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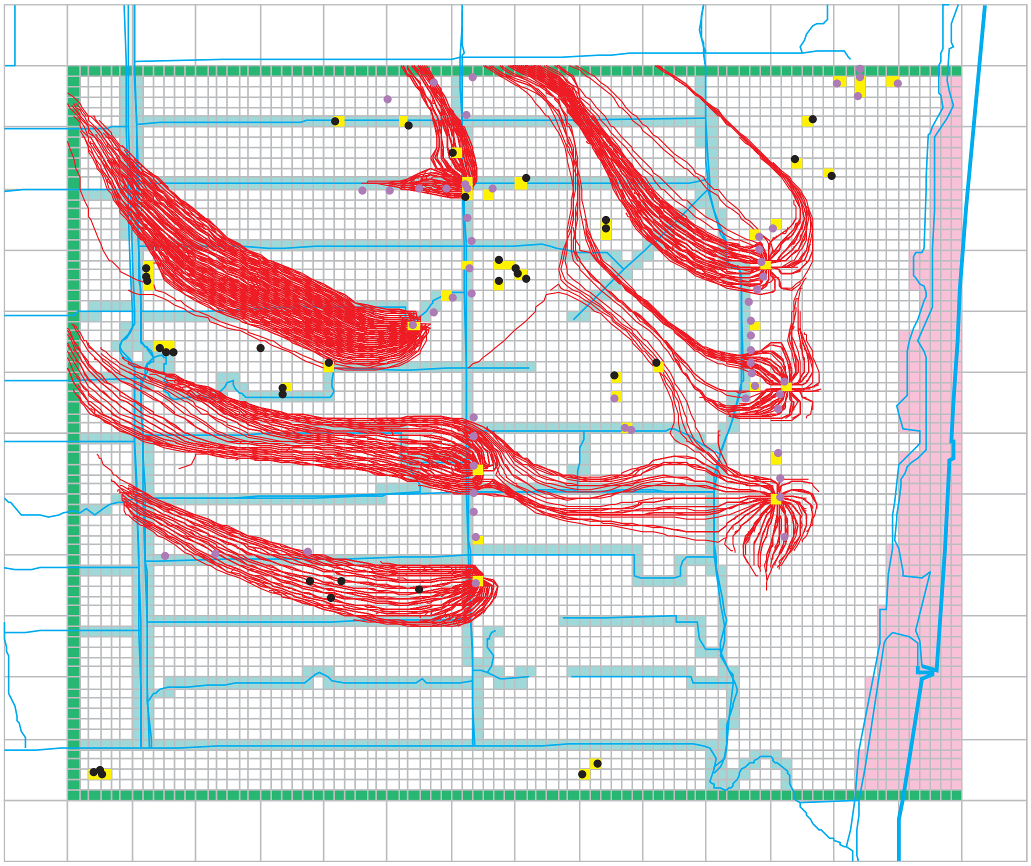
Water-Resources Investigations Report 01-4158



U.S. Geological Survey

Prepared in cooperation with the
Palm Beach County Department of Environmental Resources
and the
South Florida Water Management District

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Tallahassee, Florida
2001

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CONTENTS

FIGURES

TABLES

CONVERSION FACTORS, ACRONYMS, ABBREVIATIONS, AND VERTICAL DATUM

Multiply	By	To obtain
inch (in.)	25.4	millimeter
in/yr (inch per year)	25.4	millimeter per year
foot (ft)	0.3048	meter
foot per day (ft/d)	0.3048	meter per day
foot per year (ft/yr)	0.3048	meter per year
mile (mi)	1.609	kilometer
gallon per day (gal/d)	0.003785	cubic meter per day
Mgal/d (million gallons per day)	0.04381	cubic meter per second

ACRONYMS AND ABBREVIATIONS

GHB	General-Head Boundary package
GIS	geographic information system
GUI	graphical user interface
LRS	linear referencing system
LWDD	Lake Worth Drainage District
MODFLOW	ground-water flow model
MODTMR	MODFLOW Telescopic Mesh Refinement program
RMSE	root mean square error
SFWMD	South Florida Water Management District
TMR	telescopic mesh refinement
TMRDIFF	telescopic mesh refinement difference
UTM	universal transverse mercator
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
WHPA	wellhead protection area

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:

$$°C = (°F - 32)/1.8$$

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

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Abstract

Rapid urban development and population growth in Palm Beach County, Florida, have been accompanied with the need for additional freshwater withdrawals from the surficial aquifer system. To maintain water quality, County officials protect capture areas and determine zones of transport of municipal supply wells. A multistep process was used to help automate the delineation of wellhead protection areas.

A modular ground-water flow model (MODFLOW) Telescopic Mesh Refinement program (MODTMR) was used to construct an embedded flow model and combined with particle tracking to delineate zones of transport to supply wells; model output was coupled with a geographic information system. An embedded flow MODFLOW model was constructed using input and output file data from a preexisting three-dimensional, calibrated model of the surficial aquifer system. Three graphical user interfaces for use with the geographic information software, ArcView, were developed to enhance the telescopic mesh refinement process. These interfaces include AvMODTMR for use with MODTMR; AvHDRD to build MODFLOW river and drain input files from dynamically segmented linear (canals) data sets; and AvWELL Refiner, an interface designed to examine and convert well coverage spatial data layers to a MODFLOW Well package input file. MODPATH (the U.S. Geological Survey particle-tracking postprocessing program) and MODTOOLS (the set of U.S. Geological Survey computer programs to translate MODFLOW and MODPATH output to a geographic information system) were used to map zones of transport.

A steady-state, five-layer model of the Boca Raton area was created using the telescopic mesh refinement process and calibrated to average conditions during January 1989 to June 1990. A sensitivity analysis of various model parameters indicates that the model is most sensitive to changes in recharge rates, hydraulic conductivity for layer 1, and leakance for layers 3 and 4 (Biscayne aquifer).

Recharge (58 percent); river (canal) leakance (29 percent); and inflow through the northern, western, and southern prescribed flux model boundaries (10 percent) represent the major inflow components. Principal outflow components in the Boca Raton well field area include well discharge (56 percent), river (canal) leakance (27 percent), and water that discharges along the coast (10 percent).

A particle-tracking analysis using MODPATH was conducted to better understand well-field ground-water flow patterns and time of travel. MODTOOLS was used to construct zones-of-transport spatial data for municipal supply wells. Porosity estimates were uniformly increased to study the effect of porosity on zones of transport. Where porosity was increased, the size of the zones of transport were shown to decrease.

INTRODUCTION

The principal source of public-water supply in Palm Beach County, Fla. (fig. 1), is the surficial aquifer system. Rapid urban development and population growth in the county have increased demand for freshwater withdrawals and resulted in the installation of additional supply wells. Potable water demand for urban users is projected to increase 115 percent in Palm Beach County between 1990 and 2010 (South Florida Water Management District, 1998).

The surficial aquifer system, which consists of highly permeable limestone and sand, is highly susceptible to contamination in the urbanized areas of Palm Beach County. To address this concern, water managers delineate wellhead protection areas (WHPA's) to help protect ground-water supplies from contamination. The U.S. Environmental Protection Agency (USEPA) established the Wellhead Protection Program, under 1986 amendments to the Safe Drinking Water Act of 1974. A WHPA is defined as the surface and subsurface area surrounding a well, wellfield, or spring through which contaminants may pass and reach the ground water contributing to the supply source. Criteria and methods for WHPA delineation have been described in USEPA guidance documents (U.S. Environmental Protection Agency, 1987). A numerical ground-water flow model in combination with a particle-tracking postprocessing package is one quantitative methodology used to determine the areas contributing recharge to individual wells or well fields. The tracking of water particles backward from areas of withdrawal to areas of recharge within the model domain is a method often used to define a WHPA.

The countywide model used by the Palm Beach County Department of Environmental Resources to determine a WHPA in Palm Beach County is a two-dimensional MODFLOW model (Dames and Moore, 1986). The model was calibrated to 1984 baseline conditions, but model verification was not conducted. A proprietary telescoping computer code has been used to construct small-area local models. Water particle transport is simulated using a random walk Monte Carlo technique (Prickett and others, 1981) for mass-transport computations and to generate time-of-travel contours.

The two-dimensional MODFLOW model described above has a number of limitations. The countywide model consists of only one layer and does not account for vertical variability in the surficial aquifer system. Simplification of internal boundaries within a single-layer model can greatly affect model results. Flux into or from a river boundary cell may be improperly quantified in a single-layer model. Well withdrawals in a single layer model are assumed to have occurred over the entire thickness of the aquifer, rather than be properly assigned to a specific flow horizon. A telescoping computer code developed for this model to construct small-area models can use only prescribed-head boundary conditions. As the current water-supply utilities expand, small area well-field protection models will need to account for possible changes in boundary conditions and multiple well fields with overlapping areas of influence. A digital tool, such as a geographic information system (GIS) to transfer georeferenced particle pathlines, zones of transport, or areas contributing recharge is lacking, and WHPA's that have been delineated are subject to public scrutiny.

To address these needs, the U.S. Geological Survey (USGS), in cooperation with the Palm Beach County Department of Environmental Resources and the South Florida Water Management District (SFWMD), initiated a study to develop a process using a GIS in which telescopic mesh refinement (TMR) can be used to construct local, embedded flow models.

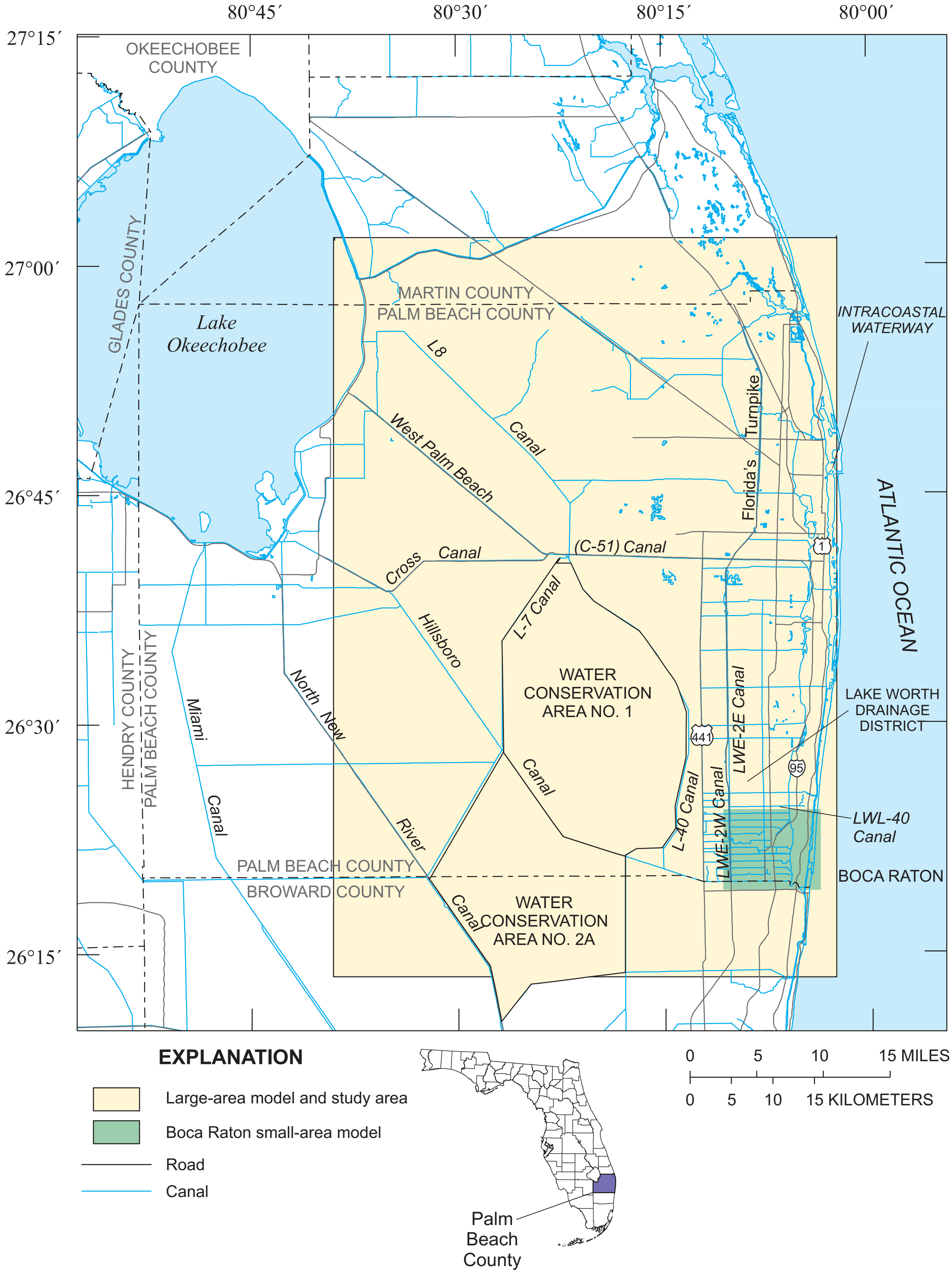

Figure 1. Location of study area in Palm Beach County, Florida.

The local models would be subsequently used to delineate a WHPA associated with supply wells. An existing multilayer SFWMD model (Yan and others, 1995) is used to illustrate the TMR process.

Purpose and Scope

The purposes of this report are to: (1) demonstrate an approach in which TMR can be used to construct an embedded flow model, (2) delineate zones of transport to public-supply wells, and (3) display examples of this approach. This study required the integrated use of MODTMR (an ArcView graphical user interface (GUI) extension for MODTMR) and ArcView GUI extensions to rediscretize canal and well spatial data sets. This report illustrates the coupled use of MODFLOW ground-water flow and MODPATH particle-tracking models. The MODTOOLS program (Orzol, 1997) is used to create digital spatial data layers of flow paths and to delineate zones of transport.

Previous Studies

Several reports provide useful background information on the hydrogeology of Palm Beach County, including those by Parker and others (1955), Land and others (1973), Land (1975; 1977), Rodis and Land (1976), Scott (1977), Scott and others (1977), Klein and Hull (1978), Fischer (1980), Swayze and Miller (1984), Miller (1985a,b; 1987; 1988), Fish (1988), and Russell and Wexler (1993). Dames and Moore (1986) documented the one-layer, countywide model developed for use in wellhead protection in Palm Beach County. The SFWMD published two reports (Shine and others, 1989; Yan and others, 1995) that document multilayer MODFLOW ground-water flow models for Palm Beach County.

Reports that discuss TMR include those by Townley and Wilson (1980), Buxton and Reilly (1986), Miller and Voss (1987), Ward and others (1987), Garza and West (1995), and Merritt (1996). Leake and Claar (1999) recently helped to automate the TMR process with development of MODTMR, RIVGRID, and TMRDIFF.

An increasing number of reports document the process of using flow models and particle tracking to determine the source of water entering an aquifer, identify recharge areas, and delineate capture zones or define zones of transport for municipal supply wells. Published reports include those by Morrissey (1989), Barlow (1989; 1995), Hutchinson (1990), Bair and Roadcap (1992), Bailey (1993), Zarriello (1993), Reilly and Pollock (1993), Sonenshein (1995), Merritt (1996), and Snyder and others (1998). Sonenshein (1995) combined particle tracking and spatial tools to identify land uses overlying flow paths that extend to wells in a ground-water quality monitoring network. Snyder and others (1998) and Orzol and Truini (1999) successfully integrated a GIS with flow modeling and particle-tracking efforts to delineate zones of transport.

DESCRIPTION OF STUDY AREA

The study area includes the eastern two-thirds of Palm Beach County, Fla., and small parts of the Atlantic Ocean to the east, Martin County to the north, and Broward County to the south (fig. 1). Water Conservation Area 2A forms the southwestern corner of the study area. Much of eastern Palm Beach County consists of residential housing, commercial, light industry, and recreational areas such as parks and golf courses. Agricultural water use is generally restricted to the western and northwestern parts of the county.

Boca Raton is located in southeastern Palm Beach County, and ground water is the sole potable water-supply source for the city. In 1990, the City of Boca Raton provided water to more than 61,450 permanent residents, and at least 23,000 additional seasonal residents (Camp, Dresser, and McKee, Inc., 2000). In 1990, the average daily per capita demand for treated water was estimated to be 327 gal/d.

Withdrawals from the Boca Raton well field area are designed to meet municipal, commercial, and recreational needs. Boca Raton obtains its water from 6 well fields including 56 operational supply wells (fig. 2) that have a total design capacity of 93.7 Mgal/d. The number of wells within the Boca Raton well fields (fig. 2) has increased considerably over time. Currently, 13 wells are not used, owing to concern about coastal saltwater intrusion or other types of contamination. Coastal wells are not pumped at maximum rates largely to minimize saltwater intrusion.

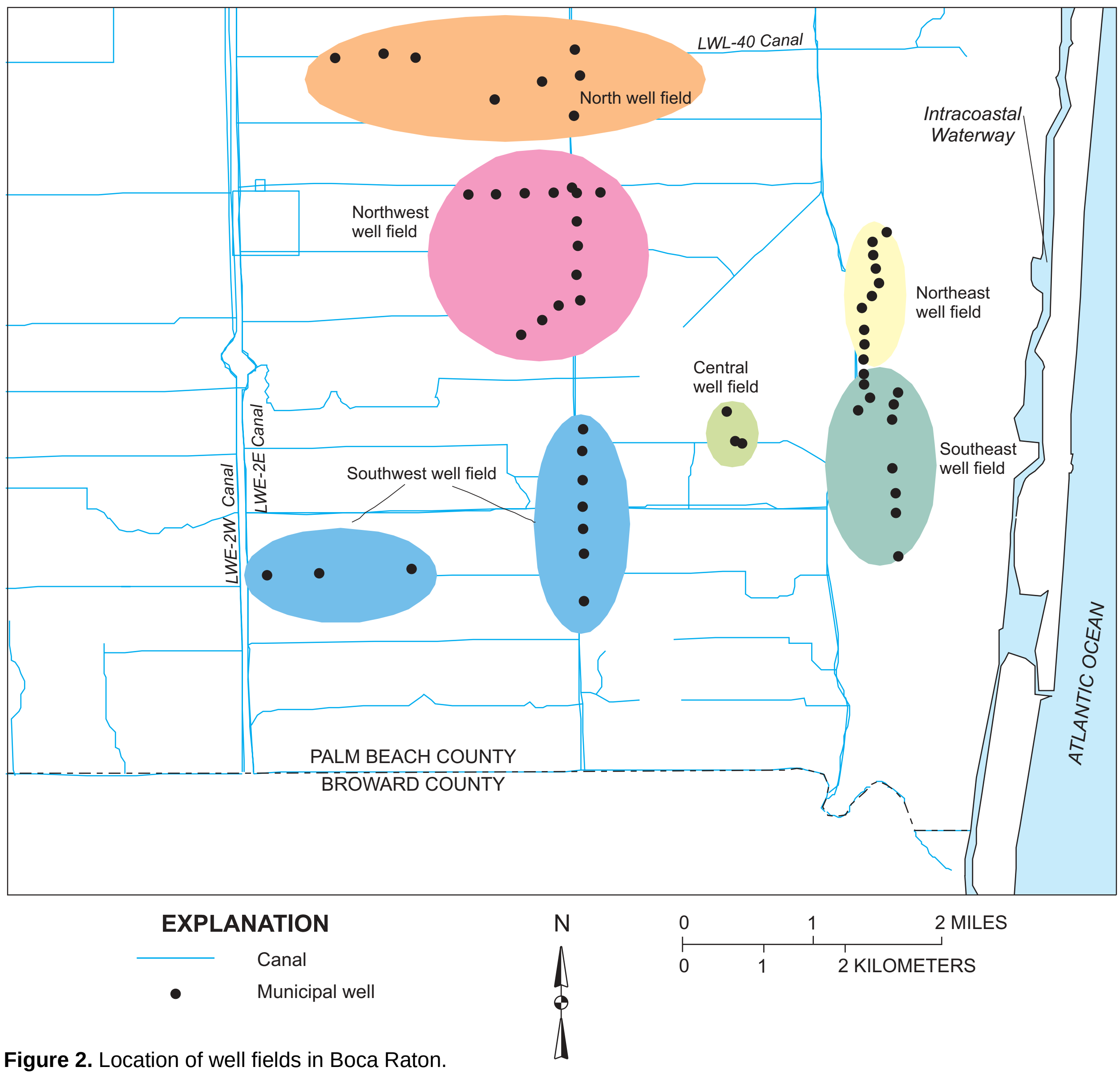

Figure 2. Location of well fields in Boca Raton.

Hydrogeology and Ground-Water Flow

Palm Beach County is underlain by two major aquifer systems: the shallow, unconfined sequence known as the surficial aquifer system and the lower, confined Floridan aquifer system. The systems are separated by the intermediate confining unit composed of silt, green clay, limestone, and fine sand. The surficial aquifer system comprises a coastward-thickening wedge of unconsolidated to poorly consolidated clastic and carbonate sediments that extend from land surface to the top of the underlying intermediate confining unit. West of Florida's Turnpike, the surficial aquifer system ranges from 150 to 200 ft thick; it is as much as 400 ft thick in southeastern Palm Beach County. Sediments comprising the surficial aquifer system are Pliocene to Pleistocene in age and consist of fossiliferous limestone of the Tamiami Formation; sand, marl and interbedded sand of the Caloosahatchee Formation; interbedded sand, shell, and limestone of the Fort Thompson Formation; sandy limestone and marl of the Anastasia Formation; and fine to medium quartz sand of the Pamlico Sand (fig. 3).

Series	Geologic unit	Hydrogeologic units		Lithology
Pleistocene	Pamlico Sand		Surficial aquifer system	Fine to medium quartz sand
	Anastasia Formation	Biscayne Aquifer		Sandy limestone and marl, coquina, and sand
	Fort Thompson Formation			Interbedded sand, shell, and limestone
	Caloosahatchee Formation			Sand, marl and interbedded sand
Pliocene	Tamiami Formation			Marl, fossiliferous limestone
Miocene	Hawthorn Group	Intermediate confining unit		Sandy silt to sand, dense, green clay, quartz sand, with beds of limestone, sandy shell or dolomite. Phosphate common
Late Oligocene				

Figure 3. Stratigraphic units included in the surficial aquifer system and the Biscayne aquifer (modified from Shine and others, 1989).

In Palm Beach County, the surficial aquifer system is divided into two hydrogeologic units: a moderate to highly transmissive “production zone” and a less transmissive “nonproduction zone” (Shine and others, 1989). In the southern part of the county, the production zone consists largely of the Biscayne aquifer, but includes moderately transmissive limestone that directly overlie and underlie it. The Biscayne aquifer is absent in the central and northern parts of the county and the non-Biscayne production zone comprises moderately transmissive limestone. The nonproduction zone includes low to moderately permeable sand and marl of the Pamlico Sand, Anastasia Formation, and the Caloosahatchee Formation.

The Biscayne aquifer (Parker, 1951; Parker and others, 1955) is the most productive source of ground water in Palm Beach County (fig. 3) and has been designated as a sole source aquifer (Federal Register Notice, 1979). In southern Palm Beach County, the Biscayne aquifer has been described alternatively as the cavity-riddled zone (Land, 1977), cavity zone (Fischer, 1980), and zone of secondary permeability (Swayze and Miller, 1984); this zone is characterized as a cavernous unit of greater permeability due to the dissolution of calcareous cement that bonds quartz sand, coquina, and sandy limestone. Hydraulic conductivity of the Biscayne aquifer in Palm Beach County is reported to be as much as 4,000 ft/d (Shine and others, 1989). Some of the highest hydraulic conductivities of the Biscayne aquifer in Palm Beach County are found in the Boca Raton area. Limestone and sand directly overlie or underlie the Biscayne aquifer in much of the area forming a zone of moderate transmissivity. Hydraulic conductivity of the non-Biscayne production zone averages 150 ft/d in the northern and central parts of the county. The hydraulic conductivity of the nonproduction zone is estimated to average 50 ft/d.

The surficial aquifer system is underlain by the intermediate confining unit that includes the phosphatic Hawthorn Group of Miocene and late Oligocene age (fig. 3) and is reported to range from 500 to 700 ft thick (Shine and others, 1989). The intermediate confining unit comprises sandy silt and includes dense, green clay with beds of limestone, shells and sand, and dolomite. A basal zone of permeable limestone contained within the Arcadia Formation (not shown) may be present.

The underlying Floridan aquifer system (not shown) forms a thick sequence of limestone and dolomite; however, this system does not contain potable water in the study area in Palm Beach County. The Floridan aquifer system in Palm Beach County is confined by the overlying Hawthorn Group, suggesting there is limited hydraulic interaction with the overlying surficial aquifer system.

The occurrence of ground water in the surficial aquifer system is under semiconfined or unconfined conditions. Regional flow patterns in Palm Beach County are mostly toward the Atlantic Ocean, major canals (Hillsboro and West Palm Beach Canals), and Water Conservation Area No. 1 (fig. 1). Ground water flows outward from a large circular high in the northern half of the county (fig. 4). In the southern half of the county, ground water flows outward from a north-trending linear high that parallels the LWE-2W/2E canals and Florida's Turnpike (figs. 1 and 4. Seasonal change in canal stage and recharge cause the water to fluctuate between 1 and 4 ft/yr. However, regulation of canal levels for agricultural and flood-control purposes masks changes in seasonal ground-water levels (Miller, 1988).

Surface-Water Conveyance System

Hydraulic interconnection between the aquifer and the canal system greatly influences ground-water flow in Palm Beach County. The Hillsboro Canal and West Palm Beach (C-51) Canals form part of a larger, more regional conveyance system that drains water from Lake Okeechobee, wetland areas, and the surficial aquifer system to the Atlantic Ocean (fig. 1). A perimeter levee and seepage canal, L-40 Canal, borders Water Conservation Area No. 1 in southern Palm Beach County. Water levels in this water-conservation area are regulated between 14 and 17 ft above sea level to provide storage for rainfall and to accommodate a wet- and dry-season regime. An extensive series of secondary and lateral canals form a widespread surface-water conveyance system that substantially affects ground-water levels in the surficial aquifer system through recharge and drainage.

Shine and others (1989) separate surface-water systems into three types; namely maintained systems, weir and control structure systems, and water catchment and retention systems. Maintained systems are characterized by canal networks that have specified water levels and can recharge or drain an aquifer depending on the head gradient. Weir and control structure systems induce drainage of the aquifer where ground-water levels are above weir elevations and are more widespread in the northern half of the county. Drainage of the aquifer occurs in those areas where ground-water levels are above weir elevations. Water catchment and retention systems mostly function as recharge systems that hold excess water and recharge the aquifer when stage levels exceed ground-water levels.

The Lake Worth Drainage District (LWDD) encompasses much of southern Palm Beach County and the entire area that was included as part of the Boca Raton small-area model (fig. 1). The LWDD is a maintained canal system in which stage is maintained at specified levels; the canal stage varies from sea level near the coast to 15.5 ft in north-trending lateral canals that parallel Florida's Turnpike.

BACKGROUND

Five criteria have been described by the U.S. Environmental Protection Agency (1987) that are used separately or collectively to define a WHPA. These criteria include distance, drawdown, time of travel, flow boundaries, and assimilative capacity. Distance criterion is used to place a protection zone that is an arbitrary fixed radius from the withdrawal well. A zone of influence (fig. 5) is the distance from a well in which a cone of depression and drawdown can be measured. Ground-water divides or other physical boundaries of an aquifer are used to define a zone of contribution; a zone of contribution is a three-dimensional volume within an aquifer that contributes ground water to a pumping well. Time of travel is the time needed for a water particle to travel along a flow path to the well. A zone of transport, is defined by the volume within an aquifer that contributes water to a discharge feature for a specific time of travel. A zone of transport can be projected to land surface in a map view and defined by the two-dimensional area bounded by lines connecting points of equal time of travel. Zones of transport for several intervals of time may comprise a zone of contribution. Assimilate capacity criterion can be used to reduce the size of a WHPA if contaminants are attenuated during movement through the vadose zone of an aquifer due to absorption, dilution, dispersion, precipitation, or degradation.

As a result of physical framework and flow system complexities, wellhead protection strategies described above may not adequately define the area contributing recharge to a supply well. Barlow (1989; 1995) employed the concept of "contributing area" to

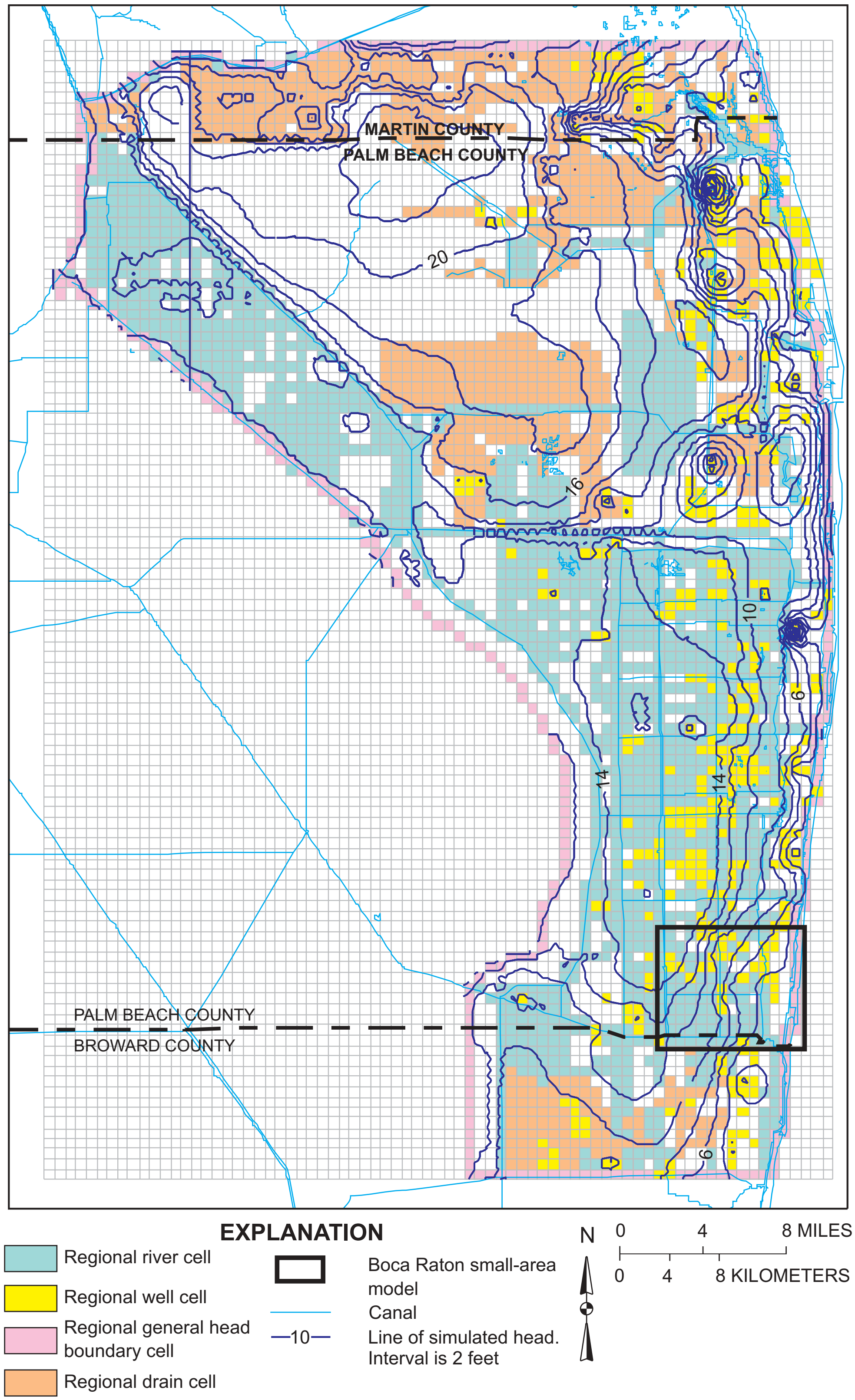

Figure 4. Palm Beach County regional model grid showing model domain, boundary conditions in layer 1, and simulated head for average steady-state conditions during January 1989 to June 1990 (modified from Yan and others, 1995).

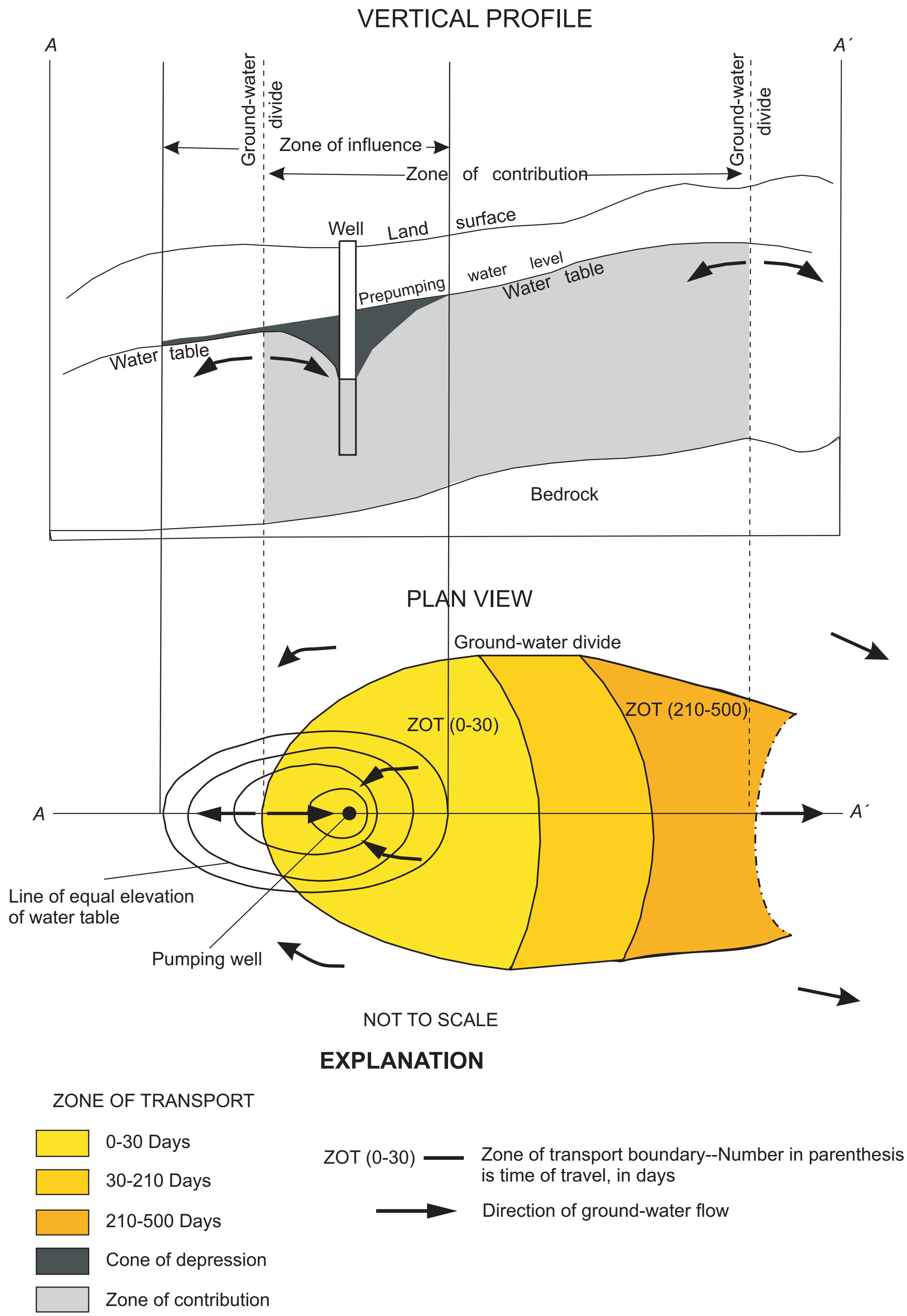

Figure 5. Zones of contribution, influence, and transport under sloping water-table conditions (modified from U.S. Environmental Protection Agency, 1987).

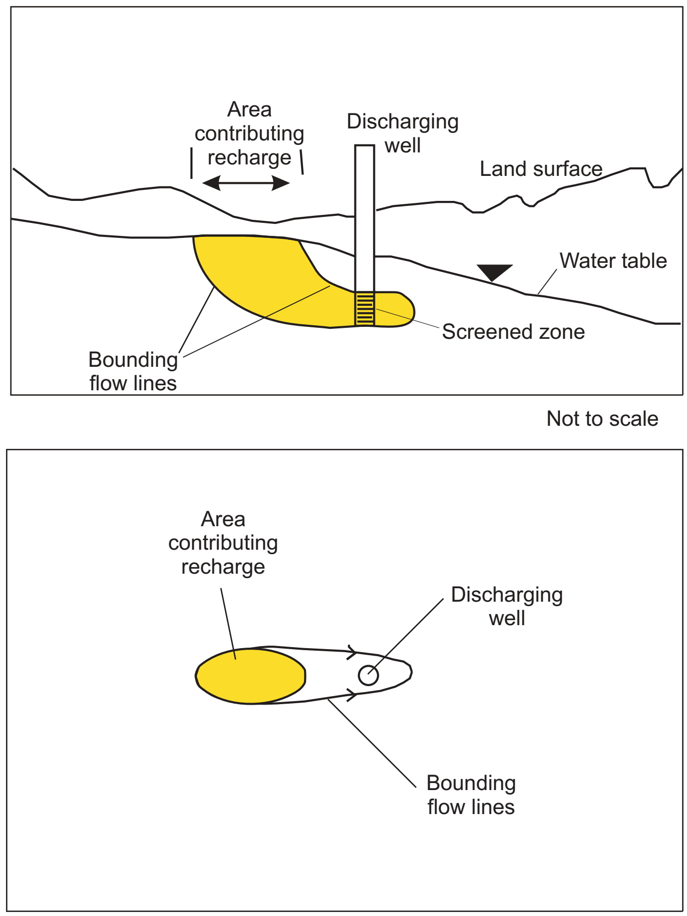

Figure 6. Area contributing recharge to a single discharging well in a simplified hypothetical ground-water system. Upper diagram is cross-sectional view, and lower diagram is map view (modified from Reilly and Pollock, 1993).

avoid use of the regulatory wellhead protection terminology and problems that can be associated with analytical, empirical, and numerical methods used to determine recharge areas. A contributing area can be defined as the land-surface area that delineates the location of water entering the ground-water system at the water table that eventually flows to the well and discharges (Reilly and Pollock, 1993) (fig. 6).

Different methods can be applied to define local hydrologic conditions in a small-area model. With TMR (Ward and others, 1987), a large-area model is used to define perimeter boundary conditions and to provide model parameters for the small-area model. This approach is used in studies that require a detailed model for a geographically small area (when compared to the extent of the entire aquifer system), such as in the vicinity of a well field or contaminant plume. An important advantage to such an approach is that the boundaries for the small-area model do not have to coincide with physical boundaries of the aquifer because the effects of the regional aquifer are represented in the boundary conditions of the small-area model. Another advantage to TMR is scale-dependent problems can be resolved with an appropriate scale model. For example, the curvature of the potentiometric surface can be more accurately simulated if the grid spacing is more finely discretized. Reports that document the TMR approach include Miller and Voss (1987), Ward and others (1987), Buxton and Reilly (1986), and Merritt (1996).

A second approach to simulate local hydrologic conditions is to modify the regional model to a smaller grid size in the vicinity of the well field or in the vicinity of river or drain nodes. One important advantage of this “modified-grid” approach, in which the large-area model domain is used, is that it allows simulation of an area bounded by the physical limits of the aquifer. Additionally, this approach requires that only the original model be modified and recalibrated without construction of a new model. A major drawback to a modified finite-difference grid is the creation of model cells of finer discretization outside the area of interest. A grid with fewer nodes is preferred to minimize data manipulation and the amount of computer computation time.

A third approach, rarely used, is to construct a large-area model domain with comparatively small grid spacing. Although only one model has to be calibrated, powerful computers may be required to reduce computation time. Additionally, calibration difficulties and convergence problems may arise because some solvers are not designed to handle very large matrices. The Palm Beach County study area is traversed by an extensive surface-water conveyance and drainage system; therefore, refinement of a countywide model grid that accurately depicts all details of the canal system in a single model was not considered practical.

The advantages and disadvantages of the three methods were weighed. As such, the TMR process of creating a small-area model was chosen for purposes of this study.

Review of Existing Ground-Water Flow Models

Several large-area MODFLOW models have been developed to simulate ground-water flow in Palm Beach County. A two-dimensional MODFLOW model that is currently being used by the Palm Beach County Department of Environmental Resources was developed by Dames and Moore (1986). Three-dimensional, large-area flow models have been prepared by the SFWMD (Shine and others, 1989; Yan and others, 1995).

The MODFLOW model developed by Dames and Moore (1986) is designed for wellhead protection purposes. The thickness of the surficial aquifer system is treated as single unconfined model layer. Encompassing the entire county, the model was calibrated to average 1984 steady-state conditions. Model verification was not performed. The Palm Beach County Department of Environmental Resources used this model in combination with a random-walk technique to compute mass transport and particle time of travel.

Separate three-dimensional MODFLOW models were constructed to simulate flow in northern and southern parts of Palm Beach County for purposes of resource assessment and water management (Shine and others, 1989). Multilayering (six layers) allowed for variations in permeability within the aquifer and partial penetration of wells and canals. A steady-state calibration was conducted using average water levels between October 1983 and May 1985, and a transient verification was performed using monthly time steps during the same period.

The large-area MODFLOW model constructed by Yan and others (1995) encompasses much of Palm Beach County, northernmost Broward County, and southernmost Martin County and was designed to aid water-supply planning. This MODFLOW model was selected to illustrate the TMR process and is referred herein, as the SFWMD model.

Large-Area Flow Model for Palm Beach County

The SFWMD model grid consists of 41,250 uniform grid cells, of which 55 percent are active cells. Each of the five-grid layers consists of 110 rows and 75 columns (fig. 4). The SFWMD model uses five model layers to represent different parts of the surficial aquifer system (fig. 7). Layer 1 generally extends to a depth of 20 ft below sea level and is considered to represent soil and low-permeability sediments that form the uppermost part of the surficial aquifer system. Layer 2 consists of rock that lies between the base of layer 1 and the upper surface of a highly transmissive water-bearing zone that includes the Biscayne aquifer in southern Palm Beach County. Layers 3 and 4 represent the Biscayne aquifer and northern lateral equivalents. The boundaries of these two layers were selected on the basis of highly permeable limestone found in cores or where hydraulic conductivity was reported to

Geologic unit	Hydrogeologic unit		Regional model layer	Boca Raton well field model
Undifferentiated sand of Pleistocene age (Pamilco Sand)	Surficial aquifer system	Unnamed	Layer 1	Layer 1
			Layer 2	Layer 2
Fort Thompson Formation Anastasia Formation		Biscayne aquifer	Layer 3	Layer 3
			Layer 4	Layer 4
Tamiami Formation Caloosahatchee Formation		Unnamed	Layer 5	Layer 5
Hawthorn Group	Confining unit		Not modeled	Not modeled

Figure 7. Relation between geologic and hydrogeologic units and the Palm Beach County regional and Boca Raton well field model layers.

be 1,600 ft/d or greater. Model layer 5 extends from the base of the highly transmissive zone to the base of the surficial aquifer system and represents less-permeable sand, silt, and shell material.

Recharge is treated in the SFMWD model as a prescribed-flux boundary, computing it as the amount of precipitation *minus* water lost to runoff, and evapotranspiration losses at the land surface. The bottom of the model was treated as a prescribed-flux (no-flow) boundary. Head-dependent flux and prescribed-head boundaries were selected along the perimeter boundaries using the MODFLOW General-Head Boundary (GHB) package. Along the eastern model Intracoastal/Atlantic Ocean boundary (layers 1 and 2), a general-head boundary with a high conductance was used with a mean monthly sea level equivalent to the head of the nearshore tidal body. This effectively allowed the general-head boundary to function as a prescribed-head boundary. Lower conductance values were used in successively lower layers (3 to 5) along the Intracoastal Waterway/Atlantic Ocean boundary. A similar structure for the general-head boundary condition was used to represent Water Conservation Area No. 1 and L-8 Canal on the western model perimeter (fig. 1). High conductance values were used in layer 1 so that the boundary functioned as a prescribed head, and lower conductance values were used in lower model layers. Layers 2 to 5 function more as general head cells, and flux movement across the boundary is based more on conductance and head gradient. General-head boundaries also were applied along the northern and southern boundaries in Martin and Broward Counties. These boundaries were constructed, in part, using hydrologic and hydraulic conditions from calibrated models of Martin (Adams, 1992) and Broward Counties (Restrepo and others, 1992). The northern and southern edges of the model was placed away from the county line to reduce the boundary effects on hydrologic stress.

Hydraulic head was the only type of observation used for model calibration. Although the SFMWD model documentation reveals simulated head failed to meet calibration standards in about one third of the observation wells, no effort was made as part of this study to improve the existing regional calibration (an activity considered beyond the scope of this study).

Numerical modeling requires simplification of the hydrogeologic system, some of which may limit its applicability. Unfortunately, simplifying assumptions of the large-area Palm Beach County model are not explicitly described in the SFMWD model documentation. A 1:10 ratio of leakance to horizontal conductivity was assumed. Although a thorough evaluation was not conducted, Yan and others (1995) assumed insensitivity to changes in specific yield and storage coefficient. This assumption parallels sensitivity results of Broward County (Restrepo and others, 1992) and Martin County (Adams, 1992) ground-water flow models.

Simulation of Ground-Water Flow (MODFLOW) and Particle Tracking (MODPATH)

Simulation of ground-water flow in the Palm Beach County and Boca Raton well field area was performed using the MODFLOW model. MODFLOW is the USGS computer program for simulating hydrologic processes and features in ground-water systems (McDonald and Harbaugh, 1988; Harbaugh and McDonald, 1996). MODFLOW solves the partial differential equation for ground-water flow by using a finite-difference algorithm. The SFWMD Palm Beach County model was converted to the MODFLOW96 format to allow construction of a small-area model using USGS TMR software.

Particle tracking is a method used in conjunction with numerical simulation of ground-water flow to delineate flow paths and evaluate advective contaminant transport. Particle tracking can be used also to determine recharge and discharge areas, identify errors in the conceptual model, evaluate the effect of internal and external boundary conditions, and calculate time of travel (Anderson and Woessner, 1992). The transport process of dissolved contaminants, in many cases, is dominated by ground-water advection. Particle tracking does provide an estimate of the contaminant migration--a fundamental concern in wellhead protection. However, particle tracking does not consider the chemical effects of contaminant absorption, degradation, or decay. Particle tracking does not account for dispersion which could increase the areal extent of a contaminant plume.

MODPATH (Pollock, 1989; 1994), a USGS particle-tracking postprocessing program designed for use with MODFLOW, uses a semianalytical particle-tracking scheme to describe flow paths of water particles within a grid cell. MODPATH calculates three-dimensional pathlines, and particles of water as time-of-travel information are tracked individually through the flow system. Particle paths are computed in MODPATH by tracking particles from one cell to the next until the particle reaches a boundary, an internal sink/source, or satisfies some other termination criterion. MODPATH requires two areal input parameters not used in MODFLOW96 (Harbaugh and McDonald, 1996): bottom elevation of a model layer and porosity.

Telescopic Mesh Refinement Programs for MODFLOW

Three software programs have been developed for use in TMR using the USGS MODFLOW model: MODTMR, TMRDIFF, and RIVGRID (Leake and Claar, 1999). MODTMR (<u>MOD</u>FLOW <u>T</u>elescopic <u>M</u>esh <u>R</u>efinement) is a software program designed to construct small-area model input files using MODFLOW96 input and output data sets from a large-area model. A separate program, RIVGRID (Leake and Claar, 1999), was developed to construct MODFLOW96 input data sets for linear hydrologic features contained in both regional and local models. RIVGRID uses grid-independent line segment data to define the location of continuous, narrow surface-water features such as rivers, streams, drains, or general-head boundaries, which may be represented by the River, Stream, Drain, and GHB packages for MODFLOW. TMRDIFF (<u>T</u>elescopic <u>M</u>esh <u>R</u>efinement <u>DIFF</u>erence) can be used to compare computed head or drawdown in the small-area model with simulated head or drawdown in the large-area model.

MODTMR uses regridding, rediscretization, and interpolation processes to assign parameters to the small-area model. The program is designed also to extract perimeter boundary conditions using simulated head and cell-by-cell flux data. MODTMR constructs perimeter boundary conditions using the FHB1 package (Leake and Lilly, 1997), a MODFLOW package that allows a user to specify flux or head boundaries using flow and/or head information obtained from the-large area model. MODTMR will construct small-area model data sets for River, Drain, GHB, and Well package input files which represent linear or point features. The data sets, however, may not be properly placed within specific small-area model layer cells; instead, they are placed in small-area model cells that intersect the regional cell and contain the boundary condition (Leake and Claar, 1999). It is important to recognize that external and internal boundaries represented by these MODFLOW packages can be inappropriately distributed if MODTMR is used strictly, and consideration is not given to the validity of the assigned boundary location (Leake and Claar, 1999, p. 26-27).

The computer program ZONEBUDGET (Harbaugh, 1990) was used as part of the TMR process to compare SFMWD and Boca Raton well field water-budget components. ZONEBUDGET calculates subarea water budgets using MODFLOW cell-by-cell flow data. Leake and Claar (1999, p. 5) indicate that consistency should be maintained between corresponding large- and small-area water-budget components. Modification of small-area model parameters and internal boundaries should be incorporated into the large-area model, with the regional model resimulated and recalibrated. The upscaling transfer of modified local model parameters and sources and sinks into the large-area model was considered to be beyond the scope of this study.

Postprocessing (MODTOOLS)

MODTOOLS (Orzol, 1997) is a series of computer programs that translate MODFLOW and MODPATH data into GIS output files suited to illustrate complex hydrologic conditions. MODTOOLS uses input or output data from a MODFLOW or MODPATH simulation to construct several types of GIS output files. MODFLOW GIS output generated by MODTOOLS includes velocity vectors, contours of input and output data arrays, and cell value data. MODPATH GIS files created by MODTOOLS include particle pathlines, particle endpoints, particle time series, zones of transport, and model grids. For purposes of this study, MODTOOLS was used to create GIS spatial data that included contours of simulated head, pathlines, and zones of transport.

ENDPOINT and TIMESERS MODPATH analyses are required to use the MODTOOLS zone of transport option. MODTOOLS constructs zones of transport for discharge features (wells) by projecting these volumetric zones on a two-dimensional surface (plan or cross-sectional view). Particle positions used in the zone of transport output may lie well below the water table. Accordingly, a plan view of a zone-of-transport polygon does not necessarily represent a recharge or source area (Orzol, 1997, p.10). A MODTOOLS limitation in the zone-of-transport option is that the method used to construct spatial data layers may produce triangular inflections in zone boundaries.

DEVELOPMENT OF GRAPHICAL USER INTERFACES FOR CREATING EMBEDDED MODELS

Three GUI’s for ArcView were developed to enhance the TMR process. They include AvMODTMR for use with MODTMR; AvHDRD to build MODFLOW River and Drain input files from dynamically segmented linear (canals) data sets; and AvWELL Refiner, an interface designed to examine and convert well coverage spatial data layers to a MODFLOW Well package input file (app. I). ArcView, rather than ARCINFO (Version 7.X), was used to link MODTMR with GIS due its more graphical nature and programming ease. AVENUE is the programming language used to customize the ArcView GUI and is an object-oriented programming language.

Graphical User Interface for MODTMR

The user-friendly ArcView extension, AvMODTMR. was developed as a graphical user interface to MODTMR. The AvMODTMR (app. II) application enhances use of MODTMR by offering dialog boxes and graphical tools which are designed to create the input file for MODTMR. The most cumbersome part of creating the MODTMR input file is spatially relating the local grid to the regional grid and specifying the boundary conditions for the MODFLOW96 FHB1 package. The AvMODTMR interface facilitates this process by capitalizing on GIS georeferencing capabilities. The regional grid is placed in its spatial domain in a convenient map projection such as a Universal Transverse Mercator (UTM) or State Plane Coordinate System. The local grid is defined by use of a dialog box to specify coordinates and model dimensions or by drawing it on the map canvas (or view) and using the graphical tools. AvMODTMR contains capabilities for layer discretization and selection of boundary conditions. The user can select a single layer, a subset, or all regional model layers for inclusion in the small-area model.

The AvMODTMR GUI is an ArcView “plug-in” and is accessed by loading it through the “File” menu, “Extensions” item. Once the AvMODTMR launch  button is invoked, the main dialog box opens (fig. 8), requiring the user to browse to the large-area model MODFLOW96 NAME file. Large-area model input and output data sets must be located on disk space identified by the NAME file which are subsequently read and posted to the “Regional Model” area of the dialog box. The user directs their attention to the “Local Model” area of the dialog box where information pertaining to the small-area model must be prescribed. A root filename for local simulation is entered, options are selected, and the plan view, local model domain is defined.

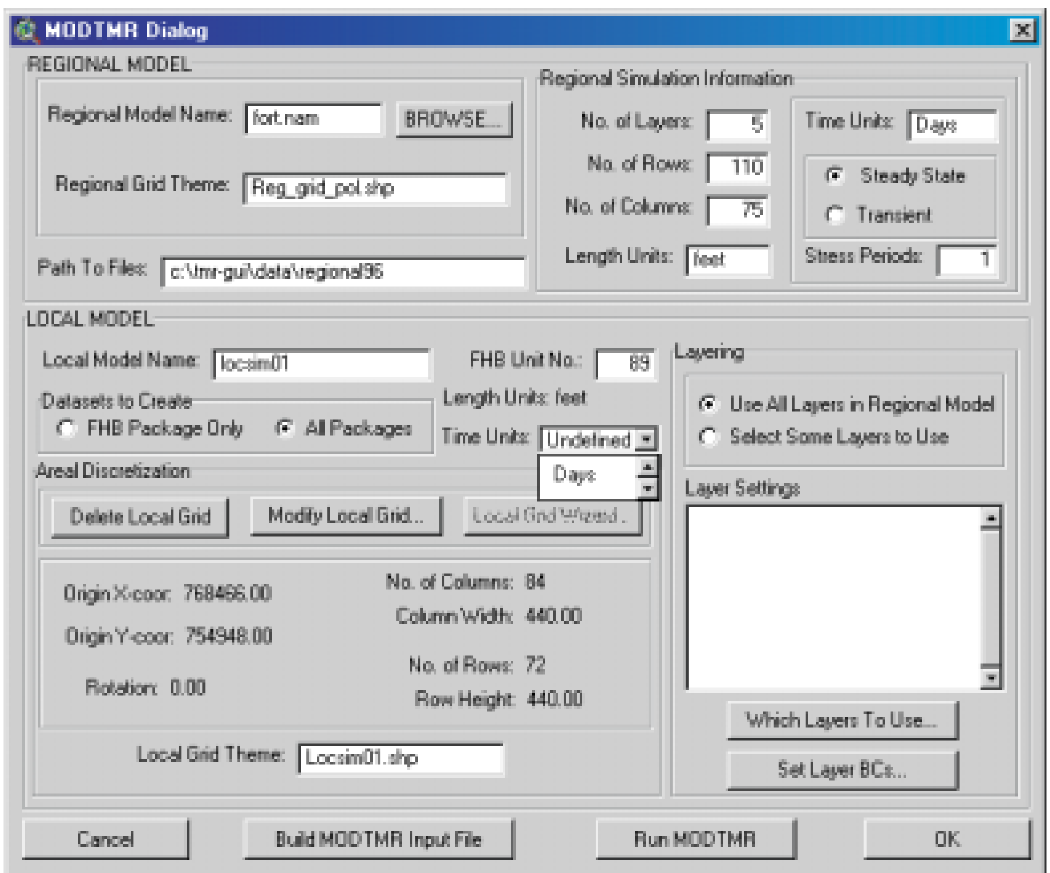

Figure 8. AvMODTMR graphical user interface dialog box for telescopic mesh refinement. The dialog box is visible upon launching the graphical user interface.

There are two ways to define the plan view domain, with each method having a dialog box that is launched from the Main dialog box. If small-area model dimensions and orientation are predetermined, the values are entered into the dialog box (fig. 9A) launched by the Create Local Grid... button; otherwise, the Local Grid Wizard... button can be used. The first of these buttons toggles to a Modify Local Grid... button once the AvMODTMR grid construction process is initiated. The "Local Grid Wizard" is a dialog box (fig. 9B) that contains graphical tools for creating the local grid interactively on the map canvas. A "Draw Study Area" tool allows the user to draw an irregular polygon bounding the study. In addition, a "Draw Rotation" tool enables the user to draw a vector line on the canvas to indicate the rotation of the grid. The user then enters the dimensions of the column width and row height in text boxes. At this point, either method has provided enough information to uniquely define the local grid. Pressing the "Preview" button permits the user to examine the small-area grid dimensions before actually creating the file by drawing a box oriented in the direction of line, circumscribed on the polygon. Construction of the model grid as an ArcView Shapefile is initiated by clicking the "OK" button; once completed, it is added to the "View" as a theme or layer. Another layer added is the FHB theme, which consists of the same source data as the grid, but only shows the cells forming the perimeter of the small-area model grid. With either method used, the embedded model grid must be placed wholly inside the regional model grid and should avoid points of concentrated flow, such as rivers, drains, and wells (Leake and Claar, 1999, p. 4).

Model layers to be used in the small-area model are selected by clicking the Which Layers To Use... button and choosing a continuous range of layers shown in a dialog box (fig. 9C) from the large-area model to be simulated in the small-area model. No additional discretization of model layers can be performed with AvMODTMR, so another preprocessor would be required if finer vertical discretization is required.

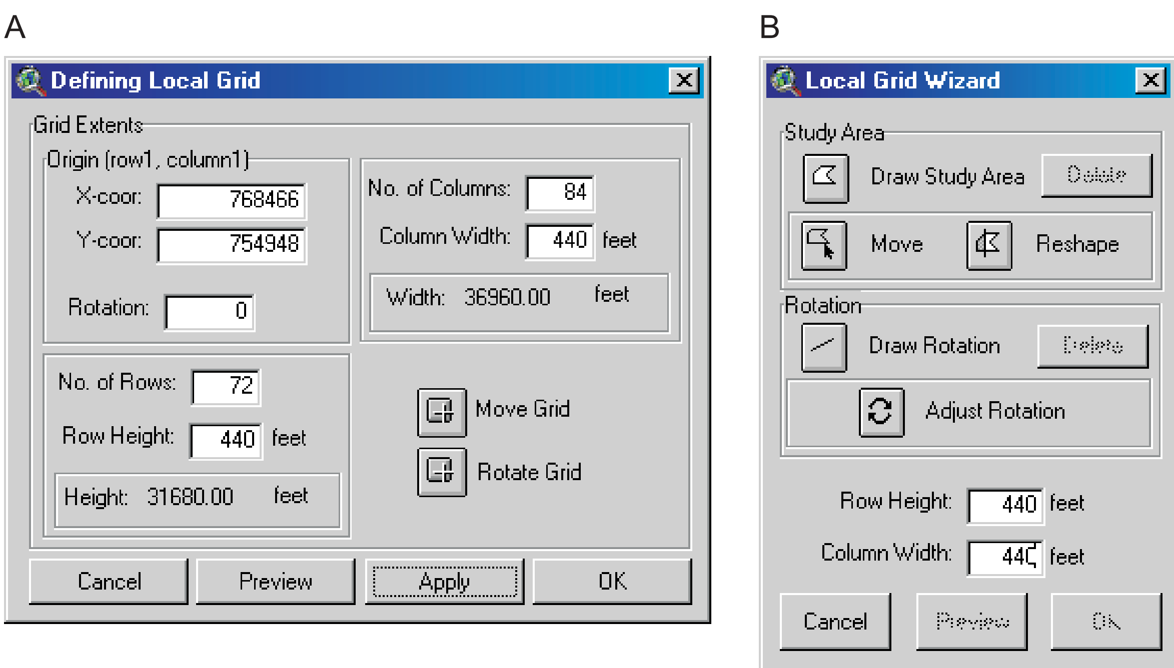

Figure 9. AvMODTMR dialog boxes for defining local grid, using local grid wizard, selecting layers, setting layer boundary conditions, and choosing units.

Further layer discretization requires a greater programming effort and was considered beyond the scope of this study. However, a text editor may be used to modify the MODTMR input file constructed by AvMODTMR.

Prescribed-head or prescribed-flux boundary conditions are selected for each small-area model layer using the AvMODTMR graphical tool set. By default, prescribed flux is automatically assigned for all perimeter cells (designated by a blue cell color). From the main dialog box, the 

button launches a separate dialog box (fig. 9D) permitting modification of boundary conditions, one layer at a time; any combination of prescribed-flux or prescribed-head boundary conditions can be applied to perimeter cells.

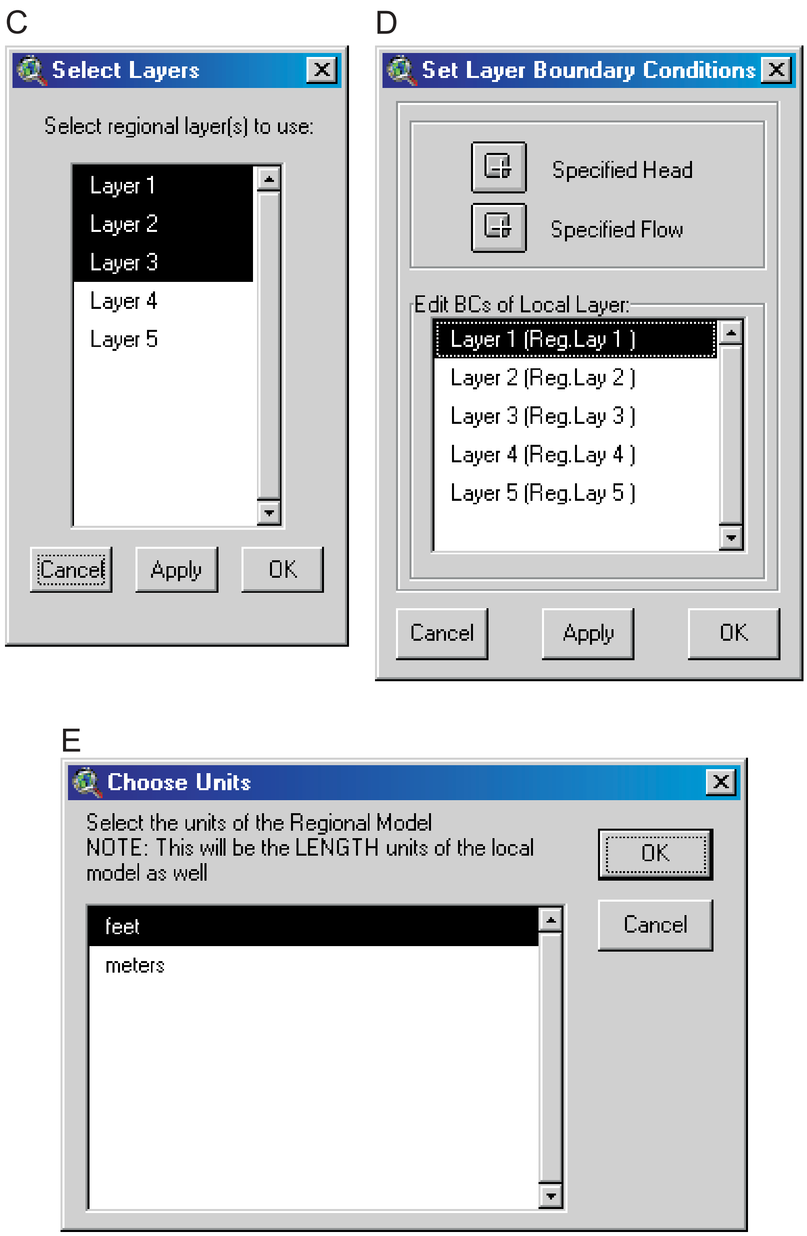

Figure 9. (Continued) AvMODTMR dialog boxes for defining local grid, using local grid wizard, selecting layers, setting layer boundary conditions, and choosing units.

The current version of the AvMODTMR imposes several restrictions on the use of MODTMR. Although time units may differ between regional and local models, the length unit prescribed by the user in the regional model is automatically used in the local model (fig. 9E). MODTMR permits local grid rotation to be specified at any model corner. With the current version of AvMODTMR, the user can only specify a local grid rotation angle centered around the upper left grid corner (outer corner of row 1, column 1); MODTMR allows any corner to be used as the reference point for rotation (a flexibility that is not available to the AvMODTMR user). However, this limitation is offset by the intuitive graphical nature of AvMODTMR.

AvHDRD and AvWELL Refiner Graphical User Interfaces for MODFLOW

RIVGRID (Leake and Claar, 1999) is a program released with MODTMR to generate River, Drain, Stream, and GHB package files, which improve on the limited geometric accuracy provided in the discretized large-area model. All of the head-dependent flow boundaries created by MODTMR use an interpolation scheme that utilized location information based solely on row, column, and layer large-area model spatial indices. The discretization process used in MODFLOW generalizes the information to discrete cells, and the exact path of linear features cannot be reconstructed from input files alone. Geometric information regarding feature alignment must be provided, either from coordinates of points where a feature changes course (vertices) or from GIS coverages that contain their alignment and topology within their data structure. RIVGRID utilizes the former method as coordinate data must be input for each vertex, along with locations where the various required parameters change (bottom elevation, riverbed conductance, and stage). RIVGRID is not a GIS-based program and is not a program designed to interface with GIS data sets.

A more efficient technique to work with linear hydrologic spatial data sets is dynamic segmentation (Wilsnack, 1998). Dynamic segmentation is a GIS data model that is implemented in ARCINFO and ArcView as a route system with attribute information (hydrologic properties) stored in attribute tables. In a route system, each canal is a distinct and unique feature represented by a linear element, the geometry of which matches that of the real-world hydrologic features (river, stream, and canal). Each route has a definite origin, where a measuring system begins at zero and increases with the length of the feature in a downstream sense to its terminus. In other words, a linear referencing system (LRS) is established on the feature.

A LRS is analogous to a Cartesian referencing system in that any point can be specified with two pieces of information; the latter requires an *X,Y* value and the former requires a *Route-ID* and a *Measure*. The *Route-ID* (name or a sequential value) indicates the name of the linear feature in which data are assigned, and the measure places it in the proper location along the feature length. This enables geocoding of information related to the feature (including hydrologic modeling parameters, such as sediment thickness) to their exact location along the feature. For instance, if a sediment thickness measurement was taken on a canal, it can be associated and mapped to its exact location along the canal by simply using the “feature identifier” (canal name), and the “position along” (meters from its origin). A common function in dynamic segmentation is to associate an approximate *X,Y* location to a route to obtain the position along the feature (distance from the origin) of the datapoint. In a dynamic segmentation model, attribute tables are called “event” tables, and there is one table for each hydrologic parameter of interest. In an event table, each observation is a separate record that includes its route identifier (river name), a “position along” (linear distance), and the value of the observation at the specified location. Events (river properties) can be defined, depending on how the hydrologic property varies along the river, as either *continuous* or *step-wise* (fig. 10A,B). Continuous properties vary linearly from one point to the next along the length of the hydrologic feature and include sediment thickness, bottom elevation, and stage (fig. 10A). Step-wise properties remain constant over a certain length (fig. 10B). Man-made canals are engineered channels with fixed bottom widths over long stretches. For purposes of this study, bottom width was the only property designated as step-wise. The records of a step-wise event only require one position location to be specified; the position indicates where the value is defined.

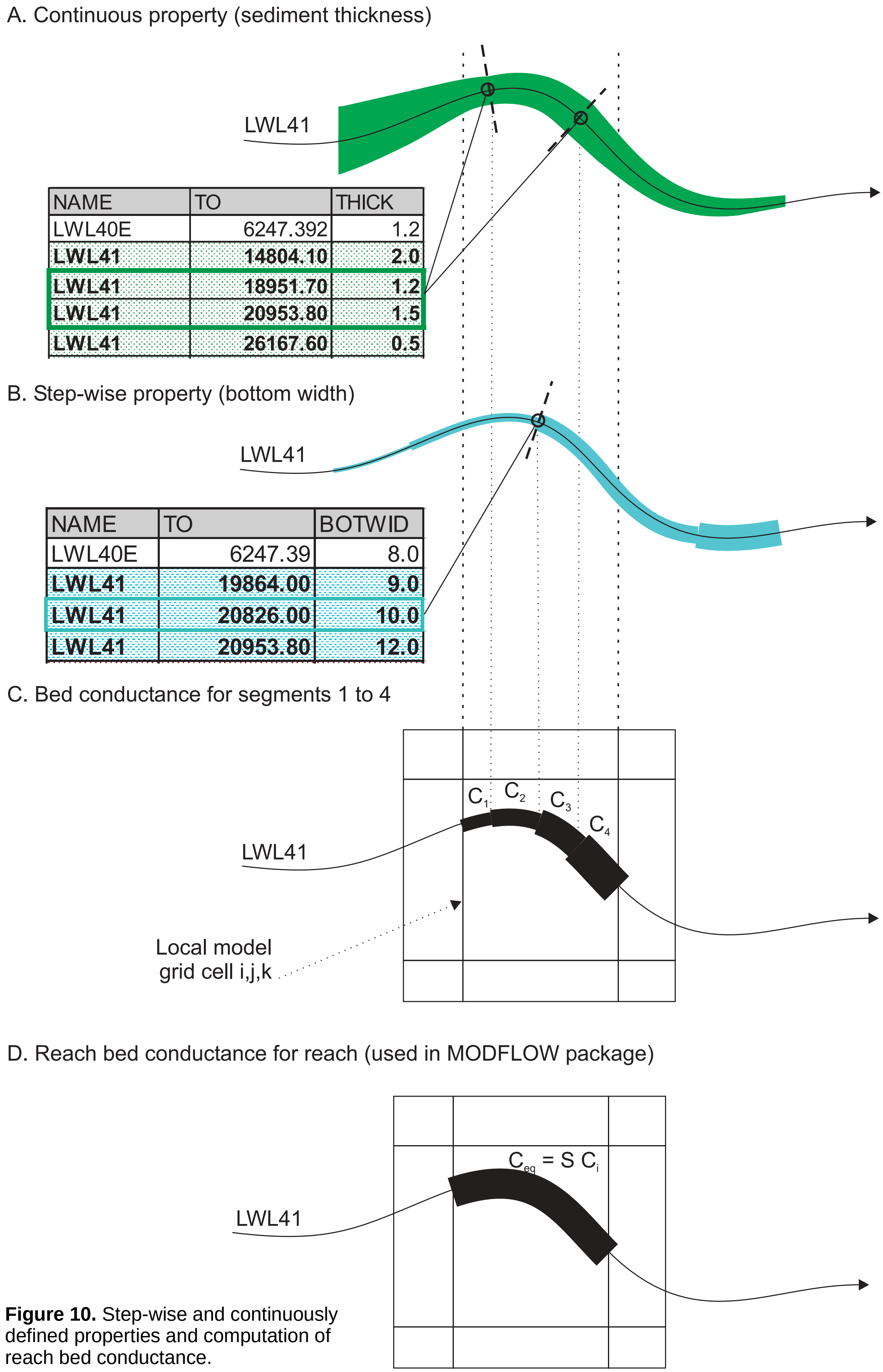

Figure 10. Step-wise and continuously defined properties and computation of reach bed conductance.

A separate GUI extension, AvHDRD (app. III and fig. 11), was designed as part of this study to read dynamically segmented canal data and construct River and Drain MODFLOW input files. The AvHDRD GUI is an ArcView "plug-in" and is accessed by loading it through the "File" menu, "Extensions" item. The AvHDRD GUI is launched by pressing the button. AvHDRD can be used to extract information from each canal property event table and compute conductance terms by canal reach within each River (or Drain) cell. One event table is created for each of the relevant hydrologic properties: sediment thickness and hydraulic conductivity, bottom width and elevation, and, in the case of rivers, stage. Using standard GIS

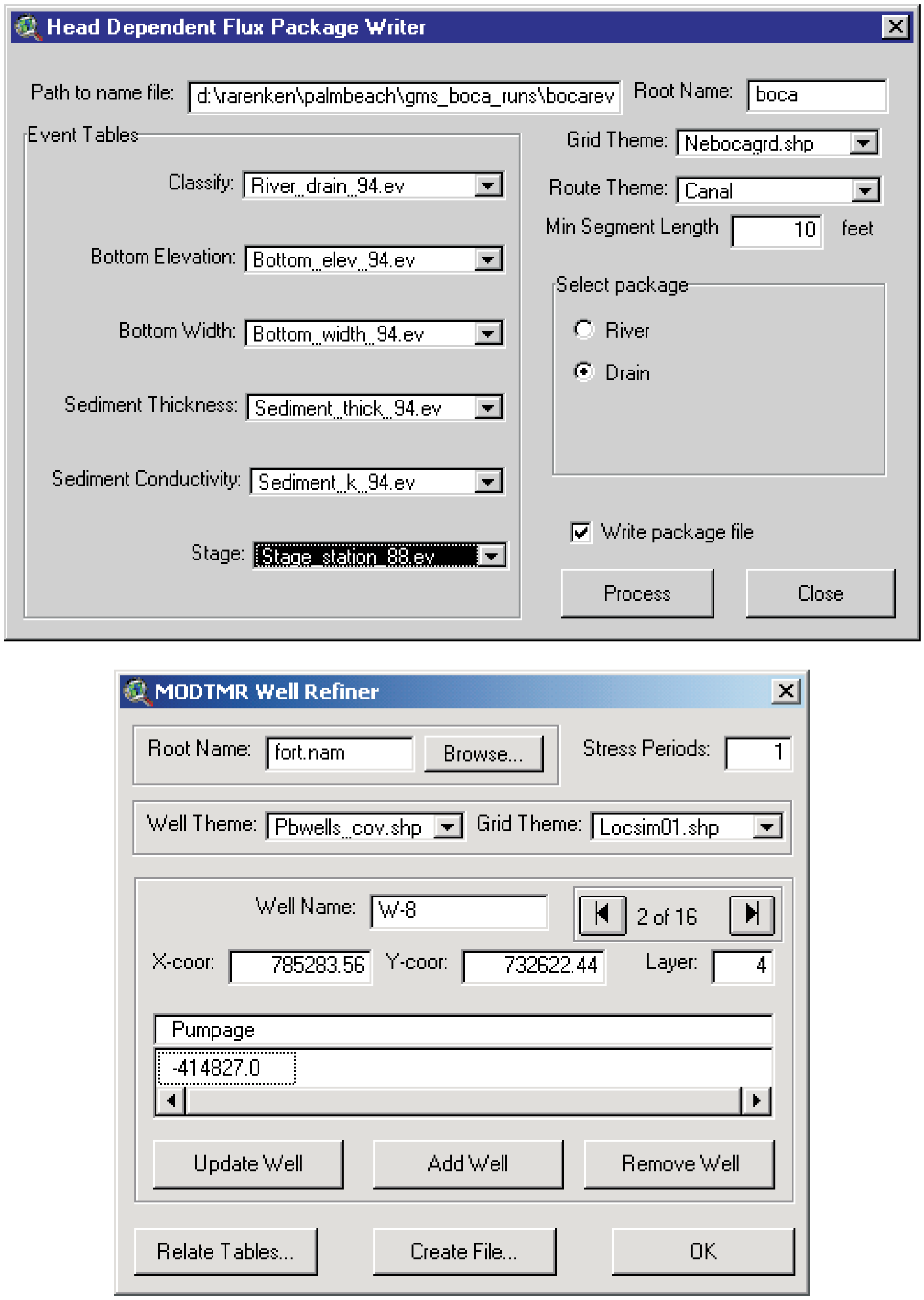

Figure 11. AvHDRD and AvWell graphical user interface dialog boxes for telescopic mesh refinement.

procedures, the event tables are mapped to the route system. AvHDRD can handle any combination of continuous or step-wise events (any or all properties could be step-wise or continuous). The user must decide which of the properties should be continuous and which should be step-wise in their application. A segment is defined as a stretch of a linear hydrologic feature within a cell in which step-wise properties remain constant and continuous properties may vary linearly (fig. 10C). In contrast, a reach is the length of the river that traverses the entire cell. There may be more than one segment in a reach because a property change may occur within the reach, marking the break point between segments.

The AvHDRD GUI extension computes values for each river or drain reach by use of a model grid overlay, extracting hydrologic feature properties, calculating conductance values, and writing an input file. The model grid is placed over the route system, and each cell that overlies a river feature is marked along with the measures that mark its cell intersection points. This method accounts for rivers that may meander, begin, or end at the cell. River meanders may result in more than two cell intersection points, and rivers that begin/end with a cell result in one cell intersection point. By using the route system and the information in the property event tables, a mean value for each property is extracted for each segment. The conductances are computed for each segment from the mean values, and then reach conductance is computed as the sum of the segment conductances (fig. 10D). Each item of information is sorted by cell sequence number and then by canal name, and records of the following type are printed to an ASCII file (table 1). A pound sign "#" is inserted after the required River/Drain file parameters to separate the River/Drain MODFLOW input data from spatial data record information. This latter information facilitates identification of a river or drain reach. This information, particularly useful if a cell contains more than one reach, can be used to map route system conductance values as a spatial data set property event.

Table 1. Sample of part of MODFLOW River output file from AvHDRD

[Dots represent continuation of output file]

832	83								
832									
1	1	7	15.6300	3667.47	5.73	#	LWE2W	106381.15	106821.25
1	1	8	15.6600	3668.05	6.74	#	LWE2E	91759.19	92199.35
1	1	38	14.9500	3315.57	4.13	#	LWE3	104852.22	105170.52
1	1	39	14.8700	1279.68	4.31	#	LWE3	105170.52	105293.37
1	1	61	8.1400	1467.23	3.15	#	LWE4	90946.33	91386.50
1	2	7	15.6400	3667.47	5.71	#	LWE2W	106821.25	107261.34
1	2	8	15.6600	3667.21	6.68	#	LWE2E	92199.35	92639.42
1	2	20	15.6000	1107.18	7.58	#	LWL39	10389.71	10611.15
1	2	21	15.4800	4766.83	7.51	#	LWL39	10611.15	11051.16
1	2	22	15.3200	4766.83	7.43	#	LWL39	11051.16	11491.18
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.

Table 2. ArcView attribute table of well geospatial data set

Well No.	x-coordinate	y-coordinate	Layer	Pumpage (cubic feet per day)		
				1	2	3
23-E	797548.63	747954.06	4	-96,348	0.0	-96,348
15-W	784291.00	744933.88	5	-427,410	.0	-427,410
25-E	796869.50	741082.50	3	80,513	.0	-80,513
11-E	798050.56	741293.31	3	111,260	.0	-111,260
25-W	785987.75	749589.75	4	584,438	.0	584,438
13-W	782753.00	743712.13	5	206,513	.0	-206,153

Point coverage data layers were constructed using public and nonpublic supply well construction and location data documented in Yan and others (1995) or available in the SFWMD model well package data set. Pumpage rates for specific wells were provided in the SFWMD model documentation (Yan and others, 1995). Accordingly, estimated pumpage rates for discrete wells are based on regional cell withdrawal rates.

A separate GUI extension (AvWELL Refiner) for ArcView (app. IV and fig. 11) was prepared to allow the user to inspect or modify point spatial data sets, modify withdrawal rates and cell and layer location, or add/remove supply wells for purposes of local model simulation. The AvWELL Refiner GUI creates a new MODFLOW96 Well input file for an embedded model data set. The MODFLOW96 Well file created by MODTMR divides flux rates obtained from regional well cells and redistributes flux rates into all of corresponding local model cells. The redistribution of well flux from the regional to local model is completed on a percentage area basis. Withdrawal or injection wells are point features and can be more properly assigned to a single local model cell based on its physical location. AvWELL Refiner takes advantage of GIS functionality to assign the entire flow rate to the correct local model cell. A geographically referenced local model grid is superimposed on a point geospatial data set so that only local cells that overlie a well are treated as a MODFLOW Well (prescribed-flux) boundary condition.

A point geospatial data set and a local model grid are required to use AvWELL Refiner and must be loaded as "themes" on the ArcView map canvas or "View." A point geospatial data set must be constructed and contain the well identifier, map coordinates with the same projection and units provided in the local model grid, local model layer in which the well pumps from/to, and a flux rate for each stress period (table 2). The local model grid must also be in an ArcView Shapefile format, with the following *integer* fields as attributes: "Row," "Col," and "Seqnum" where "Seqnum" is the sequence number of the cells in model layer 1.

Well control points and the local model grid geospatial data sets are added as themes to an ArcView "view." The AvWELL Refiner extension is loaded by accessing the *File > Extensions…*menu option. The AvWELL Refiner dialog window is launched by clicking on the launch button , or by the menu item "Well Refiner" on the "MODTMR" menu bar. The MODFLOW96 local model Name file is loaded using the "Browse" dialog box option. Once loaded, the number of stress periods are automatically read and printed on the dialog box next to the "Stress Periods" label. The file path to the model data set is printed on the line labeled "Path to files." The user must select the well point geospatial data set from a list box marked "Well Theme" and is immediately prompted to indicate the data field that contains the "Well ID," "Layer," and "Pumpage" information. The user is prompted consecutively to indicate the “Pumpage” data fields for each stress period. One must also identify the local model grid geospatial data set, selecting it from a list box labeled “Grid Theme.” AvWELL Refiner overlays the local model grid on the well data set and associates each well control point with a corresponding local grid cell. More than one well control point in a specific grid cell is permitted. The data can be reviewed in the central area of the dialog by navigating through the records with the left and right arrows. A MODFLOW96 Well input file is prepared by clicking on the “Write File” button. AvWELL Refiner will overwrite the MODFLOW96 Well input file generated by MODTMR so the user may prefer to first rename the MODTMR-generated Well filename.

The records are written in blocks, with one block for each stress period. This is accomplished programmatically by use of a nested loop; an outer loop iterates through a stress period (pumpage fields), and an inner loop examines each well that lies within the local model grid. Pumpage rates for each record (a well) are read as part of the inner loop, discarding a well control point if its withdrawal rate is equal to zero. A check is made at the start of the outer loop to determine if the user wishes to utilize the same pumpage field in the next stress period (i.e., pumpage rates are the same). If a “yes” response is given, a value of “-1” is written to the Well file and the loop terminates, moving to the next stress period. The “-1” is used in MODFLOW to indicate that the pumpage from the previous stress period will be used for the current one.

APPLICATION OF THE EMBEDDED MODEL

Development of an embedded wellhead protection model and delineation of well-specific zones of transport required a multitask process (fig. 12). The four principal tasks are: (1) development of an embedded ground-water flow model in which input files are extracted from a calibrated, multilayer, SFWMD regional ground-water flow model; (2) perform calibration and evaluate embedded model sensitivity to hydrologic parameters; (3) perform backward tracking of water particles from selected municipal supply wells; and (4) postprocessing and storage of flow and particle-tracking information into a GIS database.

Boca Raton Well Field Embedded Model

A small-area MODFLOW model of the Boca Raton well field was constructed and calibrated (tasks 1 and 2 in fig. 12) using information provided in the SFWMD regional model. Steady-state calibration was based on average conditions from January 1989 to June 1990. As a result of the large cell size (2,650 x 2,650 ft) in the countywide, large-area model, simulation results did not meet acceptable scale requirements for flow and particle analysis in the Boca Raton well field area. A five-layer, embedded, small-area MODFLOW model was constructed to simulate ground-water flow in the Boca Raton area (figs. 13-17). The embedded model area was subdivided using a uniform grid containing 72 rows and 84 columns; each of the 6,048 cells is 440 ft long on each side. Five layers were used in the regional model and embedded model (fig. 7).

Prior to selection of the Boca well field model domain, backward tracking was performed using the SFWMD regional model to delineate the direction and extent of particle movement from selected municipal wells. The northern, southern, and western model perimeter prescribed-flux boundaries, extracted as part of the TMR process, were placed away from the Boca Raton well field area to reduce boundary effects. The Intracoastal Waterway (figs. 1 and 2) lies near the eastern edge of the well field; initially, the entire model domain was located inland, but subsequently was modified to extend beyond the coastline. Although the general direction of ground-water flow is eastward, water levels maintained in the LWDD canal system (fig. 1) create variations in the water table and locally affect the direction of ground-water flow. The southern boundary was selected south of Hillsboro Canal, a ground-water sink. The northern boundary was selected near the LWL-40 Canal (fig.1). The western boundary was placed along a primary lateral canal (LWE-2W Canal) located along a regional ground-water divide as indicated on water-table maps (Kane, 1992 a,b).

A prescribed-head boundary along the coastline was set equal to mean monthly sea level (0.5 ft) in layer 1 (fig. 13) for all cells east of the west shore of the Intracoastal Waterway. Prescribed-head cell boundary values also were used in column 84 in layers 2 to 5 (figs. 14-17) and assumed to represent mean monthly sea level. No effort was made to adjust heads in offshore prescribed-head cells for salinity differences–– an important model limitation discussed later.

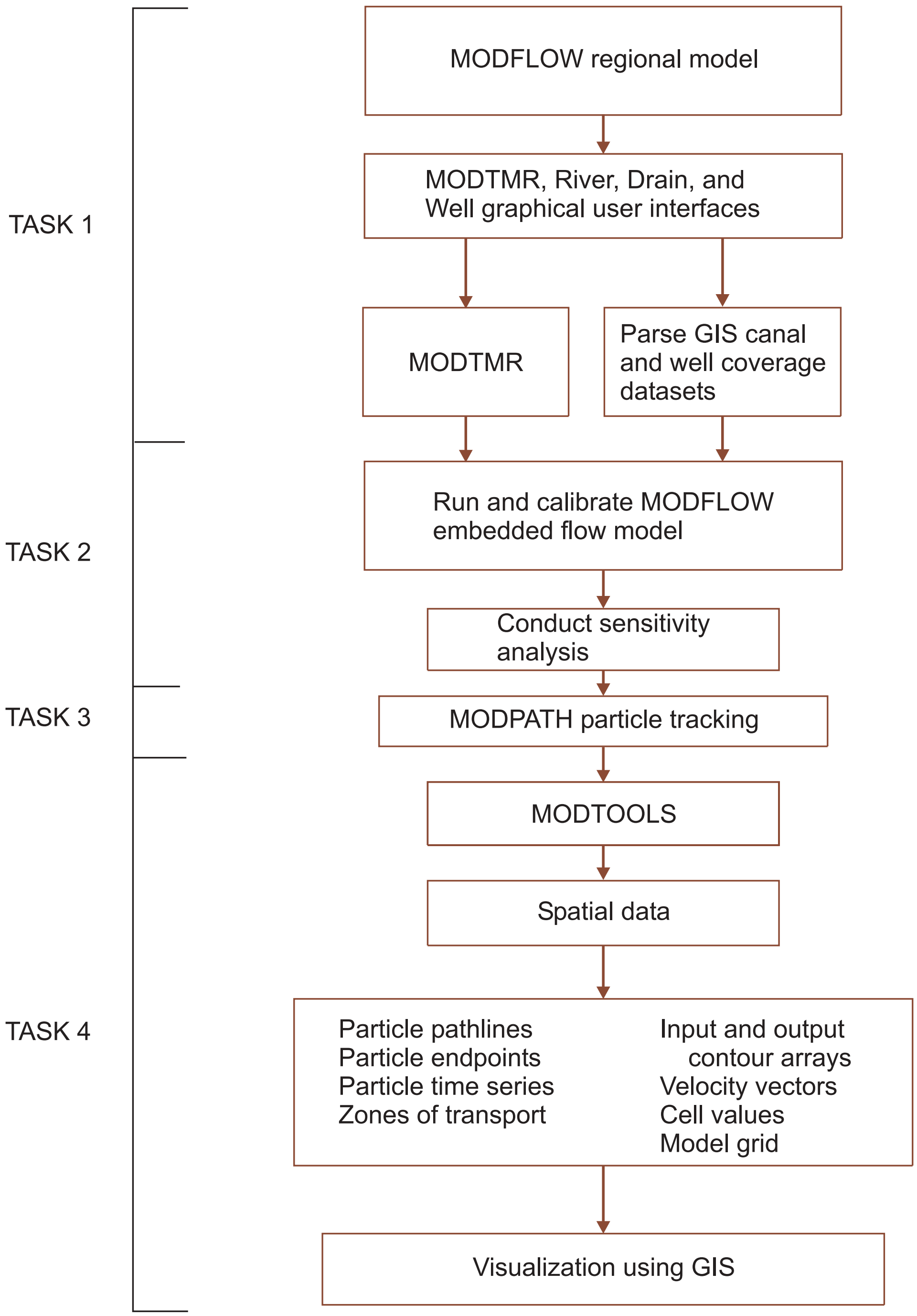

Figure 12. Process for delineating zone-of-transport areas to public-supply wells in a local-scale model. GIS is geographic information system.

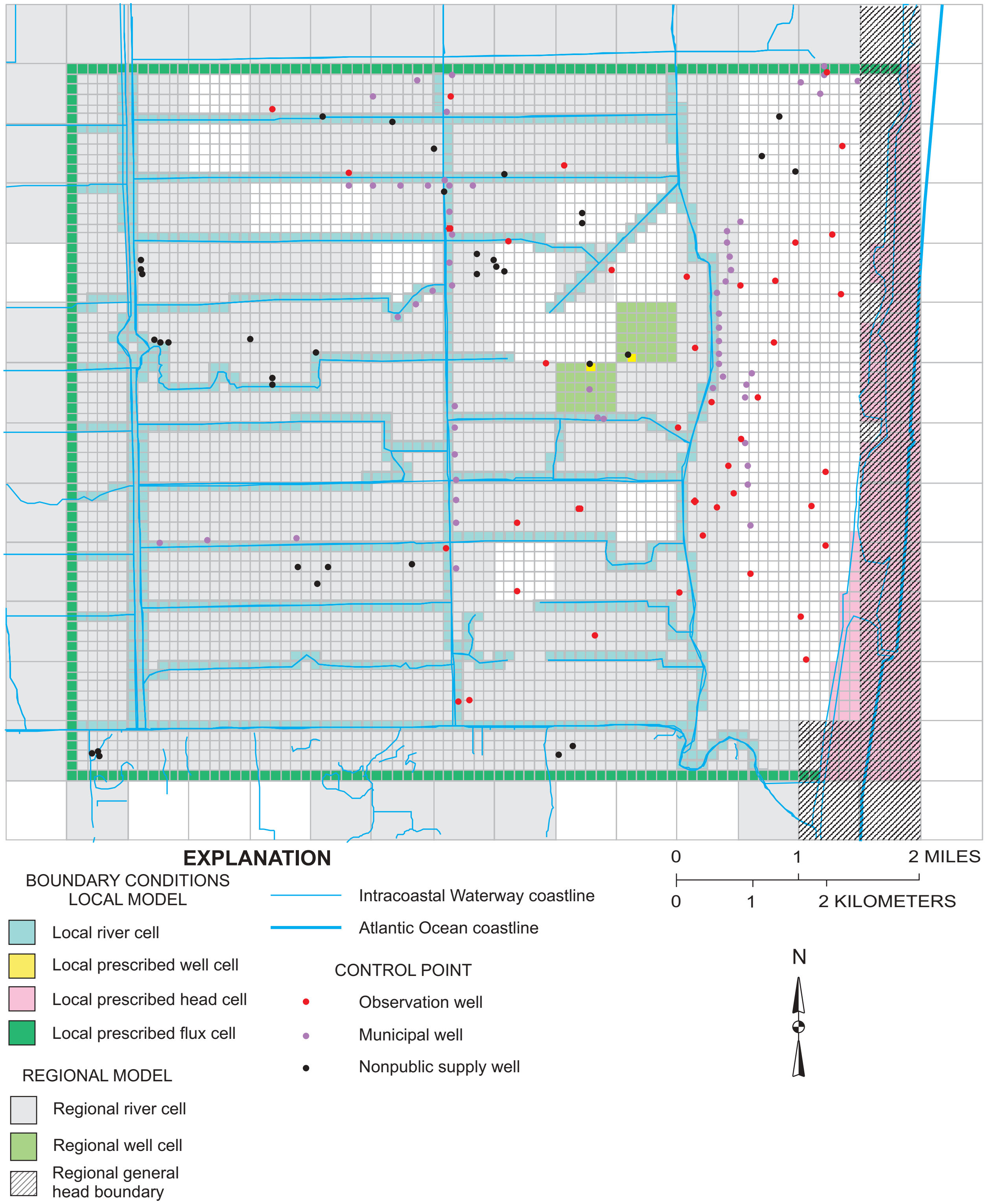

Figure 13. Well field model grids showing relation between regional and local domains and internal and external boundary conditions for model layer 1.

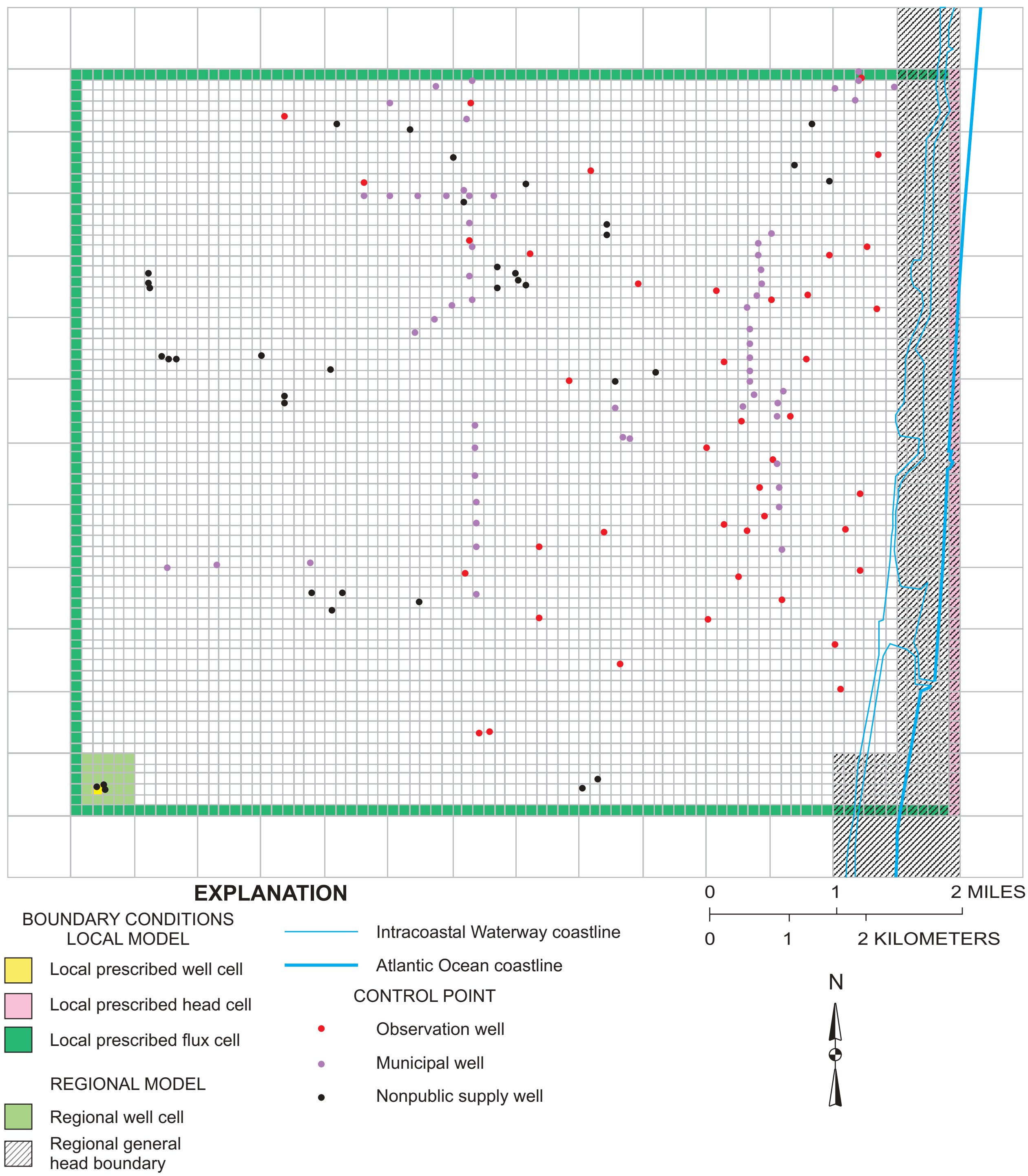

Figure 14. Well field model grids showing relation between regional and local domains and internal and external boundary conditions for model layer 2.

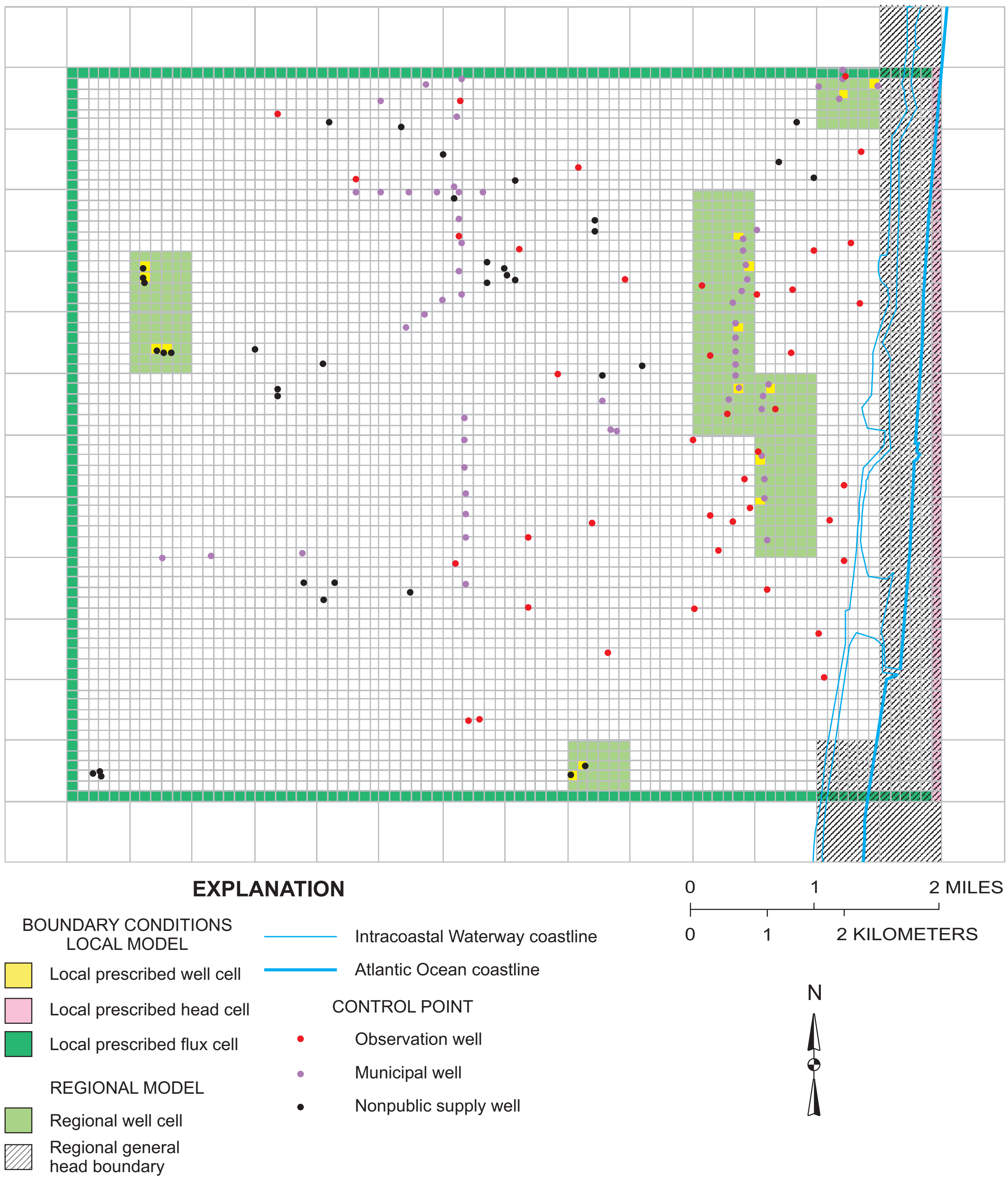

Figure 15. Well field model grids showing relation between regional and local domains and internal and external boundary conditions for model layer 3.

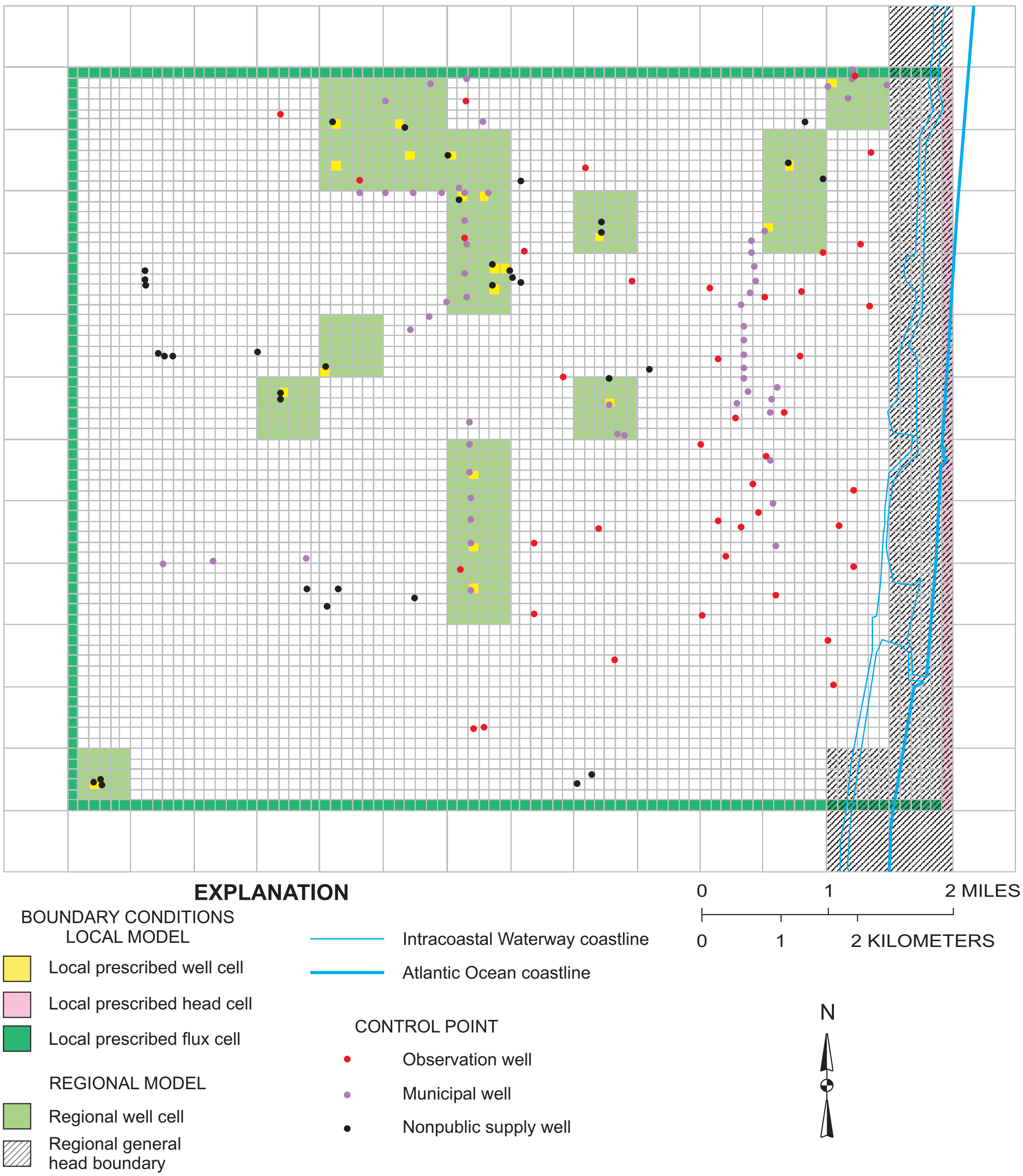

Figure 16. Well field model grids showing relation between regional and local domains and internal and external boundary conditions for model layer 4.

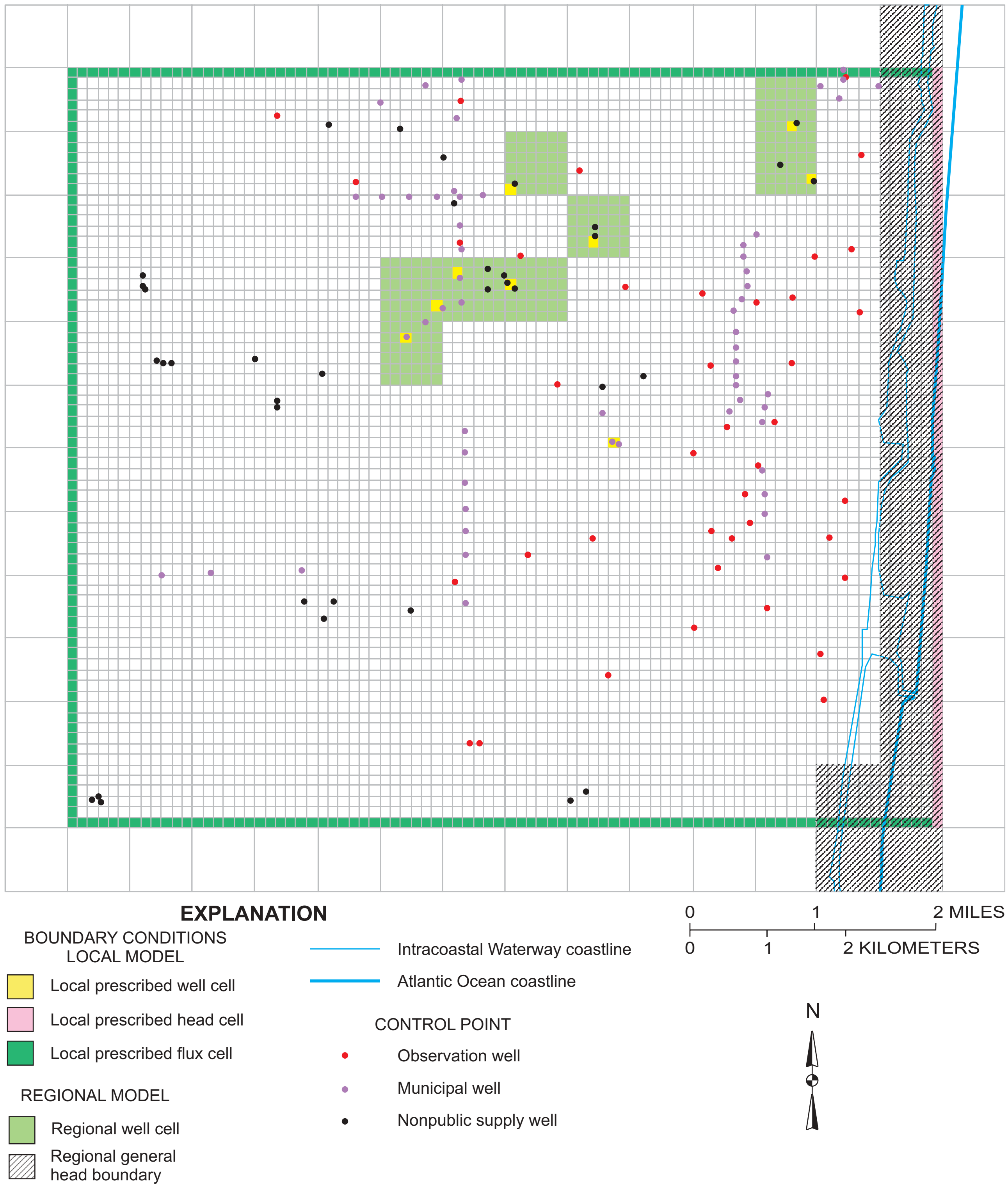

Figure 17. Well field model grids showing relation between regional and local domains and internal and external boundary conditions for model layer 5.

Automated selection of prescribed-head or prescribed-flux boundaries along an irregular coastline is not possible in the current version of MODTMR or AvMODTMR. Manual regridding to modify IBOUND and other areal model parameters in layer 1 was required to accurately represent the coastline.

The MODFLOW River package (McDonald and Harbaugh, 1988; Harbaugh and McDonald, 1996) was used to allow leakage to or from the aquifer along drainage and lateral canals. Some canals in the large-area model (Yan and others, 1995) were represented by the MODFLOW Drain package to simulate the discharge from uncontrolled drainage canals with uncontrolled water levels. All canals in the Boca Raton small-area embedded model area were represented as rivers in the large-area model. Accordingly, internal boundary conditions of the same type were used to maintain consistency between the large-area and embedded small-area models. The AvHDRD GUI and GIS canal data were used to construct a new River package input file. Canal GIS data sets included canal-bottom elevation, bottom width, hydraulic conductivity of the bed sediment, canal-bottom sediment thickness, and canal stage. Stage levels within the canal reaches were set to the LWDD maintenance control levels. Before model calibration, bed conductance values for the small-area model cells were compared with the cell in the corresponding area of the regional model to ensure consistency between both models. The user must compare conductance data in the large-area and small-area models to ensure consistency between the two models. The principal reason to maintain consistency is that river water-budget components in the small-area model should be similar to the inflow and outflow components in the corresponding area of the large-area model (Leake and Claar, 1999, p. 5).

The MODFLOW Well package (McDonald and Harbaugh, 1988; Harbaugh and McDonald, 1996) was used to simulate well withdrawals. Detailed information regarding well-field operation rates at specific wells during 1989-90 were not available during the course of this study. Well discharge was obtained directly from the regional model cell-value data set. Discharge rates for regional cells were reallocated, divided equally among the various supply wells contained within a discrete cell.

Recharge rates in the embedded local model were extracted as part of the TMR process from the MODFLOW Recharge package input file. Recharge estimates were modified further as part of model calibration. On the basis of the calibrated model, the mean estimate of calibrated recharge is 0.006 ft/d or about 27 in/yr.

Hydraulic conductivity and transmissivity arrays extracted during the TMR process are based originally on aquifer test data collected for the large-area SFWMD model. Transmissivity and leakance arrays also were extracted directly during the TMR process. Regional precalibrated leakance values were calculated by assuming leakance was equal to 0.1 *multiplied* by the horizontal conductivity, *divided* by the approximate thickness between midpoints of vertically adjacent cells.

A modified Blaney-Criddle algorithm was used to estimate maximum evapotranspiration rates for the large-area SFWMD model. An evapotranspiration surface elevation of 1.5 ft below land surface was used during the large-area model calibration process, and extinction depths that ranged from 1 to 5 ft (in the small-area domain area) were based on land use and estimated root depths for various types of vegetation. Evapotranspiration rates, evapotranspiration surface elevation, and extinction depths in the embedded local model were extracted as part of the TMR process from the MODFLOW Evapotranspiration package input file.

Calibration and Sensitivity Analysis

Mean water levels between January 1989 and June 1990 were used to simulate steady-state ground-water flow in the telescoped Boca Raton well field and calibrated to the observed mean water-level data for that period of time. The embedded model simulated potentiometric surface compares favorably to the simulated surface in the regional model and is similar to countywide potentiometric surface maps by Kane (1992a,b).

The purpose of model calibration was to develop a set of parameters and stresses that result in a reasonable simulation of ground-water flow within the surficial aquifer system in the embedded Boca Raton model area. Calibration was achieved by a trial-and-error approach in which model parameters including transmissivity, hydraulic conductivity, leakance, riverbed conductance, and recharge were adjusted to minimize differences between simulated and observed hydraulic head.

Model parameters were modified during the calibration process, but limited to the range of values identified elsewhere in the regional model. Estimates of recharge, hydraulic conductivity, leakance, and transmissivity are shown in figures 18 to 27. Evapotranspiration and withdrawal rates from wells were not adjusted during calibration.

Calibration criteria were based on matching observed and simulated heads within 1.5 ft of the mean water levels. Of the 41 observation wells screened in the model layers, 37 wells are included in layer 1. Layer 4 includes one well, and layer 5 includes three wells. Although the model is numerically sensitive to leakance associated with layers 3 and 4, the small number of observation wells make it difficult to evaluate if the model satisfies actual hydrologic conditions.

A comparison of the measured water level at observation wells and the simulated potentiometric surface of model layer 1 is shown in figure 28. A positive number indicates that the observed water level is higher than the simulated water level; whereas, a negative number indicates that the observed water level is less than the simulated water level. Calibration criteria were met at 34 observation wells; however, simulated head could be matched only within 3 ft of observed water levels at 5 wells. Differences at two wells, all located near pumping centers, exceeded 3 ft. A review of the calibrated regional model indicated that eight observation wells in the Boca Raton well field area were poorly calibrated (Yan and others, 1995).

Differences between observed and simulated water levels after an adjustment of a parameter were used as indicators of the model sensitivity. If a small change in a parameter results in relatively large changes in model results, the outcome is considered sensitive to that parameter. This may mean that the model parameter has to be determined very accurately or alternatively; the model cannot be used to determine whether a calibrated parameter is reasonable.

The root mean square error (RMSE) is used as a measure of the fit between observed and simulated water levels. If the errors between the observed and simulated water levels are normally distributed, the RMSE is an approximation of standard deviation of the errors. In this case, two-thirds of the errors are less than the RMSE (1.95 for the calibration period). The RMSE was calculated in feet and plotted to display the range of sensitivity when model parameters were decreased one-half or increased two fold (fig. 29). The model appears most sensitive to a reduction in the leakance of layer 3, a reduction in leakance of layer 4, increases in the rate of recharge, and increases in hydraulic conductivity of layer 1. The model is moderately sensitive to changes in riverbed conductance and transmissivity of layer 4. Adjustments to riverbed conductance seem to best help the calibration results in places where an observation well is located near a canal. The model is effectively insensitive to all other parameters.

Water Budget

The steady-state budget of the simulated system of the Boca Raton well field model (table 3) indicates that recharge is the major inflow component (58 percent), with river leakage contributing 29 percent of the inflow. Prescribed flux along the northern, western, and southern boundaries contributed about 10 percent of the total amount of water entering the Boca Raton well field model area. Well recharge and inflow at the coastal (prescribed-head) boundary (Intracoastal Canal) contributed only 2.8 and 0.2 percent of the inflow, respectively.

Well discharge (56 percent) and river leakage (27 percent) represent the principal outflow water-budget components. Discharge at the coastal prescribed-head boundary represents about 10 percent of the total budget, whereas northern, western, and eastern prescribed flux boundaries represent only 6.5 percent of the outflow component. Evapotranspiration is less than 0.001 percent of the total outflow components. In the Boca Raton model domain area, the extinction depth lies above the simulated head in nearly all model cells. Water-budget data suggest that evapotranspiration occurs either at land surface or in the unsaturated zone--zones not simulated in MODFLOW96.

The Boca Raton well field water budget and water-budget components obtained from the SFWMD model using ZONEBUDGET were compared to evaluate consistency between large-area and small-area models. Inflow budget components including prescribed head (treated as a head-dependent boundary in the SFWMD model), prescribed flux, and injection well components are comparatively consistent, both in terms of volume and percent of the total water budget.

Outflow budget components including prescribed head (head-dependent boundary in the SFWMD model), well discharge, and evapotranspiration are similar.

Several water-budget differences are evident. The total Boca Raton water budget (47.2 in.) is less than the SFWMD model subarea total budget (50.9 in.) determined using ZONEBUDGET. Budget differences are largely attributed to the changes made to the Boca Raton well field model, including modification of boundary conditions in layer 1 to accurately represent the coastline configuration.

River leakage and recharge are the major inflow water-budget components in the small area model that do not favorably compare with the zone budget determination, also attributed to modification of model parameters during the calibration process. Recharge represents a larger percentage of inflow in the Boca Raton water-budget analysis. River (canal) leakage similarly represented a smaller inflow component in the Boca Raton model of the overall water budget (29 percent) when compared to zone budget amount (34.6 percent). River (canal) leakage was a smaller outflow component in the local model (27.2 percent) when compared to the regional model (31.7 percent).

Pathlines, Contributing Areas, and Delineation of Zones of Transport

Flow pathlines, contributing areas, and time-of-travel estimates for selected municipal Boca Raton supply wells were constructed using the MODPATH particle-tracking program (Task 3 in fig. 12). Particle paths can be tracked forward in time from recharge areas or backward from a supply well to contributing areas. Contributing areas for recharge were defined by backtracking particles from the supply well to the water table. Although not performed in this study, forward tracking can be used to clarify poorly defined areas located between backward-tracked particles and help to ensure areas contributing recharge to wells are correct in size (Barlow, 1995). A pathline analysis was conducted initially to provide insight to the general configuration of contributing areas and for definition of a 500-day time-of-travel zone of transport. Subsequently, particles were permitted to travel until they encountered internal sinks or sources or boundaries.

Ground-water pathlines under simulated steady-state head conditions between January 1989 and June 1990 were created by placing 1,000 particles in each selected cell containing municipal supply wells that discharge water at prescribed rates. Zones of transport and time of travel in the Boca Raton well field were estimated assuming steady-state conditions and the pumping conditions defined in the large-area model analysis. For modeling purposes, steady-state hydrologic conditions were considered to represent average hydrologic conditions; such conditions could vary considerably if new supply wells were added to the well field. An independent effort to verify ground-water flow velocities, such as through the use of chemical tracers, was considered beyond the scope of this study and was not conducted.

Canals located within the Boca Raton embedded model were collectively treated as weak sinks; cells that contain weak sinks do not discharge at rates sufficient to consume all water entering them. Although not considered in this study, one of two approaches can be used to resolve the issue of weak sinks: (1) reduce model cell size so that flow entering cells with internal sinks is completely discharged, or (2) conduct two analyses. In one analysis, weak sinks are ignored; in an alternative analysis, particles are programmed as stopping at weak sinks.

The Boca Raton embedded flow model is based on input parameters developed as part of a regional flow model. Unfortunately, porosity estimates are sparse; the spatial distribution of porosity within the surficial aquifer system is poorly known in Palm Beach County and the Boca Raton well field area. Porosity estimates of limestone from the Tamiami Formation in southwestern Palm Beach County range from 20 to 30 percent (Reese and Cunningham, 2000). The porosity of Tamiami Formation core samples collected from the North Dixie well field in eastern Broward County (not shown) is reported to range from 38 to 40 percent (Fish, 1988).

For purposes of this study, uniform porosity distributions of 20, 30, and 40 percent were separately assumed for the surficial aquifer system. Porosity within the surficial aquifer system can vary considerably, and therefore, could affect time of travel. However, such variations are not likely to affect pathline configurations.

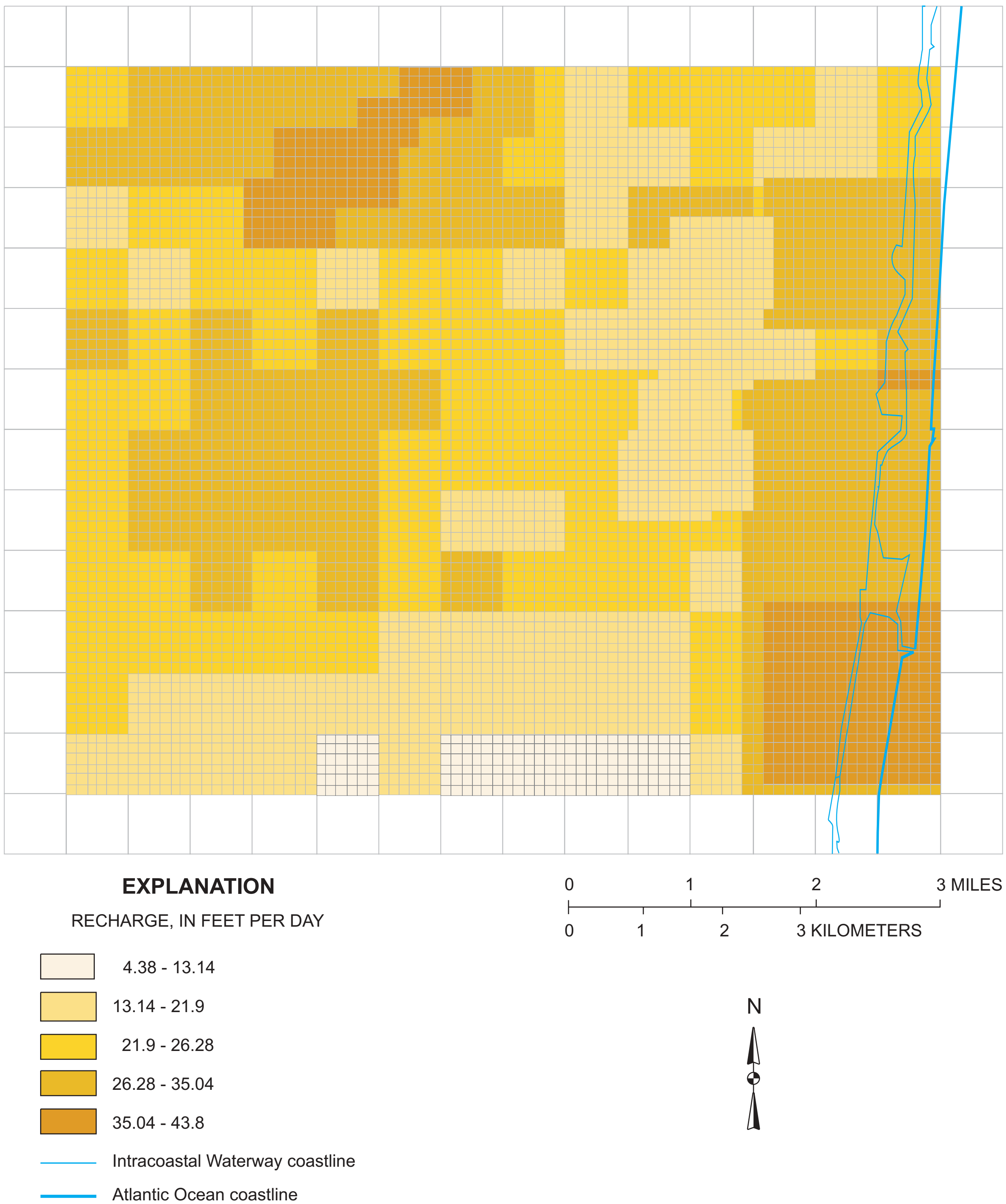

Figure 18. Calibrated recharge for the Boca Raton well field model.

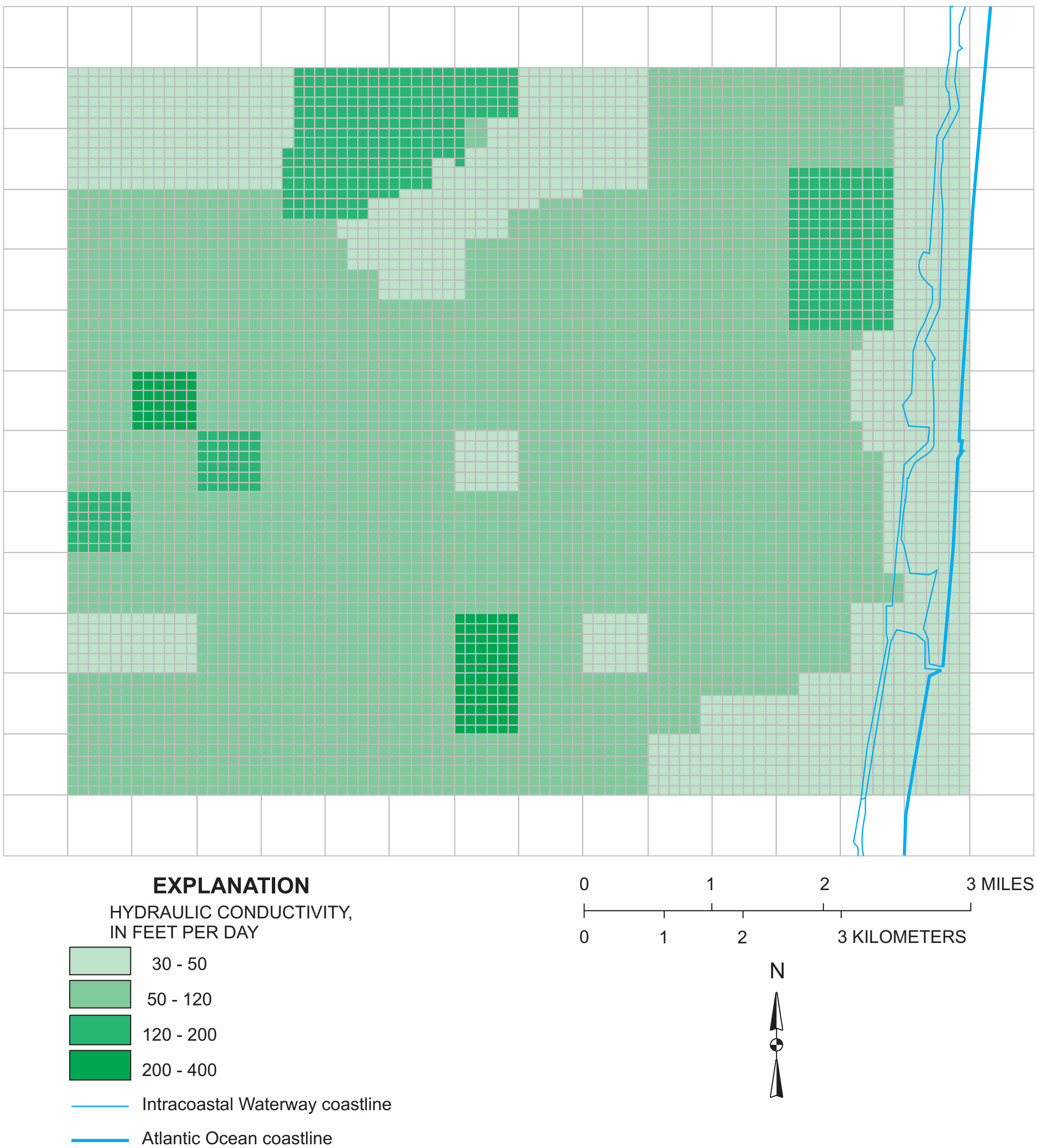

Figure 19. Hydraulic conductivity for layer 1, Boca Raton well field model.

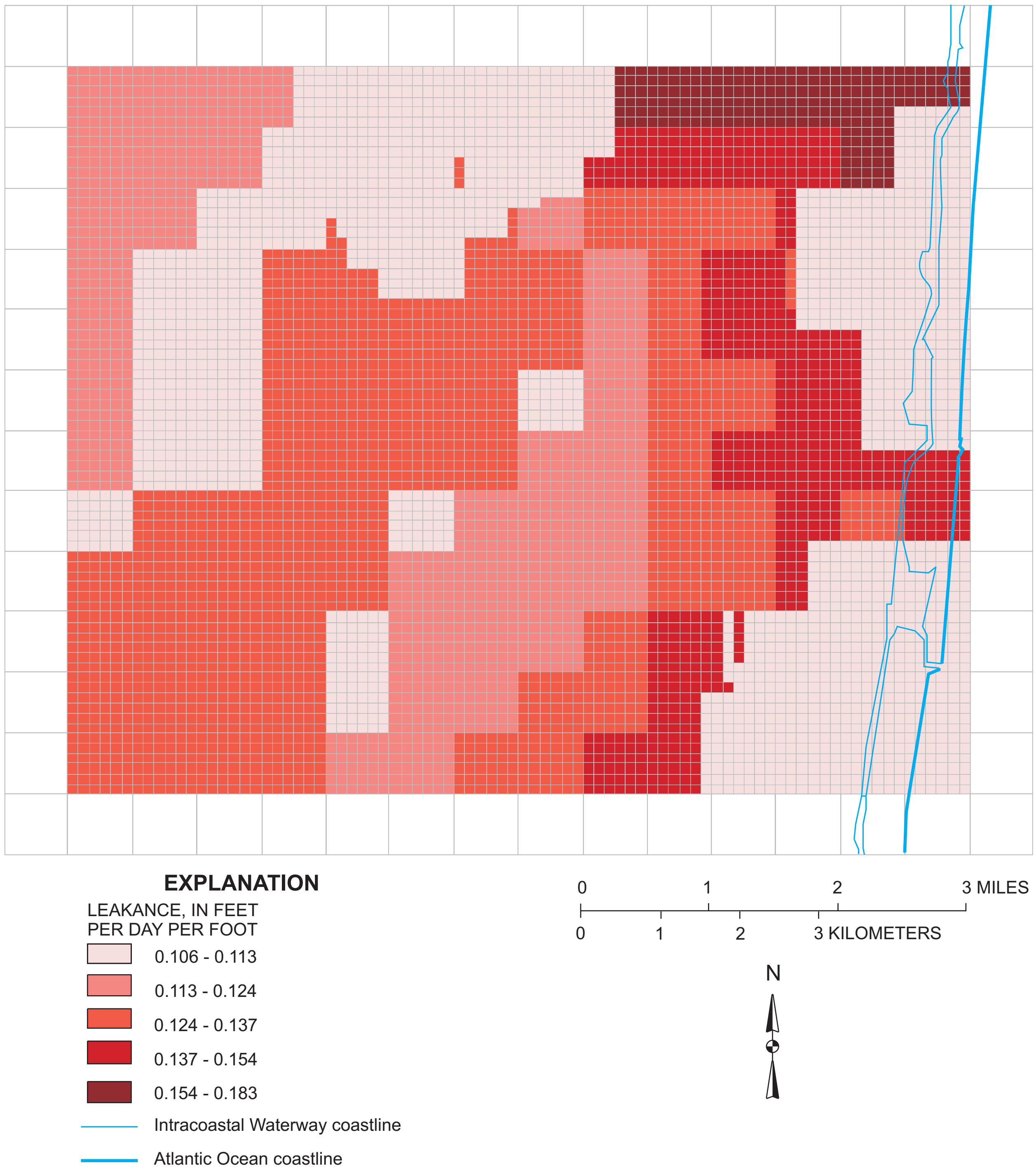

Figure 20. Leakance for layer 1, Boca Raton well field model.

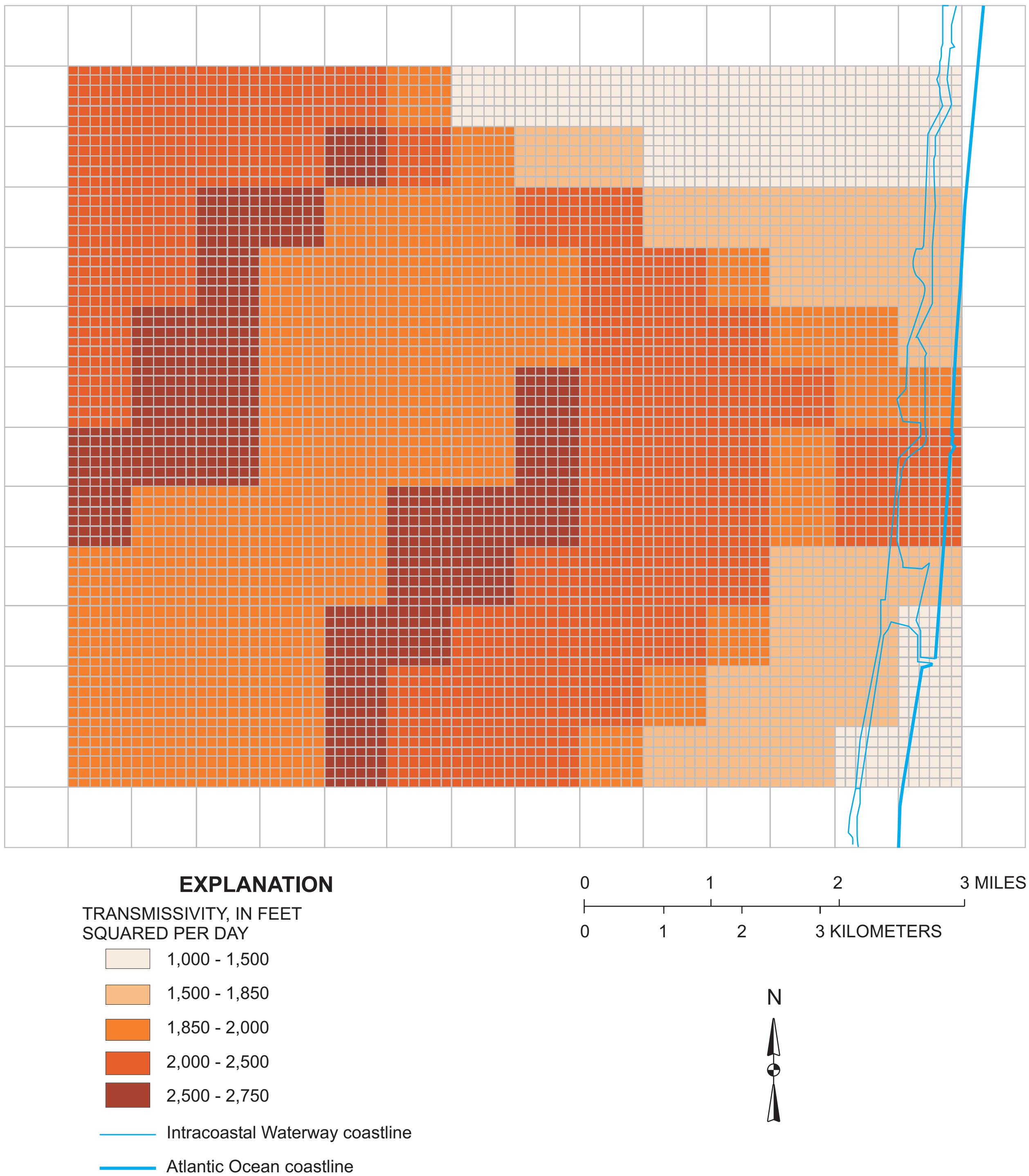

Figure 21. Transmissivity for layer 2, Boca Raton well field model.

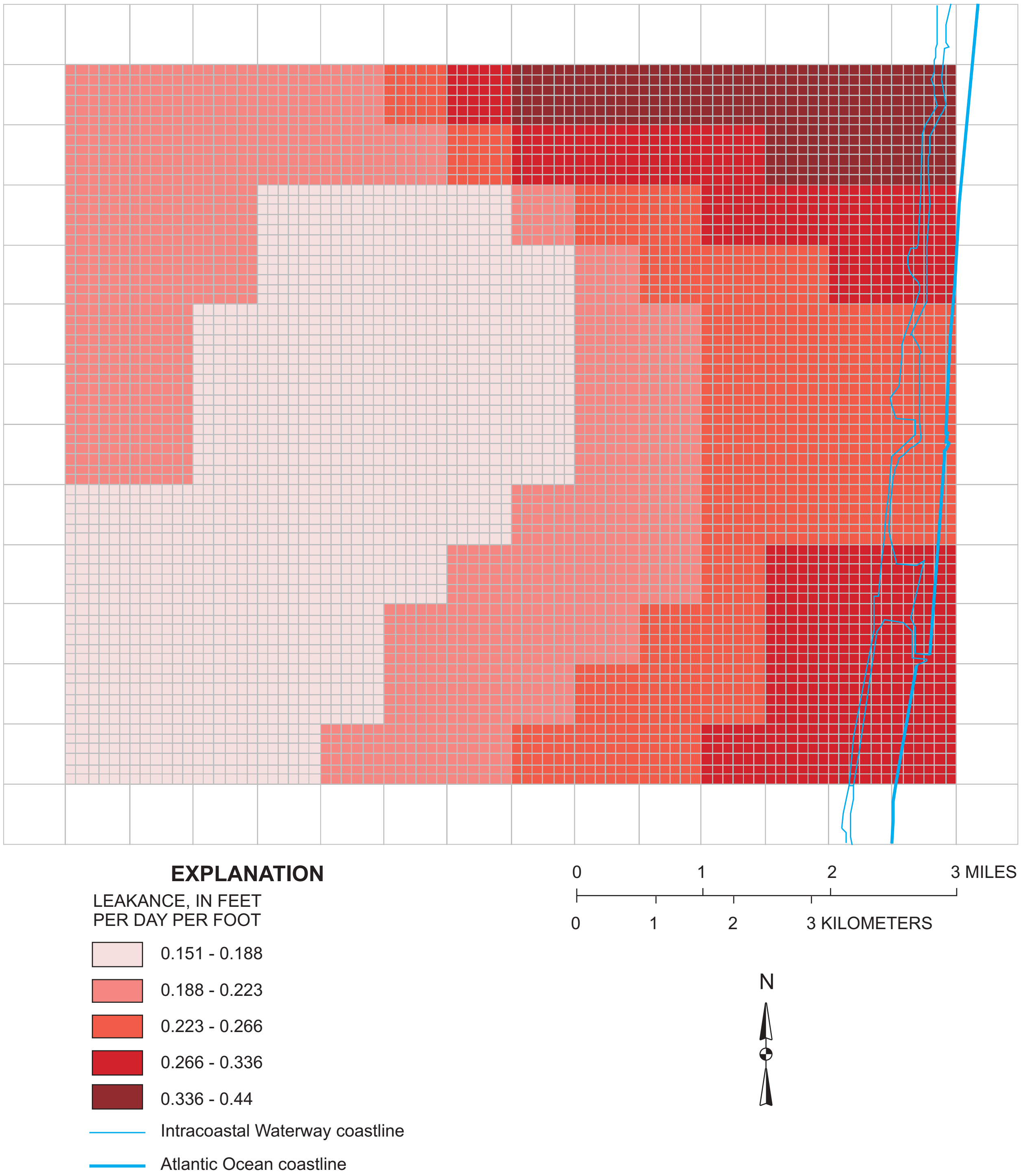

Figure 22. Leakance for layer 2, Boca Raton well field model.

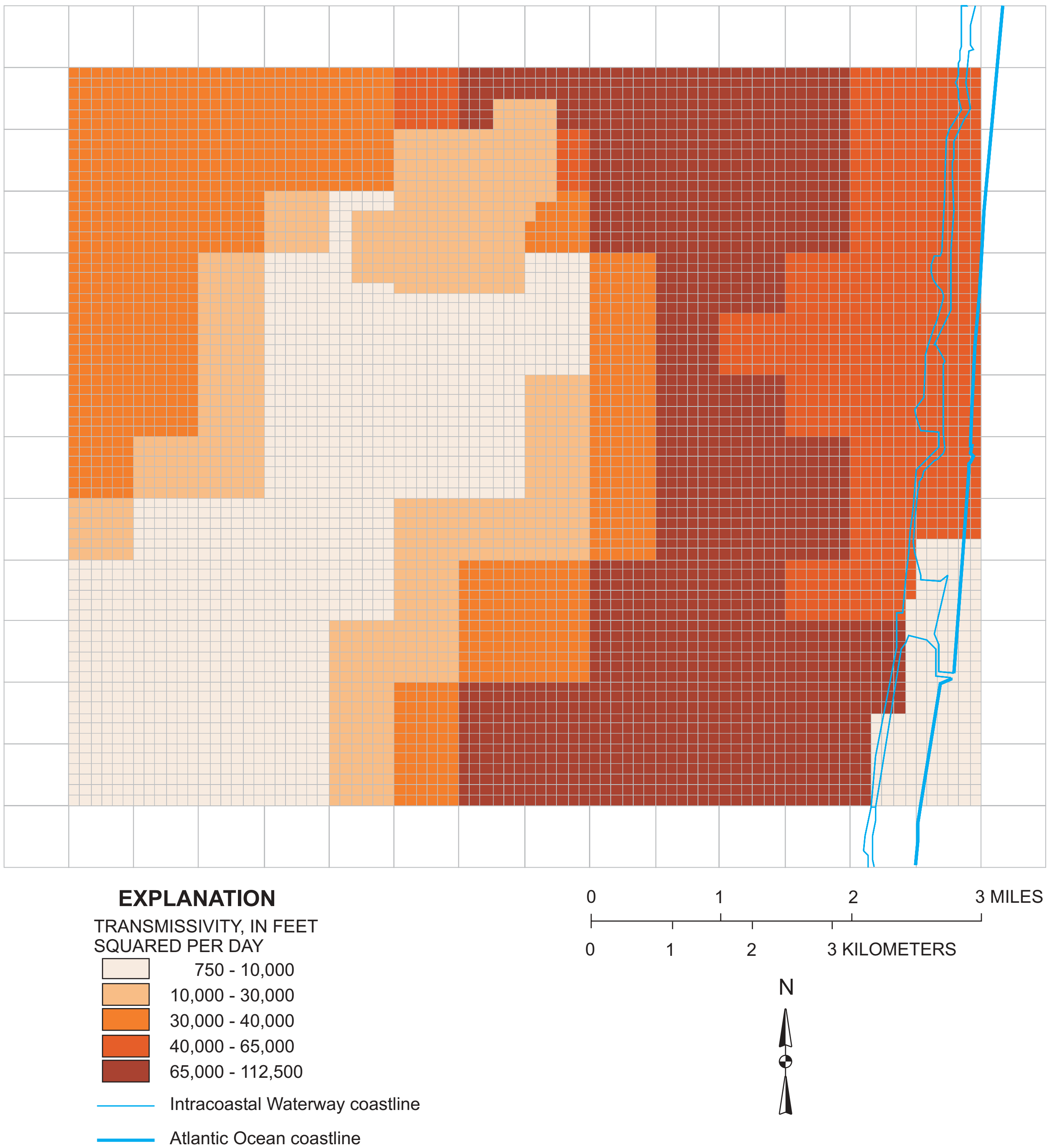

Figure 23. Transmissivity for layer 3, Boca Raton well field model.

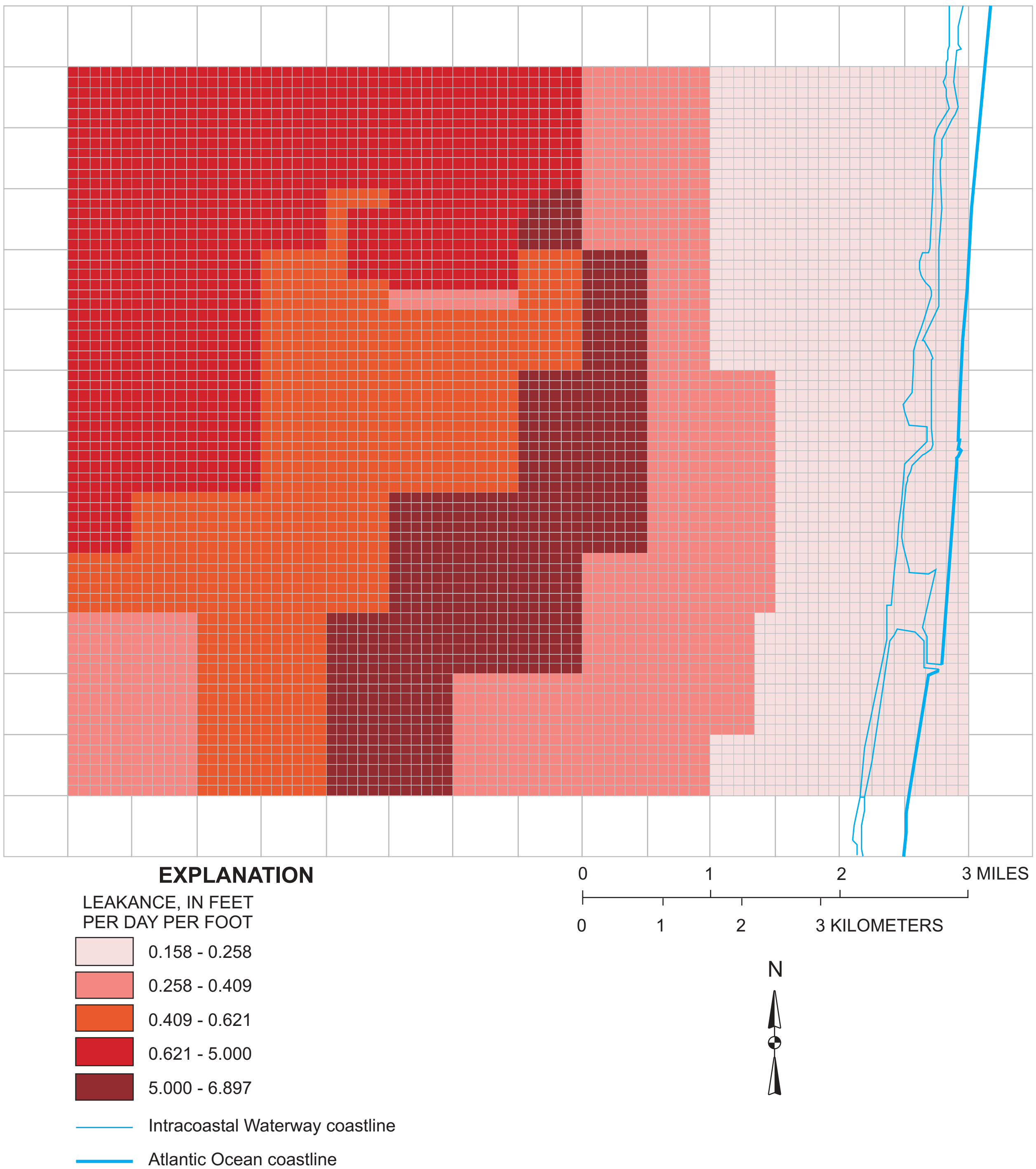

Figure 24. Leakance for layer 3, Boca Raton well field model.

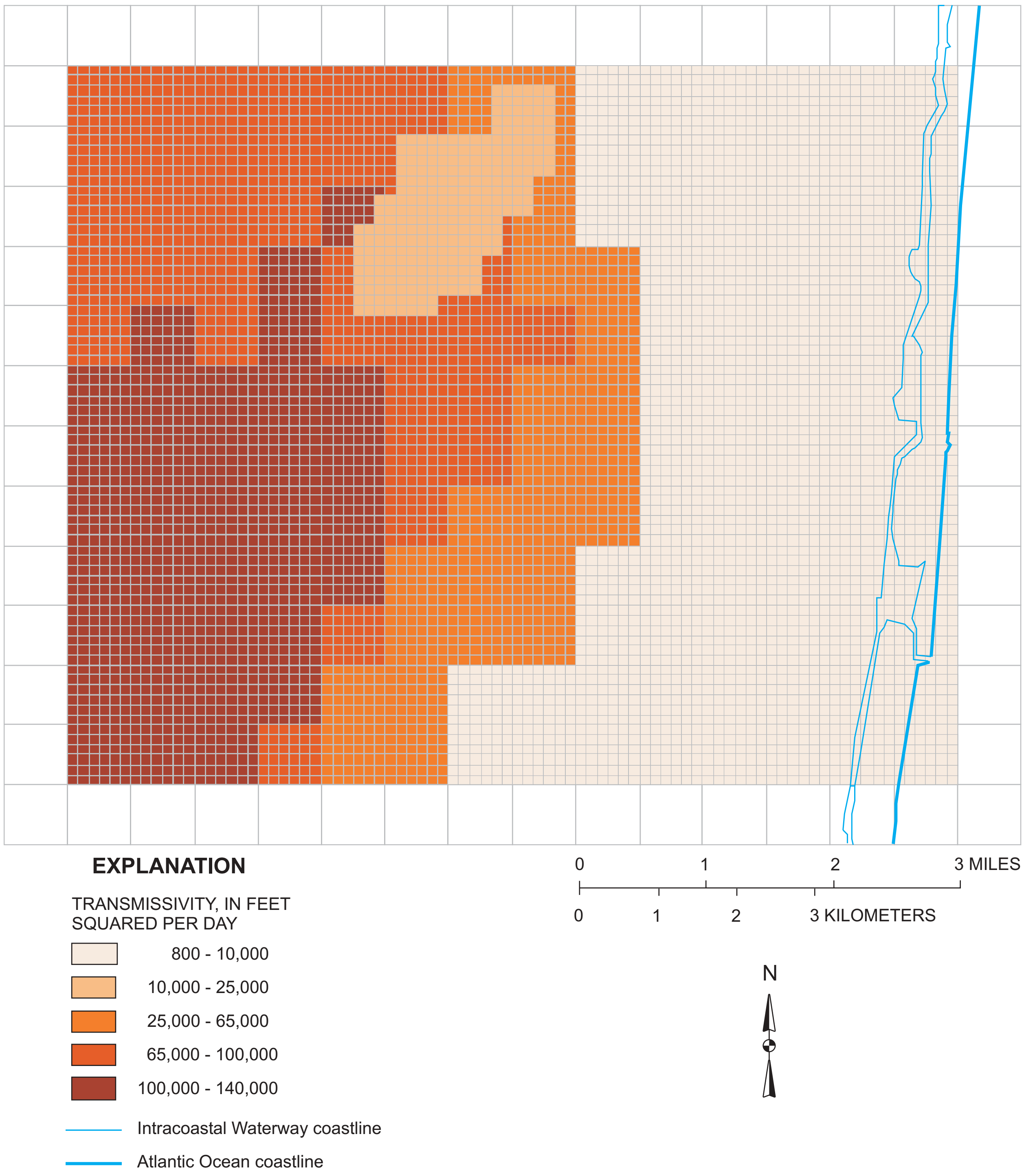

Figure 25. Transmissivity for layer 4, Boca Raton well field model.

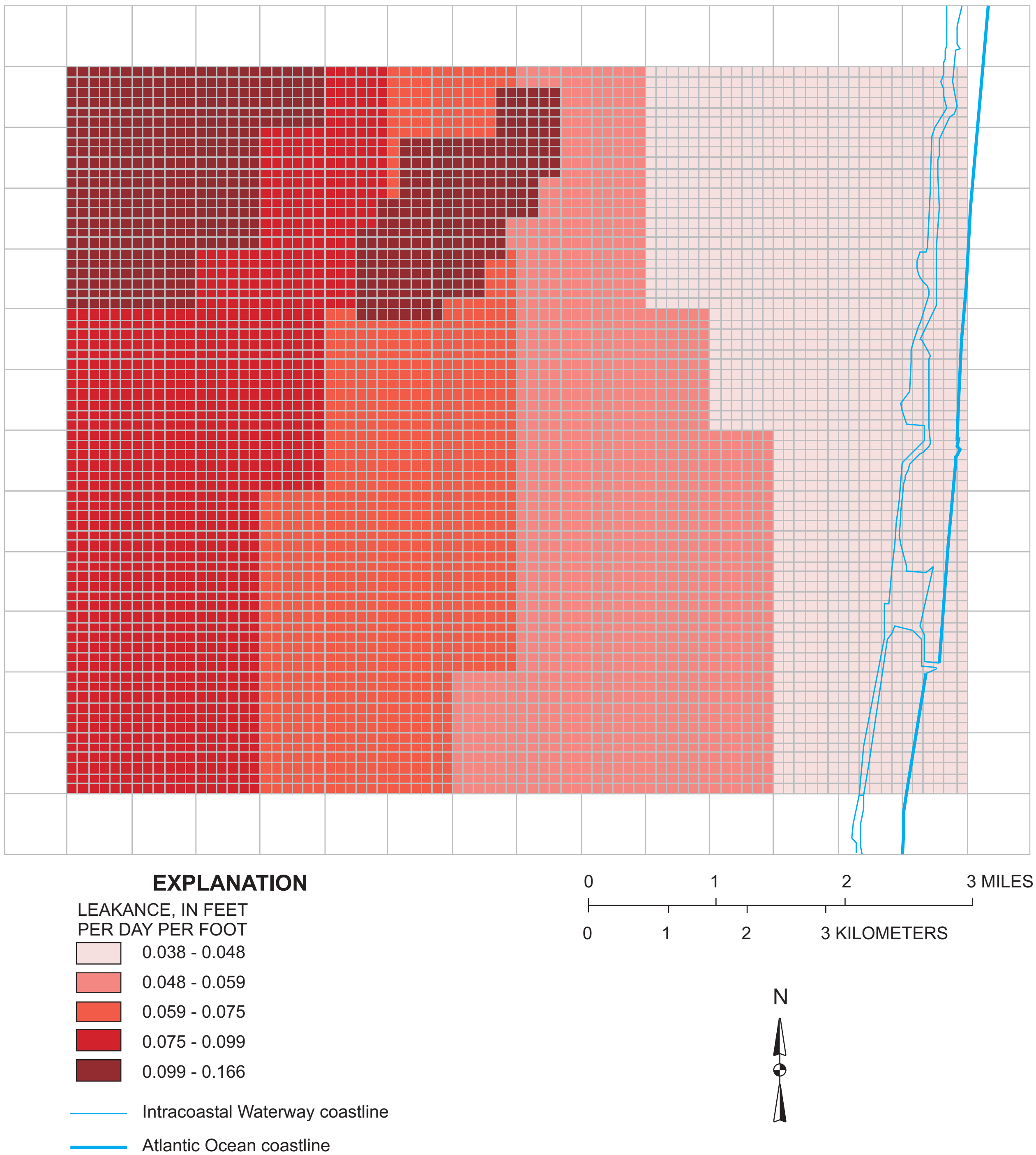

Figure 26. Leakance for layer 4, Boca Raton well field model.

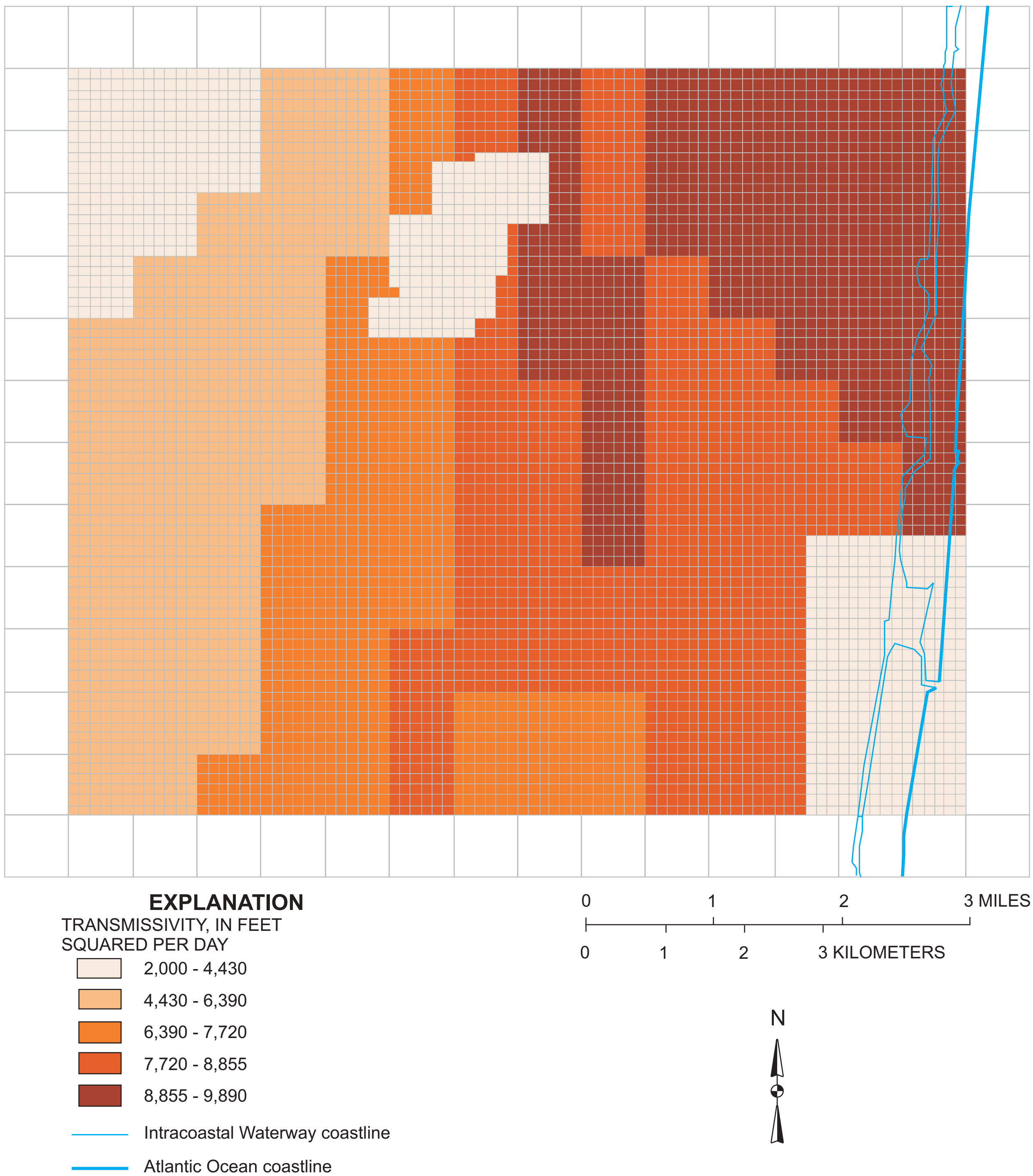

Figure 27. Transmissivity for layer 5, Boca Raton well field model.

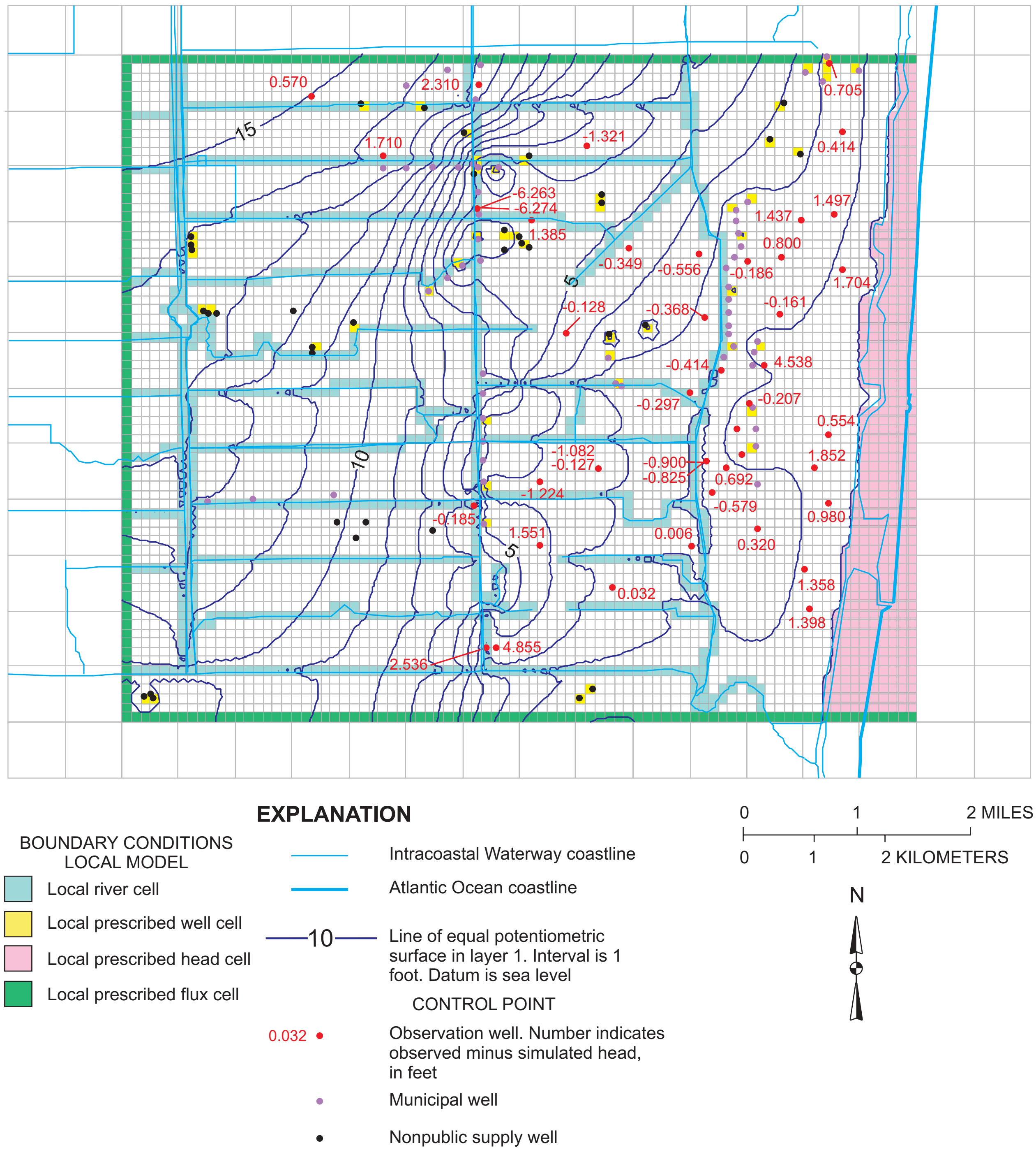

Figure 28. Simulated steady-state potentiometric surface and residual differences between simulated and observed water levels in the Boca Raton well field, average January 1989 to June 1990 conditions.

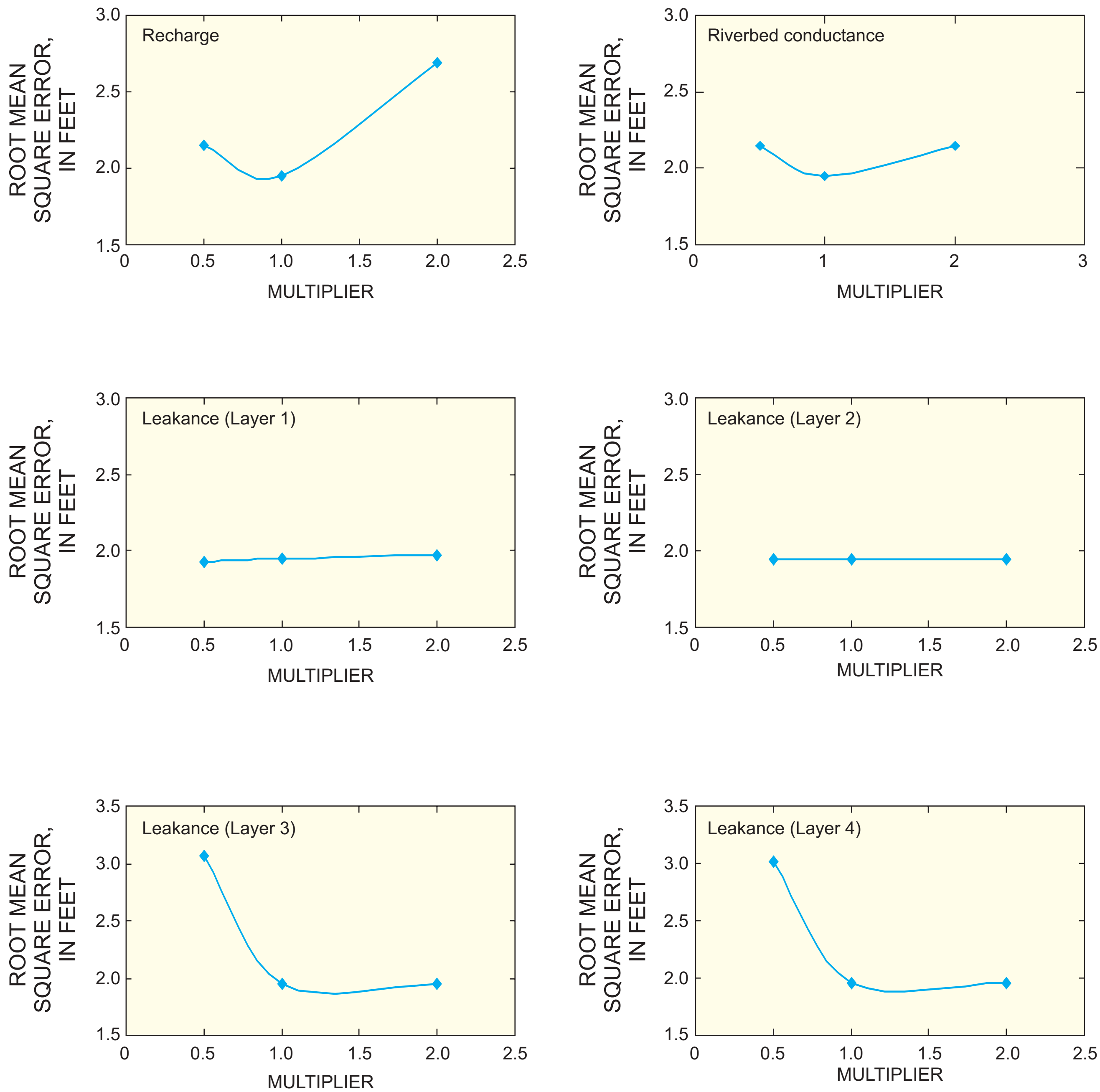

Figure 29. Sensitivity of the Boca Raton well field model to changes in selected model parameters.

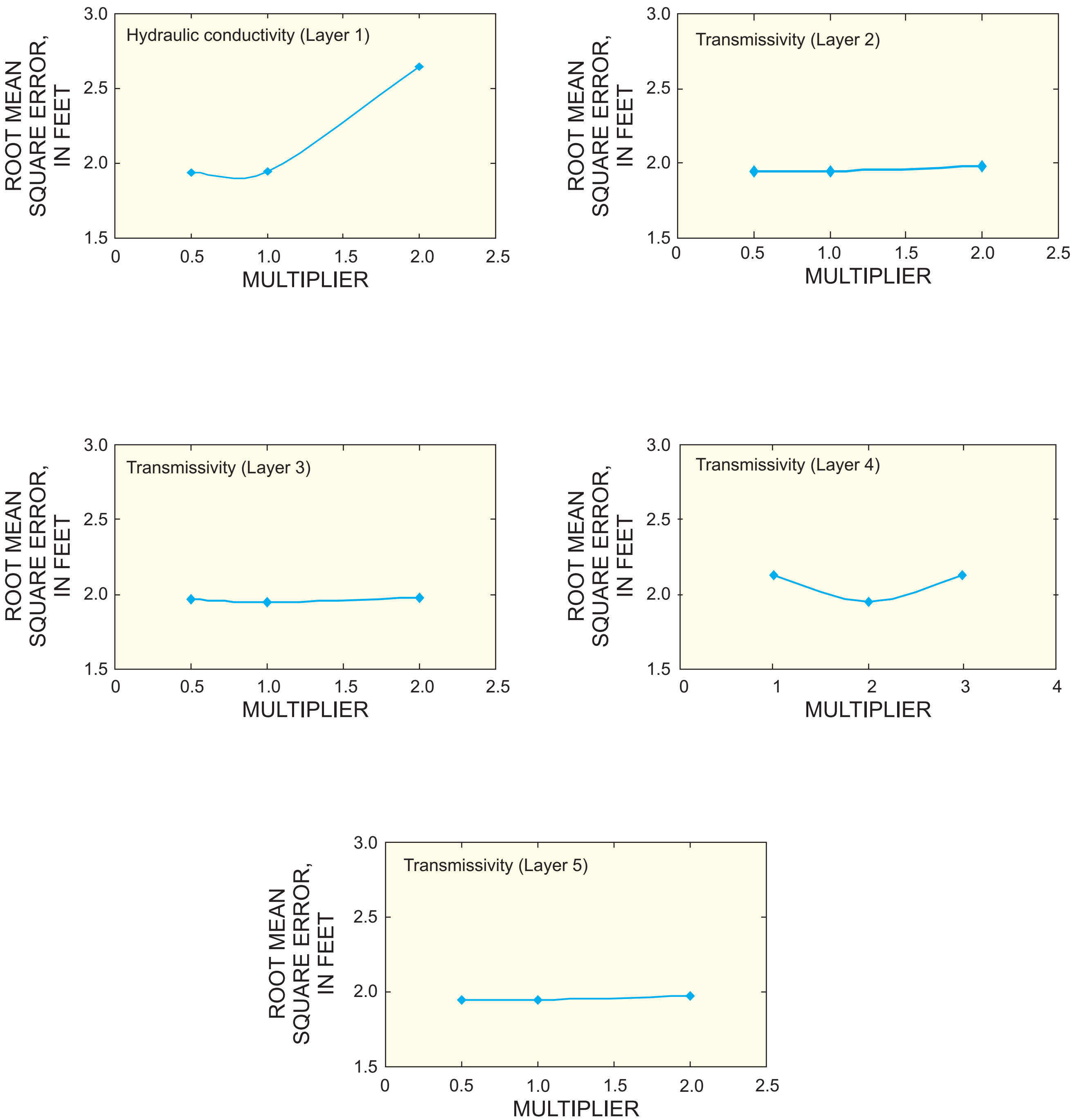

Figure 29. (Continued) Sensitivity of the Boca Raton well field model to changes in selected model parameters.

Table 3. Water budget for the Boca Raton embedded flow model

[Prescribed flux along the northern, western, and eastern boundaries. --, no data; <, less than the value]

Component	Boca Raton model		Zone budget	
	Percent	Inches	Percent	Inches
Inflow components				
Recharge	58	27.4	54	27.5
Prescribed-flux boundaries	10	.5	8.8	4.5
Coastal prescribed-head boundary	.2	.012	--	--
Head-dependent boundary	--	--	0	0
River (canal) leakage	29	14	34.6	17.6
Well recharge	2.8	1.3	2.6	1.3
Total	100.0	47.2	100.0	50.9
Outflow components				
Prescribed-flux boundaries	6.5	3.1	6	3.1
Coastal prescribed-head boundary	10.4	4.9	--	--
Coastal head-dependent boundary	--	--	10.8	5.5
Well discharge	55.9	26.4	51.3	26.2
Evapotranspiration	<.001	.001	.2	.1
River (canal) leakage	27.2	12.8	31.7	16
Total	100.0	47.2	100.0	50.9

Previous investigators, including Barlow (1989), Morrisey (1989), Reilly and Pollock (1993), and Orzol and Truini (1999), have evaluated physical factors that may influence the location, extent, and shape of the areas of contribution and zones of transport. These factors include the specific character of the physical hydrogeologic framework (permeability, porosity, saturated thickness, recharge from induced infiltration, well interference, and extent of the aquifer) and the anthropogenic stress on the hydrologic environment that causes changes in head, flow, and boundary conditions.

Analysis

A pathline analysis in which particles were permitted to travel until they encountered internal sinks, sources, or boundaries illustrates ground-water movement within the system (fig. 30). In this analysis, the average time of travel for such conditions was more than 22 years. Long-term pathlines to supply wells mostly extend to the west and northwest from supply wells. Contributing areas of recharge to the supply wells were defined where particles were back-tracked to the water table (fig. 31). Contributing areas generally conform to the same configuration illustrated by the pathline analysis and also extend to the north-west and west. Some particle endpoints are located along the edge of the model domain and intersect external boundaries; in these areas, contributing recharge areas for supply wells extend beyond the simulated area of the Boca Raton well field.

Zones of transport were delineated for several different Boca Raton municipal supply wells (figs. 32-34) assuming separate uniform distributions of 20, 30, and 40 percent porosity. Transport zones surrounding each major well field correspond to contoured areas that lie between 30-, 210-, and 500-day time-of-travel contours to a producing water-supply well.

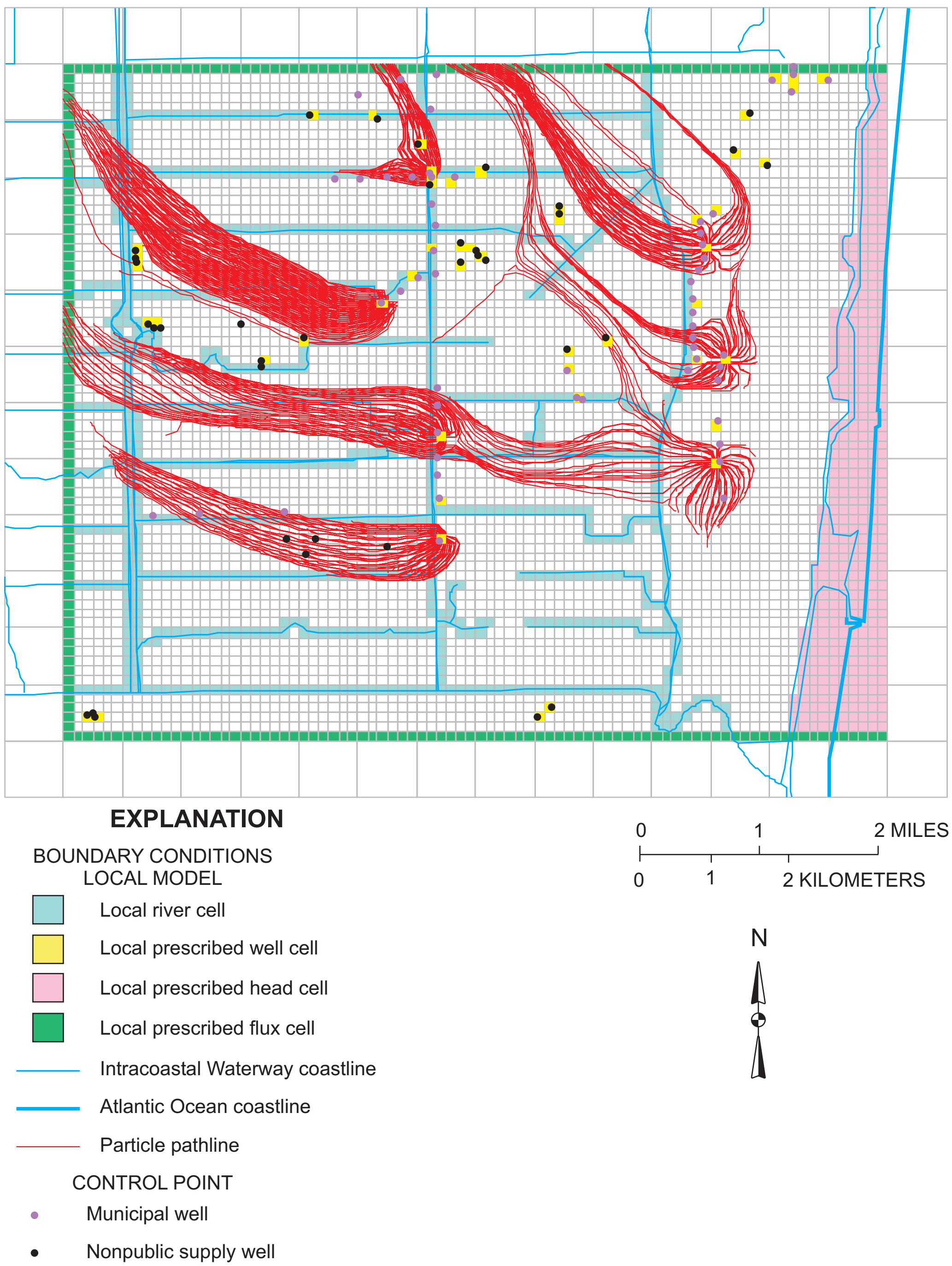

Figure 30. Boca Raton model domain showing backward-tracked particle pathlines from selected municipal supply wells in which particles were allowed to travel until encountering internal sinks, sources, or boundaries.

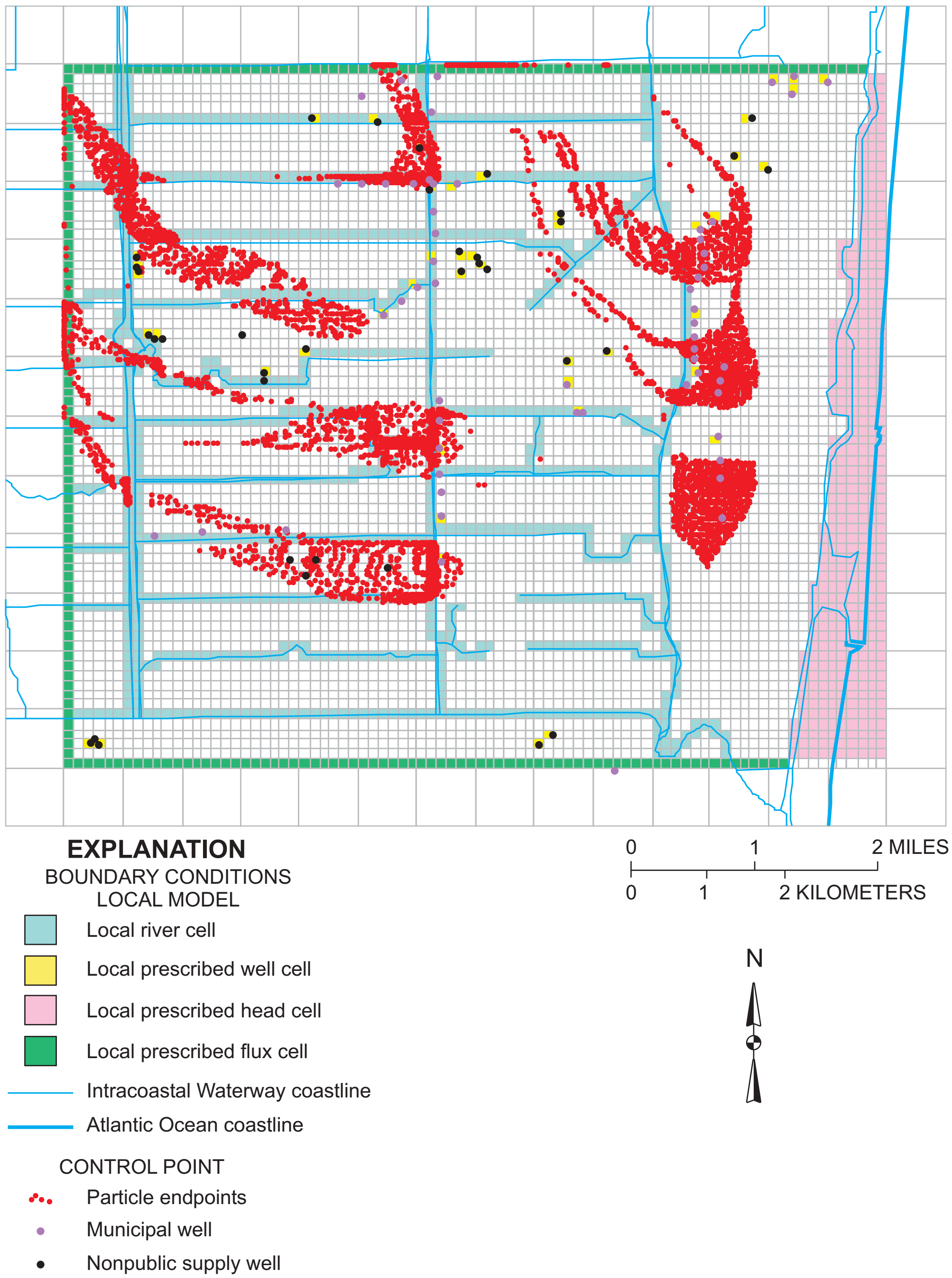

Figure 31. Boca Raton model domain with backward-tracked endpoint analysis showing contributing areas for selected municipal supply wells in which particles were allowed to travel until encountering internal sinks, sources, or boundaries.

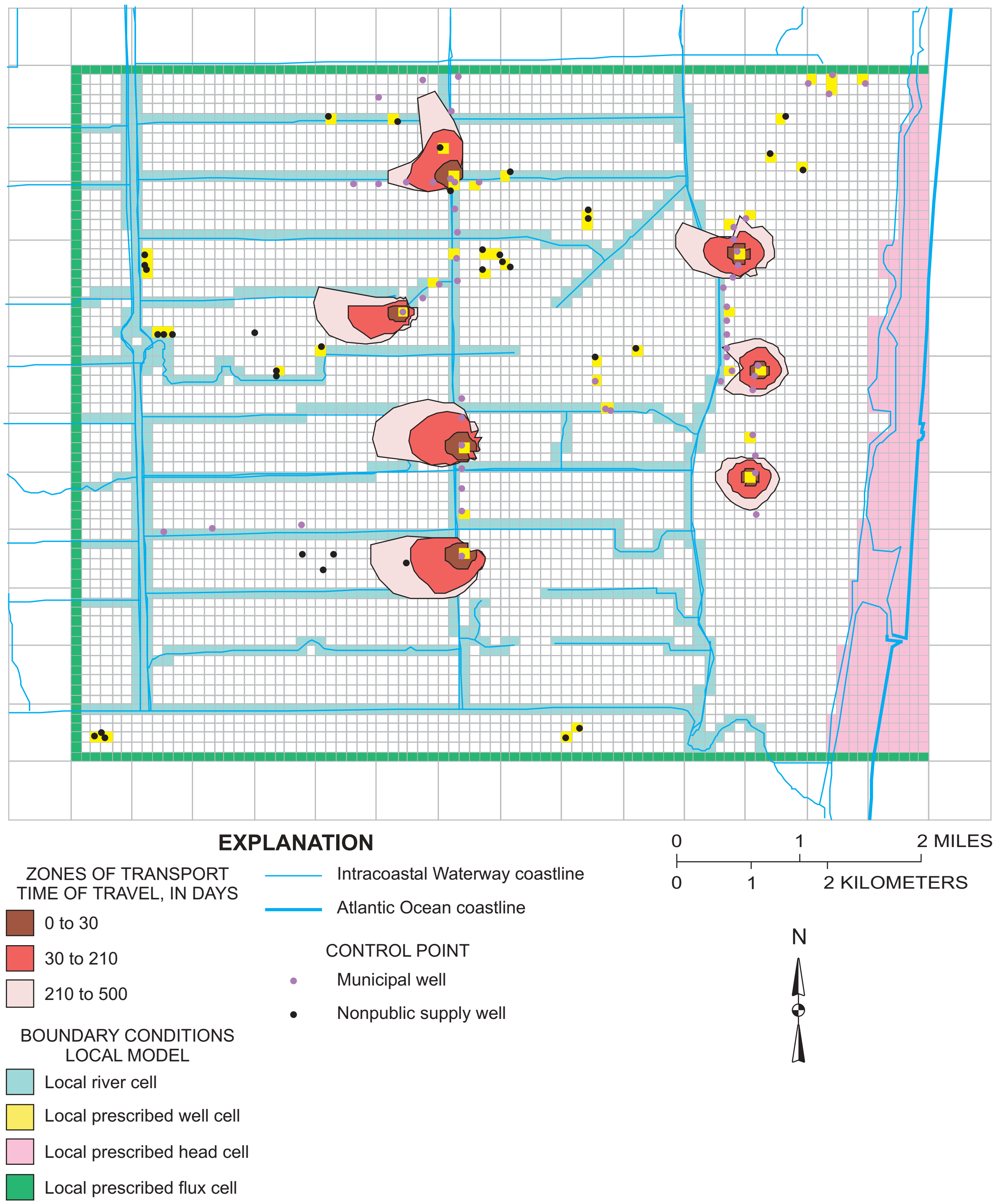

Figure 32. Zones of transport for selected municipal supply wells in the Boca Raton well field, assuming uniform porosity of 20 percent.

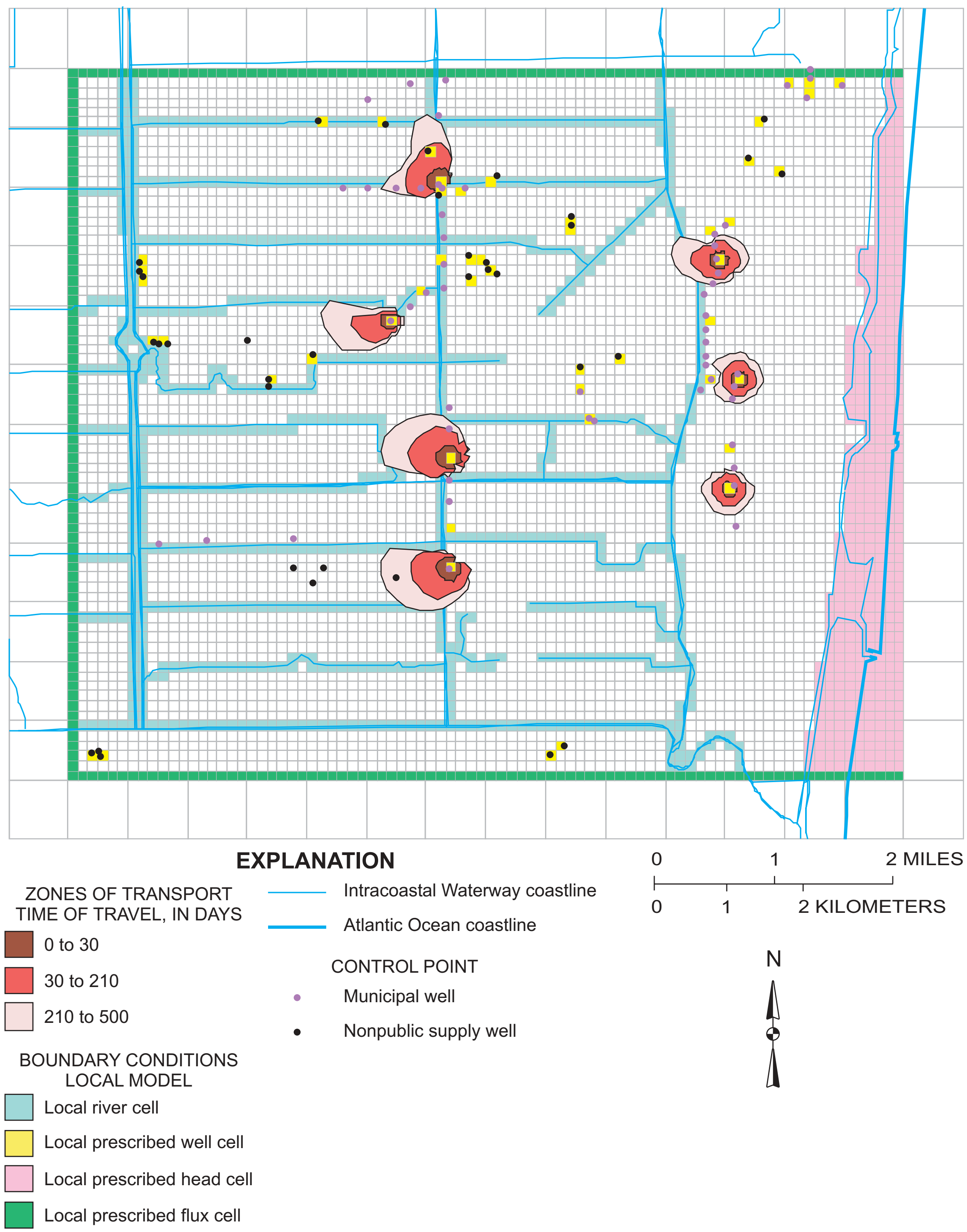

Figure 33. Zones of transport for selected municipal supply wells in the Boca Raton well field, assuming uniform porosity of 30 percent.

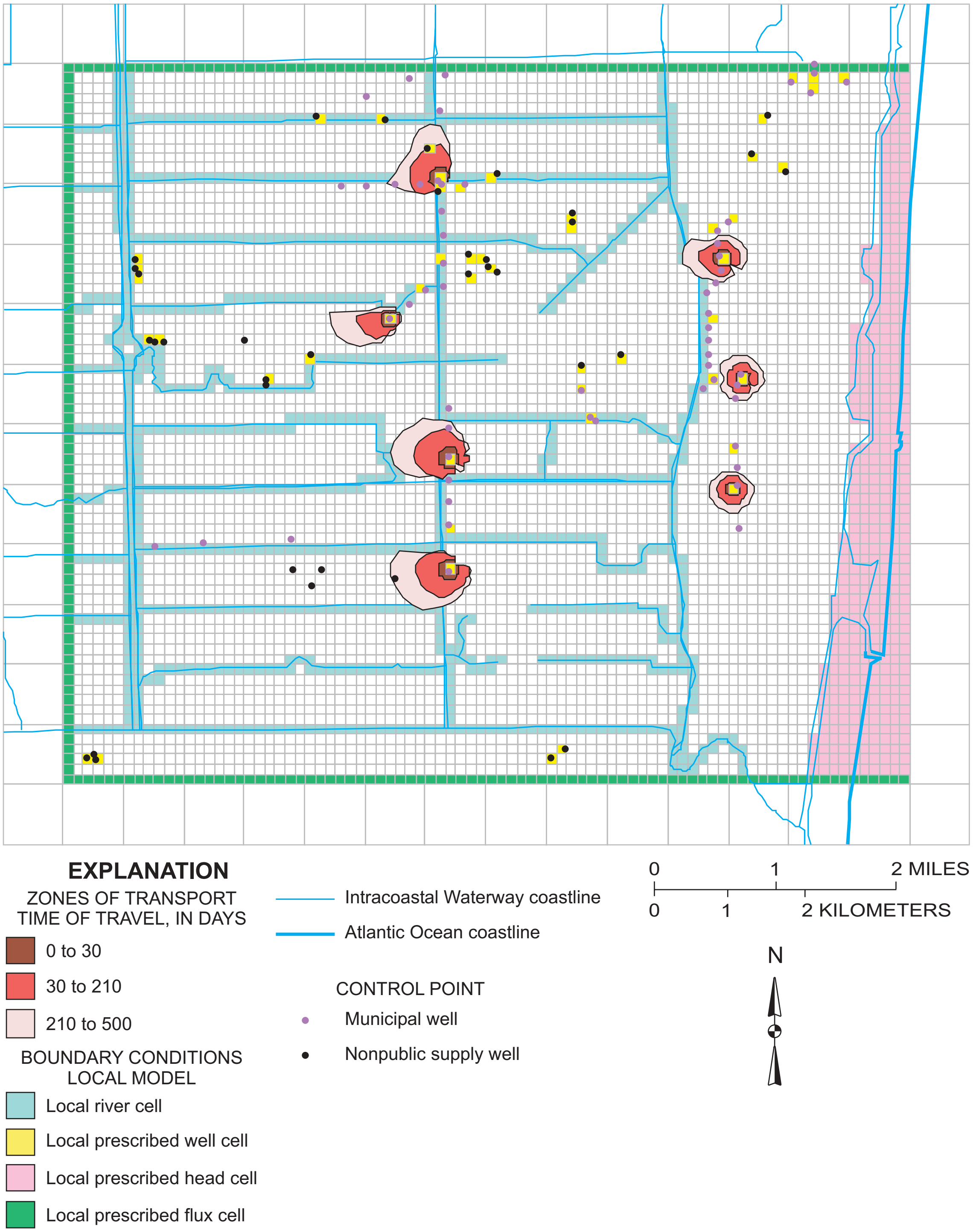

Figure 34. Zones of transport for selected municipal supply wells in the Boca Raton well field, assuming uniform porosity of 40 percent.

For purposes of this study, the effect of porosity on the location, extent, or shape of zone of transport was the only physical factor evaluated. Porosity estimates, a physical parameter used in particle tracking but not in flow simulation, partly determine particle velocity and the time of travel. Particle velocity will change, but flow paths remain unchanged. In general, particle velocity increases as porosity decreases. Where porosity is increased uniformly, the size and shape of individual zones-of-transport areas were shown to increase. The total area encompassed by individual zones of transport occurred where a 20 percent porosity was assumed. Conversely, zone-of-transport areas are smallest areally where a uniform 40 percent porosity was assumed.

Limitations

The embedded Boca Raton model uses steady-state, time-averaged, climatic conditions from January 1989 to June 1990 which were the conditions of the regional model calibration. The small-area model was not calibrated to transient conditions; thus, it cannot be used to evaluate a transient response to changes in hydrologic stress (such as an increase or a decrease in well-pumpage rates).The SFWMD model would require recalibration if it were deemed necessary to evaluate other stress scenarios within the embedded area.

Boundary conditions involve considerable simplification of the system and could greatly affect model results. For purposes of the embedded model, prescribed-head and prescribed-flux boundaries are considered valid for the January 1989 to June 1990 steady-state calibration period. The scope of this study did not include an adjustment of heads in offshore prescribed-head cells for salinity differences. Equivalent freshwater heads would be greater than mean monthly tidal stage. Therefore, the embedded model may not be properly calibrated near the coast.

A limitation of a small-area, embedded model is that it is ultimately constrained by the conceptual framework of a large-area model and how well the SFWMD model accurately reflects actual conditions. As the focus of this study was to develop a GUI to facilitate and expedite TMR, little effort was made to improve the conceptual framework. A calibrated, small-scale model will be more finely discretized, but may not depict realistic physical and hydrologic conditions.

Discharge rates for individual withdrawal wells were estimated because data could not be obtained. An additional limitation to the small-area embedded model could result from the observation wells available for calibration purposes. All but 4 of 41 observation wells were assigned to model layer 1 of the Boca Raton embedded model. Model layers 3 and 4 represent the Biscayne aquifer. In the Boca Raton well field area, however, no observation wells were completed in the section of the Biscayne aquifer assigned to model layer 3 and only one observation well was completed in the lower part of the aquifer (layer 4). Therefore, a calibrated model may not properly represent conditions within that horizon. The lack of observation well data could adversely affect the parameter values not directly connected to these layers.

Some parameters estimated during model calibration may be highly correlated; consequently, the set of calibrated parameter values may not be unique. For example, the model may respond nearly identically to either a decrease in recharge and an increase in hydraulic conductivity or an increase in recharge and a decrease in hydraulic conductivity. If a condition such as this were to exist, either recharge or hydraulic conductivity could be estimated by model calibration but not both--one parameter would have to be independently estimated and not adjusted during model calibration. Nonunique parameters pose a problem because model response may not be correct for stresses that differ from those used during model calibration (for example, an increase in well pumpage). However, it was beyond the scope of this study to investigate this possibility in more detail.

Limitations to the particle-tracking phase of the study and the analysis of zones of transport are those directly attributed to the Boca Raton embedded numerical flow model. Additionally, a transient model may better illustrate flow path variability that occurs in response to transient change in hydrologic conditions. The steady-state model described herein cannot be used to assess the transient development of pathlines or zones of transport.

An additional limitation is that particle tracking in an heterogeneous carbonate aquifer (Biscayne aquifer) containing cavernous and vuggy porosity or preferential flow zones may be of limited value. Ground-water flow in carbonate aquifers is broadly controlled by hydraulic gradient, but the actual flow paths are constrained by a rock fabric that has been subject to diagenetic alteration, dissolution, and tectonic stress (fractures). Numerical flow models in combination with particle tracking in karstic aquifers may be used to delineate a zone of transport or zone of contribution, but realistic field conditions are probably poorly represented.

SUMMARY

On the basis of a rapid rise in population and urban development in Palm Beach County, Fla., during the last decade, the demand for potable water is expected to increase 115 percent between 1990 and 2010. Increased demand on public-water supply has resulted in the installation of additional supply wells with an accompanying need to update the Palm Beach County wellhead protection model.

A TMR process was used to construct an embedded flow model and combined with particle tracking to delineate contributing areas to supply wells. Model input and output files were then coupled with a GIS. An embedded flow model of the Boca Raton well field was constructed using input and output file data from a preexisting large area, three-dimensional, calibrated MODFLOW ground-water flow model that simulated flow within the surficial aquifer system in Palm Beach County. An ArcView GUI for MODTMR was developed to accelerate the process to construct MODFLOW model input files. The ArcView GUI, AvHDRD, was prepared to process dynamically segmented canal coverage data and was used in the MODFLOW River package. A third ArcView GUI extension, AvWELL Refiner, was constructed to process well point coverage data for purposes of constructing MODFLOW Well package data sets.

Mean water levels between January 1988 and June 1990 were used to simulate steady-state flow in the Boca Raton well field. Simulation of steady-state ground-water flow within the embedded flow model of the Boca Raton well field shows that recharge (58 percent) is the major source of water to the system. Other large budget inflow components include river leakage (29 percent) and prescribed-flux boundaries (10 percent). Major outflow components are well discharge (55.9 percent), river leakage (27.2 percent), prescribed head (10.4 percent) and prescribed flux (6.5 percent) boundaries. Evapotranspiration represented less than 1 percent of the total outflow from the local system; this is attributed to regionally calibrated evapotranspiration parameters in which simulated head lies below the extinction depth.

The model appears most sensitive to reductions in the vertical conductivity of layers 3 and 4 (Biscayne aquifer) and increases in recharge rates and in the hydraulic conductivity of layer 1. The model is insensitive to changes in evapotranspiration; transmissivity in layers 2, 3, and 5; and variations in vertical conductivity in layers 1 and 2. Canal (river) leakance adjustments were made to locally improve calibration results in some areas.

Backward particle tracking was conducted using MODPATH to identify flow paths from selected municipal supply wells and for purposes of estimating time of travel. MODTOOLS was used to translate flow and particle-tracking model output to GIS and to map contributing recharge areas and zones of transport. A pathline analysis was conducted in which water particles were allowed to pass through weak sinks. Particle paths suggest that supply wells located in the central and western parts of the Boca Raton well field area are recharged, in part, by ground water that moves west and northwest. Coastal wells appear to be recharged by water that enters the system closer to the supply wells. Zones of transport for 30, 210, and 500 days were constructed using model output data and placed into a GIS. Sparse porosity data are available in the Boca Raton well field area. Porosity distributions were varied to evaluate the effect of this parameter on zones of transport. In general, a zone of transport for a supply well is greater in areal extent if a lower porosity estimate is assumed.

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APPENDIX I

Installation and Instructions for AvMODTMR, AvHDRD, and AvWELL Refiner

INSTALLATION AND INSTRUCTIONS FOR AvMODTMR

To install:

1. Create a folder for the AvMODTMR files and set an environment variable named "AVMODTMR" to its path, for example:

```
D:\modtmr\tmr-gui
```

2. Create a folder named "images" and another named "legends" in the folder created in step 1:

```
D:\modtmr\tmr-gui\images
D:\modtmr\tmr-gui\legends
```

3. Expand AvMODTMR zip file, and place the following files in the corresponding folders:

   avmodtmr.avx~`ESRI\AV_GIS30\ARCVIEW\EXT32\`
   water_banner1.gifin "images" folder
   fhb.avl, locgrid.avl, reggrid.avlin "legends" folder

4. Create a file named avmodtmr.ini (or change the one provided in the AvMODTMR zip file) so it contains one line for each of the paths to: the legends, the images and the MODTMR executable (modtmr.exe) file in the following format:

```
theLegendPath=D:\modtmr\tmr-gui\avmodtmracc\legends
theImagePath=D:\modtmr\tmr-gui\avmodtmracc\images
theExePath=D:\modtmr\tmrprogs
```

   Place the avmodtmr.ini file in the folder indicated by the AVMODTMR environment variable.

General information:

1. ArcView version 3.2 is required to run AvMODTMR.

2. AvMODTMR can be used to create input files for use with the USGS MODTMR program.

3. The regional grid must be in an ArcView shapefile format. A MODFLOW grid named "reg_grid_pol" in ArcView shapefile format is provided in the sample dataset in this CD[1] in the "covers" folder under "data." A MODFLOW grid *coverage* (in ArcInfo format) can be converted to an ArcView shapefile by adding the coverage as a theme in ArcView and saving it as a shapefile, using the "Theme" > "Convert to Shapefile…" menu choice. The Column, Row, and Seqnum fields must be integers and they must be named, respectively, "Col," "Row," and "Seqnum." Seqnum is the sequential number of cells (of layer 1), starting with number 1 at row 1, column 1, incrementing by one while moving along the columns in the first row, and continuing the same sequence for each successive row until reaching the last column of the last row.

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[1]The CD containing the dataset and executable files is available upon request from the Miami Subdistrict office (U.S. Geological Survey, 9100 N.W. 36th Street, Suite 107, Miami, FL 33178). For further information, call (305) 717-5800.

4. The regional ground-water flow simulation must have been completed using MODFLOW-96 as specified in *Leake, S.A., and Claar, D.V., 1999, Procedures and Computer Programs for Telescopic Mesh Refinement, USGS/OFR 99-238*. Additionally, the cell-by-cell flow and the heads files must use the file extensions “.cbc” and “.hed”, respectively. A MODFLOW regional ground-water flow simulation is provided in the sample dataset of this CD in the “data” folder under “models”.

5. MODTMR allows for vertical rediscretization of layers in the input file, but AvMODTMR does not provide for manipulation of bottom elevations for the local model. However, if needed, you may be able to import the local model input datasets created by MODTMR into a MODFLOW preprocessing software package to modify the layer elevations.

6. MODTMR allows for different distance units to be used for the local model. However, AvMODTMR requires that the distance units for the local model be the same as for the regional model. Because GIS requires the use of a single map projection for both the regional and local model grids, it follows that the distance units should be the same for both grids. This is not a restriction, but rather a safeguard.

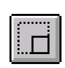
To run:

1. Start ArcView. Open an existing project or create a new one.

2. Click on “File” > “Extensions...” to open the “Extensions” window. Load the extension named “ArcView MODTMR Extension” by selecting it so that a check mark appears next to the name.

3. Go to the project window and select an existing view or create a new one. (Make sure “Views” is the selected object in the vertical scroll bar of the project window). To open an existing view, select it in the project window and click “Open.” To create a new View, click on the “New” button.

4. With a View window active, go to the button bar and press the AvMODTMR launch button:

   If the ArcView project has not been saved, a prompt will appear requiring to do so.

5. A prompt will immediately appear to locate the Regional Grid, which is a polygon theme of the regional model grid (see item 1 under “General Information” above). Browse to the location of the regional grid theme and select it. The regional model grid theme will appear on the View, and the AvMODTMR dialog will open. The remaining steps refer to the AvMODTMR dialog unless they specify otherwise.

6. Load the regional simulation name file by clicking on the "BROWSE..." button next to the “Regional Model Name” text box at the top of the dialog box. Browse to the location of the name file (*.nam). Basic information about the regional model will be posted in the area labeled “REGIONAL MODEL” in the top part of the dialog.

7. In the “LOCAL MODEL” area of the dialog, enter a name for the local simulation, enter a unit number on which to process the FHB package, and select the “All Packages” option (if creating all of the different MODFLOW input files for the local model). Then select the Time Units for the local model (years, days, hours, minutes, or seconds).

8. Create the local grid theme. The user may choose from either of two methods to create the local grid theme. If using the “Create Local Grid” method, the user must have all of the following parameters cited below to define the local grid. Click the “Create Local Grid…” button to bring up the “Defining Local Grid” dialog, and enter values in the respective boxes:

   a. X and Y coordinates of the grid origin (extreme corner of row 1, column 1 cell),
   b. Rotation angle about the grid origin,
   c. Number of rows,
   d. Row height,
   e. Number of columns,
   f. Column width.
   g. Clicking on the “Preview” button will draw an outline of the local grid under the current settings. Adjust the values if desired and click on “Apply” or “OK” to create the local grid.

   The second method to create the local grid is to use the “Local Grid Wizard” to define the local grid graphically:

   a. Click on the “Local Grid Wizard” button to bring up the “Local Grid Wizard” dialog.

   b. Click on the "Draw Study Area" tool. Go to the view, and digitize a study area polygon, which bounds the area of interest for the local model. The “Delete” button can be used to delete the study area polygon and start over. Use the “Move”/“Reshape” buttons to adjust the location/shape of the study area polygon, if desired.

   c. The slope of the orientation line will be used to align the local model grid. Click on the "Draw Rotation" tool. Return to the view and draw a rotation line for indicating the direction for orienting the local grid. This is done by clicking once in the "upstream" side of the study area polygon, and then a second time on the "downstream" side. The “Delete” button can be used to delete the rotation line and start over. The alignment of the rotation line can be changed with the “Adjust Rotation” tool by moving its endpoints to new locations.

   d. Enter values in the "Row Size" and "Column Size" boxes. The extent of the local grid may be previewed by clicking on the “Preview” button. Click “OK” to create the local grid, and enter a name for the local grid at the prompt. The local grid will then be created and added to the View.

   Creating the local grid may take several minutes, depending on the number of cells and on the computer being used.

   Regardless of the method used to create the local grid, the FHB theme (which contains the user-defined boundary conditions for the vertical faces of the local grid) will also be created and added to the View. By default, all of the boundary conditions will be initially set to specified flow and will appear blue. The user will be allowed to specify the boundary conditions in step 10.

   Once you have created the local grid theme, you can modify it (its orientation, origin location, as well as the number and size of the rows and columns), by clicking on the “Modify Local Grid…” button that now appears in place of the “Create Local Grid…” button. The local grid may also be deleted by clicking on the “Delete Local Grid” button and then recreated by either of the two methods described above. Modifying the width and/or height of the local grid will result in the boundary conditions being reset to the default value of specified flow (see step 10 below); the only modifications to the local grid that allow the set boundary conditions to remain are rotation and translation.

9. Select the layers to be used. Only use this if the local model vertical domain is to differ from that of the regional model (that is, a subset of the regional model layers will be used in the local model). Click on the “Which Layers To Use…” button to open the “Select Layers to Use” window. To change the layers being used, click and drag to select them. Register your selection by clicking “Apply” or “OK” to close the window as well.

10. Designate the boundary conditions (BCs) for the local model. Click on the "Set Layer BCs…" button. The “Set Layer Boundary Conditions” window will appear. By default, all boundary conditions are initially set to specified flow. They are shown in blue in the view, whereas specified head cells are displayed in red. Use the "Specified Head" or "Specified Flow" tools to change the boundary conditions for the desired layers. Follow these steps to change the BCs for <u>each layer</u>:

    a. Select the layer on the list box.
    b. Choose the tool of the desired BC: either specified flow or specified head.
    c. Apply the tool onto the view over the cells to be changed. Clicking on a single cell will change its BC. To change the BC of multiple adjacent cells, click-and-drag a rectangle with the pointer: all the underlying cells will take on the value of the selected tool.
    d. Repeat for all desired layers.
    e. Click on “OK” button to dismiss the window. Respond “Yes” to confirmation pop-up window to save your changes.

11. Create the MODTMR input file by clicking on the "Build MODTMR Input File." Save it in the same directory as the regional MODFLOW model data set. A window will appear showing the contents of the MODTMR input file. Click on “OK” to dismiss it. A second pop-up window will prompt you to save the file to disk. Hit “Yes” if you wish to save it and indicate the location. Inspect the contents of the file for adherence to the MODTMR input file requirements.

12. Open a DOS window and run MODTMR with the MODTMR input file created in step 11. The MODFLOW dataset for the local simulation will be created.

INSTALLATION AND INSTRUCTIONS FOR AvHDRD

To install:

Copy the file AvHDRD.avx into the Ext32 folder of the ArcView installation directory (usually C:\ESRI\AV_GIS30\ARCVIEW\EXT32\).

General information:

1. ArcView version 3.2 is required to run AvHDRD.

2. AvHDRD can be used to create River and Drain input files for use with the USGS MODFLOW program.

3. AvHDRD can be used only for steady-state conditions.

4. All rivers and drains are assumed to be in the top model layer (that is, no penetration into the second layer).

5. A MODFLOW-96 data set output from MODTMR containing a River and/or Drain input file.

6. A dynamically segmented GIS dataset of the area being modeled is required consisting of a route coverage (representing the river and/or drain hydrographic features) along with related tables ("event" tables for each of the conductance properties). A sample dataset is provided in this CD (available upon request from the USGS Miami Subdistrict office) in the folder "data." A route coverage named "Canals" is located in the "covers" folder, and an event table for each conductance property is located in the "tables" folder.

7. A MODFLOW grid in ArcView shapefile format is required. A MODFLOW grid in ArcView shapefile format is provided in the sample dataset in the "covers" folder under "data." A MODFLOW grid *coverage* (in ArcInfo format) can be converted to an ArcView shapefile by adding the coverage as a theme in ArcView and saving it as a shapefile, using the "Theme" > "Convert to Shapefile…" menu choice. The Column and Row fields must be integers and they must be named "Col" and "Row," respectively.

8. The files created contain conductance values computed from the event tables overlaid with the local grid indicated by the user. Thus, the conductance values in the input files created by this program may not be consistent with those from the calibrated regional model from which MODTMR created the original River and/or Drain input files.

9. The names of the value fields contained in the conductance property event tables are hard coded, and they must be named as follows: Bottom Elevation: "Botel;" Bottom Width: "Botwid;" Sediment Thickness: "Thick;" Sediment Hydraulic Conductivity: "K;" Classification of Rivers/Drains: "classify;" Stage: "Stage" (only for River input files). All fields are numeric, with the exception of "classify," which is alphanumeric. Use a value of "RIVER" for rivers, and "DRAIN" for drains in the "classify" field.

10. Any existing River or Drain input files with the same root name located in the root directory will be overwritten. In order to preserve an existing file, create a duplicate with a different name, or copy it to another location. The original files should not be deleted or renamed so that the header information can be duplicated in the files output by AvHDRD.

11. Any reaches for which data were missing will be assigned conductance values of - 9999. Also, in the "comments" field in the table, a comment will be written in the input file (following a “#” character) indicating which parameter had missing data and over what interval. If the "Write package file" option is used, these values of -9999 will be written to the river or drain input file.

To run:

1. Start ArcView and add the AvHDRD extension to the project. Choose “Extensions…” from the File menu and check on the AvHDRD extension.

2. Add the route coverage as a theme to a View.

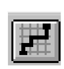
3. Add the local grid theme into the View.

4. Add the **event tables** for the various conductance properties to the ArcView Project. The event tables in the sample dataset consist of: botel.dbf (bottom elevation); botwid.dbf (bottom width); classify.dbf (classifies features into rivers or drains); sed_k.dbf (sediment hydraulic conductivity); thick.dbf (sediment thickness); and stage.dbf (stage for rivers).

5. Add each event table to the View as an **event theme**. For each event table:

   a. Open the "Add Event Theme" window. Click on “View” > “Add Event Theme...”
   b. Click on the second button at the top of the window (the one that looks like a ruler).
   c. Select the Route theme and the Route field. In the sample dataset the Route field is "Name,"
   d. Choose either “points” or “lines” (choose points for those events where the property varies linearly from one point to the next, and lines for those events where the property is constant throughout entire intervals).
   e. Select the event table, the “Event field” in the table. In the sample dataset, the Event field is “Name.”
   f. Select location field(s). For “points,” set the "Location field" to be “Measure”; for the linear events, set the "From field" to be “Measure” and leave the “To field” as “<None>”.

6. Open the "Head Dependent River & Drain Package Writer" dialog by clicking on “River or Drain...” from the “MODTMR” menu, or by clicking on the AvRDHD launch button:



   The remaining steps refer to the "Head Dependent River & Drain Package Writer" dialog.

7. Load the name file by clicking on the "BROWSE..." button and browse to the location of the name file (*.nam). The path to files and the root name for the simulation will be automatically entered in the “Path to files” and “Root Name” text boxes, respectively.

8. Select the “Grid Theme” and “Route Theme” in their respective list boxes near the upper right corner of the dialog.

9. Enter a minimum segment length. A segment is defined as a portion of a reach over which all parameters are either constant or vary linearly. However, when conductance property locations are too close to one another, it is practical to consider them to be at the same position. The minimum segment length is used as a criterion to identify these cases so that a new segment is not created. Care must be taken when two sample points very close to one another are purposely used to represent abrupt changes in a parameter. For example, the bottom width of a man-made channel can change in a very short distance. If this exists in the dataset, an amount smaller than this should be used as the minimum segment length.

10. In the area of the dialog entitled "Event Tables," indicate each property by choosing the appropriate event table.

11. In the "Select package" area of the dialog, select either "River" or "Drain." The unit number for writing cell-by-cell flow terms (as indicated in the original River or Drain file) will be automatically copied to the adjacent text box, under "CBC Unit No."

12. Check the "Write package file" checkbox to create the package file on disk.

13. Click on "Process" to finish. A package event table will be created for the selected package and added as a theme to your view. The package event table will be named like the root name of the simulation, with "_riv" or "_drn" appended, and it contains the data required by the package. If the user has checked the option "Write package file," a fixed-format ASCII input file will be created in the folder indicated by the "Path to files" and named like the root name of the simulation. Comments are inserted at the end of each line, indicating the canal name and the "from" and "to" locations along the canal for each reach.

INSTALLATION AND INSTRUCTIONS FOR AvWELL Refiner

To install:

Copy the file AvWell.avx into the Ext32 folder of the ArcView installation directory (usually C:\ESRI\AV_GIS30\ARCVIEW\EXT32\).

General information:

1. ArcView version 3.2 is required to run AvWELL Refiner.

2. AvWELL Refiner can be used to create well input files for use with the USGS MODFLOW program.

3. Requirements are a point theme of the wells in the model area with a *Well_name* or *Well_id* field, a *Layer* field containing the layer where each well pumps (the user must split up the pumpage among the layers for any wells that pump from multiple layers), and one *Pumpage* field for each stress period in the simulation containing the pumpage rate for each well.

4. A MODFLOW grid in ArcView shapefile format is required. A MODFLOW grid in ArcView shapefile format is provided in the sample dataset in the “covers” folder under “data.” A MODFLOW grid *coverage* (in ArcInfo format) can be converted to an ArcView shapefile by adding the coverage as a theme in ArcView and saving it as a shapefile, using the “Theme” > “Convert to Shapefile…” menu choice. **The Column and Row fields must be integers, and they must be named “Col” and “Row,” respectively.**

5. A MODFLOW-96 local simulation output by MODTMR is needed to improve the spatial accuracy of the wells in the WEL file.

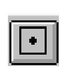
6. If an existing well input file with the same root name is located in the root directory it will be overwritten. In order to preserve an existing file, create a duplicate with a different name, or copy it to another location. The original files should not be deleted or renamed so that AvWell can duplicate the header information in the well input file.

To run:

1. Start ArcView and add the AvWELL extension to the project. Choose “Extensions…” from the File menu and check on the AvWELL extension.

2. Add the well point theme and the model grid theme.

3. Open the "MODTMR Well Refiner" dialog by clicking on “Well Refiner...” from the “MODTMR” menu, or by clicking on the AvWELL launch button:



The remaining steps refer to the "MODTMR Well Refiner" dialog.

4. On the dialog, click on the "Browse…" button next to the "Root Name:" text box and browse to and select thePF*am*). The path to files and the number of stress periods (NPER) will be read from the BAS file and posted on the dialog.

5. Select the Well Theme. A set of windows will open prompting for a well name (or well ID) field, a layer field and one pumpage field for each stress period.

6. In the "Grid theme" list box, select the model grid theme.

7. (Optional) Use the navigate buttons on the form to inspect the well data (*Note: to add/change/ delete wells, use ArcView's feature editing capabilities to modify the well theme*).

8. Click on the "Write File" button to create the well file.

APPENDIX II

Documentation of AvMODTMR Avenue Scripts

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                AvMODTMR.BuildBCTArrays          *************
'******************************************************************************
'**                         Language: ArcView Avenue                         **
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                  Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                        FAX: (305) 717-5801
'*   9100 NW 36th St., Suite 109
'*   Miami, Florida 33178 USA                      Internet: rdpatter@usgs.gov
'*
'*============================================================================
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*
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'          connection therewith.
'*
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Locates the Local Grid in the View and gets the LML dictionary
' from its object tag.  Reads the LML dictionary and creates the FHB Field List
' from the positions of the 0's and 1's (i.e. if at position 3 there's a 1,
' then the field "FHB_L3" is added to the list).  Then, it creates query
' strings for each of the four faces of the local model ('Col = 1' for the
' First Col or FCBCT Array, 'Row = NROW2' for the Last Row or LRBCT Array,
' etc...).  An outer loop constructs each BCT Array by selecting the cells that
' satisfy the query,with an inner loop looking up the values for each of the
' fields in the FHB Field List.  While constructing the current BCT Array, when
' the current line hits 80 characters (or when it reaches the length of the
' Array Size) a New Line chr is inserted to begin a new line. At end of inner
' loop a check is made to see if the current Array, is a constant array; if it
' is, the array is replaced by "CONSTANT i", where i is 0 or 1. After the inner
' loop, the current BCT Array is appended to theBCTArray.
'
'12345678901234567890123456789012345678901234567890123456789012345678901234567 8


'get arguments sent:
theView = SELF.Get(0)

theBCTArray = ""

'Locate the Local grid theme and it's BCT theme:
theLocGridTheme = av.Run("AvMODTMR.GetGridTheme", {theView, "L"})
theLocParamList = theLocGridTheme.GetObjectTag
theBCTFTheme = theLocParamList.Get(1)
theBCTFTab = theBCTFTheme.GetFTab

'grab the LML dictionary from the loc theme's obj tag:
theLMLDict = theLocGridTheme.GetObjectTag.Get(5)
```

```
'Create the BCT Field List
theBCTFieldList = List.Make
for each n in theLMLDict.ReturnKeys
  theFlag = theLMLDict.Get(n)
  if (theFlag = 1) then
    theFieldName = "FHB_L"+n.AsString
    theBCTFieldList.Add(theFieldName)
  end
end
'Create the BCT Array Query String Dictionary:
theBCTArrayQStringDict = Dictionary.Make(10)
theBCTArrayQStringDict.Add(1, "([Col] = 1)")
NCOL2 = theLocParamList.Get(7).AsNumber
theBCTArrayQStringDict.Add(2, "([Col] = "+NCOL2.AsString+" )")
theBCTArrayQStringDict.Add(3, "([Row] = 1)")
NROW2 = theLocParamList.Get(6).AsNumber
theBCTArrayQStringDict.Add(4, "([Row] = "+NROW2.AsString+" )")

'Create BCT Array Dictionary (empty, to be filled below):
for each n in theBCTArrayQStringDict.ReturnKeys
  aBCTArrayString = ""

  'set array size for BCTArray:
  theArraySize = Nil
  if ((n = 1) or (n = 2)) then
    theArraySize = NROW2
  elseif ((n = 3) or (n = 4)) then
    theArraySize = NCOL2
  end

  'Query the table to select only the current face for processing:
  theBCTFTheme.ClearSelection
  theQString = theBCTArrayQStringDict.Get(n)
  theBCTFTab.Query(theQString, theBCTFTab.GetSelection, #VTAB_SELTYPE_NEW)
  theBCTFTab.UpdateSelection

  'Process the entire face, one field at a time, to create the BCT array
  'for this face:
  theValueList = List.Make
  Fcount = 0
  for each aFieldName in theBCTFieldList
    aField = theBCTFTab.FindField(aFieldName)
    Fcount = Fcount + 1
    charCounter = 0
    for each  rec in theBCTFTab.GetSelection
      theValue = theBCTFTab.ReturnValue(aField, rec)
      aBCTArrayString = aBCTArrayString + theValue.AsString
      charCounter = charCounter + 1
      if (((charCounter.Mod(theArraySize) = 0) and
              (Fcount <= (theBCTFieldList.Count - 1))) or
                               (charCounter.Mod(80) = 0)) then
        aBCTArrayString = aBCTArrayString + NL
      end
      theValueList.Add(theValue)
    end
  end

  'test if min = max; if yes, array is constant, else, create header and append
  'to beginnig of BCTArrayString:
  theValueList.Sort(TRUE)
  MinValue = theValueList.Get(0)
  MaxValue = theValueList.Get(theValueList.Count - 1)
```

```
  if (MinValue = MaxValue) then
    aBCTArrayString = "CONSTANT "+MaxValue.AsString
  else  'create a header for the array:
    theArrayHeader = "INTERNAL 1 ("+theArraySize.AsString+"I1) 8"
    aBCTArrayString = theArrayHeader + NL + aBCTArrayString
  end

  'append to theBCTArray:
  if (theBCTArray = "") then
    theBCTArray = aBCTArrayString
  else
    theBCTArray = theBCTArray+NL+aBCTArrayString
  end

  'go on to process next face,

end

theBCTFTheme.ClearSelection

Return theBCTArray
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                AvMODTMR.ChangeFHBFlag              *************
'******************************************************************************
'**                         Language: ArcView Avenue                         **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                  Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                        FAX: (305) 717-5801
'*   9100 NW 36th St., Suite 109
'*   Miami, Florida 33178 USA                     Internet: rdpatter@usgs.gov
'*
'*=============================================================================
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Sets FHB Boundary Condition Type (BCT) for the FHB Theme.  This
' script is called by 'apply' scripts used with tools to either click on a
' perimeter cell or drag a rectangle to enclose several perimeter cells to
' change their BCT value.  'theValue' is 0 or 1, depending on the BCT tool
' being used to call this script: if it is the specified flow tool, then the
' value is 0, and if it is the specified head tool, it is 1. 'r' is either a
' point or a rectangle sent by the calling script.  'theLayer' is the current
' layer for which the BCT's are being set.
'
'012345678901234567890123456789012345678901234567890123456789012345678901234567


theValue = SELF.Get(0)
theView = SELF.Get(1)
r = SELF.Get(2)
theLayer = SELF.Get(3)

theThemes = theView.GetThemes

'Determine which is FHB theme, error out if none exists:
theFHBTheme = NIL
for each T in theThemes
  if ((T.GetObjectTag.Is(List)) and (T.GetObjectTag.Get(0) = "L")) then
    theFHBTheme = T.GetObjectTag.Get(1)
    break
  end
end
if (theFHBTheme = NIL) then
  MsgBox.Error("Error: no FHB theme.", "")
  Return Nil
end
```

```
if (r.IsNull) then
  p = theView.GetDisplay.ReturnUserPoint
  if (System.IsShiftKeyDown) then
    op = #VTAB_SELTYPE_XOR
  else
    op = #VTAB_SELTYPE_NEW
  end
  theFHBTheme.SelectByPoint(p, op)
else
  if (System.IsShiftKeyDown) then
    op = #VTAB_SELTYPE_OR
  else
    op = #VTAB_SELTYPE_NEW
  end
  theFHBTheme.SelectByRect(r, op)
end
av.GetProject.SetModified(true)

theVTab = theFHBTheme.GetFTab
theVTab.StartEditingWithRecovery

theFieldName = "FHB_L"+theLayer
theFHBField = theVTab.FindField(theFieldName)
theShapeF = theVTab.FindField("Shape")


for each Rec in theVTab.GetSelection
  theVTab.SetValue(theFHBField, Rec, theValue)
  thePoly = theVTab.ReturnValue(theShapeF, Rec)
end

theRedrawRect = theFHBTheme.GetSelectedExtent
theFHBTheme.ClearSelection
theView.GetDisplay.InvalidateRect (theRedrawRect)
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                 AvMODTMR.CreateGrid                 *************
'******************************************************************************
'**                         Language: ArcView Avenue                         **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                   Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                         FAX: (305) 717-5801
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'*
'*=============================================================================
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Creates a polygon grid theme for use in creating MODFLOW
' simulations. Used in this application to create the local grid theme.
' Requires the X and Y coordinates of the upper left hand corner of the model
' grid (XCRNR2 and YCRNR2, respectively.), the number of rows and columns
' (NROW2, NCOL2), and their dimensions (DELR2, DELC2).  Note that DELR2 and
' DELC2 must be constant, but do not need to be the same.  Called whenever the
' local model grid is to be created or re-created (occurs when the dimensions
' are altered upon modifying it).
'
'0123456789012345678901234567890123456789012345678901234567890123456789012345678

XCRNR2 = SELF.Get(0)
YCRNR2 = SELF.Get(1)
NROW2 = SELF.Get(2)
NCOL2 = SELF.Get(3)
DELR2 = SELF.Get(4)
DELC2 = SELF.Get(5)
theFileName = SELF.Get(6)

theGridFTab = FTab.MakeNew (theFileName, Polygon)

theGridFTab.StartEditingWithRecovery

theRowF = Field.Make ("Row", #FIELD_LONG, 5, 0)
theColF = Field.Make ("Col", #FIELD_LONG, 5, 0)
theSeqnumF = Field.Make ("Seqnum", #FIELD_LONG, 5, 0)
theAreaF = Field.Make ("Area", #FIELD_DOUBLE, 10, 2)
theFieldList = {theAreaF, theRowF, theColF, theSeqnumF}

theGridFTab.AddFields(theFieldList)
```

```
theShapeF = theGridFTab.FindField("Shape")


'Initialize remaining parameters (those not being sent as arguments):
MaxColLength = NROW2 * DELR2
MaxRowLength = NCOL2 * DELC2
theMaxSeqnum = NROW2 * NCOL2

'Initialize loop counters and accumulators:
theColLength = 0
theRowLength = 0
theRowNum = 0
theColNum = 0
theSeqnum = 0


av.ShowMsg ("Creating Output Grid...")
av.SetStatus(0)

for each i in 1..NROW2

  for each j in 1..NCOL2

    'update counters:
    theSeqnum = theSeqnum + 1
    PercentDone = (theSeqnum/theMaxSeqnum)*100
    av.SetStatus(PercentDone)

    'create corner points for new cell:
    PtA = (XCRNR2 + theRowLength)@(YCRNR2 - theColLength)
    PtB = PtA.Clone
    PtB.Move(DELC2, 0)
    PtC = PtA.Clone
    PtC.Move(DELC2, -DELR2)
    PtD = PtA.Clone
    PtD.Move(0, -DELR2)

    'Create new cell with above points:
    aNewCell = Polygon.Make({{PtA, PtB, PtC, PtD}})

    'Get parameters
    anArea = aNewCell.ReturnArea
    aNewRec = theGridFTab.AddRecord
    theGridFTab.SetValue(theShapeF, aNewRec, aNewCell)
    theGridFTab.SetValue(theRowF, aNewRec, i)
    theGridFTab.SetValue(theColF, aNewRec, j)
    theGridFTab.SetValue(theSeqNumF, aNewRec, theSeqnum)
    theGridFTab.SetValue(theAreaF, aNewRec, anArea)

    theRowLength = theRowLength + DELC2

  end
  theRowLength = 0
  theColLength = theColLength + DELR2
end

av.ShowMsg("")
av.ClearStatus

theGridFTab.StopEditingWithRecovery(TRUE)
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************    AvMODTMR.DlgEditLayerBCs.lbxSelLocalLayer.Select ************
'******************************************************************************
'**                        Language: ArcView Avenue                          **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                 Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                       FAX: (305) 717-5801
'*   9100 NW 36th St., Suite 109
'*   Miami, Florida 33178 USA                    Internet: rdpatter@usgs.gov
'*
'*=============================================================================
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Sets the active layer for modifying BCT's in the FHB Theme.
' Whenever a layer is selected in the dialog, the legend of the FHB Theme is
' redrawn using that layers' BCT array, which is encoded in the field
' "FHB_LayN", where N is the layer number.
'
'123456789012345678901234567890123456789012345678901234567890123456789012345678

theView = av.GetActiveDoc

'Find the FHB theme:
theFHBTheme = NIL
theLocTheme = av.Run("AvMODTMR.GetGridTheme", {theView, "L"})
theFHBTheme = theLocTheme.GetObjectTag.Get(1)

'Find the FHBFieldName of current Layer:
theLayer = SELF.GetSelection.Get(0).AsList.Get(3)
theFHBFieldName = "FHB_L"+theLayer

theOrigFHBLegend = theFHBTheme.GetLegend

aFHBLegend = Legend.Make(#SYMBOL_FILL)
aFHBLegend.Unique (theFHBTheme, theFHBFieldName)

aFHBLegend.SetClassInfo(0, theOrigFHBLegend.ReturnClassInfo(0))
aFHBLegend.SetClassInfo(1, theOrigFHBLegend.ReturnClassInfo(1))

'Reset the TOC and redraw themes:
theFHBTheme.SetLegend(aFHBLegend)
theFHBTheme.SetName(theLocTheme.GetName+"  FHB BCs, Layer "+theLayer.AsString)
theFHBTheme.Invalidate(FALSE)
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************              AvMODTMR.DlgEditLayerBCs.Open       **************
'******************************************************************************
'**                          Language: ArcView Avenue                         **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                  Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                        FAX: (305) 717-5801
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'*=============================================================================
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'*=============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: loads the 'Select local layer' list box with lines of the form
' "Layer n (Reg.Lay m )".  The LML array is used to indicate which regional
' model layers are to be included in the local model.  The LMLDict is a
' dictionary that contains values 1..n, corresponding to the n layers in the
' regional model, the keys are either 0's or 1's, the former being the flag
' indicating that the regional model layer will be used in the local model. m
' is a sequential number for the local model layers. Created from LMLDict
' values that are not 0.
'
'0123456789012345678901234567890123456789012345678901234567890123456789012345678
theView = av.GetActiveDoc


'Locate the Local grid theme:
theLocGridTheme = av.Run("AvMODTMR.GetGridTheme", {theView, "L"})

theLMLDict = theLocGridTheme.GetObjectTag.Get(5)
theRegLays = theLMLDict.ReturnKeys
theRegLays.Sort(TRUE)


'_LocalLayDict = Dictionary.Make(100)
aLocalLayList = List.Make

counter = 1
for each aLay in theRegLays
  if (theLMLDict.Get(aLay) <> 0) then
    aLocalLayer = "Layer "+counter.AsString+" (Reg.Lay "+aLay.AsString++")"
    theValue = aLay
    '_LocalLayDict.Add(aLocalLayer, aLay)
    counter = counter + 1
```

```
    aLocalLayList.Add(aLocalLayer)
  end
end


SELF.FindByName("lbxSelLocalLayer").DefineFromList (aLocalLayList)
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                AvMODTMR.DlgLayers.Open         **************
'******************************************************************************
'**                          Language: ArcView Avenue                        **
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                  Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                        FAX: (305) 717-5801
'*   9100 NW 36th St., Suite 109
'*   Miami, Florida 33178 USA                      Internet: rdpatter@usgs.gov
'*
'*============================================================================
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
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'*
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Populates the list of choices in the dialog with the currently
' selected layers from the LML Array, stored in the variable LMLDict.
'
'012345678901234567890123456789012345678901234567890123456789012345678901234567 8

theView = av.GetActiveDoc

'Locate the Local grid theme:
theLocGridTheme = NIL
for each T in theView.GetThemes
  if ((T.GetObjectTag.Is(List)) and (T.GetObjectTag.Get(0) = "L")) then
    theLocGridTheme = T
    break
  end
end


theLMLDict = theLocGridTheme.GetObjectTag.Get(5)

theListOfLayers = theLMLDict.ReturnKeys
theListOfLayers.Sort(TRUE)

theTextListOfLayers = {}
aSelectedLayerList = {}
theSelRangeFirstRow = nil
CountNoOfLaysUsed = 0

for each aLay in theListOfLayers
  thisLayerLMLCode = theLMLDict.Get(aLay)

  if (thisLayerLMLCode = 1) then
```

```
    'Sets the first layer being used - 1 into theSelRangeOrigin:

    if (theSelRangeFirstRow = Nil) then
      theSelRangeFirstRow = aLay - 1
    end

    CountNoOfLaysUsed = CountNoOfLaysUsed + 1
  end

  aStringLay = "Layer"++aLay.AsString
  theTextListOfLayers.Add(aStringLay)

end

theListBox = SELF.FindByName("lbxLayers")
theListBox.DefineFromList(theTextListOfLayers)
theStartSel = 0@theSelRangeFirstRow
theExtent = 1@CountNoOfLaysUsed
theSelRange = Rect.Make(theStartSel, theExtent)
theListBox.SetSelection (theSelRange, FALSE)
theListBox.ShowCurrent



'Set Listeners of this control to be the "Apply" button in this control:

theListBox.AddListener(SELF.FindByName("lbtApply"))
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************            AvMODTMR.DlgLocGridWiz.lbtOK.Click      *************
'******************************************************************************
'**                            Language: ArcView Avenue                      **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                  Phone: (305) 717-5865
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'*=============================================================================
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'*=============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Obtains some of the parameters to create the local grid from the
' text lines in the dialog, and the remaining ones from calling the script
' 'AvMODTMR.MakeOrientedBox'.  Then runs the script 'AvMODTMR.MakeLocGridTheme'
' passing it the parameters.
'
'12345678901234567890123456789012345678901234567890123456789012345678901234567 8

theView = av.GetActiveDoc

'get the Column Width and Row Height from the dialog:
DlgLocGridWiz = SELF.GetDialog
theDELC2 = DlgLocGridWiz.FindByName("txlColWidth").GetText.AsNumber
theDELR2 = DlgLocGridWiz.FindByName("txlRowHeight").GetText.AsNumber

'get the rest of the local grid dimensions from the oriented bounding box:
theLocGridParam = av.Run("AvMODTMR.MakeOrientedBox", {theView, theDELC2,
                         theDELR2})
theNCOL2 = theLocGridParam.Get(0)
theNROW2 = theLocGridParam.Get(1)
theX_coor = theLocGridParam.Get(2)
theY_coor = theLocGridParam.Get(3)
theRotation = theLocGridParam.Get(4)


theRegGridTheme = av.Run("AvMODTMR.GetGridTheme", {theView, "R"})
theFileName = NIL


av.Run("AvMODTMR.MakeLocGridTheme", {theX_coor, theY_coor, theRotation,
       theNROW2, theDELR2, theNCOL2, theDELC2, theView, theRegGridTheme,
       theFileName})
```

```
SELF.GetDialog.Close
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************         AvMODTMR.DlgLocGridWiz.lbtPreview.Click   **************
'******************************************************************************
'**                           Language: ArcView Avenue                       **
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'*     Author/Site,      Date,        Event
'*   ---------------------------------------------------------------------------
'*   Raul D. Patterson                                 Phone: (305) 717-5865
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'*
'*============================================================================
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
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'*
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Draws the preview box for the local grid theme.  Calls the script
' 'AvMODTMR.MakeLocalGridOutline', sending it the parameters obtained by calling
' 'AvMODTMR.MakeOrientedBox' and by reading the values from the "Row Height" and
' "Column Width" textlines.
'
'012345678901234567890123456789012345678901234567890123456789012345678901234567 8

theView = av.GetActiveDoc
DELC2 = SELF.GetDialog.FindByName("txlColWidth").GetText.AsNumber
DELR2 = SELF.GetDialog.FindByName("txlRowHeight").GetText.AsNumber

theLocGridParameters = av.Run("AvMODTMR.MakeOrientedBox", {theView, DELC2,
                              DELR2})

NCOL2 = theLocGridParameters.Get(0)
NROW2 = theLocGridParameters.Get(1)
XCRNR1 = theLocGridParameters.Get(2)
YCRNR1 = theLocGridParameters.Get(3)
theRotation = theLocGridParameters.Get(4)

H = NROW2 * DELR2
W = NCOL2 * DELC2

av.Run("AvMODTMR.MakeLocalGridOutline", {XCRNR1, YCRNR1, theRotation, H, W})
```

```
'************* U.S. Geological Survey preliminary computer program ************
'*****************************************************************************
'*************     AvMODTMR.DlgLocGridWiz.tolDrawStudyArea.Update    **********
'*****************************************************************************
'**                         Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'*      Author/Site,      Date,        Event
'*    -------------------------------------------------------------------------
'*    Raul D. Patterson                                    Phone: (305) 717-5865
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'*============================================================================
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: checks if the 'Study Area' graphic is present, and if it is,
' it sets the control disabled; if it is not, it sets the control enabled.
'
'0123456789012345678901234567890123456789012345678901234567890123456789012345678


theView = av.GetActiveDoc


LocPolyPresent = av.Run("AvMODTMR.IsGraphicPresent", {theView,
                        "theLocalPolygon"})

SELF.SetEnabled(LocPolyPresent.Not)
SELF.GetDialog.FindByName("txtDrawStudyArea").SetEnabled(LocPolyPresent.Not)
```

```
'************* U.S. Geological Survey preliminary computer program ***********
'****************************************************************************
'*************           AvMODTMR.DlgLocGridWiz.tolMove.Click        ***********
'****************************************************************************
'**                         Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*===========================================================================
'*     Author/Site,      Date,        Event
'*   ------------------------------------------------------------------------
'*   Raul D. Patterson                                  Phone: (305) 717-5865
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*===========================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: calls up the arcview script 'View.SelectTool', which works for
' moving any selected graphic, however, this tool can only be used for the
' 'Study Area' polygon.  This restriction is set in the "if.." statement.
'
'0123456789012345678901234567890123456789012345678901234567890123456789012345678

theView = av.GetActiveDoc
theMapDisplay =theView.GetDisplay
theGraphics = theView.GetGraphics

LocalPolygonPresent = av.Run("AvMODTMR.IsGraphicPresent", {theView,
                             "theLocalPolygon"})

if (LocalPolygonPresent) then
  theLocalPolygon = theGraphics.FindByName("theLocalPolygon")
  if (theGraphics.GetSelected.Count > 0) then
    theMapDisplay.InvalidateRect(theGraphics.ReturnSelectedExtent.Scale(1.25))
  end
  theGraphics.UnselectAll
  theLocalPolygon.SetSelected(TRUE)
  theMapDisplay.InvalidateRect(theGraphics.ReturnSelectedExtent.Scale(1.25))
end

av.Run("View.SelectTool", {})
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************          AvMODTMR.DlgMODTMR.cbxLocITMUNI.Select       ***********
'******************************************************************************
'**                          Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                    Phone: (305) 717-5865
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: When a time unit is selected in the LOCAL MODEL's time unit drop
' down list box, the corresponding ITMUNI2 variable is set to the 8th position
' in the local theme's object tag.


'set the ITMUNI2 space in the local grid themes'
'object tag to be the chosen time unit:

theChosenTimeUnit = SELF.GetSelection

theITMUNIList = _theTimeUnitDict.ReturnKeys

thePropLocITMUNI = NIL

for each anITMUNI in theITMUNIList
  aTimeUnit = _theTimeUnitDict.Get(anITMUNI)
  if (theChosenTimeUnit = aTimeUnit) then
    thePropLocITMUNI = anITMUNI.AsNumber
    break
  end
end

theView = av.GetActiveDoc
theLocTheme = av.Run("AvMODTMR.GetGridTheme", {theView, "L"})
if (theLocTheme = NIL) then
  Return NIL
else
  theLocParamList = theLocTheme.GetObjectTag
  theLocParamList.Set(8, thePropLocITMUNI)
  theLocTheme.SetObjectTag(theLocParamList)
end
```

```
SELF.BroadcastUpdate
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************        AvMODTMR.DlgMODTMR.cpaToggleLMPRF.Click       ***********
'******************************************************************************
'**                          Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                   Phone: (305) 717-5865
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'*=============================================================================
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Locates local grid theme, and, if present, resets object tag with
' changed LMPRF:
'
'012345678901234567890123456789012345678901234567890123456789012345678901234567

'Retrieve local grid theme:
theView = av.GetActiveDoc
theLocThemeTypeFlag = "L"
theLocTheme = av.Run ("AvMODTMR.GetGridTheme", {theView,theLocThemeTypeFlag})

if (theLocTheme = NIL) then
  Return Nil
else
  theLMPRRFlagKW = SELF.GetLabel.AsList.Get(0)
  av.Run("AvMODTMR.SetLocalModelPRocessingFlag", {theLMPRRFlagKW, theView,
         theLocTheme})
end

SELF.BroadcastUpdate
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************       AvMODTMR.DlgMODTMR.lbtCreateLocGrid.Click    *************
'******************************************************************************
'**                          Language: ArcView Avenue                        **
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'*     Author/Site,      Date,        Event
'*   -------------------------------------------------------------------------
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'*
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'*============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Opens the dialog that defines the local grid and immediately
' creates a graphic that consists of a box that wraps around the local grid and
' places a bullseye-type of symbol at XCRNR1, XCRNR2 for reference in rotation.
'
'012345678901234567890123456789012345678901234567890123456789012345678901234567

theView = av.GetActiveDoc
theGraphics = theView.GetGraphics

theThemeTypeFlag = "L"
theLocGridTheme = av.run("AvMODTMR.GetGridTheme", {theView, theThemeTypeFlag})


'If there's no local theme, then simply open the dialog:
'script, else, draw the box and origin before opening it:
if (theLocGridTheme = NIL) then
  theDlgDefineLocGrid = av.FindDialog("AvMODTMR.DlgDefineLocGrid")
  theDlgDefineLocGrid.Open
  Return NIL
else
  theLocParamList = theLocGridTheme.GetObjectTag
  'the following lines create a graphic box that wraps around the local grid
  'and places a bulls-eye like symbol on the UL corner
  '(row1, col1).  The graphic box comes from the box stored
  'in the 17th element of the local grid's obj tag
  'parameter list.

  theXCRNR2 = theLocParamList.Get(11).AsNumber
  theYCRNR2 = theLocParamList.Get(12).AsNumber
  theANGL2 = theLocParamList.Get(13).AsNumber
  theNROW2 = theLocParamList.Get(6).AsNumber
```

```
  theDELR2 = theLocParamList.Get(14).AsNumber
  H = theNROW2 * theDELR2
  theNCOL2 = theLocParamList.Get(7).AsNumber
  theDELC2 = theLocParamList.Get(15).AsNumber
  W = theNCOL2 * theDELC2

  theOrigin = theXCRNR2@theYCRNR2

  av.Run("AvMODTMR.MakeLocalGridOutline", {theXCRNR2, theYCRNR2, theANGL2,
         H, W})

  theDlgDefineLocGrid = av.FindDialog("AvMODTMR.DlgDefineLocGrid")
  theDlgDefineLocGrid.Open

  theView.Invalidate
end
```

```
'************* U.S. Geological Survey preliminary computer program ************
'*****************************************************************************
'**************   AvMODTMR.DlgMODTMR.lbtRegSimBrowse.Click  *****************
'*****************************************************************************
'**                        Language: ArcView Avenue                         **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'*     Author/Site,      Date,        Event
'*   -------------------------------------------------------------------------
'*   Raul D. Patterson                                    Phone: (305) 717-5865
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Browse for .NAM file of regional simulation data set.  Verifies
' that words were used to specify options in .OC file by and that the option
' 'COMPACT BUDGET FILES' was used in the regional model by searching for the
' phrase among the first 8 lines, something required by MODTMR.  An error
' message is created with the problems found if any of these items don't
' check.  It then reads the NLAY, NCOL, NROW, NPER and ITMUNI values from
' record 3 of the BAS file and writes them to their respective text boxes in
' the 'REGIONAL MODEL' portion of the dialog. Reads ISS (is steady state) flag
' from the BCF package.  Checks that all the files listed in the name file are
' in the paths as indicated in it.  Error string is reported at the end in a
' text box that can be copied and pasted to a text editor to be used as a
' checklist for making the required modifications.  NOTE: THE REGIONAL
' SIMULATION MUST BE RUN IN MODFLOW 96 WITH ALL OF THESE OPTIONS.  MERELY
' CHANGING THE OPTIONS IN THE DATASET WITHOUT RUNNING THE SIMULATION WILL
' ALLOW YOU TO CONTINUE WITH AVMODTMR, BUT MODTMR WILL LIKELY ERROR OUT.

'Point to regional simulation name file, return nil if nothing set:

theRegNameFileFullPath = FileDialog.Show ("*.nam", "MODFLOW Name File (*.nam)",
             "Select Name File for Regional MODFLOW Simulation")


if (theRegNameFileFullPath = NIL) then
  MsgBox.Info("No NAME file selected, returning to MODTMR dialog", "")
  return Nil
else
  'Set the Path to files and the Name file file name, but not as globals yet,
  'since checks need to be made.  If it passes all checks, the globals will be
  'set at the end.
  thePathToFiles = theRegNameFileFullPath.ReturnDir.AsString
  theRegNameFile = theRegNameFileFullPath.GetBaseName.AsString
```

```
end


'Initialize an error string to contain all error messages:

theErrorString = ""

'Look for Output Control file and make sure "COMPACT BUDGET FILES" is among
'first 8 lines (this also assures words were used to specify options):

theOC_File = av.Run("AvMODTMR.GetFileNameFromNameFile",
                    {theRegNameFileFullPath,"OC"})

theOC_FileName = (thePathToFiles + "\" + theOC_File).AsFileName

  '  Check if the OC file exists, exit if it doesn't:
  if (theOC_FileName.IsFile.Not) then
    theErrorString = theErrorString + "No *.oc file found in path: "+NL+
                      thePathToFiles+NL+
                      NL+
                      NL
  else
    'Proceed to check if the string "COMPACT BUDGET FILES" exists among first
    '8 lines:
    aLineList = List.Make
    theOC_File = LineFile.Make(theOC_FileName, #FILE_PERM_READ)
    theOC_File.Read(aLineList, 8)
    OCFileInCorrectFormat = FALSE
    for each aLine in aLineList
      if (aLine = "COMPACT BUDGET FILES") then
        OCFileInCorrectFormat = TRUE
        Break
      end
    end
    if (OCFileInCorrectFormat.Not) then
      theErrorString = theErrorString + "Output Control file is in wrong " +
                       "format."+NL+ "Make sure options are specified using " +
                       "words and that the option 'COMPACT BUDGET FILES' is" +
                       "used"+ NL + NL
    end
    theOC_File.Close
    aLineList = Nil
  end


'Look for cbc file, if not found, append error message to theErrorString,
'if found, then set the Cell-by-cell file text box to hold theCellByCellFile:
theCellByCellFile = thePathToFiles + "\" + theRegNameFile + ".cbc"
theCellByCellFileName = theCellByCellFile.AsFileName
if (theCellByCellFileName = NIL) then
  theErrorString = theErrorString + "No Cell-by-cell (*.cbc) file found in " +
                    "path: " + NL +
                    thePathToFiles + NL + NL
end


'Look for hed file, if not found, append error message to theErrorString, if
'found, then set the Head file text box to hold theHeadFile:
theHeadFile = thePathToFiles + "\" + theRegNameFile + ".hed"
theHeadFileName = theHeadFile.AsFileName
if (theHeadFileName = NIL) then
  theErrorString = theErrorString + "No Head (*.hed) file found in path: "+NL+
                    thePathToFiles+ NL + NL + NL
```

```
end



'Check for option 'FREE' in 4th line of .BAS file and grab NLAY, NCOL, etc...
'from line 3:
theBAS_File = av.Run("AvMODTMR.GetFileNameFromNameFile",
                     {theRegNameFileFullPath, "BAS"})

theBAS_FileName = (thePathToFiles + "\" + theBAS_File).AsFileName

  '  Check if the BAS file exists, exit if it doesn't:
  if (theBAS_FileName.IsFile.Not) then
    theErrorString = theErrorString + "No *.bas file found in path: "+NL+
                      thePathToFiles+NL+
                      NL+
                      NL
  else
    '  Open the BAS file:
    aLineList = List.Make
    theBASFile = LineFile.Make (theBAS_FileName, #FILE_PERM_READ)
    theBASFile.Read( aLineList, 4 )
    the3rdLine = aLineList.Get(2)
    delimit = "SPACE"
    if (the3rdLine.Left(11).Contains(",")) then
      delimit = "COMMA"
    end
    if (delimit = "COMMA") then
      theVariableList = the3rdLine.AsTokens(",")
    elseif (delimit = "SPACE") then
      theVariableList = the3rdLine.AsList
    end

    theRegNLAY = theVariableList.Get(0)
    theRegNROW = theVariableList.Get(1)
    theRegNCOL = theVariableList.Get(2)
    theRegNPER = theVariableList.Get(3)
    theRegTimeUnit = theVariableList.Get(4)

    theTimeUnitDict = _theTimeUnitDict
    theRegITMUNI = theTimeUnitDict.Get(theRegTimeUnit)

    theBASFile.Close
    aLineList = Nil

  end




'Get the ISS (SS or Trans.) value in position 1, 1st line of .BCF file:
theBCF_File = av.Run("AvMODTMR.GetFileNameFromNameFile",
                     {theRegNameFileFullPath, "BCF"})

theBCF_FileName = (thePathToFiles + "\" + theBCF_File).AsFileName

  '  Check if the BCF file exists, exit if it doesn't:
  if (theBCF_FileName.IsFile.Not) then
    theErrorString = theErrorString + "No *.bcf file found in path: "+NL+
                      thePathToFiles+NL+
                      NL+
                      NL
  else
```

```
    '  Open the BCF file:
    aLineList = List.Make
    theBCFFile = LineFile.Make (theBCF_FileName, #FILE_PERM_READ)
    theBCFFile.Read( aLineList, 1 )

    the1stLine = aLineList.Get(0)

    delimit = "SPACE"
    if (the1stLine.Left(11).Contains(",")) then
      delimit = "COMMA"
    end
    if (delimit = "COMMA") then
      theVariableList = the1stLine.AsTokens(",")
    elseif (delimit = "SPACE") then
      theVariableList = the1stLine.AsList
    end

    theISSFlag = the1stLine.AsList.Get(0)

    theBCFFile.Close
    aLineList = Nil
  end


'Check the rest of the files listed in the name file are in the directory:
theMissingFileString = ""
aLineList = List.Make
theNameFile = LineFile.Make (theRegNameFileFullPath, #FILE_PERM_READ)
theNameFile.Read(aLineList, theNameFile.GetSize)
n = 0

theListOfUnitsUsed = List.Make

for each aLine in aLineList
  n = n + 1
  theNameFileLineParaList = aLine.AsList

  if (theNameFileLineParaList.Count <> 3) then
    MsgBox.ListAsString(theNameFileLineParaList, "not 3 args in NAM file Line",
    "")
    continue
  end

  aFileType = theNameFileLineParaList.Get(0).Left(4)
  aUnitNo = theNameFileLineParaList.Get(1)
  theListOfUnitsUsed.Add(aUnitNo)
  aFileName = theNameFileLineParaList.Get(2)

  theFileName = (thePathToFiles + "\" + aFileName).AsFileName
  if ((aFileType = "LIST") or (aFileType = "DATA")) then
    continue
  elseif (theFileName.IsFile.Not) then
    MsgBox.Report("the following is a file name of a pkg from the name file, "+
                "but it's not where the name file indicates" + NL +
                theFileName.AsString, "")
    aFileExtension = aFileName.Right(3).UCase
    theMissingFileString = theMissingFileString + aFileExtension + NL
  end
end


if((theMissingFileString = "").Not) then
  theErrorString = theErrorString + NL + NL + "The following input files " +
```

```
                    "are listed in the regional model name file, but are " +
                    "not in: "+thePathToFiles
end


'Make sure the view contains a Regional grid theme:
theView = av.GetActiveDoc
theRegTheme = av.run("AvMODTMR.GetGridTheme", {theView, "R"})
theRegParamList = theRegTheme.GetObjectTag


'Finally, if there are no problems (i.e., theErrorString = "") then set
'variables and set read-only reg sim controls in the MODTMR dialog with their
'values.

if (theErrorString = "") then

  'Set View units with user-defined query:
  theUnitDict = Dictionary.Make(1)
  theUnitDict.Add("feet", #UNITS_LINEAR_FEET)
  theUnitDict.Add("meters", #UNITS_LINEAR_METERS)

  theUnits = MsgBox.ListAsString(theUnitDict.ReturnKeys, "Select the units " +
            "of the Regional Model" + NL +
            "NOTE: This will be the LENGTH units of the local model as well",
            "Choose Units")
  if (theUnits = NIL) then
    MsgBox.Warning("You must specify the units of the regional model, " +
                   "terminating program",
                   "Can Not Continue Without Length Units")
    Return NIL
  else
    theView.SetUnits(theUnitDict.Get(theUnits))
    theRegGridTheme = NIL
    txlUnits = SELF.GetDialog.FindByName("txlUnits")
    txlUnits.SetText(theUnits)
    theLocUnitsLabel = SELF.GetDialog.FindByName("txtLocUnits").SetLabel(
                       "Length Units: "+theUnits)
  end

  'Set the regional simulation variables and place them in the reg theme's
  'object tag:

  MFNAME = theRegNameFile
  PathToFiles = thePathToFiles
  RegNLAY = theRegNLAY
  RegNROW = theRegNROW
  RegNCOL = theRegNCOL
  RegITMUNI = theRegITMUNI
  RegNPER = theRegNPER
  UsedIUNITS = theListOfUnitsUsed
  aTempMFNAMEString = theRegNameFile
  XXCBC = MFNAME.Substitute(".nam", ".cbc")
  XXHED = MFNAME.Substitute(".nam", ".hed")
  theRegParamList.Set(1, MFNAME)
  theRegParamList.Set(7, XXCBC)
  theRegParamList.Set(8, XXHED)
  '*****  these parameters (9 - 15) need to be added to the obj tag of the
  '*****  reg grid theme with all the rest and then Set here:
  theRegParamList.Set(9, UsedIUNITS)
  theRegParamList.Set(10, RegNLAY)
  theRegParamList.Set(11, RegITMUNI)
  theRegParamList.Set(12, RegNROW)
```

```
  theRegParamList.Set(13, RegNCOL)
  theRegParamList.Set(14, theISSFlag)
  theRegParamList.Set(15, RegNPER)
  theRegParamList.Set(16, theUnits)
  theRegParamList.Set(17, thePathToFiles)

  SELF.GetDialog.FindByName("txlRegNameFile").SetText(MFNAME)
  SELF.GetDialog.FindByName("txlPathToFiles").SetText(PathToFiles)
  SELF.GetDialog.FindByName("txlRegNLAY").SetText(RegNLAY)
  SELF.GetDialog.FindByName("txlRegNROW").SetText(RegNROW)
  SELF.GetDialog.FindByName("txlRegNCOL").SetText(RegNCOL)
  SELF.GetDialog.FindByName("txlRegITMUNI").SetText(RegITMUNI)
  SELF.GetDialog.FindByName("txlRegNPER").SetText(RegNPER)

  theRegTheme.SetObjectTag(theRegParamList)



  if (theISSFlag = "1") then
    radRegSteadyState = SELF.GetDialog.FindByName("radRegSteadyState")
    radRegSteadyState.Select
  elseif (theISSFlag = "0") then
    radRegTransient = SELF.GetDialog.FindByName("radRegTransient")
    radRegTransient.Select
  end

  'select the radio button for using all regional layers (the default):
   SELF.GetDialog.FindByName("radUseAllLayers").Select

  'select the radio button for processing all files (not just FHB pkg):
   SELF.GetDialog.FindByName("radAllPackages").Select

  av.GetProject.SetModified(TRUE)

else
  Clipboard.The.Empty
  Clipboard.The.Add(theErrorString)
  Clipboard.The.Update
  MsgBox.Report (theErrorString, "These are the errors in your Regional " +
                 "data set")
  Return Nil
end
```

```
'************* U.S. Geological Survey preliminary computer program ************
'*****************************************************************************
'*************          AvMODTMR.DlgMODTMR.lbtWriteFile.Click      ************
'*****************************************************************************
'**                          Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'*     Author/Site,      Date,        Event
'*   -------------------------------------------------------------------------
'*   Raul D. Patterson                                    Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                          FAX: (305) 717-5801
'*   9100 NW 36th St., Suite 109
'*   Miami, Florida 33178 USA                       Internet: rdpatter@usgs.gov
'*
'*============================================================================
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: reads the data items from the obj tags of the regional and local
' themes copying them into a string that is formatted as a MODTMR input file
' and written to disk at the user's option.
'
'123456789012345678901234567890123456789012345678901234567890123456789012345678

theView = av.GetActiveDoc

theRegTheme = av.Run("AvMODTMR.GetGridTheme", {theView, "R"})
theRegParamList = theRegTheme.GetObjectTag

theLocTheme = av.Run("AvMODTMR.GetGridTheme", {theView, "L"})
theLocParamList = theLocTheme.GetObjectTag


'Get regional parameters:

MFNAME = theRegParamList.Get(1)

XYFAC1 = theRegParamList.Get(2).AsString

ICRNR1 = theRegParamList.Get(3).AsString

XCRNR1 = theRegParamList.Get(4).AsString

YCRNR1 = theRegParamList.Get(5).AsString

ANGL1 = theRegParamList.Get(6).AsString

XXCBC = theRegParamList.Get(7).AsString
```

```
XXHED = theRegParamList.Get(8).AsString


'Get local parameters:

LMDSN = theLocParamList.Get(3)

LMPRF = theLocParamList.Get(4).AsString

'get LML:
LML = ""
LMLDict = theLocParamList.Get(5)
theLayers = LMLDict.ReturnKeys
theLayers.Sort(TRUE)
for each aLay in theLayers
  LML = LML + LMLDict.Get(aLay).AsString+ " "
end
'trim last space:
LML = LML.Left(LML.Count - 1)

NROW2 = theLocParamList.Get(6).AsString

NCOL2 = theLocParamList.Get(7).AsString

ITMUN2 = theLocParamList.Get(8).AsString

XYFAC2 = theLocParamList.Get(9).AsString

ICRNR2 = theLocParamList.Get(10).AsString

XCRNR2 = theLocParamList.Get(11).AsString

YCRNR2 = theLocParamList.Get(12).AsString

ANGL2 = theLocParamList.Get(13).AsString

DELR2 = "CONSTANT "+theLocParamList.Get(14).AsString

DELC2 = "CONSTANT "+theLocParamList.Get(15).AsString

theBCTArray = av.Run("AvMODTMR.BuildBCTArrays", {theView})

'get the FHB unit number from the dialog:
IFHBUN = SELF.GetDialog.FindByName("txlIFHBUN").GetText

'string together the parameters:

  'initiate the string for the input file:
  aMODTMRFileString = ""

  'build 1st line:
  aMODTMRFileString = MFNAME++LMDSN++IFHBUN++LMPRF+nl

  'build 2nd line:
  aMODTMRFileString = aMODTMRFileString+XYFAC1++ICRNR1++XCRNR1++YCRNR1++ANGL1+
                      nl

  'build 3rd line:
  aMODTMRFileString = aMODTMRFileString+LML+nl

  'build 4th line:
  aMODTMRFileString = aMODTMRFileString+NROW2++NCOL2++ITMUN2+nl
```

```
  'build 5th line:
  aMODTMRFileString = aMODTMRFileString+XYFAC2++ICRNR2++XCRNR2++YCRNR2++ANGL2+
                      nl

  'build 6th line:
  aMODTMRFileString = aMODTMRFileString+DELR2+nl

  'build 7th line:
  aMODTMRFileString = aMODTMRFileString+DELC2+nl

  'build 8th line:
  aMODTMRFileString = aMODTMRFileString+XXCBC+nl

  'build 9th line:
  aMODTMRFileString = aMODTMRFileString+XXHED+nl

  'build 10th line:
  aMODTMRFileString = aMODTMRFileString+theBCTArray+nl

MsgBox.Report(aMODTMRFileString, "This is the MODTMR input file")

SaveFile = MsgBox.YesNo("Would you like to write this to a file?",
                          "Saving MODTMR Input File", TRUE)
if (SaveFile.Not) then
  Return NIL  'else, continue...
end

'See if a MODTMR input file has already been associated with this local grid:
theFileName = NIL
if (theLocParamList.Count = 18) then
  'there's something there, check if it's an existing file:
  if (theLocParamList.Get(17).AsFileName.IsFile) then
    theFileName = theLocParamList.Get(17).AsFileName
  end
end

'If theFileName is NIL, none has been associated before (or maybe file was
'deleted), so ask for one:
if (theFileName = NIL) then
  'Create a default one with the same path to files as the regional sim.:
  theDlgMODTMR_Dialog = SELF.GetDialog
  thePathToFiles = theDlgMODTMR_Dialog.FindByName("txlPathToFiles").GetText
  theFileNameString = theDlgMODTMR_Dialog.FindByName(
                                                 "txlLocalNameFile").GetText
  theDefFileNameString = thePathToFiles+"\"+theFileNameString
  theDefFileName = FileName.Make(theDefFileNameString)
else
  'Grab the one that's already there and use it as the default:
  theDefFileName = theFileName
end

'Prompt user for a file name:
theFileName = FileDialog.Put(theDefFileName,"", "Save MODTMR Input File")

if (theFileName = NIL) then
  MsgBox.Warning("No File Name Given", "File Not Created")
  Return NIL
end

theTextFile = TextFile.Make (theFileName, #FILE_PERM_WRITE)
theTextFile.Write (aMODTMRFileString, aMODTMRFileString.Count)
theTextFile.Close
```

```
if (theLocParamList.Count = 17) then
  theLocParamList.Add(theFileName.AsString)    '*** 18th item in theLocParamList
else
  theLocParamList.Set(17, theFileName.AsString)
end

theLocTheme.SetObjectTag(theLocParamList)

av.GetProject.SetModified(TRUE)
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************          AvMODTMR.DlgMODTMR.txlFHBUN.FocusLost      ************
'******************************************************************************
'**                          Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*      Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*    Raul D. Patterson                                  Phone: (305) 717-5865
'*    U. S. Geological Survey - WRD                        FAX: (305) 717-5801
'*    9100 NW 36th St., Suite 109
'*    Miami, Florida 33178 USA                     Internet: rdpatter@usgs.gov
'*
'*=============================================================================
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Checks if the file unit entered by the user for the FHB package
' has been used, sending the user an error message that it's been used and
' reporting the unit numbers that have already been used by other packages.

thePropFHBUnitNo = SELF.GetText

theView = av.GetActiveDoc
theThemeTypeFlag = "R"
theRegTheme = av.run("AvMODTMR.GetGridTheme", {theView, theThemeTypeFlag})


theRegParamList = theRegTheme.GetObjectTag
theUsedIUNITS = theRegParamList.Get(9)

for each aUnitNo in theUsedIUNITS
  if (aUnitNo = thePropFHBUnitNo) then
    'make a string will all the used IUNITS:
    aStringOfIUNITS = ""
    for each anItem in theUsedIUNITS
      aStringOfIUNITS = aStringOfIUNITS + anItem +", "
    end
    MsgBox.Info("The following unit numbers have been used: "+aStringOfIUNITS,
      "Try a Different Unit Number")
    SELF.SetText("")
    SELF.Focus
    break
  end
end

'Find the local grid theme in the view and set its 17th item in the obj. tag
'to be this IFHBUN value:
```

```
theLocThemeTypeFlag = "L"
theLocTheme = av.run("AvMODTMR.GetGridTheme", {theView, theLocThemeTypeFlag})
if ((theLocTheme = NIL).Not) then
  theLocParamList = theLocTheme.GetObjectTag
  theLocParamList.Set(16, thePropFHBUnitNo)
  theLocTheme.SetObjectTag(theLocParamList)
end

SELF.BroadcastUpdate
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                AvMODTMR.DrawTempBox               *************
'******************************************************************************
'**                       Language: ArcView Avenue                           **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                    Phone: (305) 717-5865
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'*
'*=============================================================================
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: a routine that takes in an origin point and a polygon designating
' the UL origin and boundaries of the local grid and draws a graphics of them
' on the view.
'
'123456789012345678901234567890123456789012345678901234567890123456789012345678

theView = av.GetActiveDoc
theGraphics = theView.GetGraphics

'Check if any of the graphics exist on the view and delete them
'if they do:
av.Run("AvMODTMR.DeletePreviewBox", {theView})


theOrigin = SELF.Get(0)
theBox = SELF.Get(1)

aBoxGShp = GraphicShape.Make(theBox)
aBoxGShp.SetName("LocBounds")
theBoxSymbol = Symbol.Make(#SYMBOL_FILL)
theBoxSymbol.SetOlColor(Color.GetBlack)
theBoxSymbol.SetOlWidth (2)
aClearColor = Color.Make
aClearColor.SetTransparent(TRUE)
theBoxSymbol.SetColor(aClearColor)
aBoxGShp.SetSymbol(theBoxSymbol)

'get the Upper Left vertex of the box & place point:
aBullseyeGShp = GraphicShape.Make(theOrigin)
aBullseyeGshp.SetName("LocOrigin")
'set point's symbol to a bulls-eye (default palette #42):
```

```
thePalette = Palette.Make
thePaletteFile = "$AVHOME/symbols/default.avp".AsFileName
thePalette.LoadFromFile(#PALETTE_LIST_MARKER, thePaletteFile)
theMarkerList = thePalette.GetList(#PALETTE_LIST_MARKER)
theSymbol = theMarkerList.Get(42).Clone
aBullseyeGShp.SetSymbol (theSymbol)


aGraphicGroup = GraphicGroup.Make
aGraphicGroup.Add(aBoxGShp)
aGraphicGroup.Add(aBullseyeGShp)
aGraphicGroup.SetName("theRefBox")


theGraphics.Add(aGraphicGroup)
theView.GetDisplay.InvalidateRect(aGraphicGroup.GetBounds)
```

```
'************* U.S. Geological Survey preliminary computer program ************
'*****************************************************************************
'*************              AvMODTMR.EnsurePosRealEntry          **************
'*****************************************************************************
'**                         Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                    Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                          FAX: (305) 717-5801
'*   9100 NW 36th St., Suite 109
'*   Miami, Florida 33178 USA                      Internet: rdpatter@usgs.gov
'*
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: used as the lost focus script for the DELC2 and DELR2 text lines
' in the 'Local Grid Wizard' dialog. It runs 'AvMODTMR.CheckForPositiveReal',
' returns an error message if the entry is not a positive number.  Then, it
' clears the text and returns focus to the textline.
'
'01234567890123456789012345678901234567890123456789012345678901234567890123456678


theNumber = SELF.GetText
theArgs = {theNumber}
theAnswer = av.Run("AvMODTMR.CheckForPositiveReal", theArgs)
if (theAnswer = NIL) then
  MsgBox.Error("Enter a positive number", "Grid Spacings Must be Positive Num-
bers")
  SELF.SetText("")
  SELF.Focus
end
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************             AvMODTMR.GetFieldMinMaxValues         **************
'******************************************************************************
'**                          Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,       Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                  Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                        FAX: (305) 717-5801
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'*=============================================================================
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: returns a list containing the minimum and maximum elements in a
' field of a table.
'
'012345678901234567890123456789012345678901234567890123456789012345678901234567


theVTab = SELF.Get(0)
theFieldName = SELF.Get(1)

theField = theVTab.FindField(theFieldName)

aValueList = List.Make

for each aRec in theVTab
  aValue = theVTab.ReturnValue(theField, aRec)
  aValueList.Add(aValue)
end

aValueList.RemoveDuplicates
aValueList.Sort(TRUE)

theMinVal = aValueList.Get(0)
theMaxVal = aValueList.Get(aValueList.Count - 1)

Return {theMinVal, theMaxVal}
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************           AvMODTMR.GetFileNameFromNameFile         ************
'******************************************************************************
'**                            Language: ArcView Avenue                      **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                  Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                        FAX: (305) 717-5801
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'*
'*=============================================================================
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: receives the FileName of the Name File of a MODFLOW96 simulation
' and a keyword used to specify the type of file (i.e. "WEL" for the Well file)
' and it returns a string of the path indicated in the name file for the file.
' If it does not find the file it returns an empty string.  NOTE: the path will
' returned will be exactly as it appears in the name file, if it is a relative
' path, then that is what will returned.
'
'01234567890123456789012345678901234567890123456789012345678901234567890123456789


'AvMODTMR.GetFileNameFromNameFile

theNameFileName = SELF.Get(0)
theFileKeyword = SELF.Get(1)

theNAMFile = LineFile.Make(theNameFileName, #FILE_PERM_READ)
theLineList = {}
theNAMFile.Read(theLineList, theNAMFile.GetSize)

theWantedFileName = NIL
for each aLine in theLineList
  aLine = aLine.Trim
  if ((aLine = "") or (aLine.Left(1) = "#")) then
    continue
  end
  theWords = aLine.AsList
  if (theWords.Get(0) = theFileKeyword) then
    theWantedFileName = theWords.Get(2)
    break
  end
end
```

```
theNAMFile.Close

'strip any relative path characters (ie. "..\")
theWantedFileName.Substitute("..\", "")

Return theWantedFileName
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                AvMODTMR.GetGridGeometry              *************
'******************************************************************************
'**                           Language: ArcView Avenue                       **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                    Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                          FAX: (305) 717-5801
'*   9100 NW 36th St., Suite 109
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'*
'*=============================================================================
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: receives a grid theme of a MODFLOW simulation and returns a list
' containing three items: 1 and 2: the X and Y coordinates of the Upper Left
' (UL) corner vertex of the grid and, 3: the rotation angle of the grid.  The
' UL corner is the lone vertex of the cell located at Row 1 Col 1.  Also returns
' the rotation angle of the grid relative to the positive x-axis in degrees
' counter clock-wise.
'
'0123456789012345678901234567890123456789012345678901234567890123456789012345678

theGridTheme = SELF.Get(0)
theVTab = theGridTheme.GetFTab

'Locate the first cell:
theFirstCellNo = 1
theFirstCell = av.Run("AvMODTMR.ReturnACertainCell", {theVTab, theFirstCellNo})


'Locate the lone vertex of the first cell:
  'Select arbitrarily small number to use as search radius for identifying lone
  'vertex
  theMinDist = 1

  the1stCellVertex = av.Run("AvMODTMR.ReturnLoneVertex", {theFirstCell, theVTab,
                          theMinDist})

theXCRNR = the1stCellVertex.GetX
theXCRNR.SetFormat("d.")
theYCRNR = the1stCellVertex.GetY
theYCRNR.SetFormat("d.")

'Locate the lone vertex of the last cell in the first row:
```

```
theColFldName = "Col"
theNCOL = av.Run("AvMODTMR.GetFieldMinMaxValues", {theVTab,
                 theColFldName}).Get(1)
the1stRowLastCellNo = theNCOL
the1stRowLastCell = av.Run("AvMODTMR.ReturnACertainCell", {theVTab,
                           the1stRowLastCellNo})
the1stRowLastCellVertex = av.Run("AvMODTMR.ReturnLoneVertex",
                                 {the1stRowLastCell, theVTab, theMinDist})

'Calculate the angle of inclination:
X1 = theXCRNR
Y1 = theYCRNR
X2 = the1stRowLastCellVertex.GetX
Y2 = the1stRowLastCellVertex.GetY
Slope = (Y2 - Y1)/(X2 - X1)

'the rotation angle (in the range -180 to 180, in radians)
theANGLpm180Rad = Slope.ATan
theANGLpm180Deg = theANGLpm180Rad.AsDegrees

'convert to degrees CCW:
if (theANGLpm180Deg >= 0) then
  theANGL = theANGLpm180Deg
elseif (theANGLpm180Deg < 0) then
  theANGL = 360 + theANGLpm180Deg
end

theANGL.SetFormat( "d." )

theXCRNRtext = theXCRNR.AsString+"."
theYCRNRtext = theYCRNR.AsString+"."
theANGLtext = theANGL.AsString+"."

theGridGeomParamList = {theXCRNRtext, theYCRNRtext, theANGLtext}
Return theGridGeomParamList
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                AvMODTMR.GetGridTheme              *************
'******************************************************************************
'**                         Language: ArcView Avenue                          **
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*==============================================================================
'*      Author/Site,      Date,        Event
'*    --------------------------------------------------------------------------
'*    Raul D. Patterson                                   Phone: (305) 717-5865
'*    U. S. Geological Survey - WRD                         FAX: (305) 717-5801
'*    9100 NW 36th St., Suite 109
'*    Miami, Florida 33178 USA                      Internet: rdpatter@usgs.gov
'*
'*==============================================================================
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*
'* Disclaimer:
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'            no warranty, expressed or implied, is made by the USGS as to the
'            accuracy and functioning of the program and related program
'            material nor shall the fact of distribution constitute any such
'            warranty, and no responsibility is assumed by the USGS in
'            connection therewith.
'*
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*==============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: requires the view and the Theme Type Flag, a string with values
' "R" (for Regional) or "L" (for Local). Returns either the Local Grid theme or
' the Regional Grid theme, depending on the value of the Theme Type Flag. If no
' theme with that value in its object tag, then NIL is returned.
'
'012345678901234567890123456789012345678901234567890123456789012345678901234567

'Usage:  av.run("AvMODTMR.GetGridTheme", {theView, theThemeTypeFlag})

theView = SELF.Get(0)
theThemeTypeFlag = SELF.Get(1)

theWantedTheme = NIL
for each T in theView.GetThemes
  if ((T.GetObjectTag.Is(List)) and
        (T.GetObjectTag.Get(0) = theThemeTypeFlag)) then
    theWantedTheme = T
    break
  end
end

Return theWantedTheme
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                   AvMODTMR.Install                ************** 
'******************************************************************************
'**                          Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                   Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                         FAX: (305) 717-5801
'*   9100 NW 36th St., Suite 109
'*   Miami, Florida 33178 USA                      Internet: rdpatter@usgs.gov
'*
'*=============================================================================
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Installs extension, adding all the GUI elements and their scripts
' to the ArcView.  The dialogs and scripts are automatically added.  However,
' any  buttons and menus that are in the extension must be explicitly added to
' the current project's GUIs.
'
'01234567890123456789012345678901234567890123456789012345678901234567890123456789012345678

'Install ONLY if there is an active project
if (av.GetProject = nil) then
  return NIL
end

''Retrieve objects from extension:
theProject = av.GetProject
theDlgMODTMROpenButton = SELF.Get(0)

'Install the open button for the MODTMR dialog:
viewGUI = av.GetProject.FindGUI("View")
if (viewGUI <> NIL) then
  theViewGUIButtonBar = viewGUI.GetButtonBar
  theViewGUIButtons = theViewGUIButtonBar.GetControls
  'Make it the last item
  thePlace = theViewGUIButtons.Count
  theViewGUIButtonBar.Add(theDlgMODTMROpenButton, thePlace)
end
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                   AvMODTMR.Load                   **************
'******************************************************************************
'**                        Language: ArcView Avenue                          **
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                  Phone: (305) 717-5865
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'*   Miami, Florida 33178 USA                     Internet: rdpatter@usgs.gov
'*
'*============================================================================
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
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'*
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: gets executed before the extension objects are actually added to
' the project.  This checks that the environment variable $AVMODTMR has been set
' in the operating system.  This variable contains the path to the AVMODTMR ini
' file and should be set by the systems administrator.  The ini file is looked
' for (using the path inidicated by $AVMODTMR) and if it is not found, then it
' is created by this script.  The user the user is first prompted for a location
' where to write the ini file (should be in the folder where the $AVMODTMR is
' set to or will be set to subsequently) then for these three paths: 1. the
' legends  folder, 2. the images folder, and 3. the MODTMR executable folder.
' From this the ini file is written, and the next time the extension is loaded, '
this script will again try to locate it.  Only when the 3 paths can be
' verified in this script will the loading of the extension proceed.  Also, the
' global variable for the Time Unit Dictionary is created, as well as the splash
' screen is displayed.
'
'01234567890123456789012345678901234567890123456789012345678901234567890123456789012345678

theAvMODTMR_iniFileName = NIL
'look for AvMODTMR.ini file in $AVMODTMR:
'try locating $AVMODTMR:
theAVMODTMRPath = System.GetEnvVar("AVMODTMR")
if (theAVMODTMRPath = NIL) then  'the env var wasn't set, but AvMODTMR.ini may
still exist
  MsgBox.Warning("the AVMODTMR environment variable has not been set.  Set it
pointing to "+
    "the location of the folders "+"legends".Quote+" and "+"images".Quote ++
    "(ie. c:\..\tmr-gui\) to avoid being prompted again next time you load "+
    "the AvMODTMR extension", "")
  theAvMODTMR_iniFileName = FileDialog.Show("*.ini", "AvMODTMR.ini File",
    "Click 'Cancel' if none found")
  if (theAvMODTMR_iniFileName = NIL) then
```

```
    theAvMODTMR_iniFileName = FileDialog.Put ("$HOME\AvMODTMR.ini".AsFileName,
"*.ini", "")
  end
  if (theAvMODTMR_iniFileName = NIL) then
    MsgBox.Error("A Path for the AvMODTMR ini file must be given", "Can Not Load
Extension")
    Return NIL
  end
  theAVMODTMRPath = System.SetEnvVar("AVMODTMR",
theAvMODTMR_iniFileName.ReturnDir.AsString)
else
  'try to get ini file in $AVMODTMR:
  theAvMODTMR_iniFileName = "$AVMODTMR\AvMODTMR.ini".AsFileName
end


LegendPathOK = FALSE
ImagePathOK = FALSE
ExePathOK = FALSE

if (theAvMODTMR_iniFileName.IsFile) then

  'get the paths and parse its values into variables:
  theAvMODTMRIniFile = LineFile.Make(theAvMODTMR_iniFileName, #FILE_PERM_READ)
  thePathLineList = List.Make
  theAvMODTMRIniFile.Read(thePathLineList, 3)
  theAvMODTMRIniFile.Close
  theLegendPath = thePathLineList.Get(0).AsTokens("=").Get(1)
  if ( theLegendPath.AsFileName.IsDir ) then
    LegendPathOK = TRUE
    _theLegendPath = theLegendPath
  end
  theImagePath = thePathLineList.Get(1).AsTokens("=").Get(1)
  if ( theImagePath.AsFileName.IsDir ) then
    ImagePathOK = TRUE
    _theImagePath = theImagePath
  end
  theExePath = thePathLineList.Get(2).AsTokens("=").Get(1)
  if ( theExePath.AsFileName.IsDir ) then
    ExePathOK = TRUE
    _theExePath = theExePath
  end

end

if (LegendPathOK.Not) then
  theLegendFile = FileDialog.Show("*.avl", "AvMODTMR Legend File",
     "Select a legend file")
  if (theLegendFile = NIL) then
    MsgBox.Error("the AvMODTMR legends folder does not exist",
    "Can not load AvMODTMR Extension")
    Return NIL
  else
    theLegendPath = theLegendFile.ReturnDir.AsString
    _theLegendPath = theLegendPath
  end
end

if (ImagePathOK.Not) then
  theImageFile = FileDialog.Show("*.*", "AvMODTMR Image File",
     "Select an image file")
  if (theImageFile = NIL) then
    MsgBox.Error("the AvMODTMR images folder does not exist",
```

```
    "Can not load AvMODTMR Extension")
    Return NIL
  else
    theImagePath = theImageFile.ReturnDir.AsString
    _theImagePath = theImagePath
  end
end

if (ExePathOK.Not) then
  theExeFile = FileDialog.Show("*.exe", "MODTMR Executable",
     "Select the MODTMR exe file")
  if (theExeFile = NIL) then
    MsgBox.Error("the MODTMR executable does not exist",
    "Can not load AvMODTMR Extension")
    Return NIL
  else
    theExePath = theExeFile.ReturnDir.AsString
    _theExePath = theExePath
  end
end


if ( LegendPathOK.Not or ImagePathOK.Not or ExePathOK.Not ) then
  're-write AvMODTMR ini file
  theAvMODTMRIniFile = LineFile.Make(theAvMODTMR_iniFileName, #FILE_PERM_WRITE)
  aLineList = {"theLegendPath="+theLegendPath, "theImagePath="+theImagePath,
    "theMODTMRexePath="+theExePath}
  theAvMODTMRIniFile.Write(aLineList, 3)
  theAvMODTMRIniFile.Close
end


'Build the ITMUNI dictionary and set as a global variable:
theTimeUnitDict = Dictionary.Make(1)

theTimeUnitDict.Add("0","Undefined")
theTimeUnitDict.Add("1","Seconds")
theTimeUnitDict.Add("2","Minutes")
theTimeUnitDict.Add("3","Hours")
theTimeUnitDict.Add("4","Days")
theTimeUnitDict.Add("5","Years")

_theTimeUnitDict = theTimeUnitDict


'Show the splash screen:
theImageFileName = FileName.Make(theImagePath.AsString + "\" +
"water_banner1.gif")
MsgBox.Banner (theImageFileName, 3, "ArcView MODTMR Extension")
```

```
'************* U.S. Geological Survey preliminary computer program ************
'*****************************************************************************
'*************              AvMODTMR.LoadParamToDialog          *************
'*****************************************************************************
'**                          Language: ArcView Avenue                       **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'*     Author/Site,      Date,        Event
'*   -------------------------------------------------------------------------
'*   Raul D. Patterson                                    Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                          FAX: (305) 717-5801
'*   9100 NW 36th St., Suite 109
'*   Miami, Florida 33178 USA                       Internet: rdpatter@usgs.gov
'*
'*============================================================================
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Called by the MODTMR Doc Activate script.  Writes the parameters
' stored in the object tags of the regional and grid themes to their respective
' controls in the dialog.


'0123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789
theView = SELF.Get(0)
theMODTMR_Dlg = SELF.Get(1)


theLocThemeTypeFlag = "L"
theLocTheme = av.run("AvMODTMR.GetGridTheme", {theView, theLocThemeTypeFlag})

theRegThemeTypeFlag = "R"
theRegTheme = av.run("AvMODTMR.GetGridTheme", {theView, theRegThemeTypeFlag})



if ((theRegTheme = NIL).Not) then


  theRegParamList= theRegTheme.GetObjectTag


  MFNAME = theRegParamList.Get(1)
  if ((MFNAME = "").Not) then
    theMODTMR_Dlg.FindByName("txlRegNameFile").SetText(MFNAME)
  end

  theMODTMR_Dlg.FindByName("txlRegGridTheme").Update
```

```
  RegNLAY = theRegParamList.Get(10)
  if ((RegNLAY = "").Not) then
    theMODTMR_Dlg.FindByName("txlRegNLAY").SetText(RegNLAY)
  end

  RegITMUNI = theRegParamList.Get(11)
  if ((RegITMUNI = "").Not) then
    theMODTMR_Dlg.FindByName("txlRegITMUNI").SetText(RegITMUNI)
  end

  RegNROW = theRegParamList.Get(12)
  if ((RegNROW = "").Not) then
    theMODTMR_Dlg.FindByName("txlRegNROW").SetText(RegNROW)
  end

  RegNCOL = theRegParamList.Get(13)
  if ((RegNCOL = "").Not) then
    theMODTMR_Dlg.FindByName("txlRegNCOL").SetText(RegNCOL)
  end

  RegISSFlag = theRegParamList.Get(14)
  if (RegISSFlag = 0) then
    theMODTMR_Dlg.FindByName("radRegTransient").Select
  elseif (RegISSFlag = 1) then
    theMODTMR_Dlg.FindByName("radRegSteadyState").Select
  end

  RegNPER = theRegParamList.Get(15)
  if ((RegNPER = "").Not) then
    theMODTMR_Dlg.FindByName("txlRegNPER").SetText(RegNPER)
  end

  theUnits = theRegParamList.Get(16)
  if ((theUnits = "").Not) then
    theMODTMR_Dlg.FindByName("txlUnits").SetText(theUnits)
  end

  thePathToFiles = theRegParamList.Get(17)
  if ((thePathToFiles = "").Not) then
    theMODTMR_Dlg.FindByName("txlPathToFiles").SetText(thePathToFiles)
  end
end



'Now, let's look at the local grid theme, if present, and fill its att's:


if ((theLocTheme = NIL).Not) then


  theLocParamList= theLocTheme.GetObjectTag

  theMODTMR_Dlg.FindByName("txlLocalGridTheme").Update

  theRegGridTheme = theLocParamList.Get(2)
  if ((theRegGridTheme = NIL).Not) then
    'continuetheMODTMR_Dlg.FindByName("txlRegNameFile").SetText(MFNAME)
  elseif ((theRegGridTheme.GetView = theLocTheme.GetView).Not) then
    'issue warning because the view does not contain a regional grid theme
    'IN FUTURE, PUT A MECHANISM TO DEAL WITH THIS, PREVENTING THE EXISTANCE
    'OF LOCAL GRID THEMES W/O A REG. GRID THEME.
```

```
else
  'do something else
end

theLMDSN = theLocParamList.Get(3)
if ((theLMDSN = "").Not) then
  theMODTMR_Dlg.FindByName("txlLocalNameFile").SetText(theLMDSN)
end

theLMPRF = theLocParamList.Get(4)
if (theLMPRF = 0) then
  theMODTMR_Dlg.FindByName("radAllPackages").Select
elseif (RegISSFlag = 1) then
  theMODTMR_Dlg.FindByName("radFHBPkgOnly").Select
end

theNROW2 = theLocParamList.Get(6)
if ((theNROW2 = "").Not) then
  theMODTMR_Dlg.FindByName("txtNROW2rpt").SetLabel("No. of Rows:  "+theNROW2)
end

theNCOL2 = theLocParamList.Get(7)
if ((theNCOL2 = "").Not) then
  theMODTMR_Dlg.FindByName("txtNCOL2rpt").SetLabel("No. of Columns:  "+
                                                      theNCOL2)
end

theITMUN2 = theLocParamList.Get(8)
if ((theITMUN2 = "").Not) then
  cbxLocITMUNI = theMODTMR_Dlg.FindByName("cbxLocITMUNI")
  'SET THE VALUE OF THIS AND MAKE IT THE VISIBLE CHOICE:
end

theXCRNR2num = theLocParamList.Get(11).AsNumber
theXCRNR2num.SetFormat("d.dd")
theXCRNR2 = theXCRNR2num.AsString
if ((theXCRNR2 = "").Not) then
  theMODTMR_Dlg.FindByName("txtXCRNR2rpt").SetLabel("Origin X-coor:  "+
                                                        theXCRNR2)
end

theYCRNR2num = theLocParamList.Get(12).AsNumber
theYCRNR2num.SetFormat("d.dd")
theYCRNR2 = theYCRNR2num.AsString
if ((theYCRNR2 = "").Not) then
  theMODTMR_Dlg.FindByName("txtYCRNR2rpt").SetLabel("Origin Y-coor:  "+
                                                        theYCRNR2)
end

theANGL2num = theLocParamList.Get(13).AsNumber
theANGL2num.SetFormat("d.dd")
theANGL2 = theANGL2num.AsString
if ((theANGL2 = "").Not) then
  theMODTMR_Dlg.FindByName("txtANGL2rpt").SetLabel("Rotation:  "+theANGL2)
end

theDELR2 = theLocParamList.Get(14)
if ((theDELR2 = "").Not) then
  theMODTMR_Dlg.FindByName("txtDELR2rpt").SetLabel("Row Height:  "+theDELR2)
end

theDELC2 = theLocParamList.Get(15)
if ((theDELC2 = "").Not) then
```

```
    theMODTMR_Dlg.FindByName("txtDELC2rpt").SetLabel("Column Width:  "+theDELC2)
  end

  theIFHBUN = theLocParamList.Get(16)
  if ((theIFHBUN = NIL).Not) then
    theMODTMR_Dlg.FindByName("txlIFHBUN").SetText(theIFHBUN)
  end

end
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************               AvMODTMR.MakeCenteredLine             ************
'******************************************************************************
'**                          Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                   Phone: (305) 717-5865
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Receives an angle Theta, a point theCenPt, and a number
' theLength.  Creates and returns a line oriented at an angle Theta, centered
' at point theCenPt and of length theLength.
'
'123456789012345678901234567890123456789012345678901234567890123456789012345678

Theta = SELF.Get(0)
theCenPt = SELF.Get(1)
theLength = SELF.Get(2)
theHalfLength = theLength / 2
theDeltaX = theHalfLength * Theta.Cos
theDeltaY = theHalfLength * Theta.Sin
theAxialBegPt = (theCenPt.GetX - theDeltaX)@(theCenPt.GetY - theDeltaY)
theAxialEndPt = (theCenPt.GetX + theDeltaX)@(theCenPt.GetY + theDeltaY)
theAxialLine = PolyLine.Make({{theAxialBegPt, theAxialEndPt}})

Return theAxialLine
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************               AvMODTMR.MakeLocalGridOutline          ************
'******************************************************************************
'**                        Language: ArcView Avenue                          **
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                 Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                       FAX: (305) 717-5801
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'*============================================================================
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'*
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Receives the numbers X1, X2, Theta, H, and W. X1, Y1 are the x
' and y coordinates of the Upper Left (UL) corner of a model grid; Theta is the
' angle of orientation of the grid relative to the pos x-axis, and H, W are the
' Height (length of a column) and Width (length of a row) of the grid. Computes
' the size and location of the rectangle forming the edge of the grid and calls
' the script 'AvMODTMR.DrawTempBox' to draw outline and origin of the grid.
'
'012345678901234567890123456789012345678901234567890123456789012345678901234567


theView = av.GetActiveDoc
theGraphics = theView.GetGraphics

'Get all sent arguments:
X1 = Self.Get(0)
Y1 = Self.Get(1)
Theta = SELF.Get(2)
  Theta = Theta.AsRadians
H = Self.Get(3)
W = SELF.Get(4)


'Create graphic origin point and add to view:
  theOrigin = Point.Make(X1, Y1)


'Create graphic box and add to view:

  'create vertices:
  Theta2 = Theta
  X2 = X1 + (W*Theta2.Cos)
```

```
Y2 = Y1 + (W*Theta2.Sin)

Theta3 = Theta2 - (Number.GetPi/2)
X3 = X2 + (H*Theta3.Cos)
Y3 = Y2 + (H*Theta3.Sin)

Theta4 = Theta3 - (Number.GetPi/2)
X4 = X3 + (W*Theta4.Cos)
Y4 = Y3 + (W*Theta4.Sin)

'make box and add to view as a graphic:
theBox = Polygon.Make( {{X1@Y1, X2@Y2, X3@Y3, X4@Y4}} )
'Call the script to draw it:
av.Run("AvMODTMR.DrawTempBox", {theOrigin, theBox})
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                AvMODTMR.MakeLocGridTheme            *************
'******************************************************************************
'**                           Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                   Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                         FAX: (305) 717-5801
'*   9100 NW 36th St., Suite 109
'*   Miami, Florida 33178 USA                      Internet: rdpatter@usgs.gov
'*
'*=============================================================================
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Receives the variables to discretize, orient, and position the
' local grid theme and then calls the script to Make grid w/o rotation
' (AvMODTMR.CreateGrid), script to rotate grid if rotation <> 0
' (AvMODTMR.RotateGrid), populates the local grid parameter list (the local grid
' theme's obj. tag), and then creates the FHB theme.
'
'012345678901234567890123456789012345678901234567890123456789012345678901234345678

'Get parameters sent:
theX_coor = SELF.Get(0)
theY_coor = SELF.Get(1)
theRotation = SELF.Get(2)
theNROW2 = SELF.Get(3)
theDELR2 = SELF.Get(4)
theNCOL2 = SELF.Get(5)
theDELC2 = SELF.Get(6)
theView = SELF.Get(7)
theRegGridTheme = SELF.Get(8)
theFileName = SELF.Get(9)

'get file name for the local grid if not NIL:
if (theFileName = NIL) then

  theDlgMODTMR = av.FindDialog("AvMODTMR.DlgMODTMR")
  theOutName = theDlgMODTMR.FindByName("txlLocalNameFile").GetText
  theDefaultFileName = (FileName.GetCWD.AsString +"\"+theOutName).AsFileName
  theFileName = FileDialog.Put (theDefaultFileName, "*.shp",
                               "Save Output Local Grid")
  if (theFileName = NIL) then
  MsgBox.Warning("No Output Local Grid Shapefile specified",
        "Can Not Proceed")
```

```
  Return Nil
  elseif ((theFileName.AsString.Right(4) = ".shp").Not) then
    theFileName = (theFileName.AsString + ".shp").AsFileName
  end

end



'create local grid:
av.Run("AvMODTMR.CreateGrid", {theX_coor, theY_coor, theNROW2,
       theNCOL2, theDELR2, theDELC2,theFileName})
theLocGridTheme = Theme.Make(theFileName.AsString.AsSrcName)
theView.AddTheme(theLocGridTheme)
'set legend:
theLocGridLegend = Legend.Make(#SYMBOL_FILL)
theLocGridLegendFileName = (_theLegendPath+"\locgrid.avl").AsFileName
theLocGridLegend.Load(theLocGridLegendFileName, #LEGEND_LOADTYPE_ALL)
theLocGridTheme.SetLegend(theLocGridLegend)
theLocGridTheme.SetVisible(TRUE)



'rotate grid as well, if rotation is not 0:
if (theRotation <> 0) then
  av.Run("AvMODTMR.RotateGrid", {theLocGridTheme, theRotation})
end



'add the "FHB_L#" fields to the local grid theme, one for each of the n layers
'in the regional model:

  aFieldList = {}
  theRegParamList = theRegGridTheme.GetObjectTag
  RegNLAY = theRegParamList.Get(10)
  for each n in 1..RegNLAY.AsNumber
    aFieldName = "FHB_L"+n.AsString
    aNewField = Field.Make (aFieldName, #FIELD_LONG, 1, 0)
    aFieldList.Add(aNewField)
  end

  'Add FHB fields:
  theLocGridFTab = theLocGridTheme.GetFTab
  theLocGridFTab.StartEditingWithRecovery
  theLocGridFTab.AddFields(aFieldList)
  theLocGridFTab.Flush
  theLocGridFTab.StopEditingWithRecovery(TRUE)

  'create the FHB theme by cloning the local grid theme:
  theFHBTheme = theLocGridTheme.Clone
  theFHBTheme.SetName(theLocGridTheme.GetName++"FHB BCs")

  'set legend:
  aFHBLegend = Legend.Make(#SYMBOL_FILL)
  theFHBLegendFileName = (_theLegendPath+"\FHB.avl").AsFileName
  aFHBLegend.Load(theFHBLegendFileName, #LEGEND_LOADTYPE_ALL)
  theFHBTheme.SetLegend(aFHBLegend)

  qString = "( [Row] = 1) or ([Row] = "+theNROW2.AsString+") or "+
                  "([Col] = 1) or ([Col] = "+theNCOL2.AsString+" )"
  theFHBVTab = theFHBTheme.GetFTab
  theFHBVTab.SetDefinition (qString)
```

```
  theView.AddTheme(theFHBTheme)
  theFHBTheme.SetVisible(TRUE)


'create and populate the param. list for the local grid:
theLocGridObjList = List.Make
theGridThemeType = "L"
DlgMODTMR = av.FindDialog("AvMODTMR.DlgMODTMR")
theRegGridTheme = theRegGridTheme

LMDSN = DlgMODTMR.FindByName("txlLocalNameFile").GetText
theLMPRFoption = DlgMODTMR.FindByName("cpaLMPRF").GetSelected.GetLabel
if (theLMPRFoption = "FHB Package Only") then
  LMPRF = "1"
elseif (theLMPRFoption = "All Packages") then
  LMPRF = "0"
end


'Populate the LML dictionary so all regional layers are used (as default):
RegLayCount = DlgMODTMR.FindByName("txlRegNLAY").GetText.AsNumber
LML = Dictionary.Make(RegLayCount)
for each i in 1..RegLayCount by 1
  LML.Add(i, 1)    'All 1's since we start out with all the Reg layers.
end


NROW2 = theNROW2.AsString
NCOL2 = theNCOL2.AsString

ITMUN2text = DlgMODTMR.FindByName("txlRegITMUNI").GetText

ITMUN2 = NIL
for each i in 0..5
  aTimeTextValue = _theTimeUnitDict.Get(i.AsString)
  if (aTimeTextValue = ITMUN2text) then
    ITMUN2 = i
    break
  end
end

XYFAC2 = 1.AsString
ICRNR2 = 1.AsString

XCRNR2 = theX_coor.SetFormat("d.dd").AsString
YCRNR2 = theY_coor.SetFormat("d.dd").AsString

theAngle = av.Run("AvMODTMR.Return0to360Angle", {theRotation})
ANGL2 = theAngle.SetFormat("d.dd").AsString

DELR2 = theDELR2.AsString
DELC2 = theDELC2.AsString

IFHBUN = NIL

txlIFHBUN = DlgMODTMR.FindByName("txlIFHBUN")

if ((txlIFHBUN.GetText = NIL).Not) then
  IFHBUN = txlIFHBUN.GetText
end

theLocGridObjList = {theGridThemeType, theFHBTheme, theRegGridTheme,
  LMDSN, LMPRF, LML, NROW2, NCOL2, ITMUN2, XYFAC2, ICRNR2, XCRNR2,
```

```
  YCRNR2, ANGL2, DELR2, DELC2, IFHBUN}

theLocGridTheme.SetObjectTag(theLocGridObjList)

av.GetProject.SetModified(TRUE)
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                 AvMODTMR.MakeOrientedBox              *************
'******************************************************************************
'**                            Language: ArcView Avenue                        **
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'*     Author/Site,      Date,        Event
'*   ------------------------------------------------------------------------
'*   Raul D. Patterson                                   Phone: (305) 717-5865
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'*
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose:  Receives the View, and the numbers DELC and DELR.  Finds the
' graphics named "theLocalPolygon", and "theDirectionLine" in the view
' and then constructs a bounding rectangle that is circumscribed around the
' Local Polygon and oriented in the direction of the Direction Line.  From the
' rectangle it obtains the Upper Left corner of the model domain (ie. theX_coor
' and theY_coor), the number of columns, and rows (NCOL and NROW), and the
' Rotation angle (theRotation).  The circumscribed rectangle almost always
' extends slightly beyond the bounds of the Local Polygon since the DELC and
' DELR are constant and NROW and NCOL are integers.
'
'123456789012345678901234567890123456789012345678901234567890123456789012345678


theView = SELF.Get(0)
DELC = SELF.Get(1)
DELR = SELF.Get(2)

theView = av.GetActiveDoc
theGraphics = theView.GetGraphics
theLocPoly = theGraphics.FindByName("theLocalPolygon").GetShape
theDirLine = theGraphics.FindByName("theDirectionLine").GetShape

'Get properties of poly to be used to construct lines:
theLength = theLocPoly.ReturnLength
theHalfLength = theLength / 2
theCenPt = theLocPoly.ReturnCenter

'Get theDirLine's slope as a pos angle relative to the pos x-axis:
ThetaDeg = av.Run("AvMODTMR.ReturnAngleNormalized", {theDirLine})
Theta = ThetaDeg.AsRadians
```

```
'Create Axial Line.  Passes through centroid of theLocPoly and is of length
'equal to the Lengtheter of same.
theAxialLine = av.Run("AvMODTMR.MakeCenteredLine", {Theta, theCenPt, theLength})


'Create Transverse Line.  Perpendicular to Axial Line, through poly center and
'same length (eq. to poly Length).
'create begining point:
theTransAngle = Theta + (Number.GetPi/2)
theTransLine = av.Run("AvMODTMR.MakeCenteredLine", {theTransAngle, theCenPt,
                      theLength})
theTransLine = theTransLine.Flip

'Create the Axial pair lines and the Transverse pair lines:
theAxialPair = av.Run("AvMODTMR.ReturnLinesOffsetToPolyBnd", {theLocPoly,
                      theAxialLine})
theRightLine = theAxialPair.Get(0)
theLeftLine = theAxialPair.Get(1)
theTransPair = av.Run("AvMODTMR.ReturnLinesOffsetToPolyBnd", {theLocPoly,
                      theTransLine})
theBackLine = theTransPair.Get(0)
theFrontLine = theTransPair.Get(1)

'Intersect lines to create points 1, 2, & 4 (defining the oriented bounding
'box around the poly, numbered clockwise):
Pt1 = theLeftLine.PointIntersection(theBackLine).AsList.Get(0)
Pt2 = theFrontLine.PointIntersection(theLeftLine).AsList.Get(0)
Pt4 = theRightLine.PointIntersection(theBackLine).AsList.Get(0)

theNCOL = (Pt1.Distance(Pt2)/DELC).Ceiling
theNROW = (Pt1.Distance(Pt4)/DELR).Ceiling
theX_coor = Pt1.GetX
theY_coor = Pt1.GetY
theRotation = ThetaDeg

Return {theNCOL, theNROW, theX_coor, theY_coor, theRotation}
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************              AvMODTMR.Modify_CreateLocGrid            ************
'******************************************************************************
'**                           Language: ArcView Avenue                        **
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*==============================================================================
'*     Author/Site,      Date,        Event
'*   ---------------------------------------------------------------------------
'*   Raul D. Patterson                                    Phone: (305) 717-5865
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'*   Miami, Florida 33178 USA                       Internet: rdpatter@usgs.gov
'*
'*==============================================================================
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'*
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*==============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: receives the dialog and the active view; from the dialog it gets
' all the values stored in the text lines; from the active view it gets the
' Regional grid theme and the Local Grid theme (if one exists).  If a Local
' grid theme exists, it modifies it if its geometry has been altered (ie.
' rotation change or re-discretizing); if one does not exist or if it does but
' its geometry has been altered, then it is created, by calling the script
' "AvMODTMR.MakeLocGridTheme".
'
'0123456789012345678901234567890123456789012345678901234567890123456789012345678


theView = SELF.Get(0)
dlgDefineLocGrid = SELF.Get(1)

'find local grid and regional grid:
theLocGridTypeFlag = "L"
theLocGridTheme = av.Run("AvMODTMR.GetGridTheme", {theView, theLocGridTypeFlag})
theRegGridTypeFlag = "R"
theRegGridTheme = av.Run("AvMODTMR.GetGridTheme", {theView, theRegGridTypeFlag})



theX_coorString = dlgDefineLocGrid.FindByName("txlXcoor").GetText
theX_coor = theX_coorString.AsNumber.SetFormat("d.dd")
theY_coorString = dlgDefineLocGrid.FindByName("txlYcoor").GetText
theY_coor = theY_coorString.AsNumber.SetFormat("d.dd")
theRotationString = dlgDefineLocGrid.FindByName("txlRotation").GetText
theRotation = theRotationString.AsNumber.SetFormat("d.dd")
theNROW2 = dlgDefineLocGrid.FindByName("txlNROW2").GetText.AsNumber
theDELR2 = dlgDefineLocGrid.FindByName("txlDELR2").GetText.AsNumber.SetFor-
mat("d.dd")
```

```
theNCOL2 = dlgDefineLocGrid.FindByName("txlNCOL2").GetText.AsNumber
theDELC2 = dlgDefineLocGrid.FindByName("txlDELC2").GetText.AsNumber.SetFor-
mat("d.dd")



if (theLocGridTheme = NIL) then
  'then create it:
  av.Run("AvMODTMR.MakeLocGridTheme", {theX_coor, theY_coor, theRotation,
          theNROW2, theDELR2, theNCOL2, theDELC2, theView, theRegGridTheme,
          NIL})
  theView.Invalidate
  Return NIL
end

'run tests to find out what needs to be done (rotate/translate, regrid):

theLocParamList = theLocGridTheme.GetObjectTag

'Check to see if regridding is necessary, if it is, then delete local grid &
'its FHB theme:

Regridding = FALSE

theOldNROW2 = theLocParamList.Get(6).AsNumber
theOldNCOL2 = theLocParamList.Get(7).AsNumber
theOldDELR2 = theLocParamList.Get(14).AsNumber.SetFormat("d.dd")
theOldDELC2 = theLocParamList.Get(15).AsNumber.SetFormat("d.dd")
ChangeInNROW2 = theNROW2 - theOldNROW2
ChangeInNCOL2 = theNCOL2 - theOldNCOL2
ChangeInDELR2 = theDELR2 - theOldDELR2
ChangeInDELC2 = theDELC2 - theOldDELC2

'Check if re-gridding is required, if yes, call AvMODTMR.MakeLocGridTheme,
'sending it the new local grid dimension parameters:
if ((ChangeInNROW2 <> 0) or (ChangeInNCOL2 <> 0) or (ChangeInDELR2 <> 0) or
                                                    (ChangeInDELC2 <> 0)) then
  Regridding = TRUE
end

'then it must be deleted and re-created:
if (Regridding) then

  'get its file name before deleting the theme to re-use it:
  theLocGridFileName = theLocGridTheme.GetSrcName.GetFileName

  'delete the local theme, its FHB theme and their tables:
  av.run("AvMODTMR.DeleteLocGridThemes", {theView, theLocGridTheme})

  'recreate the local grid:
  av.Run("AvMODTMR.MakeLocGridTheme", {theX_coor, theY_coor, theRotation,
          theNROW2, theDELR2, theNCOL2, theDELC2, theView, theRegGridTheme,
          theLocGridFileName})
  Return NIL
end



'regrid or rotate/translate, if necessary:

'Check to see if there's been any change in origin location or rotation:
theCurrentX_coor = theLocParamList.Get(11).AsNumber
theCurrentY_coor = theLocParamList.Get(12).AsNumber
```

```
if ((theCurrentX_coor <> theX_coor) or (theCurrentY_coor <> theY_coor)) then
  'ie., translation required:
  av.Run("AvMODTMR.TranslateGrid", {theLocGridTheme, theX_coor, theY_coor})
  theLocParamList.Set(11, theX_coor.AsString)
  theLocParamList.Set(12, theY_coor.AsString)
  theLocGridTheme.SetObjectTag(theLocParamList)
  av.GetProject.SetModified(TRUE)
end

'Check to see if there's been any change in rotation:
theCurrentRotation = theLocParamList.Get(13).AsNumber
if (theCurrentRotation <> theRotation) then
  'ie., rotation required:
  av.Run("AvMODTMR.RotateGrid", {theLocGridTheme, theRotation})
  theAngle = av.Run("AvMODTMR.Return0to360Angle", {theRotation})
  theLocParamList.Set(13, theAngle.AsString)
  theLocGridTheme.SetObjectTag(theLocParamList)
  av.GetProject.SetModified(TRUE)
end
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************               AvMODTMR.OpenDlgMODTMR              *************
'******************************************************************************
'**                          Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                    Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                          FAX: (305) 717-5801
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'*   Miami, Florida 33178 USA                       Internet: rdpatter@usgs.gov
'*
'*=============================================================================
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'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: launched by button in view GUI, this script opens the MODTMR
' dialog.  It first checks that the project has been saved and prompts user to
' do so if it has not.  Then, it searches for the regional grid theme in the
' view, and prompts the user to add it with a browse window if there isn't one.
' Regional Grid theme is added to the view with a pre-defined legend, its
' object tag is initialized with the parameter list, and the parameter list is
' filled with empty values that are place-holders, except for a few basic
' geometry information that is determined from the theme itself by calling
' 'AvMODTMR.GetGridGeometry'.  Finally, the 'AvMODTMR.LoadParamToDialog' is
' called to load the parameters to the dialog.
'
'0123456789012345678901234567890123456789012345678901234567890123456789012345678

theView = av.GetActiveDoc

'Make sure the project has been saved:
theProjectHasBeenSaved = TRUE
if (av.GetProject.GetFileName = NIL) then
  theProjectHasBeenSaved = FALSE
  av.Run("Project.Save", {})
  theProjectFileName = av.GetProject.GetFileName
  if (theProjectFileName = NIL) then
    MsgBox.Error("You can not continue unless you save the project first", "")
    Return NIL
  end
end


ThereIsAGridThemeAlready = FALSE
for each T in theView.GetThemes
  if ((T.GetObjectTag.Is(List)) and (T.GetObjectTag.Get(0) = "R")) then
```

```
    ThereIsAGridThemeAlready = TRUE
    break
  end
end

DlgMODTMR = av.FindDialog("AvMODTMR.DlgMODTMR")

if (ThereIsAGridThemeAlready.Not) then
  LoadExistingRegGridTheme = MsgBox.YesNo("Would you like to add a Regional "+
    "Grid theme?", "No Regional Grid Theme in View", TRUE)
  if (LoadExistingRegGridTheme) then
    theRegGridThemeFileName = FileDialog.Show ("*.shp", "ArcView Shapefile",
        "Select the Regional Grid Theme")
    theRegGridThemeSrcName = SrcName.Make(theRegGridThemeFileName.AsString)
    theRegGridTheme = Theme.Make(theRegGridThemeSrcName)

    'Initialize the object tag of the local grid theme:

    theLocGridObjList = List.Make

    theGridThemeType = "R"
    MFNAME = ""
    XYFAC1 = 1
    ICRNR1 = 1

    regGridGeomParamList = av.Run("AvMODTMR.GetGridGeometry", {theRegGridTheme})

    XCRNR1 = regGridGeomParamList.Get(0)
    YCRNR1 = regGridGeomParamList.Get(1)
    ANGL1 = regGridGeomParamList.Get(2)
    XXCBC = ""
    XXHED = ""
    UsedIUNITS = ""
    RegNLAY = ""
    RegITMUNI = ""
    RegNROW = ""
    RegNCOL = ""
    theISSFlag = ""
    RegNPER = ""
    theUnits = ""
    thePathToFiles = ""
    theRegParamList = {theGridThemeType, MFNAME, XYFAC1, ICRNR1, XCRNR1,
        YCRNR1, ANGL1, XXCBC, XXHED, UsedIUNITS, RegNLAY, RegITMUNI, RegNROW,
        RegNCOL, theISSFlag, RegNPER, theUnits, thePathToFiles}


    theRegGridTheme.SetObjectTag(theRegParamList)

    theView.AddTheme(theRegGridTheme)
    theRegGridTheme.SetVisible(TRUE)
    theRegGridThemeLegend = Legend.Make(#SYMBOL_FILL)

    theRegGridAVL = (_theLegendPath+"\reggrid.avl").AsFileName

    theRegGridThemeLegend.Load( theRegGridAVL , #LEGEND_LOADTYPE_ALL)
    theRegGridTheme.SetLegend(theRegGridThemeLegend)
    theRegGridTheme.UpdateLegend
    theView.Invalidate
    av.GetProject.SetModified(TRUE)

    'CLEAR UP ALL CONTROLS BECAUSE IT'S A NEW TMR VIEW:
    theTextLineControls = DlgMODTMR.FindByClass(TextLine)
    for each aControl in theTextLineControls
```

```
      aControl.SetText("")
    end



  else
    MsgBox.Info("No regional grid theme, no AvMODTMR",
      "Can Not Continue Without a Regional Grid Theme")
    return NIL
  end
else
  theControls = DlgMODTMR.FindByClass(Control)
  for each aControl in theControls
    aControl.SetEnabled(TRUE)
  end
  av.run("AvMODTMR.LoadParamToDialog", {theView, DlgMODTMR})
end


'UPDATE SCRIPTS TO LAUNCH:
DlgMODTMR.FindByName("cbxLocITMUNI").Update

'Update the Reg Grid theme text line:
DlgMODTMR.FindByName("txlRegGridTheme").Update

'Update the Local Grid theme text line:
DlgMODTMR.FindByName("txlLocalGridTheme").Update

DlgMODTMR.Update
DlgMODTMR.Open
```

```
'************* U.S. Geological Survey preliminary computer program ************
'*****************************************************************************
'*************             AvMODTMR.Return0to360Angle            *************
'*****************************************************************************
'**                         Language: ArcView Avenue                         **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                   Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                         FAX: (305) 717-5801
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'*   Miami, Florida 33178 USA                     Internet: rdpatter@usgs.gov
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: receives an angle in degrees and returns the angle expressed as
' degrees CCW from pos-X axis.
'
'12345678901234567890123456789012345678901234567890123456789012345678901234567 8

theAngle = SELF.Get(0)

if (theAngle.Abs > 360) then
  theAngle = theAngle.Mod(360)
end

if (theAngle < 0) then
  theAngle = 360 + theAngle
end

Return theAngle
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                AvMODTMR.ReturnACertainCell        **************
'******************************************************************************
'**                          Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
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'*   Miami, Florida 33178 USA                      Internet: rdpatter@usgs.gov
'*
'*=============================================================================
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: receives the attribute table of a grid (polygonal) theme, and
' returns the cell with the sequence number given by the argument "theCellNo"
' NOTE: the field "Seqnum" is hardcode in this script and so it must be in the
' attribute table.  This should contain the sequential numbering of the cell
' ids, which customarily start with 1 at Row 1, Col 1, increment through the
' cells of the row and then begin at Col 1 of the next row, and so on.
'
'0123456789012345678901234567890123456789012345678901234567890123456789012345678

theVTab = SELF.Get(0)
theCellNo = SELF.Get(1)

theSeqnumFld = theVTab.FindField("Seqnum")
theShapeFld = theVTab.FindField("Shape")
theCell = NIL
for each aRow in theVTab
  theSeqnum = theVTab.ReturnValue(theSeqnumFld, aRow)
  if (theSeqnum = theCellNo) then
    theCell = theVTab.ReturnValue(theShapeFld, aRow)
    break
  end
end

if (theCell = NIL) then
  MsgBox.Error("No such cell found in the grid theme", "Terminating")
  Return Nil
else
  Return theCell
end
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************             AvMODTMR.ReturnAngleNormalized          *************
'******************************************************************************
'**                         Language: ArcView Avenue                          **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                   Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                         FAX: (305) 717-5801
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'*   Miami, Florida 33178 USA                      Internet: rdpatter@usgs.gov
'*
'*=============================================================================
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'*
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'*=============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: takes in a line and returns the angle it makes with the positive
' X-axis.
'
'12345678901234567890123456789012345678901234567890123456789012345678901234567 8

theDirLine = SELF.Get(0)

theBegPt = theDirLine.Along(0)
theEndPt = theDirLine.Along(100)

X1 = theBegPt.GetX
Y1 = theBegPt.GetY
X2 = theEndPt.GetX
Y2 = theEndPt.GetY
Hyp = theDirLine.ReturnLength

'Account for angles of 0, 90, 180, and 270:
if (Y1 = Y2) then
  if (X1 < X2) then
    ThetaDeg = 0
  elseif (X1 > X2) then
    ThetaDeg = 180
  end
  Return ThetaDeg
end
if (X1 = X2) then
  if (Y1 < Y2) then
    ThetaDeg = 90
  elseif (Y1 > Y2) then
    ThetaDeg = 270
  end
```

```
  Return ThetaDeg
end

Adj = X2 - X1
Opp = Y2 - Y1
CosPhi = Adj/Hyp
SinPhi = Opp/Hyp
TanPhi = Opp/Adj

Theta = NIL
if ((SinPhi > 0) and (CosPhi > 0)) then
  Phi = SinPhi.ASin
  Theta = Phi
elseif ((SinPhi > 0) and (CosPhi < 0)) then
  Phi = SinPhi.ASin
  Theta = (Number.GetPi) - Phi
elseif ((SinPhi < 0) and (CosPhi < 0)) then
  Phi = TanPhi.ATan
  Theta = (Number.GetPi) + Phi
elseif ((SinPhi < 0) and (CosPhi > 0)) then
  Phi = CosPhi.ACos
  Theta = (2 * Number.GetPi) - Phi
end

ThetaDeg = Theta * (180/Number.GetPi)

Return ThetaDeg
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************          AvMODTMR.ReturnLinesOffsetToPolyBnd        ***********
'******************************************************************************
'**                        Language: ArcView Avenue                          **
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'*     Author/Site,      Date,        Event
'*   -------------------------------------------------------------------------
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'*
'*============================================================================
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'*
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'*============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: receives the 'Local Polygon' and the 'Direction Line', and returns
' lines parallel to the Direction Line, and tangent to the Local Polygon.
'
'012345678901234567890123456789012345678901234567890123456789012345678901234567

theLocPoly = SELF.Get(0)
theDirLine = SELF.Get(1)

'Find the farthest pt on the right and left sides:
  theLeftMaxDist = 0
  theRightMaxDist = 0
  for each n in 0..100 by 0.1
    thePointAlongPoly = theLocPoly.Along(n)
    theDist = -1 * theDirLine.QueryPointDistance(thePointAlongPoly,1)
    if (theDist > 0) then
      if (theDist > theRightMaxDist) then
        theRightMaxDist = theDist
      end
    else
      if (theDist < theLeftMaxDist) then
        theLeftMaxDist = theDist
      end
    end
  end

  theRightLine = theDirLine.ReturnOffset(theRightMaxDist)
  theLeftLine = theDirLine.ReturnOffset(theLeftMaxDist)

  theLinePair = {theRightLine, theLeftLine}

  Return theLinePair
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************               AvMODTMR.ReturnLoneVertex          **************
'******************************************************************************
'**                          Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: receives a Cell, the Attribute Table of the Grid Theme, and a
' distance (theMinDist) and returns the lone vertex in the Cell, which is the
' vertex that is not touching any other cells.
'
'0123456789012345678901234567890123456789012345678901234567890123456789012345678


theCell = SELF.Get(0)
theVTab = SELF.Get(1)
theMinDist = SELF.Get(2)

theMinDist = 1

theShapeFld = theVTab.FindField("Shape")

theListOfVertices = theCell.AsMultiPoint.AsList
theLoneVertex = NIL
theThreshDist = theMinDist/2

aCountOfTouches = 0
for each aVert in theListOfVertices
  for each aRec in theVTab
    aCell = theVTab.ReturnValue(theShapeFld, aRec)
    if (aVert.Distance(aCell) < theThreshDist) then
      aCountOfTouches = aCountOfTouches + 1
    end
    if (aCountOfTouches > 1) then
      aCountOfTouches = 0
      break
    end
  end
```

```
  if (aCountOfTouches = 1) then
    theLoneVertex = aVert
    break
  end
end

if (theLoneVertex = NIL) then
  MsgBox.Error("No lone vertex found", "Terminating")
  Return Nil
else
  Return theLoneVertex
end
```

```
'************* U.S. Geological Survey preliminary computer program ************
'*****************************************************************************
'*************                 AvMODTMR.RotateGrid                *************
'*****************************************************************************
'**                         Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'*     Author/Site,      Date,        Event
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'*
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'*============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Receives the grid theme to be rotated and a rotation angle.
' Obtains the current rotation angle of the grid, as well as the x and y coor's
' of the origin, by calling 'AvMODTMR.GetGridGeometry'.  Then, it computes the
' difference between the angles and rotates each vertex of each cell by that
' angle difference using the distance from each vertex to the origin as the
' radius of rotation, pivoted about the origin.
'
'12345678901234567890123456789012345678901234567890123456789012345678901234567 8

theGridTheme = SELF.Get(0)
theNewANGL = SELF.Get(1)

'Get theNewANGL to be from 0 to 360:
if (theNewANGL.Abs > 360) then
  theNewANGL = theNewANGL.Mod(360)
end
if (theNewANGL < 0) then
  theNewANGL = 360 + theNewANGL
end

theCurrentParam = av.Run ("AvMODTMR.GetGridGeometry", {theGridTheme})

  Xorigin = theCurrentParam.Get(0).AsNumber
  Yorigin = theCurrentParam.Get(1).AsNumber

theCurrentANGL = theCurrentParam.Get(2).AsNumber


'Get theCurrentANGL to be from 0 to 360:
if (theCurrentANGL.Abs > 360) then
  theCurrentANGL = theCurrentANGL.Mod(360)
```

```
end
if (theCurrentANGL < 0) then
  theCurrentANGL = 360 + theCurrentANGL
end

'Get the difference of the new and curr angl's to be bet. -180 & 180:
theDeltaANGL = theNewANGL - theCurrentANGL
if (theDeltaANGL > 180) then
  theDeltaANGL = theDeltaANGL - 360
elseif (theDeltaANGL < -180) then
  theDeltaANGL = theDeltaANGL + 360
end
theFTab = theGridTheme.GetFTab
theShapeF = theFTab.FindField("Shape")

theSeqnumF = theFTab.FindField("Seqnum")


theFTab.StartEditingWithRecovery

aTempList = List.Make
total = theFTab.GetNumRecords

i = 0

av.ShowMsg ("Rotating Grid...")

for each aRec in theFTab
  i = i + 1
  aTempList.Empty

  PercentDone = (i / total)*100
  av.SetStatus(PercentDone)

  aCell = theFTab.ReturnValue(theShapeF, aRec)

  theListOfSegments = aCell.AsList
  theListOfVertices = theListOfSegments.Get(0)

  for each aVertex in theListOfVertices

    X1world = aVertex.GetX
    Y1world = aVertex.GetY
    X1 = X1world - Xorigin
    Y1 = Y1world - Yorigin
    r = ((X1^2) + (Y1^2)).Sqrt

    if (r > 0) then

      Theta1 = (Y1/X1).Atan
      Theta1_deg = Theta1.AsDegrees

      'Make sure Theta1_deg in deg CCW:
      if (X1 < 0) then
        Theta1_deg = Theta1_deg + 180
      end

      Theta2_deg = Theta1_deg + theDeltaANGL

      Theta2 = Theta2_deg.AsRadians
      X2 = r * (Theta2.Cos)
      Y2 = r * (Theta2.Sin)
      X2world = Xorigin + X2
```

```
      Y2world = Yorigin + Y2

      aVertex.SetX(X2world)
      aVertex.SetY(Y2world)
    end

    aTempList.Add(aVertex)

  end

  aMovedCell = Polygon.Make({aTempList})

  theFTab.SetValue(theShapeF, aRec, aMovedCell)

end

av.ShowMsg("")
av.ClearStatus

theFTab.StopEditingWithRecovery(TRUE)
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                AvMODTMR.SetLayersUsed            **************
'******************************************************************************
'**                          Language: ArcView Avenue                         **
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'*      Author/Site,      Date,        Event
'*   ---------------------------------------------------------------------------
'*   Raul D. Patterson                                 Phone: (305) 717-5865
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'*
'*============================================================================
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'*
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Sets the LML array.  The LMLDict is a dictionary that holds the
' LML array information  the LMLDict has as many entries as there are layers in
' the regional model. the regional model layer number is the key, and the value
' is either 0 (notused in the local model) or 1 (used in local model).  There
' must be a continuous range of regional model layers selected, (i.e. the local
' model can consist of layers 2,3, and 4 of a 5 layer model, but it can not
' consist of layers 1,2 and 4).  This script sets the range of layers from the
' regional model that will be used in the local model by modifying the LMLDict.
'
'0123456789012345678901234567890123456789012345678901234567890123456789012345678


theListBox = av.FindDialog("AvMODTMR.DlgLayers").FindByName("lbxLayers")
theNewLayersUsed = theListBox.GetSelection


'creates a temp dictionary where to store values for the theLMLDict, should the
user
'choose to override it:
aTempLayUsedDict = Dictionary.Make(100)

for each aLay in theListBox.GetList
  aKey = aLay.AsList.Get(1).AsNumber
  aTempLayUsedDict.Set(aKey, 1)
end

'make a list of the layers not being used, to assign them an LML value of 0:
theLayersNotUsed = theListBox.GetList - theNewLayersUsed

for each aLay in theLayersNotUsed
  theKey = aLay.AsList.Get(1).AsNumber
```

```
  theValue = 0
  aTempLayUsedDict.Set(theKey, theValue)
end


'Compare if any changes have taken place in the layers being used:

'Locate the Local grid theme:
theView = av.GetActiveDoc
theLocGridTheme = NIL
for each T in theView.GetThemes
  if ((T.GetObjectTag.Is(List)) and (T.GetObjectTag.Get(0) = "L")) then
    theLocGridTheme = T
    break
  end
end


theLMLDict = theLocGridTheme.GetObjectTag.Get(5)

theLays = theLMLDict.ReturnKeys
theLays.Sort(TRUE)
for each aLay in theLays
  theCurrentValue = theLMLDict.Get(aLay)
  theNewValue = aTempLayUsedDict.Get(aLay)
  if (theCurrentValue <> theNewValue) then
    SaveChanges = MsgBox.YesNo("Keep changes to the layer selection?",
          "The Layer Selection Has Changed", FALSE)
    if (SaveChanges) then
      theLMLDict = aTempLayUsedDict
      av.GetProject.SetModified (true)
    end
  aTempLayUsedDict = Nil
  break
  end
end

theParamList = theLocGridTheme.GetObjectTag
theParamList.Set(5,theLMLDict)
theLocGridTheme.SetObjectTag(theParamList)


aTempLayUsedDict = Nil
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************          AvMODTMR.SetLocalModelPRocessingFlag     **************
'******************************************************************************
'**                          Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                     Phone: (305) 717-5865
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'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: sets the local model processing flag (LMPRF), which is a flag used
' in the MODTMR input file that indicates wether MODTMR should create all
' MODFLOW packages (LMPRF = 0), or just the FHB package (LMPRF = 1).  The value
' is stored in the object tag of the Local Grid theme as the 5th item.
'
'012345678901234567890123456789012345678901234567890123456789012345678901234345678


LMPRFFlagKW = SELF.Get(0)
theView = SELF.Get(1)
theLocTheme = SELF.Get(2)

LMPRF = NIL

theLocParamList = theLocTheme.GetObjectTag

if (LMPRFFlagKW = "All") then
  LMPRF = "0"
elseif (LMPRFFlagKW = "FHB") then
  LMPRF = "1"
end

theLocParamList.Set(4, LMPRF)

theLocTheme.SetObjectTag(theLocParamList)
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                AvMODTMR.TranslateGrid             *************
'******************************************************************************
'**                         Language: ArcView Avenue                         **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                  Phone: (305) 717-5865
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVMODTMR 11MAY2001 9:19 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: translates the grid from its current position to one given by
' it's new X_coor and Y_coor.  Receives the new X_coor, the new Y_coor, and the
' Local Grid theme.  The current origin X_coor and Y_coor are obtained by
' reading them off the 12th and 13th position in the Local Grid Theme's object
' tag.  Then the difference between the X_coor and the Y_coor of the new origin
' and those of the current origin are subtracted to obtain offsets in the X and
' Y directions.  Each vertex of every cell is moved by these offsets, thereby
' moving the grid.
'
'0123456789012345678901234567890123456789012345678901234567890123456789012345678

theLocalGridTheme = SELF.Get(0)
theNewX_coor = SELF.Get(1)
theNewY_coor = SELF.Get(2)

'retrieve current values:
theLocParamList = theLocalGridTheme.GetObjectTag
theCurrentX_coor = theLocParamList.Get(11).AsNumber
theCurrentY_coor = theLocParamList.Get(12).AsNumber

'Find offset values:
theDeltaX = theNewX_coor - theCurrentX_coor
theDeltaY = theNewY_coor - theCurrentY_coor

theFTab = theLocalGridTheme.GetFTab

theShapeF = theFTab.FindField("Shape")

theFTab.StartEditingWithRecovery

aTempList = List.Make
```

```
total = theFTab.GetNumRecords

i = 0

av.ShowMsg ("Moving Grid...")

for each aRec in theFTab
  i = i + 1
  aTempList.Empty

  PercentDone = (i / total)*100
  av.SetStatus(PercentDone)

  aCell = theFTab.ReturnValue(theShapeF, aRec)

  theListOfSegments = aCell.AsList
  theListOfVertices = theListOfSegments.Get(0)

  for each aVertex in theListOfVertices
    aVertex.Move(theDeltaX, theDeltaY)
    aTempList.Add(aVertex)
  end
  aMovedCell = Polygon.Make({aTempList})

  theFTab.SetValue(theShapeF, aRec, aMovedCell)

end

av.ShowMsg("")
av.ClearStatus

theFTab.StopEditingWithRecovery(TRUE)
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                  Make Extension                ***************
'******************************************************************************
'**                        Language: ArcView Avenue                          **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*      Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                    Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                          FAX: (305) 717-5801
'*   9100 NW 36th St., Suite 109
'*   Miami, Florida 33178 USA                     Internet: rdpatter@usgs.gov
'*
'*=============================================================================
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*
'* Disclaimer:
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'           warranty, and no responsibility is assumed by the USGS in
'           connection therewith.
'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVMODTMR 11NOVEMBER2000 8:57 PM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: This script creates the extension, adding all scripts and dialogs
' to the extension and then saving the extension to disk to create the file
' AvMODTMR.avx
'
'012345678901234567890123456789012345678901234567890123456789012345678901234567

AvMODTMRExt = Extension.Make("$TEMP\AvMODTMR.avx".AsFileName, "ArcView MODTMR "+
  "Extension",  av.FindScript("AvMODTMR.Install"),
  av.FindScript("AvMODTMR.Uninstall"), {"$AVBIN/avdlog.dll".AsFileName})

AvMODTMRExt.SetAbout("ArcView GUI for the"+
  " USGS's MODTMR MODFLOW Telescopic Mesh Refinement program")

AvMODTMRExt.SetExtVersion( 1 )
AvMODTMRExt.SetLoadScript(av.FindScript("AvMODTMR.Load"))
AvMODTMRExt.SetUnLoadScript(av.FindScript("AvMODTMR.UnLoad"))


'Add Controls and Dialogs:

  'Add GUI buttons:
  theViewGUIButtons = av.FindGUI("View").GetButtonBar.GetControls
'012345678901234567890123456789012345678901234567890123456789012345678901234567
  '*****
  AvMODTMRExt.Add(theViewGUIButtons.Get(theViewGUIButtons.Count - 3))'1ST OBJECT
  '*****

  'Add dialogs:
  theDlgMODTMR = av.FindDoc("AvMODTMR.DlgMODTMR").GetDialog

  '*****
```

```
  AvMODTMRExt.Add(theDlgMODTMR)                                      '2ND OBJECT
  '*****

  theDlgLayers = av.FindDoc("AvMODTMR.DlgLayers").GetDialog

  '*****
  AvMODTMRExt.Add(theDlgLayers)                                      '3RD OBJECT
  '*****

  theDlgEditLayerBCs = av.FindDoc("AvMODTMR.DlgEditLayerBCs").GetDialog

  '*****
  AvMODTMRExt.Add(theDlgEditLayerBCs)                                '4TH OBJECT
  '*****

  theDlgDefineLocGrid = av.FindDoc("AvMODTMR.DlgDefineLocGrid").GetDialog

  '*****
  AvMODTMRExt.Add(theDlgDefineLocGrid)                               '5TH OBJECT
  '*****

  theDlgLocGridWiz = av.FindDoc("AvMODTMR.DlgLocGridWiz").GetDialog

  '*****
  AvMODTMRExt.Add(theDlgLocGridWiz)                                  '6TH OBJECT
  '*****


'Add scripts:
for each aDoc in av.GetProject.GetDocs
  if ((aDoc.Is(SEd)) and (aDoc.GetName.Left("AvMODTMR".Count + 1) = "
                                                         AvMODTMR.")) then
    if (aDoc.IsCompiled) then
     AvMODTMRExt.Add(aDoc.GetScript)
    else
      MsgBox.Info("the script" ++aDoc.GetName++"is not compiled, extension not"+
            " created", "")
      aDoc.GetWin.Open
      Return Nil
    end
  end
end

AvMODTMRExt.Commit
```

APPENDIX III

Documentation of AvHDRD Avenue Scripts

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                AvHDRD Make Extension                *************
'******************************************************************************
'**                           Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                   Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                         FAX: (305) 717-5801
'*   9100 NW 36th St., Suite 109
'*   Miami, Florida 33178 USA                      Internet: rdpatter@usgs.gov
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'*=============================================================================
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVHDRD 20APRIL2001 12:37 PM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: This script creates the extension, adding all scripts and dialogs
' to the extension and then saving the extension to disk to create the file
' avhdrd.avx
'
'01234567890123456789012345678901234567890123456789012345678901234567890123456789012345678


AvHDFExt = Extension.Make("$TEMP\AvHDRD.avx".AsFileName,
  "AvHDRD Extension",
  av.FindScript("AvHDRD.Install"), av.FindScript("AvHDRD.Uninstall"),
  {"$AVBIN/avdlog.dll".AsFileName})


AvHDFExt.SetUnloadScript(av.FindScript("AvHDRD.UnLoad"))

AvHDFExt.SetAbout("AvHDRD: ArcView GUI for creating River and Drain MODFLOW "+
  "input files from dynamically-segmented data")

AvHDFExt.SetExtVersion( 1 )

'Add Controls and Dialogs:

  'Add GUI controls:
  theViewGUI = av.FindGUI("View")
  theViewGUIButtons = theViewGUI.GetButtonBar.GetControls
  theOpenButton = theViewGUIButtons.Get(theViewGUIButtons.Count - 3)
  theViewGUIMenuBar = theViewGUI.GetMenuBar
  theMenu = theViewGUIMenuBar.GetControls.Get(5)
  theChoice = theMenu.GetControls.Get(1)
  theSpace = theMenu.GetControls.Get(0)
```

```
  '*****
  AvHDFExt.Add(theOpenButton)                                              '1ST OBJECT
  AvHDFExt.Add(theSpace)                                                   '2RD OBJECT
  AvHDFExt.Add(theChoice)                                                  '3TH OBJECT
  '*****

  'Add dialogs:
  theDlgAvHDF = av.FindDoc("DlgAvHDF").GetDialog

  '*****
  AvHDFExt.Add(theDlgAvHDF)                                                '4TH OBJECT
  '*****

  'Add scripts:
  for each aDoc in av.GetProject.GetDocs
    if ((aDoc.Is(SEd)) and
      (aDoc.GetName.Left("AvHDRD".Count + 1) = "AvHDRD.")) then
      if (aDoc.IsCompiled) then
        AvHDFExt.Add(aDoc.GetScript)
      else
        MsgBox.Info("the script" ++aDoc.GetName++
          "is not compiled, extension not created", "")
        aDoc.GetWin.Open
        Return Nil
      end
    end
  end
  AvHDFExt.Add(av.FindDoc("VTab.FieldUniqueList").GetScript)
  AvHDFExt.Add(av.FindDoc("VTab.GetFieldMinMaxValues").GetScript)

AvHDFExt.Commit
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************              AvHDRD.BuildLocValPairDict           *************
'******************************************************************************
'**                         Language: ArcView Avenue                          **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                  Phone: (305) 717-5865
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVHDRD 20APRIL2001 12:37 PM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Builds a dictionary with keys that are canal names and values that
' are lists of pairs (themselves lists) of locations with their respective
' values. Such a dictionary is property specific, for example, bottom width.  It
' is called by other scripts to obtain locations of property changes and also to
' obtain values between property changes to interpolate them.  Receives the
' Feature table of the event theme for the property, the event field, which is
' the field containing the canal or river identifier (name or id used in dynamic
' segmentation), the location field, which is the field containing the
' "position along" the canal or drain, the value field, which contains the value
' of the property (actual bottom elevations) and a value called Canal Count. The
' feature table has selected all the records that touch the grid. It is from
' this selected set of records that the dictionary is built.  Returns the
' Location Value Pair Dictionary.
'
'
'012345678901234567890123456789012345678901234567890123456789012345678901234567

theFTab = SELF.Get(0)
theEventFld = SELF.Get(1)
theLocFld = SELF.Get(2)
theValueFld = SELF.Get(3)
theCanalCount = SELF.Get(4)
theProp = SELF.Get(5)

theLocValPairDict = Dictionary.Make(theCanalCount/15)

av.ClearMsg
av.ShowMsg("Assembling "+theProp+" arrays")

theRecTotal = theFTab.GetNumSelRecords
```

```
theRecCounter = 0

for each aRec in theFTab.GetSelection

  theCanalName = theFTab.ReturnValue(theEventFld, aRec)
  thePosition = theFTab.ReturnValue(theLocFld, aRec)
  theValue = theFTab.ReturnValue(theValueFld, aRec)
  theCanalPropDataList = theLocValPairDict.Get(theCanalName)
  if (theCanalPropDataList = NIL) then
    theCanalPropDataList = List.Make
  end
  theCanalPropDataList.Add({thePosition, theValue})
  theLocValPairDict.Add(theCanalName, theCanalPropDataList)

  theRecCounter = theRecCounter + 1

  av.SetStatus((theRecCounter/theRecTotal)*100)

end

av.ClearStatus
av.ClearMsg

Return theLocValPairDict
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                AvHDRD.CreateRivDrnEvent          **************
'******************************************************************************
'**                          Language: ArcView Avenue                        **
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'*     Author/Site,      Date,        Event
'*   -------------------------------------------------------------------------
'*   Raul D. Patterson                                  Phone: (305) 717-5865
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'*
'*============================================================================
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
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'*
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'
'---VERSION 1.0 AVHDRD 20APRIL2001 12:37 PM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Called by the script 'AvHDRD.MainProcessor', it creates an event
' table which is subsequently added to the the view as an event theme.  The
' event table looks like a River or Drain package, with the addition of the
' fields needed to make it an event table. It creates the fields 'Name', 'From',
' 'To', 'Seqnum', 'Row', 'Col', 'Cond'(conductance), a bottom elevation field, a
' 'Comment' field and a stage field in the case of rivers (RIV).  The Cell Canal
' Dictionary (theCellCanalDict) is looped through to access each cell.  Then,
' each cell is looped through to access the canal(s) contained in it (individual
' Reaches), for each of which one record will be written in the event table.
' Finally, a third loop accesses the segment parameter list and computes a
' conductance for each segment (a Reach is broken up into Segments at the
' locations where any property changes).  The segment conductances are added for
' the reach (Ceq = C1 + C2 +...+ Cn) to obtain the conductance for the reach.
' The parameters (bottom width, sediment K, stage, etc...) have values of -9999
' for missing data.  If any such segments are found the value entered for the
' reach will be -9999, and an entry will be made into the 'Comments' field
' indicating the parameter(s) and over what interval(s) there was missing data.
'
'012345678901234567890123456789012345678901234567890123456789012345678901234567

RivOrDrn = SELF.Get(0)
theCellCanalDict = SELF.Get(1)
theOutFileName = SELF.Get(2)
NROW = SELF.Get(3)
NCOL = SELF.Get(4)
theRouteThemeFld = SELF.Get(5)
theLocPrecision = SELF.Get(6)
theLocWidth = SELF.Get(7)
theValPrecision = SELF.Get(8)
theValWidth = SELF.Get(9)
theBEValFld = SELF.Get(10)
```

```
theRowFld = SELF.Get(11)
theColFld = SELF.Get(12)
theSeqnumFld = SELF.Get(13)
if (RivOrDrn = "RIVER") then
  theStageValFld = SELF.Get(14)
end

theVTab = VTab.MakeNew(theOutFileName, dBASE)
theVTab.StartEditingWithRecovery

theNameFld = theRouteThemeFld.Clone
theFromFld = Field.Make("From", #FIELD_DOUBLE, theLocWidth, theLocPrecision)
theToFld = Field.Make("To", #FIELD_DOUBLE, theLocWidth, theLocPrecision)
theOutVTabSeqnumFld = theSeqnumFld.Clone
theOutVTabRowFld = theRowFld.Clone
theOutVTabColFld = theColFld.Clone
theOutVTabSeqnumFld = theSeqnumFld.Clone
theOutVTabBEValFld = theBEValFld.Clone

theConductanceFld = Field.Make("Cond", #FIELD_DOUBLE, 15, 3)

theCommentFld = Field.Make("Comment", #FIELD_CHAR, 255, 0)
theFldList = {theNameFld, theFromFld, theToFld, theOutVTabSeqnumFld,
              theOutVTabRowFld, theOutVTabColFld, theConductanceFld,
               theOutVTabBEValFld, theCommentFld}
if (RivOrDrn = "RIVER") then
  theOutVTabStageValFld = theStageValFld.Clone
  theFldList.Add(theOutVTabStageValFld)
  theFldList.Shuffle(theOutVTabStageValFld, 7)
end

theVTab.AddFields(theFldList)


'get the cell seqnum to sort by them:
theCells = theCellCanalDict.ReturnKeys

theCells.Sort(TRUE)

'get a count of reaches (for MXRIVR and ITMP):
NoOfReaches = 0

for each aCell in theCells
  theRow = (aCell/NCOL).Ceiling
  theCol = aCell - ((theRow - 1)*NCOL)
  for each aCanal in theCellCanalDict.Get(aCell)
    theReachError = ""
    theCondError = ""
    theStageError = ""
    theBEError = ""
    NoOfReaches = NoOfReaches + 1
    'this gets all the info for a river or drain file record:
    aCanalName = aCanal.GetName
    theReachLength = 0
    aSegStgWeightedAccum = 0
    aSegBEWeightedAccum = 0
    theReachCond = 0
    theReachFrom = 99999999
    theReachTo = 0
    for each aSegParamList in aCanal
      aSegFrom = aSegParamList.Get(0)
      if (aSegFrom < theReachFrom) then
        theReachFrom = aSegFrom
```

```
  end
  aSegTo = aSegParamList.Get(1)
  if (aSegTo > theReachTo) then
    theReachTo = aSegTo
  end
  aSegLength = aSegTo - aSegFrom
    theReachLength = theReachLength + aSegLength
  aSegK = aSegParamList.Get(2)
    if (aSegK = -9999) then
      theCondError = theCondError + "SK [" + aSegFrom.AsString +
         ", " + aSegTo.AsString + "]; "
    end
  aSegBW = aSegParamList.Get(3)
    if (aSegBW = -9999) then
      theCondError = theCondError + "BW [" + aSegFrom.AsString +
         ", " + aSegTo.AsString + "]; "
    end
  aSegST = aSegParamList.Get(4)
    if (aSegST = -9999) then
      theCondError = theCondError + "ST [" + aSegFrom.AsString +
         ", " + aSegTo.AsString + "]; "
    end
  aSegBE = aSegParamList.Get(5)
    if (aSegBE = -9999) then
      theBEError = theBEError + "BE [" + aSegFrom.AsString +
         ", " + aSegTo.AsString + "]; "
    end
    aSegBEWeighted = aSegBE * aSegLength
    aSegBEWeightedAccum = aSegBEWeightedAccum + aSegBEWeighted
  if ((RivOrDrn) = "RIVER") then
    aSegStg = aSegParamList.Get(6)
      if (aSegStg = -9999) then
        theStageError = theStageError + "Stg [" + aSegFrom.AsString +
           ", " + aSegTo.AsString + "]; "
      end
      aSegStgWeighted = aSegStg * aSegLength
      aSegStgWeightedAccum = aSegStgWeightedAccum + aSegStgWeighted
  end
  aSegCond = ( aSegK * aSegBW * aSegLength ) / aSegST
  theReachCond = theReachCond + aSegCond '(Ceq = C1 + C2 + ... + Cn)
end

if (RivOrDrn = "RIVER") then
  if (theStageError = "") then
    theReachStage = aSegStgWeightedAccum/theReachLength
  else
    theReachStage = -9999
  end
end

if ((theCondError = "").Not) then
  theReachCond = -9999
end

if (theBEError = "") then
  theReachBE = aSegBEWeightedAccum/theReachLength
else
  theReachBE = -9999
end

theReachError = theStageError + theCondError + theBEError

'populate table:
```

```
    aNewRec = theVTab.AddRecord
    theVTab.SetValue(theNameFld, aNewRec, aCanalName)
    theVTab.SetValue(theFromFld, aNewRec, theReachFrom)
    theVTab.SetValue(theToFld, aNewRec, theReachTo)
    theVTab.SetValue(theOutVTabSeqnumFld, aNewRec, aCell)
    theVTab.SetValue(theOutVTabRowFld, aNewRec, theRow)
    theVTab.SetValue(theOutVTabColFld, aNewRec, theCol)
    if (RivOrDrn = "RIVER") then
      theVTab.SetValue(theOutVTabStageValFld, aNewRec, theReachStage)
    end
    theVTab.SetValue(theOutVTabBEValFld, aNewRec, theReachBE)
    theVTab.SetValue(theConductanceFld, aNewRec, theReachCond)
    theVTab.SetValue(theCommentFld, aNewRec, theReachError)

  end
end

theVTab.StopEditingWithRecovery(TRUE)

Return {theVTab, theNameFld, theToFld, theFromFld}
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************          AvHDRD.DlgMain.cbxGridTheme.Update       **************
'******************************************************************************
'**                          Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*    -------------------------------------------------------------------------
'*   Raul D. Patterson                                  Phone: (305) 717-5865
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVHDRD 20APRIL2001 12:37 PM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Update script for the 'Grid Theme' drop-down list box.  It
' populates the control with the polygon themes in the view.
'
'01234567890123456789012345678901234567890123456789012345678901234567890123456789012345678


theView = av.GetActiveDoc
theType = #FIELD_SHAPEPOLY
thePolyThemes = av.Run("AvHDRD.FindFThemesOfAType", {theView, theType})

SELF.DefineFromList(thePolyThemes)
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************           AvHDRD.DlgMain.cbxRouteTheme.Update      *************
'******************************************************************************
'**                        Language: ArcView Avenue                          **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                  Phone: (305) 717-5865
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVHDRD 20APRIL2001 12:37 PM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Update script for the 'Route Theme' drop-down list box.  It
' populates the control with the Route themes in the view.
'
'0123456789012345678901234567890123456789012345678901234567890123456789012345678

theView = av.GetActiveDoc

theRouteThemes = {}

for each T in theView.GetThemes
  if (T.Is(FTheme)) then
    theSrc = T.GetSrcName.GetSubName.AsString
    if (theSrc = "*route*".AsPattern) then
      theRouteThemes.Add(T)
    end
  end
end

SELF.DefineFromList(theRouteThemes)
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************             AvHDRD.DlgMain.lbtProcess.Click        *************
'******************************************************************************
'**                          Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                    Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                          FAX: (305) 717-5801
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'*
'*=============================================================================
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*
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'            connection therewith.
'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVHDRD 20APRIL2001 12:37 PM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Checks which package was selected by the user for processing and
' obtains the necessary parameters input by the user in the main dialog and runs
' the main processing script (AvHDRD.MainProcessor).  If 'Write package file'
' option is checked, then call AvHDRD.WriteRivDrnFile.
'
'0123456789012345678901234567890123456789012345678901234567890123456789012345678

DlgMain = SELF.GetDialog
cpaPkgSelections = DlgMain.FindByName("cpaPkgSelections")
RivOrDrn = cpaPkgSelections.GetSelected.GetLabel.UCase

if (RivOrDrn = "RIVER") then
  IXXXCB = DlgMain.FindByName("txlIRIVCB").GetText
elseif (RivOrDrn = "DRAIN") then
  IXXXCB = DlgMain.FindByName("txlIDRNCB").GetText
end

PathToFiles = DlgMain.FindByName("txlPathToFiles").GetText
RootName = DlgMain.FindByName("txlRootName").GetText
MinSegLength = DlgMain.FindByName("txlMinSegLength").GetText.AsNumber

theGridTheme = DlgMain.FindByName("cbxGridTheme").GetSelection
theCanalRteTheme = DlgMain.FindByName("cbxRouteTheme").GetSelection
theRivDrnTheme = DlgMain.FindByName("cbxClassify").GetSelection
theBETheme = DlgMain.FindByName("cbxBottElev").GetSelection
theBWTheme = DlgMain.FindByName("cbxBottWid").GetSelection
theSedThickTheme = DlgMain.FindByName("cbxSedThick").GetSelection
theSedKTheme = DlgMain.FindByName("cbxSedK").GetSelection
if (RivOrDrn = "RIVER") then
  theStageTheme = DlgMain.FindByName("cbxStage").GetSelection
else
```

```
  theStageTheme = NIL
end

theFileName = PathToFiles + "\" + RootName
theArgList = {RivOrDrn, theFileName, MinSegLength, theGridTheme,
  theCanalRteTheme, theRivDrnTheme, theBETheme, theBWTheme, theSedThickTheme,
  theSedKTheme, theStageTheme}

'run the Main processor, but return the pkg event VTab:
thePkgEventVTab = av.Run("AvHDRD.MainProcessor", theArgList)

'if write file checkbox is checked, write out the package file:
if (DlgMain.FindByName("chkWriteFile").IsSelected) then
  av.Run("AvHDRD.WriteRivDrnFile",
    {thePkgEventVTab, theFileName, RivOrDrn, IXXXCB})
end
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************             AvHDRD.DlgMain.radDrain.Click          **************
'******************************************************************************
'**                          Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
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'*   9100 NW 36th St., Suite 109
'*   Miami, Florida 33178 USA                     Internet: rdpatter@usgs.gov
'*
'*=============================================================================
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVHDRD 20APRIL2001 12:37 PM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Calls the script 'AvHDRD.GetIXXXCB' to locate the Cell-by-Cell
' file unit number indicated in the existing drain file, since, presumably, the
' user may wish to use the same one for the new drain file.  It is placed into
' the IXXXCB textline adjacent to it.  If the file is not found, then nothing
' happens and the user can enter any value into the text box.
'
'012345678901234567890123456789012345678901234567890123456789012345678901234545678

txlIDRNCB = SELF.GetDialog.FindByName("txlIDRNCB")
theCurrentNo = txlIDRNCB.GetText
if (theCurrentNo = Nil) then
  theCurrentNo = ""
end

theFType = "DRN"
IDRNCB = av.Run("AvHDRD.GetIXXXCB", {theFType, theCurrentNo})
txlIDRNCB.SetText(IDRNCB)
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************              AvHDRD.DlgMain.radRiver.Click         **************
'******************************************************************************
'**                          Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                   Phone: (305) 717-5865
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVHDRD 20APRIL2001 12:37 PM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Calls the script 'AvHDRD.GetIXXXCB' to locate the Cell-by-Cell
' file unit number indicated in the existing river file, since, presumably, the
' user may wish to use the same one for the new river file.  It is placed into
' the IXXXCB textline adjacent to it.  If the file is not found, then nothing
' happens and the user can enter any value into the text box.
'
'0123456789012345678901234567890123456789012345678901234567890123456789012345678


txlIRIVCB = SELF.GetDialog.FindByName("txlIRIVCB")
theCurrentNo = txlIRIVCB.GetText
if (theCurrentNo = Nil) then
  theCurrentNo = ""
end

theFType = "RIV"
IRIVCB = av.Run("AvHDRD.GetIXXXCB", {theFType, theCurrentNo})
txlIRIVCB.SetText(IRIVCB)
```

```
'************* U.S. Geological Survey preliminary computer program ************
'*****************************************************************************
'*************               AvHDRD.FindFThemesOfAType              *************
'*****************************************************************************
'**                          Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'*     Author/Site,      Date,        Event
'*   -------------------------------------------------------------------------
'*   Raul D. Patterson                                  Phone: (305) 717-5865
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'*============================================================================
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'
'---VERSION 1.0 AVHDRD 20APRIL2001 12:37 PM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: called by the update scripts of the theme drop-down list boxes
' 'Route Theme' and 'Grid Theme' to retrieve all the themes in the view
' (theView) of type "theType".
'
'0123456789012345678901234567890123456789012345678901234567890123456789012345678

theView = SELF.Get(0)
theType = SELF.Get(1)

theFThemes = List.Make

for each T in theView.GetThemes
  if (T.Is(FTheme)) then
    if (T.GetFTab.FindField("Shape").GetType = theType) then
      theFThemes.Add(T)
    end
  end
end

Return theFThemes
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                  AvHDRD.FixedOrFree                *************
'******************************************************************************
'**                         Language: ArcView Avenue                         **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                   Phone: (305) 717-5865
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'*
'*=============================================================================
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
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'            connection therewith.
'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVHDRD 20APRIL2001 12:37 PM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: determines whether free or fixed format is being used in the
' input files for the simulation.
'
'0123456789012345678901234567890123456789012345678901234567890123456789012345678

theNameFileName = SELF.Get(0)

theLineList = List.Make
theNameFile = LineFile.Make(theNameFileName, #FILE_PERM_READ)
theNameFile.Read(theLineList, 4)
theNameFile.Close

theOptions = theLineList.Get(3).AsList

theAnswer = "FIXED"

for each anOpt in theOptions
  if (anOpt.UCase = "FREE") then
    theAnswer = "FREE"
    Return theAnswer
  end
end

Return theAnswer
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                AvHDRD.GetDynSegThemes              *************
'******************************************************************************
'**                          Language: ArcView Avenue                         **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                    Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                          FAX: (305) 717-5801
'*   9100 NW 36th St., Suite 109
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'*
'*=============================================================================
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVHDRD 20APRIL2001 12:37 PM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: called by the update scripts of the theme drop-down list boxes
' of all the event themes ('Classify', 'Bottom Width', etc...) to retrieve all
' the dynamically segmented event themes in the view (theView).
'
'012345678901234567890123456789012345678901234567890123456789012345678901234567

theView = SELF.Get(0)

theDynSegThemes = {}

for each T in theView.GetThemes
  if (T.GetSrcName.Is(DynName)) then
    theDynSegThemes.Add(T)
  end
end

Return theDynSegThemes
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                AvHDRD.GetEventThemeInfo              ************
'******************************************************************************
'**                          Language: ArcView Avenue                          **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                    Phone: (305) 717-5865
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVHDRD 20APRIL2001 12:37 PM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Determines whether the event theme is a point event theme or a
' linear, continuous event theme, and returns the Position field, the Event
' field, and the type (point or linear).
'
'01234567890123456789012345678901234567890123456789012345678901234567890123345678

theEventTheme = SELF.Get(0)

theDynName = theEventTheme.GetSrcName

if (theDynName.IsPoint) then
  theType = "Point"
  thePosFld = theDynName.GetMeasureField
elseif (theDynName.IsContinuous) then
  thePosFld = theDynName.GetFromField
  theType = "Continuous"
end

theEventFld = theDynName.GetEventRouteId

Return {thePosFld, theEventFld, theType}
```

```
'************* U.S. Geological Survey preliminary computer program ************
'*****************************************************************************
'*************                AvHDRD.GetIXXXCB                  **************
'*****************************************************************************
'**                          Language: ArcView Avenue                       **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'*     Author/Site,      Date,        Event
'*   -------------------------------------------------------------------------
'*   Raul D. Patterson                                  Phone: (305) 717-5865
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'*============================================================================
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'
'---VERSION 1.0 AVHDRD 20APRIL2001 12:37 PM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: receives the FType, which is either 'RIV' or 'DRN' and the current
' number that is in the text line next to the package option button (it could
' be blank) and it uses the name file in the path to files and root name to find
' the name of the FType file.  Then it tries to open the FType file and retrieve
' the unit number in the variable IDRNCB or IRIVCB.
'
'012345678901234567890123456789012345678901234567890123456789012345678901234567

theFType = SELF.Get(0)
theCurrentNo = SELF.Get(1)

'get existing RIV, DRN files:
DlgAvHDF = av.FindDialog("DlgAvHDF")
thePathToFiles = DlgAvHDF.FindByName("txlPathToFiles").GetText
theRootName = DlgAvHDF.FindByName("txlRootName").GetText
theNameFileOnDisk = (thePathToFiles + "\" + theRootName + ".nam").AsFileName

if (theNameFileOnDisk = NIL) then
  Return NIL
end

'initialize thePkgFileName:
thePkgFileName = NIL

'locate it in the name file, if it exists...
theLineList = List.Make
theNameFile = LineFile.Make(theNameFileOnDisk, #FILE_PERM_READ)
theNameFile.Read(theLineList, theNameFile.GetSize)
for each aLine in theLineList
  theItemList = aLine.AsList
  if (theItemList.Get(0) = theFType) then
```

```
    thePkgFileName = theItemList.Get(2)
    break
  end
end
theNameFile.Close

'at this point, if no Pkg File Name, then return nil with message:
if (thePkgFileName = NIL) then
  MsgBox.Warning("No file of type "+theFType+" indicated in name file "+
    theNameFileOnDisk.AsString, "")
  Return theCurrentNo
end

'open the package file and get the CBC Unit No.
thePkgFileName = (thePathToFiles + "\" + thePkgFileName).AsFileName
if (thePkgFileName.IsFile.Not) then
  thePkgFileName = FileDialog.Show("*."+theFType.LCase,
    "*."+theFType.LCase, "Locate the "+theFType+" file")
  if (thePkgFileName = Nil) then
    Return theCurrentNo  'return a blank string if pkg file not given
  end
end

thePkgFile = LineFile.Make(thePkgFileName, #FILE_PERM_READ)
thePkgFile.SetPos(0)
the1stLine = thePkgFile.ReadElt
IXXXCB = the1stLine.AsList.Get(1)
thePkgFile.Close

Return IXXXCB
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************              AvHDRD.InsertBreaksAtChanges           *************
'******************************************************************************
'**                          Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                   Phone: (305) 717-5865
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVHDRD 20APRIL2001 12:37 PM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Called by the Main Processing script (AvHDRD.MainProcessor) to
' insert breaks at changes in canal properties in the cell-canal dictionary.
' The location where a property changes along the length of a reach (the
' stretch of a canal within a given cell) is called a breakpoint.  The cell-
' canal dictionary has cell sequence numbers as keys and lists of canals as
' values.  Each of these canals has a list of breakpoint pairs, which define a
' continuous stretch of canals where all properties are the same (in the case
' of continuously defined properties) or varying linearly between known values
' (in the case of point-defined properties).  The initial set of breakpoint
' pairs for a reach are just the cell boundaries, where the canal crosses in
' and out of the cell.  When a canal is being processed, its existing breakpoint
' pairs are checked against the locations of the property's event location-value
' pair dictionary (theEventLocValPairDict) for inclusion.  If a location is
' within a breakpoint pair, the breakpoint pair is split into two (2) breakpoint
' pairs using the location to separate them.  Because changes in properties can
' occur in different places for the various parameters and no knowledge of their
' location is known until they are visited, this process is repeated for each
' property.  Accordingly, this script is executed once for each property.
'
'0123456789012345678901234567890123456789012345678901234567890123456789012345678

theCellCanalDict = SELF.Get(0)
theEventLocValPairDict = SELF.Get(1)
MinSegLength = SELF.Get(2)

aNewCellCanalDict = Dictionary.Make(theCellCanalDict.GetSize)

for each aCell in theCellCanalDict.ReturnKeys  '(ie. Seqnum 156)
  aListOfCanals = theCellCanalDict.Get(aCell)  '(ie. lists {"C2", "C111"},
                                               'where "C2" = {{1000,1250},
                                               '{1500, 1649}})
```

```
  aNewListOfCanals = List.Make
  for each aCanal in aListOfCanals

    aCanalName = aCanal.GetName
    'skip this canal altogether if no data for it in theEventLocValPairDict

    if (theEventLocValPairDict.Get(aCanalName) = NIL) then
      aNewListOfBrkPntPairLists = aCanal
    else
      aNewListOfBrkPntPairLists = List.Make
      aNewListOfBrkPntPairLists.SetName(aCanalName)

      for each aBrkPntPair in aCanal

        theBegPos = aBrkPntPair.Get(0)
        theEndPos = aBrkPntPair.Get(1)

        'search for any prop changes in this range:
        aTempBrkPntList = List.Make
        for each aListOfLocValPairs in theEventLocValPairDict.Get(aCanalName)
          theChangePos = aListOfLocValPairs.Get(0)
          if (((theChangePos - theBegPos) > MinSegLength) and
                ((theEndPos - theChangePos) > MinSegLength)) then
              aTempBrkPntList.Add(theChangePos)
          end
        end
        if (aTempBrkPntList.Count = 0) then
          aNewListOfBrkPntPairLists.Add(aBrkPntPair)
          aTempBrkPntList = Nil
        else
          aCanalSegBrkPntList = aTempBrkPntList + aBrkPntPair
          aCanalSegBrkPntList.Sort(TRUE)
          for each i in 0..(aCanalSegBrkPntList.Count - 2)
            aNewBegPos = aCanalSegBrkPntList.Get(i)
            aNewEndPos = aCanalSegBrkPntList.Get(i + 1)
            aNewBrkPntPair = {aNewBegPos, aNewEndPos}
            aNewListOfBrkPntPairLists.Add(aNewBrkPntPair)
          end
        end
      end  'aCanalSegBrkPntList now has all new pairs resulting from the
           'splitting of the original pairs at the brk pnts.
    end
    aNewListOfCanals.Add(aNewListOfBrkPntPairLists)
  end
  aNewCellCanalDict.Add(aCell, aNewListOfCanals)
end
aCellCanalDict = NIL

Return aNewCellCanalDict
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                    AvHDRD.Install                  **************
'******************************************************************************
'**                         Language: ArcView Avenue                          **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                 Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                       FAX: (305) 717-5801
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVHDRD 20APRIL2001 12:37 PM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Install script is executed only when the extension is loaded for
' the first time in an ArcView session.  Installs the dialog, dlgAvHDF, the
' extension scripts, as well as the button and MODTMR menu (if not already
' present), and the 'River and Drain...' choice for launching the dialog.
'
'012345678901234567890123456789012345678901234567890123456789012345678901234567


'Install ONLY if there is an active project
if (av.GetProject = nil) then
  return NIL
end

'Retrieve objects from extension:
theProject = av.GetProject

theOpenButton = SELF.Get(0)
theSpace = SELF.Get(1)
theChoice = SELF.Get(2)

'the project must have a View GUI:
theViewGUI = av.GetProject.FindGUI("View")
if (theViewGUI = NIL) then
  Return NIL
end

'Install the open button:
theViewGUIButtonBar = theViewGUI.GetButtonBar
theViewGUIButtons = theViewGUIButtonBar.GetControls
'Make it the last item
thePlace = theViewGUIButtons.Count
```

```
theViewGUIButtonBar.Add(theOpenButton, thePlace)

'now install menu choice and MODTMR menu if not present:
theViewMenuBar = theViewGUI.GetMenuBar
theMODTMRMenu = theViewMenuBar.FindByLabel("MODTMR")
if (theMODTMRMenu = NIL) then
  'add it:
  theWindowMenu = theViewMenuBar.FindByName("Window")
  thePlace = theViewMenuBar.GetControls.Find(theWindowMenu) - 1
  theMenu = theViewMenuBar.New(thePlace)
  theMenu.SetLabel("&MODTMR")
  theMenu.Add(theChoice, 0)
else
  'add a space and then it:
  theMODTMRMenu.Add(theSpace, 99)
  theMODTMRMenu.Add(theChoice, 99)
end

theViewGUI.SetModified(TRUE)
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                 AvHDRD.MainProcessor                ************
'******************************************************************************
'**                          Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                    Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                          FAX: (305) 717-5801
'*   9100 NW 36th St., Suite 109
'*   Miami, Florida 33178 USA                      Internet: rdpatter@usgs.gov
'*
'*=============================================================================
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*
'* Disclaimer:
'            Although this program has been used by the U.S. Geological Survey,
'            no warranty, expressed or implied, is made by the USGS as to the
'            accuracy and functioning of the program and related program
'            material nor shall the fact of distribution constitute any such
'            warranty, and no responsibility is assumed by the USGS in
'            connection therewith.
'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVHDRD 20APRIL2001 12:37 PM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Receives the following information as an argument list: 1.
' RivOrDrn ('RIVER' or 'DRAIN', a string indicating which package to create) ;
' 2. theFileName (the file name to use for the package input file, named by
' using the root name of the simulation and appending a .riv, or .drn); 3.
' MinSegLength (a length threshold below which segments will not be processed
' nor written); 4. theGridTheme ; 5. theCanalRteTheme (the Route coverage theme
' of canal feaures); 6. theRivDrnTheme (an event theme classifying the canal
' features as either River or Drain); 7. theBETheme (an event theme of bottom
' elevations for the rivers and drain features); 8. theBWTheme (an event theme
' of bottom width); 9. theSedThickTheme (an event theme of sediment thickness);
' 10. theSedKTheme (event theme of sediment K); 11. theStageTheme (an event
' theme of stages).  Builds a dictionary (a type of look-up array) that has
' cell seqnum as keys and as values named lists of canal names (one for each
' canal that crosses the cell) with breakpoints and parameter values.  The event
' themes for the various conductance properties and stage may be defined as
' either linear or point.  If linear, they must be defined as continuous events.
' The algorithm will detect from the event theme what type it is and interpolate
' accordingly.  An event theme with the package information is created by
' calling 'AvHDRD.MakeEventFromFile'and added to the view.  The event theme is
' named <root_name>_xxx.dbf, where xxx is "riv" or "drn".
'
'01234567890123456789012345678901234567890123456789012345678901234567890123456789012345678


theView = av.GetActiveDoc
theMapDisplay = theView.GetDisplay

RivOrDrn = SELF.Get(0)
theFileName = SELF.Get(1)
MinSegLength = SELF.Get(2)
```

```
theGridTheme = SELF.Get(3)
theCanalRteTheme = SELF.Get(4)
theRivDrnTheme = SELF.Get(5)
theBETheme = SELF.Get(6)
theBWTheme = SELF.Get(7)
theSedThickTheme = SELF.Get(8)
theSedKTheme = SELF.Get(9)
if (RivOrDrn = "RIVER") then
  theStageTheme = SELF.Get(10)
end


theGridThemeFTab = theGridTheme.GetFTab
theGridShapeFld = theGridThemeFTab.FindField("Shape")
theGridIDFld = theGridThemeFTab.FindField("Seqnum")
theGridRowFld = theGridThemeFTab.FindField("Row")
NROW = av.Run("VTab.GetFieldMinMaxValues", {theGridThemeFTab, "Row"}).Get(1)
theGridColFld = theGridThemeFTab.FindField("Col")
NCOL = av.Run("VTab.GetFieldMinMaxValues", {theGridThemeFTab, "Col"}).Get(1)


theCanalRteThemeFTab = theCanalRteTheme.GetFTab
theCanalNameFld = theCanalRteThemeFTab.FindField("Name")
theCanalShapeFld = theCanalRteThemeFTab.FindField("Shape")

theRivDrnThemeFTab = theRivDrnTheme.GetFTab
theRivDrnShapeFld = theRivDrnThemeFTab.FindField("Shape")
theRivDrnValueFld = theRivDrnThemeFTab.FindField("Classify")
theRivDrnThemeInfo = av.Run("AvHDRD.GetEventThemeInfo", {theRivDrnTheme})
theRivDrnLocFld = theRivDrnThemeInfo.Get(0)
theRivDrnEventFld = theRivDrnThemeInfo.Get(1)
theRivDrnThemeType = theRivDrnThemeInfo.Get(2)

theBEThemeFTab = theBETheme.GetFTab
theBEValueFld = theBEThemeFTab.FindField("Botel")
theBEThemeInfo = av.Run("AvHDRD.GetEventThemeInfo", {theBETheme})
theBELocFld = theBEThemeInfo.Get(0)
theBEEventFld = theBEThemeInfo.Get(1)
theBEThemeType = theBEThemeInfo.Get(2)

theBWThemeFTab = theBWTheme.GetFTab
theBWValueFld = theBWThemeFTab.FindField("Botwid")
theBWThemeInfo = av.Run("AvHDRD.GetEventThemeInfo", {theBWTheme})
theBWLocFld = theBWThemeInfo.Get(0)
theBWEventFld = theBWThemeInfo.Get(1)
theBWThemeType = theBWThemeInfo.Get(2)

theSTThemeFTab = theSedThickTheme.GetFTab
theSTValueFld = theSTThemeFTab.FindField("Thick")
theSedThickThemeInfo = av.Run("AvHDRD.GetEventThemeInfo", {theSedThickTheme})
theSTLocFld = theSedThickThemeInfo.Get(0)
theSTEventFld = theSedThickThemeInfo.Get(1)
theSTThemeType = theSedThickThemeInfo.Get(2)

theSKThemeFTab = theSedKTheme.GetFTab
theSKValueFld = theSKThemeFTab.FindField("K")
theSedKThemeInfo = av.Run("AvHDRD.GetEventThemeInfo", {theSedKTheme})
theSKLocFld = theSedKThemeInfo.Get(0)
theSKEventFld = theSedKThemeInfo.Get(1)
theSKThemeType = theSedKThemeInfo.Get(2)

if (RivOrDrn = "RIVER") then
  theStageThemeFTab = theStageTheme.GetFTab
```

```
  theStageValueFld = theStageThemeFTab.FindField("Stage_avg")
  theStageThemeInfo = av.Run("AvHDRD.GetEventThemeInfo", {theStageTheme})
  theStageLocFld = theStageThemeInfo.Get(0)
  theStageEventFld = theStageThemeInfo.Get(1)
  theStageThemeType = theStageThemeInfo.Get(2)
else
  theStageValueFld = NIL
end


'Select all the chosen features (rivers or drains), based on RivOrDrn, that
'touch grid as well:

  theGridTheme.ClearSelection
  theRivDrnTheme.SelectByTheme(theGridTheme, #FTAB_RELTYPE_INTERSECTS, 0,
                                     #VTAB_SELTYPE_NEW)
  theRivOrDrnCriteria = "(["+theRivDrnValueFld.GetName+"] = "+RivOrDrn.Quote+")"
  theRivDrnThemeFTab.Query(theRivOrDrnCriteria, theRivDrnThemeFTab.GetSelection,
                             #VTAB_SELTYPE_AND)
  theRivDrnThemeFTab.UpdateSelection


'Conversely, select grid cells that touch chosen features:
 theGridTheme.SelectByTheme(theRivDrnTheme, #FTAB_RELTYPE_INTERSECTS, 0,
                                 #VTAB_SELTYPE_NEW)
 theGridThemeFTab.UpdateSelection


'select linear events based on touching selected grid cells:
  theCanalRteTheme.SelectByTheme(theGridTheme, #FTAB_RELTYPE_INTERSECTS, 0,
                                     #VTAB_SELTYPE_NEW)
  aCanalNameShapeDict = Dictionary.Make(theCanalRteThemeFTab.GetNumSelRecords /
                                          15)

  for each aCan in theCanalRteThemeFTab.GetSelection
    theCanalName = theCanalRteThemeFTab.ReturnValue(theCanalNameFld, aCan)
    theCanal = theCanalRteThemeFTab.ReturnValue(theCanalShapeFld, aCan)
    aCanalNameShapeDict.Add(theCanalName, theCanal)
  end

  theBWTheme.SelectByTheme(theGridTheme, #FTAB_RELTYPE_INTERSECTS, 0,
                                #VTAB_SELTYPE_NEW)


'select point events based on being on a canal touching grid:

  theBETheme.SelectByTheme(theCanalRteTheme, #FTAB_RELTYPE_INTERSECTS, 0,
                                 #VTAB_SELTYPE_NEW)

  theSedThickTheme.SelectByTheme(theCanalRteTheme, #FTAB_RELTYPE_INTERSECTS, 0,
                                 #VTAB_SELTYPE_NEW)

  theSedKTheme.SelectByTheme(theCanalRteTheme, #FTAB_RELTYPE_INTERSECTS, 0,
                                 #VTAB_SELTYPE_NEW)

  if (RivOrDrn = "RIVER") then
    theStageTheme.SelectByTheme(theCanalRteTheme, #FTAB_RELTYPE_INTERSECTS, 0,
                                 #VTAB_SELTYPE_NEW)
  end
```

```
'Intersect each cell with each canal and create a dictionary of cells made up
'of the seqnum as key and a list of canal lists as values.  These canal lists
'will be one per each canal that intersects the cell with canal name as list
'name and the list of breakpoints as list items:

  theCellCanalDict = Dictionary.Make(theGridThemeFTab.GetNumSelRecords/15)

  for each aRec in theGridThemeFTab.GetSelection

    theCell = theGridThemeFTab.ReturnValue(theGridShapeFld, aRec)
    theSeqnum = theGridThemeFTab.ReturnValue(theGridIDFld, aRec)

    for each aRow in theRivDrnThemeFTab.GetSelection

      theCanalName = theRivDrnThemeFTab.ReturnValue(theRivDrnEventFld, aRow)
      theCanalStretch = theRivDrnThemeFTab.ReturnValue(theRivDrnShapeFld, aRow)

      theCanal = aCanalNameShapeDict.Get(theCanalName)

      theCanalLength = theCanal.ReturnLength

      if (theCell.Intersects(theCanalStretch)) then

        aCanalBrkPntList = List.Make
        aCanalBrkPntList.SetName(theCanalName)
        theCanalParts = theCell.LineIntersection(theCanalStretch).Explode

        theSegPairList = List.Make

        for each aPart in theCanalParts



          if (theCell.Contains(aPart)) then
            the1stPoint = aPart.Along(0)
            theLastPoint = aPart.Along(100)
          elseif (theCell.Intersects(aPart)) then
            theIntPolyline = theCell.LineIntersection(aPart)
            theListOfSegs = theIntPolyline.AsList
            the1stSegPointList = theListOfSegs.Get(0)
            the1stPoint = the1stSegPointList.Get(0)

            theLastSegPointList = theListOfSegs.Get(theListOfSegs.Count - 1)
            theLastPoint = theLastSegPointList.Get(theLastSegPointList.Count -
                                                            1)
          end

          the1stLocation = (theCanal.PointPosition(the1stPoint)/100) *
                              theCanalLength
          theLastLocation = (theCanal.PointPosition(theLastPoint)/100)*
                              theCanalLength

          aSegPair = {the1stLocation, theLastLocation}
          aCanalBrkPntList.Add(aSegPair)


        end

        'Done processing this reach for current cell, add its Canal Brk Pnt
        'List to the ListOfCanalBrkPntLists:

        if (theCellCanalDict.Get(theSeqnum) = NIL) then
          ListOfCanalBrkPntList = List.Make
```

```
        ListOfCanalBrkPntList.Add(aCanalBrkPntList)
        theCellCanalDict.Add(theSeqnum, ListOfCanalBrkPntList)
      else
        ListOfCanalBrkPntList = theCellCanalDict.Get(theSeqnum)
        ListOfCanalBrkPntList.Add(aCanalBrkPntList)
        theCellCanalDict.Add(theSeqnum, ListOfCanalBrkPntList)
      end

    end

  end

end



'with every canal touching the grid, make a dictionary that has
'the canal name as key, and a list of location, value pairs as values.

  'get a count of canals that intersect grid:
  theCanalCount = theCanalRteThemeFTab.GetNumSelRecords

  theBELocValPairDict = av.Run("AvHDRD.BuildLocValPairDict", {theBEThemeFTab,
                        theBEEventFld, theBELocFld, theBEValueFld,
                        theCanalCount, "Bottom Elevation"})


  theSTLocValPairDict = av.Run("AvHDRD.BuildLocValPairDict", {theSTThemeFTab,
                        theSTEventFld, theSTLocFld, theSTValueFld,
                        theCanalCount, "Sediment Thickness"})


  theSKLocValPairDict = av.Run("AvHDRD.BuildLocValPairDict", {theSKThemeFTab,
                        theSKEventFld, theSKLocFld, theSKValueFld,
                        theCanalCount, "Sediment Conductivity"})


  if (RivOrDrn = "RIVER") then
    theStageLocValPairDict = av.Run("AvHDRD.BuildLocValPairDict",
                          {theStageThemeFTab, theStageEventFld, theStageLocFld,
                           theStageValueFld, theCanalCount, "Stage"})
  end


  theBWLocValPairDict = av.Run("AvHDRD.BuildLocValPairDict", {theBWThemeFTab,
                        theBWEventFld, theBWLocFld, theBWValueFld,
                        theCanalCount, "Bottom Width"})


'insert breaks at any location where property changes within a pair of points.

theCellCanalDict = av.Run("AvHDRD.InsertBreaksAtChanges", {theCellCanalDict,
                              theBELocValPairDict, MinSegLength})

theCellCanalDict = av.Run("AvHDRD.InsertBreaksAtChanges", {theCellCanalDict,
                              theBWLocValPairDict, MinSegLength})

theCellCanalDict = av.Run("AvHDRD.InsertBreaksAtChanges", {theCellCanalDict,
                              theSTLocValPairDict, MinSegLength})

theCellCanalDict = av.Run("AvHDRD.InsertBreaksAtChanges", {theCellCanalDict,
                              theSKLocValPairDict, MinSegLength})
```

```
if (RivOrDrn = "RIVER") then
  theCellCanalDict = av.Run("AvHDRD.InsertBreaksAtChanges", {theCellCanalDict,
                                      theStageLocValPairDict, MinSegLength})
end

'add values to the LocValPairs for each canal in each cell of the Cell Canal
'Dictionary:

theCellCanalDict = av.Run("AvHDRD.PropValExtract", {theCellCanalDict,
                              theSKLocValPairDict, theSKThemeType})

theCellCanalDict = av.Run("AvHDRD.PropValExtract", {theCellCanalDict,
                              theBWLocValPairDict, theBWThemeType})

theCellCanalDict = av.Run("AvHDRD.PropValExtract", {theCellCanalDict,
                              theSTLocValPairDict, theSTThemeType})

theCellCanalDict = av.Run("AvHDRD.PropValExtract", {theCellCanalDict,
                              theBELocValPairDict, theBEThemeType})

if (RivOrDrn = "RIVER") then
  theCellCanalDict = av.Run("AvHDRD.PropValExtract", {theCellCanalDict,
                            theStageLocValPairDict, theStageThemeType})
end

'Find the highest precision of all the location fields in the event tables to
'use for the location fields in the conductance event table:

theLocationFields = {theBELocFld, theSTLocFld, theSKLocFld, theBWLocFld}

if (RivOrDrn = "RIVER") then
  theLocationFields.Add(theStageLocFld)
end


theLocPrecisionList = List.Make
theLocWidthList = List.Make
for each aField in theLocationFields
  thePrecision = aField.GetPrecision
  theLocWidth = aField.GetWidth
  theLocWidthList.Add(theLocWidth)
  theLocPrecisionList.Add(thePrecision)
end
theLocPrecisionList.Sort(TRUE)
theLocPrecision = theLocPrecisionList.Get(theLocPrecisionList.Count - 1)
theLocWidthList.Sort(TRUE)
theLocWidth = theLocWidthList.Get(theLocWidthList.Count - 1)

'Find the lowest precision of all the cond param fields in the event tables to
'use for the conductance field in the conductance event table:
theCondFields = {theSTValueFld, theSKValueFld, theBWValueFld}

'initialize with the lowest presicion of the location fields, since length for
'cond is computed from it:
theCondPrecision = theLocPrecisionList.Get(0)
for each aField in theCondFields
  thePrecision = aField.GetPrecision
  if (thePrecision < theCondPrecision) then
    theCondPrecision = thePrecision
  end
end

'****the cond field is arbitrarily sized 16, but should be sized according
```

```
'to the highest cond value obtained from the largest width, and K, some
'appropriate length (such as 3x the larger of DELR, DELC) and the smallest
'thickness appearing in the respective event tables:

theCondWidth = 16    '****Should be the highest cond computed -
                     '    theCondPrecision - 1

theFileExt = ""
if (RivOrDrn = "RIVER") then
  theFileSuffix = "_riv"
elseif (RivOrDrn = "DRAIN") then
  theFileSuffix = "_drn"
end

theOutFileName = (theFileName + theFileSuffix+ "." + "dbf").AsFileName

thePkgEventInfo = av.Run("AvHDRD.CreateRivDrnEvent", {RivOrDrn,
                        theCellCanalDict, theOutFileName, NROW, NCOL,
                        theCanalNameFld, theLocPrecision, theLocWidth,
                        theCondPrecision, theCondWidth, theBEValueFld,
                        theGridRowFld, theGridColFld, theGridIDFld,
                        theStageValueFld})

thePkgEventVTab = thePkgEventInfo.Get(0)
theNameFld = thePkgEventInfo.Get(1)
theFromFld = thePkgEventInfo.Get(2)
theToFld = thePkgEventInfo.Get(3)

thePkgDynName = DynName.Make(theCanalRteThemeFTab, theCanalNameFld)
thePkgDynName.SetLineEvent    (thePkgEventVTab, theNameFld, theFromFld, theToFld)
thePkgEventTheme = Theme.Make(thePkgDynName)
theView.AddTheme(thePkgEventTheme)

Return thePkgEventVTab
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                   AvHDRD.PropValExtract                *************
'******************************************************************************
'**                          Language: ArcView Avenue                          **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   ---------------------------------------------------------------------------
'*   Raul D. Patterson                                  Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                        FAX: (305) 717-5801
'*   9100 NW 36th St., Suite 109
'*   Miami, Florida 33178 USA                     Internet: rdpatter@usgs.gov
'*
'*=============================================================================
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*
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'           connection therewith.
'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVHDRD 20APRIL2001 12:37 PM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Called by the AvHDRD.MainProcessor script once for each property
' (bottom elevation, stage, etc...).  The CellCanalDict is a dictionary that
' contains cell seqnum as keys and lists of canals breakpoint lists as values.
' For instance one entry will be named '156', for the 156th cell; its value
' will be a list of named lists, one for each canal that crosses it and the
' name of the each list will be the canal name, for example 'C2'; list 'C2'
' will contain breakpoint pair lists.  For instance if the canal goes thru the
' cell, crossing it first at measure 1000, then at 1649, and there's a single
' property change within it at 1250, then there will be two breakpoint lists:
' {1000, 1250} and {1250, 1649} in it.  In summary, one of the canals (there
' could be more than one) that crosses cell 156 is canal C2, which has two
' segments (due to a change in properties at a location within the cell) and
' thus, two breakpoint lists.  The breakpoint lists are visited one at a time
' and a value of the property is interpolated at the midpoint of the segment
' from the surrounding values of the property for that canal in the canal
' propertydictionary.  The method of interpolation for the property depends on
' the event type.  For point events, a linear interpolation is done between the
' nearest upstream and downstream points.  For continuous linear events (as
' bottom width may be for drainage canals), the value is simply taken as the
' nearest upstream value.  If the interpolation can not be done due to lack of
' data, a value of -9999 is entered for the property.  The value is entered at
' at the end of the canal breakpoint list as the last item.
'
'0123456789012345678901234567890123456789012345678901234567890123456789012345678


theCellCanalDict = SELF.Get(0)
thePropLocValPairDict = SELF.Get(1)
theEventType = SELF.Get(2)

for each aCell in theCellCanalDict.ReturnKeys '(ie. Seqnum 156)
```

```
aListOfCanals = theCellCanalDict.Get(aCell) '(ie. lists {"C2", "C111"},
                                            'C2 = {{1000, 1250},{1250,1649}})

for each aCanal in aListOfCanals

  aCanalName = aCanal.GetName

  for each aBrkPntPair in aCanal

    theBegPos = aBrkPntPair.Get(0)
    theEndPos = aBrkPntPair.Get(1)

    theMidPos = (theBegPos + theEndPos)/2
    if (thePropLocValPairDict.Get(aCanalName) = NIL) then
      theVal = -9999
    elseif (theEventType = "Point") then  'ie, it's a point property
      theBeforePos = 0
      theBeforeVal = -9999
      theAfterPos = 99999999
      theAfterVal = -9999
      for each aLocValPair in thePropLocValPairDict.Get(aCanalName)
        aPos = aLocValPair.Get(0)
        if ((aPos < theMidPos) and (aPos > theBeforePos)) then
          theBeforePos = aPos
          theBeforeVal = aLocValPair.Get(1)
        elseif ((aPos > theMidPos) and (aPos < theAfterPos)) then
          theAfterPos = aPos
          theAfterVal = aLocValPair.Get(1)
        end
      end
      if ((theAfterVal = -9999) and (theBeforeVal = -9999)) then
        theVal = -9999
      end
      if ((theAfterVal = -9999) xor (theBeforeVal = -9999)) then
        if(theAfterVal > theBeforeVal) then
          theVal = theAfterVal
        else
          theVal = theBeforeVal
        end
      end
      if ((theAfterVal <> -9999) and (theBeforeVal <> -9999)) then
        'then we linearly interpolate:
        theVal = theBeforeVal +
          (((theAfterVal - theBeforeVal)/
            (theAfterPos - theBeforePos))*(theMidPos - theBeforePos))

      end
    elseif (theEventType = "Continuous") then
      theAfterPos = 99999999
      theAfterVal = -9999
      for each aLocValPair in thePropLocValPairDict.Get(aCanalName)
        aPos = aLocValPair.Get(0)
        if ((aPos > theMidPos) and (aPos < theAfterPos)) then
          theAfterPos = aPos
          theAfterVal = aLocValPair.Get(1)
        end
      end
      theVal = theAfterVal
    end

    aBrkPntPair.Add(theVal)

  end
```

```
  end
end

Return theCellCanalDict
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                   AvHDRD.UnInstall                 *************
'******************************************************************************
'**                         Language: ArcView Avenue                          **
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'*     Author/Site,      Date,        Event
'*   -------------------------------------------------------------------------
'*   Raul D. Patterson                                  Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                        FAX: (305) 717-5801
'*   9100 NW 36th St., Suite 109
'*   Miami, Florida 33178 USA                   Internet: rdpatter@usgs.gov
'*
'*============================================================================
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*
'* Disclaimer:
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'*
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'
'---VERSION 1.0 AVHDRD 20APRIL2001 12:37 PM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Uninstalls the extension and all of its objects.  If after
' removing the 'River and Drain...' choice from the MODTMR menu there are no
' more choices left in it, then the menu itself is removed.

' AvHDRD.UnInstall

theProject = av.GetProject

if (theProject = nil) then
  return nil
end

if (theProject.IsClosing) then
  return nil
end

' Remove the button from the button bar
theViewGUI = av.GetProject.FindGUI("View")
theButtonBar = theViewGUI.GetButtonBar
theButtonBar.Remove(SELF.Get(0))


'start removing menu/menu item:
theMenuBar = theViewGUI.GetMenuBar

'quit if no MODTMR menu:
if (theMenuBar.FindByLabel("MODTMR") = NIL) then
  Return NIL
end

'remove "River and Drain..." item, if it exists:
```

```
theMODTMRmenu = theMenuBar.FindByLabel("MODTMR")
theChoice = theMODTMRmenu.FindByLabel("River and Drain...")
if ((theChoice = NIL).Not) then
  theMODTMRmenu.Remove(theChoice)
end

'Remove the MODTMR menu if it contains no items at this point:

theMenuChoices = 0
for each aControl in theMODTMRmenu.GetControls
  if (aControl.Is(Choice)) then
    theMenuChoices = theMenuChoices + 1
  end
end
if (theMenuChoices = 0) then
  theMenuBar.Remove(theMODTMRmenu)
end
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                AvHDRD.WriteRivDrnFile              *************
'******************************************************************************
'**                          Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                   Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                         FAX: (305) 717-5801
'*   9100 NW 36th St., Suite 109
'*   Miami, Florida 33178 USA                      Internet: rdpatter@usgs.gov
'*
'*=============================================================================
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*
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'            connection therewith.
'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVHDRD 20APRIL2001 12:37 PM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Receives the table (theVTab) containing the package information,
' the file name (theFileName), the river/drain keyword (RivOrDrn), and the unit
' number for writing cell-by-cell flow values (IXXXCB).  Writes the package file
' for river or drains, depending on the value of RivOrDrn.  River files will
' have extension "*.riv", while drain files will have extension "*.drn".  The
' files are written in fixed format (using 10 column fields), and beyond the
' last column writes three additional fields: feature name (the name of the
' canal or river - "C2", for instance), From, and To, which are the measures
' along the river for each reach.  This permits spatial association of the
' records with the route coverage being used.
'
'0123456789012345678901234567890123456789012345678901234567890123456789012345678

theVTab = SELF.Get(0)
theFileName = SELF.Get(1)
RivOrDrn = SELF.Get(2)
IXXXCB = SELF.Get(3)

thePosNumFmtString = "d.ddd"
theValueNumFmtString = "d.dddd"

theNameFld = theVTab.FindField("Name")
theFromFld = theVTab.FindField("From")
theToFld = theVTab.FindField("To")
theRowFld = theVTab.FindField("Row")
theColFld = theVTab.FindField("Col")
theCondFld = theVTab.FindField("Cond")
if (RivOrDrn = "RIVER") then
  theStageFld = theVTab.FindField("Stage_avg")
end
theBEFld = theVTab.FindField("Botel")
```

```
if (RivOrDrn = "River") then
  theFileExt = ".riv"
elseif (RivOrDrn = "Drain") then
  theFileExt = ".drn"
end
theFileName = (theFileName + theFileExt).AsFileName

theFileString = ""
the10SpaceBlank = "          "
the15SpaceBlank = "               "

NoOfReaches = theVTab.GetNumRecords
'Create the File String:
for each aRecord in theVTab
    theRow = theVTab.ReturnValue(theRowFld, aRecord)
    theRow.SetFormat( "d" )
      theRowString = the10SpaceBlank.Left(10 - theRow.AsString.Count) +
                       theRow.AsString
    theCol = theVTab.ReturnValue(theColFld, aRecord)
    theCol.SetFormat( "d" )
      theColString = the10SpaceBlank.Left(10 - theCol.AsString.Count) +
                       theCol.AsString
    theReachCond = theVTab.ReturnValue(theCondFld, aRecord)
      theReachCond.SetFormat( "d.dd" )
      theReachCondString = the10SpaceBlank.Left(10 -
                             theReachCond.AsString.Count) +
                             theReachCond.AsString
    theReachBE = theVTab.ReturnValue(theBEFld, aRecord)
    theReachBE.SetFormat( "d.dd" )
      theReachBEString = the10SpaceBlank.Left(10 - theReachBE.AsString.Count) +
                         theReachBE.AsString
    theReachFrom = theVTab.ReturnValue(theFromFld, aRecord)
    theReachFrom.SetFormat ( "d.dd" )
      theReachFromString = the10SpaceBlank.Left(10 -
                             theReachFrom.AsString.Count) +
                             theReachFrom.AsString
    theReachTo = theVTab.ReturnValue(theToFld, aRecord)
    theReachTo.SetFormat ( "d.dd" )
      theReachToString = the10SpaceBlank.Left(10 - theReachTo.AsString.Count) +
                         theReachTo.AsString
    aCanalName = theVTab.ReturnValue(theNameFld, aRecord)
    aCanalName = the15SpaceBlank.Left(15 - aCanalName.Count) + aCanalName

    if (RivOrDrn = "RIVER") then

      theReachStage = theVTab.ReturnValue(theStageFld, aRecord)
      theReachStage.SetFormat( "d.dddd" )
      theReachStageString = the10SpaceBlank.Left(10 -
                              theReachStage.AsString.Count) +
                              theReachStage.AsString
      aRecordString = "         1" + theRowString + theColString +
                        theReachStageString +
                        theReachCondString + theReachBEString +
                        aCanalName + theReachFromString + theReachToString

    elseif (RivOrDrn = "DRAIN") then

      aRecordString = "         1" + theRowString + theColString +
                      theReachBEString + theReachCondString +
                      aCanalName + theReachFromString + theReachToString
    end
    theFileString = theFileString + aRecordString + nl
```

```
  end

theFileString = the10SpaceBlank.Left(10 - NoOfReaches.AsString.Count) +
                  NoOfReaches.AsString + the10SpaceBlank.Left(10 -
                  IXXXCB.AsString.Count) + IXXXCB.AsString + NL +
                  the10SpaceBlank.Left(10 - NoOfReaches.AsString.Count) +
                  NoOfReaches.AsString + NL + theFileString

theTextFile = TextFile.Make(theFileName, #FILE_PERM_WRITE)

theTextFile.Write(theFileString, theFileString.Count)
theTextFile.Close
```

APPENDIX IV

Documentation of AvWELL Avenue Scripts

```
'************* U.S. Geological Survey preliminary computer program ************
'*****************************************************************************
'*************                 AvWell Make Extension               *************
'*****************************************************************************
'**                            Language: ArcView Avenue                      **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*===========================================================================
'*     Author/Site,      Date,        Event
'*   -------------------------------------------------------------------------
'*   Raul D. Patterson                                  Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                        FAX: (305) 717-5801
'*   9100 NW 36th St., Suite 109
'*   Miami, Florida 33178 USA                     Internet: rdpatter@usgs.gov
'*
'*===========================================================================
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*
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'           connection therewith.
'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*===========================================================================
'
'---VERSION 1.0 AVWELL 08MAY2001 8:36 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: This script creates the extension, adding all scripts and dialogs
' to the extension and then saving the extension to disk to create the file
' AvWell.avx
'
'012345678901234567890123456789012345678901234567890123456789012345678901234567


AvWellExt = Extension.Make("$AVEXT\AvWell.avx".AsFileName,
            "ArcView MODTMR Well Extension", av.FindScript("AvWell.Install"),
            av.FindScript("AvWell.UnInstall"), {"$AVBIN\avdlog.dll".AsFileName})

AvWellExt.SetAbout("ArcView GUI for refining MODFLOW Well (WEL) packages")

AvWellExt.SetExtVersion( 1 )
AvWellExt.SetUnloadScript(av.FindScript("AvWell.Unload"))


'Add GUI Controls and Dialogs:

  'Add GUI controls:
  theViewGUI = av.FindGUI("View")
  theViewGUIButtons = theViewGUI.GetButtonBar.GetControls
  theOpenButton = theViewGUIButtons.Get(theViewGUIButtons.Count - 1)
  theViewGUIMenuBar = theViewGUI.GetMenuBar
  theMenu = theViewGUIMenuBar.GetControls.Get(5)
  theChoice = theMenu.GetControls.Get(1)
  theSpace = theMenu.GetControls.Get(0)

  '*****
  AvWellExt.Add(theOpenButton)                                         '1ST OBJECT
  AvWellExt.Add(theSpace)                                              '2RD OBJECT
```

```
  AvWellExt.Add(theChoice)                                                  '3TH OBJECT
  '*****

  'Add dialogs:
  dlgAvWell = av.FindDoc("dlgAvWell").GetDialog

  '*****
  AvWellExt.Add(dlgAvWell)                                                  '4TH OBJECT
  '*****


  'Add scripts:
  for each aDoc in av.GetProject.GetDocs
    if ((aDoc.Is(SEd)) and (aDoc.GetName.Left("AvWell".Count + 1) =
        "AvWell.")) then
      if (aDoc.IsCompiled) then
        AvWellExt.Add(aDoc.GetScript)
      else
        MsgBox.Info("the script" ++aDoc.GetName++"is not compiled, extension" +
                    "not created", "")
        aDoc.GetWin.Open
        Return Nil
      end
    end
  end

  'add any other misc scripts:
  AvWellExt.Add(av.FindDoc("View.FindFThemesOfAType").GetScript)
  AvWellExt.Add(av.FindDoc("Avtmr.GetGridTheme").GetScript)
  AvWellExt.Add(av.FindDoc("Avtmr.GetFileNameFromNameFile").GetScript)

AvWellExt.Commit
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************               AvWell.dlgAvWell.btnNext.Click        **************
'******************************************************************************
'**                            Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                    Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                          FAX: (305) 717-5801
'*   9100 NW 36th St., Suite 109
'*   Miami, Florida 33178 USA                         Internet: rdpatter@usgs.gov
'*
'*=============================================================================
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVWELL 08MAY2001 8:36 AM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Clicking advances current record by one.  It grabs the existing
' current records' record number and increments it by one by calling the script
' "AvWell.MoveRecord" with the keyword "NEXT" as an argument.  Sends updates
' to all the well reporting controls.
'
'0123456789012345678901234567890123456789012345678901234567890123456789012345678
'

theView = av.GetActiveDoc
theWellTheme = av.Run("Avtmr.GetGridTheme", {theView, "W"})

if (theWellTheme = NIL) then
  Return NIL
end

theCurrRecNo = av.Run("AvWell.MoveRecord", {theWellTheme, "NEXT"})

SELF.Update
SELF.BroadcastUpdate
av.GetProject.SetModified(TRUE)
```

```
'************* U.S. Geological Survey preliminary computer program ************
'*****************************************************************************
'*************          AvWell.dlgAvWell.btnPrevious.Click        ************
'*****************************************************************************
'**                           Language: ArcView Avenue                      **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'*     Author/Site,      Date,        Event
'*   -------------------------------------------------------------------------
'*   Raul D. Patterson                                    Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                          FAX: (305) 717-5801
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'*
'*============================================================================
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'
'---VERSION 1.0 AVWELL 08MAY2001 8:36 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Clicking rewinds current record by one.  It grabs the existing
' current records' record number and decreases it by one by calling the script
' "AvWell.MoveRecord" with the keyword "PREVIOUS" as an argument.  Sends updates
' to all the well reporting controls.
'
'0123456789012345678901234567890123456789012345678901234567890123456789012345678


theView = av.GetActiveDoc
theWellTheme = av.Run("Avtmr.GetGridTheme", {theView, "W"})

if (theWellTheme = NIL) then
  Return NIL
end

av.Run("AvWell.MoveRecord", {theWellTheme, "PREVIOUS"})

SELF.Update
SELF.BroadCastUpdate
av.GetProject.SetModified(TRUE)
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************         AvWell.dlgAvWell.cbxGridTheme.Select        *************
'******************************************************************************
'**                          Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                  Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                        FAX: (305) 717-5801
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'*
'*=============================================================================
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVWELL 08MAY2001 8:36 AM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: executed upon selecting a polygon theme as the grid theme, it sets
' the selected grid theme into the object tag of the well theme, then calls the
' script "AvWell.OverlayWellsWithGrid".  Also, resets the record tracker item in
' the well theme and issues an update to the well reporting controls.
'
'0123456789012345678901234567890123456789012345678901234567890123456789012345678
theDialog = SELF.GetDialog

'identify controls:
cbxWellTheme = theDialog.FindByName("cbxWellTheme")

theWellTheme = cbxWellTheme.GetSelection
theGridTheme = SELF.GetSelection
theWellTheme.GetObjectTag.Set(4, theGridTheme)  '*** 5th pos well theme obj tag
av.Run("AvWell.OverlayWellsWithGrid",
  {theWellTheme, theGridTheme})

theVTab = theWellTheme.GetFTab
theDialog.SetServer(theVTab)
theTotalRecs = theVTab.GetNumSelRecords
theCurrentRec = theVTab.GetSelection.GetNextSet(-1)
theWellNo = 1
theWellTheme.GetObjectTag.Set(6,{theCurrentRec, theTotalRecs, theWellNo})

'Reset the Record tracker item in the well theme's object tag:
av.Run("AvWell.MoveRecord", {theWellTheme, "RESET"})

'in a previous call, the well theme was overlain with the grid theme,
'selecting all the wells within it; now we load their pumpage data to
'the pumpage listbox:
  lbxPumpage = theDialog.FindByName("lbxPumpage")
```

```
  av.Run("AvWell.LoadPumpage", {theWellTheme, lbxPumpage})
  lbxPumpage.Update


'send updates to the record navigating controls
SELF.BroadcastUpdate

av.GetProject.SetModified(TRUE)
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************          AvWell.dlgAvWell.cbxWellTheme.Select        ************
'******************************************************************************
'**                        Language: ArcView Avenue                          **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                 Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                       FAX: (305) 717-5801
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'*
'*=============================================================================
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVWELL 08MAY2001 8:36 AM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: sets up the selected point theme as the well theme.  Upon
' selecting the theme, the user is prompted for a well name or id field (should
' be a text field with identifiers for the wells), then prompts for the layer
' field (contains the layer number in the simulation that the well withdraws
' from), and then it asks the user to select the pumpage fields.  One pumpage
' field must be designated by the user for each period in the variable NPER,
' which is obtained from the basic package of the local simulation.  The pumpage
' field should be numeric with pumpage in the units used by the local simulation
' and the values should be negative for withdrawal, positive for injection.  The
' above information (along with place holders for other information yet to be
' entered) is assembled into a list which is set as the well theme's object tag.
' The information in the list is needed by the rest of the programs to create
' the well package file.  The attribute table of the well theme is then set as
' the server for the dialog.  At the beginning, a search is made in the view for
' a well theme that may have previously been designated, by calling the script
' "Avtmr.GetGridTheme"; if one is found, the user is asked whether to keep it or
' replace it with the selected theme.  Updates are broadcast to listening
' controls at the end.
'
'012345678901234567890123456789012345678901234567890123456789012345678901234567


theView = av.GetActiveDoc
theDialog = SELF.GetDialog
txlWellName = theDialog.FindByName("txlWellName")
txtNPER = theDialog.FindByName("txtNPER")
lbxPumpage = theDialog.FindByName("lbxPumpage")
cbxGridTheme = theDialog.FindByName("cbxGridTheme")


'if a well theme's been designated, then ask user whether
```

```
'to change to the new one and delete old one's object tag.

theSelTheme = SELF.GetSelection
theWellTheme = av.Run("Avtmr.GetGridTheme", {theView, "W"})



if (theSelTheme = theWellTheme) then
  theFTab = theWellTheme.GetFTab
  theDialog.SetServer(theFTab)
  lbxPumpage.Update
  return NIL
elseif (theWellTheme = NIL) then
  'none's been designated, we'll go with this one
  theWellTheme = theSelTheme
else  'they're choosing a new well theme
  'verify:
  change = MsgBox.YesNo ("The well theme is currently "+theWellTheme.GetName +
                          ", Would you like to change it to be " +
                         theSelTheme.GetName + "?", "Selecting Well Theme", TRUE)
  if (change) then
    theWellTheme.SetObjectTag("")
    theWellTheme = theSelTheme
  else
    SELF.Update
    theFTab = theWellTheme.GetFTab
    theDialog.SetServer(theFTab)
    lbxPumpage.Update
    Return NIL
  end
end

theFTab = theWellTheme.GetFTab

theWellList = List.Make

theWellList.Add("W")  '**0th item added to theWellList



'make lists of all string flds and all num flds:
theStringFlds = {}
theNumFlds = {}
for each F in theFTab.GetFields
  if (F.IsTypeNumber) then
    theNumFlds.Add(F)
  elseif (F.IsTypeString) then
    theStringFlds.Add(F)
  end
end

'get the well name field:
theWellFld = MsgBox.ListAsString(theStringFlds, "Select Well Name field",
                  "Selecting Fields")
theWellFldName = theWellFld.GetName
theWellList.Add(theWellFldName)  '**1st item added to theWellList
theStringFlds.RemoveObj(theWellFld)

'get the layer field:
theLayerFld = MsgBox.ListAsString(theNumFlds, "Select Layer field",
                "Selecting Fields")
theLayerFldName = theLayerFld.GetName
theWellList.Add(theLayerFldName)  '**2nd item added to theWellList
```

```
theNumFlds.RemoveObj(theLayerFld)

'get the flds for each stress period:
NPER = txtNPER.GetLabel.AsList.Get(2).AsNumber
thePumpFlds = List.Make
for each i in 1..NPER
  'get the fld for the i-th stress period pumpage:
  anPumpFld = MsgBox.ListAsString(theNumFlds, "Select Stress Period"++
                i.AsString++"field", "Selecting Fields")
  thePumpFlds.Add(anPumpFld.GetName)
end

'get the file name for the name file in the path to files:
theRootName = theDialog.FindByName("txlRootName").GetText
thePath = theDialog.FindByName("txtPathToFiles").GetLabel.AsList.Get(3)
theFileNameString = thePath + "\" + theRootName + ".nam"
theFileName = FileName.Make(theFileNameString)

theWellList.Add(thePumpFlds)  '**3rd item added to theWellList
theWellList.Add(NIL)          '**4th item added to the WellList (placeholder
                              '      for theGridTheme)
theWellList.Add(theFileName)  '**5th item added to the WellList
theWellList.Add("")           '**6th item added to the WellList (placeholder
                              '      for theRecTrackList)

theWellTheme.SetObjectTag(theWellList)

theDialog.SetServer(theFTab)

SELF.BroadcastUpdate

av.GetProject.SetModified(TRUE)
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************          AvWell.dlgAvWell.lbtBrowse.Click         **************
'******************************************************************************
'**                         Language: ArcView Avenue                         **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                    Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                          FAX: (305) 717-5801
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'*=============================================================================
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVWELL 08MAY2001 8:36 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
'  Purpose: Prompts the user to browse to the MODFLOW Name File of the local
' simulation.  Locates the basic file and reads the value NPER from it.  Posts
' the Path to Files, NPER and the Root name of the simulation into their
' respective controls and send an update to enable the drop-down list box for
' the well theme.
'
'012345678901234567890123456789012345678901234567890123456789012345678901234567 8
'

theView = av.GetActiveDoc

theDialog = SELF.GetDialog

'identify controls:
txlRootName = theDialog.FindByName("txlRootName")
txtPathToFiles = theDialog.FindByName("txtPathToFiles")
txtNPER = theDialog.FindByName("txtNPER")
cbxWellTheme = theDialog.FindByName("cbxWellTheme")
cpaThemes = theDialog.FindByName("cpaThemes")

'browse to the simulation's name file:
theWellTheme = av.Run("Avtmr.GetGridTheme", {theView, "W"})
if ((theWellTheme = NIL).Not) then
  theNameFileName = theWellTheme.GetObjectTag.Get(5)
  theNameFileName.ReturnDir.SetCWD
end

theNameFileName = FileDialog.Show ("*.nam", "MODFLOW Name File (*.nam)",
             "Select Name File for Local MODFLOW Simulation")
```

```
if (theNameFileName = NIL) then
  Return NIL
end

if ((theWellTheme = NIL).Not) then
  theWellTheme.GetObjectTag.Set(5, theNameFileName)
  av.GetProject.SetModified(TRUE)
end

PathToFiles = theNameFileName.ReturnDir.AsString
txtPathToFiles.SetLabel("Path to Files:" ++ PathToFiles)
txtPathToFiles.SetEnabled(TRUE)
txlRootName.SetText(theNameFileName.GetBaseName)
txlRootName.SetEnabled(TRUE)

'set NPER:

theBASFileName = (PathToFiles + "\" +
    av.Run("Avtmr.GetFileNameFromNameFile",
        {theNameFileName, "BAS"})).AsFileName

theBASFile = LineFile.Make(theBASFileName, #FILE_PERM_READ)
theBASFile.SetPos(2)
the3rdLine = theBASFile.ReadElt
NPER = the3rdLine.AsList.Get(3)
theBASFile.Close

txtNPER.SetLabel("Stress Periods: "+NPER)
txtNPER.SetEnabled(TRUE)

cpaThemes.SetEnabled(TRUE)
cbxWellTheme.SetEnabled(TRUE)
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************          AvWell.dlgAvWell.lbtWriteFile.Click         ***********
'******************************************************************************
'**                          Language: ArcView Avenue                        **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                    Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                          FAX: (305) 717-5801
'*   9100 NW 36th St., Suite 109
'*   Miami, Florida 33178 USA                     Internet: rdpatter@usgs.gov
'*
'*=============================================================================
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*
'* Disclaimer:
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'            connection therewith.
'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVWELL 08MAY2001 8:36 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Writes the WEL file by using the parameters stored in the Well
' Theme's object tag.  Locates the current WEL package file, giving the user
' the opportunity to re-name the old file before creating the new one to avoid
' over-writing it.  Loops through the Pump fields, writing a block of data to
' the WEL file for each new stress pump field by looping through the records,
' and writes a -1 in a new line for those stress periods using the same field as
' the previous stress period.  The determination of whether the previous stress
' period's information will be used is done by comparing the pump field in the
' current iteration with that of the previous one.  If it is the same field,
' then there is no need to write a new block of data and a -1 is written on the
' next line indicating that the previous stress period’s pumping values will be
' reused in the current stress period.  If a well is inactive for a given stress
' period, then its pumping value is 0. Accordingly, at the beginning of the loop
' a reselect query is executed for "[PumpFldName] <> 0", and this selection is
' then processed, leaving out the wells with pumping values of 0.
'
'01234567890123456789012345678901234567890123456789012345678901234567890123456789012345678


theView = av.GetActiveDoc

theWellTheme = av.Run("Avtmr.GetGridTheme", {theView, "W"})
theWellFTab = theWellTheme.GetFTab

'Get current list of parameters:
theParamList = theWellTheme.GetObjectTag
theWellFldName = theParamList.Get(1)
theLayFldName = theParamList.Get(2)
thePumpFldNames = theParamList.Get(3)
theGridTheme = theParamList.Get(4)
theNamFileName = theParamList.Get(5)
```

```
the10SpaceString = "          "
the12SpaceString = "         "

'momentarily, for the duration of this script:



'locate current WEL pkg file where NAME file points, copying existing file to a
'new name and reusing the name in the NAME file for the new one:

theOldFile = av.Run("Avtmr.GetFileNameFromNameFile", {theNamFileName, "WEL"})
theOldFileName = (theNamFileName.ReturnDir.AsString + "\" +
theOldFile).AsFileName

if (theOldFileName.IsFile.Not) then
  MsgBox.Info("The location indicated in the Name file for the WEL file will "+
              "be used", "the Current WEL file," + theOldFile +
              " was not found", "")
else
  OverWrite = MsgBox.YesNo("the Current WEL file exists:"+NL+theOldFile,
    "Over-write Current WEL File?", FALSE)
  if (OverWrite.Not) then
    MsgBox.Info("To run again, re-name the old WEL file and then try again",
      "Terminating Execution")
    Return NIL
  end
end

theNewFileName = theOldFileName


'Open up the old file to read the first non-comment line:

theOldWellFile = LineFile.Make(theOldFileName, #FILE_PERM_READ)
the1stLine = NIL

While (the1stLine = NIL)
  aLine = theOldWellFile.ReadElt
  if (aLine.Trim.Left(1) <> "#") then
    the1stLine = aLine
    break
  end
end

theOldWellFile.Close

if (the1stLine = NIL) then
  MsgBox.Error("Invalid WEL file: no valid records found", "Terminating "+
                  "Execution")
  Return NIL
end

'get IWELCB, the only thing to be retained from the old well file:
IWELCB = the1stLine.AsList.Get(1)

'Start up the new file (this will overwrite the old file)
theNewFile = LineFile.Make(theNewFileName, #FILE_PERM_WRITE)


'get NCOL and NROW from BAS file:

theBASFileName = (theNamFileName.ReturnDir.AsString +
```

```
 "\" + av.Run("Avtmr.GetFileNameFromNameFile",
   {theNamFileName, "BAS"})).AsFileName

theBASFile = LineFile.Make(theBASFileName, #FILE_PERM_READ)
theBASFile.SetPos (2)
the3rdBASLine = theBASFile.ReadElt
theItems = the3rdBASLine.AsList

NROW = theItems.Get(1).AsNumber
NCOL = theItems.Get(2).AsNumber

NROWxNCOL = NROW * NCOL

NPER = theItems.Get(3).AsNumber

theBASFile.Close

'the PumpFldName is used as a Key to a dictionary that contains either bitmaps
'or a number, -1.  A -1 is used whenever a pump field is used for consecutive
'stress periods.

theNumOfRecs = theWellFTab.GetNumRecords
PER = 0
thePrevFldName = ""
theNullVal = 0
MXWELL = 0

'save selection to issue it in the upcoming loop:
theOrigBitmap = theWellFTab.GetSelection.Clone
theWellFTab.GetSelection.ClearAll
theWellFTab.UpdateSelection
aStressPerDict = Dictionary.Make((thePumpFldNames.Count/10).Ceiling)
av.ClearMsg
av.ShowMsg("Sizing arrays...")
for each aPumpFldName in thePumpFldNames
  PER = PER + 1
  aStressPerList = List.Make
  if (aPumpFldName = thePrevFldName) then
    ITMP = -1
    aStressPerList = {ITMP}
  else  'Determine MXWELL, ITMP for this stress period by doing selects:
    aBitmap = theOrigBitmap.Clone
    theWellFTab.SetSelection( theOrigBitmap )
    theWellFTab.UpdateSelection

    theQString = "(["+aPumpFldName+"] <> "+theNullVal.AsString+" )"
      theWellFTab.Query(theQString, aBitmap, #VTAB_SELTYPE_AND)
    theWellFTab.SetSelection(aBitmap)
    theWellFTab.UpdateSelection
    ITMP = theWellFTab.GetNumSelRecords
    if (ITMP > MXWELL) then
      MXWELL = ITMP
    end
    aStressPerList = {ITMP, aBitmap}
  end
  aStressPerDict.Add(PER, aStressPerList)
  thePrevFldName = aPumpFldName
end
av.ClearMsg

MXWELL = MXWELL.AsString
the1stLine = the10SpaceString.Left(10 - MXWELL.Count)+MXWELL +
  the10SpaceString.Left(10 - IWELCB.Count)+IWELCB
```

```
theNewFile.WriteElt(the1stLine)

theLayFld = theWellFTab.FindField(theLayFldName)
theRowFld = theWellFTab.FindField("Row")
theColFld = theWellFTab.FindField("Col")
theShpFld = theWellFTab.FindField("Shape")

theWellFld = theWellFTab.FindField(theWellFldName)
thisPumpFldName = NIL

'thePumpFldNames contain one field for each stress period and they may
'be repeated (ie. the same Pump field may be used by more than one stress
'period, whether the stress periods are consecutive or not).  A determi-
'nation is made at the beginning of the loop to check if the same pump field
'is being used as in the previous stress period, if yes, a -1 is written
'otherwise, a whole new block of data is written.

  'initialize variables:
  ITMP = 0
  aTenSpaceString = "          "

for each i in 1..NPER

  theList = aStressPerDict.Get(i)
  ITMP = theList.Get(0)

  if (ITMP < 0) then
    theNewFile.WriteElt("        -1")
    continue  'a new set of type3 recs isn't needed, so next PERiod...
  else
    theITMPSpaces = aTenSpaceString.Left(10 - ITMP.AsString.Count)
    theNewFile.WriteElt(theITMPSpaces + ITMP.AsString)
  end

  'access the values of this selection and put them into a dictionary that
  'uses SeqNum as its key, and the values are lists of Item Lists. Each
  'anItemList containing, in sequence, the elements of a record:

  aBitmap = theList.Get(1)

  theDict = Dictionary.Make(theWellFTab.GetNumSelRecords/10)
  theWellFTab.SetSelection(aBitmap)
  theWellFTab.UpdateSelection

  aPumpFldName = thePumpFldNames.Get(i - 1)
  thePumpFld = theWellFTab.FindField(aPumpFldName)

  for each aRec in theWellFTab.GetSelection

    theLay = theWellFTab.ReturnValue(theLayFld, aRec)
    theRow = theWellFTab.ReturnValue(theRowFld, aRec)
    theCol = theWellFTab.ReturnValue(theColFld, aRec)
      theSeqnum = ((theLay - 1) * NROWxNCOL) + ((theRow - 1) * NCOL) + theCol
    theLay = theLay.AsString
    theRow = theRow.AsString
    theCol = theCol.AsString
    thePumpage = theWellFTab.ReturnValue(thePumpFld, aRec).SetFormat(
                   "d.d").AsString
    theWell = theWellFTab.ReturnValue(theWellFld, aRec)
    theWell = theWell.Left(12) + the12SpaceString.Left(12 - theWell.Count)
    theShape = theWellFTab.ReturnValue(theShpFld, aRec)
    theXcoor = theShape.GetX.SetFormat("d.dd").AsString
    theYcoor = theShape.GetY.SetFormat("d.dd").AsString
```

```
    aRecord = {theLay, theRow, theCol, thePumpage, theWell, theXcoor, theYcoor}

    if (theDict.Get(theSeqnum) = NIL) then
      aListOfRecords = List.Make
      aListOfRecords.Add(aRecord)
      theDict.Add(theSeqnum, aListOfRecords)
    else
      aListOfRecords = theDict.Get(theSeqnum)
      aListOfRecords.Add(aRecord)
      theDict.Set(theSeqnum, aListOfRecords)
    end
  end

  'write out the records:

  theSeqnums = theDict.ReturnKeys
  theSeqnums.Sort(TRUE)
    'create a string for this PER's data:
    PERString = ""
  for each aSeqnum in theSeqnums
    theListOfRecords = theDict.Get(aSeqnum)
    for each aRecord in theListOfRecords
      aRecString = ""
      for each i in 0..3
        anItem = aRecord.Get(i)
        theSpaces = aTenSpaceString.Left(10 - anItem.Count)
        aRecString = aRecString + theSpaces + anItem
      end
      aRecString = aRecString + " #"
      for each i in 4..6
        anItem = aRecord.Get(i)
        aRecString = aRecString ++ anItem
      end
      theNewFile.WriteElt(aRecString)
    end
  end

end

theNewFile.Close
```

```
'************* U.S. Geological Survey preliminary computer program ************
'*******************************************************************************
'*************                AvWell.dlgAvWell.Open                **************
'*******************************************************************************
'**                         Language: ArcView Avenue                          **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*==============================================================================
'*     Author/Site,      Date,        Event
'*   ---------------------------------------------------------------------------
'*   Raul D. Patterson                                      Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                            FAX: (305) 717-5801
'*   9100 NW 36th St., Suite 109
'*   Miami, Florida 33178 USA                          Internet: rdpatter@usgs.gov
'*
'*==============================================================================
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*
'* Disclaimer:
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'            connection therewith.
'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*==============================================================================
'
'---VERSION 1.0 AVWELL 08MAY2001 8:36 AM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Sets up environment for dialog.  First, all controls are
' referenced.  Then, the broadcast-listener relationships are set up among the
' controls.  At the end, updates are sent to all the controls to initialize the
' dialog.  Prior to initialization, a well theme is searched for in the current
' view; if a well theme has been designated in the view, then it is determined
' whether a grid theme has been associated with it.  If there is no
' well theme, the form will open up with all controls disabled except for the
' Browse and Close buttons.  If a well theme exists but no grid theme, then
' additionally, the well theme drop-down list box and the grid theme drop-down
' list box will be enabled as well.
'
'0123456789012345678901234567890123456789012345678901234567890123456789012345678
'

theView = av.GetActiveDoc

'identify controls:

txlRootName = SELF.FindByName("txlRootName")
cbxWellTheme = SELF.FindByName("cbxWellTheme")
cbxGridTheme = SELF.FindByName("cbxGridTheme")

txtNPER = SELF.FindByName("txtNPER")
txtPathToFiles = SELF.FindByName("txtPathToFiles")
txlWellName = SELF.FindByName("txlWellName")
txlXcoor = SELF.FindByName("txlXcoor")
txlYcoor = SELF.FindByName("txlYcoor")
txlLayer = SELF.FindByName("txlLayer")
lbxPumpage = SELF.FindByName("lbxPumpage")
txtRecTracker = SELF.FindByName("txtRecTracker")
btnPrevious = SELF.FindByName("btnPrevious")
```

```
btnNext = SELF.FindByName("btnNext")
lbtWriteFile = SELF.FindByName("lbtWriteFile")

'set up broadcast/listener relationships:

theRecTrackingControls = {txlWellName, btnNext, btnPrevious, txtRecTracker,
  txlXcoor, txlYcoor, txlLayer, lbxPumpage}
btnPrevious.SetListeners(theRecTrackingControls)
btnNext.SetListeners(theRecTrackingControls)
cbxGridTheme.SetListeners(theRecTrackingControls)
cbxWellTheme.SetListeners(theRecTrackingControls)
cbxGridTheme.AddListener(cbxWellTheme)
cbxGridTheme.AddListener(lbtWriteFile)
cbxWellTheme.AddListener(cbxGridTheme)
cbxWellTheme.AddListener(lbtWriteFile)


'check if a well theme exists in the view, if it does, check if a grid theme
'is in the View, if not in the view.  If a well theme exists nd its grid
'a theme also exists, then overlay grid with wells, and initialize dialog:

theWellTheme = av.Run("Avtmr.GetGridTheme", {theView, "W"})
if ((theWellTheme = NIL).Not) then

  theWellParamList = theWellTheme.GetObjectTag
  theGridTheme = theWellParamList.Get(4)

  if (theGridTheme = NIL) then
    'do nothing
  elseif (theView.GetThemes.Find(theGridTheme) = -1) then
    MsgBox.Warning("The previosly selected grid theme, "+theGridTheme.GetName+
                  ", is not in the view, select a new grid theme",
                  "Grid Theme Not Found")
    theWellParamList.Set(4, NIL)
    theWellTheme.SetObjectTag(theWellParamList)
  else  'overlay themes, reset controls:
    av.Run("AvWell.OverlayWellsWithGrid", {theWellTheme, theGridTheme})
    SELF.SetServer(theWellTheme.GetFTab)
    'reset record tracker:
    av.Run("AvWell.MoveRecord", {theWellTheme, "RESET"})
    'reload pumpage data to Pumpage listbox:
    av.Run("AvWell.LoadPumpage", {theWellTheme, lbxPumpage})
  end

end


'send updates for initialization:

txlRootName.Update
txtPathToFiles.Update
txtNPER.Update

cbxWellTheme.Update
cbxGridTheme.Update

btnPrevious.Update
btnNext.Update
txtRecTracker.Update
txlWellName.Update
txlXcoor.Update
txlYcoor.Update
txlLayer.Update
```

```
lbxPumpage.Update

lbtWriteFile.Update
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                    AvWell.Install                 **************
'******************************************************************************
'**                          Language: ArcView Avenue                       **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                    Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                          FAX: (305) 717-5801
'*   9100 NW 36th St., Suite 109
'*   Miami, Florida 33178 USA                      Internet: rdpatter@usgs.gov
'*
'*=============================================================================
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVWELL 08MAY2001 8:36 AM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: Install script is executed only when the extension is loaded for
' the first time in an ArcView session.  Installs the dialog, dlgAvWell, the
' extension scripts, as well as the button and MODTMR menu (if not already
' present), and the 'Well Refiner...' choice for launching the dialog.
'
'0123456789012345678901234567890123456789012345678901234567890123456789012345678


'Install ONLY if there is an active project
if (av.GetProject = nil) then
  return NIL
end

'Retrieve objects from extension:
theProject = av.GetProject

theOpenButton = SELF.Get(0)
theSpace = SELF.Get(1)
theChoice = SELF.Get(2)

'the project must have a View GUI:
theViewGUI = av.GetProject.FindGUI("View")
if (theViewGUI = NIL) then
  Return NIL
end

'Install the open button:
theViewGUIButtonBar = theViewGUI.GetButtonBar
theViewGUIButtons = theViewGUIButtonBar.GetControls
'Make it the last item
thePlace = theViewGUIButtons.Count
```

```
theViewGUIButtonBar.Add(theOpenButton, thePlace)

'now install menu choice and MODTMR menu if not present:
theViewMenuBar = theViewGUI.GetMenuBar
theMODTMRMenu = theViewMenuBar.FindByLabel("MODTMR")
if (theMODTMRMenu = NIL) then
  'add it:
  theWindowMenu = theViewMenuBar.FindByName("Window")
  thePlace = theViewMenuBar.GetControls.Find(theWindowMenu) - 1
  theMenu = theViewMenuBar.New(thePlace)
  theMenu.SetLabel("&MODTMR")
  theMenu.Add(theChoice, 0)
else
  'add a space and then it:
  theMODTMRMenu.Add(theSpace, 99)
  theMODTMRMenu.Add(theChoice, 99)
end

theViewGUI.SetModified(TRUE)
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                  AvWell.LoadPumpage                **************
'******************************************************************************
'**                          Language: ArcView Avenue                          **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   --------------------------------------------------------------------------
'*   Raul D. Patterson                                  Phone: (305) 717-5865
'*   U. S. Geological Survey - WRD                        FAX: (305) 717-5801
'*   9100 NW 36th St., Suite 109
'*   Miami, Florida 33178 USA                     Internet: rdpatter@usgs.gov
'*
'*=============================================================================
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVWELL 08MAY2001 8:36 AM
'
':::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
' .. Purpose: loads the pumpage data for the wells in the pumpage fields to the
' Pumpage list box, and sets the first row visible.
'
'01234567890123456789012345678901234567890123456789012345678901234567890123456789012345678


theWellTheme = SELF.Get(0)
lbxPumpage = SELF.Get(1)

theDialog = lbxPumpage.GetDialog

theWellParams = theWellTheme.GetObjectTag

theWellFTab = theWellTheme.GetFTab

thePumpFlds = {}
thePumpFldsNames = theWellParams.Get(3)
for each P in thePumpFldsNames
  aPumpFld = theWellFTab.FindField(P)
  thePumpFlds.Add(aPumpFld)
end

lbxPumpage.DefineFromVTab (theDialog.GetServer, thePumpFlds, TRUE)
lbxPumpage.SetRowHeight(100)
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************                     AvWell.MoveRecord               *************
'******************************************************************************
'**                           Language: ArcView Avenue                       **
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'*     Author/Site,      Date,        Event
'*   ---------------------------------------------------------------------------
'*   Raul D. Patterson                                   Phone: (305) 717-5865
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'*
'*=============================================================================
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'*
'*:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*=============================================================================
'
'---VERSION 1.0 AVWELL 08MAY2001 8:36 AM
'
'::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'
'
' .. Purpose: Moves the current record in the selected set of the well attribute
' table one up or down, or rewinds back to the first selected record, depending
' on the keyword that is received as an argument ("NEXT", "PREVIOUS" or
' "RESET").  Updates the obj tag of the well theme to store the new record
' number.
'
'0123456789012345678901234567890123456789012345678901234567890123456789012345678


theWellTheme = SELF.Get(0)
theAction = SELF.Get(1)

theWellParams = theWellTheme.GetObjectTag

theRecTrackList = theWellParams.Get(6)
CurrRec = theRecTrackList.Get(0)
theWellNo = theRecTrackList.Get(2)

theWellThemeSelection = theWellTheme.GetFTab.GetSelection

if (theAction = "NEXT") then
  CurrRec = theWellThemeSelection.GetNextSet(CurrRec)
  theWellNo = theWellNo + 1
elseif (theAction = "PREVIOUS") then
  CurrRec = theWellThemeSelection.GetPrevSet(CurrRec)
  theWellNo = theWellNo - 1
elseif (theAction = "RESET") then
  CurrRec = theWellThemeSelection.GetNextSet(-1)
  theWellNo = 1
end
```

```
theRecTrackList.Set(0, CurrRec)
theRecTrackList.Set(2, theWellNo)
theWellParams.Set(6, theRecTrackList)

theWellTheme.SetObjectTag(theWellParams)

Return CurrRec
```

```
'************* U.S. Geological Survey preliminary computer program ************
'******************************************************************************
'*************              AvWell.OverlayWellsWithGrid             ************
'******************************************************************************
'**                          Language: ArcView Avenue                        **
'*::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
'*============================================================================
'*     Author/Site,      Date,        Event
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'*
'* Disclaimer:
'           Although this program has been used by the U.S. Geological Survey,
'           no warranty, expressed or implied, is made by the USGS as to the
'           accuracy and functioning of the program and related program
'           material nor shall the fact of distribution constitute any such
'           warranty, and no responsibility is assumed by the USGS in
'           connection therewith.
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'*============================================================================
'
'---VERSION 1.0 AVWELL 08MAY2001 8:36 AM
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'
' .. Purpose: overlays the grid theme on the well theme, thereby appending to
' the attribute table of the latter the grid fields 'seqnum', 'row', and 'col'.
' the overlay is performed by a spatial join in which the "from" field is the
' shape field of the grid theme, and the "to" field is the shape field of the
' well theme.  Then, a selection by theme is done on the well theme with the
' grid theme to select only those wells that fall inside the grid theme.
'
'012345678901234567890123456789012345678901234567890123456789012345678901234567 8


theWellTheme = SELF.Get(0)
theGridTheme = SELF.Get(1)

'do the spatial join:
theWellFTab = theWellTheme.GetFTab
theWellShpFld = theWellFTab.FindField("Shape")
theGridFTab = theGridTheme.GetFTab
theGridShpFld = theGridFTab.FindField("Shape")

'check if well ftab has any joins, unjoining all if yes:
if (theWellFTab.IsBase.Not) then
  av.GetProject.SetModified(true)
  theWellFTab.UnjoinAll
end

theWellFTab.Join(theWellShpFld, theGridFTab, theGridShpFld)
theWellTheme.SelectByTheme (theGridTheme, #FTAB_RELTYPE_ISCOMPLETELYWITHIN,
 0, #VTAB_SELTYPE_NEW)
theWellFTab.UpdateSelection
```