Kansas Geological Survey

GEOGRAPHIC INFORMATION SYSTEM TOOLS FOR ASSESSING POTENTIAL IMPACTS OF PESTICIDE USE ON GROUNDWATER QUALITY IN KANSAS

By

D.P. Young, R.O. Sleezer, G. Misgna, D. Li, and D.O Whittemore

A Report to the Kansas Department of Agriculture

GEOHYDROLOGY

The University of Kansas, Lawrence, KS 66047 Tel.(785) 864-3965

KANSAS GEOLOGICAL SURVEY
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Abstract

The Kansas Department of Agriculture (KDA) contracted with the Kansas Geological Survey (KGS) to develop a collection of spatial data and geographic information system (GIS) project files to be used in assessing the potential impacts of pesticide use on groundwater quality in Kansas. It was determined that the most important factors to be considered when making these assessments are physical properties of the soils that describe its potential for pesticide transport as well as an estimate of the depth to groundwater. KGS subcontracted with Emporia State University to provide soils and other GIS information. The result is a suite of GIS products tiled by county and covering the entire state of Kansas. GIS layers include detailed soils information, depth to water estimates, surface water features, alluvial aquifer boundaries, and base map features such as roads, railroads, cities, townships and sections.

Introduction

During the fall of 2000 discussions were initiated between personnel at the Kansas Department of Agriculture (KDA) and the Kansas Geological Survey (KGS) about the feasibility of using geographic information systems (GIS) in a decision support capacity for managing agricultural pesticide use. The basic question was — Would it be possible to develop a simple measure of the potential for groundwater pollution from agricultural pesticides for the State of Kansas utilizing existing or easily creatable GIS datasets? Of particular interest was the availability of accurate information about soil properties affecting the leaching potential for pesticides and the distance from the soil surface to the top of aquifers throughout the State. A number of possibilities were discussed during a December 2000 meeting and a prototype GIS package that utilized ArcView software (Environmental Systems Research Institute, ESRI) and ARC/INFO coverages was demonstrated by KGS and Emporia State University staff in February of 2001. The system demonstrated used depth to water information derived from three databases: 1) KDA's Water Information Management and Storage (WIMAS) system, 2) KGS' Water Information Storage and Retrieval Database (WIZARD), 3) KGS' Water Well Completion Records (WWC-5) database. Supplementary shallow (< 60") water table depth information for areas without water well data was also obtained from the National Resource Conservation Service's digital soil survey databases (SSURGO and 1:24k detailed). Soil properties potentially affecting pesticide leaching were portrayed using the Soils Lite database (Apolzer et al., 2001) and available SSURGO and 1:24k detailed soil coverages. The Soils Lite database is a simplified and streamlined version of the existing SSURGO database tables. The specific soil properties from the Soils Lite database that were considered were soil texture, clay content, organic matter content, and permeability.

At the time of the demonstration mentioned above, it was decided that the final product would include the three sources of water table depth information plus the water table depth and water table kind (apparent versus perched) data from the Soils Lite database plus two soil properties, surface horizon soil texture (Table 1) and the permeability of the most limiting soil horizon

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(Perm_min). Additional GIS data layers were also added for reference and spatial context. These additional data layers included the highways, major roads, railroads, city boundaries, county boundaries, township boundaries, section boundaries, surface water features, and the extent of alluvial aquifers. To facilitate more rapid completion of the project and to minimize the size of the individual data layers, the final products are tiled by county. Details about the individual data layers, and the ArcView project files (*.apr) are included in the following documentation.

Products

Products include an ArcView project (*.apr) file for every county in Kansas, with two exceptions. NRCS combines the soil surveys for Linn and Miami counties and for Leavenworth and Wyandotte counties into single datasets, so they were combined similarly for this project. In other words, the project files and GIS layers are "tiled" by county (except for the two pairs mentioned above), resulting in 103 project files with associated GIS layers. This scheme is the same as that of the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) for certified soil survey geographic (SSURGO) coverages, which are among the key GIS layers included for each tile. These data are currently being updated by NRCS through a certification process, therefore requiring periodic updates from NRCS or from the Kansas Data Access and Support Center (DASC). By employing the same tiling scheme, these maintenance updates should be much easier to incorporate by the Kansas Department of Agriculture. Each project file also includes a means of determining the minimum depth to water in underlying aquifers where data are available. In areas with no depth to water data, the soils data may be used to determine if groundwater is present within the soil profile (within 60" of the soil surface). Each project file contains base map layers suitable for determining locations within each county.

The products (electronic files) are being provided on CD-ROM. These products for each tile (or county) include an ArcView project (*.apr) file referencing the following GIS layers:

- Highways, major roads, and railroads
- Cities
- Public Land Survey System boundaries (county, township, section)
- Surface water features
- Extent of alluvial aquifers
- NRCS SSURGO and 1:24,000 scale detailed soils coverage, attributed from "Soils Lite" data tables
  NRCS and Soils Lite data are used for several themes, including:
  water table kind
  water table depth
  minimum permeability rate
  surface texture
- Minimum depth to water estimates for individual wells, or depth to water where no minimum value can be determined for individual wells
  Depth to water data are provided in a set of three point coverages for each tile. Those coverages contain points for all groundwater wells with depth to water data from:

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KDA's Water Information Management and Storage (WIMAS) database
KGS' Water Information Storage and Retrieval Database (WIZARD)
KGS' Water Well Completion Record (WWC-5) database

See Appendix A for projection details.

Representatives from the Kansas Geological Survey and Emporia State University met with the Kansas Department of Agriculture for an on-site training session on June 14, 2001. This report provides documentation describing data sources and procedures used, and suggested methods for updating soils coverages from NRCS or DASC.

Description of GIS Layers

Most of the GIS layers and/or the data used to produce the GIS layers were downloaded from the Data Access and Support Center (DASC) and Kansas Geological Survey (KGS) web sites, at *http://gisdasc.kgs.ukans.edu/* and *http://www.kgs.ukans.edu/* , respectively. Many of the original data layers were tiled by state, and were clipped by county for this project.

The soils information was available in two forms from NRCS. SSURGO coverages are digital versions of county level soil surveys that have been extensively checked by NRCS to ensure that they meet their accuracy standards. Unfortunately only about 70 of the 103 soil survey areas within the State of Kansas were SSURGO certified at the time of this project. Each of these coverages is tiled by county or multi-county area in the two cases mentioned earlier. These coverages were downloaded via the internet directly from an NRCS web site. The remaining 33 counties were available only in an uncertified form referred to as 1:24k detailed soil coverages. These are preliminary digital versions of county level soil surveys that have not been certified by NRCS as meeting their standards for accuracy. These soil coverages were available from the Data Access and Support Center at the Kansas Geological Survey. The 1:24k detailed soils coverages are tiled by USGS topographic quadrangle. It was necessary, therefore, to merge a number of tiles together and then clip them to the particular counties of interest. The 1:24k detailed soils coverages are reasonably accurate but they do include some errors. Database errors that could be easily fixed were repaired. The database information (attributes) used for both types of coverages were the Soils Lite tables developed by Apolzer et al. (2001). The 33 counties that are not SSURGO certified at present may be updated by downloading the necessary SSURGO coverages (from NRCS) and Soils Lite tables (from DASC) when they become available.

This section includes a brief description of each layer, if necessary.

Metadata, where available, are included in this smaller font. Metadata files for most of the databases were downloaded from the DASC web site.

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Highways, Major Roads, Railroads, and Cities

GIS layers for highways, major roads, railroads, and cities were obtained from U.S. Bureau of Census 1992 Tiger Line Files downloaded from the DASC web site. These files were already tiled by county but it was necessary to project them from geographic coordinates to the Lambert Conformal Conic projection used in this project (see Appendix A for projection details).

```
Metadata:

Identification_Information:
  Citation:
    Citation_Information:
      Originator: Data Access and Support Center (DASC)
      Publication_Date: 19940401
      Title: TIGER
      Online_Linkage: http://gisdasc.kgs.ukans.edu
  Description:
    Abstract: As suggested by the GIS Technical Advisory Committees DASC
subcommittee, the DASC staff has imported and converted the U.S. Bureau of
Census 1992 Tiger Line Files into ESRI's Arc/Info software.  The purpose of
this conversion was to derive a subset of coverages from the Tiger Files that
would be of wide use by DASC clientele.  These coverages reflect only a
portion of the possible themes that could be created from Tiger and serve as
a common ground for all to work from and should be customized for each of the
users individual needs.  None of the coverages have been edited from the
original Tiger line files. DASC Tiger coverages are provided "as-is," please
submit any corrections or errors to DASC so the dataset can be corrected.
    Purpose: Fourteen themes were extracted and built in Arc/Info from the
1992 US Census Tiger line files for general reference use.
  Time_Period_of_Content:
    Time_Period_Information:
      Single_Date/Time:
        Calendar_Date: 19940401
    Currentness_Reference: publication date
  Status:
    Progress: Complete
    Maintenance_and_Update_Frequency: None planned
  Spatial_Domain:
    Bounding_Coordinates:
      West_Bounding_Coordinate: -102.5
      East_Bounding_Coordinate: -94.6
      North_Bounding_Coordinate: 40.0
      South_Bounding_Coordinate: 37.0
  Keywords:
    Theme:
      Theme_Keyword_Thesaurus: None
      Theme_Keyword: TIGER, Address matching, Census, Tracts, Blocks, Streets
  Access_Constraints: None
  Use_Constraints: None
  Point_of_Contact:
    Contact_Information:
      Contact_Organization_Primary:
        Contact_Organization: Data Access and Support Center (DASC)
      Contact_Address:
        Address_Type: mailing and physical address
```

```
      Address:
        University of Kansas
        1930 Constant Avenue, West Campus
      City: Lawrence
      State_or_Province: KS
      Postal_Code: 66047-3726
      Country: USA
    Contact_Voice_Telephone: 785-864-3965
    Contact_Facsimile_Telephone: 785-864-5317
    Contact_Electronic_Mail_Address: dasc@kgs.ukans.edu
  Browse_Graphic:
    Browse_Graphic_File_Name: tiger
    Browse_Graphic_File_Description: Various Layers for Jackson County
    Browse_Graphic_File_Type: GIF
  Native_Data_Set_Environment: Arc/Info
Data_Quality_Information:
  Logical_Consistency_Report:
    Datasets delivered to the Data Access and Support Center are quality
assurance tested for major documentation and topological errors using macros.
The databases are evaluated based on questions similar to the following:

    Does the database's documentation properly explain the dataset?
    Does the data import properly into its native dataset environment?
    Is consistent methodology used throughout the data?
    Are all of the database's fields and values legitimate compared to the
documentation?
    Is the database's topology free of errors that could impair the
functionality of the data?

    Once the data is tested a report is written describing the evaluation.  A
copy of the report is then forwarded to the data originator for his/her
review.  If errors are found, the data originator is expected to make any
necessary corrections and then provide those corrected coverages.  After
these steps have been taken data is considered archivable and made available
for distribution.  Data that is archived by DASC has been tested and
corrected.
  Completeness_Report:
  Lineage:
    Source_Information:
      Source_Citation:
        Citation_Information:
          Originator: U.S. Census Bureau
          Publication_Date: 1992
          Title: 1992 U.S. Census Tiger line files
      Source_Scale_Denominator: 24000/100000
      Type_of_Source_Media: CD-ROM
      Source_Time_Period_of_Content:
        Time_Period_Information:
          Single_Date/Time:
            Calendar_Date: 1992
        Source_Currentness_Reference: publication date
      Source_Citation_Abbreviation: CENSUS
      Source_Contribution: spatial and attribute information
    Process_Step:
      Process_Description:
      Process_Date:
Spatial_Data_Organization_Information:
```

```
  Direct_Spatial_Reference_Method: Vector
Spatial_Reference_Information:
  Horizontal_Coordinate_System_Definition:
    Geographic:
      Latitude_Resolution:
      Longitude_Resolution:
      Geographic_Coordinate_Units: Decimal degrees
Entity_and_Attribute_Information:
  Overview_Description:
    Entity_and_Attribute_Overview:
        Many of the coverages have attributes attached to the point, arc, or
polygon tables.  These attributes are drawn from either the Tiger line file
tables or from the Census Population and Housing tables (STF1A table 0).  In
addition to the attached demographics the remaining STF1A tables (1-9) can be
limited through relates.  These tables can be provided upon request.  Further
documentation is available on the field names and definitions of these
tables.  These attributes can be utilized for street address matching or
statistical analysis of area demographics.  The following attribute names and
descriptions are included in the DASC Tiger coverages:

        xx_tig1*    Tiger line and polygon coverage of the entire county
dataset
        xx_tig2     Tiger polygon label points
        xx_tig3     Tiger landmarks points
        xx_tigai    Native American Reservation boundaries
        xx_tigbg    Census block group boundaries
        xx_tigbk    Census block boundaries
        xx_tigcn    County boundaries
        xx_tigcy    Incorporated areas
        xx_tighy    Hydrologic features
        xx_tiglm    Landmarks
        xx_tigmt    Miscellaneous transportation features
        xx_tigrd    Roadways
        xx_tigrr    Railroads
        xx_tigsd    Unified school districts
        xx_tigtk    Census tract boundaries
        xx_tigtp    Political townships
        xx_tigvd    Voting districts
    Entity_and_Attribute_Detail_Citation:
      U.S. Census Bureau, 1992 U.S. Census Tiger line files, Washington, D.C.

        U.S. Census Bureau, 1990 Census of Population and Housing, Summary Tape
File 1A, Washington, D.C.
Distribution_Information:
  Distributor:
    Contact_Information:
      Contact_Organization_Primary:
        Contact_Organization: Data Access and Support Center
      Contact_Address:
        Address_Type: mailing and physical address
        Address:
          University of Kansas
          1930 Constant Avenue, West Campus
        City: Lawrence
        State_or_Province: KS
        Postal_Code: 66047-3726
        Country: USA
```

Contact_Voice_Telephone: 785-864-3965
            Contact_Facsimile_Telephone: 785-864-5317
            Contact_Electronic_Mail_Address: dasc@kgs.ukans.edu
            Hours_of_Service: 0800-1700
    Distribution_Liability:
        The State of Kansas Geographic Information Systems Core Database's
digital data have been tested and their documentation carefully reviewed.
However, the State of Kansas Geographic Information Systems Policy Board's
Data Access and Support Center and its representatives make no warranty or
representation, either expressed or implied, with respect to the digital data
and their documentation, their quality, performance, merchantability, or
fitness for a particular purpose. The digital data are distributed on "as
is" basis, and the user assumes all risk to their quality, the results
obtained from their use, and the performance of the data.

        In no event will the State of Kansas Geographic Information Systems
Policy Board or its representatives be liable for any direct, indirect,
special, incidental or consequential damages resulting from and defect in the
State of Kansas Geographic Information Systems Core Database's digital data
or in their documentation.

        This disclaimer of warranty is exclusive and in lieu of all others, oral
or written, express or implied. No agent or employee is authorized to make
any modification, extension, or addition to this warranty.
    Standard_Order_Process:
      Digital_Form:
        Digital_Transfer_Information:
          Format_Name: ARCE
          Transfer_Size: 5 MB
        Digital_Transfer_Option:
          Online_Option:
            Computer_Contact_Information:
              Network_Address:
                Network_Resource_Name: http://gisdasc.kgs.ukans.edu
            Access_Instructions: The State of Kansas TIGER databases are stored
in ESRI's Arc/Info Interchange Format and can be downloaded from the DASC
home page (http:// gisdasc.kgs.ukans.edu) or by connecting directly to the
DASC anonymous FTP server at gisdasc.kgs.ukans.edu. To connect to the FTP
server use the login name of anonymous and your email address as the
password.
          Offline_Option:
            Offline_Media: CD-ROM, Iomega ZIP Disk, 3.5 inch floppy disk, 4 mm
cartridge tape, or 8 mm cartridge tape
            Recording_Format: ISO 9660
      Fees:
        Under the Kansas Public Records Law, DASC will attempt only to recover
the costs related to the processing and distribution of core database
requests. The following is a description of our Basic and Supplemental
Conversion Services, as well as costs associated with the distribution of
digital data:

        Basic Conversion Services-DASC will provide coversion services to all
Federal/State/municipal tax-support agencies/entities for the cost of media
and shipping and handling. Basic conversion services shall include the
exportation of the Core Database in their native projection and tiling scheme
into DASC supported spatial data exchange formats and technical support for
the loading and importation of the data. Basic conversion services are

                                        7

provided to other than tax-supported organizations on a fee-for-service basis.

Supplemental Conversion Services-DASC will provide supplemental conversion services to all organizations on a fee-for-service basis. Secondary services shall include the alteration of a Core Database's native projection, tiling scheme, or topological structure. Supplemental services also includes custom map production.

Where applicable, recoverable cost include:
1. Labor to process the request
2. Computer processing time to extract/convert database
3. Magnetic media to distribute the data
4. Shipping and handling charges
5. Tax

Below are the fees associated with each of the recoverable items:
1. Labor: $35.00/Hour
2. Central Processing Unit (CPU) computer time: $.14/Minute
3. Media:
3.5" HD floppy $.90
DC 2120 Mini data cartridge tape $22.00
8mm-112m Data cartridge tape $19.00
4mm-120m Data cartridge tape $20.00
Compact Disks $15.00
Network Transfer   No Charge
4. Shipping and Handling: Varies
5. Tax (State of Kansas):   6.90%
Metadata_Reference_Information:
  Metadata_Date: 19970321
  Metadata_Contact:
    Contact_Information:
      Contact_Organization_Primary:
        Contact_Organization: Data Access and Support Center
      Contact_Address:
        Address_Type: mailing and physical address
        Address:
          University of Kansas
          1930 Constant Avenue, West Campus
        City: Lawrence
        State_or_Province: KS
        Postal_Code: 66047-3726
        Country: USA
      Contact_Voice_Telephone: 785-864-3965
      Contact_Facsimile_Telephone: 785-864-5317
      Contact_Electronic_Mail_Address: dasc@kgs.ukans.edu
      Hours_of_Service: 0800-1700
  Metadata_Standard_Name: FGDC Content Standards for Digital Geospatial Metadata
  Metadata_Standard_Version: 1.0

Public Land Survey System (PLSS) Boundaries (County, Township, Section)

Public Land Survey System boundaries were downloaded from the DASC web site. These coverages were statewide in nature and it was necessary to clip them to the project boundaries (county or multi-county areas) as needed. These coverages were originally in universal transverse mercator (UTM) coordinates so it was also necessary to project them to the appropriate map projection (Appendix A).

Metadata:

```
    * Identification_Information
    * Data_Quality_Information
    * Spatial_Data_Organization_Information
    * Spatial_Reference_Information
    * Entity_and_Attribute_Information
    * Distribution_Information
    * Metadata_Reference_Information
```

```
------------------------------------------------------------------------

Identification_Information:
    Citation:
        Citation_Information:
            Originator: Kansas Geological Survey
            Publication_Date: 19970827
            Title: U.S. Public Land Survey System (PLSS) Databases of
            Kansas Counties
            Online_Linkage: http://gisdasc.kgs.ukans.edu
    Description:
        Abstract:
            The Kansas County Databases of the U.S. Public Land Survey
            System (PLSS) provide, for each of the 105 counties in
            Kansas, high quality digital representations of basic Kansas
            land divisions first established by the PLSS, primarily
            between the years of 1854 and 1877. They are derived from
            data contained in PLSS databases of the USGS 24K Digital
            Line Graph (DLG) series and data from the Kansas
            Cartographic Database (KCD) developed by the Kansas
            Geological Survey. All of the data is derived from USGS 7.5
            minute quadrangles. Only minimal edge matching was performed
            between DLG databases. Features represented in the county
            databases include the basic point, line and area features
            established in the original Public Land Surveys of Kansas.
            These features are listed below as theme keywords. Currently
            lacking from this collection is a complete representation of
            Indian land boundaries surveyed in Kansas as part of the
            original PLSS while those Indian lands were still excluded
            from the public lands. The data from the KCD was captured
            using in-house software, GIMMAP (Geodata Interactive
            Management, Mapping and Production). Using Arc Macro
            Language (AML) files, DLG's for individual quadrangles
            covering each county were imported into Arc/Info using the
            'dlgarc' command. The individual DLG's were then merged and
            cleaned to form the county databases. This procedure was
            only possible after the original USGS DLG's were reformatted
```

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to establish uniform numbers and sequences of attributes for
all nodes, areas, and lines in the original USGS DLG's.
    Purpose:
        The Kansas County Databases of the U.S. Public Land Survey
        System were designed for use as part of the core database
        collection of the Kansas Geographic Information Systems
        Policy Board. A primary objective in the development of
        these databases was the development of consistent and
        conveniently formatted databases from which users could be
        easily select desired base map information.
Time_Period_of_Content:
    Time_Period_Information:
        Single_Date/Time:
            Calendar_Date: Refer to specific quad.
    Currentness_Reference: Refer to specific quad.
Status:
    Progress:
        USGS DLG's of the PLSS have been completely reformatted and
        merged into county databases, with some modifications and
        corrections of coding. Where not represented by lines in the
        Public Land Survey, county line information has been added
        from the KCD. Addition of Indian land boundaries surveyed in
        Kansas as part of the PLSS is recommended. No schedule is
        established for this work.
    Maintenance_and_Update_Frequency:
        Analysis of data comparisons between the USGS DLG's and the
        Kansas cartographic Database are proceeding. Information on
        probable errors in the DLG's will be reported to the USGS
        Mid-Continent Mapping Center as they are identified.
        Refinements of the data, such as edge matching of section
        lines at quad edges and removal of extraneous nodes and
        interior points on section lines has not been planned, but
        is recommended.
Spatial_Domain:
    Bounding_Coordinates:
        West_Bounding_Coordinate: -102.051
        East_Bounding_Coordinate: -94.589
        North_Bounding_Coordinate: 40.003
        South_Bounding_Coordinate: 36.993
Keywords:
    Theme:
        Theme_Keyword_Thesaurus: None
        Theme_Keyword: Kansas Cartographic Database
        Theme_Keyword: County boundaries
        Theme_Keyword: State boundary
        Theme_Keyword: Public Land Survey System
        Theme_Keyword: Township
        Theme_Keyword: Range
        Theme_Keyword: Section
        Theme_Keyword: Land Grant
        Theme_Keyword: Military Reserve
        Theme_Keyword: Excluded water areas
        Theme_Keyword: Unsurveyed areas
        Theme_Keyword: Principal Meridian
        Theme_Keyword: Base Line
        Theme_Keyword: Township lines
        Theme_Keyword: Range lines

```
                    Theme_Keyword: Section lines
                    Theme_Keyword: Grant lines
                    Theme_Keyword: Correction line offsets
                    Theme_Keyword: Section corners
                    Theme_Keyword: Closing corners
                    Theme_Keyword: Quarter corners
                    Theme_Keyword: Land grant corners
                    Theme_Keyword: Witness corner
          Access_Constraints: None
          Use_Constraints: None
          Point_of_Contact:
                Contact_Information:
                    Contact_Organization_Primary:
                        Contact_Organization: Kansas Geological Survey
                        Contact_Person: Gina Ross
                    Contact_Address:
                        Address_Type: mailing and physical address
                        Address:
                            University of Kansas 1930 Constant Avenue, West
                            Campus
                        City: Lawrence
                        State_or_Province: KS
                        Postal_Code: 66047-3726
                        Country: USA
                    Contact_Voice_Telephone: 785-864-3965
                    Contact_Facsimile_Telephone: 785-864-5317
                    Contact_Electronic_Mail_Address: gina_ross@kgs.ukans.edu
          Browse_Graphic:
                Browse_Graphic_File_Name: pnplss.gif
                Browse_Graphic_File_Description: Section boundaries in Pawnee Co.
                Browse_Graphic_File_Type: GIF
          Native_Data_Set_Environment: Arc/Info


----------------------------------------------------------------------


Data_Quality_Information:
      Attribute_Accuracy:
            Attribute_Accuracy_Report:
                  Direct comparison of more than 43,000 sample entities to
                  independently derived (USGS) database for the same entities.
                  This process identified numerous coding errors in the USGS
                  DLG's which were corrected in the county databases.
            Quantitative_Attribute_Accuracy_Assessment:
                  Attribute_Accuracy_Value: 99.95%
                  Attribute_Accuracy_Explanation:
      Logical_Consistency_Report:
            Datasets delivered to the Data Access and Support Center are
            subsequently quality assurance tested for major documentation and
            topological errors using macros. The databases are evaluated
            based on questions similar to the following: Does the database's
            documentation properly explain the dataset? Does the data import
            properly into its native dataset environment? Is consistent
            methodology used throughout the data? Are all of the database's
            fields and values legitimate compared to the documentation? Is
            the database's topology free of errors that could impair the
            functionality of the data? Once the data is tested a report is
            written describing the evaluation. A copy of the report is then
```

forwarded to the data originator for his/her review. If errors
are found, the data originator is expected to make any necessary
corrections and then provide those corrected coverages. After
these steps have been taken data is considered archivable and
made available for distribution. Data that is archived by DASC
has been tested and corrected.
Completeness_Report:
Positional_Accuracy:
    Horizontal_Positional_Accuracy:
        Horizontal_Positional_Accuracy_Report:
        Quantitative_Horizontal_Positional_Accuracy_Assessment:
            Horizontal_Positional_Accuracy_Value:
                Very good/Mean deviation in mapped location from
                locations derived independently by USGS using
                stable base maps at 1:24,000 is .006 map inches or
                12 ground feet (based on 8,000 sample points).
            Horizontal_Positional_Accuracy_Explanation:
                Direct comparison to USGS database. Comparison to
                the graphic source is used as control to access
                digital location accuracy. Taken as a group,
                significantly lower quality was identified among
                early DLG's developed by the USGS in SE Kansas for
                coal resource studies, in NE Kansas along the
                Missouri River, and those DLG's covering Gray
                County developed as a pilot database development
                project.
Lineage:
    Source_Information:
        Source_Citation:
            Citation_Information:
                Originator: US Geological Survey
                Publication_Date: Refer to specific quad
                Title: USGS 7.5 minute quadrangles
        Source_Scale_Denominator: 24,000
        Type_of_Source_Media:
            Mylar for all DLG's except for use of paper source
            documents for quads 0101-0112 and 0121-0156 along the
            Oklahoma state line; 0661-1761 along the Missouri state
            line and 2601-2653 along the Nebraska state line.
        Source_Time_Period_of_Content:
            Time_Period_Information:
                Single_Date/Time:
                    Calendar_Date: Refer to specific quad
            Source_Currentness_Reference: Publication date
        Source_Citation_Abbreviation: USGS
        Source_Contribution: Spatial information
    Process_Step:
        Process_Description:
        Process_Date:

Spatial_Data_Organization_Information:
    Direct_Spatial_Reference_Method: Vector

```
Spatial_Reference_Information:
      Horizontal_Coordinate_System_Definition:
            Planar:
                  Grid_Coordinate_System:
                        Grid_Coordinate_System_Name: Universal Transverse
                        Mercator
                        Universal_Transverse_Mercator:
                              UTM_Zone_Number: 14 and 15
                              Transverse_Mercator:
                                    Scale_Factor_at_Central_Meridian: 0.9996
                                    Longitude_of_Central_Meridian: depends on
                                    zone
                                    Latitude_of_Projection_Origin: 0.0
                                    False_Easting: 500000
                                    False_Northing:0.0
                  Planar_Coordinate_Information:
                        Planar_Coordinate_Encoding_Method: coordinate pair
                        Coordinate_Representation:
                              Abscissa_Resolution: 0.61
                              Ordinate_Resolution: 0.61
                        Planar_Distance_Units: meters
            Geodetic_Model:
                  Horizontal_Datum_Name:
                        North American Datum 1927 -- DLG's for quadrangles
                        1942-1945 (Milford, Ft. Riley NE, Keats and Manhattan)
                        have been produced by the USGS with UTM coordinates
                        based on North American Datum 1983, the datum on which
                        new versions of these quadrangles are mapped. For the
                        Kansas County Databases these DLG's were converted by
                        the Kansas Geological Survey to coordinates based on
                        NAD27.
                  Ellipsoid_Name: Clarke 1866
                  Semi-major_Axis: 6378206.4
                  Denominator_of_Flattening_Ratio: 294.98
```

```
Entity_and_Attribute_Information:
      Overview_Description:
            Entity_and_Attribute_Overview:

                  The following attributes are used in the Kansas County
                  Databases with the same meaning as they have in the USGS
                  DLG's:

                  Nodes:
                  Major/Minor    Meaning
                  300/1          Section corner
                                 Closing corner -- a section corner on a
                                 surveyed line coming from the south or east
                  300/3          which has no corresponding section line
                                 extending to the north or west due to
                                 corrections or offsets in the PLSS.
                                 Witness corner -- displaced from section
                                 corner location when geographic factors
                  300/7          present the impossibility of maintaining the
                                 latter (the only case of this kind in the
```

	Kansas County Databases is found in Meade County).
300/12	Quarter corner
300/14	Land grant corner
300/15	Arbitrary section corner
300/42	Corner with elevation value

Areas:

Major/Minor	Meaning
306/6	Survey from the 6th Principal Meridian -- this code is attached to all areas with boundaries established or resurveyed as part of the PLSS in Kansas, including excluded areas and private extensions of the Public Land Survey into areas previously excluded as Indian lands.
306/5	Survey from the 5th Principal Meridian -- this code appears in areas along the Missouri River in northeast Kansas which were originally included in the public lands based on surveys from the 5th principal Meridian in Missouri but which subsequently became part of Kansas due to shifts in the path of the Missouri River which were incorperated in the boundary between Missouri and the new state of Kansas. The sole remaining exception in the present version of the Kansas County Databases is the land grant in the Baxter Springs, KS and Peoria, OK-KS quadrangle (0260 and 0160) which is coded by the USGS in the DLG for quad 0260 as 306/5 indicating that the land grant was surveyed as part of the Public Land Survey from the 5th Principal Meridian. The historical accuracy of this coding has not been checked and has therefore been maintained as represented in the USGS DLG.
302/yy	Township 'yy' North (from Missouri survey)
303/yy	Township 'yy' South
304/xx	Range 'xx' East
305/xx	Range 'xx' West
301/zz	Section 'zz'
300/100	Indian lands
300/103	Land Grant
300/104	Private extension of Public Land Survey -- any survey not accepted by the Bureau of Land Management, including Bureau of Indian Affairs surveys on Indian lands. These ares are inconsistently identified in the USGS DLG's, but those identifications are maintained in the Kansas County Databases.
300/107	Military reserve (excluded area)
300/198	Water (excluded area)
300/199	Unsurveyed area (excluded area)

Lines:

Major/Minor	Meaning
300/201	Approximate position
300/202	Protracted position
	Arbitrary closure line -- use of arbitrary

	closures is inconsistent throughout the USGS DLG's. No attempt has been made to remove this inconsistency in the Kansas County Databases.
300/203	In certain areas along the Kansas and Smoky Hill Rivers, where arbitrary closures in the DLG's clearly misrepresent the original Public Land Survey, the placements of arbitrary closures have been changed.
300/204	Base line (also a township line)
300/205	Grant line

General:

Major/Minor	Meaning
308/0	Best estimate of classification and/or position

The following attributes not included in the USGS DLG's have been added to county coverages:

Lines:

Major/Minor	Meaning
300/206	Principle Meridian (also a range line)
300/207	Township line
300/208	Range line
300/209	PLSS boundary with excluded area (e.g., Indian lands)
300/217	Survey correction line (range line shift along township line)
300/218	Survey correction line (township line shift along range line)
300/294	Boundary with 'private extension' of PLSS. (Coded as 300/209 in DLG's)
300/299	Quadrangle edge (indicates edge matching problem in DLG's
300/4320	County line taken from Kansas Cartographic Database
300/4310	State line taken from Kansas Cartographic Database

The following attributes included in the USGS DLG's have been dropped in the reformatted county databases:

Nodes:

Major/Minor	Meaning
	Poorly defined in DLG standards, this code is used for nodes created at points on section lines other than section corners. On some
300/2	DLG's it is sometimes used to indicate the termination of section lines at a quad edge. It was dropped because of its inconsistent

```
                                use.
                                Corner located in the field. This information
                                is typically long out of date and may
            300/40               frequently refer to corners which would
                                require relocation by county surveyors for
                                any practical (or legal) application.
                                Node coincident with feature from other DLG
                                layer. The USGS has dropped the
                                identification of coincident features in the
                                DLG's. These codes are found only in the
            309/xx               original DLG's developed in SE Kansas for
                                coal resource studies, DLG's in NE Kansas
                                developed along the Missouri River, and DLG's
                                covering Gray County developed as a pilot
                                database development project.
            Lines:
            Major/Minor    Meaning

            309/xx         Line coincident with feature from other DLG
                           layer. See above.


    Entity_and_Attribute_Detail_Citation:

------------------------------------------------------------------------


Distribution_Information:
    Distributor:
        Contact_Information:
            Contact_Organization_Primary:
                Contact_Organization: Data Access and Support Center
            Contact_Address:
                Address_Type: mailing and physical address
                Address:
                    University of Kansas 1930 Constant Avenue, West
                    Campus
                City: Lawrence
                State_or_Province: KS
                Postal_Code: 66047-3726
                Country: USA
            Contact_Voice_Telephone: 785-864-3965
            Contact_Facsimile_Telephone: 785-864-5317
            Contact_Electronic_Mail_Address: dasc@kgs.ukans.edu
            Hours_of_Service: 0800-1700
    Distribution_Liability:

        In no event will the State of Kansas Geographic Information
        Systems Policy Board or its representatives be liable for any
        direct, indirect, special, incidental or consequential damages
        resulting from and defect in the State of Kansas Geographic
        Information Systems Core Database's digital data or in their
        documentation.

        This disclaimer of warranty is exclusive and in lieu of all
        others, oral or written, express or implied. No agent or employee
        is authorized to make any modification, extension, or addition to
        this warranty.
    Standard_Order_Process:
```

```
Digital_Form:
        Digital_Transfer_Information:
                Format_Name: ARCE
                Transfer_Size: 600 Kb
        Digital_Transfer_Option:
                Online_Option:
                        Computer_Contact_Information:
                                Network_Address:
                                        Network_Resource_Name:
                                        http://gisdasc.kgs.ukans.edu
                        Access_Instructions: The State of Kansas KCD
                        databases are stored in ESRI's Arc/Info
                        Interchange Format and can be downloaded from the
                        DASC home page or by connecting directly to the
                        DASC anonymous FTP server at
                        gisdasc.kgs.ukans.edu. To connect to the FTP
                        server use the login name of anonymous and your
                        E-mail address as the password.
                Offline_Option:
                        Offline_Media: CD-ROM, Iomega ZIP Disk, 3.5 inch
floppy disk, 4 mm
                        cartridge tape, or 8 mm cartridge tape
                        Recording_Format: ISO 9660
        Fees:

                Basic Conversion Services-DASC will provide coversion
                services to all Federal/State/municipal tax-support
                agencies/entities for the cost of media and shipping and
                handling. Basic conversion services shall include the
                exportation of the Core Database in their native projection
                and tiling scheme into DASC supported spatial data exchange
                formats and technical support for the loading and
                importation of the data. Basic conversion services are
                provided to other than tax-supported organizations on a
                fee-for-service basis.

                Supplemental Conversion Services-DASC will provide
                supplemental conversion services to all organizations on a
                fee-for-service basis. Secondary services shall include the
                alteration of a Core Database's native projection, tiling
                scheme, or topological structure. Supplemental services also
                includes custom map production.

                Where applicable, recoverable cost include:
                1. Labor to process the request.
                2. Computer processing time to extract/convert database.
                3. Magnetic media to distribute the data.
                4. Shipping and handling charges
                5. Tax

                Below are the fees associated with each of the recoverable
                items:

                1. Labor:                    $35.00/Hour
                2. Central Processing
                Unit (CPU) time:             $.14/Minute
                3. Media:                    3.5" HD floppy        $.90
```

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```
                                 DC 2120 Mini data
                                 cartridge tape          $22.00
                                 8mm-112m Data cartridge
                                 tape                    $19.00
                                 4mm-120m Data cartridge
                                 tape                    $20.00
                                 Compact Disks           $15.00
                                 Network Transfer        No Charge
           4. Shipping and
           Handling:            Varies
           5. Tax (State of
           Kansas):             6.90%
```

```
Metadata_Reference_Information:
     Metadata_Date: 19970827
     Metadata_Contact:
          Contact_Information:
               Contact_Organization_Primary:
                    Contact_Organization: Data Access and Support Center
               Contact_Address:
                    Address_Type: mailing and physical address
                    Address:
                         University of Kansas 1930 Constant Avenue, West
                         Campus
                    City: Lawrence
                    State_or_Province: KS
                    Postal_Code: 66047-3726
                    Country: USA
               Contact_Voice_Telephone: 785-864-3965
               Contact_Facsimile_Telephone: 785-864-5317
               Contact_Electronic_Mail_Address: dasc@kgs.ukans.edu
               Hours_of_Service: 0800-1700
     Metadata_Standard_Name: FGDC Content Standards for Digital Geospatial
     Metadata
     Metadata_Standard_Version: 1.0
```

Generated by mp on Tue Feb 10 12:46:52 1998

Surface Water Features

Surface water features were obtained from the KDHE/GRAIL Surface Waters Information Management System (SWIMS) coverage, which was obtained from DASC. The coverage was tiled by state, and was clipped by county for this project.


```
Metadata:
Identification_Information:
  Citation:
    Citation_Information:
      Originator: Kansas Department of Health and Environment (KDHE) and
Geographic Research, Analysis, and Information Laboratory (GRAIL)
      Publication_Date: 1996
      Title: SWIMS
      Online_Linkage: http://gisdasc.kgs.ukans.edu
  Description:
    Abstract: The Surface Waters Information Management System (SWIMS) has
been designed to meet multi-agency hydrologic database needs for Kansas.  The
SWIMS project was supported and funded by the Kansas GIS Policy Board in 1992
to develop an enhanced digital, attributed hydrologic network for the State
and to integrate selected water quality, regulatory, and monitoring datasets
with the hydrologic network.  SWIMS was developed from EPA's RF3 dataset, a
digital cartographic hydrologic database.
    Purpose: SWIMS was designed to provide agency participants in the Kansas
GIS Initiative with a standard set of hydrologic databases to enable (1)
multi-agency water-related database integration, (2) agency specific geo-
referencing, (3) standard cartographic management, and (4) support for all
GIS analyses including network analysis and hydrologic modeling.
  Time_Period_of_Content:
    Time_Period_Information:
      Single_Date/Time:
        Calendar_Date: 1996
    Currentness_Reference: publication date
  Status:
    Progress: Complete
    Maintenance_and_Update_Frequency: Unknown
  Spatial_Domain:
    Bounding_Coordinates:
      West_Bounding_Coordinate: -104.0
      East_Bounding_Coordinate: -94.0
      North_Bounding_Coordinate: 41.0
      South_Bounding_Coordinate: 36.0
  Keywords:
    Theme:
      Theme_Keyword_Thesaurus: None
      Theme_Keyword: Surface Water Information Management System, NPDES
Permits, Stream, Effluent and Lake Monitoring
  Access_Constraints: None
  Use_Constraints: Data is current as of publication date.  KDHE and GRAIL
are not responsible for database integrity following download and
publication.  To be used at minimum scale of 1:100,000.  Contact KDHE for
more information.
  Point_of_Contact:
    Contact_Information:
```

```
      Contact_Organization_Primary:
        Contact_Organization: Kansas Department of Health and Environment
(KDHE) and Geographic Research, Analysis, and Information Laboratory (GRAIL)
        Contact_Person: A.J. Thomas
      Contact_Address:
        Address_Type: mailing and physical address
        Address: Forbes Field, Building 740
        City: Topeka
        State_or_Province: KS
        Postal_Code: 66620
        Country: USA
      Contact_Voice_Telephone: 785-296-8078
      Contact_Electronic_Mail_Address: athomas@kdhe.state.ks.us
  Browse_Graphic:
    Browse_Graphic_File_Name: swims
    Browse_Graphic_File_Description: Examples of different available levels
of data for the Surface Water Information Management System (SWIMS)
    Browse_Graphic_File_Type: GIF
  Native_Data_Set_Environment: Arc/Info
Data_Quality_Information:
  Logical_Consistency_Report:
    Datasets delivered to the Data Access and Support Center are quality
assurance tested for major documentation and topological errors using macros.
The databases are evaluated based on questions similar to the following:

    Does the database's documentation properly explain the dataset?
    Does the data import properly into its native dataset environment?
    Is consistent methodology used throughout the data?
    Are all of the database's fields and values legitimate compared to the
documentation?
    Is the database's topology free of errors that could impair the
functionality of the data?

    Once the data is tested a report is written describing the evaluation.  A
copy of the report is then forwarded to the data originator for his/her
review.  If errors are found, the data originator is expected to make any
necessary corrections and then provide those corrected coverages.  After
these steps have been taken data is considered archivable and made available
for distribution.  Data that is archived by DASC has been tested and
corrected.
  Completeness_Report:
  Lineage:
    Source_Information:
      Source_Citation:
        Citation_Information:
          Originator: USGS
          Publication_Date:
          Title: 100,000-scale USGS Quad maps
      Source_Scale_Denominator: 100000
      Type_of_Source_Media: paper
      Source_Time_Period_of_Content:
        Time_Period_Information:
          Single_Date/Time:
            Calendar_Date: Refer to specific quad
        Source_Currentness_Reference: publication date
      Source_Citation_Abbreviation: USGS
      Source_Contribution: spatial information
```

```
    Source_Information:
      Source_Citation:
        Citation_Information:
          Originator: EPA
          Publication_Date:
          Title: EPA-RF3 digital data
        Source_Scale_Denominator: 100000
        Type_of_Source_Media:
        Source_Time_Period_of_Content:
          Time_Period_Information:
            Single_Date/Time:
              Calendar_Date:
          Source_Currentness_Reference: publication date
        Source_Citation_Abbreviation: EPA-RF3
        Source_Contribution: spatial information
    Source_Information:
      Source_Citation:
        Citation_Information:
          Originator: USGS
          Publication_Date:
          Title: DLG
        Source_Scale_Denominator: 100000
        Type_of_Source_Media:
        Source_Time_Period_of_Content:
          Time_Period_Information:
            Single_Date/Time:
              Calendar_Date:
          Source_Currentness_Reference: publication date
        Source_Citation_Abbreviation: USGS
        Source_Contribution: spatial information
    Process_Step:
      Process_Description:
      Process_Date:
Spatial_Data_Organization_Information:
  Direct_Spatial_Reference_Method: Vector
Spatial_Reference_Information:
  Horizontal_Coordinate_System_Definition:
    Planar:
      Map_Projection:
        Map_Projection_Name: Lambert Conformal Conic
        Lambert_Conformal_Conic:
          Standard_Parallel:
            1st Standard Parallel 33.0
            2nd Standard Parallel 45.0
          Longitude_of_Central_Meridian: -98.25
          Latitude_of_Projection_Origin: 36.0
          False_Easting: 0 meters
          False_Northing: 0 meters
      Planar_Coordinate_Information:
        Planar_Coordinate_Encoding_Method: coordinate pair
        Coordinate_Representation:
          Abscissa_Resolution: 0.001 to 24.075
          Ordinate_Resolution: 0.000
        Planar_Distance_Units: Meters
Entity_and_Attribute_Information:
  Overview_Description:
```

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Entity_and_Attribute_Overview: See full SWIMS documentation report for
Entity and Attribute overview of five coverage series composing the SWIMS
dataset.
        Entity_and_Attribute_Detail_Citation:
Distribution_Information:
  Distributor:
    Contact_Information:
      Contact_Organization_Primary:
        Contact_Organization: Data Access and Support Center
      Contact_Address:
        Address_Type: mailing and physical address
        Address:
          University of Kansas
          1930 Constant Avenue, West Campus
        City: Lawrence
        State_or_Province: KS
        Postal_Code: 66047-3726
        Country: USA
      Contact_Voice_Telephone: 785-864-3965
      Contact_Facsimile_Telephone: 785-864-5317
      Contact_Electronic_Mail_Address: dasc@kgs.ukans.edu
      Hours_of_Service: 0800-1700
  Distribution_Liability:
    The State of Kansas Geographic Information Systems Core Database's
digital data have been tested and their documentation carefully reviewed.
However, the State of Kansas Geographic Information Systems Policy Board's
Data Access and Support Center and its representatives make no warranty or
representation, either expressed or implied, with respect to the digital data
and their documentation, their quality, performance, merchantability, or
fitness for a particular purpose. The digital data are distributed on "as
is" basis, and the user assumes all risk to their quality, the results
obtained from their use, and the performance of the data.

    In no event will the State of Kansas Geographic Information Systems
Policy Board or its representatives be liable for any direct, indirect,
special, incidental or consequential damages resulting from and defect in the
State of Kansas Geographic Information Systems Core Database's digital data
or in their documentation.

    This disclaimer of warranty is exclusive and in lieu of all others, oral
or written, express or implied. No agent or employee is authorized to make
any modification, extension, or addition to this warranty.
  Standard_Order_Process:
    Digital_Form:
      Digital_Transfer_Information:
        Format_Name: ARCE
        Transfer_Size: 1-5 MB
      Digital_Transfer_Option:
        Online_Option:
          Computer_Contact_Information:
            Network_Address:
              Network_Resource_Name: http://gisdasc.kgs.ukans.edu
          Access_Instructions: The State of Kansas SWIMS database is stored
in ESRI's Arc/Info Interchange Format and can be downloaded from the DASC
home page or by connecting directly to the DASC anonymous FTP server at
gisdasc.kgs.ukans.edu. To connect to the FTP server use the login name of
anonymous and your E-mail address as the password.

```
        Offline_Option:
            Offline_Media: CD-ROM, Iomega ZIP Disk, 3.5 inch floppy disk, 4 mm
cartridge tape, or 8 mm cartridge tape
            Recording_Format: ISO 9660
    Fees:
        Under the Kansas Public Records Law, DASC will attempt only to recover
the costs related to the processing and distribution of core database
requests.  The following is a description of our Basic and Supplemental
Conversion Services, as well as costs associated with the distribution of
digital data:

        Basic Conversion Services-DASC will provide coversion services to all
Federal/State/municipal tax-support agencies/entities for the cost of media
and shipping and handling.  Basic conversion services shall include the
exportation of the Core Database in their native projection and tiling scheme
into DASC supported spatial data exchange formats and technical support for
the loading and importation of the data.  Basic conversion services are
provided to other than tax-supported organizations on a fee-for-service
basis.

        Supplemental Conversion Services-DASC will provide supplemental
conversion services to all organizations on a fee-for-service basis.
Secondary services shall include the alteration of a Core Database's native
projection, tiling scheme, or topological structure.  Supplemental services
also includes custom map production.

        Where applicable, recoverable cost include:
        1. Labor to process the request
        2. Computer processing time to extract/convert database
        3. Magnetic media to distribute the data
        4. Shipping and handling charges
        5. Tax

        Below are the fees associated with each of the recoverable items:
        1. Labor:                          $35.00/Hour
        2. Central Processing Unit (CPU) computer time: $.14/Minute
        3. Media:
        3.5" HD floppy                     $.90
        DC 2120 Mini data cartridge tape        $22.00
        8mm-112m Data cartridge tape       $19.00
        4mm-120m Data cartridge tape       $20.00
        Compact Disks                      $15.00
        Network Transfer                   No Charge
        4. Shipping and Handling:               Varies
        5. Tax (State of Kansas):               6.90%
Metadata_Reference_Information:
  Metadata_Date: 19970318
  Metadata_Contact:
    Contact_Information:
    Contact_Organization_Primary:
        Contact_Organization: Data Access and Support Center (DASC)
    Contact_Address:
        Address_Type: mailing and physical address
        Address:
            University of Kansas
            1930 Constant Avenue, West Campus
        City: Lawrence
```

```
        State_or_Province: KS
        Postal_Code: 66047-3726
        Country: USA
      Contact_Voice_Telephone: 785-864-3965
      Contact_Facsimile_Telephone: 785-864-5317
      Contact_Electronic_Mail_Address: dasc@kgs.ukans.edu
      Hours_of_Service: 0800-1700
  Metadata_Standard_Name: FGDC Content Standards for Digital Geospatial
Metadata
  Metadata_Standard_Version: 1.0
```

Extent of Alluvial Aquifers

The alluvial aquifer GIS layer was downloaded from the DASC web site. The coverage was tiled by state, and was clipped by county for this project.

```
Metadata:
  Identification_Information:
    Citation:
      Citation_Information:
        Originator: Kansas Geological Survey
        Publication_Date: 1996
        Title: Alluvial Aquifer
    Description:
      Abstract: This coverage shows the extents of the alluvial aquifers in
Kansas.  The alluvial aquifers consist of unconsolidated Quaternary alluvium
and contiguous terrace deposits.  The coverage was developed from 1:500,000-
scale information.  The data used to construct this coverage are from the
state geologic map of Kansas.
      Purpose: This coverage was developed as part of a larger project to
define the extent, chemical quality, and flow systems within the major
aquifers in Kansas.  The data presented can be used to delineate the extent
of the alluvial aquifers.  Such information is valuable in studies focusing
on the management of water resources in these aquifers and other
hydraulically connected sources of water.
      Time_Period_of_Content:
        Time_Period_Information:
          Single_Date/Time:
            Calendar_Date: 1996
        Currentness_Reference: Publication date
    Status:
      Progress: Complete
      Maintenance_and_Update_Frequency: None
    Spatial_Domain:
      Bounding_Coordinates:
        West_Bounding_Coordinate: -102.5
        East_Bounding_Coordinate: -94.6
        North_Bounding_Coordinate: 40.0
        South_Bounding_Coordinate: 37.0
    Keywords:
      Theme:
        Theme_Keyword_Thesaurus: None
        Theme_Keyword: Alluvial, Extent, Kansas
    Access_Constraints: None
    Use_Constraints: Because of the small scale of the coverage and the data
source used in its development (1:500,000) it is best to use this coverage
for regional scale analysis and not local, site-specific investigations.
    Point_of_Contact:
      Contact_Information:
        Contact_Person_Primary:
          Contact_Person: P. Allen Macfarlane and Jeffrey A. Schloss
          Contact_Organization: Kansas Geological Survey
        Contact_Address:
          Address_Type: mailing and physical address
          Address:
            University of Kansas
            1930 Constant Avenue, West Campus
```

```
          City: Lawrence
          State_or_Province: Kansas
          Postal_Code: 66047-3726
          Country: USA
        Contact_Voice_Telephone: (785)864-3965
        Contact_Facsimile_Telephone: (785)864-5317
    Browse_Graphic:
      Browse_Graphic_File_Name: alluvaq
      Browse_Graphic_File_Description: Alluvial aquifer extent
      Browse_Graphic_File_Type: GIF
    Native_Data_Set_Environment: Arc/Info
  Data_Quality_Information:
    Logical_Consistency_Report:
      Datasets delivered to the Data Access and Support Center are quality
assurance tested for major documentation and topological errors using macros.
The databases are evaluated based on questions similar to the following:

      Does the database's documentation properly explain the dataset?
      Does the data import properly into its native dataset environment?
      Is consistent methodology used throughout the data?
      Are all of the database's fields and values legitimate compared to the
documentation?
      Is the database's topology free of errors that could impair the
functionality of the data?

      Once the data is tested a report is written describing the evaluation.
A copy of the report is then forwarded to the data originator for his/her
review.  If errors are found, the data originator is expected to make any
necessary corrections and then provide those corrected coverages.  After
these steps have been taken data is considered archivable and made available
for distribution.  Data that is archived by DASC has been tested and
corrected.
    Completeness_Report:
    Lineage:
      Source_Information:
        Source_Citation:
          Citation_Information:
            Originator:
              Kansas Geological Survey
              D.O. Nebert
            Publication_Date: 1989
            Title: Review of edgematching procedures for digital cartographic
data used in geographic information systems (GIS)
        Type_of_Source_Media: paper
        Source_Time_Period_of_Content:
          Time_Period_Information:
            Single_Date/Time:
              Calendar_Date: 1989
          Source_Currentness_Reference: publication date
        Source_Citation_Abbreviation: KGSMapM-23
        Source_Contribution: procedure information
      Source_Information:
        Source_Citation:
          Citation_Information:
            Originator:
              Kansas Geological Survey
              J.A. Ross
```

```
            Publication_Date: 1989
            Title: Geology Map of Kansas
        Source_Scale_Denominator: 500,000
        Type_of_Source_Media: paper
        Source_Time_Period_of_Content:
          Time_Period_Information:
            Single_Date/Time:
              Calendar_Date: 1991
          Source_Currentness_Reference: publication date
        Source_Citation_Abbreviation: KGSMapM-23
        Source_Contribution: spatial information
      Process_Step:
        Process_Description: The extent of the alluvial aquifers in Kansas is
defined by the extent of the Quaternary alluvial deposits in Kansas.  The
boundary was taken from the Geologic Map of Kansas (Ross, 1991; scale
1:500,000).  The extent was manually converted into digital information by
digitizing directly into ARC/INFO in the Lambert Conformal Conic Projection.
The RMSE for this procedure was 0.009 in at the original scale of the map or
about 120 m on the ground.  The RMSE is close to the suggested National Map
Accuracy Standards of the USGS of 0.02 in at the scale of the original map
(Nebert, 1989).
        Process_Date: 1994
  Spatial_Data_Organization_Information:
    Direct_Spatial_Reference_Method: Vector
  Spatial_Reference_Information:
    Horizontal_Coordinate_System_Definition:
      Planar:
        Map_Projection:
          Map_Projection_Name: Lambert Conformal Conic
          Lambert_Conformal_Conic:
            Standard_Parallel:
              1st Standard Parallel 33.0
              2nd Standard Parallel 45.0
            Longitude_of_Central_Meridian: -98.25
            Latitude_of_Projection_Origin: 36.0
            False_Easting: 0 meters
            False_Northing: 0 meters
        Planar_Coordinate_Information:
          Planar_Coordinate_Encoding_Method: coordinate pair
          Coordinate_Representation:
            Abscissa_Resolution: 0.010
            Ordinate_Resolution: 0.010
          Planar_Distance_Units: Meters
  Entity_and_Attribute_Information:
    Overview_Description:
      Entity_and_Attribute_Overview:
        The Alluvial aquifer coverage contains items which assist in
describing the coverage features.  The al_extent aat contains two items named
ALTITUDE_FEET and CODE and the pat contains an item named DESCRIPTION.  The
following is a brief description of each item:

        ALTITUDE_FEET-This item exists strictly to maintain consistency with
the other coverages prepared as part of this project.  It would normally be
an integer representing the elevation in feet above mean sea level of a
contour, but this coverage has no contours.
```

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CODE-A 3- or 4-digit number that indicates the type of feature represented and the cartographic symbol with which the feature is displayed.

DESCRIPTION-This item contains a two to four letter character string which indicates the type of surface geology or surface feature.
     Entity_and_Attribute_Detail_Citation:
  Distribution_Information:
    Distributor:
      Contact_Information:
        Contact_Organization_Primary:
          Contact_Organization: Data Access and Support Center
        Contact_Address:
          Address_Type: mailing and physical address
          Address:
            University of Kansas
            1930 Constant Avenue, West Campus
          City: Lawrence
          State_or_Province: Kansas
          Postal_Code: 66047-3726
        Contact_Voice_Telephone: (785)864-3965
        Contact_Facsimile_Telephone: (785)864-5317
        Contact_Electronic_Mail_Address: dasc@kgs.ukans.edu
        Hours_of_Service: 0800-1700
    Distribution_Liability:
     The State of Kansas Geographic Information Systems Core Database's digital data have been tested and their documentation carefully reviewed. However, the State of Kansas Geographic Information Systems Policy Board's Data Access and Support Center and its representatives make no warranty or representation, either expressed or implied, with respect to the digital data and their documentation, their quality, performance, merchantability, or fitness for a particular purpose. The digital data are distributed on "as is" basis, and the user assumes all risk to their quality, the results obtained from their use, and the performance of the data.

     In no event will the State of Kansas Geographic Information Systems Policy Board or its representatives be liable for any direct, indirect, special, incidental or consequential damages resulting from and defect in the State of Kansas Geographic Information Systems Core Database's digital data or in their documentation.

     This disclaimer of warranty is exclusive and in lieu of all others, oral or written, express or implied. No agent or employee is authorized to make any modification, extension, or addition to this warranty.
     Standard_Order_Process:
      Digital_Form:
        Digital_Transfer_Information:
          Format_Name: ARCE
          Transfer_Size: 4 MB
        Digital_Transfer_Option:
          Online_Option:
            Computer_Contact_Information:
              Network_Address:
                Network_Resource_Name: http://gisdasc.kgs.ukans.edu
          Access_Instructions: The State of Kansas Alluvial Aquifer database is stored in ESRI's Arc/Info Interchange Format and can be downloaded from the DASC home page or by connecting directly to the DASC

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anonymous FTP server at gisdasc.kgs.ukans.edu. To connect to the FTP server use the login name of anonymous and your E-mail address as the password.
                Offline_Option:
                    Offline_Media: CD-ROM, Iomega ZIP Disk, 3.5 inch floppy disk, 8 mm cartridge tape, or 4 mm cartridge tape
                    Recording_Format: ISO 9660 or tar
        Fees:
            Under the Kansas Public Records Law, DASC will attempt only to recover the costs related to the processing and distribution of core database requests. The following is a description of our Basic and Supplemental Conversion Services, as well as costs associated with the distribution of digital data:

            Basic Conversion Services-DASC will provide conversion services to all Federal/State/municipal tax-support agencies/entities for the cost of media and shipping and handling. Basic conversion services shall include the exportation of the Core Database in their native projection and tiling scheme into DASC supported spatial data exchange formats and technical support for the loading and importation of the data. Basic conversion services are provided to other than tax-supported organizations on a fee-for-service basis.

            Supplemental Conversion Services-DASC will provide supplemental conversion services to all organizations on a fee-for-service basis. Secondary services shall include the alteration of a Core Database's native projection, tiling scheme, or topological structure. Supplemental services also include custom map production.

            Where applicable, recoverable cost include:
            1. Labor to process the request
            2. Computer processing time to extract/convert database
            3. Magnetic media to distribute the data
            4. Shipping and handling charges
            5. Tax

            Below are the fees associated with each of the recoverable items:
            1. Labor: $35.00/Hour
            2. Central Processing Unit (CPU) computer time: $.14/Minute
            3. Media:
            3.5" HD floppy $.90
            DC 2120 Mini data cartridge tape $22.00
            8mm-112m Data cartridge tape $19.00
            4mm-120m Data cartridge tape $20.00
            Compact Disks $15.00
            Network Transfer   No Charge
            4. Shipping and Handling: Varies
            5. Tax (State of Kansas):   6.90%

    Metadata_Reference_Information:
        Metadata_Date: 19970210
        Metadata_Contact:
            Contact_Information:
                Contact_Organization_Primary:
                    Contact_Organization: Data Access and Support Center (DASC)
                Contact_Address:
                    Address_Type: mailing and physical address
                    Address:

```
            University of Kansas
            1930 Constant Avenue, West Campus
         City: Lawrence
         State_or_Province: Kansas
         Postal_Code: 66047-3726
         Country: USA
      Contact_Voice_Telephone: (785)864-3965
      Contact_Facsimile_Telephone: (785)864-5317
      Contact_Electronic_Mail_Address: dasc@kgs.ukans.edu
      Hours_of_Service: 0800-1700
   Metadata_Standard_Name: FGDC Content Standards for Digital Geospatial
Metadata
   Metadata_Standard_Version: 1.0
```

NRCS SSURGO and 1:24,000 Scale Detailed Soils Coverage, Attributed from "Soils Lite" Data Tables

As noted earlier the SSURGO coverages were downloaded directly from NRCS *http://www.ftw.nrcs.usda.gov/ssur_data.html* and the 1:24k detailed soil coverages were obtained from DASC. Documentation for the SSURGO coverages and databases can be found at the following world-wide-web address

http://www.ncg.nrcs.usda.gov/pdf/ssurgo_db.pdf

Soils Lite tables were created at Emporia State University using procedures outlined in KGS Open-File Report 2000-33 (Apolzer et al., 2001). Original coverages were available in UTM coordinates so it was necessary to project them to match the other coverages (see Appendix A for projection information).

Four attributes from the Soils Lite database were used.

The water table kind (wtkind) information indicates whether or not a water table is typically encountered within 60" of the land surface in the soil corresponding to each map unit. There are four possibilities in the database. Apparent (APPAR) – a water table is typically encountered within 60" of the land surface and appears to be associated with the top of an unconfined aquifer. Artesian (ARTES) – water is encountered within 60" of the land surface and appears to be upward flowing thus associated with artesian conditions and a confined aquifer. Perched (PERCH) – a perched water table is encountered within 60" of the land surface. None – no water table is typically found within 60" of the land surface in these soils.

The water table depth (wtdepth) information indicates the depth at which a water table is typically encountered in feet.

The texture of the surface soil horizons in the Soils Lite database (surftex) were ranked according to the classification scheme in Table 1. The ranking scheme is based on the idea that coarser textured soils will be more permeable than finer textured soils. Thus a Coarse Sand (CoS) would have a textural rank of 21 indicating that it has a high risk for chemical leaching whereas, a Clay (C) would have a rank of 1 indicating that leaching risk is very low in these soils. It should be remembered that the ranks are only for the surface horizon and thus only represent the texture of the upper 4 – 12 inches of soil in most cases. More details about the ranking scheme are available in the Soils Lite documentation (Apolzer et al., 2001).

While the surface texture rank gives some indication of initial infiltration rate for a soil, it does not necessarily represent a good indicator of leaching potential because many soils in Kansas have coarser surface textures than are found at depth. To give a better indication of soil profile susceptibility to leaching a second soil physical property was included (Perm_min).

The Perm_min parameter is the permeability of the least permeable layer found in the database for soil(s) assigned to each map unit in the soil coverages. They represent a better indicator for the overall leaching potential of the soil because the least permeable layer in the soil will be likely to represent the strongest control on vertical water movement through the soil. Details of

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how the Perm_min parameter is calculated are available in the Soils Lite documentation (Apolzer et al., 2001).

Table 1. Surface Soil Textural Ranking Scheme from the Soils Lite documentation (Apolzer et al., 2001).

Texture Name	Texture Abbreviation	New Ranking
Coarse Sand	CoS	21
Sand	S	20
Fine Sand	FS	19
Very Fine Sand	VFS	18
Loamy Coarse Sand	LCoS	17
Loamy Sand	LS	16
Loamy Fine Sand	LFS	15
Loamy Very Fine Sand	LVFS	14
Coarse Sandy Loam	CoSL	13
Sandy Loam	SL	12
Fine Sandy Loam	FSL	11
Very Fine Sandy Loam	VFSL	10
Loam	L	9
Silt Loam	SiL	8
Silt	Si	7
Sandy Clay Loam	SCL	6
Clay Loam	CL	5
Silty Clay Loam	SiCL	4
Sandy Clay	SC	3
Silty Clay	SiC	2
Clay	C	1
Un/Weathered Bedrock	UWB/WB	Blank
	VAR	Blank

Depth to Water from the KDA Water Information Management and Analysis System (WIMAS) Database

The WIMAS points-of-diversion coverage was downloaded from the DASC web site. WIMAS, which is based on KDA's Water Rights Information System (WRIS) database, contains information on surface and groundwater rights. Only groundwater rights were selected for inclusion. The coverage was tiled by state, and was clipped by county for this project. The date of each depth to water measurement is included in the table (wimas.dbf file) for each respective county.

```
Metadata:

Identification_Information:
  Citation:
    Citation_Information:
      Originator: Kansas Department of Agriculture, Division of
                  Water Resources
      Publication_Date: 19980601
      Title: Water Information Management and Analysis System (WIMAS),
            version 4, for ArcView
  Description:
    Abstract:
      The Water Information Management and Analysis System (WIMAS) is an
ArcView based GIS application that allows users to query Kansas water right
data maintained by the Kansas Department of Agriculture, Division of Water
Resources (KDA-DWR). Using a shape file representing points of water
diversion that is developed from SQL queries to the KDA-DWR's ORACLE-based
Water Rights Information System (WRIS), WIMAS users can summarize total
authorized quantity and annual reported water usage for Kansas counties,
subbasins, user-defined study areas, or individual water rights. WIMAS
consists of two customized Graphical User Interfaces and several forms
developed from Avenue and the Dialog Designer Extension for ArcView.  The
output options of WIMAS allows users to print hardcopy outputs or export
their queries into other applications in the form of text reports, graphs,
and maps.
    Purpose:
      WIMAS provides users a desktop application that sorts through the
intricacies of the many-to-many database relationships often found in water
rights without a strong understanding of the business rules that govern the
KDA-DWR data sets.
  Time_Period_of_Content:
    Time_Period_Information:
      Single_Date/Time:
        Calendar_Date: Varies on the PD ArcView shape file date.
    Currentness_Reference: Varies on the PD ArcView shape file date.
  Status:
    Progress: Complete
    Maintenance_and_Update_Frequency: Semi-annual
  Spatial_Domain:
    Bounding_Coordinates:
      West_Bounding_Coordinate: -102
      East_Bounding_Coordinate: -94.5
      North_Bounding_Coordinate: 40
      South_Bounding_Coordinate: 36.9
  Keywords:
```

```
Theme:
   Theme_Keyword_Thesaurus: None.
   Theme_Keyword: Water Information Management and Analysis System
   Theme_Keyword: Water Rights
   Theme_Keyword: Point of Diversion (PD)
   Theme_Keyword: Authorized Quantity
   Theme_Keyword: Reported Water Use
Place:
   Place_Keyword_Thesaurus: None
   Place_Keyword: State of Kansas
Access_Constraints: None
Use_Constraints:
   WIMAS requires that the user be running ArcView (version 3.0a or greater)
with the Dialog Designer Extension for ArcView installed in a Windows 95 or
Windows NT 4.0 environment.
   Information contained in the WIMAS program is a public record; however,
by accessing the WIMAS program, associated data, and any products generated
by WIMAS (i.e. maps, graphs, tables, and reports) the user agrees that they
will not use them for selling, or offering the sale, of any property or
services in violation of K.S.A 45-220(c)(2).  The use of the PD.SHP file
outside of the WIMAS program is strongly discouraged without a strong
understanding of both water rights in general and the KDA-DWR's ORACLE
database modeling rules and structure.
   Water rights are dynamic and often complex entities.  The water rights
data used in WIMAS represents the water rights files as of certain date and
should not be viewed as current.
   Reported water use information used in WIMAS at this time represents only
a single calender year.
   Information provided in WIMAS can not be used to determine whether a
water right has been lawfully used in accordance with the terms, conditions
and limitations specified in the vested right, certificate or permit. To
obtain current standing information on a particular water right file, please
contact the DWR.  The term "status", as used in the WIMAS program, denotes
one of the following phases of a water right's development: (1) The
application is pending initial review by the KDA-DWR; (2) A permit has been
issued; (3) The KDA-DWR has received a notice and proof of completion of the
diversion works; (4) The time to perfect the water right has expired; (5) A
Certificate of Appropriation has been issued; or (6) The water right has been
dismissed for some reason.
   Point_of_Contact:
      Contact_Information:
         Contact_Person_Primary:
            Contact_Person: Kelly Emmons
            Contact_Organization: Kansas Department of Agriculture, Division of
                                  Water Resources (KDA-DWR)
         Contact_Address:
            Address_Type: Mailing and Physical Address
            Address: 901 S. Kansas Ave, 2nd Floor
            City: Topeka
            State_or_Province: Kansas
            Postal_Code: 66612-1283
         Contact_Voice_Telephone: (785) 296-8439
         Contact_Facsimile_Telephone: (785) 296-1176
         Contact_Electronic_Mail_Address: kemmons@kda.state.ks.us
   Native_Data_Set_Environment: ArcView
Data_Quality_Information:
   Logical_Consistency_Report:
```

The WIMAS program was tested on Windows 95 and Windows NT platforms by several agencies and database managers within the KDA-DWR.
  Completeness_Report:
    WIMAS only contains the current year of publishable reported water use data. The water rights data used in WIMAS represents the water rights file as of a certain date and should not be viewed as current.
  Attribute_Accuracy:
    Attribute_Accuracy_Report:
      Several water right queries and processing routines were conducted between data stored in the WIMAS program and that in WRIS.
  Lineage:
    Source_Information:
      Source_Citation:
        Citation_Information:
          Originator: Kansas Department of Agriculture, Division of Water Resources
          Publication_Date: Varies
          Title: Water Rights Information System
          Publication_Information:
            Publication_Place: Topeka, Kansas
            Publisher: KDA-DWR
      Source_Scale_Denominator: 24000
      Type_of_Source_Media: Electronic ORACLE Database
      Source_Time_Period_of_Content:
        Time_Period_Information:
          Single_Date/Time:
            Calendar_Date: Varies
        Source_Currentness_Reference: Based on the date listed in the PD ArcView Shape File
      Source_Citation_Abbreviation: WRIS
      Source_Contribution: Attributes and spatial data
    Source_Information:
      Source_Citation:
        Citation_Information:
          Originator: DASC and KDA-DWR
          Publication_Date: Varies
          Title: Supporting GIS data layers
          Publication_Information:
            Publication_Place: Lawrence, KS and Topeka, KS
            Publisher: KDA-DWR
      Source_Scale_Denominator: 24000 to 100000
      Type_of_Source_Media: Electronic GIS Databases
      Source_Time_Period_of_Content:
        Time_Period_Information:
          Single_Date/Time:
            Calendar_Date: Varies
        Source_Currentness_Reference:
      Source_Citation_Abbreviation:
      Source_Contribution: Attributes and spatial data for supporting GIS layers
    Process_Step:
      Process_Description:
        WIMAS was written uses AVENUE programming language and the Dialog Designer for ArcView. For information on each dataset used in the WIMAS program, refer to the individual metadata files for each data layer listed within the WIMAS program.
      Process_Date: 1997 to 1998

```
Spatial_Data_Organization_Information:
  Direct_Spatial_Reference_Method: Vector
Spatial_Reference_Information:
  Horizontal_Coordinate_System_Definition:
    Geographic:
      Latitude_Resolution:
      Longitude_Resolution:
      Geographic_Coordinate_Units: Decimal Degrees
Entity_and_Attribute_Information:
  Overview_Description:
    Entity_and_Attribute_Overview:
      The composition of GIS layers and databases used in the WIMAS program
were created by the KDA-DWR or obtained from the DASC.  For more detailed
information on each GIS layer and database, refer to the individual metadata
files listed within the WIMAS program.
    Entity_and_Attribute_Detail_Citation:
Distribution_Information:
  Distributor:
    Contact_Information:
      Contact_Organization_Primary:
        Contact_Organization: Kansas Department of Agriculture, Division of
                              Water Resources (KDA-DWR).
      Contact_Address:
        Address_Type: Mailing and Physical Address
        Address: 901 S. Kansas Ave, 2nd Floor
        City: Topeka
        State_or_Province: Kansas
        Postal_Code: 66612-1283
      Contact_Voice_Telephone: (785) 296-8439
      Contact_Facsimile_Telephone: (785) 296-1176
      Contact_Electronic_Mail_Address: kemmons@kda.state.ks.us
  Distribution_Liability:
    The Kansas Department of Agriculture, Division of Water Resources (DWR)
exercises great care in the creation of its Water Information Management and
Analysis System (WIMAS) program.  However, the DWR offers no warranty or
guarantee of the accuracy or completeness of the WIMAS program and the data
contained therein, the DWR assumes no liability for errors in, interpretation
of, or use of these data.
Metadata_Reference_Information:
  Metadata_Date: 19980528
  Metadata_Contact:
    Contact_Information:
      Contact_Organization_Primary:
        Contact_Organization: Kansas Department of Agriculture, Division of
                              Water Resources (KDA-DWR)
      Contact_Address:
        Address_Type: Mailing and Physical Address
        Address: 901 S. Kansas Ave, 2nd Floor
        City: Topeka
        State_or_Province: Kansas
        Postal_Code: 66612-1283
      Contact_Voice_Telephone: (785) 296-8439
      Contact_Facsimile_Telephone: (785) 296-1176
      Contact_Electronic_Mail_Address: kemmons@kda.state.ks.us
  Metadata_Standard_Name: FGDC Content Standards for Digital Geospatial
Metadata
  Metadata_Standard_Version: 1.0
```

Depth to Water from the KGS Water Information Storage and Retrieval Database (WIZARD)

The WIZARD database is part of the KGS Oracle database system. WIZARD, which is based primarily on the Ground Water Site Inventory (GWSI) database of the U.S. Geological Survey, contains all of the annual KGS and DWR water level measurements as well as other available water well information. The date of each depth to water measurement is included in the table (wisard.dbf file) for each respective county.

Depth to Water from the KGS Water Well Completion Record (WWC-5) Database

The WWC-5 database contains information from records submitted by water well drillers to the Kansas Department of Health and Environment. Since 1975, drilling companies have been mandated by state legislation to provide information including location, type, use, well construction details, nearest source of contamination, and static water level, using the WWC-5 form. The depth to water measurement included in this database is typically that reported by the driller at the time of well drilling, as indicated in the table (wwc5.dbf file) for each respective county. The WWC-5 database is part of the KGS Oracle database system.

References

Apolzer, K., C. Cooper, and R. Sleezer, 2001. Description of the Soils Lite Database. A report to the Kansas Water Office and the State GIS Policy Board. Kansas Geological Survey Open-file Report Number 2000-33, 33 pp.

Acknowledgments

Melany Miller assisted in the production of this report. Emporia State University graduate students Cameron Cooper, Lee Snead, and Kathleen Apolzer did most of the grungy database manipulation and coverage compilations for the soils. Jeff Schloss participated in initial stages of the project development before leaving the Survey.

Appendix A--Projection Information

Datum: NAD 27

Projection: Lambert
Units: Meters
PARAMETERS
Central Meridian: -98 15 00
Reference Latitude: 36 00 00
Standard Parallel 1:   33 00 00
Standard Parallel 2:   45 00 00
False E: 0
False N: 0