Memorandum

From:

To: File

Date: July 22, 1999

Subject: GIS Data Used in the Risk Analysis for the HWC Final Rule

Enclosed are data compiled and organized using a geographic information system (GIS). These data provide many of the model input parameter values used in the risk analysis for hazardous waste combustion units. The material is organized into four parts as described below.

I. **Introduction.** This section provides an overview of the information contained in this document. It includes an explanation of docket materials, map of all 76 sites, and table of all sites.

II. **Description of GIS data sources and methodologies.** This section provides documentation of all GIS data collection strategies and data sources. Also included are a flowchart of the GIS workflow and a flowchart of watershed/waterbody delineation workflow.

III. **Program code.** This section provides hardcopy printouts of the Arc Macro Language (AML) programs that were used to process the GIS data.
- gen_sector.aml - creates sector coverages
- sector_pop.aml - calculates population data by sector
- ag_pop.aml - calculates population and agricultural data by sector
- sect_surf.aml - calculates ICF3 concentration data by sector
- ws_surf.aml - calculates ICF3 concentration data by watershed
- lk_surf.aml - calculates ICF3 concentration data by lake
- st_surf.aml - calculates ICF3 concentration data by stream

IV. **Maps and data tables.** This section provides hardcopy printouts of the raw and processed GIS data tables along with maps of the various GIS data layers at each site.

Master table of all sites and stacks

Maps - There are 4 for each of the 76 modeled sites:
- Map of census data
- Map of soil data
- Map of watershed & waterbodies
- Map of landuse data

Raw data tables:

- Ag Census item definitions
- Ag Census data for all HWC Counties
- Recreational Fisher Data:
  - Memo and tables describing items, SAS program and processed data
  - rural3.log - SAS program used to process NSFHWAR survey data and census data. Contains methodology and raw survey data
  - Definitions - item definitions of fishers3.dat table
  - fishers3.dat - table of processed rec. fisher data
- Landuse Data for all sites
- Soils Data for all sites
- Census Block Group item definitions
- Census Block Group data for all 20km site areas
- Waterbody Data
- Emissions Data by stack and constituent for the 76 Modeled HWC Facilities:
  - Baseline
  - MACT Floor
  - MACT Standard
  - MACT BTF

Processed data tables:

- Sector emissions averages
- Watershed & waterbody emissions averages
- Processed population item definitions
- Processed population numbers by sector

GIS Data Used in the Risk Analysis for the HWC Final Rule

Section I.

Introduction.

The purpose of this packet of information is to combine all of the various components that were used in the GIS data gathering and processing portion of the HWC project. Because of the quantity and the complexity of the data, we thought it best to bundle the data and documentation in the manner that follows:

- Data Sources
- Description of Methodology
- Program Code
- Maps
- Raw Data Tables
- Processed Data Tables

All data tables list data by site of stack based on the order that the sites and stacks appear in the master site list. All maps are grouped by site and are also ordered by site as they appear in the master table list.

GIS Data Used in the Risk Analysis for the HWC Final Rule

Section II.

Description of GIS data sources and methodologies.

HWC GIS Data Sources:

- 1990 U.S. Census TIGER/Line Block Group Coverages
- 1990 U.S. Census STF 3A Attribute Data
- Census of Agriculture
- National Survey of Fishing, Hunting, and Wildlife
- GIRAS Landuse data
- STATSGO Soils
- 1-Degree USGS Digital Elevation Models
- Reach File, Version 3 (RF3)
- WATSTORE Data
- From BASINS CD-ROM:
  - Drinking Water Supply (DWS) Sites
  - Stream Gage Stations
  - Reach File, Version 1 (RF1)

1990 U.S. Census TIGER/Line Block Group Coverages:

The BG90 layer in the EPA Spatial Data Library System (ESDLS) provide block group boundary coverages based on U.S. Bureau of the Census 1990 TIGER/line data in a polygon ARC/INFO coverage (U.S. EPA, 1995a,b). The 1990 TIGER/line data provide digital data for all 1990 Census map features and boundaries, the associated 1990 Census final tabulation of geographic area codes (such as 1990 Census block numbers), and the codes for the January 1, 1990, legal and statistical areas on both sides of each line segment of every mapped feature. (Additional information is available online at **http://nsdi.epa.gov/nsdi/projects/bl90.htm** and **http://nsdi.epa.gov/nsdi/projects/bg90.htm**.)

The 1990 Census TIGER/line block group coverages, a subset of 1:100,000 scale data, are derived from 1990 Census TIGER/line files (U.S. Bureau of the Census, 1990). The 1990 Census TIGER/line files provide digital data for all 1990 Census map features and boundaries and the associated 1990 Census final tabulation of geographic area codes. (Additional information is available online at http://www.census.gov/geo/www/tiger/.)

1990 U.S. Census STF 3A Attribute Data:

Summary Tape File 3A (STF 3A) is a national data set of 1990 population and housing data collected by the U.S. Bureau of the Census (U.S. Bureau of the Census, 1992). It consists of approximately 70 tables of data for states, counties, county subdivisions, places, census tract/block numbering areas (BNAs), and block groups. This STF 3A production process focused on the block group level for the United States. Subject matter of the data covers population items such as age and citizenship, as well as housing items such as rent, age of householder, and number of rooms. Table 9-5 lists the STF 3A data fields used in the HWIR analysis. (STF 3A data are available online at http://www.census.gov/mp/www/rom/msrom6ae.html.)

Table: Specific STF 3A Block Group-Level Census Items Used to Estimate HWC Human Receptor Populations

Item Code	Item Description	Item Code	Item Description
P0010001	total persons	P0130013	total persons 18 yr
P0060001	persons inside urbanized area	P0130014	total persons 19 yr
P0060002	persons outside urbanized area	P0130015	total persons 20 yr
P0060003	persons in rural area on farm	P0130016	total persons 21 yr
P0060004	persons in rural area not on farm	P0130017	total persons 22 to 24 yr
H0010001	total housing units	P0130018	total persons 25 to 29 yr
H0050003	housing units, rural farm	P0130019	total persons 30 to 34 yr
P0130001	total persons younger than 1 yr	P0130020	total persons 35 to 39 yr
P0130002	total persons 1 and 2 yr	P0130021	total persons 40 to 44 yr
P0130003	total persons 3 and 4 yr	P0130022	total persons 45 to 49 yr
P0130004	total persons 5 yr	P0130023	total persons 50 to 54 yr
P0130005	total persons 6 yr	P0130024	total persons 55 to 59 yr
P0130006	total persons 7 to 9 yr	P0130025	total persons 60 and 61 yr
P0130007	total persons 10 and 11 yr	P0130026	total persons 62 to 64 yr
P0130008	total persons 12 and 13 yr	P0130027	total persons 65 to 69 yr
P0130009	total persons 14 yr	P0130028	total persons 70 to 74 yr
P0130010	total persons 15 yr	P0130029	total persons 75 to 79 yr
P0130011	total persons 16 yr	P0130030	total persons 80 to 84 yr
P0130012	total persons 17 yr	P0130031	total persons 85 yr or older

Note: The block group coverages and attribute data used in the HWC project were acquired from ftp://valley.rtpnc.epa.gov/usr/var/ftp/pub/STF3A

Census of Agriculture:

The census of agriculture provides periodic and comprehensive statistics about agricultural operations, production, operators, and land use. It is conducted every 5 years, for years ending in 2 and 7. Its coverage includes all operators of U.S. farms or ranches (Division A, SIC 01-02) that sold or normally would have sold $1,000 worth of agricultural products during the census year. In 1992, approximately 1.9 million operators produced $162 billion in crops and livestock. All operators provide crop acreage and quantities harvested, inventories of livestock and poultry, value of products sold, land use and ownership, irrigation activities, amount of commodity credit loans, number of hired laborers, federal program payments, and operator characteristics. Selected operators provide additional information on production expenses (including interest), fertilizer and chemical use, machinery and equipment, market value of land and buildings, and income from farm-related sources. (Additional information is available online at **http://www.census.gov/econ/www/ag0100.html**). Census of agriculture data used for the HWC analysis included county-level data on beef and dairy and produce farms. For consistency with the 1990 population census data, data for 1987 and 1992 were averaged.

National Survey of Fishing, Hunting, and Wildlife:

The National Survey of Fishing, Hunting, and Wildlife presents microdata records (with any information that might identify a specific person or household removed) on individuals involved in fishing, hunting, and other wildlife-associated recreational activities such as wildlife observation, photography, and feeding. Available data include the state in which these activities occurred; number of trips taken; duration of trips; and expenditures for food, lodging, transportation, and equipment. The U.S. Census Bureau conducted the survey for the U.S. Fish and Wildlife Service (FWS), Department of the Interior (DOI), which prepares printed reports in this field. (Additional information is available online at **http://www.census.gov/prod/3/97pubs/fhw91nat.pdf**).

GIRAS Landuse data:

GIRAS (U.S. Environmental Protection Agency [EPA], 1994) provides comprehensive land use data, in digital GIS format, for the conterminous United States. This spatial data set represents digital data originally collected by the USGS and then converted into the ARC/INFO GIS format by EPA. These digital coverages are available from EPA by 1-degree quadrangles (1:250,000 scale). This information was extracted from metadata available on GIRAS. The full metadata record may be found at http://www.epa.gov/ngispgm3/nsdi/projects/giras.htm (U.S. EPA, 1994).

GIRAS land use/land cover (LU/LC) data are useful for environmental assessment of land use patterns based on water quality analysis, growth management, and other types of environmental impact assessment. Data are meant to be used by quadrangle, or among adjacent quadrangles where they are temporally contiguous. The data can be used in any geographic application where intermediate scale land use data are appropriate and the dates are representative of the need. Each quadrangle of land use data has a different representative date. Date ranges from mid-1970's to early 1980's are common.

When joined together, quadrangles will not likely match along edges due to differences in interpretation and time coverage. Edges of each map file were manually digitized and may not join neighboring maps. For some quadrangles, edges have been mathematically recalculated (using a GIRASNEAT Arc Macro Language [AML] program) to join without overlap or gaps in coverage with adjacent maps.

The GIRAS series includes several themes of spatial data. The LU/LC data were used in HWC. LU/LC in GIRAS was mapped and coded using the Anderson classification system (Anderson et al.,1976), which is a hierarchical system of general (one-digit, level 1) to more specific (two-digit, level 2) characterizations (see Table).

Anderson Land Use Codes

1 Urban or builtup land	5 Water
11 Residential	51 Streams and canals
12 Commercial and services	52 Lakes
13 Industrial	53 Reservoirs
14 Transportation, communication, utilities	54 Bays and estuaries
15 Industrial and commercial complexes	6 Wetland
16 Mixed urban or builtup land	61 Forested wetland
17 Other urban or builtup land	62 Nonforested wetland
2 Agricultural land	7 Barren land
21 Cropland and pasture	71 Dry salt flats
22 Orchards, groves, vineyards, nurseries, and ornamental horticultural land	72 Beaches
	73 Sandy areas not beaches
23 Confined feeding operations	74 Bare exposed rock
24 Other agricultural land	75 Strip mines, quarries, gravel pits
3 Rangeland	76 Transitional areas
31 Herbaceous rangeland	8 Tundra
32 Shrub and brush rangeland	81 Shrub and brush tundra
33 Mixed rangeland	82 Herbaceous tundra
4 Forest land	83 Bare ground
41 Deciduous forest land	84 Wet tundra
42 Evergreen forest land	85 Mixed tundra
43 Mixed forest land	9 Perennial snow or ice
	91 Perennial snowfields
	92 Glaciers

Source: Anderson et al. (1976)

<u>Soils:</u>

The primary sources for site-specific soil properties were the State Soil Geographic (STATSGO) database maintained by the U.S. Department of Agriculture (USDA, 1994) and two GIS-based compilations of STATSGO data, USSOILS (Schwarz and Alexander, 1995) and the Conterminous United States Multi-Layer Soil Characteristics (CONUS) data set (Miller and White, 1998). USSOILS, maintained by the U.S. Geological Survey (USGS), averages STATSGO data by map unit, with depth-weighted averages to the water table. CONUS, created by Pennsylvania State University, averages by STATSGO map unit and converts STATSGO soil layers into a set of 11 standardized soil layers extending to a depth of 2.5 m (60 in).

STATSGO: (USDA, 1994) is a GIS database designed primarily for regional, multistate, river basin, State, and multicounty planning, managing, and monitoring resources. Soil maps for STATSGO are compiled from more detailed county soil survey maps. When county soil survey maps are not available, data on geology, topography, vegetation, and climate are assembled, together with Land Remote Sensing Satellite (LANDSAT) images. Soils of like areas are studied, and the probable classification and extent of the soils are determined.

Using the USGS 1:250,000 scale, 1- by 2-degree quadrangle series as a map base, the soil data are digitized by vector method to comply with national guidelines and standards. Data for the STATSGO database are collected in 1- by 2-degree topographic quadrangle units and merged and distributed as statewide coverages. Features are edge-matched between states. The STATSGO data provide national coverage at a scale of 1:250,000, except for Alaska, which is at a scale of 1:200,000.

The approximate minimum area delineated is 625 ha (1,544 acres), which is represented on a 1:250,000-scale map by an area approximately 1 cm by 1 cm (0.4 in by 0.4 in). Linear delineations are no less than 0.5 cm (0.2 in) in width. The number of delineations per 1:250,000 quadrangle typically is 100 to 200 but may range up to 400. Delineations depict the dominant soils making up the landscape. Other dissimilar soils, too small to be delineated, are present within a delineation.

Attribute accuracy is tested by manual comparison of the source with hardcopy plots and/or symbolized display of the map data on an interactive computer graphic system. Selected attributes that cannot be visually verified on plots or on screen are interactively queried and verified on screen. In addition, the attributes are tested against a master set of valid attributes. All attribute data conform to the attribute codes in the signed classification and correlation document and amendments and are current as of the date of digitalizing.

A map unit is a collection of areas defined and named the same in terms of their soil and/or nonsoil areas. Each map unit differs in some respect from all others in a survey area and is uniquely identified. Each individual area is a delineation. Each map unit consists of 1 to 21 components.

In those few areas where detailed maps do not exist, reconnaissance soil surveys were combined with data on geology, topography, vegetation, climate, and remote sensing images to delineate map units and estimate the percentages of the components. The STATSGO map unit components are soil series phases, and their percentage composition represents the estimated area proportion of each within the STATSGO map unit. The composition for a map unit is generalized to represent the statewide extent of that map unit and not the extent of any single map unit delineation. These specifications provide a nationally consistent representation of STATSGO attribute data.

Refer to metadata available on the Internet at http://www.ftw.nrcs.usda.gov/stat2.html (USDA, 1994) for greater detail on STATSGO.

USSOILS (Schwarz and Alexander, 1995) and CONUS (Miller and White, 1998) are simplified compilations of STATSGO data. The USSOILS coverage was originally compiled to support a national model of water quality. USSOILS aggregates the STATSGO layer and component information up to the level of a map unit by depth-averaging, over the entire soil column, median properties within a component and then area-averaging component values across a map unit. Metadata on USSOILS can be found at: http://water.usgs.gov/lookup/getspatial?ussoils.

The CONUS soil data set was compiled by the Earth System Science Center in the College of Earth and Mineral Sciences at Pennsylvania State University for application to a wide range of climate, hydrology, and other environmental models (Miller and White, 1998). CONUS contains STATSGO soil properties averaged to 11 standard layer depths from the STATSGO layers to a depth of 2.5 m. Within each STATSGO map unit and CONUS standard layer, soil properties either represent the predominant property (as with soil texture) or are area-weighted averages of STATSGO component values. Additional information on CONUS can be found at:
http://www.essc.psu.edu/soil_info/index.cgi?soil_data&conus.

1-Degree USGS Digital Elevation Models:

A Digital Elevation Model (DEM), consists of a sampled array of elevations for ground positions that are normally at regularly spaced intervals. The 1-Degree DEM (3- by 3-arc-second data spacing) provides coverage in 1- by 1-degree blocks for all of the contiguous United States, Hawaii, and limited portions of Alaska. The basic elevation model is produced by or for the Defense Mapping Agency (DMA), but is distributed by the USGS, EROS Data Center, in the DEM data record format. In reformatting the product the USGS does not change the basic elevation information. 1-degree DEM's are also referred to as "3-arc second" or "1:250,000 scale" DEM data.
ftp://mapping.usgs.gov/pub/ti/DEM/demguide/
http://rockyweb.cr.usgs.gov/nmpstds/demstds.html

Reach File Version 3 (RF3)

Reach indexing is a process of linking electronically or georeferencing state/interstate/tribal water quality information to the EPA Reach File for mapping and spatial analysis. In 1998, the latest version on the Reach File - RF3 (at 1:100,000 scale) - will become part of the federal National Hydrography Dataset (NHD).
http://www.epa.gov/OWOW/NPS/rf/refs.html

WATSTORE:

Water-data stations throughout the United States are used to obtain records on stream discharge (flow), stage (height), reservoir and lake stage and storage, groundwater levels, well and spring discharge, and the quality of surface and groundwater. All data collected are stores in the USGS Water Data Storage and Retrieval system (WATSTORE) data base, and also are published annually for each State in U.S. Geological Survey Water-Data Reports.

This section serves as a guide for retrieving data from the Water Data Storage and Retrieval System (WATSTORE). The WATSTORE consists of several files in which water data are grouped and stored by common characteristics and data-collection frequencies. Files are maintained for the storage of (1) surface-water, quality-of-water, and ground-water data measured daily or more frequently, (2) annual peak values and peaks above a base flow for streamflow stations, (3) chemical analyses for surface- and

ground-water sites, (4) geologic and inventory data for ground- water sites, and (5) water use summary data . In addition, an index file station header file of sites for which data are stored in the system is maintained in WATSTORE.
Metadata --- http://water.usgs.gov/lookup/getspatial?sfbc

The following files are generally used in retrieving data from WATSTORE:

- Daily Values File
- Water-Quality File
- Peak Flow File

BASINS CD-ROM:

The U.S. Environmental Protection Agency's water programs and their counterparts in states and pollution control agencies are increasingly emphasizing watershed and water quality-based assessment and integrated analysis of point and nonpoint sources. Better Assessment Science Integrating Point and Nonpoint Sources (BASINS) is a system developed to meet the needs of such agencies. It integrates a geographic information system (GIS), national watershed data, and state-of-the-art environmental assessment and modeling tools into one convenient package. For the HWC project several data sources were used from this product. http://www.epa.gov/OST/BASINS/index.html

Drinking Water Supply (DWS) Sites

Drinking Water Supply Sites from Public Water Systems for BASINS
Under the Safe Drinking Water Act (SDWA), EPA is responsible for regulating more than 200,000 distinct Public Water Systems (PWS) (systems that serve at least 25 people) and the water they provide. Some systems use surface water from a river or lake and serve millions of urban customers. Others use wells or ground water and serve only a few dozen visitors to a campground or gas station. EPA regulations help to guarantee that Americans find safe drinking water everywhere in the country. In order to best manage these water systems and their widely different local conditions, EPA allows states to directly supervise water systems within their borders. SDWIS contains several types of information about water systems and their compliance with drinking water standards. The database contains general information as well as the technical details of a water system's violation of water quality regulations. Other information describes enforcement actions taken by regulatory agencies and the results of water testing done for a water system. SDWIS also contains data that indicate whether a water system has been granted state permission not to meet certain water standards, and whether a water system has been significantly non-compliant (i.e., the water system's violations are significant from a health perspective). For distribution with BASINS v.1.0, the spatial attributes of the database were prepared in Arcview shape file format while selected relational attributes were prepared in Arcview DBF file format.

Data source media: Facility coordinates in the DWS file were interpolated from USGS topographic maps varying in scale from 1:24000 to 1:62500. Location determined via phone interview with plant offical s. Metatdata ---
http://www.epa.gov/OST/BASINS/metadata.htm

Stream Gage Stations

Inventory of surface water gaging station data including 7-Q-10 low and monthly stream flow. The gage data were retrieved from the Gage File database. If necessary state and county FIPS codes were filled in from other fields where possible. The resulting ASCII file was converted into an ARC/INFO National Albers projection coverage for the United States. The coverage was then overlaid with county coverages (conterminous U.S., Alaska, Hawaii) to assign accuracy codes based on the state-county FIPS codes.
For distribution with BASINS v1.0, the national coverage was split into a series of coverages that included the spatial extent of each of the nine US EPA regions, plus the hydrologic accounting units that crossed Region boundaries. The nine regional coverages therefore overlapped at Regional boundaries. The coverages were distributed in PC ARC/INFO coverage format.

Reviews Applied to Data: an accuracy code was assigned based on a comparison of state and county FIPS codes. A site with a code value of 1 is within the correct county. A value of 2 is outside the county but inside the state. A value of 3 or 9 indicates coordinates outside the state. A site with value of 4 was formerly assigned a value of 3 or 9 but was reassigned based on visual inspection to be on the border of the correct county. Due to the amount of data, points with an accuracy code of 2 were not visually checked.
The sites with accuracy codes of 3 or 9 outside the correct state were visually inspected to determine if they were on the border of the county within which they were associated.
The gage data was obtained from the US EPA Gage File database. Metadata --- http://www.epa.gov/OST/BASINS/metadata/gage.htm

Reach File, Version 1 (RF1)

Reach File Version 1.0 (RF1) is a vector database of approximately 700,000 miles of streams and open waters in the conterminous United States. It is used extensively by EPA and States, and has been used by the U.S. Fish and Wildlife Service and the National Weather Service for many years. This configuration of RF1 for the geographic information systems community extends the use of RF1 to ARC/INFO users in the U.S.Geological Survey, the U.S. Environmental Protection Agency and others.
RF1 was prepared by the U.S. Environmental Protection Agency (EPA) in 1982 from stable base color separates of National Oceanographic and Aeronautical Administration (NOAA) aeronautical charts having a scale of 1:500,000. These charts provided the best nationwide hydrographic coverage available on a single scale at that time. They included all hydrography shown on USGS maps having a scale of 1:250,000 with extensive additions, corrections and improvements in detail made by NOAA from aerial photography and satellite imagery. All hydrographic features on those charts were optically scanned from the color separates using a scanner resolution finer than feature line width. The surface water features selected for inclusion in the RF1 database were converted from the scanned raster form to vector form with coordinates expressed as latitude and longitude. Surface water names in RF1 were derived from the source maps and supplemented by names from miscellaneous state maps and maps of the USGS.
Many other RF1 attributes are described herein.

In the 1980's, EPA used RF1 for performing water quality modeling on whole river basins for all of the hydrologic regions in the conterminous United States. In this role, it was used to provide national assessments and overviews of water quality and to provide the foundation for a nationwide stratified sampling frame for performing statistical summaries of modeled and measured water quality on all the surface waters of the 48 States.

In the 1980's, environmental data integration was strengthened significantly by EPA using the Reach File. STORET had, for many years, integrated the water quality monitoring data of EPA, States, the USGS, and other Federal agencies by agency codes, standard water quality parameter codes, date, time, depth, site coordinates, state, basin, and user-definable polygons. The Reach File provided STORET with the capability to search upstream and downstream to relate the environmental data of many agencies to each other along stream paths. This brought about the ability to integrate ambient water quality at sites sampled by the several hundred official monitoring agencies using STORET in a new and powerful manner. Thus, for example, any and all water quality measurements made by the USGS and stored in WATSTORE were easily accessed via STORET prior to the introduction of the Reach File. With the Reach File, it became possible to integrate the data from USGS WATSTORE records with the much larger holdings of environmental data from States, EPA, and other Federal agencies on a station-by-station basis along stream paths. Stream ordered data integration of this type was important in the development of effluent guidelines pursuant to the Clean Water Act during the 1980's. This is but one example of the new dimension in data integration made possible by the standard reach numbering scheme and the hydrologic networking provided in RF1.

Linking multiple databases to RF1 and hence to each other, was accomplished by a process called reach indexing. The process takes advantage of the facts that each reach has been assigned a unique identifier and the stream path for each reach is described in terms of latitude/longitude coordinates. Using simple algebraic processing, each lat/lon point for every point of interest in a database is indexed to the closest point in the nearest RF1 reach. The unique reach number for that reach and its relative position, prorated against the full computed reach length, is placed in the database being reach indexed. From then on, access to all points that have been reach indexed in that indexed database, may be achieved in hydrological order by navigating upstream or downstream through RF1, picking up reach numbers in hydrological order from RF1 and retrieving the points of interest, if present, from the indexed database by reach numbers as the reaches are encountered in the navigation of RF1. For distribution with BASINS v.2.0, the spatial attributes of the database were prepared in Arcview shape file format while selected relational attributes were prepared in Arcview DBF file format. Metadata --- http://www.epa.gov/OST/BASINS/metadata/rf1.htm

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U.S. Environmental Protection Agency, Office of Science and Technology. 1996. U.S. *EPA Reach File 1 (RF1) for the Conterminous United States in BASINS. U.S.* Environmental Protection Agency, Washington, D.C. http://www.epa.gov/OST/BASINS/metadata/rf1.htm

Description of Methodologies and Data Sources Used in Characterizing Land Use (including Human/Livestock Populations), Air Modeling Impacts, and Waterbody/Watershed Characteristics for HWC Study Areas:

This memo describes the methodologies and data sources used to: (1) select and characterize waterbody/watersheds for inclusion in risk modeling, (2) establish air deposition/concentration values based on air modeling runs for the 76 modeled study areas, and (3) establish site-specific human and livestock populations. Determination of site characteristics associated with air dispersion modeling (e.g. terrain, meteorology) are not included in this discussion. They will be presented in the background document as part of the documentation of the dispersion modeling methods.

1.0 Introduction

A risk analysis of this nature demands a large amount of site-specific data. Because of the data volume, semiautomated techniques were used to access existing nationwide databases to provide the site-specific data used in site characterization.

A geographic information system (GIS) provides the platform for projecting the impact of hazardous waste combustors (HWC) emissions on individual study areas and watersheds/waterbodies and for characterizing land use for estimation of human and ecological risk (e.g., location, shape, and size of watersheds and waterbodies and densities of human and livestock populations). The human health component of the HWC risk assessment includes risk estimates for receptor populations located within the modeled study areas (e.g., beef cattle farmers and recreational fishermen). The HWC risk assessment also includes risk estimates for those human populations located outside of modeled study areas that may be impacted by ingestion of dioxin contained in food commodities produced within these study areas (e.g., individuals eating beef from beef cattle that were raised within a given study area and thereby exposed to dioxin from the associated HWC facility).

A GIS was selected as the platform for conducting the site characterization component of the HWC risk analysis because GIS can be easily automated and can perform spatial overlay of georegistered data. Most of the GIS processing was conducted using ARC/INFO for UNIX on SUN Microsystems workstations while some took place in the PC environment with ARC/VIEW. The term “program” is used throughout this memo to refer to Arc Macro Language (AML) scripts, a batch-process scripting language used with the ARC/INFO GIS software. The term “coverage” refers to a GIS map layer (e.g., geographically referenced digital points, lines, or polygons with attached data).

To achieve the desired degree of spatial resolution for this risk assessment, a 20-km radius polar grid was used. This polar grid, which is centered on the geographic coordinate for the HWC facility, is divided into 16 sectors. An individual polar grid together with its HWC facility is termed a “study area.” The term “sector” refers to the 16-sector grid that defines the study area. The sector polygons are created by dividing four concentric circles around the site location (2, 5, 10, and 20 km radius) by the north-south and east-west axes.

The number of individuals for each receptor population at the sector level must be projected to estimate risks for receptor populations located within study areas. Similarly, the number of livestock at the sector level must be projected to estimate risks for individuals located outside of the study areas who are exposed to dioxin through the ingestion of food commodities. Once these sector-level population projections are completed, they can be combined with individual risk estimates for the human receptor populations, individual dioxin concentration estimates, or livestock populations in order to generate the desired risk estimates.

The GIS modeling results provided three sets of data inputs for the risk analysis:

Waterbody characteristics and average emission concentration values by watershed and waterbody within the study area

Average emission concentration values by sector within the study area

Spatially averaged human and livestock populations by sector.

The remainder of this memo discusses the various methodologies used to derive these data inputs for the risk analysis.

2.0 Waterbody/Watershed Selection, Delineation, and Characterization

From one to four waterbodies were selected for inclusion in the HWC risk analysis from each study area. These selected waterbodies were delineated and characterized. These waterbodies, termed “modeled waterbodies,” were used to provide site-specific data used in the risk analysis.[1] In characterizing modeled waterbodies, the following attributes were compiled for each waterbody and associated watershed:

Watershed area
Length of stream reach
Waterbody area
Flow velocity and discharge
Stream width/depth.

Each of these attributes is defined for that portion of the watershed/waterbody located within the 20-km radius study area under consideration.

[1] As noted in the Section 2.2 (Waterbody Selection), the modeled waterbodies used in the HWC risk analysis should not be viewed as a random sample of the waterbodies located across the study areas, but should be viewed as generally representing those waterbodies located in areas more heavily impacted by HWC emissions.

A combination of desktop evaluations using available maps/databases and GIS techniques was used to obtain site-specific values for each of these attributes. This section describes the approach used to select and delineate modeled waterbodies. In addition, the data sources and methodologies used in site-specific characterization of those modeled waterbodies are described.

2.1 Compilation of Study Area Data

Existing data layers were compiled to create a single comprehensive map for each study area. These maps, which were generated with the GIS tools, were called "compilation maps." They were used to (1) select waterbodies for inclusion in the study and (2) delineate their associated watersheds. These 17 x 17 inch color maps were generated using an automated batch script that started with the point coverage of the site's assumed location and then added the following map layers:

Sector boundaries: generated previously with an automated batch script.

RF3 data: EPA stream reach files (U.S. EPA, 1994) generated from 1:100,000 scale USGS digital line graphs (DLGs)

Drinking Water Supply Sites: Supplied from the BASINS CD-ROM database (Laveck and Coombs, 1996)

Stream Gaging Stations: Obtained from the BASINS CD-ROM and WATSTORE databases (USGS, 1994)

Pseudo drainage basin lines: generated from 1:250,000 Digital Elevation Model (DEM) coverages obtained from USGS. (A DEM consists of an array of elevation values for ground positions that are usually at regularly spaced intervals.)

2.2 Waterbody Selection

The following criteria were used to select modeled waterbodies/watersheds for inclusion in the HWC risk analysis:

Probable impact from facility emissions: Those waterbodies located in the direction of prevalent winds and relatively close to the HWC facility were favored in selecting waterbodies for modeling to ensure that risks generated for study areas included heavily impacted waterbodies.

Probable recreational use (including fishing): Although it is difficult to determine patterns of recreational use at waterbodies from the maps used in selecting modeled waterbodies, characteristics suggestive of recreational use (e.g., larger waterbody size, location in favorable land-use areas, and good public access as determined from road and parking lot patterns) were considered in selecting waterbodies for inclusion in the HWC risk analysis.

Drinking water source: Priority was given to waterbodies identified as drinking water sources. If several drinking water sources were identified for a given study area, priority was given to the one likely to be impacted to a greater extent by HWC emissions due to its location.

In general, the waterbodies selected for modeling favor those located in areas more heavily impacted by HWC emissions and do not represent a random sample that can be considered representative of all waterbodies located across the study areas. There is, however, an important caveat to this general statement. In selecting waterbodies for a given study area, often a different waterbody was selected to match each of the three criteria listed above (e.g., waterbody A may be selected from a more impacted location within the study area; waterbody B may be selected because it looked like a probable recreational location; and waterbody C may be selected because it was the drinking water source closest to the facility). Because all three criteria are considered in selecting waterbodies for inclusion in the HWC risk analysis, the waterbodies that are selected do not always represent those waterbodies most impacted by HWC emissions. In certain instances, the goal of including a drinking water source, or a waterbody that looked as a likely location of recreational activity, resulted in the exclusion of a more heavily impacted waterbody.

2.3 Watershed Delineation

The compilation maps and U.S. Geological Survey (USGS) 7.5 minute 1:24,000 scale quadrangle maps were used to delineate the watersheds for the selected waterbodies. The following delineation protocol was applied to each selected waterbody:

Watershed boundaries were delineated by starting at the farthest downstream point of the selected stream (or outlet of the selected lake) that was still within the 20-km radius. A line was then drawn perpendicular to the topographic contour lines upgradient from that point. This line was extended until it reached the point at which the elevation ceased to increase or until it intersected with the radius. Then, starting again from the farthest downstream point, a line was drawn (in the opposite direction) perpendicular to the contour lines until the elevation ceased to increase. The endpoints of these two lines were connected through the peaks and ridges on the map or along the radius, whichever covered less area.

Only the watershed area that drains into the selected waterbody **before** the waterbody flows out of the 20-km study area was included. If a tributary to the selected waterbody merged with the waterbody downstream of the study area, the area that drained to this tributary was not included in the watershed area.

No watershed area that lies outside of the radius was included. Because we are only interested in the 20-km study area, the radius acts as a cutoff point for watershed delineation.

Only the main stem for the selected streams (i.e., no tributaries) and waterbody surface areas for lakes and reservoirs were drawn in.

Arcs (lines) and polygons were digitized manually with a standard digitizing tablet and ARC/INFO workstation. Lakes and watershed polygons were labeled with name and site identification. Stream/river lines were labeled with name, width, and site identification. Stream coverages were processed in a program that changed the line coverage into a polygon coverage based on each stream's width.

Watershed delineation and digitization allowed for collection of the necessary model input parameters. Watershed area, stream length, and waterbody area values were extracted from the data tables associated with the digitized coverages.

Quality control measures were taken on each major step of the delineation process. A quality control check was completed after manual delineation to ensure correct watershed delineation and on the completed GIS coverages to ensure correct translation of watershed area and other parameters.

2.3 Waterbody Characterization

Hydrologic Parameters

Parameters that were required for the model but were not supplied by watershed delineation were stream/river velocity, discharge, width, and depth. BASINS Reach Files Version 1 (RF1) was queried by region for the selected waterbodies. Most of the selected waterbodies were listed, with all of the necessary parameter values. Many of the waterbodies had multiple data sets associated with different locations along the waterbody. If there was more than one valid datapoint, the most inclusive data were selected; thus, dilution effects from all tributaries were included.

If the waterbody did not appear in the RF1 tables, the BASINS Stream Gaging File was queried. This file only provides values for waterbodies' discharges. The discharge value was then entered into three equations derived from Keup (1985): Velocity = $1.0662x^{0.127}$, Width = $5.1867x^{0.4559}$, Depth = $0.1808x^{0.4171}$ where x is the discharge value.

If a discharge value for a particular waterbody was not available in BASINS Stream Gaging File, the USGS WATSTORE database was queried. If a value was available, it was used to estimate the velocity, width, and depth of the waterbody using the three equations from Keup (1985).

If no discharge data were available, the parameter estimations were derived from stream order using RF3 maps or preferably 1:24,000 USGS quad maps. Strahler's stream order classification system was used to order the selected streams. The stream order (1-10) was used in Keup's table (Keup, 1985) to estimate values for discharge, velocity, width, and depth.

3.0 Establishing Air Concentration/Deposition Values for Sectors and Waterbodies/ Watersheds within Study Areas

After the waterbodies/watersheds selected for inclusion in the HWC risk analysis were integrated into the GIS platform (after being delineated and digitized), the results of air modeling runs were used to generate air concentration/deposition values for those waterbodies. Similarly, the results of the air modeling runs were used to generate air concentration/deposition values for the 16 sectors located within each of the study areas. This section describes the methodology used to establish air concentration/deposition values for both the modeled waterbodies/watersheds and the sectors.

3.1 Waterbodies/Watersheds

Air concentration and deposition values and coordinates were provided by the ISCST3 model in the form of ASCII files labeled individually by site and concentration type:

AV	=	Air concentration of vapors
CDP	=	Combined deposition of particles
WDV	=	Wet deposition of vapors
VHG	=	Air concentration of elemental mercury vapor
VHG2	=	Air concentration of divalent mercury vapor
WVHG	=	Wet deposition of elemental mercury vapor
WVHG2	=	Wet deposition of divalent mercury vapor.

In an automated batch program, the ASCII files were converted from a polar array of values into an evenly spaced grid of concentration values centered around the center of the polar grid. The program then individually overlaid the watershed and waterbody polygons with this grid and averaged the overlapping points. These **mean** concentration values and their associated watershed/waterbody names are the output of the program and represent the average air concentrations and deposition values falling within that particular waterbody or watershed.

3.2 Sectors within Study Areas

Air concentration averages by sector were generated much in the same way as the watershed/waterbody averages. Air concentrations and deposition values of the following types were provided by the ISCST3 model in the form of ASCII files:

AP	=	Air concentration of particles
AV	=	Air concentration of vapors
CDP	=	Combined deposition of particles
DDP	=	Dry deposition of particles
WDP	=	Wet deposition of particles
WDV	=	Wet deposition of vapors
VHG	=	Air concentration of elemental mercury vapor
VHG2	=	Air concentration of divalent mercury vapor
WVHG	=	Wet deposition of elemental mercury vapor
WVHG2	=	Wet deposition of divalent mercury vapor.

The polar array of concentration values from the ISCST3 model were converted from an ASCII list into a point coverage. One of the main tasks of the AML program was to convert the polar array of point concentration values to an evenly spaced grid of points for more accurate spatial analysis. This grid point coverage was then overlaid with the sector coverage. Sector coverages for each site had been created previously with another AML and were in the form of polygon coverages. Concentration point values within each sector were averaged to determine mean emission concentration per sector. Output from this program was an ASCII file with a list of site identification numbers, sector numbers, and concentration averages. These average concentration values represent the average air concentration and deposition values falling within that particular sector.

4.0 Generating Spatially Averaged Sector-Level Human and Livestock Populations

Human population estimates were used to generate both cancer and noncancer estimates for local populations (i.e., those human populations living within study areas). Livestock population estimates were used to project statistical cancer incidence within the general population (i.e., the human population located across the United States) resulting from the ingestion of agricultural commodities that are produced within study areas and impacted by dioxin released from HWC facilities but distributed nationally for consumption. This section describes the data sources and methodologies used to generate the sector-level human and livestock population estimates that are used in the HWC risk analysis.

4.1 Human Receptor Populations

The projection of human receptor populations at the sector level involves using both 1990 U.S. Census (U.S. Department of Commerce, 1990) block-group-level data (U.S. Census data) and 1987/1992 Census of Agriculture (U.S. Department of Commerce, 1987 and 1992) county-level data (Census of Agriculture data).[2] The U.S. Census provides detailed population density data, which is broken down into the number of *total persons* and the number of *persons in rural area on farm*.[3] However, the U.S. Census does not provide a detailed breakdown of the type of agricultural activity for individuals or families (e.g., how many beef cattle farm families or dairy farm families are present in a given census block). Therefore, county-level Census of Agriculture data, which do contain detailed agricultural activity data at the farm-level, were used.

Because individual U.S. Census block groups often do not correspond exactly to the shape of individual sectors within a given study area (e.g., some census blocks may overlap several sectors while others are contained completely within a given sector), it is often necessary to apportion a given census block group's population between several sectors. The assumption was made in the HWC risk analysis that the U.S. Census block group populations are evenly distributed within each census block. Therefore, the proportion of a census block group that lies

---

[2] The Census of Agriculture county level data are collected on a 5-year cycle. The most recent collection efforts (1987 and 1992) did not include 1990, the year when the most recent U.S. Census data were published. Therefore, to match the U.S. Census data with the Census of Agriculture data, with regard to year of coverage, Census of Agriculture data from 1987 (U.S. Department of Commerce, 1987) were averaged together with Census of Agriculture data from 1992 in order to represent 1990.

[3] The HWC risk analysis estimates risks for four separate age groups for each receptor population (0-5 yr, 6-11 yr, 12-19 yr, and >19 yr). Therefore, U.S. Census data, for both total persons and persons in rural area on farms, were obtained for each of these four age groups.

within a given sector can be used to determine the proportion of that census block's population that should be apportioned to that sector

County-level Census of Agriculture data then were used to further differentiate sector population estimates for total farmers (differentiated into four age groups) into estimates for specific farmer receptor populations (e.g., to convert the number of farmers >19 years of age in a given sector into the number of beef cattle farmers >19 years of age or the number of dairy cattle farmers >19 years of age). Because Census of Agriculture data are only available at the county level and not at the smaller scale block level, the assumption was made that the ratios of *specific farm type* to *total farms* at the county level applied uniformly across the entire county. This assumption allowed the trends in specific farm family ratios (e.g., the percentage of farm families that are dairy farm families) to be applied to all sectors that fall within a given county. When a given sector extended across more than one county, the specific farm family ratios from the different counties were apportioned based on the area proportion of the sector that each county overlapped. Unlike the farmers, the numbers of residents estimated for each sector were not differentiated further using Census of Agriculture data, but were broken down into residents and home gardeners using the assumption that a certain percentage of residents are home gardeners. As with the farmer receptors, both the residents and home gardeners included population estimates for the four age groups of interest.

The following U.S. Census and Census of Agriculture data categories were used to differentiate specific receptor populations:

- **Residents***:* U.S. Census data were used to estimate the number of residents in each of the four age groups of interest. These data were also used to estimate the number of farmer individuals in each of the four age groups. As described earlier, the estimated number of individuals on farms forms the basis of the receptor population estimates made for each of the specific farmer-receptor populations listed below. Home gardener estimates were based on the sector-specific numbers generated for the resident receptors.

- **Beef cattle farmers:** The total number of individuals on farms, obtained from the U.S. Census data, was adjusted by the ratio of beef farms to total farms obtained from county-level Census of Agriculture data. The specific Census of Agriculture data category used to represent beef farmers is "beef cows (farms)" obtained from Table 1, County Summary Highlights.

- **Dairy cattle farmers**: The total number of individuals on farms, obtained from the U.S. Census data, was adjusted by the ratio of dairy farms to total farms obtained from county-level Census of Agriculture data. The specific Census of Agriculture data category used to represent dairy farmers is "milk cows (farms)" obtained from Table 1, County Summary Highlights.

- **Hog farmers**: The total number of individuals on farms, obtained from the U.S. Census data, is adjusted by the ratio of hog farms to total farms obtained from county-level Census of Agriculture data. The specific Census of Agriculture data category used to represent hog farmers was “hog and pig inventory (farms)” obtained from Table 1, County Summary Highlights.

- **Produce farmers**: The total number of individuals on farms, obtained from the U.S. Census data, is adjusted by the ratio of produce farms to total farms obtained from county-level Census of Agriculture data. The produce receptor is intended to include all individuals engaged in raising exposed fruits/vegetables and root vegetables. Therefore, the following Census of Agriculture data categories were summed to obtain an estimate of the total number of farms raising these crops: “Irish potatoes (farms),” “Veg hv for sale (farms),” “Land in orchards (farms),” and “Dry edible beans, exc dry limas (farms).” Each of these data categories is found in Table 1, County Summary Highlights.

The sector-level estimates for each receptor population obtained using the methodologies detailed above are combined with sector-specific individual risk estimates for each receptor population to project population risks for a given study area.

4.2 Livestock Populations

The projection of livestock populations at the sector level also involves integrating U.S. Census block-group-level data with Census of Agriculture county-level data. The U.S. Census data provide detailed estimates of the number of farms located within each sector. These sector-level estimates are then modified using adjustment factors derived from county-level Census of Agriculture data to estimate the total number of animals, for livestock species of interest, located within each sector.[4] The adjustment factors used were:

- *Proportion of total farms that are within each specific farm category*: This adjustment factor converts the sector-level total farm numbers into totals for each of the farm categories (e.g., beef farms and dairy farms).

- *Average number of animals located on a single farm*: This adjustment factor allows the number of farms within a given sector to be converted to number of animals for livestock categories of interest within a given sector.

The use of Census of Agriculture data in this manner assumes that trends in the county-level data hold across the entire county and therefore can be applied to all sectors falling within that county.

The assumption is also made that when a given U.S. Census block group falls within several sectors, the total number of farms within that block group can be apportioned to the different sectors based on the relative portion of that census block that falls within each sector. This assumption is the same as that used in projecting human receptor populations.

[4] The HWC risk analysis evaluates dioxin cancer risks to the general public from the ingestion of the following food commodities: pork, beef, and milk. Therefore, sector-level livestock population projections are completed for beef cattle, dairy cattle, and hogs.

As test cases were evaluated to determine the viability of the approach described here for projecting livestock populations, a compatibility issue between the U.S. Census data and the Census of Agriculture data surfaced. When the county-level totals for farms obtained from the U.S. Census data were compared to county-level totals obtained from Census of Agriculture data, the Census of Agriculture values were found to be consistently larger than the U.S. Census values. This difference results from the fact that the Census of Agriculture includes all farms, irrespective of whether there is a house located on the farm, while the U.S. Census data include only those farms containing houses. For the purposes of the HWC risk analysis, it is preferable to have sector-specific numbers for livestock that reflect the total number of farms and not only those farms that contain houses. Farms without houses would include many corporate farms, which can contribute significantly to the livestock population numbers. To reconcile this issue, the ratio of *housing units rural (farm)*, obtained from the county-level U.S. Census data, to *total farms*, obtained from the county-level Census of Agriculture data, was used to adjust the sector-specific estimates of total farm numbers. This ratio corrects for the fact that the U.S. Census data, which form the basis of the sector-level projections of total farms, do not include farms lacking houses.

The sector-level estimates for each livestock category obtained using the methodologies detailed above are combined with sector-specific dioxin concentrations for each livestock species to project the amount of diet-accessible dioxin produced within a given sector (i.e., the amount of dioxin contained in the commercial meats produced within a given sector during a modeling year). These data can then be combined with data from other sectors within a given combustor category to generate a total estimate of diet- accessible dioxin for that combustor category. This total is used in a statistical cancer incidence evaluation to determine the cancer risk to the general public resulting from the ingestion of commercial meat produced within the study areas for each combustor category.

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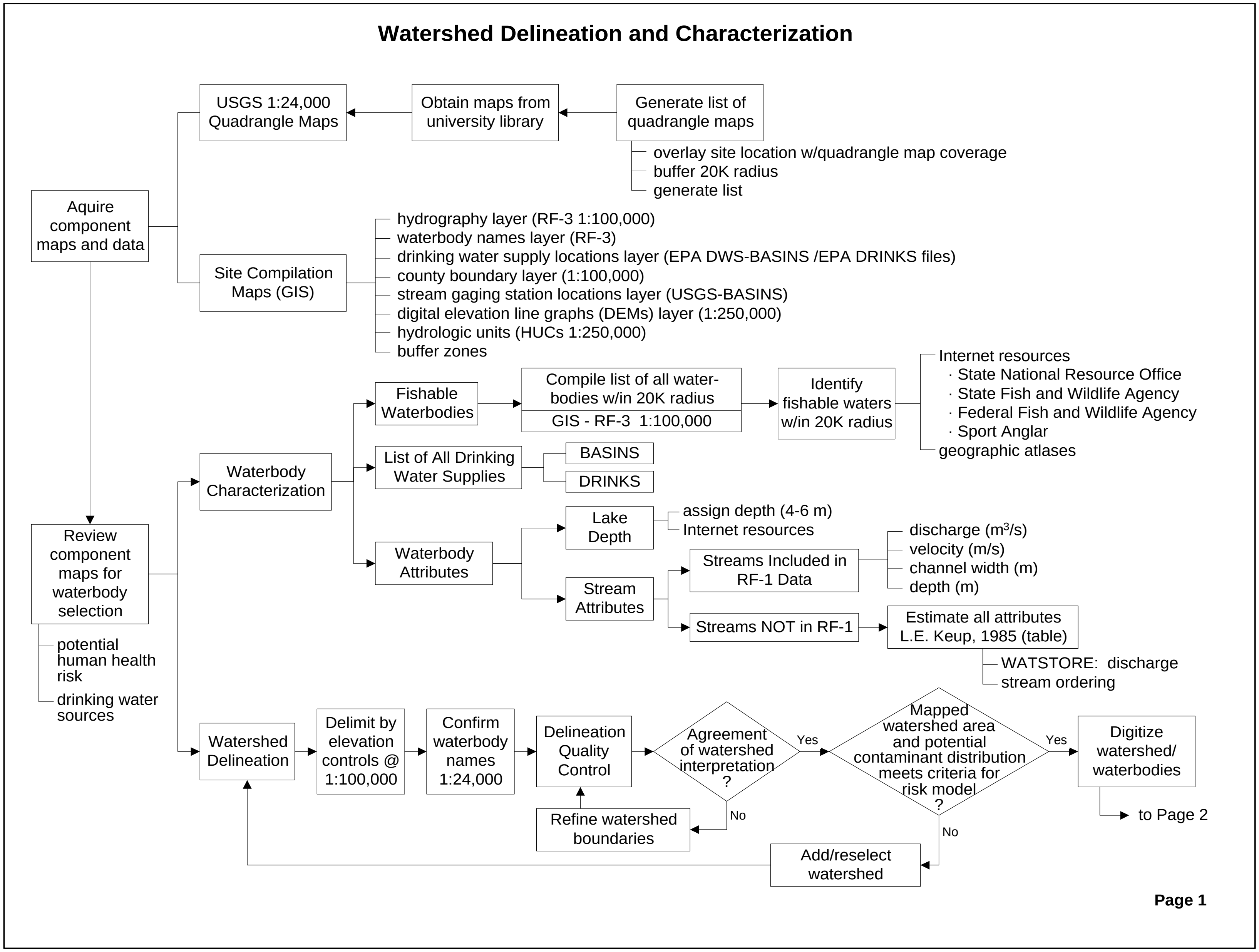
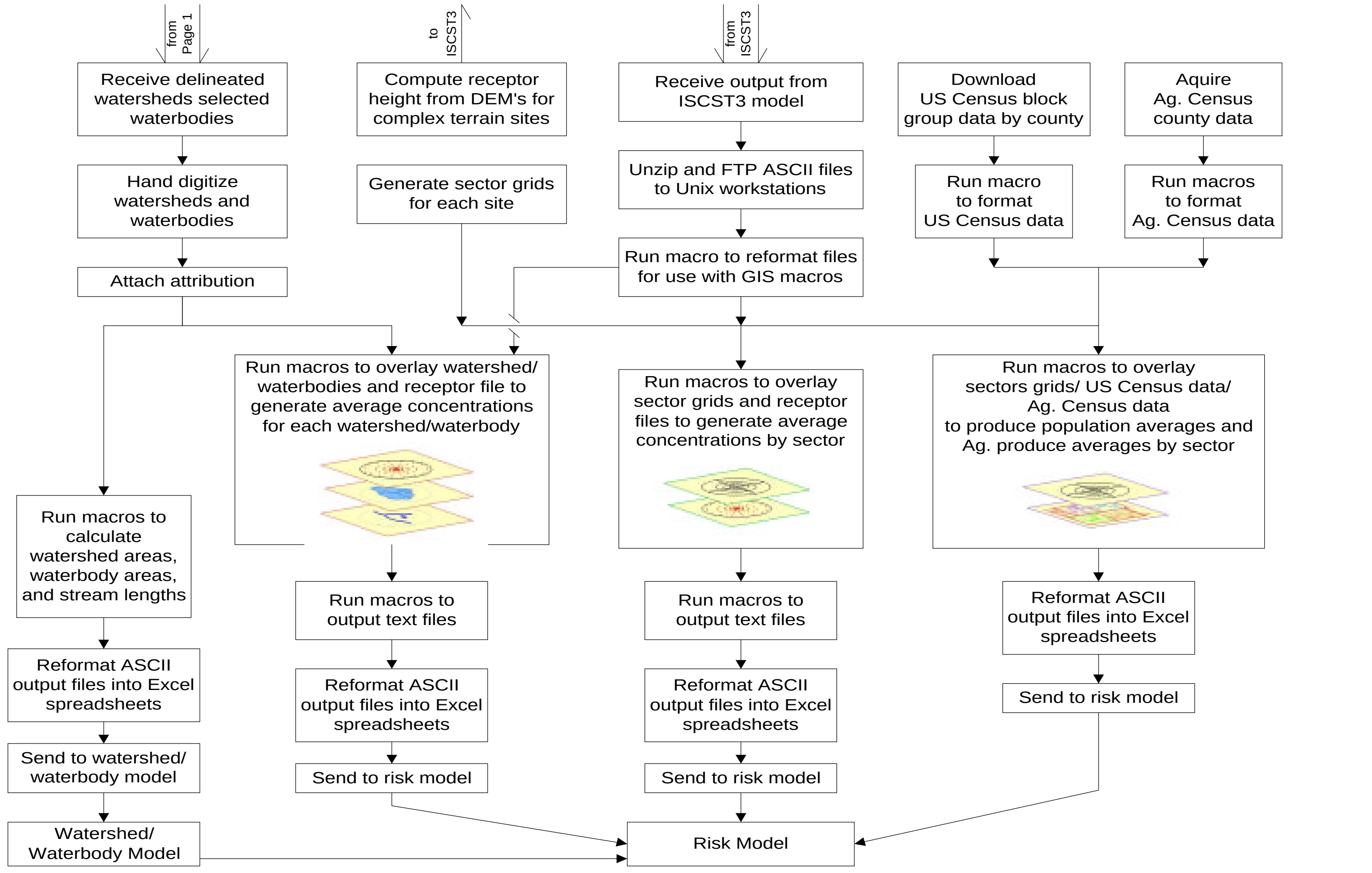
Watershed/waterbody Flowchart



GIS Processing Flowchart



GIS Data Used in the Risk Analysis for the HWC Final Rule

Section III.

Program code.

```
/*============================================================================
/*                     RESEARCH TRIANGLE INSTITUTE
/*                         CEMQA - GIS Program
/*                           P.O. Box 12194
/*                Research Triangle Park, NC  27709-2194
/*============================================================================
/*
/*      PROGRAM: gen_sector.aml
/*
/*      PURPOSE: given an x,y location and a name or number, this program
/*               generates a sector coverage.  Concentric circles at 5, 10, 15
/*               and 20K meters are generated along with dividers at every
/*               22.5 degrees.
/*
/*    INFO FILES NEEDED TO RUN:
/*
/*    CALLED BY: run_gen_sector.aml
/*
/*     CALLS TO:
/*
/* GLOBAL VAR'S:
/*
/*  INPUT FILES:
/*
/* OUTPUT FILES: sect_%site% coverage
/*
/*        NOTES:
/*
/*      HISTORY:
/*
/*      CONTACT: gtc@rti.org
/*
/*      PROJECT: HWC
/*
/*============================================================================

&args site x_cen y_cen

&if [null %y_cen%] &then
&return &inform Usage: gen_sector <site> <x_cen> <y_cen>

&if [exists sect_%site% -cover] &then
kill sect_%site% all
&if [exists sect_%site%c -cover] &then
kill sect_%site%c all

/* get into arcedit
display 9
arcedit

/* initialize original angle
&s ang = 0

createcover sect_%site% template
ef arc
arctype line
```

```
/* generate lines

&do i := 1 &to 4 &by 1
coord keyboard
add
2,%x_cen%,%y_cen%
2,%x_cen%,%y_cen%
[unquote '']

coord keyboard polar
add
2,0,0
2,[calc %ang% + 90],20000
9

&s ang = %ang% + 90

&end

/* generate circles
coord key
add
2,%x_cen%,%y_cen%
2,%x_cen%,%y_cen%
9

arctype circle
coord keyboard

&do radius &list 2000 5000 10000 20000

add
2,%x_cen%,%y_cen%
2,%x_cen%,[calc %y_cen% + %radius%]
9

&end

save

/* quite from arcedit
quit

/* clean the coverage
clean sect_%site% sect_%site%c 0 .1

/* createlabels
createlabels sect_%site%c 0
build sect_%site%c

/* clean up coverages
kill sect_%site% all
rename sect_%site%c sect_%site%
additem sect_%site%.pat sect_%site%.pat name 3 3 I
&data arc info
    ARC
    SEL SECT_[translate %site%].PAT
```

```
    CALC  NAME = SECT_[translate %site%]-ID
    Q STOP
&end

&return
/*
```

```
/*==============================================================================
/*                      RESEARCH TRIANGLE INSTITUTE
/*                          CEMQA - GIS Program
/*                            P.O. Box 12194
/*                 Research Triangle Park, NC  27709-2194
/*==============================================================================
/*
/*      PROGRAM: sector_pop.aml
/*
/*      PURPOSE: identifies which counties touch the 20K buffer around
/*               each site, does a union of the sector and the county,
/*               then sums up the population within each sector...
/*
/*    INFO FILES NEEDED TO RUN:
/*
/*    CALLED BY:
/*
/*     CALLS TO:
/*
/* GLOBAL VAR'S:
/*
/*  INPUT FILES:
/*
/* OUTPUT FILES: SECT_POP.TXT
/*
/*        NOTES:
/*
/*      HISTORY:
/*
/*      CONTACT: gtc@rti.org
/*
/*      PROJECT: HWC
/*
/*==============================================================================
/* sector_pop.aml

/* identifies which counties touch the 20K buffer around
/* each site, does a union of the sector and the county,
/* then sums up the population within each sector...

&s cntypath  /files8/p6720-005/census /* path to the county coverages...
&s sites /files8/p6720-005/sectors/sitesall

/* go through the sites coverage one site at a time...

cursor cur1 declare %sites% point ro /* rtp-id = '468'
cursor cur1 open


&do &while %:cur1.aml$next%

/* for each site, find the counties that overlay it and run the analysis...
&s rtp-id = %:cur1.rtp-id%

&call getcounties

cursor cur1 next  /* go to the next site...
```

```
&end


/*  ROUTINE getcounties*****************************************
&routine getcounties

&s counter = 1  /* first time for this site...

/* for each site, do the overlay for the county that touches the site....
display 0
arcplot

/* use arcplot reselect to get the list of counties..
reselect /files/base/us-county poly overlap ../secti_%rtp-id%  poly

cursor county declare /files/base/us-county poly ro
cursor county open

&s num = 1
&do &while %:county.aml$next%

/* find out if the fips code needs a leading '0'
&if [length  %:county.fips%] = 4 &then
&s fips%num% 0%:county.fips%
&else
&s fips%num% %:county.fips%

&s high = %num%

&s num = %num% + 1

cursor county next
&end

quit /* out of arcplot

     &call overlay  /* call the overlay for this sector/county combo...
     &call sumpop  /* call the routine that sums up pop for each county...


&return
/*************************************************************************
/* overlay the identified county coverage on the sites polygons
&routine overlay

&do i := 1 &to %high%  &by 1

&if [exists xx[value fips%i%]%rtp-id% -cover] &then
kill xx[value fips%i%]%rtp-id% all

&if [exists %cntypath%/bg9[value fips%i%] -cover] &then
&do
union %cntypath%/bg9[value fips%i%] ../secti_%rtp-id% xx[value fips%i%]%rtp-id%

/* perform the calculations
```

```
additem xx[value fips%i%]%rtp-id%.pat xx[value fips%i%]%rtp-id%.pat p0010001b 4
12 f 3
additem xx[value fips%i%]%rtp-id%.pat xx[value fips%i%]%rtp-id%.pat p0060003b 4
12 f 3
additem xx[value fips%i%]%rtp-id%.pat xx[value fips%i%]%rtp-id%.pat p0780009b 4
12 f 3
additem xx[value fips%i%]%rtp-id%.pat xx[value fips%i%]%rtp-id%.pat h0010001b 4
12 f 3
additem xx[value fips%i%]%rtp-id%.pat xx[value fips%i%]%rtp-id%.pat h0050003b 4
12 f 3

/* copy the .pat from the original county coverage for the relate processing...
&if [exists bg9[value fips%i%].tmp -info] &then
&s d [delete bg9[value fips%i%].tmp -info]

copyinfo %cntypath%/bg9[value fips%i%].pat bg9[value fips%i%].tmp

/* do a frequency on the original block groups so we have just one population
/* value for each block group...
&if [exists bg9[value fips%i%].frq -info] &then
&s d [delete bg9[value fips%i%].frq -info]

frequency /files8/p6720-005/census/bg9[value fips%i%].pat bg9[value fips%i%].frq
stcntrbg
p0010001
p0060003
p0780009
h0010001
h0050003
end
area
end


&data arc info
ARC
SEL XX[value FIPS%i%][translate %RTP-ID%].PAT
RESELECT LAND/WATER = 'L'
RELATE BG9[value FIPS%i%].TMP 1 BY BG9[value FIPS%i%]# ordered
RELATE BG9[value FIPS%i%].FRQ 2 by $1STCNTRBG ordered
CALCULATE P0010001B = $2P0010001 * ( AREA / $2AREA )
CALCULATE P0060003B = $2P0060003 * ( AREA / $2AREA )
CALCULATE P0780009B = $2P0780009 * ( AREA / $2AREA )
CALCULATE H0010001B = $2H0010001 * ( AREA / $2AREA )
CALCULATE H0050003B = $2H0050003 * ( AREA / $2AREA )
Q STOP
&end

/* delete the copy of the original county .pat file...
&s d [delete bg9[value fips%i%].tmp -info]

/* delete the frequency file of block groups...
&s d [delete bg9[value fisp%i%].frq -info]

/* now do a frequency to get population by sector...

&if [exists secti_%rtp-id%.frq%i% -info] &then
```

```
&s d [delete secti_%rtp-id%.frq%i% -info]

frequency xx[value fips%i%]%rtp-id%.pat secti_%rtp-id%.frq%i%
secti_%rtp-id%-id
end
p0010001b
p0060003b
p0780009b
h0010001b
h0050003b
end

/* end the if statement for if there is a county coverage
&end

/* kill the temporary overlaid coverage
&if [exists xx[value fips%i%]%rtp-id% -cover] &then
kill xx[value fips%i%]%rtp-id% all


/* end the do loop
&end


/* go to the next county that touches the sectors
&return

/*********************************************
&routine sumpop

/* make a final version for frequency...
&if [exists secti_%rtp-id%.frq -info] &then
&s d [delete secti_%rtp-id%.frq -info]


copyinfo secti_%rtp-id%.frq1 secti_%rtp-id%.frq

&s rtp-id = [translate %rtp-id%]

&data arc info
ARC
SEL SECTI_%RTP-ID%.FRQ
PURGE
Y
Q STOP
&end

&do i := 1 &to %high% &by 1

  &data arc info
  ARC
  SEL SECTI_%RTP-ID%.FRQ%I%
  MERGE INTO SECTI_%RTP-ID%.FRQ SECTI_%RTP-ID%-ID
  Q STOP
  &end

&end
```

```
/* now do the final frequency
&if [exists secti_%rtp-id%.frqfinal -info] &then
&s d [delete secti_%rtp-id%.frqfinal -info]

frequency secti_%rtp-id%.frq secti_%rtp-id%.frqfinal
secti_%rtp-id%-id
end
p0010001b
p0060003b
p0780009b
h0010001b
h0050003b
end

/* output the ascii file
&sys touch /files8/p6720-005/sectors/sector_pop/sect_pop.txt
&sys echo %rtp-id% >> /files8/p6720-005/sectors/sector_pop/sect_pop.txt

&data arc info
ARC
SEL SECTI_%RTP-ID%.FRQFINAL
RESELECT $RECNO GT 1
OUTPUT ../SECT_POP.TXT APPEND
DISPLAY SECTI_%RTP-ID%-ID, P0010001B, P0060003B, P0780009B, H0010001B, H0050003B
PRINT
Q STOP
&end

&return  /* end of routine
```

```
/*===========================================================================
/*                      RESEARCH TRIANGLE INSTITUTE
/*                          CEMQA - GIS Program
/*                            P.O. Box 12194
/*                 Research Triangle Park, NC  27709-2194
/*===========================================================================
/*
/*      PROGRAM: ag_pop.aml
/*
/*      PURPOSE: calculates population and ag numbers for sites
/*
/*    INFO FILES NEEDED TO RUN:
/*
/*    CALLED BY:
/*
/*     CALLS TO:
/*
/* GLOBAL VAR'S:
/*
/*  INPUT FILES:
/*
/* OUTPUT FILES: AG_INFO.TXT
/*
/*        NOTES:
/*
/*      HISTORY:
/*
/*      CONTACT: gtc@rti.org
/*
/*      PROJECT: HWC
/*
/*===========================================================================


&args listfile

&s cntypath  /files8/p6720-005/census /* path to the county coverages...
&s sites /files8/p6720-005/new_sectors/remodel
&s sectors /files8/p6720-005/new_sectors /* path of sector coverages

&s infile [open %listfile% openstatus -read]

/* Check for errors with text file
&if %openstatus% <> 0 &then
    &return &warning Error opening file.

&s sitelist = [read %infile% readstatus]
&do &while %readstatus% = 0
    &s sitelist = %sitelist% [read %infile% readstatus]
&end

/* go through the sites list one site at a time...

&do rtp-id &list %sitelist%
   &type %rtp-id%

&if [length %rtp-id%] eq 0 &then
```

```
     &return &type 'all done.'

/* for each site, find the counties that overlay it and run the analysis...

&call getcounties

&end
&return

/*  ROUTINE getcounties*****************************************
&routine getcounties

&s counter = 1  /* first time for this site...

/* for each site, do the overlay for the county that touches the site....
display 0
arcplot

/* use arcplot reselect to get the list of counties..
reselect /files/base/us_covers/us_cnty_alb83 poly overlap %sectors%/secti_%rtp-
id%  poly

&sv fips_list = [listunique /files/base/us_covers/us_cnty_alb83 -poly fips]

quit /* out of arcplot

/*&do fip &list %fips_list%
/*&if %fip% = 18119 or %fip% = 26149 or %fip% = 37131 or %fip% = 45027 &then
/*  &do
/*   &sys touch warning.txt
/*   &sys echo "Please re-do this site:" >> warning.txt
/*   &sys echo %rtp-id% >> warning.txt
/*   &return
/*  &end
/*&end

&sys touch /files8/p6720-005/census/fips.txt
&sys echo %rtp-id% >> /files8/p6720-005/census/fips.txt
&sys echo %fips_list% >> /files8/p6720-005/census/fips.txt

     &call overlay  /* call the overlay for this sector/county combo...
     &call sumpop  /* call the routine that sums up pop for each county...


&return
/***********************************************************************
/* overlay the identified county coverage on the sites polygons
&routine overlay

&s i = 0
&do fips &list %fips_list%

&s i = %i% + 1

&if [length  %fips%] = 4 &then
&s fips 0%fips%
&else
```

```
&s fips %fips%

&if [exists xx%fips%%rtp-id% -cover] &then
kill xx%fips%%rtp-id% all

&sys echo %fips%
&s st [substr %fips% 1 2]

&if %st% lt 25 &then &s cntypath = /files8/p6720-005/census/county1
&else &s cntypath = /files8/p6720-005/census/county2

&if [exists %cntypath%/bg9%fips% -cover] &then
&do
union %cntypath%/bg9%fips% %sectors%/secti_%rtp-id% xx%fips%%rtp-id%

/* perform the calculations

joinitem xx%fips%%rtp-id%.pat template.dat ~
xx%fips%%rtp-id%.pat $recno land/water

/* copy the .pat from the original county coverage for the relate processing...
&if [exists bg9%fips%.tmp -info] &then
&s d [delete bg9%fips%.tmp -info]

copyinfo %cntypath%/bg9%fips%.pat bg9%fips%.tmp

/* do a frequency on the original block groups so we have just one population
/* value for each block group...
&if [exists bg9%fips%.frq -info] &then
&s d [delete bg9%fips%.frq -info]

&sv alllist = 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22
~
 23 24 25 26 27 28 29 30 31
&sv tlist = 02 03 04 05 06 07 08 09 10 11 12 13 14

frequency %cntypath%/bg9%fips%.pat bg9%fips%.frq
stcntrbg
p0010001
p0060003
p0780009
h0010001
h0050003
&do t &list %alllist%
p01300%t%
&end
end
area
end

&s st [substr %fips% 1 2]
&s cny [substr %fips% 3 3]
&sys echo %st%
&sys echo %cny%
&sv jlist = 39 40 41 42 43 44 45 46 47 48 49 50
additem xx%fips%%rtp-id%.pat xx%fips%%rtp-id%.pat farm_rat 8 12 f 4
```

```
&data arc info
ARC
SEL AG3.DAT
RESELECT ST = [QUOTE %st%] AND COU = [QUOTE %cny%]
CALC $NUM1 = R_TOTFARM
CALC $NUM2 = R_39_1
CALC $NUM3 = R_41_1
CALC $NUM4 = R_43_1
CALC $NUM5 = R_45_1
CALC $NUM6 = R_47_1
CALC $NUM7 = R_49_1
CALC $NUM8 = R_40_39
CALC $NUM9 = R_42_41
CALC $NUM10 = R_44_43
CALC $NUM11 = R_46_45
CALC $NUM12 = R_48_47
CALC $NUM13 = R_50_49
SEL XX%fips%[translate %RTP-ID%].PAT
RESELECT LAND/WATER = 'L'
RELATE BG9%fips%.TMP 1 BY BG9%fips%# ordered
RELATE BG9%fips%.FRQ 2 by $1STCNTRBG ordered
CALC P0010001B = $2P0010001 * ( AREA / $2AREA )
CALC P0060003B = $2P0060003 * ( AREA / $2AREA )
CALC P0780009B = $2P0780009 * ( AREA / $2AREA )
CALC H0010001B = $2H0010001 * ( AREA / $2AREA )
CALC H0050003B = $2H0050003 * ( AREA / $2AREA )
SEL XX%fips%[translate %RTP-ID%].PAT
CALC FARM_RAT = 0
RESELECT P0010001B GT 0
CALC FARM_RAT = P0060003B / P0010001B
SEL XX%fips%[translate %RTP-ID%].PAT
RESELECT LAND/WATER = 'L'
RELATE BG9%fips%.TMP 1 BY BG9%fips%# ordered
RELATE BG9%fips%.FRQ 2 by $1STCNTRBG ordered
&do z &list %alllist%
CALC P13%Z% = $2P01300%Z% * ( AREA / $2AREA )
&end
&do z &list %alllist%
CALC P13%Z%F = P13%Z% * FARM_RAT
&end
&do z &list %alllist%
CALC P13%Z%C = P13%Z%F * $NUM2
&end
&do z &list %alllist%
CALC P13%Z%B = P13%Z%F * $NUM3
&end
&do z &list %alllist%
CALC P13%Z%M = P13%Z%F * $NUM4
&end
&do z &list %alllist%
CALC P13%Z%P = P13%Z%F * $NUM6
&end
CALC TOT_FARM = H0050003B * $NUM1
CALC AG39 = TOT_FARM * $NUM2
CALC AG40 = TOT_FARM * $NUM8
CALC AG41 = TOT_FARM * $NUM3
CALC AG42 = TOT_FARM * $NUM9
```

```
CALC AG43 = TOT_FARM * $NUM4
CALC AG44 = TOT_FARM * $NUM10
CALC AG45 = TOT_FARM * $NUM5
CALC AG46 = TOT_FARM * $NUM11
CALC AG47 = TOT_FARM * $NUM6
CALC AG48 = TOT_FARM * $NUM12
CALC AG49 = TOT_FARM * $NUM7
CALC AG50 = TOT_FARM * $NUM13
Q STOP
&end

/* delete the copy of the original county .pat file...
&s d [delete bg9%fips%.tmp -info]

/* delete the frequency file of block groups...
&s d [delete bg9%fips%.frq -info]

/* now do a frequency to get population by sector...

&if [exists secti_%rtp-id%.frq%i% -info] &then
&s d [delete secti_%rtp-id%.frq%i% -info]
&if [exists secti_%rtp-id%.frqf%i% -info] &then
&s d [delete secti_%rtp-id%.frqf%i% -info]
&if [exists secti_%rtp-id%.frq2f%i% -info] &then
&s d [delete secti_%rtp-id%.frq2f%i% -info]

frequency xx%fips%%rtp-id%.pat secti_%rtp-id%.frq%i%
secti_%rtp-id%-id
end
p0010001b
p0060003b
p0780009b
h0010001b
h0050003b
&do z &list %alllist%
p13%z%
&end
&do z &list %alllist%
p13%z%f
&end
tot_farm
ag39
ag40
ag41
ag42
ag43
ag44
ag45
ag46
ag47
ag48
ag49
ag50
end

frequency xx%fips%%rtp-id%.pat secti_%rtp-id%.frqf%i%
secti_%rtp-id%-id
```

```
end
&do z &list %alllist%
p13%z%c
&end
&do z &list %alllist%
p13%z%b
&end
end

frequency xx%fips%%rtp-id%.pat secti_%rtp-id%.frq2f%i%
secti_%rtp-id%-id
end
&do z &list %alllist%
p13%z%m
&end
&do z &list %alllist%
p13%z%p
&end
end


/* end the if statement for if there is a county coverage
&end

/* kill the temporary overlaid coverage
&if [exists xx%fips%%rtp-id% -cover] &then
kill xx%fips%%rtp-id% all

/* end the do loop
&end

/* go to the next county that touches the sectors
&return

/*********************************************
&routine sumpop

/* make a final version for frequency...
&if [exists secti_%rtp-id%.frq -info] &then
&s d [delete secti_%rtp-id%.frq -info]

copyinfo secti_%rtp-id%.frq1 secti_%rtp-id%.frq

&if [exists secti_%rtp-id%.frqf -info] &then
&s d [delete secti_%rtp-id%.frqf -info]

copyinfo secti_%rtp-id%.frqf1 secti_%rtp-id%.frqf

&if [exists secti_%rtp-id%.frq2f -info] &then
&s d [delete secti_%rtp-id%.frq2f -info]

copyinfo secti_%rtp-id%.frq2f1 secti_%rtp-id%.frq2f

&s rtp-id = [translate %rtp-id%]

&data arc info
ARC
```

```
SEL SECTI_%RTP-ID%.FRQ
PURGE
Y
SEL SECTI_%RTP-ID%.FRQF
PURGE
Y
SEL SECTI_%RTP-ID%.FRQ2F
PURGE
Y
Q STOP
&end

&do i := 1 &to [token %fips_list% -count] &by 1

  &data arc info
  ARC
  SEL SECTI_%RTP-ID%.FRQ%I%
  MERGE INTO SECTI_%RTP-ID%.FRQ SECTI_%RTP-ID%-ID
  SEL SECTI_%RTP-ID%.FRQ%I%
  DELETE SECTI_%RTP-ID%.FRQ%I%
  Y
  SEL SECTI_%RTP-ID%.FRQF%I%
  MERGE INTO SECTI_%RTP-ID%.FRQF SECTI_%RTP-ID%-ID
  SEL SECTI_%RTP-ID%.FRQF%I%
  DELETE SECTI_%RTP-ID%.FRQF%I%
  Y
  SEL SECTI_%RTP-ID%.FRQ2F%I%
  MERGE INTO SECTI_%RTP-ID%.FRQ2F SECTI_%RTP-ID%-ID
  SEL SECTI_%RTP-ID%.FRQ2F%I%
  DELETE SECTI_%RTP-ID%.FRQ2F%I%
  Y
  Q STOP
  &end

&end

/* now do the final frequency
&if [exists secti_%rtp-id%.frqfinal -info] &then
&s d [delete secti_%rtp-id%.frqfinal -info]
&if [exists secti_%rtp-id%.frqfinalf -info] &then
&s d [delete secti_%rtp-id%.frqfinalf -info]
&if [exists secti_%rtp-id%.frqfinal2f -info] &then
&s d [delete secti_%rtp-id%.frqfinal2f -info]

frequency secti_%rtp-id%.frq secti_%rtp-id%.frqfinal
secti_%rtp-id%-id
end
p0010001b
p0060003b
p0780009b
h0010001b
h0050003b
&do i &list %alllist%
p13%i%
&end
&do i &list %alllist%
p13%i%f
```

```
&end
tot_farm
ag39
ag40
ag41
ag42
ag43
ag44
ag45
ag46
ag47
ag48
ag49
ag50
end

frequency secti_%rtp-id%.frqf secti_%rtp-id%.frqfinalf
secti_%rtp-id%-id
end
&do z &list %alllist%
p13%z%c
&end
&do z &list %alllist%
p13%z%b
&end
end

frequency secti_%rtp-id%.frq2f secti_%rtp-id%.frqfinal2f
secti_%rtp-id%-id
end
&do z &list %alllist%
p13%z%m
&end
&do z &list %alllist%
p13%z%p
&end
end


&sys touch ag_info.txt
&sys echo %rtp-id% >> ag_info.txt

/* output the ascii file
&data arc info
ARC
SEL SECTI_%RTP-ID%.FRQFINAL
RESELECT $RECNO GT 1
OUTPUT ../AG_INFO.TXT APPEND
DISPLAY SECTI_%RTP-ID%-ID, P0010001B, P0060003B, P0780009B, H0010001B,
H0050003B, TOT_FARM PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1301, P1302, P1303, P1304, P1305, P1306 PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1307, P1308, P1309, P1310, P1311, P1312 PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1313, P1314, P1315, P1316, P1317, P1318 PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1319, P1320, P1321, P1322, P1323, P1324 PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1325, P1326, P1327, P1328, P1329, P1330 PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1331, P1301F, P1302F, P1303F, P1304F, P1305F PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1306F, P1307F, P1308F, P1309F, P1310F, P1311F PRINT
```

```
DISPLAY SECTI_%RTP-ID%-ID, P1312F, P1313F, P1314F, P1315F, P1316F, P1317F PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1318F, P1319F, P1320F, P1321F, P1322F, P1323F PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1324F, P1325F, P1326F, P1327F, P1328F, P1329F PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1330F, P1331F, AG39, AG40, AG41, AG42 PRINT
DISPLAY SECTI_%RTP-ID%-ID, AG43, AG44,  AG45, AG46, AG47, AG48 PRINT
DISPLAY SECTI_%RTP-ID%-ID, AG49, AG50 PRINT
SEL SECTI_%RTP-ID%.FRQFINALF
RESELECT $RECNO GT 1
OUTPUT ../AG_INFO.TXT APPEND
DISPLAY SECTI_%RTP-ID%-ID, P1301C, P1302C, P1303C, P1304C PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1305C, P1306C, P1307C, P1308C, P1309C, P1310C PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1311C, P1312C, P1313C, P1314C, P1315C, P1316C PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1317C, P1318C, P1319C, P1320C, P1321C, P1322C PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1323C, P1324C, P1325C, P1326C, P1327C, P1328C PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1329C, P1330C, P1331C, P1301B, P1302B, P1303B PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1304B, P1305B, P1306B, P1307B, P1308B, P1309B PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1310B, P1311B, P1312B, P1313B, P1314B, P1315B PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1316B, P1317B, P1318B, P1319B, P1320B, P1321B PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1322B, P1323B, P1324B, P1325B, P1326B, P1327B PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1328B, P1329B, P1330B, P1331B PRINT
SEL SECTI_%RTP-ID%.FRQFINAL2F
RESELECT $RECNO GT 1
OUTPUT ../AG_INFO.TXT APPEND
DISPLAY SECTI_%RTP-ID%-ID, P1301M, P1302M PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1303M, P1304M, P1305M, P1306M, P1307M, P1308M PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1309M, P1310M, P1311M, P1312M, P1313M, P1314M PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1315M, P1316M, P1317M, P1318M, P1319M, P1320M PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1321M, P1322M, P1323M, P1324M, P1325M, P1326M PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1327M, P1328M, P1329M, P1330M, P1331M, P1301P PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1302P, P1303P, P1304P, P1305P, P1306P, P1307P PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1308P, P1309P, P1310P, P1311P, P1312P, P1313P PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1314P, P1315P, P1316P, P1317P, P1318P, P1319P PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1320P, P1321P, P1322P, P1323P, P1324P, P1325P PRINT
DISPLAY SECTI_%RTP-ID%-ID, P1326P, P1327P, P1328P, P1329P, P1330P, P1331P PRINT
Q STOP
&end

&if [exists secti_%rtp-id%.frq -info] &then
&s d [delete secti_%rtp-id%.frq -info]

&if [exists secti_%rtp-id%.frqf -info] &then
&s d [delete secti_%rtp-id%.frqf -info]

&if [exists secti_%rtp-id%.frq2f -info] &then
&s d [delete secti_%rtp-id%.frq2f -info]

&if [exists secti_%rtp-id%.frqfinal -info] &then
&s d [delete secti_%rtp-id%.frqfinal -info]
&if [exists secti_%rtp-id%.frqfinalf -info] &then
&s d [delete secti_%rtp-id%.frqfinalf -info]
&if [exists secti_%rtp-id%.frqfinal2f -info] &then
&s d [delete secti_%rtp-id%.frqfinal2f -info]


&return  /* end of routine
```

```
/*============================================================================
/*                     RESEARCH TRIANGLE INSTITUTE
/*                         CEMQA - GIS Program
/*                           P.O. Box 12194
/*                Research Triangle Park, NC  27709-2194
/*============================================================================
/*
/*      PROGRAM: sect_surf.aml
/*
/*      PURPOSE: sect_surf.aml generates a point coverage from a given
/*               ascii file containing  x,y, and z coordinates of the
/*               icf3 concentration data.  It then creates a TIN, converts
/*               the TIN to a lattice, creates a point coverage from the lattice
/*               and finally overlays the points into the sector coverage
/*               and calculates the average concentration by sector....
/*
/*    INFO FILES NEEDED TO RUN:
/*
/*    CALLED BY: run_sect_surf.aml
/*
/*     CALLS TO:
/*
/* GLOBAL VAR'S:
/*
/*  INPUT FILES:
/*
/* OUTPUT FILES: sect_%final%%type%.avg info file
/*
/*        NOTES:
/*
/*      HISTORY:
/*
/*      CONTACT: gtc@rti.org
/*
/*      PROJECT: HWC
/*
/*============================================================================

&args site site_x site_y /* site is the stack id of the site, file is the
/* ascii generate file...

&if [null %site_y%] &then
&return &inform Usage: sect_surf <site> <site_x> <site_y>

&s site [locase %site%]

&if ^ [exists plt_files/%site%ap.plt -file] &then
&return &inform Error:  No files for %site%.  Stopping Program.

/* do for each type of concentration...

&do type &list ap av cdp ddp wdp wdv vhg vhg2 wvhg wvhg2

/* master variables
&s file /files8/p6720-005/sectors/plt_files/%site%%type%.plt
&s ptcov [translate pt_%site%] /* coverage generated from ascii file
&s tin [translate tin_%site%] /* tin created from ptcov
```

```
&s lat [translate lat_%site%] /* lattice created from tin
&s icf3_cov [translate elev_%site%] /* point cover from latticespot
&s icf3_covnd [translate %icf3_cov%nd] /* the reselect for Non no-data values
&s sect [translate secti_%site%] /* the sector coverage
&s final [translate fin_%site%] /* the final coverage of points by sector

/* clean up anything left over from previous runs...
&if [exists %ptcov% -cover] &then
kill %ptcov% all

&if [exists %tin% -tin] &then
kill %tin% all

&if [exists %lat% -grid] &then
kill %lat% all

&if [exists %icf3_cov% -cover] &then
kill %icf3_cov% all

&if [exists %icf3_covnd% -cover] &then
kill %icf3_covnd% all

&if [exists %final% -cover] &then
kill %final% all

rm xx*

/* check to see if the sector coverage exists...
&if ^ [exists %sect% -cover] &then
&return &inform Error:  Sector coverage sect_%site% does not exist...

/* load the ascii file into INFO
&data arc info
    ARC
    SELECT %ptcov%.DAT
    ERASE %ptcov%.DAT
    Y
    DEFINE %ptcov%.DAT
    X-COORD,4,12,F,3
    Y-COORD,4,12,F,3
    ELEV,4,12,F,3

    ADD FROM %FILE%
    Q STOP
&end

/* add an id item to the file
additem %ptcov%.dat %ptcov%.dat  %ptcov%-id 4 5 b

/* calculate the record number into the site-id and outpu the generate file
&data arc info
    ARC
    SEL %ptcov%.DAT
    CALC %ptcov%-ID = $RECNO
    OUTPUT ../%ptcov%.GEN INIT
    CALC $COMMA-SWITCH = -1
    DISPLAY %ptcov%-ID,X-COORD,Y-COORD PRINT
```

```
    Q STOP
&end

/* generate the point coverage...
&severity &error &ignore
generate %ptcov%
input %ptcov%.gen
points
quit

/* build the .pat
build %ptcov% point

/* join the elevation coordinates onto the .pat
joinitem %ptcov%.pat %ptcov%.dat %ptcov%.pat %ptcov%-id %ptcov%-id ordered

/* transform the units into albers meters coordinates...

/* add four tics into the coverage using the relative units...
display 0
ae
graphics off
ec %ptcov% tics
select all
delete
calc $id = 1

coord key
add
3
1
1,-20000,-20000
3
2
1,-20000,20000
3
3
1,20000,20000
3
4
1,20000,-20000
[unquote '']

save /* save with the new tics
quit

/* copy the coverage into an empty version for the transform...
copy %ptcov% %ptcov%tr

/* update the tic coordinates with the albers meters coordinates for
/* the site...
&s llx [calc %site_x% - 20000]
&s lly [calc %site_y% - 20000]
&s ulx [calc %site_x% - 20000]
&s uly [calc %site_y% + 20000]
&s urx [calc %site_x% + 20000]
&s ury [calc %site_y% + 20000]
```

```
&s lrx [calc %site_x% + 20000]
&s lry [calc %site_y% - 20000]

&data arc info
ARC
SEL %PTCOV%TR.TIC
UPDATE XTIC, YTIC BY IDTIC PROMPT
1
%LLX%
%LLY%
2
%ULX%
%ULY%
3
%URX%
%URY%
4
%LRX%
%LRY%
[UNQUOTE '']

Q STOP
&end

/* now do the transform...
transform %ptcov% %ptcov%tr

/* kill the original coverage and rename the new one
kill %ptcov% all
rename %ptcov%tr %ptcov%

/* generate the tin
arctin %ptcov% %tin% point elev

/* create the lattice

tinlattice %tin% %lat% linear
[calc %site_x% - 20000] [calc %site_y% - 20000] /* lower left of lattice
[calc %site_x% + 20000] [calc %site_y% + 20000]  /* upper right of lattice
[unquote ''] /* blank for resolution
200 /* distance between mesh points

/* create a point coverage for use in the overlay
generate %icf3_cov%
fishnet
[calc %site_x% - 20000] [calc %site_y% - 20000]  /* lower left of grid
[calc %site_x% - 20000] [calc %site_y% - 10000]  /* coord on z-axis
200 200  /* distance between grids
200 200  /* number of grids in x and y
quit

/* create the point coverage from the nodes
/*build %icf3_cov% node
nodepoint %icf3_cov% %icf3_cov%p

/*  kill the grid coverage and rename the point coverage
kill %icf3_cov% all
```

```
rename %icf3_cov%p %icf3_cov%

/* do the latticespot command to get the concentrations at every
/* point in the point coverage
latticespot %lat% %icf3_cov%

/* reselect out only those points that are NOT NO DATA
reselect %icf3_cov% %icf3_covnd% point
reselect spot ge 0
[unquote '']
n
n
copy %icf3_covnd% test_705ap

/* now overlay the icf3_cov onto the sector coverage to find out
/* which points fall in each sector
intersect %icf3_covnd% %sect% %final% point

/* now calculate the average for each sector polygon
&if [exists %final%%type%.avg -info] &then
&s d [delete %final%%type%.avg -info]

statistics %final%.pat %final%%type%.avg %sect%-ID
mean spot
end

/* Output ascii files for each file and site...

/* clean up



/* clean up anything left over from previous runs...

&if [exists %ptcov% -cover] &then
kill %ptcov% all

&if [exists %tin% -tin] &then
kill %tin% all

&if [exists %lat% -grid] &then
kill %lat% all

&if [exists %icf3_cov% -cover] &then
kill %icf3_cov% all

&if [exists %icf3_covnd% -cover] &then
kill %icf3_covnd% all

&if [exists %final% -cover] &then
kill %final% all

rm xx*

&end
```

```
/*===========================================================================
/*                     RESEARCH TRIANGLE INSTITUTE
/*                         CEMQA - GIS Program
/*                           P.O. Box 12194
/*                 Research Triangle Park, NC  27709-2194
/*===========================================================================
/*
/*      PROGRAM: ws_surf.aml
/*
/*      PURPOSE: ws_surf.aml generates a point coverage from a given
/*               ascii file containing  x,y, and z coordinates of the
/*               icf3 concentration data.  It then creates a TIN, converts
/*               the TIN to a lattice, creates a point coverage from the lattice
/*               and finally overlays the points into the watershed coverage
/*               and calculates the average concentration by watershed...
/*
/*    INFO FILES NEEDED TO RUN:
/*
/*    CALLED BY: run_ws_surf.aml
/*
/*     CALLS TO:
/*
/* GLOBAL VAR'S:
/*
/*  INPUT FILES:
/*
/* OUTPUT FILES: ws_%final%%type%.avg info file
/*
/*        NOTES:
/*
/*      HISTORY:
/*
/*      CONTACT: gtc@rti.org
/*
/*      PROJECT: HWC
/*
/*===========================================================================

&args site site_x site_y /* site is the stack id of the site, file is the
/* ascii generate file...

&if [null %site_y%] &then
&return &inform Usage: sect_surf <site> <site_x> <site_y>

&s site [locase %site%]

&if ^ [exists plt_files/%site%av.plt -file] &then
&return &inform Error:  No files for %site%.  Stopping Program.

/* do for each type of concentration...

&do type &list  av cdp wdv vhg vhg2 wvhg wvhg2

/* master variables
&s file /files8/p6720-005/sectors/plt_files/%site%%type%.plt
&s ptcov [translate pt_%site%] /* coverage generated from ascii file
&s tin [translate tin_%site%] /* tin created from ptcov
```

```
&s lat [translate lat_%site%] /* lattice created from tin
&s icf3_cov [translate elev_%site%] /* point cover from latticespot
&s icf3_covnd [translate %icf3_cov%nd] /* the reselect for Non no-data values
&s sect [translate secti_%site%] /* the sector coverage
&s watershed /files8/p6720-005/watershed/ws_%site%
&s final [translate fin_%site%] /* the final coverage of points by watershed


/* clean up anything left over from previous runs...
&if [exists %ptcov% -cover] &then
kill %ptcov% all

&if [exists %tin% -tin] &then
kill %tin% all

&if [exists %lat% -grid] &then
kill %lat% all

&if [exists %icf3_cov% -cover] &then
kill %icf3_cov% all

&if [exists %icf3_covnd% -cover] &then
kill %icf3_covnd% all

&if [exists %final% -cover] &then
kill %final% all

rm xx*

/* load the ascii file into INFO
&data arc info
    ARC
    SELECT %ptcov%.DAT
    ERASE %ptcov%.DAT
    Y
    DEFINE %ptcov%.DAT
    X-COORD,4,12,F,3
    Y-COORD,4,12,F,3
    ELEV,4,12,F,3

    ADD FROM %FILE%
    Q STOP
&end

/* add an id item to the file
additem %ptcov%.dat %ptcov%.dat  %ptcov%-id 4 5 b

/* calculate the record number into the site-id and outpu the generate file
&data arc info
    ARC
    SEL %ptcov%.DAT
    CALC %ptcov%-ID = $RECNO
    OUTPUT ../%ptcov%.GEN INIT
    CALC $COMMA-SWITCH = -1
    DISPLAY %ptcov%-ID,X-COORD,Y-COORD PRINT
    Q STOP
&end
```

```
/* generate the point coverage...
&severity &error &ignore
generate %ptcov%
input %ptcov%.gen
points
quit

/* build the .pat
build %ptcov% point

/* join the elevation coordinates onto the .pat
joinitem %ptcov%.pat %ptcov%.dat %ptcov%.pat %ptcov%-id %ptcov%-id ordered

/* transform the units into albers meters coordinates...

/* add four tics into the coverage using the relative units...
display 0
ae
graphics off
ec %ptcov% tics
select all
delete
calc $id = 1

coord key
add
3
1
1,-20000,-20000
3
2
1,-20000,20000
3
3
1,20000,20000
3
4
1,20000,-20000
[unquote '']

save /* save with the new tics
quit

/* copy the coverage into an empty version for the transform...
copy %ptcov% %ptcov%tr

/* update the tic coordinates with the albers meters coordinates for
/* the site...
&s llx [calc %site_x% - 20000]
&s lly [calc %site_y% - 20000]
&s ulx [calc %site_x% - 20000]
&s uly [calc %site_y% + 20000]
&s urx [calc %site_x% + 20000]
&s ury [calc %site_y% + 20000]
&s lrx [calc %site_x% + 20000]
&s lry [calc %site_y% - 20000]
```

```
&data arc info
ARC
SEL %PTCOV%TR.TIC
UPDATE XTIC, YTIC BY IDTIC PROMPT
1
%LLX%
%LLY%
2
%ULX%
%ULY%
3
%URX%
%URY%
4
%LRX%
%LRY%
[UNQUOTE '']

Q STOP
&end

/* now do the transform...
transform %ptcov% %ptcov%tr

/* kill the original coverage and rename the new one
kill %ptcov% all
rename %ptcov%tr %ptcov%

/* generate the tin
arctin %ptcov% %tin% point elev

/* create the lattice

tinlattice %tin% %lat% linear
[calc %site_x% - 20000] [calc %site_y% - 20000] /* lower left of lattice
[calc %site_x% + 20000] [calc %site_y% + 20000]  /* upper right of lattice
[unquote ''] /* blank for resolution
200 /* distance between mesh points

/* create a point coverage for use in the overlay
generate %icf3_cov%
fishnet
[calc %site_x% - 20000] [calc %site_y% - 20000]  /* lower left of grid
[calc %site_x% - 20000] [calc %site_y% - 10000]  /* coord on z-axis
200 200  /* distance between grids
200 200  /* number of grids in x and y
quit

/* create the point coverage from the nodes
/*build %icf3_cov% node
nodepoint %icf3_cov% %icf3_cov%p

/*  kill the grid coverage and rename the point coverage
kill %icf3_cov% all
rename %icf3_cov%p %icf3_cov%
```

```
/* do the latticespot command to get the concentrations at every
/* point in the point coverage
latticespot %lat% %icf3_cov%

/* reselect out only those points that are NOT NO DATA
reselect %icf3_cov% %icf3_covnd% point
reselect spot ge 0
[unquote '']
n
n

/* now overlay the icf3_cov onto the watershed coverage to find out
/* which points fall in each watershed
intersect %icf3_covnd% %watershed% region.lap %final% point

/* now calculate the average for each sector polygon
&if [exists ws_%final%%type%.avg -info] &then
&s d [delete ws_%final%%type%.avg -info]

statistics %final%.pat ws_%final%%type%.avg name /*ws_%site%-id
mean spot
end

/* Output ascii files for each file and site...

/* clean up

/* remove point coverage

&if [exists %ptcov% -cover] &then
kill %ptcov% all

/* remove intersection coverage

&if [exists %final% -cover] &then
kill %final% all

/* clean up anything left over from previous runs...

&if [exists %tin% -tin] &then
kill %tin% all

&if [exists %lat% -grid] &then
kill %lat% all

&if [exists %icf3_cov% -cover] &then
kill %icf3_cov% all

&if [exists %icf3_covnd% -cover] &then
kill %icf3_covnd% all

rm xx*

&end
```

```
/*============================================================================
/*                    RESEARCH TRIANGLE INSTITUTE
/*                        CEMQA - GIS Program
/*                          P.O. Box 12194
/*               Research Triangle Park, NC  27709-2194
/*============================================================================
/*
/*      PROGRAM: lk_surf.aml
/*
/*      PURPOSE: lk_surf.aml generates a point coverage from a given
/*               ascii file containing  x,y, and z coordinates of the
/*               icf3 concentration data.  It then creates a TIN, converts
/*               the TIN to a lattice, creates a point coverage from the lattice
/*               and finally overlays the points into the lake coverage
/*               and calculates the average concentration by lake....
/*
/*    INFO FILES NEEDED TO RUN:
/*
/*    CALLED BY: run_lk_surf.aml
/*
/*     CALLS TO:
/*
/* GLOBAL VAR'S:
/*
/*  INPUT FILES:
/*
/* OUTPUT FILES: lk_%final%%type%.avg info file
/*
/*        NOTES:
/*
/*      HISTORY:
/*
/*      CONTACT: gtc@rti.org
/*
/*      PROJECT: HWC
/*
/*============================================================================

&args site site_x site_y /* site is the stack id of the site, file is the
/* ascii generate file...

&if [null %site_y%] &then
&return &inform Usage: sect_surf <site> <site_x> <site_y>

&s site [locase %site%]

&if ^ [exists old_plt_files/%site%av.plt -file] &then
&return &inform Error:  No files for %site%.  Stopping Program.

/* do for each type of concentration...

&do type &list av cdp wdv vhg vhg2 wvhg wvhg2

/* master variables
&s file /files8/p6720-005/sectors/old_plt_files/%site%%type%.plt
&s ptcov [translate pt_%site%] /* coverage generated from ascii file
&s tin [translate tin_%site%] /* tin created from ptcov
```

```
&s lat [translate lat_%site%] /* lattice created from tin
&s icf3_cov [translate elev_%site%] /* point cover from latticespot
&s icf3_covnd [translate %icf3_cov%nd] /* the reselect for Non no-data values
/*&s sect [translate secti_%site%] /* the sector coverage
&s lake /files8/p6720-005/lakes/lk_%site%
/*&s watershed /files8/p6720-005/watershed/ws_%site%
&s final [translate fin_%site%] /* the final coverage of points by lake

/* clean up anything left over from previous runs...
&if [exists %ptcov% -cover] &then
kill %ptcov% all

&if [exists %tin% -tin] &then
kill %tin% all

&if [exists %lat% -grid] &then
kill %lat% all

&if [exists %icf3_cov% -cover] &then
kill %icf3_cov% all

&if [exists %icf3_covnd% -cover] &then
kill %icf3_covnd% all

&if [exists %final% -cover] &then
kill %final% all

rm xx*

/* load the ascii file into INFO
&data arc info
    ARC
    SELECT %ptcov%.DAT
    ERASE %ptcov%.DAT
    Y
    DEFINE %ptcov%.DAT
    X-COORD,4,12,F,3
    Y-COORD,4,12,F,3
    ELEV,4,12,F,3

    ADD FROM %FILE%
    Q STOP
&end

/* add an id item to the file
additem %ptcov%.dat %ptcov%.dat  %ptcov%-id 4 5 b

/* calculate the record number into the site-id and outpu the generate file
&data arc info
    ARC
    SEL %ptcov%.DAT
    CALC %ptcov%-ID = $RECNO
    OUTPUT ../%ptcov%.GEN INIT
    CALC $COMMA-SWITCH = -1
    DISPLAY %ptcov%-ID,X-COORD,Y-COORD PRINT
    Q STOP
&end
```

```
/* generate the point coverage...
&severity &error &ignore
generate %ptcov%
input %ptcov%.gen
points
quit

/* build the .pat
build %ptcov% point

/* join the elevation coordinates onto the .pat
joinitem %ptcov%.pat %ptcov%.dat %ptcov%.pat %ptcov%-id %ptcov%-id ordered

/* transform the units into albers meters coordinates...

/* add four tics into the coverage using the relative units...
display 0
ae
graphics off
ec %ptcov% tics
select all
delete
calc $id = 1

coord key
add
3
1
1,-20000,-20000
3
2
1,-20000,20000
3
3
1,20000,20000
3
4
1,20000,-20000
[unquote '']

save /* save with the new tics
quit

/* copy the coverage into an empty version for the transform...
copy %ptcov% %ptcov%tr

/* update the tic coordinates with the albers meters coordinates for
/* the site...
&s llx [calc %site_x% - 20000]
&s lly [calc %site_y% - 20000]
&s ulx [calc %site_x% - 20000]
&s uly [calc %site_y% + 20000]
&s urx [calc %site_x% + 20000]
&s ury [calc %site_y% + 20000]
&s lrx [calc %site_x% + 20000]
&s lry [calc %site_y% - 20000]
```

```
&data arc info
ARC
SEL %PTCOV%TR.TIC
UPDATE XTIC, YTIC BY IDTIC PROMPT
1
%LLX%
%LLY%
2
%ULX%
%ULY%
3
%URX%
%URY%
4
%LRX%
%LRY%
[UNQUOTE '']

Q STOP
&end

/* now do the transform...
transform %ptcov% %ptcov%tr

/* kill the original coverage and rename the new one
kill %ptcov% all
rename %ptcov%tr %ptcov%

/* generate the tin
arctin %ptcov% %tin% point elev

/* create the lattice

tinlattice %tin% %lat% linear
[calc %site_x% - 20000] [calc %site_y% - 20000] /* lower left of lattice
[calc %site_x% + 20000] [calc %site_y% + 20000]  /* upper right of lattice
[unquote ''] /* blank for resolution
200 /* distance between mesh points

/* create a point coverage for use in the overlay
generate %icf3_cov%
fishnet
[calc %site_x% - 20000] [calc %site_y% - 20000]  /* lower left of grid
[calc %site_x% - 20000] [calc %site_y% - 10000]  /* coord on z-axis
50 50  /* distance between grids
800 800  /* number of grids in x and y
quit

/* create the point coverage from the nodes
/*build %icf3_cov% node
nodepoint %icf3_cov% %icf3_cov%p

/*  kill the grid coverage and rename the point coverage
kill %icf3_cov% all
rename %icf3_cov%p %icf3_cov%
```

```
/* do the latticespot command to get the concentrations at every
/* point in the point coverage
latticespot %lat% %icf3_cov%

/* reselect out only those points that are NOT NO DATA
reselect %icf3_cov% %icf3_covnd% point
reselect spot ge 0
[unquote '']
n
n

/* copy the point cov
/*copy %icf3_covnd% %site%%type%tmp

/* now overlay the icf3_cov onto the watershed coverage to find out
/* which points fall in each watershed
intersect %icf3_covnd% %lake% %final% point

/* now calculate the average for each sector polygon
&if [exists lk_%final%%type%.avg -info] &then
&s d [delete lk_%final%%type%.avg -info]

statistics %final%.pat lk_%final%%type%.avg name /*lk_%site%-id
mean spot
end

/* Output ascii files for each file and site...

/* clean up

/* remove point coverage

&if [exists %ptcov% -cover] &then
kill %ptcov% all

/* remove intersection coverage

&if [exists %final% -cover] &then
kill %final% all

/* clean up anything left over from previous runs...

&if [exists %tin% -tin] &then
kill %tin% all

&if [exists %lat% -grid] &then
kill %lat% all

&if [exists %icf3_cov% -cover] &then
kill %icf3_cov% all

&if [exists %icf3_covnd% -cover] &then
kill %icf3_covnd% all

rm xx*

&end
```

```
/*============================================================================
/*                     RESEARCH TRIANGLE INSTITUTE
/*                         CEMQA - GIS Program
/*                           P.O. Box 12194
/*                 Research Triangle Park, NC  27709-2194
/*============================================================================
/*
/*      PROGRAM: st_surf.aml
/*
/*      PURPOSE: st_surf.aml generates a point coverage from a given
/*               ascii file containing  x,y, and z coordinates of the
/*                icf3 concentration data.  It then creates a TIN, converts
/*                the TIN to a lattice, creates a point coverage from the
lattice
/*                and finally overlays the points into the streams coverage
/*                and calculates the average concentration by stream...
/*
/*    INFO FILES NEEDED TO RUN:
/*
/*    CALLED BY: run_st_surf.aml
/*
/*     CALLS TO:
/*
/* GLOBAL VAR'S:
/*
/*  INPUT FILES:
/*
/* OUTPUT FILES: st_%final%%type%.avg info file
/*
/*        NOTES:
/*
/*      HISTORY:
/*
/*      CONTACT: gtc@rti.org
/*
/*      PROJECT: HWC
/*
/*============================================================================
/* st_surf.aml generates a point coverage from a given
/* ascii file containing  x,y, and z coordinates of the
/* icf3 concentration data.  It then creates a TIN, converts
/* the TIN to a lattice, creates a point coverage from the lattice
/* and finally overlays the points into the streams coverage
/* and calculates the average concentration by stream...

&args site site_x site_y /* site is the stack id of the site, file is the
/* ascii generate file...

&if [null %site_y%] &then
&return &inform Usage: sect_surf <site> <site_x> <site_y>

&s site [locase %site%]

&if ^ [exists old_plt_files/%site%av.plt -file] &then
&return &inform Error:  No files for %site%.  Stopping Program.

/* do for each type of concentration...
```

```
&do type &list  vhg vhg2 wvhg wvhg2 /* av cdp wdv

/* master variables
&s file /files8/p6720-005/sectors/old_plt_files/%site%%type%.plt
&s ptcov [translate pt_%site%] /* coverage generated from ascii file
&s tin [translate tin_%site%] /* tin created from ptcov
&s lat [translate lat_%site%] /* lattice created from tin
&s icf3_cov [translate elev_%site%] /* point cover from latticespot
&s icf3_covnd [translate %icf3_cov%nd] /* the reselect for Non no-data values
&s sect [translate secti_%site%] /* the sector coverage
/*&s lake /files8/p6720-005/lakes/lk_%site%
/*&s watershed /files8/p6720-005/watershed/ws_%site%
&s stream /files8/p6720-005/streams/st_%site%bufp

&s final [translate fin_%site%] /* the final cov of pts by sector or waterbody

/* clean up anything left over from previous runs...
&if [exists %ptcov% -cover] &then
kill %ptcov% all

&if [exists %tin% -tin] &then
kill %tin% all

&if [exists %lat% -grid] &then
kill %lat% all

&if [exists %icf3_cov% -cover] &then
kill %icf3_cov% all

&if [exists %icf3_covnd% -cover] &then
kill %icf3_covnd% all

&if [exists %final% -cover] &then
kill %final% all

rm xx*

/* load the ascii file into INFO
&data arc info
    ARC
    SELECT %ptcov%.DAT
    ERASE %ptcov%.DAT
    Y
    DEFINE %ptcov%.DAT
    X-COORD,4,12,F,3
    Y-COORD,4,12,F,3
    ELEV,4,12,F,3

    ADD FROM %FILE%
    Q STOP
&end

/* add an id item to the file
additem %ptcov%.dat %ptcov%.dat  %ptcov%-id 4 5 b

/* calculate the record number into the site-id and outpu the generate file
```

```
&data arc info
    ARC
    SEL %ptcov%.DAT
    CALC %ptcov%-ID = $RECNO
    OUTPUT ../%ptcov%.GEN INIT
    CALC $COMMA-SWITCH = -1
    DISPLAY %ptcov%-ID,X-COORD,Y-COORD PRINT
    Q STOP
&end

/* generate the point coverage...
&severity &error &ignore
generate %ptcov%
input %ptcov%.gen
points
quit

/* build the .pat
build %ptcov% point

/* join the elevation coordinates onto the .pat
joinitem %ptcov%.pat %ptcov%.dat %ptcov%.pat %ptcov%-id %ptcov%-id ordered

/* transform the units into albers meters coordinates...

/* add four tics into the coverage using the relative units...
display 0
ae
graphics off
ec %ptcov% tics
select all
delete
calc $id = 1

coord key
add
3
1
1,-20000,-20000
3
2
1,-20000,20000
3
3
1,20000,20000
3
4
1,20000,-20000
[unquote '']

save /* save with the new tics
quit

/* copy the coverage into an empty version for the transform...
copy %ptcov% %ptcov%tr

/* update the tic coordinates with the albers meters coordinates for
```

```
/* the site...
&s llx [calc %site_x% - 20000]
&s lly [calc %site_y% - 20000]
&s ulx [calc %site_x% - 20000]
&s uly [calc %site_y% + 20000]
&s urx [calc %site_x% + 20000]
&s ury [calc %site_y% + 20000]
&s lrx [calc %site_x% + 20000]
&s lry [calc %site_y% - 20000]

&data arc info
ARC
SEL %PTCOV%TR.TIC
UPDATE XTIC, YTIC BY IDTIC PROMPT
1
%LLX%
%LLY%
2
%ULX%
%ULY%
3
%URX%
%URY%
4
%LRX%
%LRY%
[UNQUOTE '']

Q STOP
&end

/* now do the transform...
transform %ptcov% %ptcov%tr

/* kill the original coverage and rename the new one
kill %ptcov% all
rename %ptcov%tr %ptcov%

/* generate the tin
arctin %ptcov% %tin% point elev

/* create the lattice

tinlattice %tin% %lat% linear
[calc %site_x% - 20000] [calc %site_y% - 20000] /* lower left of lattice
[calc %site_x% + 20000] [calc %site_y% + 20000]  /* upper right of lattice
[unquote ''] /* blank for resolution
200 /* distance between mesh points

/* create a point coverage for use in the overlay
generate %icf3_cov%
fishnet
[calc %site_x% - 20000] [calc %site_y% - 20000]  /* lower left of grid
[calc %site_x% - 20000] [calc %site_y% - 10000]  /* coord on z-axis
100 100  /* distance between grids
400 400  /* number of grids in x and y
quit
```

```
/* create the point coverage from the nodes
/*build %icf3_cov% node
nodepoint %icf3_cov% %icf3_cov%p

/*  kill the grid coverage and rename the point coverage
kill %icf3_cov% all
rename %icf3_cov%p %icf3_cov%

/* do the latticespot command to get the concentrations at every
/* point in the point coverage
latticespot %lat% %icf3_cov%

/* reselect out only those points that are NOT NO DATA
reselect %icf3_cov% %icf3_covnd% point
reselect spot ge 0
[unquote '']
n
n

/* now overlay the icf3_cov onto the watershed coverage to find out
/* which points fall in each watershed
intersect %icf3_covnd% %stream% %final% point

/* now calculate the average for each sector polygon
&if [exists st_%final%%type%.avg -info] &then
&s d [delete st_%final%%type%.avg -info]

statistics %final%.pat st_%final%%type%.avg name
mean spot
end

/* Output ascii files for each file and site...

/* clean up

/* remove point coverage

&if [exists %ptcov% -cover] &then
kill %ptcov% all

/* remove intersection coverage

&if [exists %final% -cover] &then
kill %final% all

/* clean up anything left over from previous runs...

&if [exists %tin% -tin] &then
kill %tin% all

&if [exists %lat% -grid] &then
kill %lat% all

&if [exists %icf3_cov% -cover] &then
kill %icf3_cov% all
```

```
&if [exists %icf3_covnd% -cover] &then
kill %icf3_covnd% all

rm xx*

&end
```

GIS Data Used in the Risk Analysis for the HWC Final Rule

Section IV.

Maps and data tables.