

# **Appendix B**

**Description of the  
Geographic Information Systems Analyses  
Utilized to Summarize Habitat Conditions within  
Historic and Projected Future Locations of Dredged  
Material Placement  
within Floodplain Areas of the  
Upper Mississippi River  
and  
Illinois Waterway Floodplains**

**DESCRIPTION OF THE  
GEOGRAPHIC INFORMATION SYSTEMS ANALYSES  
UTILIZED TO SUMMARIZE HABITAT CONDITIONS WITHIN HISTORIC AND  
PROJECTED FUTURE LOCATIONS OF DREDGED MATERIAL PLACEMENT  
WITHIN FLOODPLAIN AREAS OF THE  
UPPER MISSISSIPPI RIVER  
AND  
ILLINOIS WATERWAY FLOODPLAINS**

## **INTRODUCTION**

Spatial analyses were performed to quantify the amount of land cover/use types present within sites where dredged material has historically been placed. Prior to this study, the Rock Island District created a Geographic Information Systems (GIS) database of the locations of historical dredged material placement sites. This GIS database was one of four GIS databases used as the basis for this study. A second GIS database of land cover/use, developed by the Upper Midwest Environmental Sciences Center (UMESC; formerly the Environmental Management Technical Center) from 1989/1991 aerial photography, was used to identify the type(s) and quantify the amount(s) of land cover/use present within most areas of historical and projected future placement. For remaining areas that fell outside of the floodplain covered by 1989/1991 aerial photography, a third land cover database based on LANDSAT Satellite data, also developed by UMESC, was utilized to identify the type(s) and quantify the amount(s) of land cover/use present within remaining areas of historical placement.

Spatial analyses also were performed to quantify the amount of land cover/use types present within sites projected for potential use for future dredged material placement. As a part of this study, the Rock Island District created a GIS database of the locations of potential future placement sites. Plates of the projected future placement sites associated with this appendix are available electronically through the Rock Island District by compact disk or via the World Wide Web. Similar to the study of historical placement, this GIS database was one of three GIS databases used as the basis for this study; the second GIS database was that of land cover/use developed by UMESC from 1989/1991 aerial photography, which again was used to identify the type(s) and quantify the amount(s) of land cover/use present within most areas of potential future placement. For remaining areas that fell outside of areas covered by 1989/1991 aerial photography, a third GIS land cover/use database derived from LANDSAT Satellite data was used to identify the type(s) and quantify the amount(s) of land cover/use present within remaining areas of projected future placement.

## **SOURCES OF DATA**

### **Locations of Historical Dredged Material Placement Sites**

This GIS database contains areas (overlapping polygons coded as ArcInfo “regions”) designating locations where the Rock Island District has historically placed dredged material along the Mississippi River and Illinois Waterway. The GIS coverage contains polygons designating placement events that occurred between 1939 through early 1998 along the Mississippi River and placement events that occurred between the late 1940’s and about 1996 along the Illinois River. Each placement event is represented by a separate and unique polygon within the GIS database. The polygons outline the approximate place in which dredged material was placed after its removal from the navigation channel. Database entries for each polygon include information like: pool

number or name, year, river mile, name of the river reach (e.g., Howard's Crossing), type of placement (right or left descending bank, or thalweg), description of location, and a unique dredge cut identification number which ties the placement (if possible) to the specific dredge cut from which material was removed.

The data were created from hardcopy maps and records to: (1) provide the ability to analyze the location and historical trends of dredging events on the Mississippi River and (2) provide the starting point for the development of an up-to-date GIS database for purposes of future channel maintenance activities. In particular, this spatial database, along with its equivalent dredge cut location information database, was requested and funded (in part) by the Rock Island District's Operations Division for channel maintenance purposes and (in part) by the Corps of Engineers in support of study efforts for the Upper Mississippi River and Illinois Waterway (UMR-IWW) System Navigation Study.

The data represent the results of data collection and processing efforts for specific U.S. Army Corps of Engineers activities/functions. As such, the data are only valid for their intended use, which is limited by the content, timeframe, and accuracy of the data.

The GIS data, which indicate the locations of dredged material placement sites, came from several sources, but were most typically derived by digitizing the locations from hydrographic survey maps. The scales of map sheets have varied through the years. The accuracy of the digitized lines is estimated to be within 15 to 30 feet of the mapped location of the sites. The mapped locations, however, are subject to more significant errors because the locations of sites were drawn by hand onto the hydrographic survey maps and as such their locations are "eyeball" estimates, sometimes having been made with additional information such as topography. As a result of the historical nature of these data and the limited means for verifying site locations, the locational accuracy of the historical data (essentially pre-1996 or so) cannot be improved. The locational accuracy for more recent placement events (i.e., 1998 to present), however, is greatly improved because tools like differentially corrected global positioning systems (GPS) technology have been adopted by the Corps. It is expected that in the future the locations of dredged material placement sites will be entered directly into the database from digital sources.

To create a GIS database of placement sites, polygons indicating the locations of dredged material placement were digitized from Channel Maintenance dredging maps of various dates and scales (typically 1 inch to 400 feet or 800 feet) with map sheets marked for each year. Altek large-format digitizers and ArcInfo "arcredit" software were used to digitize the locations of placement sites. Each map was calibrated using UTM Zone 15 tic marks derived from the marked lat/long or state plane coordinates on each map. As necessary, the Topographic Engineering Center's (U.S. Army Corps of Engineers) "corpscon" software was used for coordinate conversion. Individual dredging events were digitized separately, and attribute information was added for each event. The individual polygons for each dredged material placement event which occurred between 1939 and 1989 were subsequently grouped together by year into workspaces, one subdirectory for each year. Using Arc's "polyregion" command, each coverage was converted to a region data construct. All the coverages for the Rock Island District were then appended together using ArcInfo's "append" command.

### **Locations of Projected Future Dredged Material Placement Sites**

This GIS database contains polygons designating locations where the Rock Island District anticipates (based on existing knowledge) the future placement of dredged material along the Upper Mississippi River and Illinois Waterway. The delineations of areas of future placement are based on: (1) locations already identified and addressed within final Dredged Material

Management Plans (DMMPs), (2) areas under consideration within DMMPs which are currently under development, as well as (3) additional areas where future placement will likely be needed, but have not yet been addressed within long-term planning efforts. Each projected future placement site is represented by a separate and unique polygon within the GIS database. The polygons outline the approximate locations where dredged material will likely be placed after its removal from the channel. Database entries for each polygon include information that identifies the general type of future placement, including whether or not the projected site would be considered a programmatic placement alternative.

It is critical to note that the location of these polygons representing future dredged material placement, particularly for areas not already addressed within Final DMMPs, is based on current information. The exact location of at least some of these future placement sites could potentially change in the future as these areas are further reviewed. However, this analysis does provide an overview of the general trends in dredged material placement projected for the Rock Island District over the next 40 years.

### **1989/1991 Land Cover Information from Aerial Photography**

The more than 1,300 miles of the Upper Mississippi River System include the Mississippi River from Cairo, Illinois, to Minneapolis, Minnesota, and the Illinois River La Grange and Peoria Pools (Figure B-1). Aerial photography from 1989 was utilized to develop the land cover/use database for all Mississippi River pools within the Rock Island District (Pools 11 through 24), as well as Peoria Pool on the Illinois River. Aerial photography from 1991 was utilized to develop the land cover/use database for the majority of La Grange Pool on the Illinois River (Figure B-1).

Land cover/use databases were developed from 1989/1991 color infrared aerial photography for pools within the Upper Mississippi River System by UMESC. The scale of aerial photography is 1:15,000. The following describes the standard operating procedure used by UMESC to develop the GIS coverages (Owens and Hop 1995).

Photo interpretation was performed with a Bausch and Lomb 240 zoom stereoscope at 6X magnification using 4x0 drafting pens on clear acetate overlays registered to photo transparencies. The minimum mapping unit, or the smallest area that can be delineated, is approximately 80 m<sup>2</sup>. Extensive ground-truthing was performed along with the interpretation. A Bausch and Lomb zoom transfer scope was used to transfer data from photo overlays to mylar overlays registered to USGS 7.5' quadrangle enlargements at a scale of 1:15,000 before they were manually digitized. All data were transferred and digitized into ArcInfo on Altek digitizing tables (absolute accuracy 0.001 inch up to +/- 0.003 inch). No data reduction or generalization in transferring or digitizing occurred.

The original database of 1989/1991 land cover/use contains many different attributes for each of the digitized polygons of land cover/use. Polygon attributes describe the data in generalized and specific ways. The most specific attributes describe the vegetation to the genus level of classification. The specific genus levels have also been categorized into 13 general vegetation classes. Additional modifiers representing percent of vegetation cover and tree height are also used. The original classification system used for attributing this data set is the LTRMP Vegetation Classification. As a result of the recent Habitat Needs Assessment (HNA) of the Upper Mississippi River System, scientists and resource managers affiliated with UMESC have modified the original LTRMP Vegetation Classification and have adopted a new classification system of 18 land cover/use types or classes. UMESC staff have applied the new classification system to the original 1989/1991 land cover/use databases, and these GIS databases were used for this study. More information about the new HNA classification system can be obtained from UMESC.

## **1989 Land Cover Information from Satellite Imagery**

Land cover/use GIS databases also have been developed from 1989 satellite remote sensing data for the UMRS. UMESC also developed this database. Laustrup and Lowenberg (1994) discuss the methodology utilized to collect and interpret land cover data. The resulting land cover classification system within these GIS databases is different than that utilized as a part of the HNA. For this reason, results from the analyses based upon 1989/1991 aerial photography and those using the satellite data may not be easily comparable. Therefore, this database was only utilized within areas of the Illinois Waterway not included within databases developed from aerial photographs for classification of land cover habitat types. These areas include Dresden, Marseilles, Starved Rock, Alton, and a small upstream portion of La Grange Pool within the Illinois Waterway (Figure B-1).

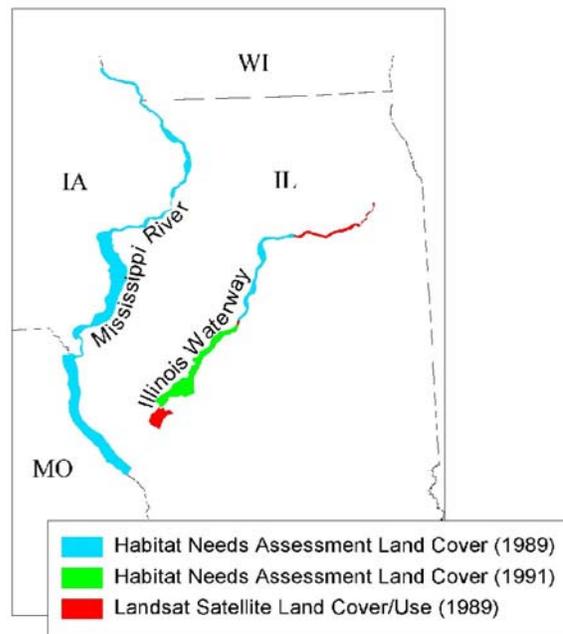


Figure B-1. Delineation of land use data utilized for evaluation of specific locations of the Upper Mississippi River and Illinois Waterway within the Rock Island District.

## **METHOD OF HISTORICAL ANALYSIS**

For purposes of this report, two time periods were evaluated for the historical analysis: pre-aerial photography or satellite data (e.g., before and including either 1989 or 1991) and post-aerial photography or satellite data to present (e.g., from either 1990 or 1992 to present). The land cover types present within historical dredged material placement sites in 1989/1991 are reflective of and influenced by past dredged material placement activities. When used in association with the GIS database of placement sites, the 1989/1991 land cover database provides an estimate of the areal extent of each of land cover type present within historical placement sites. The 1989/1991 land cover also provides an estimate as to the types and quantity of habitat that have been impacted by dredged material placement activities since 1989/1991.

ArcInfo and ArcView were used to estimate the areal extent of land cover/use types present within historical dredge placement sites during 1989/1991. The ArcInfo region coverage of historical

dredge placement sites was first divided into two separate coverages: one for placement sites prior to and including 1989 and another for placement sites from 1990/92 to the present. Since the aerial photography from which the land cover databases were developed was taken during the fall (low water season) it is assumed that the 1989/1991 land cover databases incorporate dredging activities conducted during 1989/1991.

Using ArcInfo's "regiondissolve" and "regionpoly" commands, the regions in the separate dredge placement region coverages were subsequently "dissolved" and converted to polygon coverages. The resulting polygons represent the total, composite footprint of all dredge placement events that occurred during the respective time period (i.e., pre-1989/1991 or 1990/1992 to present) and consequently in this analysis there have not been "double counts" of areas which historically have been used for dredged material placement on multiple occasions within the time period. It should be noted, however, that there are areas where dredged material was placed both before and after 1989; an estimate of the overlap between the two time periods has not been made.

The GIS coverage of historical dredge placement sites was clipped to the individual GIS coverages of 1989/1991 land cover/use for each pool. ArcView was used to generate a summary, by pool, of the total area of each land cover type present in the historical dredge placement sites for both time periods (1939 to 1989, 1990 to present).

#### **METHOD OF FUTURE ANALYSIS**

The analysis of future placement projects placement of dredged material through the year 2040. Use of the various land cover databases in conjunction with the GIS coverage of projected future dredged material placement sites provides an estimate as to the types and quantity of habitat that may be impacted through dredged material placement within the period.

Polygons for each projected future placement site were labeled as being one of the six programmatic site-types, or as some other possible future placement alternatives (e.g., thalweg, inland, bankline, island creation, etc.) not addressed within this PEA. The GIS coverage of projected future dredged material placement sites was clipped to the GIS coverages of 1989/1991 land cover/use for each pool. ArcView was used to generate a summary, by pool, of the total area of each land cover type present in the future dredge placement sites. Summaries were generated for all future placement sites, as well as for site-types only addressed by the Programmatic alternatives. As noted in the introduction, plates of the projected future placement sites associated with this appendix are available electronically through the Rock Island District by compact disk or via the World Wide Web.

Lastrup, M. S., and C. D. Lowenberg. 1994. Development of a systemic land cover/land use database for the Upper Mississippi River System derived from Landsat Thematic Mapper satellite data. National Biological Survey, Environmental Technical Center, Onalaska, Wisconsin, May 1994. LTRMP 94-T001. 103 pp.

Owens, T., and K. D. Hop. 1995. Long Term Resource Monitoring Program standard operating procedures: Photointerpretation. National Biological Service, Environmental Management Technical Center, Onalaska, Wisconsin, July 1995. LTRMP 95-P008-1. 7pp + Appendixes A-B (NTIS #PB96-264610).