

# Geographic Database of Quivira National Wildlife Refuge, Kansas for use with WHEAT

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## ABSTRACT

A geographic database in WHEAT format was assembled for the Quivira National Wildlife Refuge in south-central Kansas for use with the WHEAT electronic mapping package. This database is being distributed as an example database for use with WHEAT, a public-domain electronic mapping system that runs under MSWindows 3.1 and higher. WHEAT is available from KGS on our Web site. Geographic data in the database are in WHEAT format and a wide variety of themes and layers are included to allow the user to immediately use WHEAT with this database.

Data layers include topography, hydrology, and roads from the USGS 1:100,000 Digital Line Graphs of the area, wetlands from the US Fish and Wildlife Service's National Wetlands Inventory 1:24,000 DLGs, soils from US Natural Resource Conservation Service 1:24,000 electronic maps, US Public Land Survey System data from the Kansas Geological Survey based on 1:24,000 maps, and interpreted boundaries of the managed ponds and their drainage basins based on analysis of the other layers (1:50,000 accuracy).

All coordinate locations are in Universal Transverse Mercator (UTM) Zone14 coordinates based on the North American Datum of 1927 (NAD27). Units are meters.

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## OVERVIEW

This database was built during a project sponsored by the US Fish and Wildlife Service to simulate water budgets in managed ponds and channels at the Quivira National

Wildlife Refuge in south-central Kansas. Primary goals included delineating drainage basins of managed ponds, determining their runoff, and finding groundwater contributions to the pond hydrologic budgets. This database is being distributed both as an example database for use with WHEAT (Pouch, 1994, 1996a-d) and as a GIS map of the Quivira National Wildlife Refuge.

The database itself is in Microsoft Access 2.5 format. Geographic data are stored in WHEAT compatible XYChains. The database occupies 4.75 MByte expanded and is shipped as a pkZip file occupying 2.13 MByte.

Data layers include topography, hydrology, and roads from the USGS 1:100,000 Digital Line Graphs of the area, wetlands from the US Fish and Wildlife Service's National Wetlands Inventory 1:24,000 DLGs, soils from US Natural Resource Conservation Service 1:24,000 electronic maps, US Public Land Survey System data from the Kansas Geological Survey based on 1:24,000 maps, and interpreted boundaries of the managed ponds and their drainage basins based on analysis of the other layers (1:50,000 accuracy). In addition, several small-scale data layers for orientation purposes are present, including an outline of the state of Kansas, the counties of Kansas, the Groundwater Management Districts of Kansas, and an approximate outline of the Quivira National Wildlife Refuge.

The database includes a number of pre-defined themes and layers to allow the user to immediately begin using WHEAT. The user can modify these themes or design new ones to tailor the map for particular purposes. Loading all the pre-designed themes produces a cluttered map. Eliminating soil labels and section labels produces a much more readable map. Loading the palette bitmap SOILQNWR.BMP (included) will eliminate dithering of soil polygons on 256-color displays.

## **WHEAT**

WHEAT is a set of public-domain, user-friendly Geographic Information System (GIS) developed at the Kansas Geological Survey for the display, analysis, manipulation and retrieval of information on natural resources, especially groundwater (Pouch, 1994). It runs under the Microsoft (MS) Windows 3.1 operating system and is intended to be easy to use.

To get WHEAT, use the World Wide Web to get to [www.kgs.ukans.edu](http://www.kgs.ukans.edu), choose Kansas Geological Survey, then Software, then WHEAT, or try going directly to <http://crude2.kgs.ukans.edu/software/Wheat/whtmain.htm>.

WHEAT is modular and menu-driven so users can learn by example as much or as little of the system as necessary for their needs: it does not require the detailed understanding of the data model or extensive command vocabulary that many commercial GISs or CADs require. WHEAT stores data in Microsoft Access databases. The end-user can extend and enhance WHEAT by writing programs to manipulate data or to provide additional transfer capabilities with spreadsheets, mainframe programs, and GIS systems.

Using E-MAP (the Electronic MAPPING program in WHEAT), the user can display tile (section), point, line, polygon, text label, and grid data; select the viewing region by zooming and panning; retrieve information on a geographic feature by double-clicking on it with the mouse; and print maps directly from E-MAP or copy to graphics programs for

further manipulation using the Windows Clipboard. Maps can also be exported to Windows Metafiles.

## **DATA LAYERS**

This database contains largely pre-existing data from a variety of sources, as described below. New data layers developed in this project included the managed pond outlines and the drainage basins of the ponds.

### **Wetlands from National Wetland Inventory**

Of particular importance for this study is the ability to delineate the drainage basins of the managed units at the Quivira National Wildlife Refuge as well as the soil properties of the drainage basins in order to calculate the surface runoff characteristics. It was necessary to accurately locate the managed units before delineating their drainage basins. After examining topographic maps and USFWS plats, it was decided to delineate managed units as agglomerations of wetland areas from the USFWS's National Wetland Inventory (NWI).

The US Fish and Wildlife Service distributes electronic versions of the National Wetland Inventory maps by anonymous ftp in Digital Line Graph (DLG) format. These data come with associated data files that provide the wetlands classification for each wetland, a program that parses the wetland code into a simpler form, and keys to convert the codes into words. For the Refuge area, the National Wetland Inventory is highly detailed, containing small wetland features not shown on topographic maps at any of the available scales. It is also the most up-to-date set of maps for the area

After the DLGs were obtained for the Refuge and surrounding quadrangles, these were imported into WHEAT. This produced tables containing the points, lines, and areas described in the DLG, along with their attributes. The PARSE program was used to break the wetland codes apart into smaller codes, and queries which attached the word meanings to the codes were written in Microsoft Access. These queries were then used to produce maps in WHEAT. Examples of such maps are shown in Appendix A.

### **Soils from SSURGO**

Soil data at the 1:24,000 scale were provisionally available from Kansas State University, which is the principal Kansas contractor for digitizing the Soil Survey Geographic Data Base (SSURGO). KSU was able to provide soil outlines for most of the QNWR area, except for that part in Reno County. The data were obtained as ARC/INFO export files, converted into ARC/INFO coverages, exported as DLGs, then imported in WHEAT. The soil maps will be combined with drainage basin maps for the managed units to determine the surface runoff into each unit.

The Kansas office of the Natural Resource Conservation Service was able to provide provisional soil properties data for the state of Kansas. These were provided as text files, which were imported into Microsoft Access. These were then processed to provide available water capacity for each soil map unit. Detailed soil maps of the study area are shown in Appendix A.

### **Topography from DLGs**

Topographic maps in the form of DLGs with five-meter contour intervals were available from the Kansas Data Analysis and Support Center (DASC) and from the USGS's on-line ftp sites at 1:100,000 scale. Unfortunately, the coarse scale and large contour interval did not provide adequate detail for delineating drainage basins into the managed wetlands. However, they do provide other useful geomorphic information such as the location of internally-drained sand dune areas and the locations of the flat area surrounding the Refuge. (See Appendix A.)

### **Surface Hydrology from DLGs**

Surface hydrology maps in DLG format were also available from DASC and the USGS's on-line ftp sites at 1:100,000 scale, as were roads and other transportation features. These were also imported into the WHEAT database.

The locations of streams and other hydrologic features shown on the USGS hydrology DLGs generally compare favorably with (are a strict subset of) the USFWS NWI wetlands. However, the USGS surface hydrology did not show all the stream and canal locations needed for detailed modeling of the Refuge; the NWI wetlands did, so the wetland data are being used for both the pond and canal locations.

The road data (see Appendix A), which were originally included largely for completeness and because it was free, turns out to be useful in delineating the drainage basins, because many of the roads will be boundaries to surface water flow.

### **Miscellaneous Map Data**

In addition to the above datasets, a variety of other datasets were brought into the WHEAT database for this study. These datasets include Public Land Survey sections in the neighborhood of the Refuge, counties, a state of Kansas outline, and an approximate outline of the Quivira National Wildlife Refuge.

### **Delineation of QNWR Managed Wetlands**

Once the wetlands had been imported into WHEAT as described above, the managed wetlands at the Refuge were interactively selected by comparing the QNWR brochure map to an electronic map showing the National Wetland Inventory wetlands and other orientation map layers, selecting individual wetland areas, and assigning names (unit numbers) to the wetland regions. These maps were then sent to QNWR personnel for comment and modification by adding or deleting wetland regions. In the present form, 214 National-Wetland-Inventory wetlands make up the 34 or so managed wetlands at the Refuge. Example maps of these wetlands are shown in Appendix A; Figure 3 shows a schematic diagram of the QNWR Wetlands.

### **Delineation of Drainage Basins into Managed Ponds**

Drainage basins were delineated using a combination of automated delineation based on Voronoi polygons and manual modification based on a series of overlays of wetland/hydrology, topographic, road, and soil information. A more complete explanation

can be found in the KGS progress report to USFWS for Federal Fiscal Year 1996. The mapped drainage basins probably over-estimate the areas that drain into the managed ponds: it is the author's opinion that much of the area does not contribute surface runoff at all.

#### DISCLAIMER

**This database may and probably does contain errors. USE AT YOUR OWN RISK. The Kansas Geological Survey, University of Kansas, DOES NOT PROVIDE FREE TECHNICAL SUPPORT for using this database.**

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The information in this database was retrieved from a various sources including US Geological Survey Digital Line Graphs, US Fish and Wildlife Service's DLGs, US Natural Resource Conservation Service data files, internal KGS databases, and the author's interpretation. The data was then processed at the Kansas Geological Survey, University of Kansas. The source agencies did not, do not, and will not guarantee the accuracy and completeness of this data. The Kansas Geological Survey, University of Kansas, does not and will not guarantee the accuracy of this data. This product is based on provisional data made available solely for the convenience of interested researchers with the understanding that it is provisional, unchecked and that the user will not hold the KGS or any other agency liable in any way for the accuracy or completeness of this data.

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Magnifying a 1:100,000 map to 1:10,000 increases its size, not its data content or accuracy.

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