WEB-BASED GIS DECISION SUPPORT SYSTEM FOR IRRIGATION DISTRICTS

Brian Fischer[1]
Mark Deutschman, PhD., P.E.[2]

ABSTRACT

Water management can be a complicated effort, especially when there is a lack of supporting information for making a decision. Often information is sparse or located in multiple locations. This presentation will demonstrate an affordable web-based tool developed with Open Source software. The purpose of the tool is to bring information into a single user interface for supporting water management functions and decisions. This presentation will focus on a decision support application created for the Sun River watershed in west-central Montana. The application is not intended to compete with existing SCADA applications, but compliment them by integrating and using some of the SCADA system data.

INTRODUCTION

The Sun River Watershed is located in west-central Montana covering 1.4 million acres of land. The Sun River meanders 110 miles until it flows into the Missouri River at Great Falls, MT. Over the past 10 years water right disputes have arisen because of drought conditions. Making decisions on how to settle water right disputes or even how to prevent them are often difficult because of the sparse nature of water rights information. Another factor that complicates decision making is the lack of accessible information to forecast water demands within the watershed.

The Sun River Watershed Decision Support System was developed as a tool to aid decision makers in preventing water rights disputes and give them easier access to the information they need to manage the watershed. The Sun River Watershed Decision Support System's user interface is shown in Figure 1.

The decision support system has integrated a number of functions and tools making water management decisions easier than previous methods. The purpose of this application is to provide real-time access to environmental and monitoring data (both telemetered from the Irrigation Districts system and from other sources on the web; i.e., NWIS) along with water rights / land use / cropping information, to operate the river system (and thereby conserve water). The tools are capable of computing water demand at specific diversion locations and evaluating upstream

---

[1] GIS Specialist/Programmer, Houston Engineering, Inc. (HEI), 10900 73rd AVE N, Suite 106, Maple Grove, MN 55369; bfischer@houstonengineeringinc.com.
[2] Vice President, HEI; mdeutschman@houstonengineeringinc.com.

shortages (both existing flows in the river and in storage). The demands and storages are computed using GIS information about crop type, and historic meteorological and climate data, and hydromet data. The information is presented using an interactive map with links to various State, Federal and Local databases. The tools are also accessed through this Internet GIS interface for estimating water demands. The tool is not meant to be the only pieces of information watershed and irrigation managers use to make their decisions, but rather another piece of information they can use.
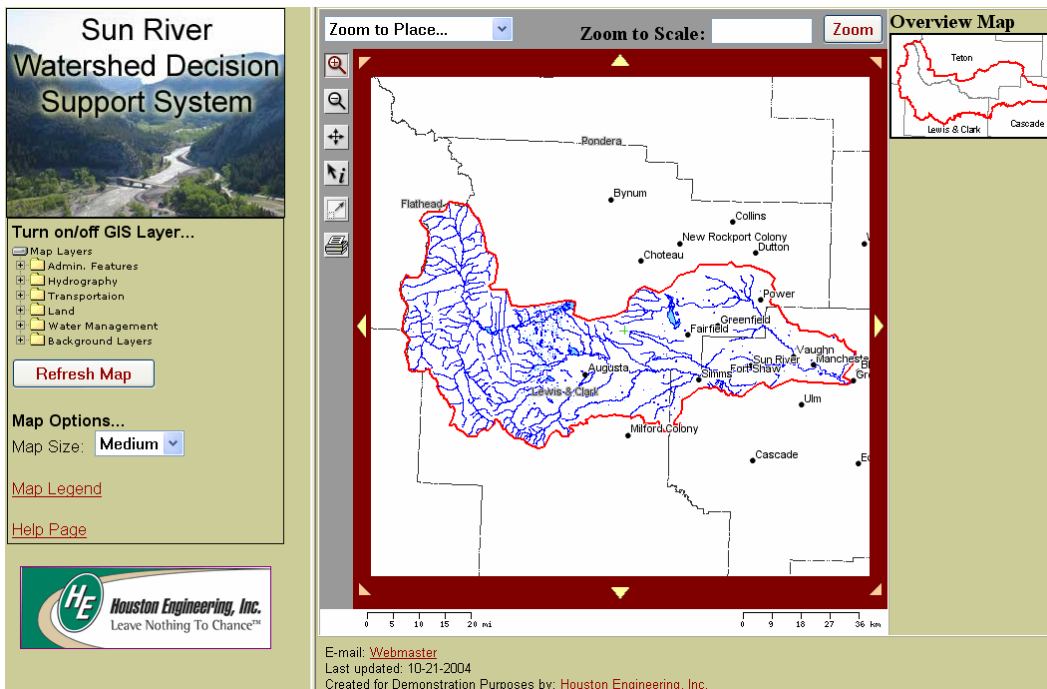

Figure1. Sun River Watershed Decision Support System User Interface.

COMPILING AND LINKING DATA

Data used by the Sun River Watershed Decision Support System includes a variety of basemap information, such as roads, hydrography, and cities, allowing users to orient themselves. Other data includes specific water management data such as water use, diversions, dams, stream flow, and reservoir operations. Most of the water management layers have an associated database allowing users to query for water rights, river discharges and reservoir conditions. Figure 2 shows a map zoomed in around Vaughn, MT with diversion and gaging station GIS layers turned on.
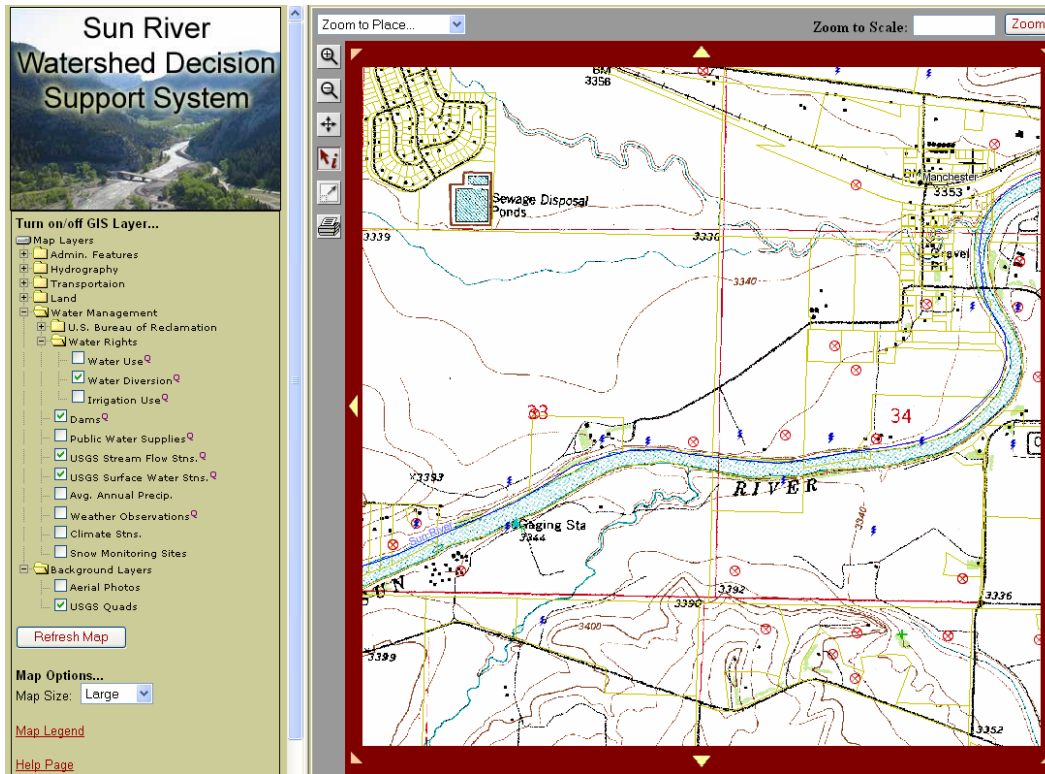
Figure 2. Web Application Zoomed in Around Vaughn, MT.

OPEN SOURCE SOFTWARE

The Sun River Watershed is made up of a watershed management organization and a few irrigation districts. Each organization is small and has limited operating budgets. In order to provide an affordable tool for staff to use in day-to-day decision making, it had to have low maintenance costs.

The logical choice to provide sophisticated functionality at a low cost was to turn to Open Source Software. Two primary Open Source GIS packages were used to develop the application. They included the University of Minnesota MapServer (http://mapserver.umn.edu) and PostGIS (http://postgis.refractions.net/). MapServer is the mapping engine and PostGIS is a spatial database that stores the data and provides querying functionality that is used to drive the web application. This allowed us to develop the application with no software costs and relies on no software maintenance costs into the future. This allows the organizations to focus maintenance costs on ensuring the data is up to date, hosting the web application and developing new tools as needs arise.

CONCLUSION

The Sun River Watershed Decision Support System is simply an Internet GIS tool developed to aid decision makers in the watershed on day-to-day water management decisions. The tool was developed with Open Source software in order to make the web application an affordable solution for local organizations with small operating budgets. The web-based tool is not meant to replace existing decision making processes, but provide additional information in an easy to use interface. Often much of the data exists to make decisions, but can be difficult to find and access. The web-based tool was developed to provide a cost-effective means of accessing the distributed information.