

U.S. EPA REGION 5 INLAND WATERWAY SPILL RESPONSE MAPPING PROJECT

INTRODUCTION

The Inland Sensitivity Atlas series is a set of Geographic Information System (GIS) products intended to provide contingency planners and spill responders with the most accurate and relevant information possible for spill preparedness and response. The atlas series was created jointly by U.S. EPA Region 5, the U.S. Geological Survey Upper Midwest Environmental Sciences Center (UMESC), the Great Lakes Commission (GLC), and the Upper Mississippi River Basin Association (UMRBA). These organizations work together to identify and collect data about sensitive environmental, economic, and cultural resources; potential spill sources; and response resources within U.S. EPA Region 5, including portions of the basins of the Great Lakes, the Ohio River, and the Upper Mississippi River. Data are also collected for some adjacent portions of other U.S. EPA regions. GIS products from this joint effort are being made available as paper atlases and in digital format, including online data postings and publications on CDROM.

MAPPING APPROACH

Mapping

As a supplement to contingency plans, U.S. EPA Region 5 has prepared detailed atlases to cover all six states in its region. Published as individual volumes of a Region 5 atlas series, these map products are designed to work in tandem with regional and sub-area contingency plans. Counties have been grouped into mapping areas that generally share hydrologic and/or political characteristics.

Mapping Products and Availability

Inland Sensitivity mapping products are produced in several formats, including digital map data, digital atlases, and paper atlases. All products are developed from the following set of GIS data themes documenting sensitive resources, potential sources of spills, and response considerations: Sensitive Species, Surface Water Intakes, Managed Natural Resource Areas, Shoreline Sensitivity, Designated Resource Areas, Fixed Oil Storage Facilities, Other Environmentally Sensitive Areas, Oil Transmission Pipelines, Tribal Lands and Interests, Boat Access Ramps, Marinas, Non-Navigation Dams, and Navigation Locks and Dams.

The GIS data are used to generate atlas documents in virtually identical digital and paper formats. GIS data and digital atlases are available on CD-ROMs prepared for individual mapping areas.

Map Data

Using digital map data in a mapping application provides full access to all tabular data linked to mapped features, allows flexibility in viewing data at varied scales and in different com-

binations, and allows for query and analysis of the data. Digital map data products include ArcView shapefiles, ArcInfo export files, and MARPLOT files for CAMEO/MARPLOT users. A customized ArcView project is also available and allows ArcView users to work with the Inland Sensitivity data themes using a standardized view and graphic formats developed for this project.

Digital and Paper Atlases

Inland Sensitivity Atlases originate with ArcInfo GIS data, using cartographic standards (e.g., colors and symbols) and document formats developed specifically for this project. For ease of distribution, map files are converted to Adobe Acrobat portable document format (PDF) which is a true digital equivalent of the paper atlas product. The PDF atlases include a "start" page that allows users to navigate to the other sections of the atlas by clicking on links for maps, tables, appendices, and descriptive text. Links to other atlas sections and other maps are also embedded into individual maps. Atlas pages are formatted to 8.5 by 11.0 inches so the PDF files can be easily printed out on a variety of printers. Paper atlases are prepared for limited distribution by U.S. EPA Region 5.

ATLAS CONTENTS

Spatial Data

Databases documenting environmentally and economically sensitive resources and oil transportation and storage systems use standardized data formats. With the exception of Natural Heritage Data and Shoreline Sensitivity Ratings, most databases and map layers were acquired and re-processed or wholly generated by the GLC/UMRBA. The UMESC compiled the Natural Heritage Data on threatened and endangered species and the shoreline sensitivity ratings (as applicable for the mapping area), and performed the final processing and cartographic production of the maps in the atlas. For paper and PDF atlases, the standard map scale is 1:100,000 with the exception of inset maps. The 1:25,000-scale inset maps cover areas containing high concentrations of mapped features. A series of higher resolution (1:12,000) insets is included for areas with dense pipeline corridors.

Base Map Imagery

USGS 30- x 60-min digital raster graphics (DRG: color scanned topographic maps) are registered to real-world coordinates, providing a map base for the addition of other thematic layers. Except for the hydrography, which remains blue, the colors of the DRG images were converted to a grayscale. These maps provide background imagery for paper and PDF atlases. The original 1:100,000-scale DRGs are also included separately for use and display with the atlas GIS data.

Database Tables

For paper and PDF atlases, the map icons display unique alphanumeric codes that are keyed to data tables accompanying the map tiles. These tables provide feature identities, emergency contact names and numbers, as well as other information relevant to spill response. For example, tables list the types of oil products handled by oil storage facilities and the facilities available at marinas. All data identified on enlarged-scale inset maps are documented in the tables prepared for their parent tile. Appendix A is a comprehensive index of all mapped features (excluding sensitive species) grouped by data type (e.g., surface water intakes and oil pipelines) and listed by site name. Appendix B provides a keyed index to all of the sensitive species groups and combinations of groups that appear throughout the map atlas. With GIS data products, tables are linked to the map graphics being viewed on-screen. Selecting an individual map feature by mouse will call up the appropriate data record.

Map Legend and Index to Tiles

For paper and PDF atlases, a graphic legend identifies and explains the meaning of the symbols used throughout the atlas. The Index to Tiles shows the layout of atlas pages over the entire mapping area, so atlas users can determine which map tile(s) they want to examine. For the ArcView project, the main view includes a graphic legend identifying the major map themes and symbols used to represent them. Map symbols used in the ArcView project are a simplified version of the paper and PDF atlas symbols.

Sensitive Species and Natural Communities Data

Sensitive species and natural communities data are developed from two primary information sources. The majority of the information is from Natural Heritage Data on state- and federally listed threatened or endangered species, acquired under license agreements with state resource agencies. Tribal, federal, state, and local resource specialists may provide additional information on sensitive species and natural communities during the review of draft atlas products. To avoid directly identifying threatened or endangered species by name, staff at the UMESC groups all sensitive species and natural communities data into the major categories. This grouping technique was developed as a protective measure, with the participation and approval of resource specialists at state and federal resource agencies within U.S. EPA Region 5. Vascular plants, birds, amphibians and reptiles, mammals, invertebrates, fish, and natural communities were grouped into two habitat subcategories: aquatic/riparian and terrestrial/upland. Species are designated aquatic/riparian if any critical life stage takes place in that setting. This distinction is drawn to aid responders in developing site-specific response approaches. For paper and PDF maps, thirteen unique map icons symbolize the seven major species groups and two primary habitat types.

Geographic coordinates for each element in the sensitive species and natural communities data were overlaid on a grid of hexagons to buffer the precise species location. This buffering provides additional protection of sensitive species information. In both digital and paper map products, hexagons represent the approximate locations of species occurrences. A single hexagon may represent more than one element and adjacent hexagons are merged to create single polygonal areas. For paper and PDF atlases, one or more of the 13 sensitive species icons are adjacent to the hexagonal areas, indicating which major resource categories are present in the area defined by the hexagon. Icons for hexagons containing federal or state threatened or endangered species are outlined in red. More information about species and species groups is available through the hexagon number positioned beneath the icon. Of note, hexagon numbers repeat on the maps

if the same combinations of species and communities are present in more than one area. Because of the complexity of this data theme, ArcView shapefile users will find simplified information in this theme's data tables, including the hexagon number (item name = "symbol"). A look up table for the symbol numbers is provided in the species metadata.

Many species are mobile or are inadequately represented by the single points used to derive the sensitive species layer. Therefore, hexagons may not accurately represent the entire area in which the element exists. Moreover, the Natural Heritage Data may not necessarily be an exhaustive database of natural community and rare species data. Species sightings in the state inventory may date back many decades, although this atlas series will include only those occurrences documented during time frames recommended by individual state natural heritage programs. For these reasons, it is strongly recommended that responders and planners contact the appropriate state and federal agencies for information about the presence and extent of sensitive species.

Natural Resource Area Data

Managed Natural Resource Areas

Many local, regional, state, and federal managed areas are high-priority sensitive natural resources that offer habitats for a wide range of plant and animal species, and may support high levels of recreational use. An inventory of state and federal managed lands serves as a starting point in compiling databases and preliminary maps of sensitive managed resource areas. Participants from private, local, state, and federal resource management organizations review preliminary maps depicting the initial inventory of managed areas and identify additional sites known to have sensitive resources. These additional sites may include public lands managed by regional or local governments, as well as private lands known to contain sensitive resources that merit protection. Map products may not show all publicly managed areas, but do show the areas identified by resource managers by virtue of their proximity to potential spill sources and intrinsic sensitivity to oil. Sensitivity was considered in the context of response operations as well as seasonal variability.

Examples of state managed areas include parks, forests, trails, and wildlife management areas. Federal managed lands in the atlas typically consist of forests, parks, recreation lands, and wildlife refuges. Regional managed lands may consist of reserves, forests, and parks managed by cities, counties, or regional entities.

Special Designated Areas

Natural resource areas of particular significance have been classed together as special designated areas. These areas are not necessarily owned or directly managed by public agencies, but have received a special designation status from public resource agencies and multi-organization commissions. This designation status accords formal recognition of resource sensitivity and may also carry with it a high level of legal protection. Designated areas can include trout streams, wild and scenic rivers, and habitat restoration projects.

Other Environmentally Sensitive Areas

Other areas of natural resource significance may be documented. These additional areas generally are not publicly managed nor do they have any special designation, but they have been identified as special places meriting spill protection. These resource areas are mapped because they are valued for natural qualities, such as habitats supporting large numbers of non-listed species. Examples include migratory waterfowl resting areas, important fishery areas, and natural communities.

Tribal Lands and Interests Data

This atlas identifies the location and provides descriptive and contact information for tribal lands. Tribes are the designated natural resource trustees for Indian communities. Reservations and other tribally owned areas may have significant cultural, environmental, and economic resources that are vulnerable to oil spill damage.

Cultural Resource Data

Historic sites, including standing structures and archeological sites, are vulnerable to the effects of spilled oil and clean-up efforts. While these sites are not presented in paper and PDF atlases, digital map data on CD-ROM includes historic standing structures and selected archeological sites to the extent this information is available from State Historic Preservation Officers (SHPO). Historic structure data includes sites that are listed or eligible for listing on the National Register. Only archeological sites listed on the National Register of Historic Places are included in the digital map data. Archeological sites are presented with buffered locations, in recognition of their sensitivity to disturbance. Because it is not practicable to provide complete archeological site information, planners and responders are strongly urged to consult with the historic preservation agency staff located in their states.

Other Sensitive Resource Data

Surface Water Intakes

Surface water intakes are sensitive because of their significance to public health and the economy. All intakes for public water supplies and power plants have been mapped, as have intakes for industries estimated to use one million gallons or more per day. Response procedures may involve temporary shutdown of these facilities. Since contamination of potable water supplies constitutes a serious threat to public health and safety, drinking water intake symbols appear with a red outline in the paper and PDF atlases to highlight their importance. Intakes used only for intermittent purposes, such as irrigation, are not mapped.

Marinas

Marinas are typically high-use recreational areas and may include picnicking, camping, and fueling facilities, as well as boat lifts, ramps, and slips. Due to the economic value of boats and other equipment located at marinas, these areas may be relatively high priorities for protection in the event they are threatened by a spill. Marinas may also serve as response staging areas and provide goods, services, and water access for the response effort.

Navigation Locks and Dams

Locks and dams on commercially navigable waterways are vulnerable economic resources that could be adversely affected by an oil spill upstream. These facilities are also essential to the flow of commercial shipping and recreational boat traffic. Closure of lock chambers for spill containment, diversion of oil to collection sites, or spill clean-up could temporarily halt navigation. These sites are also potentially useful as access sites in response situations. Since oil emulsifies after passing over a dam or through its gates and becomes increasingly difficult to recover, it is also important that containment efforts concentrate on areas above dams.

Shoreline Sensitivity

For the portions of U.S. EPA Region 5 that border the Great Lakes, Environmental Sensitivity Index (ESI) data sets were obtained from the National Oceanic and Atmospheric Administration (NOAA) to display shoreline sensitivity. The ESI shoreline data were mapped and ranked based on their potential sensitivity to

an oil spill. The elements used to determine the relative sensitivity of shoreline habitats include shoreline type (e.g., substrate, grain size, elevation, and origin), exposure to wave and current energy, biological productivity and sensitivity, and ease of cleanup.

Oil Storage and Transportation Data

This atlas documents the location of potential sources of oil, including fixed facilities and pipeline systems. For the purposes of this publication, the term oil includes crude and refined petroleum products as well as vegetable oils and animal fats. Although roads and railroads that may be used for oil transport are not part of the GIS data layers, they are visible as part of the base map imagery.

Oil Storage Facilities

Fixed facilities store quantities of oil in above- or below-ground storage tanks. This atlas documents facilities with above-ground storage capacity of 42,000 gallons or more, whether the product is stored in a single tank or a series of tanks.

While documenting all facilities that meet the 42,000-gallon threshold, the atlas highlights two special types of fixed storage facilities. Facilities that transfer oil products over water have been differentiated from the other types of potential spill sources, and are referred to as Marine Transfer Related Facilities (MTRs). Their proximity to major rivers or the Great Lakes, as well as the potential spill risk posed by loading and off-loading vessels, merits this distinction. MTR facilities that handle 42,000 gallons or more of oil are required to prepare Facility Response Plans for submission to the Coast Guard. The required elements of such plans include documentation of potential harm from accidental spills, response contingency protocols, and training documentation.

The other special case includes facilities known to handle very high volumes of oil, generally one million gallons or more. Such facilities are required to complete Facility Response Plans (FRPs) under OPA, for submission to the U.S. EPA. These facilities are highlighted in paper and PDF atlases as having FRPs. As with MTRs, the required elements of these plans include documentation of potential harm from accidental spills, response contingency protocols, and training documentation.

Oil and Oil Product Pipelines

Due to the volume of oil pumped through major pipelines, the potential impact of a rupture is significant. The atlas documents major oil handling pipeline routes throughout the mapped area. A route is defined in the atlas as an individual operator's pipeline corridor through one mapping area: routes may contain more than one pipeline. The atlas also documents the route name, the number of pipes in the route, the diameter of each pipe, and the type of product carried in the pipes. While all transmission lines are documented, the much smaller and more numerous gathering lines are not included in the atlas.

Since several pipeline routes operated by different companies may lie in close proximity, the number of routes in a given area may not always be clear at the scales typically used for paper atlases. For that reason, paper atlases may include a special pipeline inset series prepared at 1:12,500-scale to document closely spaced pipeline routes. Pipeline insets are enlargements covering one-quarter of the area shown on a 1:25,000-scale inset. As with 1:25,000-scale insets, the pipeline insets are prepared only as needed for areas of high feature density.

Response Considerations Data

Boat Access Ramps

Sites with concrete or gravel boat ramps may be useful for providing access to the water during a spill response. Access facilities typically lack the range and variety of services found at the majority of marinas. These sites are usually owned and managed by government agencies including state and federal land management agencies, city and village public works departments, and county governments. Boat ramps are not individually identified by name or further described in the atlas products.

Non-Navigation Dams

As available, locations are provided for dams not associated with commercial navigation. These dams may be used for a variety of purposes, including public water supply, power generation, flood control, irrigation, and recreation. Responders must be

aware of dam locations because oil recovery becomes more difficult after passage over a dam spillway, even with dams that may be considerably smaller than commercial navigation structures. Individual identities and descriptive attributes are not provided for non-navigation dams.

COMMENTS, INQUIRIES, AND UPDATES

Any omissions or errors in the data are the sole responsibility of project cartographers. The opinions and conclusions contained in the text are those of individual authors and do not necessarily reflect a collective agency position. To enhance the accuracy and usefulness of the atlas, your comments, questions, and suggestions are encouraged. Please address them, as well as questions or comments related to the Oil Pollution Act of 1990 or the Inland Waterways Spill Response Project, to: U.S. EPA Section Chief, Oil Planning and Response Section, 77 West Jackson Boulevard, Chicago, Illinois 60604.