

Use of GIS for Spill Response Planning to Protect a Watershed

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Abstract

As part its drinking water source protection program, Eugene Water & Electric Board (EWEB) is working closely with 27 other federal, state, and local agencies to develop a watershed emergency response plan as a Geographic Information System (GIS) application.

The plan contains GIS information on: watershed characteristics; threats; critical resources; spill response strategies to protect critical resources; equipment; emergency contact lists; and incident communications. First responders and others are able to use this GIS application in the field to efficiently and effectively stabilize accidental or intentional chemical releases as soon as possible and avoid the initial confusion associated with spills.

Introduction

The McKenzie River watershed is located in the Southern Willamette Valley east of Eugene, Oregon (Figure 1). The Eugene Water & Electric Board (EWEB) was formed in 1911 to provide reliable and safe drinking water to over 200,000 people in Eugene and surrounding areas. The McKenzie River is the sole source of this water. Five hydroelectric projects are located in the McKenzie Watershed and provide electricity to the region. The McKenzie also provides critical habitat for a number of endangered or threatened species including: spring Chinook salmon, bull trout, spotted owl, Oregon chub, osprey, and western pond turtle. The McKenzie River has one of the last remaining native bull trout and spring Chinook salmon populations in the Pacific Northwest.

EWEB maintains an infrastructure in the McKenzie River watershed that consists of dams, canals, lakes, power generation facilities, tunnels, roads, buildings, electric transmission lines, dikes, fences, transformer sub stations, intakes, and a water filtration plant. EWEB also owns property in the watershed associated with its intake structures and electric generation facilities as well as islands, riparian areas, and upland properties. In short, the McKenzie River is the lifeblood of EWEB and protection of this watershed is vital to EWEB and the community of Eugene.

In April 2001, EWEB initiated a drinking water source protection program to safe guard the McKenzie River as a critical resource (EWEB, 2001). As part of this effort, chemical spills from transportation accidents and/or releases from fixed facilities were identified as one of the highest threats to the watershed (EWEB, 2000). Following the events of September 11, 2001, protection of critical infrastructure from terrorist activities was also identified as a high priority. In response to these threats, EWEB took a lead role in the coordination, design, and development of a geographic information system (GIS) based watershed emergency response plan.

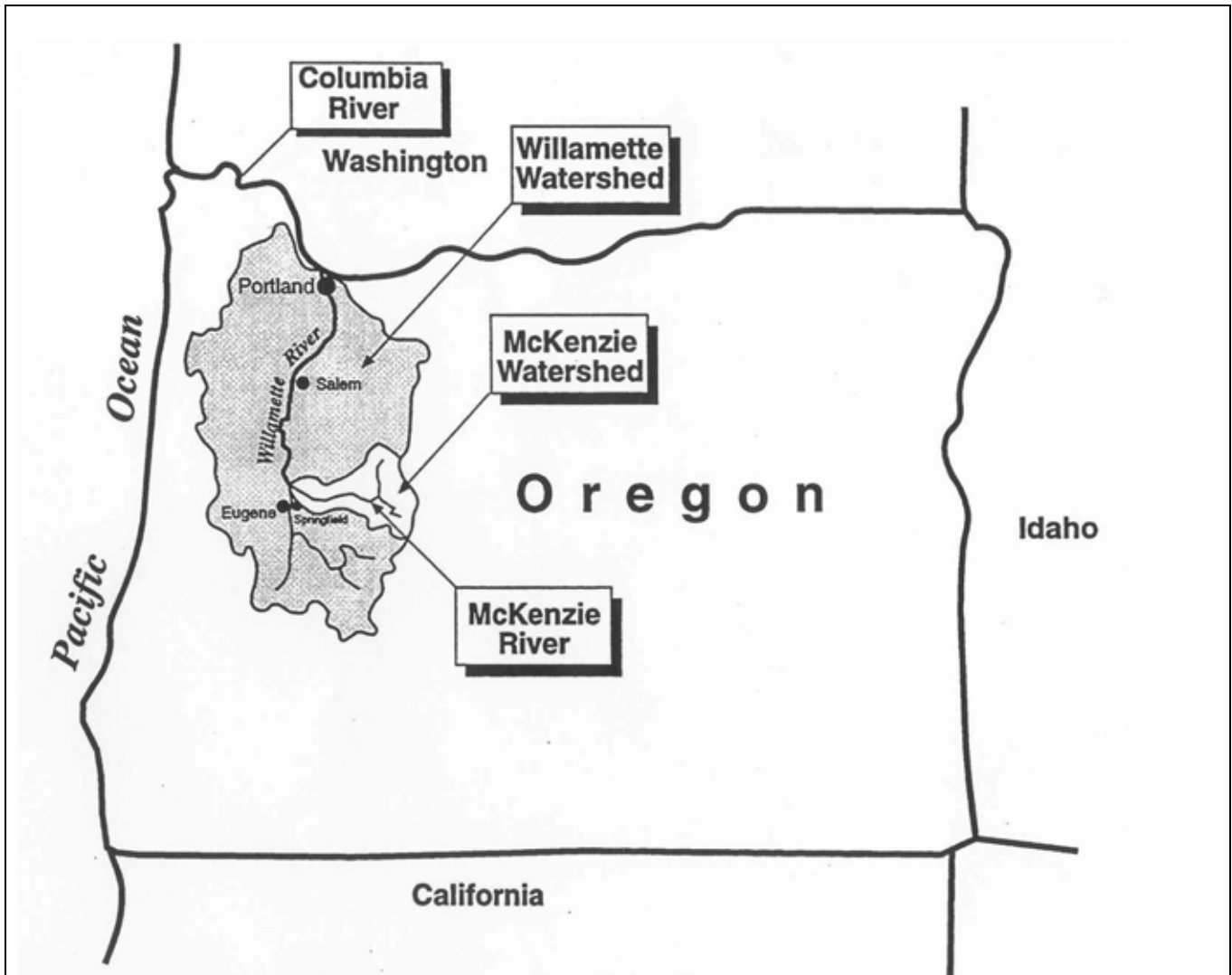


Figure 1: Location of McKenzie River watershed.

A reoccurring theme associated with major spills or releases is that there is confusion and uncertainty for first responders in the initial 6 to 12 hours following an event, and it is during those early hours when the opportunity to contain the spill may still exist. Once a large spill enters a flowing body of water, it quickly becomes out of control, impacting downstream critical resources (drinking water intakes, critical endangered species habitat, spawning beds, nesting areas, hydroelectric facilities, etc.). The goal of the watershed emergency response plan is to provide first responders with the information, support, equipment, and training to efficiently and effectively respond to and stabilize a major chemical spill or release and avoid the initial confusion associated with spill response.

EWEB and its numerous federal, state, and local partner agencies began developing a watershed emergency response plan in July 2001. This plan combines data and information relating to chemical threats, critical resources that need protection, and emergency response strategies and equipment needed to protect these critical resources. This data is housed in a GIS to allow first responders and others easy access to this information when responding to spills or other emergencies.

Approach To Watershed Emergency Response

The approach EWEB took to design, develop, and implement a coordinated and effective watershed emergency response plan involved four important components:

- 1) Developing effective partnerships among federal, state, and local agencies that may play a role in a large scale incident in the McKenzie River watershed;
- 2) Focusing initial planning efforts on a single threat (i.e., hazardous materials);
- 3) Using GIS as the tool to deliver the necessary information to first responders that allows them to effectively and efficiently stabilize a major hazardous material incident; and,
- 4) Raising the level of preparedness among all partner agencies through training and conducting drills together.

As with most regional planning efforts, the key to success is tied to the development and nourishment of partnerships among agencies and organizations that normally would not work or plan together. EWEB and the main first responder in the watershed, McKenzie Fire & Rescue, took a leadership role in forming good working relationships and building trust among the 27 different agencies. The watershed emergency response approach allows the coordination of individual agency emergency planning efforts and sharing of resources among the participating agencies. These agencies and organizations include:

U.S. Forest Service	Springfield Public Works
U.S. Bureau of Land Management	Springfield Fire & Life Safety
U.S. Environmental Protection Agency	Springfield Environmental Services Division
U.S. Army Corps of Engineers	McKenzie Fire & Rescue
Oregon Fish & Wildlife	Mohawk Rural Fire District
Oregon Dept. of Environmental Quality	Upper McKenzie Rural Fire District
Oregon State Police	Region 2 HazMat Team
Oregon Dept. of Transportation	Springfield Utility Board
Oregon Water Resources Division	Rainbow Water District
Oregon Health Division	Eugene Water & Electric Board
Lane County Public Works	Eugene Fire & EMS
Lane County Sheriff	McKenzie Watershed Council
Lane Council of Governments	Weyerhaeuser Company
Lane Regional Air Pollution Authority	

The focus of the initial watershed emergency response plan is to address hazardous material incidents (accidental or intentional). Hazardous material incidents are something that partner agencies are familiar with and understand the seriousness of potential impacts to critical resources when there is a lack of coordination and execution during incident response. In addition, hazardous material incident response is similar to terrorist and other emergency incident responses. The ability to have an efficient and effective response to a hazardous material incident establishes a good foundation for development of other regional emergency response plans (i.e., terrorist incident response, forest fire response, and natural hazards response).

GIS was identified as the tool that would be most effective in managing the large amounts of spatial data and other response information collected from partner agencies and allow first responders to have easy access to this critical information during incident response. In July 2002, ESRI awarded EWEB a

grant that provided a host of GIS tools (ArcGIS, ArcPad, ArcPad Application Builder, ArcSDE, and ArcIMS) in support of the watershed emergency response project. This grant allowed EWEB to use ArcGIS to assimilate divergent data and share information and data among partner agencies. The advantages of having a GIS-based watershed emergency response plan are:

- It allows access to the data in many different ways (workstations, laptops, hand held devices, secured web site) from a single spatial database;
- Applications can be developed to make use of and access to GIS data by first responders easy;
- Its ability to generate excellent quality maps for use in reports and/or during the incident response;
- Its ability to easily update the data and distribute updated information;
- It provides a powerful query and data presentation tool; and,
- It allows agencies to use this information for emergencies as well as for other purposes.

The ESRI grant provided EWEB with a powerful GIS tool to house and manage large amounts of spatial data from numerous partner agencies, evaluate threats, locate “hot spots,” prioritize response efforts to protect critical resources, and develop ahead of time the specific response strategies to protect critical resources based on most probable threats and “hot spot” areas.

The last critical component of EWEB’s approach to watershed emergency planning was raising the level of preparedness among all partner agencies through training and conducting drills together. EWEB was successful in providing a wide range of training courses via grants to raise the level of preparedness among partner agencies. EWEB delivered Incident Command System (ICS), Oil on Water Response Tactics, HazMat Awareness, HazMat Operations, and HazMat Incident Response Tactics training courses to partner agencies over the last year. In addition to increased preparedness and heightened awareness of HazMat issues, these training courses brought together participating agencies and allowed them to understand each other’s roles, gain familiarity, build trust and working relationships, and know what resources/expertise each agency could bring to an incident. This effort went a long way in building camaraderie and providing some benefits (i.e., free training) to participating agencies.

GIS-Based Watershed Emergency Response Plan

The GIS-based McKenzie Watershed Emergency Response Plan provides critical information to responding agencies allowing them to quickly obtain all necessary resources to implement an effective response strategy during the first few hours of a major incident. The plan contains the following elements:

- Watershed characteristics;
- Assessment of potential watershed chemical threats;
- Critical resources to be protected;
- Pre-developed specific response strategies;
- Equipment inventories and other response resources; and,
- Communications and emergency notification plan.

Watershed Characteristics

First responders need data on watershed characteristics that may influence the mobility and behavior of a chemical spill in the environment and on the river. This information includes river flow rates and travel times, hydrology, islands, winds, currents, climate, areas of slow moving water, areas of rapids

or fast moving water, precipitation patterns, river depths, river sediment material and other information.

Chemical Threats

In 2002 EWEB evaluated the potential threats from accidental or intentional releases of hazardous materials to the McKenzie watershed. This threat assessment evaluated the main chemicals that are transported, stored, and/or used in the watershed. Based on this assessment, the most likely chemicals to be spilled or released in the watershed are petroleum products, followed by fertilizers and pesticides (EWEB, 2002). The GIS-based plan includes data regarding chemical use and storage associated with fixed facilities and transportation accident hot spots.

Resources to be Protected

The GIS-based watershed emergency response plan identifies and locates all critical resources in the watershed that should be protected in the event of a spill or chemical release. These critical resources include public drinking water intakes, public drinking water well fields, endangered or threatened species habitat and spawning areas, hydroelectric facilities, individual intakes and wells, large intakes for industrial or agricultural purposes, and wetlands. Some of the basic information collected on each critical resource includes: a) type of resource and reason for protection; b) agency name(s) and contact person(s) responsible for this resource; c) critical resource priority for protection; d) criteria for notification; and, e) special response requirements.

Response Strategies

Response strategies were developed to address the most probable chemical threat (i.e., petroleum spill) based on the threat assessment (EWEB, 2002). Specific response strategies were developed for protection of some of the high priority critical resources (i.e., public drinking water intakes, shallow municipal well fields, and other large intake structures) and for 48 slow moving water areas on the river. Slow moving water areas were mapped using a helicopter with a global positioning system (GPS). Response strategies include containment boom placement, spill collection points, spill deflection strategies, river access areas, equipment and response resource staging areas, and list of equipment necessary to carryout a specific strategy.

Equipment and Other Response Resources

Each participating agency or organization provided an inventory of equipment that may be used in the event of a hazardous material incident. Each equipment warehouse was located using GPS and the inventory list for that warehouse developed. Specific information associated with each equipment warehouse such as contact person(s) and emergency numbers for use of equipment, equipment availability or restrictions on use, information on qualified equipment operators, warehouse access information, and other data was collected from each participating agency. In addition, information on special expertise that agencies could make available for hazardous material incidents was inventoried such as bomb squads, dive teams, air sampling and analytical services, air contaminant transport modeling, construction services, and many others.

An analysis was conducted to determine if there are any critical gaps in the type and location of available equipment in order to implement the response strategies listed in the plan to protect priority resources in the watershed. EWEB has used grant funds to purchase additional response equipment to

fill equipment gaps and is in the process of designing and procuring response trailers that will be staged at critical areas in the watershed for use by first responders or partner agencies.

Communications and Emergency Notification

The GIS-based watershed emergency response plan includes emergency notification contacts for all participating agencies. These emergency contacts are being provided to the areas 911-dispatch service for duplication. In addition, all communications facilities (radio repeaters, transmitters, cell phone towers, microwave towers, etc.) and their associated aerial coverage were mapped. Because the McKenzie River watershed is in mountainous terrain, there is spotty cell phone and radio coverage. It is important for responders to know when cell phone coverage is available and what frequency radio signals are available. Part of the response equipment purchased using grant funds includes portable repeaters that can be setup to augment coverage during large incidents. The GIS information on radio signal coverage will help determine optimum areas for portable repeaters to be setup during incidents.

GIS Application Development

A review of typical information requirements for the emergency planning and incident response provided insight into current response practices and the specific information needs during hazardous material responses. Given the advantages of GIS and the spatial nature of the information being collected as part of this effort, a spatial database was developed at the onset of the planning process to address the information needs associated with incident response. Based on this assessment, an information management approach was taken for the development, utilization, and distribution of GIS tools for first responders.

The challenge for developing a GIS-based system that is an effective tool for first responders is to make the system easy to use allowing responders to quickly extract the information they need to do their jobs. In addition, it is important to make this response plan information available to participating agencies in many different formats including GIS for laptops and workstations (ArcGIS or ArcView software), GIS for hand held devices (ArcPad software), GIS via internet access (a future project using ArcIMS and ArcSDE software), and hard copy reports with detailed GIS generated maps. This takes advantage of having a single spatial database that can be served on multiple platforms (Figure 2).

Data Requirements

The spatial database contains a variety of data types from numerous sources. The data can be grouped as follows: basemap, critical resources, potential threats, and response resources. All data were loaded into an ArcMap project.

Basemap

These datasets are either shapefiles that present planimetric information, or image catalogs. Shapefiles include: roads, hydrography, political boundaries, 10-meter contours, city boundaries, and towns. The image catalogs include; 1:24k USGS topographic maps in DRG format, and 1996 and 2000 ortho corrected aerial photographs in different map projections. ArcTool utilities were used extensively in setting up coordinate references and image catalogs. Given that some of the image catalogs contain over 2,000 tiles, Visual Basic for Applications (VBA) scripts were developed to automate certain processes. In order to address the slow redraw of these large image catalogs, ArcMap wire frame display options were defined.

McKenzie Watershed Emergency Response System

Development and Delivery

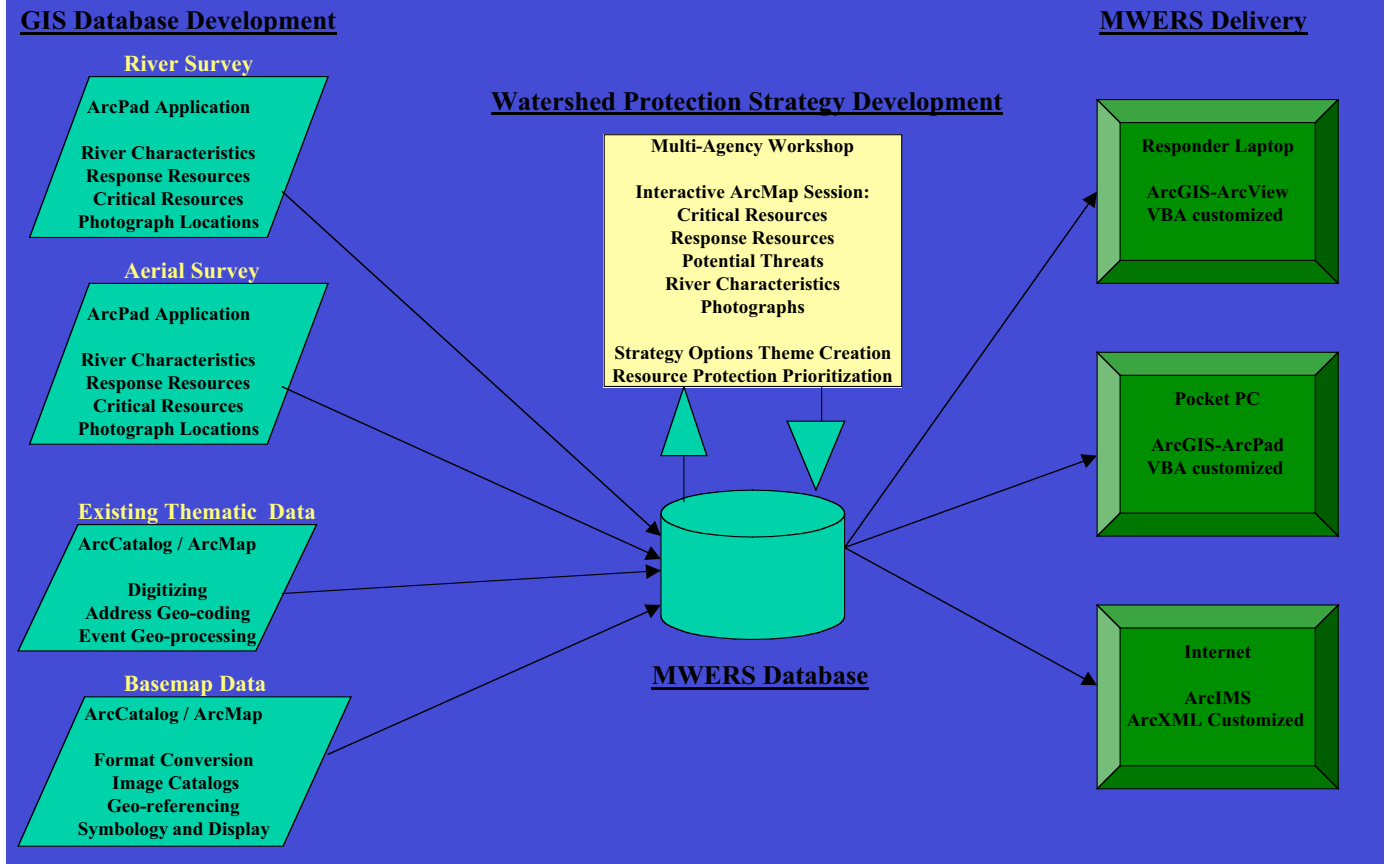


Figure 2: Overview of the GIS-based McKenzie Watershed Emergency Response System.

Critical Resources

These datasets represent a resource potentially impacted from an incident. Included are surface water intakes, threatened and endangered species, fish habitats and spawning gravels, wetlands, municipal wells, and individual intakes and wells (Figure 3). Several methods were used to develop these data. Fish and wildlife habitats, spawning areas, and threatened and endangered species were developed from previous reports and investigations in conjunction with the McKenzie Watershed Council and Oregon Fish and Wildlife. Geo-referencing was accomplished using xy coordinates where available, and heads-up digitizing in other instances. Resource manager contact information and specific data associated with each critical resource was entered as attributes into the spatial database.

Potential Threats

Potential threats from the storage and/or use of hazardous materials and the potential for transportation accidents along the McKenzie River were integrated into the spatial database.

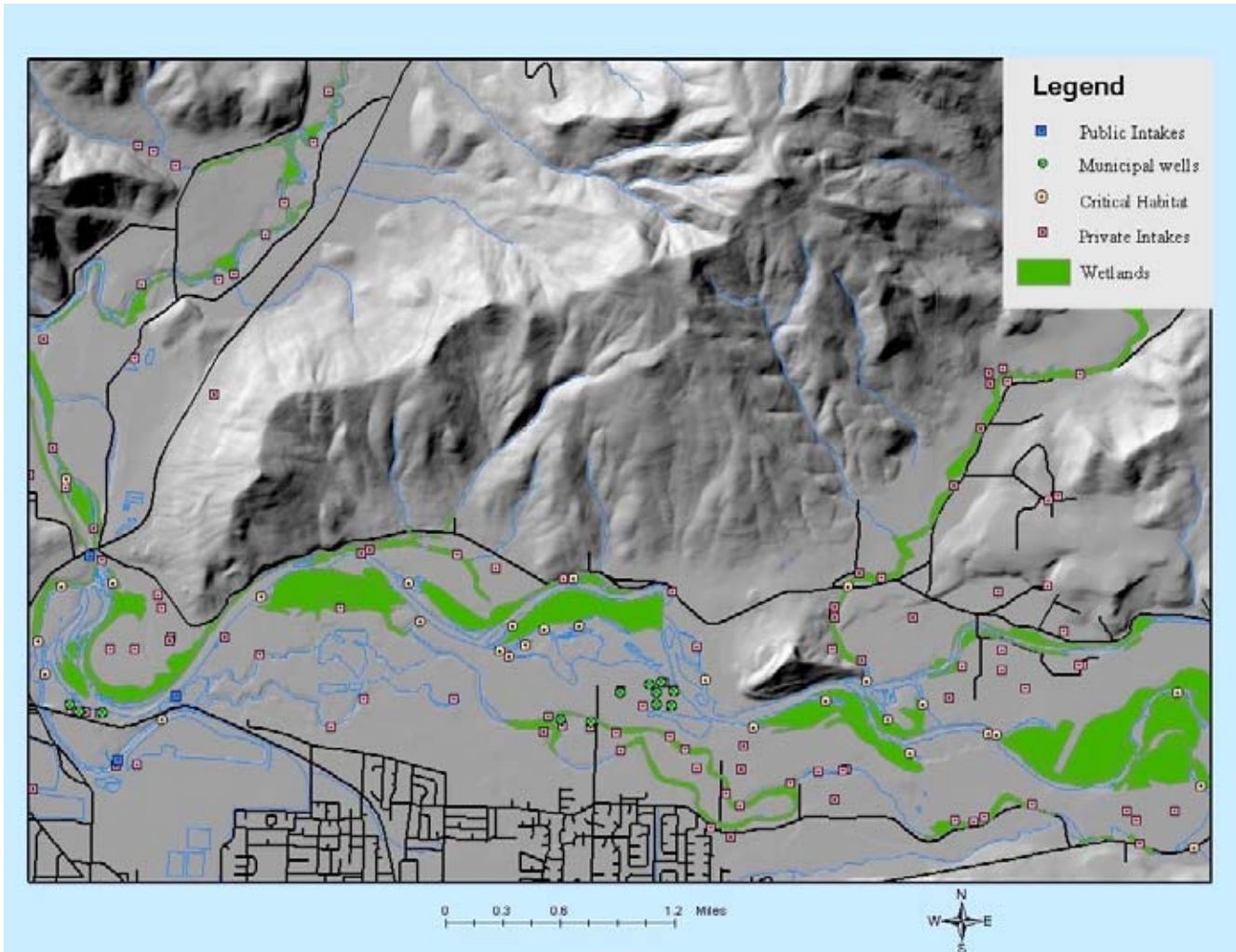


Figure 3: Sample of critical resource information in lower McKenzie River watershed.

(Figure 4). Numerous sources were used to develop these data layers including the Oregon State Fire Marshal Hazardous Substance Information System (HSIS) database, Oregon Department of Environmental Quality facilities database, City of Springfield hazardous material facilities database, Springfield Utility Board wellhead protection threat assessment, and scanning the yellow pages for potential hazardous material facilities. In addition, vehicle accident data was collected from the Oregon Department of Transportation to identify transportation accident hot spots.

The location information associated with these various sources of data ranged from providing latitude and longitude data for each facility to just providing addresses, which were used with address matching tools to generate location information. A highway accident route event table was integrated as well, by dynamically segmenting the main transport route through the watershed.

Response Resources

These datasets represent a resource that potentially can aide in the response to an incident. Included are boat ramps, staging areas, equipment warehouses, highway culvert information,

CHEMICAL SPILL OR RELEASE THREATS

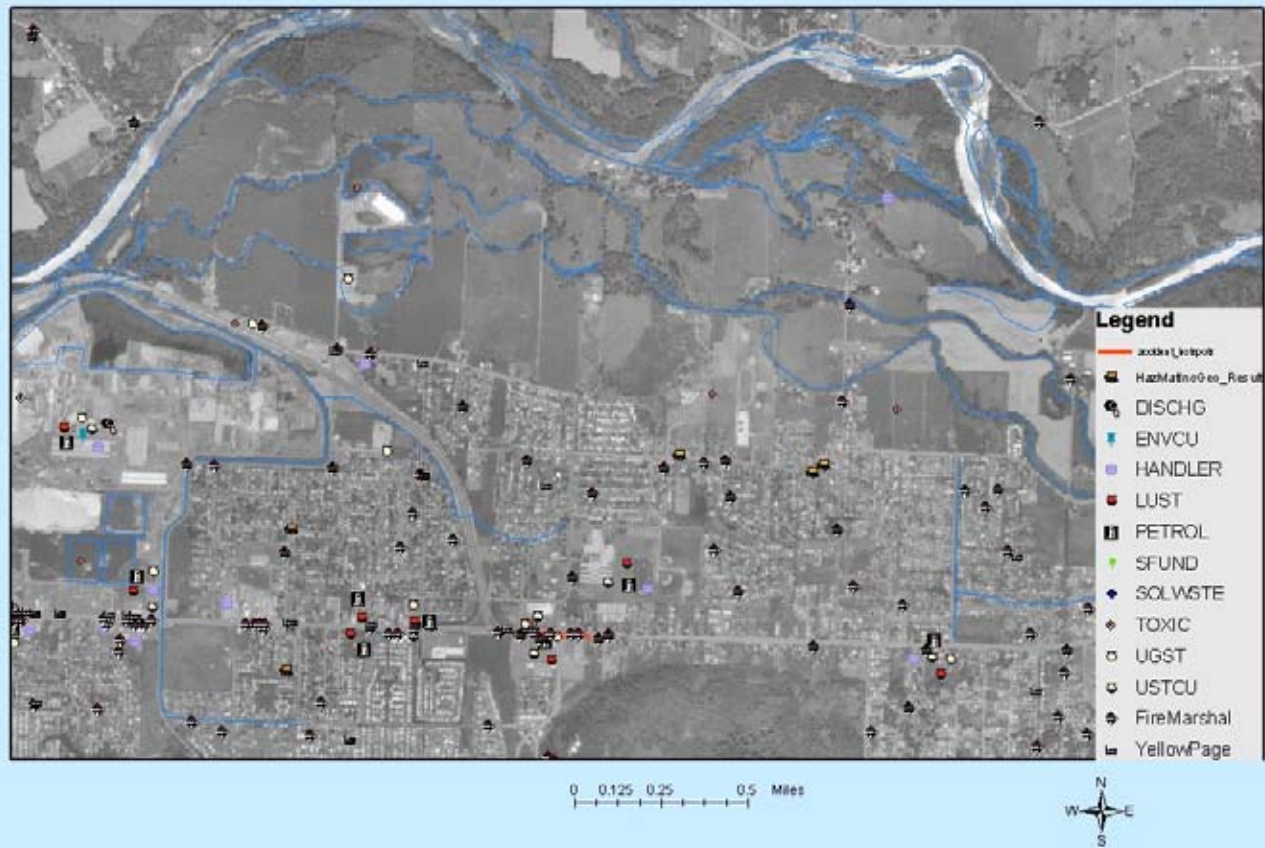


Figure 4: Chemical threats located in the Springfield area of the McKenzie River watershed.

storm sewer drains and routes, and river aerial photographs (Figure 5). Several methods were used to develop these data. Helicopter and river jet boat surveys were undertaken to refine existing data and collect missing or new data. Customized ArcPad applications were developed for each survey that allowed for the efficient collection of spatial and attribute data. Certain river characteristics viewed as response resources were also collected. These include, river flow rate, river eddies, and slow water areas. These data layers were used extensively during the development of response strategies.

An equipment database was developed from partner agency surveys. These contained information on the equipment type, warehouse location, quantity, and warehouse contacts. This database is used in a spatial and tabular search function for responders.

Response Strategy Development

Development of specific response strategies to protect critical resources is one of the most important aspects of the watershed emergency response plan. A two-day workshop was held to prioritize critical resources that need to be protected and develop integrated response strategies to protect these critical

resources. Approximately 35 people representing twenty-three different agencies participated in the workshop. It was important to orchestrate the interactive workshop to accomplish the objectives in an

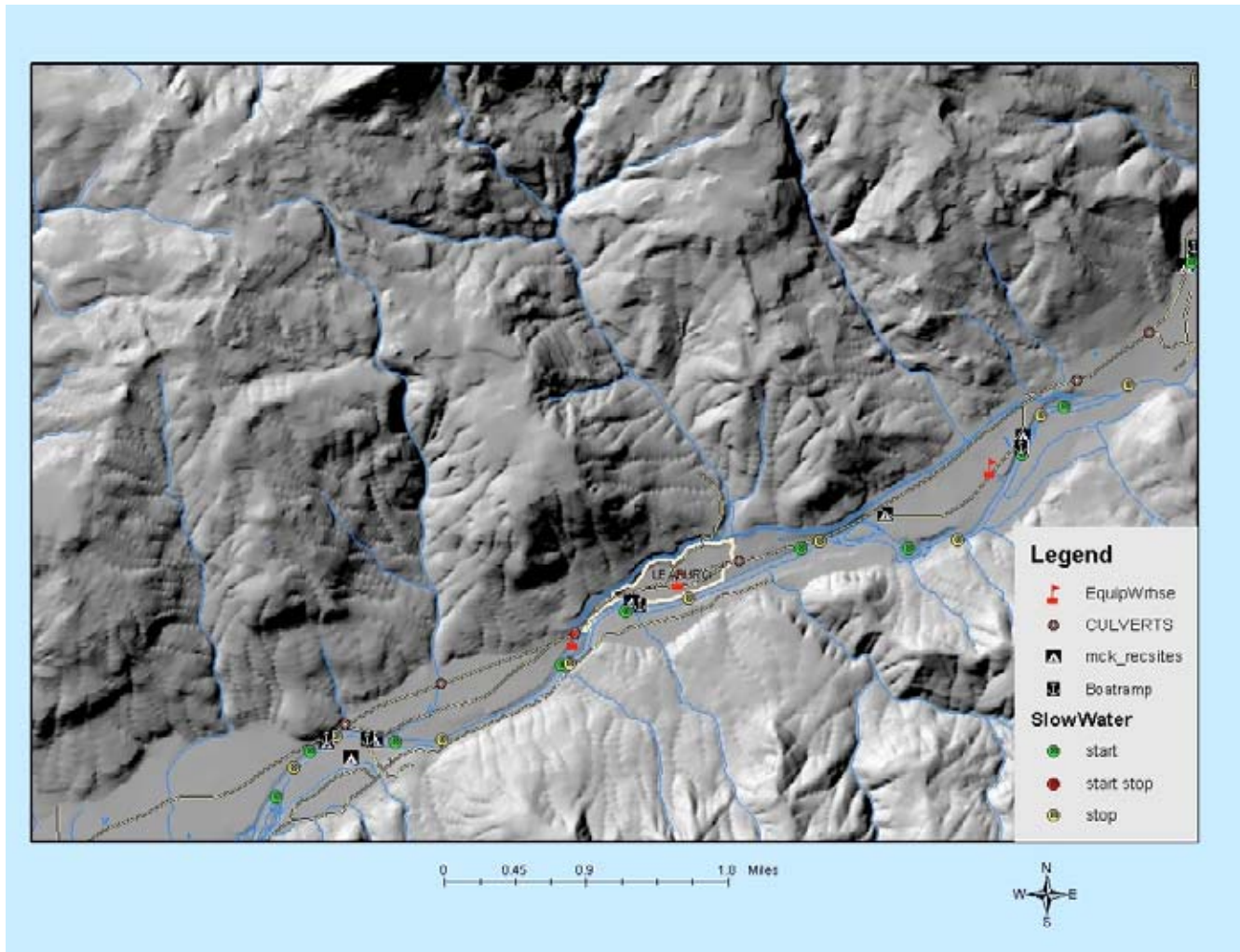


Figure 5: Sample of response resources in area of Leaburg, Oregon.

efficient manner that actively involved participants. The approach taken was to integrate and present all data related to planning for an incident response. Hardcopy maps, a large screen with projected river aerial photographs, and an ArcMap session displayed on a second large screen were interactively used in the development of incident response strategies during the workshop.

After prioritizing critical resources, participants focused on high priority areas of the watershed for development of response strategies. Response strategies were developed for all slow moving water areas in these high priority river segments as well as to protect specific critical resources. Boom placement for specific strategies was added in a live editing session, general attribute information such as strategy type, boom type, boom length, and spill collection areas were entered during the workshop, and general agreement was reached on the approach to each strategy. The strategy data layer was then edited for any changes, and reviewed by the project team. A response strategy report pdf file was created that briefly discusses strategy implementation (Figures 6a and 6b). The response strategy pdf files are hyperlinked to the slow moving water feature they were developed for or the critical resource

they were designed to protect within the spatial database. In this way a first responder can pull up a strategy report by clicking on the hyperlink feature displayed on the screen. The response strategy reports are also available in the hard copy version of the McKenzie Watershed Emergency Response Plan.

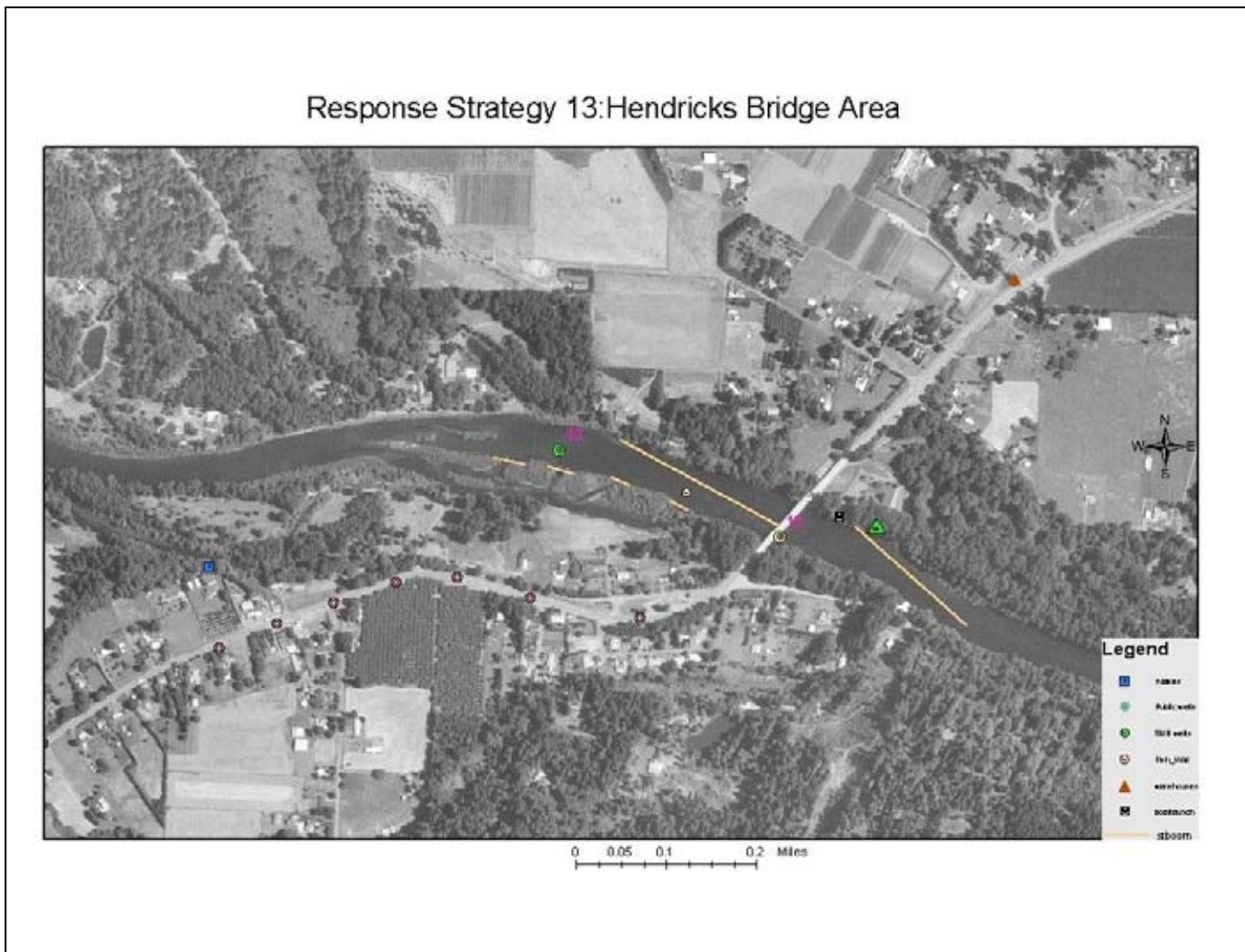


Figure 6a: Sample response strategy showing boom placement and response resources.

McKenzie Watershed Emergency Response System (MWERS)

In order to provide first responders and other partner agencies with the ability to query and interact with the spatial database during an emergency, a laptop computer based response tool was developed. This allows responders to have access to information that is not available in the response strategy reports, which are fixed documents. For example, spill travel times to each downstream critical resource can be calculated after entering spill location and river flow rate. Also, if specific equipment listed in the response strategy is “out” at another incident, a spatial search for that equipment would indicate equipment status and availability. The MWERS is a Visual Basic for Applications (VBA) customized ArcMap application. Specific menu and button driven functions were developed so that

**Strategy Number 13
Hendricks Bridge Area**



Response Objectives:

Dimension, Protection, and Collection

Critical Resources to be Protected:

- Head gate/inlets to Cedar Canal.
- Small spawning area (1 mdd) @ River Mile 23.9.
- Western pond turtle habitat in side channel along south bank of river.

Location:

Hendricks Bridge located east of Springfield 3.2 miles
44° 03' 22" N / 122° 49' 44" W
Highway 124E Milepost 11.4

Description of Response Tactics:

- Block highway drains on Hendricks Bridge (if vehicles spill on bridge).
- Deploy approximately 1,000 feet of ext or ext hard boom with curtain from south bank or anchor near south bank (upriver from bridge if spill originating from upriver) and angle to just upriver of boat ramp at natural eddy for collection.
- Deploy approximately 1,000 feet of ext or ext hard boom with curtain from southern most bridge pier to residential property along north bank for collection.
- Use southern bank to protect habitat and head gate or intake structure.
- Close head gate to Cedar Canal (Contact: William Kammis 747-1944).
- Deploy four 300-foot sections of ext or ext hard boom with curtain across 6 channels leading to a slough area along A collection area; protect shoreline with sorbent boom/pads and poly sheeting. Collect product with vac truck, skimmers, or other devices.

Access Areas:

- Hendricks Park Boat Ramp (located immediately east of Hendricks Bridge on north bank of river).
- Closest downriver access is Ballinger Landing @ River Mile 18.9 on north side of river (approximately 5 river miles downstream from bridge).

Staging Areas:

- Hendricks Park is an ideal staging area with open space, parking areas, bathroom facilities and access to the river.
- Nearest equipment warehouse is McFadden Fire & Rescue Wauwatosa Station (~ 4 miles north of bridge, west side of Hwy 124).

Equipment Needs:

- 4-Crate covers for Bridge drains (if spill on bridge)
- 3200 feet ext or ext boom
- 600 feet sorbent boom (shoreline protection)
- Multiple anchors & weights for boom placement
- 700 feet x 50 feet of Poly sheeting for shoreline protection and dewatering
- 12 bales sorbent pads
- 2 cases drum lines (85 gallons)
- 2 Jet boat (at least) to set boom
- 2 generators
- 2 light trucks
- Dewatering equipment
- Pressure washer
- 3-4 Containment basins (holding pool)
- Vac truck
- 31 immerse rope mop system

Site Specific Description:

- 0.7 m/s flow during high flow
- No data on depth.
- River width = 250-300 feet
- Sand, gravel and cobble bottom.

6b: Sample response strategy report for a slow moving water area.

responders could retrieve information quickly and easily without having to be an experienced ArcGIS user. At the same time an experienced ArcGIS user can access the full capability of ArcGIS and do more advanced query and analysis of response information.

Specific application functions associated with the MWERS include:

- Entry of an incident location using different reference methods such as: interactive with a cursor; latitude and longitude coordinates in decimal degrees or degrees/minutes/seconds; based on river mile; or based on road mile.
- Automatic zoom “mostly” downstream of the incident.
- Hyperlink to a specific response strategy reports, including hyperlink to aerial photographs.
- Entry of river flow regimes, used for the calculation of spill travel time to each critical and response resource.
- Creation of on-the-fly reports for critical resources or response resources that contain a worst case calculation of spill travel time to the specific resource with resource contact and notification information.
- Ability to search spatially for specific response equipment.
- Links to chemical database search capabilities (CAMEO).
- Project and/or response personnel search capabilities to find a specific expertise or qualified equipment operators.

The MWERS provides responders with quick and easy access to specific response strategy reports. To accomplish this, a strategy point data layer was developed that represents each strategy. Hyperlinks for each strategy were then created that open the strategy in question as an Adobe pdf file. Aerial photographs that depict strategy locations can also be accessed in the same manner.

The development of spill travel time estimates was accomplished by treating the McKenzie River as a route (using USGS river mile designations) in conjunction with a previous river study (USGS, 1968). The USGS study used dye testing to develop a travel rate for high, medium, and low river flow rates. Dye tests were conducted along fifteen segments of the McKenzie River. A flow rate - travel time matrix was developed for the various river segments. A river line file was processed as a route system based on USGS river mile. Using the matrix as a time guide, and dividing by the segment length, river impedances were assign as continuous events. The route system was also used to develop route events for all critical resource entities as well as for some response resources such as, boat ramps and access areas. VBA script was then used to perform a calculation for spill travel time for each critical resource event. This was accomplished by taking the spill location and converting it into a river mile event, coupled with river impedance segments for specific flow regimes and a mathematical summation routine. Travel time estimates, which are worst-case estimates, are then added as a virtual attribute to the critical resources data layers. When real-time reports are generated, the application will add the travel time information to the report.

The MWERS has built-in functionality to generate real-time reports. For example, the application can develop a pre-formatted report of critical resource information based on the spill location. Specifically the report presents each critical resource type, the travel time for the spill to reach the resource, and the contact information for the resource manager. Other reports such as response resources, equipment reports, and summary reports are also available for the first responder. A summary strategy report can also be created that lists each strategy identifier, strategy type, and spill travel time to each response strategy. Reporting functionality was developed creating report templates using Crystal reports, then automating the source data object when a report is requested, and passing the new data source to the Crystal report template.

The equipment search function was created by allowing the user to specify which type of equipment they are searching for, as well as a search radius from the incident or spill event. The application searches the entire equipment database for those records that match, and returns an equipment listing report grouped by the closest warehouse to the spill location. Additionally, the application has links to excel files the user can quickly open that list all equipment at a specific equipment warehouse. All equipment listing or reports provide warehouse contact information.

Update of MWERS Data

One of the more critical tasks associated with any multi-agency spatial database is making sure it is updated on a regular basis. EWEB's approach to this aspect of the project is to develop an update schedule for the various data sets and send the old data sets to the responsible agency for updating. EWEB would take the role of ensuring that that data is updated and imported back into the spatial database in a timely fashion. Periodic releases of new versions of the MWERS would be provided to participating agencies and the old versions destroyed. Once a web-based system is developed this can be accomplished through having partner agencies interact with the spatial database via the secured website for updating information and downloading new versions of the MWERS.

Use By First Responders

MWERS provides several canned functions, as mentioned above, that can aide the first responder. Other inherent ArcGIS functions can also be used depending on the incident in question, and the specific analysis and information needs. Although the possibilities of how the MWERS will be used in a specific incident are numerous and varied, presented below is an example of how the MWERS could be used during a typical response.

- Responder enters the location of the incident via one of several geo-referencing methods.
- ArcMap automatically zooms to the area, and presents a mostly downstream view.
- The responder can visually assess closest downstream response strategies and hyperlink to each response strategy report. Each strategy report provides detailed information and instructions that a responder will use to mitigate a spill (Figures 6a and 6b).
- The responder can take the list of equipment needed to implement a response strategy and enter the list into the equipment search function. This will provide the responder with the location and contacts for the equipment warehouses that have the equipment necessary to carryout the response strategy.
- The responder can zoom in to the spill area and identify storm drains and/or culverts and obtain specific information about those features that allows him to determine the size and shape of plugs to stop the spilled material from entering storm sewers or crossing under the road into the river.
- The responder can then create a critical resource report that shows each resource, spill travel time, and contact information. The responder can notify the appropriate resource manager(s) for downstream critical resources and provide approximate times until spill reaches that resource. Critical resource managers would then be able to start implementing the specific response strategies designed to protect those resources.
- If the incident material is known, the responder can quickly access CAMEO and enter the CAS number or product name and retrieve chemical and physical characteristics for the material in question.

- If the responder needs more equipment not identified in the strategy report, they can perform a search for the equipment, and retrieve a listing of warehouses and contacts to acquire the additional equipment.
- The responder can save and name the incident location, and enter new spill locations in order to track the progress of the spill over time.
- If the incident hazardous material is known, but the source is not identified, the responder can search the threats data layers and identify upstream facilities that use or store that hazardous material and use this information to identify the source of the material.
- On larger incidents the MWERS can be plugged into the incident command system to provide situation maps, aerial photos, and support response planning and design of operations.

It is anticipated that the MWERS for laptop computers will be ready for use by first responders in early August 2003. This initial version will go through various testing and will be used in drills and exercises that implement various response strategies to address simulated spills. Enhancements will be made to the system as it is used and first responders provide feedback for further development.

Conclusions

The McKenzie Watershed Emergency Response Plan is an integral part of EWEB's drinking water source protection program. It has been identified as a high priority for implementation due to the threat of chemical spills or releases and the need for heightened security of drinking water systems serving large populations. EWEB and its federal, state, and local partners have a strong commitment to development and implementation of the watershed emergency response plan. One reason for this commitment is because those who will be using it are developing the watershed emergency response plan.

A number of future modifications and additions are planned for the MWERS. These future efforts include:

- The development and distribution of the MWERS on other platforms such as a handheld Pocket PC with a customized ArcPad application;
- The development of the MWERS on the web using ArcIMS and ArcSDE technology;
- The development and integration of a river flow model, on which the refinement of the travel time function can be made;
- The development of probability impacts to critical resources that are based on contaminant transport models using different spill locations, river flow regimes, and various hazardous materials; and,
- The continual development of tools based on responder feedback and changing response needs.

In addition, various "modules" will be developed that focus on weapons of mass destruction (WMD) incident response, forest fire assessment and response, and natural disaster response. The terrorism incident response module is anticipated to be completed by fall 2003 and will include the development of specific response strategies for terrorist activities aimed at high priority targets in the watershed (i.e., chemical facilities, drinking water intakes and treatment plants, hydroelectric plants, dams, sewage treatment plants, and other targets).

This project has and will continue to make a difference in the regions emergency response community by:

- Sharing resources and expertise among 27 different agencies and organizations;

- Prioritizing areas in the watershed with a concentration of high priority critical resources for conducting drills and exercises to test use of the watershed emergency response plan;
- Being better prepared to address large scale incidents;
- Access to equipment inventories from 27 different agencies;
- Assessing response equipment locations in the watershed and identify equipment staging areas;
- Fostering communication among participating agencies and increasing the level of knowledge and training among all participating agencies (not just the first responders);
- Having a comprehensive response plan that can be easily used and accessed; and,
- Transferring this approach and GIS application to other watersheds in the area.

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