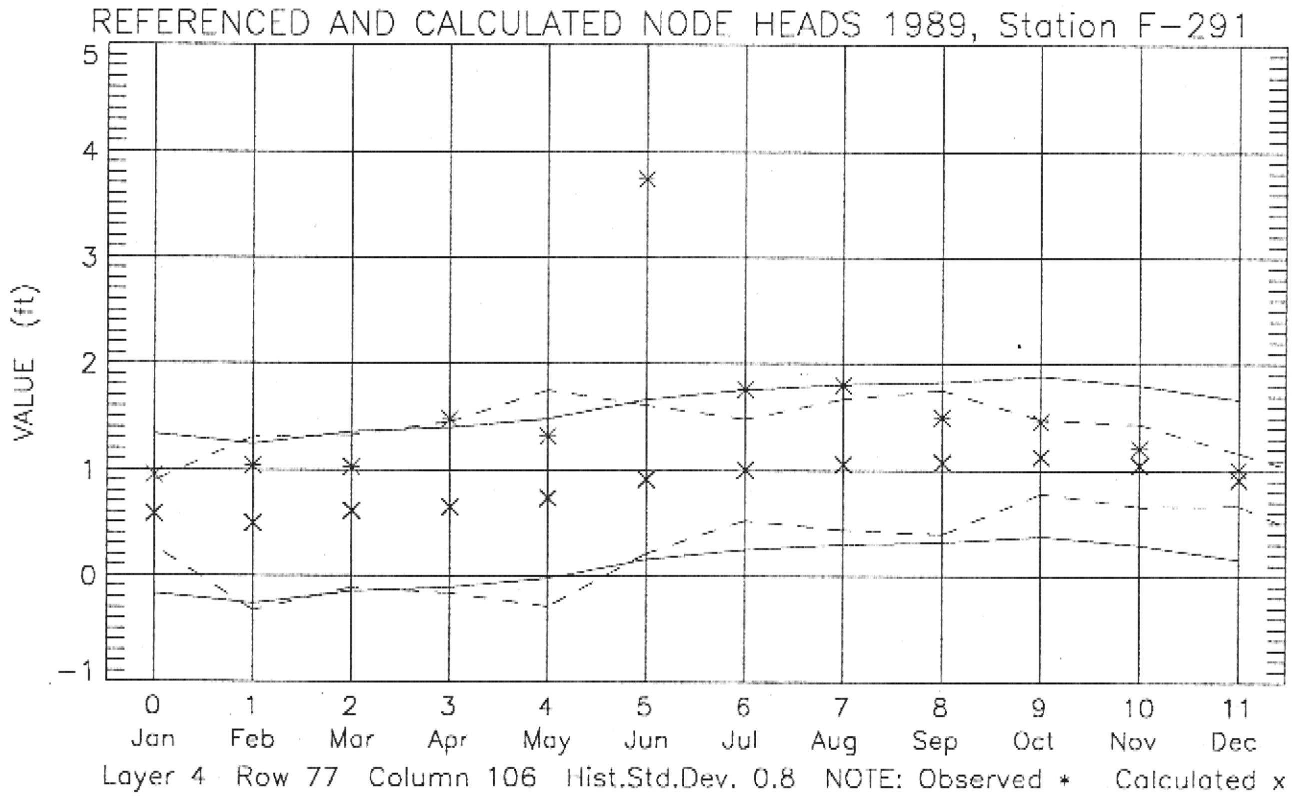

DIFFERENCE PLOT
VALUE (ft)
4 2 0 -2 -4
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Extreme Errors [-1.6, 0.3] Average Absolute Error 0.42 Standard Error 0.62


REFERENCED AND CALCULATED NODE HEADS 1989, Station G-2035
VALUE (ft)
4
3
2
1
0
-1
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Layer 3 Row 76 Column 98 Hist.Std.Dev. 0.5 NOTE: Observed * Calculated x

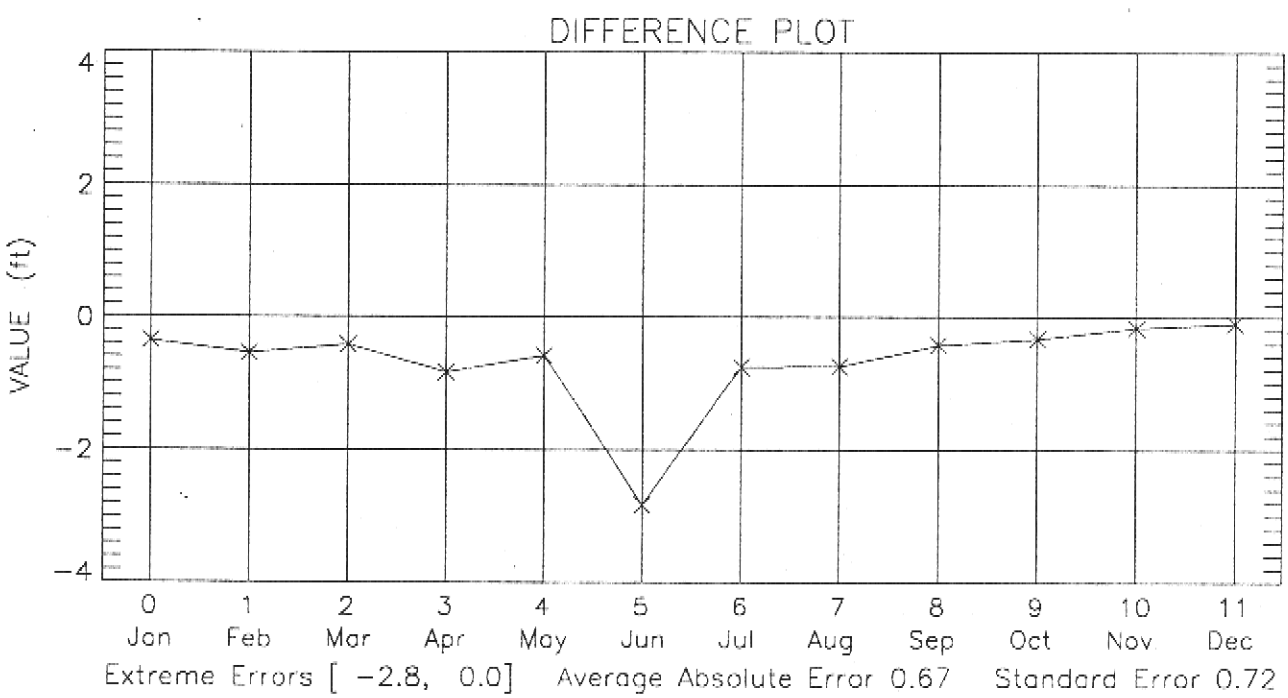

DIFFERENCE PLOT
VALUE (ft)
4
2
0
-2
-4
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Extreme Errors [-2.4, -0.5] Average Absolute Error 0.91 Standard Error 0.50


REFERENCED AND CALCULATED NODE HEADS 1989, Station G-1222
VALUE (ft)
0
1
2
3
4
5
6
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Layer 1 Row 77 Column 29 Hist.Std.Dev. 0.6 NOTE: Observed * Calculated x

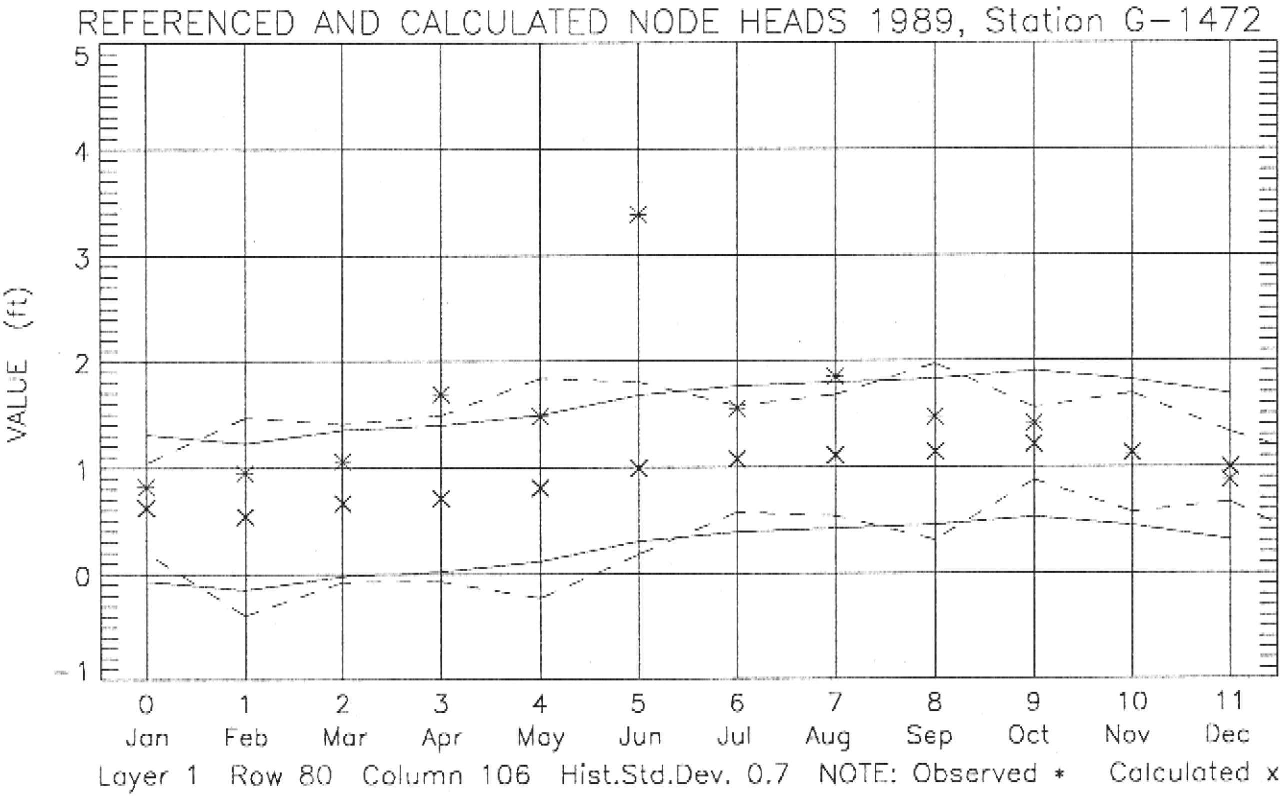

DIFFERENCE PLOT
VALUE (ft)
4
2
0
−2
−4
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Extreme Errors [−0.7, 0.8] Average Absolute Error 0.28 Standard Error 0.52

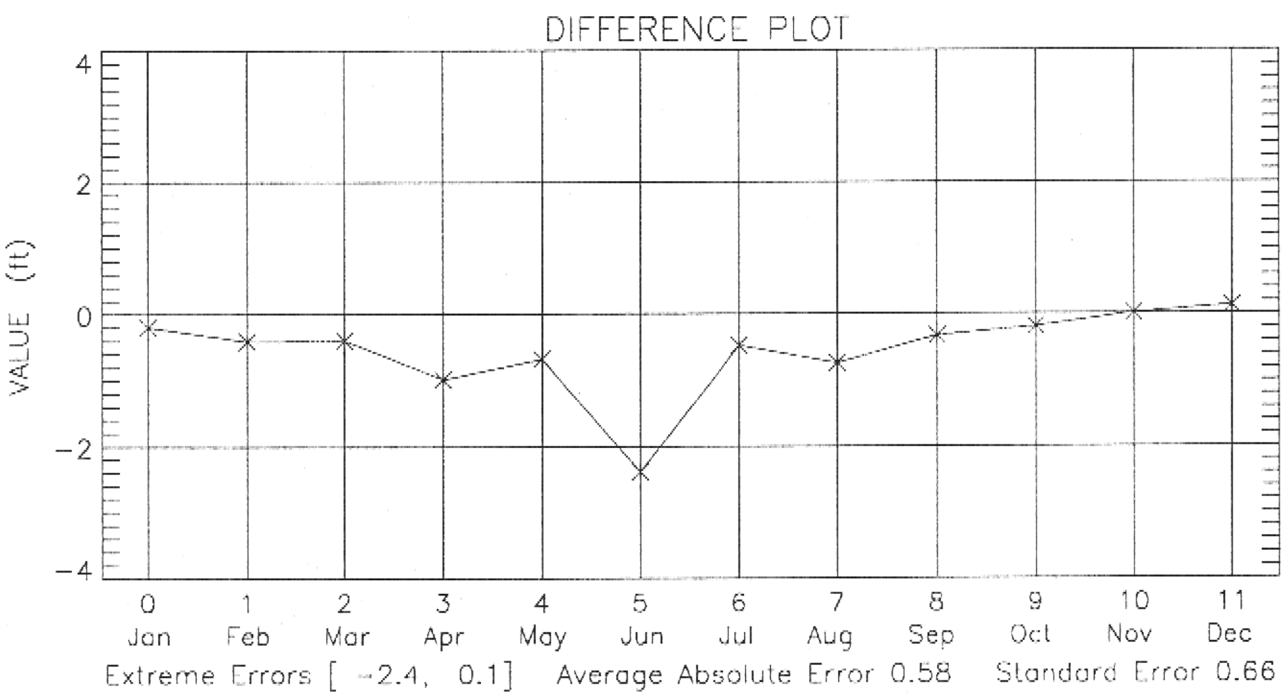


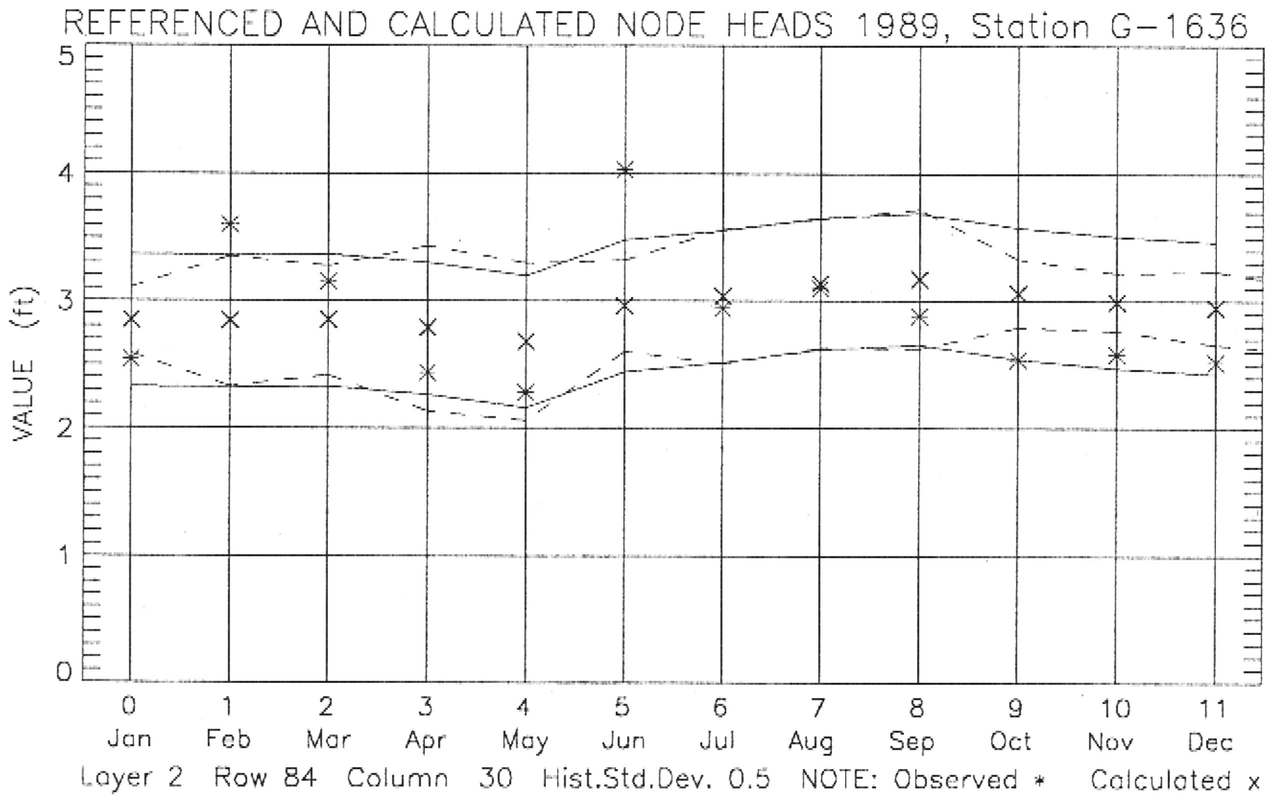
REFERENCED AND CALCULATED NODE HEADS 1989, Station F-291
VALUE (ft)
5
4
3
2
1
0
−1
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Layer 4 Row 77 Column 106 Hist.Std.Dev. 0.8 NOTE: Observed * Calculated x

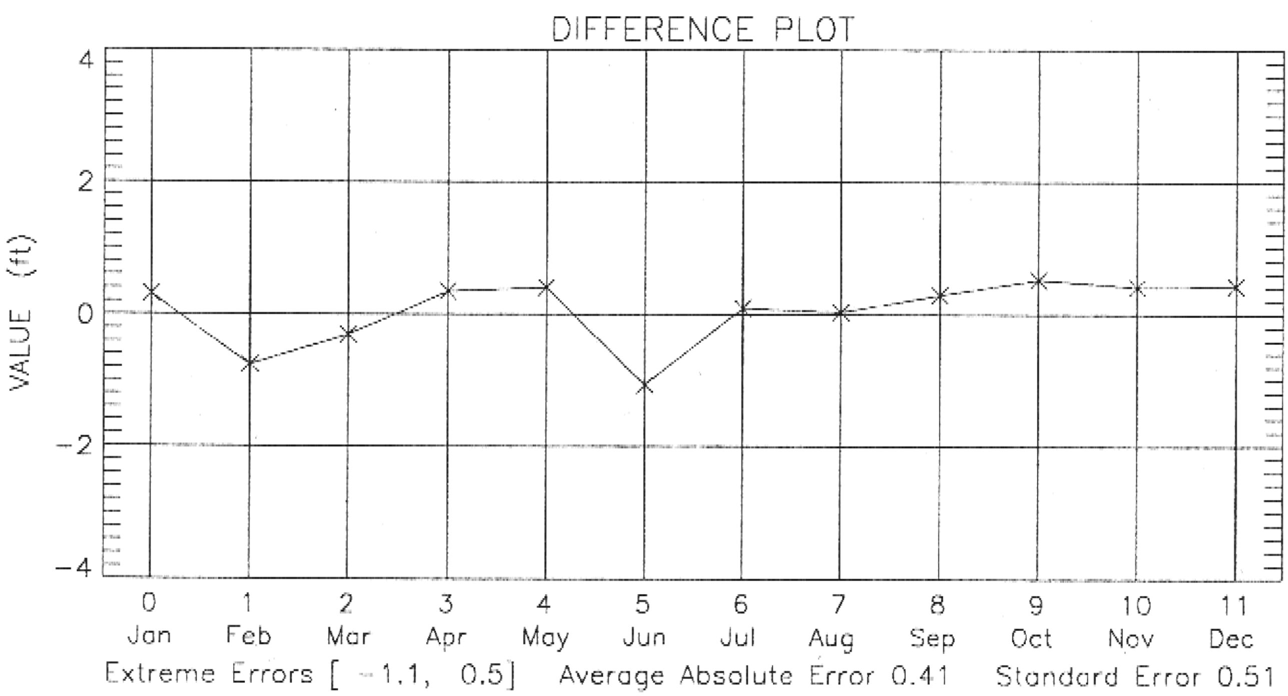


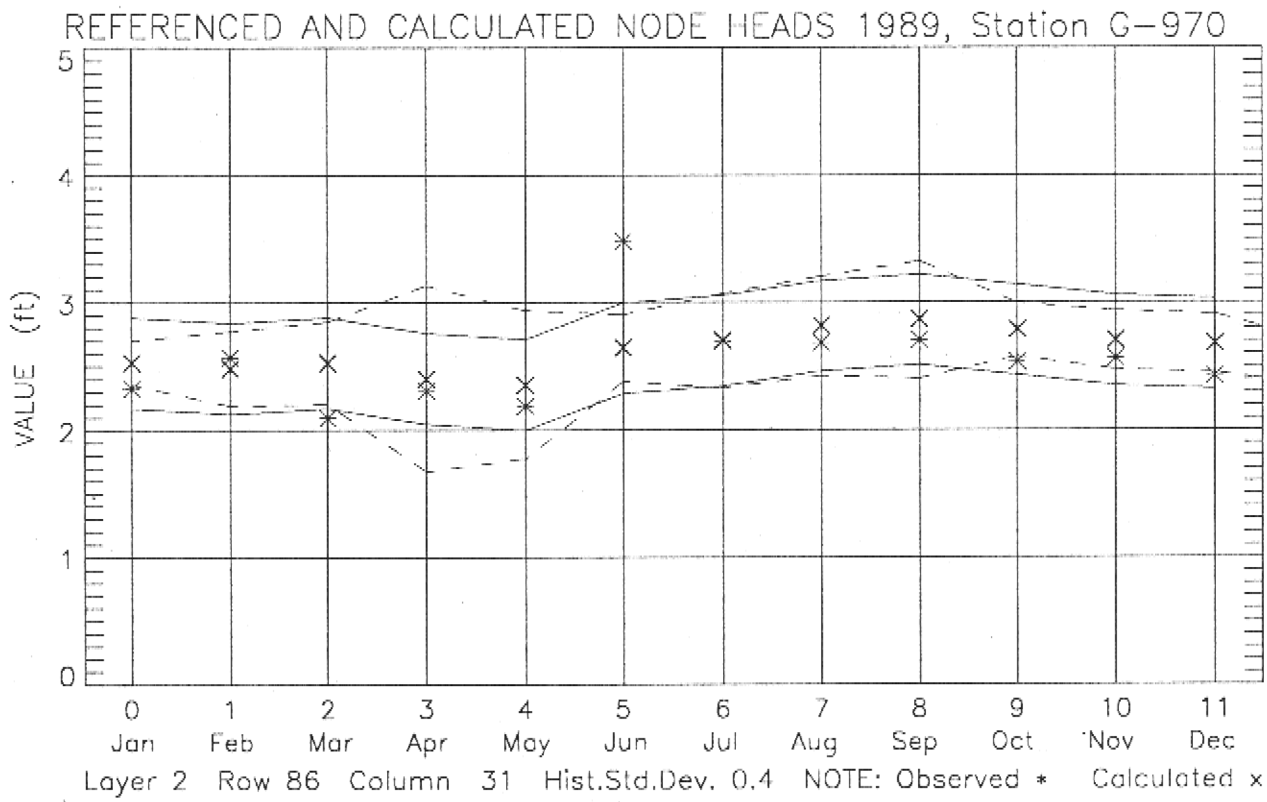
DIFFERENCE PLOT
VALUE (ft)
4
2
0
−2
−4
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Extreme Errors [−2.8, 0.0] Average Absolute Error 0.67 Standard Error 0.72

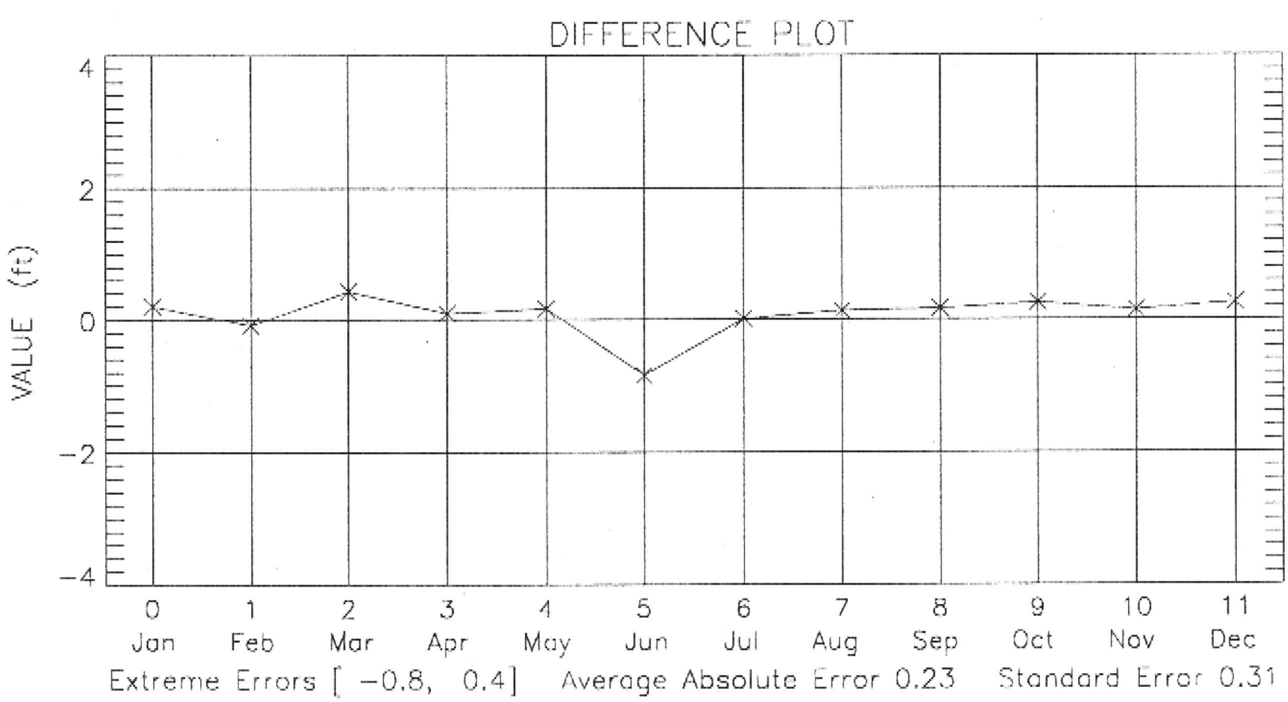

REFERENCED AND CALCULATED NODE HEADS 1989, Station G-1472
VALUE (ft)
0 Jan 1 Feb 2 Mar 3 Apr 4 May 5 Jun 6 Jul 7 Aug 8 Sep 9 Oct 10 Nov 11 Dec
Layer 1 Row 80 Column 106 Hist.Std.Dev. 0.7 NOTE: Observed * Calculated x

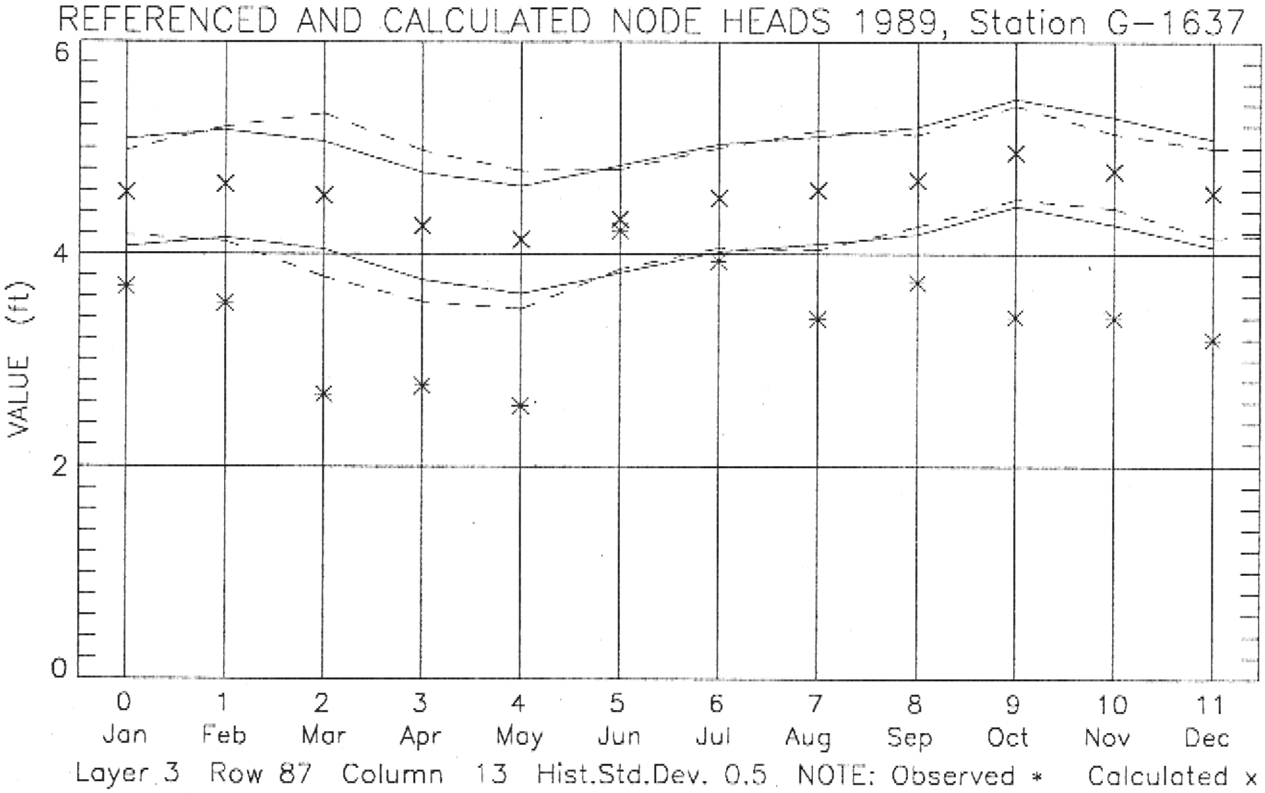

DIFFERENCE PLOT
VALUE (ft)
0 Jan 1 Feb 2 Mar 3 Apr 4 May 5 Jun 6 Jul 7 Aug 8 Sep 9 Oct 10 Nov 11 Dec
Extreme Errors [-2.4, 0.1] Average Absolute Error 0.58 Standard Error 0.66

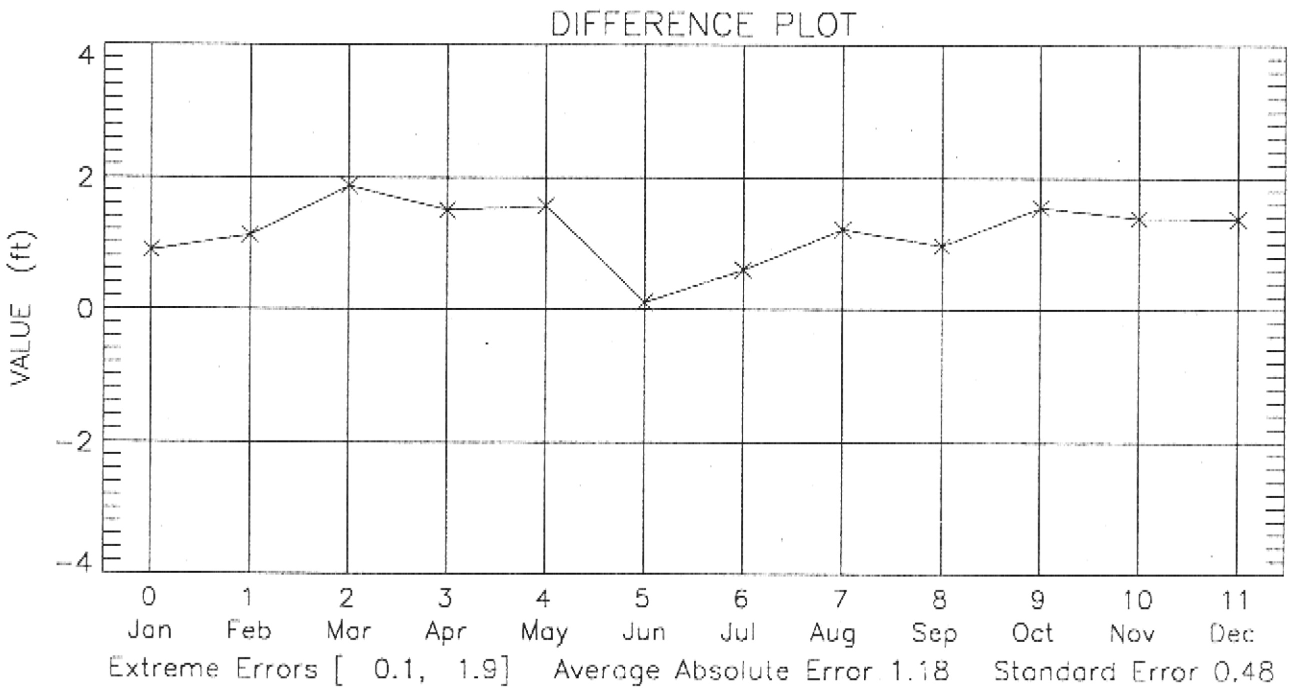

REFERENCED AND CALCULATED NODE HEADS 1989, Station G-1636
VALUE (ft)
5
4
3
2
1
0
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Layer 2 Row 84 Column 30 Hist.Std.Dev. 0.5 NOTE: Observed * Calculated x


DIFFERENCE PLOT
VALUE (ft)
4
2
0
−2
−4
0 Jan
1 Feb
2 Mar
3 Apr
4 May
5 Jun
6 Jul
7 Aug
8 Sep
9 Oct
10 Nov
11 Dec
Extreme Errors [−1.1, 0.5] Average Absolute Error 0.41 Standard Error 0.51

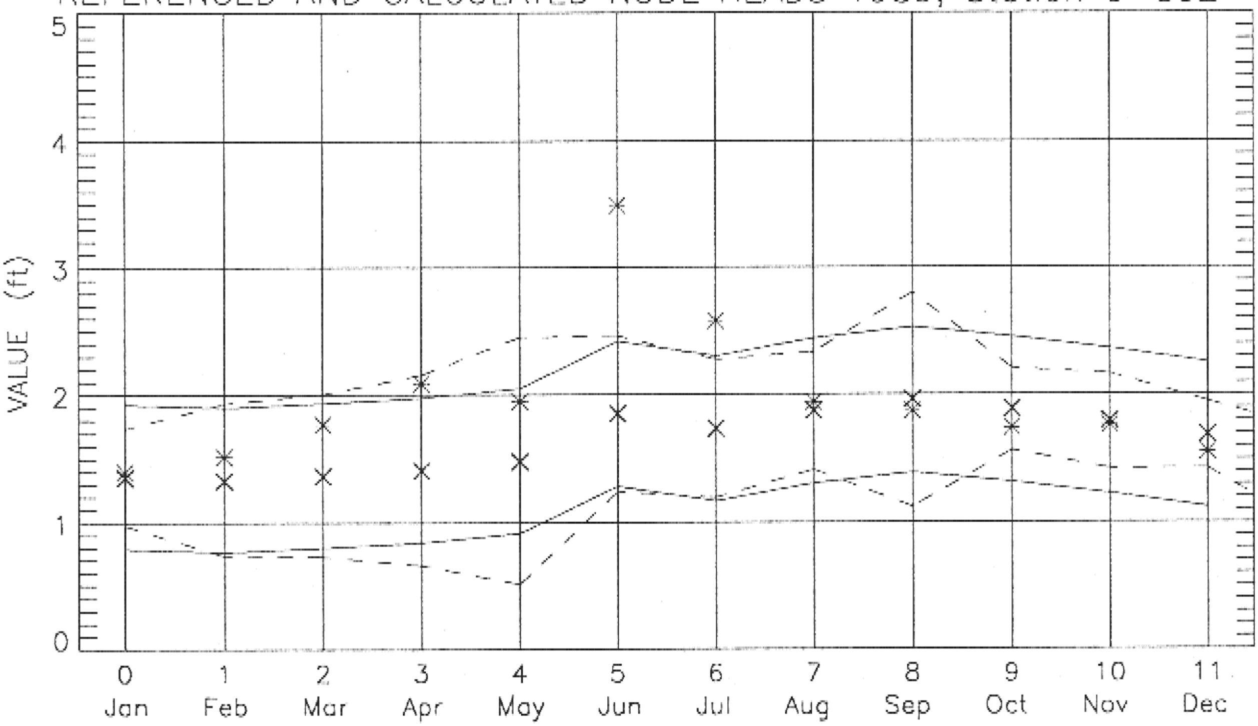

REFERENCED AND CALCULATED NODE HEADS 1989, Station G-970
VALUE (ft)
5
4
3
2
1
0
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Layer 2 Row 86 Column 31 Hist.Std.Dev. 0.4 NOTE: Observed * Calculated x


DIFFERENCE PLOT
VALUE (ft)
4
2
0
−2
−4
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Extreme Errors [−0.8, 0.4] Average Absolute Error 0.23 Standard Error 0.31


REFERENCED AND CALCULATED NODE HEADS 1989, Station G-1637
VALUE (ft)
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Layer 3 Row 87 Column 13 Hist.Std.Dev. 0.5 NOTE: Observed * Calculated x

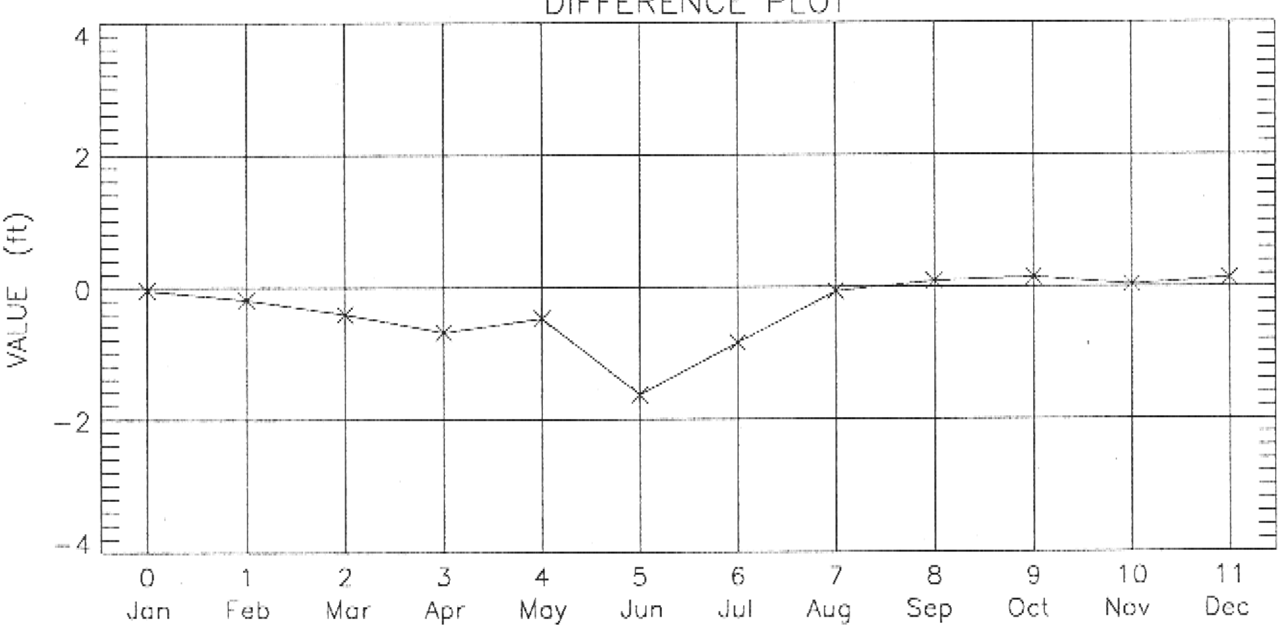

DIFFERENCE PLOT
VALUE (ft)
0 1 2 3 4 5 6 7 8 9 10 11
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Extreme Errors [0.1, 1.9] Average Absolute Error 1.18 Standard Error 0.48

REFERENCED AND CALCULATED NODE HEADS 1989, Station G-852



Layer 3 Row 94 Column 97 Hist.Std.Dev. 0.6 NOTE: Observed * Calculated x

DIFFERENCE PLOT



Extreme Errors [-1.6, 0.1] Average Absolute Error 0.39 Standard Error 0.53

APPENDIX F

SENSITIVITY DATA

Parameter Change: Hydraulic Conductivity /2
Layer(s): 1 & 2
Base Case Compared To: Steady State 1989
Dry/mound cells: none

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	3006	5774	8780	0.02	-0.02	-0.01	0.04	0.04	0.04	0.29	-0.58
2	2791	5989	8780	0.02	-0.02	-0.01	0.04	0.03	0.04	0.29	-0.39
3	2624	6156	8780	0.02	-0.01	-0.01	0.04	0.03	0.04	0.29	-0.27
4	2641	6139	8780	0.02	-0.01	-0.01	0.04	0.03	0.04	0.29	-0.27
5	2694	6086	8780	0.02	-0.01	-0.01	0.04	0.03	0.04	0.29	-0.26

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	-1%	-1%
Head Dep Bounds	-1%	-1%
Drains	N/A	-1%
ET	N/A	+1%
Total	-1%	-1%

Parameter Change: Hydraulic Conductivity * 2
Layer(s): 1 & 2
Base Case Compared To: Steady State 1989
Dry/mound cells: none

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	5840	2940	8780	0.03	-0.02	0.01	0.06	0.05	0.06	1.00	-0.28
2	5943	2837	8780	0.03	-0.02	0.01	0.06	0.05	0.06	0.62	-0.28
3	6017	2763	8780	0.02	-0.02	0.01	0.05	0.05	0.05	0.45	-0.28
4	6052	2728	8780	0.02	-0.02	0.01	0.05	0.05	0.05	0.45	-0.28
5	6054	2726	8780	0.02	-0.02	0.01	0.05	0.05	0.05	0.45	-0.28

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	+2%	+3%
Head Dep Bounds	+2%	+2%
Drains	N/A	+3%
ET	N/A	-1%
Total	+2%	+2%

Parameter Change: Transmissivity / 2
Layer(s): 3 & 4
Base Case Compared To: Steady State 1989
Dry/mound cells:

lay	col	row	reference value	new value
1	86	42	-6.9265	0.10000E+31
1	87	41	-7.5741	0.10000E+31
1	87	42	-10.757	0.10000E+31
1	88	41	-8.3746	0.10000E+31
1	88	42	-12.600	0.10000E+31
1	89	42	-10.173	0.10000E+31
1	115	24	-2.6863	0.10000E+31
1	115	25	-2.1649	0.10000E+31
1	116	23	-2.6972	0.10000E+31
1	116	24	-4.0743	0.10000E+31
1	116	25	-3.1083	0.10000E+31
1	117	23	-3.3227	0.10000E+31
1	117	24	-4.8886	0.10000E+31
1	117	25	-4.0265	0.10000E+31
1	118	24	-5.3707	0.10000E+31
1	118	25	-4.9876	0.10000E+31
1	119	24	-5.2041	0.10000E+31
1	119	25	-4.9617	0.10000E+31

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	3539	5223	8762	0.07	-0.30	-0.15	0.10	0.63	0.52	0.68	-8.39
2	3484	5296	8780	0.09	-0.33	-0.16	0.12	0.77	0.64	0.70	-13.89
3	3589	5191	8780	0.10	-0.35	-0.17	0.13	0.78	0.64	0.83	-13.93
4	3585	5195	8780	0.10	-0.35	-0.17	0.13	0.78	0.64	0.83	-13.92
5	3678	5102	8780	0.09	-0.35	-0.17	0.13	0.78	0.64	0.83	-13.42

lay.....................layer
numup...................number of cells with increase in head elevation
numdw...................number of cells with decrease in head elevation
numtl...................total number of cells experiencing change in head
upmean..................average increase in head elevation
dwmean..................average decrease in head elevation
tlmean..................average change in head elevation
upstd...................standard deviation for upward changes in elevation
dwstd...................standard deviation for downward changes in elevation
tlstd...................standard deviation for changes in elevation
maxlev..................maximum increase in head elevation occurring
minlev..................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	-2%	-14%
Head Dep Bounds	-31%	-37%
Drains	N/A	-25%
ET	N/A	-4%
Total	-14%	-14%

Parameter Change: Transmissivity * 2
Layer(s): 3 & 4
Base Case Compared To: Steady State 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	5499	3281	8780	0.25	-0.09	0.12	0.46	0.15	0.41	7.76	-0.92
2	5443	3337	8780	0.26	-0.11	0.12	0.47	0.17	0.43	7.70	-0.93
3	5526	3254	8780	0.27	-0.12	0.12	0.48	0.19	0.44	7.72	-1.08
4	5530	3250	8780	0.27	-0.12	0.13	0.48	0.19	0.44	7.72	-1.08
5	5483	3297	8780	0.27	-0.12	0.12	0.48	0.19	0.44	7.46	-1.08

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

---

Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	+3%	+19%
Head Dep Bounds	+55%	+76%
Drains	N/A	+47%
ET	N/A	+8%
Total	+24%	+24%

Parameter Change: Transmissivity / 2
Layer(s): 5
Base Case Compared To: Steady State 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	3460	5320	8780	0.01	-0.01	0.00	0.04	0.04	0.04	0.27	-0.37
2	3419	5361	8780	0.01	-0.01	0.00	0.04	0.04	0.04	0.27	-0.37
3	3527	5253	8780	0.02	-0.01	0.00	0.04	0.04	0.04	0.28	-0.47
4	3536	5244	8780	0.02	-0.01	0.00	0.04	0.04	0.04	0.28	-0.47
5	3686	5094	8780	0.02	-0.02	0.00	0.04	0.04	0.04	0.36	-0.65

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	0%	-1%
Head Dep Bounds	-1%	-2%
Drains	N/A	-1%
ET	N/A	0%
Total	-1%	-1%

Parameter Change: Transmissivity * 2
Layer(s): 5
Base Case Compared To: Steady State 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	5144	3636	8780	0.02	-0.02	0.01	0.06	0.04	0.06	0.61	-0.32
2	5068	3712	8780	0.02	-0.02	0.01	0.06	0.04	0.06	0.60	-0.32
3	5147	3633	8780	0.03	-0.02	0.01	0.06	0.05	0.06	0.72	-0.34
4	5163	3617	8780	0.03	-0.02	0.01	0.06	0.05	0.06	0.73	-0.34
5	5075	3705	8780	0.03	-0.02	0.01	0.07	0.05	0.07	0.99	-0.56

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	+1%	+2%
Head Dep Bounds	+3%	+3%
Drains	N/A	+2%
ET	N/A	0%
Total	+1%	+1%

Parameter Change: River and Drain Conductances / 2
Layer(s): 1
Base Case Compared To: Steady State 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	4041	4739	8780	0.15	-0.22	-0.05	0.14	0.23	0.27	1.09	-2.27
2	3960	4820	8780	0.15	-0.21	-0.05	0.13	0.22	0.25	0.70	-1.58
3	3941	4839	8780	0.14	-0.20	-0.05	0.13	0.21	0.25	0.64	-1.17
4	3941	4839	8780	0.14	-0.20	-0.05	0.13	0.21	0.25	0.64	-1.17
5	3959	4821	8780	0.14	-0.20	-0.05	0.13	0.21	0.25	0.64	-1.14

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	-23%	-32%
Head Dep Bounds	-14%	-4%
Drains	N/A	+2%
ET	N/A	+10%
Total	-14%	-14%

Parameter Change: River and Drain Conductances * 2
Layer(s): 1
Base Case Compared To: Steady State 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	4593	4187	8780	0.14	-0.11	0.02	0.17	0.12	0.20	2.12	-1.61
2	4627	4153	8780	0.14	-0.10	0.02	0.15	0.10	0.17	1.39	-0.63
3	4698	4082	8780	0.13	-0.10	0.02	0.14	0.10	0.17	0.92	-0.59
4	4715	4065	8780	0.13	-0.10	0.02	0.13	0.10	0.17	0.92	-0.59
5	4741	4039	8780	0.13	-0.10	0.02	0.13	0.10	0.16	0.90	-0.59

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	+33%	+43%
Head Dep Bounds	+19%	+6%
Drains	N/A	+19%
ET	N/A	-6%
Total	+20%	+20%

Parameter Change: River and Drain Conductances / 10
Layer(s): 1
Base Case Compared To: Steady State 1989

Dry/mound cells:	lay	col	row	reference value	new value
	1	87	42	-10.757	0.10000E+31
	1	88	42	-12.600	0.10000E+31
	1	89	42	-10.173	0.10000E+31
	1	116	24	-4.0743	0.10000E+31

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	3840	4936	8776	0.63	-1.21	-0.41	0.53	1.26	1.36	3.42	-7.82
2	3761	5019	8780	0.61	-1.17	-0.41	0.51	1.22	1.32	2.52	-6.09
3	3766	5014	8780	0.60	-1.16	-0.41	0.51	1.19	1.30	2.35	-5.02
4	3764	5016	8780	0.60	-1.16	-0.41	0.51	1.19	1.30	2.35	-5.00
5	3772	5008	8780	0.60	-1.16	-0.41	0.51	1.19	1.29	2.34	-4.92

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	-56%	-77%
Head Dep Bounds	-33%	-8%
Drains	N/A	-53%
ET	N/A	+52
Total	-34%	-34%

Parameter Change: River and Drain Conductances * 10
Layer(s): 1
Base Case Compared To: Steady State 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	4468	4312	8780	0.32	-0.26	0.04	0.39	0.36	0.48	5.59	-5.96
2	4540	4240	8780	0.30	-0.22	0.05	0.33	0.25	0.39	3.54	-1.82
3	4612	4168	8780	0.28	-0.21	0.05	0.30	0.24	0.37	2.23	-1.78
4	4638	4142	8780	0.28	-0.21	0.05	0.30	0.24	0.37	2.23	-1.78
5	4652	4128	8780	0.28	-0.21	0.05	0.30	0.24	0.37	2.19	-1.77

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	+209%	+232%
Head Dep Bounds	+86%	+33%
Drains	N/A	+130%
ET	N/A	-8%
Total	+110%	+110%

Parameter Change: VCONT / 2
Layer(s): 1 & 2
Base Case Compared To: Steady State 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	4118	4662	8780	0.05	-0.15	-0.06	0.06	0.20	0.18	0.96	-1.52
2	3506	5274	8780	0.04	-0.17	-0.09	0.04	0.21	0.19	0.27	-1.10
3	3357	5423	8780	0.05	-0.21	-0.11	0.06	0.26	0.24	0.46	-1.78
4	3353	5427	8780	0.05	-0.21	-0.11	0.06	0.26	0.24	0.46	-1.77
5	3364	5416	8780	0.05	-0.21	-0.11	0.06	0.25	0.24	0.45	-1.74

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	-10%	-10%
Head Dep Bounds	-4%	-4%
Drains	N/A	-7%
ET	N/A	+2%
Total	-5%	-5%

Parameter Change: VCONT * 2
Layer(s): 1 & 2
Base Case Compared To: Steady State 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	4630	4150	8780	0.09	-0.03	0.03	0.14	0.05	0.12	1.06	-0.76
2	5066	3714	8780	0.10	-0.03	0.05	0.14	0.03	0.12	0.80	-0.23
3	5246	3534	8780	0.12	-0.03	0.06	0.17	0.04	0.15	1.25	-0.33
4	5243	3537	8780	0.12	-0.03	0.06	0.17	0.04	0.15	1.24	-0.33
5	5247	3533	8780	0.12	-0.03	0.06	0.17	0.04	0.15	1.21	-0.32

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	+9%	+8%
Head Dep Bounds	+3%	+5%
Drains	N/A	+8%
ET	N/A	-1%
Total	+5%	+5%

Parameter Change: VCONT / 4
Layer(s): 1 & 2
Base Case Compared To: Steady State 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	4095	4685	8780	0.11	-0.36	-0.14	0.14	0.48	0.43	2.10	-3.31
2	3389	5391	8780	0.09	-0.42	-0.22	0.10	0.50	0.47	0.64	-2.45
3	3242	5538	8780	0.11	-0.53	-0.29	0.13	0.62	0.58	1.00	-4.03
4	3251	5529	8780	0.11	-0.53	-0.29	0.13	0.62	0.58	1.00	-4.02
5	3261	5519	8780	0.11	-0.53	-0.29	0.13	0.62	0.58	0.98	-3.96

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	-20%	-21%
Head Dep Bounds	-8%	-8%
Drains	N/A	-12%
ET	N/A	+4%
Total	-11%	-11%

Parameter Change: VCONT * 4
Layer(s): 1 & 2
Base Case Compared To: Steady State 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	4594	4186	8780	0.15	-0.06	0.05	0.22	0.09	0.20	1.76	-1.28
2	5040	3740	8780	0.16	-0.04	0.08	0.22	0.05	0.20	1.33	-0.41
3	5196	3584	8780	0.20	-0.05	0.09	0.27	0.07	0.25	2.10	-0.64
4	5198	3582	8780	0.20	-0.05	0.09	0.27	0.07	0.25	2.08	-0.63
5	5193	3587	8780	0.20	-0.05	0.09	0.27	0.07	0.25	2.01	-0.59

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	+18%	+13%
Head Dep Bounds	+5%	+11%
Drains	N/A	+14%
ET	N/A	-1%
Total	+8%	+8%

Parameter Change: VCONT / 2
Layer(s): 3 & 4
Base Case Compared To: Steady State 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	4528	4252	8780	0.00	0.00	0.00	0.00	0.01	0.01	0.04	-0.09
2	4447	4333	8780	0.00	0.00	0.00	0.00	0.01	0.01	0.04	-0.09
3	4599	4181	8780	0.00	-0.01	0.00	0.00	0.01	0.01	0.04	-0.09
4	4593	4187	8780	0.00	0.00	0.00	0.00	0.01	0.01	0.05	-0.09
5	4558	4222	8780	0.01	-0.01	0.00	0.02	0.01	0.02	0.46	-0.46

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	0%	0%
Head Dep Bounds	0%	0%
Drains	N/A	0%
ET	N/A	0%
Total	0%	0%

Parameter Change: VCONT * 2
Layer(s): 3 & 4
Base Case Compared To: Steady State 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	4146	4634	8780	0.00	0.00	0.00	0.00	0.00	0.00	0.02	-0.01
2	4111	4669	8780	0.00	0.00	0.00	0.00	0.00	0.00	0.03	-0.01
3	4225	4555	8780	0.00	0.00	0.00	0.00	0.00	0.00	0.05	-0.02
4	4416	4364	8780	0.00	0.00	0.00	0.00	0.00	0.00	0.03	-0.03
5	4659	4121	8780	0.00	0.00	0.00	0.01	0.01	0.01	0.35	-0.31

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	0%	0%
Head Dep Bounds	0%	0%
Drains	N/A	0%
ET	N/A	0%
Total	0%	0%

Parameter Change: VCONT / 4
Layer(s): 3 & 4
Base Case Compared To: Steady State 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	4531	4249	8780	0.00	0.00	0.00	0.00	0.01	0.01	0.03	-0.12
2	4491	4289	8780	0.00	0.00	0.00	0.00	0.01	0.01	0.05	-0.17
3	4575	4205	8780	0.00	-0.01	0.00	0.00	0.01	0.01	0.07	-0.23
4	4566	4214	8780	0.00	-0.01	0.00	0.00	0.01	0.01	0.11	-0.11
5	4445	4335	8780	0.01	-0.01	0.00	0.04	0.02	0.04	1.24	-0.97

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	0%	0%
Head Dep Bounds	0%	0%
Drains	N/A	0%
ET	N/A	0%
Total	0%	0%

Parameter Change: VCONT * 4
Layer(s): 3 & 4
Base Case Compared To: Steady State 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	4838	3942	8780	0.00	0.00	0.00	0.00	0.00	0.00	0.04	-0.01
2	4799	3981	8780	0.00	0.00	0.00	0.00	0.00	0.00	0.05	-0.02
3	4899	3881	8780	0.00	0.00	0.00	0.00	0.00	0.00	0.07	-0.03
4	5042	3738	8780	0.00	0.00	0.00	0.00	0.00	0.00	0.05	-0.05
5	5231	3549	8780	0.00	0.00	0.00	0.01	0.02	0.01	0.57	-0.52

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	0%	0%
Head Dep Bounds	0%	0%
Drains	N/A	0%
ET	N/A	0%
Total	0%	0%

Parameter Change: Increase Extinction Depth 1 Foot
Layer(s): 1
Base Case Compared To: Steady State 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	8	8772	8780	0.00	-0.03	-0.03	0.00	0.05	0.05	0.00	-0.48
2	2	8778	8780	0.00	-0.03	-0.03	99.99	0.05	0.05	0.00	-0.47
3	9	8771	8780	0.00	-0.03	-0.03	0.00	0.05	0.05	0.00	-0.46
4	3	8777	8780	0.00	-0.03	-0.03	99.99	0.05	0.05	0.00	-0.46
5	2	8778	8780	0.00	-0.03	-0.03	99.99	0.05	0.05	0.00	-0.46

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	+2%	-2%
Head Dep Bounds	+1%	-2%
Drains	N/A	-11%
ET	N/A	+65%
Total	+1%	+1%

Parameter Change: Decrease Extinction Depth 1 Foot
Layer(s): 1
Base Case Compared To: Steady State 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	7698	1082	8780	0.02	0.00	0.02	0.03	0.00	0.03	0.43	-0.01
2	7592	1188	8780	0.02	0.00	0.01	0.03	0.00	0.03	0.42	-0.01
3	7629	1151	8780	0.02	0.00	0.01	0.03	0.00	0.03	0.42	-0.01
4	7653	1127	8780	0.02	0.00	0.01	0.03	0.00	0.03	0.42	-0.01
5	7688	1092	8780	0.02	0.00	0.01	0.03	0.00	0.03	0.42	-0.01

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	-2%	+1%
Head Dep Bounds	-2%	+2%
Drains	N/A	+9%
ET	N/A	-49%
Total	-1%	-1%

Parameter Change: Increase Land Surface Elevation 1 Foot
Layer(s): 1
Base Case Compared To: Steady State 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	8641	139	8780	0.02	0.00	0.02	0.04	0.00	0.04	0.43	0.00
2	8550	230	8780	0.02	0.00	0.02	0.04	0.00	0.04	0.42	0.00
3	8573	207	8780	0.02	0.00	0.02	0.04	0.00	0.04	0.42	0.00
4	8604	176	8780	0.02	0.00	0.02	0.04	0.00	0.04	0.42	0.00
5	8669	111	8780	0.02	0.00	0.02	0.04	0.00	0.04	0.42	0.00

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	-2%	+2%
Head Dep Bounds	-3%	+2%
Drains	N/A	+11%
ET	N/A	-72%
Total	-2%	-2%

Parameter Change: Decrease Land Surface Elevation 1 Foot
Layer(s): 1
Base Case Compared To: Steady State 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	13	8767	8780	0.00	-0.05	-0.05	0.00	0.08	0.08	0.00	-0.67
2	9	8771	8780	0.00	-0.05	-0.05	0.00	0.08	0.08	0.00	-0.66
3	14	8766	8780	0.00	-0.05	-0.05	0.00	0.08	0.08	0.00	-0.65
4	14	8766	8780	0.00	-0.05	-0.05	0.00	0.08	0.08	0.00	-0.65
5	15	8765	8780	0.00	-0.05	-0.05	0.00	0.08	0.08	0.00	-0.65

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	+4%	-4%
Head Dep Bounds	+3%	-3%
Drains	N/A	-19%
ET	N/A	+75%
Total	+3%	+3%

Parameter Change: Increase Land Surface Elevation 2 Feet
Layer(s): 1
Base Case Compared To: Steady State 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	8622	158	8780	0.03	0.00	0.02	0.05	0.00	0.05	0.43	0.00
2	8533	247	8780	0.02	0.00	0.02	0.05	0.00	0.05	0.42	0.00
3	8561	219	8780	0.02	0.00	0.02	0.05	0.00	0.05	0.42	0.00
4	8591	189	8780	0.02	0.00	0.02	0.05	0.00	0.05	0.42	0.00
5	8653	127	8780	0.02	0.00	0.02	0.05	0.00	0.05	0.42	0.00

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	-3%	+2%
Head Dep Bounds	-3%	+3%
Drains	N/A	+14%
ET	N/A	-96%
Total	-2%	-2%

Parameter Change: Decrease Land Surface Elevation 2 Feet
Layer(s): 1
Base Case Compared To: Steady State 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	1	8779	8780	0.00	-0.12	-0.12	99.99	0.18	0.18	0.00	-1.35
2	1	8779	8780	0.00	-0.12	-0.12	99.99	0.18	0.18	0.00	-1.32
3	6	8774	8780	0.00	-0.12	-0.12	99.99	0.17	0.17	0.00	-1.31
4	8	8772	8780	0.00	-0.12	-0.12	0.00	0.17	0.17	0.00	-1.31
5	7	8773	8780	0.00	-0.12	-0.12	0.00	0.17	0.17	0.00	-1.31

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	+11%	-9%
Head Dep Bounds	+5%	-6%
Drains	N/A	-37%
ET	N/A	+264%
Total	+6%	+6%

Parameter Change: Increase Max ET Rate to 120% of Original
Layer(s): 1
Base Case Compared To: Steady State 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	352	8428	8780	0.00	0.00	0.00	0.00	0.01	0.01	0.00	-0.07
2	346	8434	8780	0.00	0.00	0.00	0.00	0.01	0.01	0.00	-0.06
3	377	8403	8780	0.00	0.00	0.00	0.00	0.01	0.01	0.00	-0.06
4	381	8399	8780	0.00	0.00	0.00	0.00	0.01	0.01	0.00	-0.06
5	388	8392	8780	0.00	0.00	0.00	0.00	0.01	0.01	0.00	-0.06

lay.........................layer
numup.....................number of cells with increase in head elevation
numdw.....................number of cells with decrease in head elevation
numtl.....................total number of cells experiencing change in head
upmean....................average increase in head elevation
dwmean....................average decrease in head elevation
tlmean....................average change in head elevation
upstd.....................standard deviation for upward changes in elevation
dwstd.....................standard deviation for downward changes in elevation
tlstd.....................standard deviation for changes in elevation
maxlev....................maximum increase in head elevation occurring
minlev....................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	0%	0%
Head Dep Bounds	+1%	0%
Drains	N/A	-2%
ET	N/A	+18%
Total	+.5%	+.5%

Parameter Change: Decrease Max ET Rate to 80% of Original
Layer(s): 1
Base Case Compared To: Steady State 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	8462	318	8780	0.00	0.00	0.00	0.01	0.00	0.01	0.08	0.00
2	8361	419	8780	0.00	0.00	0.00	0.01	0.00	0.01	0.06	0.00
3	8331	449	8780	0.00	0.00	0.00	0.01	0.00	0.01	0.06	0.00
4	8375	405	8780	0.00	0.00	0.00	0.01	0.00	0.01	0.06	0.00
5	8457	323	8780	0.00	0.00	0.00	0.01	0.00	0.01	0.06	0.00

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	0%	0%
Head Dep Bounds	-1%	0%
Drains	N/A	+2%
ET	N/A	-18%
Total	-.5%	-.5%

Parameter Change: Increase Recharge Rate to 120% of Original
Layer(s): 1
Base Case Compared To: Steady State 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	8779	1	8780	0.04	0.00	0.04	0.03	99.99	0.03	0.18	0.00
2	8777	3	8780	0.04	0.00	0.04	0.03	99.99	0.03	0.18	0.00
3	8669	111	8780	0.04	0.00	0.04	0.03	0.00	0.03	0.18	0.00
4	8683	97	8780	0.04	0.00	0.04	0.03	0.00	0.03	0.18	0.00
5	8699	81	8780	0.04	0.00	0.04	0.03	0.00	0.03	0.18	0.00

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	-3%	+4%
Head Dep Bounds	-1%	+3%
Drains	N/A	+10%
ET	N/A	+4%
Total	+3%	+3%

Parameter Change: Decrease Recharge Rate to 80% of Original
Layer(s): 1
Base Case Compared To: Steady State 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	0	8780	8780	99.99	-0.04	-0.04	99.99	0.03	0.03	0.00	-0.19
2	0	8780	8780	99.99	-0.04	-0.04	99.99	0.03	0.03	0.00	-0.19
3	20	8760	8780	0.00	-0.04	-0.04	0.00	0.03	0.03	0.00	-0.19
4	19	8761	8780	0.00	-0.04	-0.04	0.00	0.03	0.03	0.00	-0.19
5	19	8761	8780	0.00	-0.04	-0.04	0.00	0.03	0.03	0.00	-0.19

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	+3%	-3%
Head Dep Bounds	+1%	-3%
Drains	N/A	-9%
ET	N/A	-3%
Total	-3%	-3%

Parameter Change: Recharge = 0
Layer(s): 1
Base Case Compared To: Steady State 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	0	8780	8780	99.99	-0.21	-0.21	99.99	0.18	0.18	0.00	-0.95
2	0	8780	8780	99.99	-0.21	-0.21	99.99	0.17	0.17	0.00	-0.94
3	19	8761	8780	0.00	-0.21	-0.21	0.00	0.16	0.16	0.00	-0.93
4	22	8758	8780	0.00	-0.21	-0.21	0.00	0.16	0.16	0.00	-0.93
5	20	8760	8780	0.00	-0.21	-0.21	0.00	0.16	0.16	0.00	-0.93

lay.....................layer
numup...................number of cells with increase in head elevation
numdw...................number of cells with decrease in head elevation
numtl...................total number of cells experiencing change in head
upmean..................average increase in head elevation
dwmean..................average decrease in head elevation
tlmean..................average change in head elevation
upstd...................standard deviation for upward changes in elevation
dwstd...................standard deviation for downward changes in elevation
tlstd...................standard deviation for changes in elevation
maxlev..................maximum increase in head elevation occurring
minlev..................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	+20%	-16%
Head Dep Bounds	+7%	-11%
Drains	N/A	-39%
ET	N/A	-17%
Total	-12%	-12%

Parameter Change: Specific Yield / 2
Layer(s): 1
Base Case Compared To: Transient 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	2182	6598	8780	0.02	-0.01	0.00	0.02	0.01	0.01	0.08	-0.05
2	2406	6374	8780	0.02	-0.01	0.00	0.02	0.00	0.01	0.09	-0.03
3	2586	6194	8780	0.02	-0.01	0.00	0.02	0.00	0.01	0.09	-0.02
4	2591	6189	8780	0.02	-0.01	0.00	0.02	0.00	0.01	0.09	-0.02
5	2627	6153	8780	0.02	-0.01	0.00	0.02	0.00	0.02	0.09	-0.02

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	-5%	-7%
River Leakage	-1%	0%
Head Dep Bounds	-1%	-1%
Drains	N/A	+1%
ET	N/A	+1%
Total	-1%	-1%

Parameter Change: Specific Yield * 2
Layer(s): 1
Base Case Compared To: Transient 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	6078	2702	8780	0.01	-0.03	0.00	0.01	0.03	0.03	0.07	-0.16
2	5751	3029	8780	0.01	-0.03	0.00	0.01	0.03	0.03	0.04	-0.16
3	5477	3303	8780	0.01	-0.03	0.00	0.01	0.03	0.03	0.03	-0.16
4	5514	3266	8780	0.01	-0.03	0.00	0.01	0.03	0.03	0.03	-0.16
5	5515	3265	8780	0.01	-0.03	-0.01	0.01	0.03	0.03	0.03	-0.16

lay.......................layer
numup.....................number of cells with increase in head elevation
numdw.....................number of cells with decrease in head elevation
numtl.....................total number of cells experiencing change in head
upmean....................average increase in head elevation
dwmean....................average decrease in head elevation
tlmean....................average change in head elevation
upstd.....................standard deviation for upward changes in elevation
dwstd.....................standard deviation for downward changes in elevation
tlstd.....................standard deviation for changes in elevation
maxlev....................maximum increase in head elevation occurring
minlev....................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	+8%	+12%
River Leakage	+2%	-1%
Head Dep Bounds	+1%	+2%
Drains	N/A	-2%
ET	N/A	-1%
Total	+2%	+2%

Parameter Change: Storage Coefficient / 10
Layer(s): 3, 4 & 5
Base Case Compared To: Transient 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	0	8780	8780	99.99	0.00	0.00	99.99	0.00	0.00	0.00	0.00
2	0	8780	8780	99.99	0.00	0.00	99.99	0.00	0.00	0.00	0.00
3	0	8780	8780	99.99	0.00	0.00	99.99	0.00	0.00	0.00	0.00
4	0	8780	8780	99.99	0.00	0.00	99.99	0.00	0.00	0.00	0.00
5	0	8780	8780	99.99	0.00	0.00	99.99	0.00	0.00	0.00	0.00

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	0%	0%
River Leakage	0%	0%
Head Dep Bounds	0%	0%
Drains	N/A	0%
ET	N/A	0%
Total	0%	0%

Parameter Change: Storage Coefficient * 10
Layer(s): 3, 4 & 5
Base Case Compared To: Transient 1989
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxlev	minlev
1	0	8780	8780	99.99	0.00	0.00	99.99	0.00	0.00	0.00	0.00
2	0	8780	8780	99.99	0.00	0.00	99.99	0.00	0.00	0.00	0.00
3	0	8780	8780	99.99	0.00	0.00	99.99	0.00	0.00	0.00	0.00
4	0	8780	8780	99.99	0.00	0.00	99.99	0.00	0.00	0.00	0.00
5	0	8780	8780	99.99	0.00	0.00	99.99	0.00	0.00	0.00	0.00

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	0%	0%
River Leakage	0%	0%
Head Dep Bounds	0%	0%
Drains	N/A	0%
ET	N/A	0%
Total	0%	0%

Parameter Change: Increase Starting Head Elevations By +2 Feet
Layer(s): 1
Base Case Compared To: Transient 1989, 1st stress period only
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxdif	mindif
1	8737	43	8780	0.23	0.00	0.23	0.14	0.00	0.14	0.80	0.00
2	8681	99	8780	0.24	0.00	0.23	0.12	0.00	0.12	0.62	0.00
3	8673	107	8780	0.23	0.00	0.23	0.10	0.00	0.11	0.51	0.00
4	8690	90	8780	0.23	0.00	0.23	0.11	0.00	0.11	0.51	0.00
5	8716	64	8780	0.23	0.00	0.23	0.10	0.00	0.11	0.50	0.00

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	+559%	+378%
River Leakage	-34%	+61%
Head Dep Bounds	-11%	+90%
Drains	N/A	+143%
ET	N/A	+39%
Total	+114%	+114%

Parameter Change: Increase Starting Head Elevations By +2 Feet
Layer(s): 1
Base Case Compared To: Transient 1989, 1st stress period only - no wells, rivers, drains, recharge, or ET
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxdif	mindif
1	8740	40	8780	0.35	0.00	0.34	0.14	0.00	0.14	0.83	0.00
2	8690	90	8780	0.33	0.00	0.33	0.12	0.00	0.13	0.64	0.00
3	8678	102	8780	0.32	0.00	0.31	0.12	0.00	0.12	0.55	0.00
4	8684	96	8780	0.32	0.00	0.31	0.12	0.00	0.12	0.55	0.00
5	8722	58	8780	0.31	0.00	0.31	0.12	0.00	0.12	0.55	0.00

lay.......................layer
numup.....................number of cells with increase in head elevation
numdw.....................number of cells with decrease in head elevation
numtl.....................total number of cells experiencing change in head
upmean....................average increase in head elevation
dwmean....................average decrease in head elevation
tlmean....................average change in head elevation
upstd.....................standard deviation for upward changes in elevation
dwstd.....................standard deviation for downward changes in elevation
tlstd.....................standard deviation for changes in elevation
maxlev....................maximum increase in head elevation occurring
minlev....................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	+377%	+209%
River Leakage	N/A	N/A
Head Dep Bounds	-16%	+126%
Drains	N/A	N/A
ET	N/A	N/A
Total	+189%	+189%

Parameter Change: Decrease Starting Head Elevations By -2 Feet
Layer(s): 1
Base Case Compared To: Transient 1989, 1st stress period only
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxdif	mindif
1	4	8776	8780	0.00	-0.24	-0.24	99.99	0.14	0.14	0.00	-0.81
2	3	8777	8780	0.00	-0.24	-0.24	99.99	0.12	0.12	0.00	-0.62
3	30	8750	8780	0.00	-0.24	-0.24	0.00	0.11	0.11	0.00	-0.52
4	26	8754	8780	0.00	-0.24	-0.24	0.00	0.11	0.11	0.00	-0.51
5	22	8758	8780	0.00	-0.24	-0.24	0.00	0.11	0.11	0.00	-0.51

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	+341%	+667%
River Leakage	+81%	-27%
Head Dep Bounds	+38%	-27%
Drains	N/A	-66%
ET	N/A	-26%
Total	+110%	+110%

Parameter Change: Decrease Starting Head Elevations By -2 Feet
Layer(s): 1
Base Case Compared To: Transient 1989, 1st stress period only - no wells, rivers, drains, recharge, or ET
Dry/mound cells: None

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxdif	mindif
1	4	8776	8780	0.00	-0.34	-0.34	99.99	0.14	0.14	0.00	-0.83
2	0	8780	8780	99.99	-0.33	-0.33	99.99	0.13	0.13	0.00	-0.64
3	26	8754	8780	0.00	-0.31	-0.31	0.00	0.12	0.12	0.00	-0.55
4	24	8756	8780	0.00	-0.31	-0.31	0.00	0.12	0.12	0.00	-0.55
5	22	8758	8780	0.00	-0.31	-0.31	0.00	0.12	0.12	0.00	-0.55

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	+304%	+262%
River Leakage	N/A	N/A
Head Dep Bounds	+64%	-31%
Drains	N/A	N/A
ET	N/A	N/A
Total	+189%	+190%

Parameter Change: General Head Boundary Conductance * 10
Layers: All
Base Case Compared To: Steady State 1989
Dry/mound cells: none

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxdif	mindif
1	4680	4100	8780	0.00	0.00	0.00	0.01	0.00	0.01	0.20	-0.08
2	4693	4087	8780	0.00	0.00	0.00	0.00	0.00	0.00	0.03	-0.01
3	4750	4030	8780	0.00	0.00	0.00	0.00	0.00	0.00	0.06	-0.05
4	4756	4024	8780	0.00	0.00	0.00	0.00	0.00	0.00	0.09	-0.09
5	4762	4018	8780	0.00	0.00	0.00	0.01	0.01	0.01	0.47	-0.42

Note: Statistics reflect entire model area

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	0%	0%
Head Dep Bounds	+1%	+3%
Drains	N/A	0%
ET	N/A	0%
Total	+1%	+1%

Parameter Change: General Head Boundary Conductance * 10
Layers: All
Base Case Compared To: Steady State 1989
Dry/mound cells: none

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxdif	mindif
1	3784	3037	6821	0.00	0.00	0.00	0.00	0.00	0.00	0.10	-0.03
2	3790	3031	6821	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
3	3808	3013	6821	0.00	0.00	0.00	0.00	0.00	0.00	0.01	-0.01
4	3811	3010	6821	0.00	0.00	0.00	0.00	0.00	0.00	0.01	-0.01
5	3828	2993	6821	0.00	0.00	0.00	0.00	0.00	0.00	0.03	-0.01

Note: Statistics reflect model area within Broward County only

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	0%	0%
Head Dep Bounds	+1%	+3%
Drains	N/A	0%
ET	N/A	0%
Total	+1%	+1%

Parameter Change: General Head Boundary Conductance * 0.1
Layers: All
Base Case Compared To: Steady State 1989
Dry/mound cells: none

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxdif	mindif
1	3813	4967	8780	0.00	0.00	0.00	0.00	0.01	0.01	0.09	-0.17
2	3809	4971	8780	0.00	0.00	0.00	0.00	0.01	0.01	0.09	-0.20
3	3762	5018	8780	0.00	0.00	0.00	0.01	0.01	0.01	0.42	-0.44
4	3754	5026	8780	0.00	0.00	0.00	0.01	0.01	0.01	0.42	-0.44
5	3759	5021	8780	0.00	0.00	0.00	0.01	0.01	0.01	0.41	-0.44

Note: Statistics reflect entire model area

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	0%	0%
Head Dep Bounds	-3%	-7%
Drains	N/A	0%
ET	N/A	0%
Total	-1%	-1%

Parameter Change: General Head Boundary Conductance * 0.1
Layers: All
Base Case Compared To: Steady State 1989
Dry/mound cells: none

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxdif	mindif
1	2754	4067	6821	0.00	0.00	0.00	0.00	0.01	0.00	0.01	-0.11
2	2750	4071	6821	0.00	0.00	0.00	0.00	0.01	0.01	0.01	-0.20
3	2723	4098	6821	0.00	0.00	0.00	0.00	0.01	0.00	0.01	-0.10
4	2716	4105	6821	0.00	0.00	0.00	0.00	0.01	0.00	0.01	-0.10
5	2719	4102	6821	0.00	0.00	0.00	0.00	0.01	0.01	0.01	-0.10

Note: Statistics reflect model area within Broward County only

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	0%	0%
Head Dep Bounds	-3%	-7%
Drains	N/A	0%
ET	N/A	0%
Total	-1%	-1%

Parameter Change: General Head Boundary Conductance * 2
Layers: All
Base Case Compared To: Steady State 1989
Dry/mound cells: none

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxdif	mindif
1	4334	4446	8780	0.00	0.00	0.00	0.00	0.00	0.00	0.02	-0.01
2	4350	4430	8780	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
3	4404	4376	8780	0.00	0.00	0.00	0.00	0.00	0.00	0.03	-0.03
4	4414	4366	8780	0.00	0.00	0.00	0.00	0.00	0.00	0.04	-0.04
5	4414	4366	8780	0.00	0.00	0.00	0.00	0.00	0.00	0.11	-0.10

Note: Statistics reflect entire model area

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	0%	0%
Head Dep Bounds	0%	+1%
Drains	N/A	0%
ET	N/A	0%
Total	0%	0%

Parameter Change: General Head Boundary Conductance * 2
Layers: All
Base Case Compared To: Steady State 1989
Dry/mound cells: none

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxdif	mindif
1	3405	3416	6821	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
2	3422	3399	6821	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
3	3445	3376	6821	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
4	3452	3369	6821	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
5	3459	3362	6821	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00

Note: Statistics reflect model area within Broward County only

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	0%	0%
Head Dep Bounds	0%	+1%
Drains	N/A	0%
ET	N/A	0%
Total	0%	0%

Parameter Change: General Head Boundary Conductance * 0.5
Layers: All
Base Case Compared To: Steady State 1989
Dry/mound cells: none

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxdif	mindif
1	3971	4809	8780	0.00	0.00	0.00	0.00	0.00	0.00	0.01	-0.02
2	3956	4824	8780	0.00	0.00	0.00	0.00	0.00	0.00	0.01	-0.03
3	3903	4877	8780	0.00	0.00	0.00	0.00	0.00	0.00	0.05	-0.06
4	3900	4880	8780	0.00	0.00	0.00	0.00	0.00	0.00	0.06	-0.06
5	3905	4875	8780	0.00	0.00	0.00	0.00	0.00	0.00	0.09	-0.09

Note: Statistics reflect entire model area

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	0%	0%
Head Dep Bounds	-1%	+1%
Drains	N/A	0%
ET	N/A	0%
Total	0%	0%

Parameter Change: General Head Boundary Conductance * 0.5
Layers: All
Base Case Compared To: Steady State 1989
Dry/mound cells: none

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxdif	mindif
1	2856	3965	6821	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.02
2	2839	3982	6821	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.03
3	2814	4007	6821	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01
4	2812	4009	6821	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01
5	2820	4001	6821	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01

Note: Statistics reflect model area within Broward County only

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	0%	0%
Head Dep Bounds	-1%	+1%
Drains	N/A	0%
ET	N/A	0%
Total	0%	0%

Parameter Change: General Head Boundary Conductance * 100
Layers: All
Base Case Compared To: Steady State 1989
Dry/mound cells: none

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxdif	mindif
1	5011	3769	8780	0.00	0.00	0.00	0.05	0.02	0.04	1.24	-0.56
2	5031	3749	8780	0.00	0.00	0.00	0.00	0.00	0.00	0.04	-0.01
3	5098	3682	8780	0.00	0.00	0.00	0.00	0.00	0.00	0.07	-0.05
4	5100	3680	8780	0.00	0.00	0.00	0.00	0.00	0.00	0.12	-0.12
5	5096	3684	8780	0.00	0.00	0.00	0.01	0.01	0.01	0.83	-0.75

Note: Statistics reflect entire model area

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	+3%	+1%
Head Dep Bounds	+4%	+11%
Drains	N/A	0%
ET	N/A	0%
Total	+3%	+2%

Parameter Change: General Head Boundary Conductance * 100
Layers: All
Base Case Compared To: Steady State 1989
Dry/mound cells: none

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxdif	mindif
1	4044	2777	6821	0.00	0.00	0.00	0.01	0.01	0.01	0.73	-0.16
2	4056	2765	6821	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
3	4086	2735	6821	0.00	0.00	0.00	0.00	0.00	0.00	0.01	-0.01
4	4087	2734	6821	0.00	0.00	0.00	0.00	0.00	0.00	0.02	-0.01
5	4092	2729	6821	0.00	0.00	0.00	0.00	0.00	0.00	0.05	-0.01

Note: Statistics reflect model area within Broward County only

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	+3%	+1%
Head Dep Bounds	+4%	+11%
Drains	N/A	0%
ET	N/A	0%
Total	+3%	+2%

Parameter Change: General Head Boundary Conductance * 0.01
Layers: All
Base Case Compared To: Steady State 1989
Dry/mound cells: none

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxdif	mindif
1	3945	4835	8780	0.01	-0.02	-0.01	0.03	0.06	0.05	0.67	-1.03
2	3951	4829	8780	0.01	-0.02	-0.01	0.03	0.07	0.05	0.68	-1.20
3	3915	4865	8780	0.01	-0.03	-0.01	0.05	0.09	0.07	2.06	-2.39
4	3912	4868	8780	0.01	-0.03	-0.01	0.05	0.08	0.07	2.03	-2.36
5	3914	4866	8780	0.01	-0.03	-0.01	0.04	0.08	0.07	1.70	-2.05

Note: Statistics reflect entire model area

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

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Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	+1%	-4%
Head Dep Bounds	-17%	-30%
Drains	N/A	-2%
ET	N/A	-4%
Total	-7%	-7%

Parameter Change: General Head Boundary Conductance * 0.01
Layers: All
Base Case Compared To: Steady State 1989
Dry/mound cells: none

Estimated Statistics for aquifer drawdowns (new head - reference head):
(mean with 1 or more values, std with 7 or more values, and
for sample size too small shows 99.99)

lay	numup	numdw	numtl	upmean	dwmean	tlmean	upstd	dwstd	tlstd	maxdif	mindif
1	2866	3955	6821	0.00	-0.02	-0.01	0.00	0.05	0.04	0.05	-0.68
2	2868	3953	6821	0.00	-0.02	-0.01	0.00	0.05	0.04	0.07	-1.20
3	2849	3972	6821	0.00	-0.02	-0.01	0.00	0.05	0.04	0.07	-0.99
4	2847	3974	6821	0.00	-0.02	-0.01	0.00	0.05	0.04	0.07	-0.99
5	2848	3973	6821	0.00	-0.02	-0.01	0.00	0.05	0.04	0.07	-0.98

Note: Statistics reflect model area within Broward County only

lay......................layer
numup....................number of cells with increase in head elevation
numdw....................number of cells with decrease in head elevation
numtl....................total number of cells experiencing change in head
upmean...................average increase in head elevation
dwmean...................average decrease in head elevation
tlmean...................average change in head elevation
upstd....................standard deviation for upward changes in elevation
dwstd....................standard deviation for downward changes in elevation
tlstd....................standard deviation for changes in elevation
maxlev...................maximum increase in head elevation occurring
minlev...................maximum decrease in head elevation occurring

---

Volumetric Changes from Base Case

	IN	OUT
Storage	N/A	N/A
River Leakage	+1%	-4%
Head Dep Bounds	-17%	-30%
Drains	N/A	-2%
ET	N/A	-4%
Total	-7%	-7%

APPENDIX G

QUALITY ASSURANCE/QUALITY CONTROL PROCEDURE

QUALITY ASSURANCE/QUALITY CONTROL PROCEDURE

The South Florida Water Management District developed a quality assurance/quality control (QA/QC) procedure pertaining to ground water flow models as they progressed from the development stage to use by the Planning Department. The process involves a series of iterations between the model developer and the end user in the Planning Department as well as a peer review team selected for each model.

Each model is evaluated in terms of: a) acceptability and b) impacts of deficiencies on application of the model. Acceptability is divided into three categories: 1) meets all standards of completeness and accuracy, 2) meets main standards, however enhancements are necessary to improve the overall accuracy of the model, and 3) does not meet standards and the model is not ready for use. All parameters that did not meet standards were corrected as a first priority. Parameters needing enhancements were prioritized into those that should be upgraded before the models are used to minimize future problems and those items which can be continually enhanced even while the model is in use.

The QA/QC checklist is divided in two parts; a conceptualization section and a data sets section. The conceptualization section is a narrative discussion of the methodology and assumptions used in creating the data sets. It covers such topics as boundary conditions, time and space discretization, recharge and evapotranspiration calculations, water use data sources and assumptions, aquifer parameters, creation of parameters for rivers and drains, and calibration criteria. This discussion was intended to familiarize the user with all assumptions used in creating the model to make them aware of situations which may affect results. The data set checklist includes all data sets used in the model and verifies that there are no data anomalies. Data was checked both graphically and numerically. Three-dimensional plots of many arrays were created to point out errant data points. Contour plots were compared with data points used to create them to make sure they were accurate. The minimum and maximum value for each plot was determined and checked for reasonableness. River, drain and general head cell values were also printed spatially and checked for reasonableness and consistency between cells. All well locations were verified both in row,column and planar coordinate formats. Modeled pumpage was compared to permitted allocations for reasonableness. The volumetric budget was also checked to determine if anything was out of proportion.

Some data corrections were made and changes in recharge and evapotranspiration sections resulted in model modifications. Finally, agreement was reached and checklists from the peer review panel were approved with no unacceptable sections and several sections identified as acceptable under current conditions with future enhancements necessary.