The Benefits of Web-Based Map Deployment in Environmental Consulting Project Work

I. INTRODUCTION

Geographic Information System (GIS) software is a powerful tool for displaying and analyzing geographic or geospatial data. These data describe both a feature's location and its properties or attributes. In the past, GIS tools were used primarily by those in science and government, as well as for certain transportation and engineering projects. However, as new technologies have emerged, the geospatial community has grown to include those involved in real estate, parks and recreation, urban planning, and other businesses and organizations that benefit from harnessing the power of geospatial data and information.

GIS Maps and Data

Until recently, GIS maps and spatial data, either on paper or in electronic format, have typically been available only to a limited work group or project team. Maps were often highly technical, and required the use of sophisticated GIS software to navigate, edit, and print. Each time new data was made available, the map had to be updated by a GIS technician, and then redistributed to the project team or work group. This method was not only costly and inefficient; it was also problematic in that it allowed for the possibility of obsolete and/or inaccurate maps to remain in circulation.

Server based systems have addressed many of the issues encountered in the past by centralizing datasets on local networks for multi-user access. Allowing multiple users to access maps and spatial data from one location makes map modification and distribution much easier and more efficient. One method of using a server based system for GIS is to use a file based system in which spatial data is stored on a local network allowing users to download the data files to their computer and view/edit them using desktop GIS software. As before, numerous obsolete copies of previously downloaded data can remain in circulation on users' desktop computers if a good protocol is not adopted and adhered to. In addition, since desktop GIS software allows users to modify map files and data, the author/owner can no longer exercise exclusive control, potentially creating problems with data accuracy and quality control and assurance.

A more sophisticated method of utilizing a server based GIS system is to store the spatial data in a database management system (DBMS) such as SQL server, Oracle or MySQL. This is typically a more complicated and expensive system with respect to both setup and maintenance, but can allow for much better data management protocol and easy data distribution by allowing multiple users to "link" their local GIS software to the datasets stored on the DBMS.

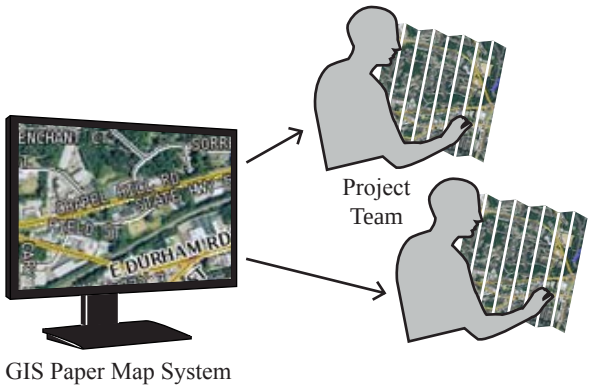
Web Based Mapping

Web based mapping offers an easy solution to the issues encountered with both traditional methods and server based systems using desktop GIS software. Web based mapping secures the actual map and data files on the file server and allows the user to request that selected map

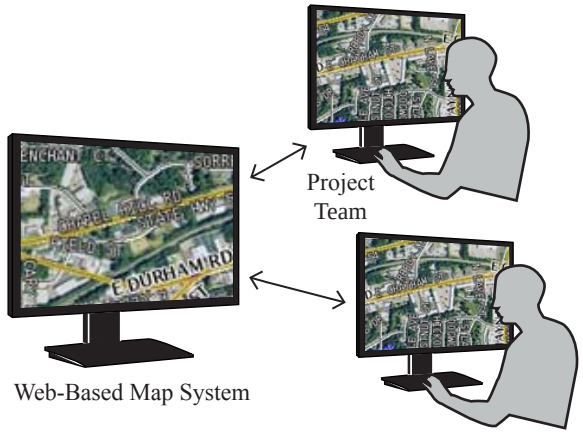
views and data layers be displayed on their desktop computer via a standard internet browser. This eliminates costs associated with the purchase and maintenance of many desktop GIS software installations, and eliminates the need for multiple users to learn sophisticated GIS software.

Web based mapping, while attractive for the end user, requires the organization that prepared the map to setup and maintain its own map server system. They must purchase and configure the required hardware and specialized software, set up and maintain the accounts for the project team and other users, maintain the system to ensure compatibility with the latest software versions and to ensure high system reliability and uptime, and provide for periodic backups to guard against loss of valuable project data.

Hosted web mapping services offer an alternative solution. The internet map hosting service provider handles the majority of web based mapping functions for a low monthly subscription fee. The system hardware and software are already in place and provided as part of a monthly fee, easily allowing map authors to create, upload, store, modify, and maintain maps, and make them available to an unlimited number of users without compromising administrative and quality control. Furthermore, a hosting service can be employed for only as long as it is needed for the project, and the service can be terminated at any time with no expensive "leftover" equipment. MapServing.com, LLC is one of the leading providers of hosted web based mapping services. For a low monthly subscription fee, MapServing provides a secure, reliable, and easy to use environment that allows its clients to upload and share their maps with whomever they choose while maintaining complete control of their account and web based mapping projects.



Multiple map copies are distributed; outdated copies may remain in circulation as map is updated.



Project team accesses single copy of map and data via internet connections; GIS Function maintains control and quality as map is updated.

II. CASE STUDY: INTRODUCTION

The use of maps and geospatial data has been, and continues to be a vital asset to engineers, geologists, environmental scientists, and other environmental professionals involved in environmental consulting projects. Environmental compliance and resource development projects are rich in the need for, and use of, spatial data. Site features can include:

- Roads, buildings, facilities operations areas, and other landmark features
- Location and extent of soil types and geologic features
- Streams, lakes, ponds, wetlands and other hydrologic features
- Water supply wells
- Areas of target resources to be developed
- Sources and locations of chemical contamination
- Environmental or resource sampling locations
- Extent of impacted environmental media and/or impacted natural resources and receptors
- Proposed locations for resource extraction or environmental cleanup actions
- Numerous other types of spatial data related to the particular project

Information about these spatial data are typically recorded, displayed, and communicated to interested parties using one or more types of maps. Challenges can often arise on a project from the need to ensure that the data on the map are current and accurate; that the data are displayed in a way that meets the needs of a particular viewer (i.e. only the important features are displayed for that viewer's purpose to avoid distracting or confusing clutter); and that the map is readily available to those who need to use it while allowing the project director to maintain control over map distribution.

The following case study describes the evolution of a typical environmental compliance project and how MapServing.com, LLC's hosted web based mapping technology can be utilized by environmental professionals to easily and effectively manage project data, and provide their clients with instant access to a wide range of maps and spatial information. The case study begins with a description of the Site, nature of the data, and investigations that have been conducted, and moves on to describe how a hosted web based mapping service was used to compile and manage project data. While the data utilized for this case study are based on actual site data, the names and locations of facilities and their associated activities have been modified to protect confidential information.

III. SITE DESCRIPTION & HISTORY

Site Description

Groundwater resources beneath the Snyder Industrial Park Superfund Site (the Site) are contaminated. Remediation programs are currently underway for several of the industrial sites that have potentially impacted groundwater resources in the area, and are in various stages of completion. Identification of sources of, and assessment of contribution to, groundwater contamination beneath and downgradient from the Site is the subject of ongoing regulatory-driven investigations at the Site. It is the hope of the local population that these groundwater issues can be resolved quickly and efficiently in-order to facilitate the Town's plans for reuse of the former industrial park property. The sites in the industrial park include:

- The Noonan Company, a golf equipment manufacturer
- Czervik, a former chemical distribution company
- Lacey's Laundry, located south of the industrial park
- Smails Fabricators, a former metal products manufacturer
- Spackler Cleaners
- TR Wiggins, a former manufacturer of pest control chemicals
- Webb Chemicals, a former chemical manufacturer specializing in custom made products

Years of operations at these sites varied, with the earliest beginning in 1951 and the last ending operations in 2001. The major chemicals of concern for the area are Tetrachloroethene (PCE), Trichloroethene (TCE), and 1,1,1-Trichloroethene (1,1,1-TCA). Numerous investigations involving many different consultants have been performed over the past 20 years at many of the properties resulting in delineation of groundwater contamination and evaluation of threats to public supply wells downgradient from the Site.

Nature of the Data

Investigations at the Site have been conducted by a dozen different environmental consulting firms, with oversight by 3 different case managers at the State Department of Environmental Protection (DEP). As such, geologic, hydrogeologic, and soil and water quality information have been obtained in several different formats. Several consulting companies submitted only paper copies of reports and data, which comprise most of the earlier data for the Site. Along with this "paper" information, much of the remaining data were electronic but not assembled in a consistent and comprehensive manner. Compiling data for a task or analysis often involved mining various reports in a piecemeal fashion for information that had been obtained at various times from various facilities throughout the Site. This lack of cohesive data organization and data management has made it difficult for consultants, regulators, and other interested parties to conduct a meaningful data analysis and bring the Site closer to a final remedy, and ultimately closure with the State DEP.

IV. DEVELOPMENT OF THE SOLUTION

The project team was tasked with pulling together the various datasets of site base map data and sampling data (described above) into a central location using a Geographic Information System (GIS). The team began by importing into a central GIS various available datasets, including; roads, buildings, facilities operations areas, sources of potential chemical contamination, sampling locations, extents of impacted environmental media and/or impacted natural resources and receptors, proposed locations for resource extraction or environmental cleanup actions, and numerous other types of spatial data related to the particular project. What was not readily available they digitized from old reports and USGS figures. The GIS team also coordinated with the groundwater modeling team to incorporate many of the modeling results that could be displayed on the map to illustrate various modeling analyses, such as water level contours, particle tracking pathlines, and capture zones.

As a major goal, the project team wished to make the map and its underlying data available to all members, as it would help to facilitate data collection, analysis, and utilization by members of the team, which would maximize the workflow efficiency and facilitate project collaboration. After exploring several options, the project director established a subscription for a MapServing.com internet map hosting account, which enabled the map to be accessed and shared by the project team. The project director was able to set up as many user/viewer accounts as required, and set an appropriate level of access protection for each. The MapServing.com account also included system resource usage reports, which allowed the project administrator to monitor usage and charges each month for billing purposes. In addition, the fact that the system is maintained and backed up for speed, reliability, and safety provided the project team with a sense of confidence and security.

Once the Mapserving.com account was set up, a working copy of the project map was uploaded, allowing team members to access a wide range of spatial data using a standard internet connection, without the need to have large volumes of data sent via hard copy or electronic format. Collaborative map usage allowed the team to identify data gaps, request additional data as needed, and utilize the map and associated data to facilitate project tasks.

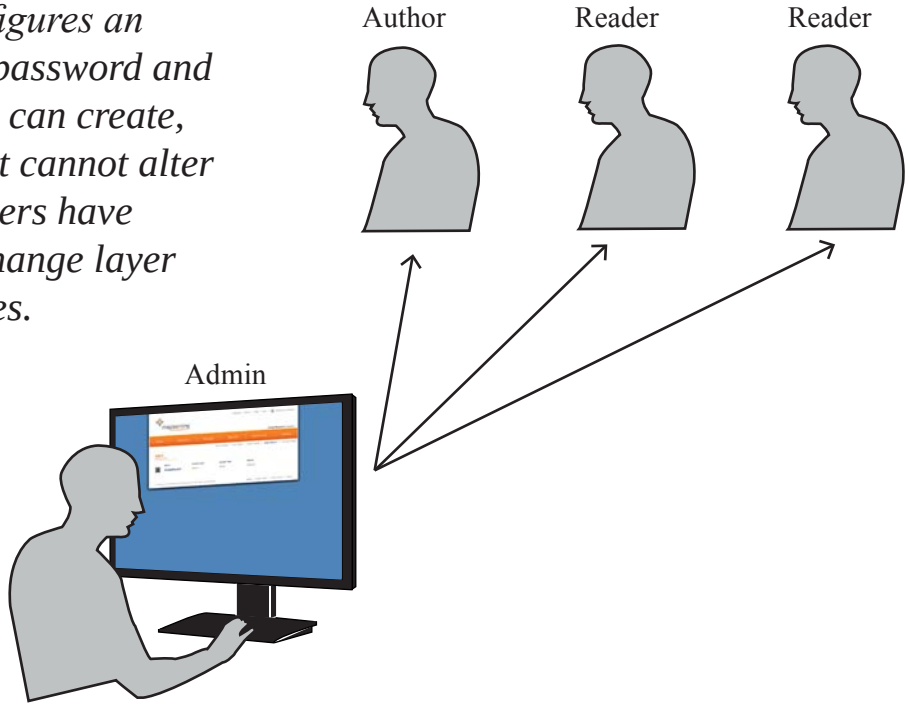
After the map, and its various features and underlying data had been completed and quality-checked, the map was ready to be deployed over the internet where the client and potentially other viewers (e.g. regulatory or permitting agencies, stakeholders and members of the public) could easily access the map, interact with the map and data, and customize the map features and views to meet their particular needs.

The team quickly discovered that there were many advantages of a web-based mapping system for the project. A subscription-based hosting service makes an interactive system easily available to the project team in a way that maximizes flexibility and minimizes cost. Some of the key functions and/or features that proved to be invaluable to the project team include:

User Administration

Here, the project manager was able to set up profiles for members of the workgroup. Users could be added or deleted throughout the course of the project, and the level of access for each user could be set and modified as needed, which helped to maintain creative control of the map and underlying data and prevent unauthorized access.

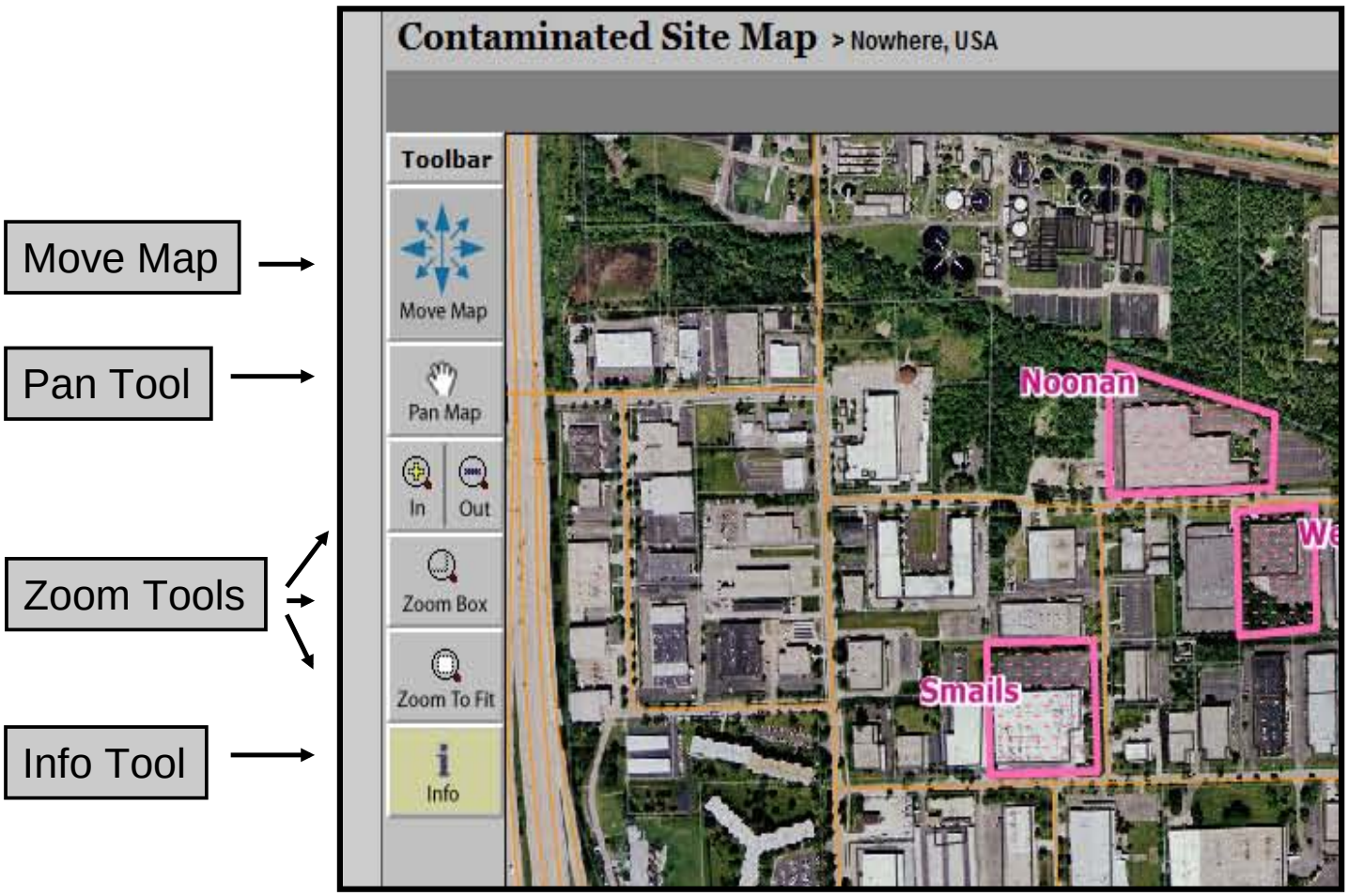
Account Administrator configures an account for each user with password and level of access. Map Author can create, upload and modify maps but cannot alter account settings. Map Readers have permission to view maps, change layer settings, and perform queries.



Intuitive Map Navigation Tools

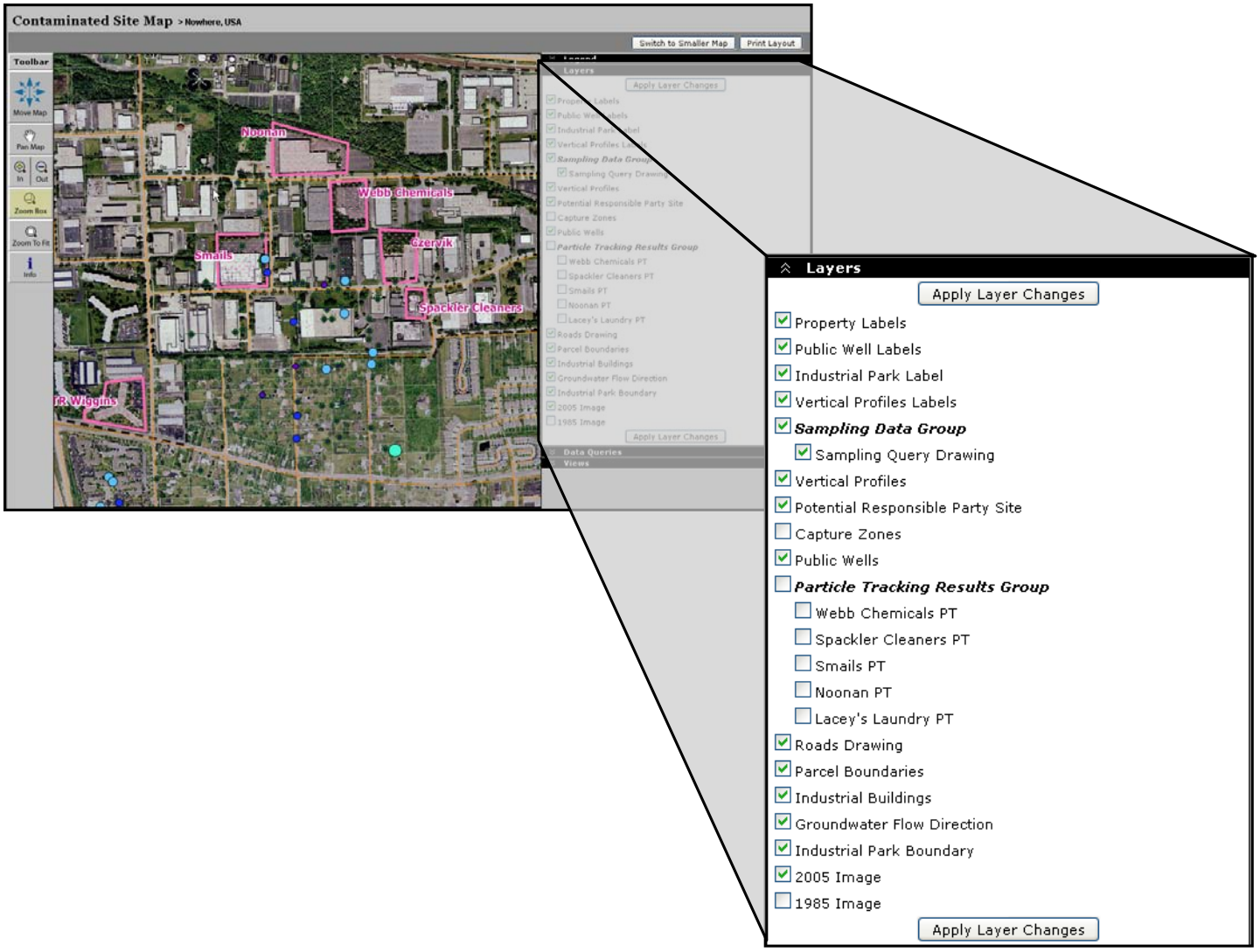
Through the use of intuitive navigation tools, members of the workgroup were able to explore and access a wide range of site data on demand. Map tools include:

- "Move Map" Tool – Allows user to move map in desired direction
- "Pan" Tool – Allows user to "drag" and move map within navigation window
- "Zoom" Tools – Allows user to zoom in, out, or to a selected area
- "Info" Tool – Allows user to access data pertaining to selected data layer



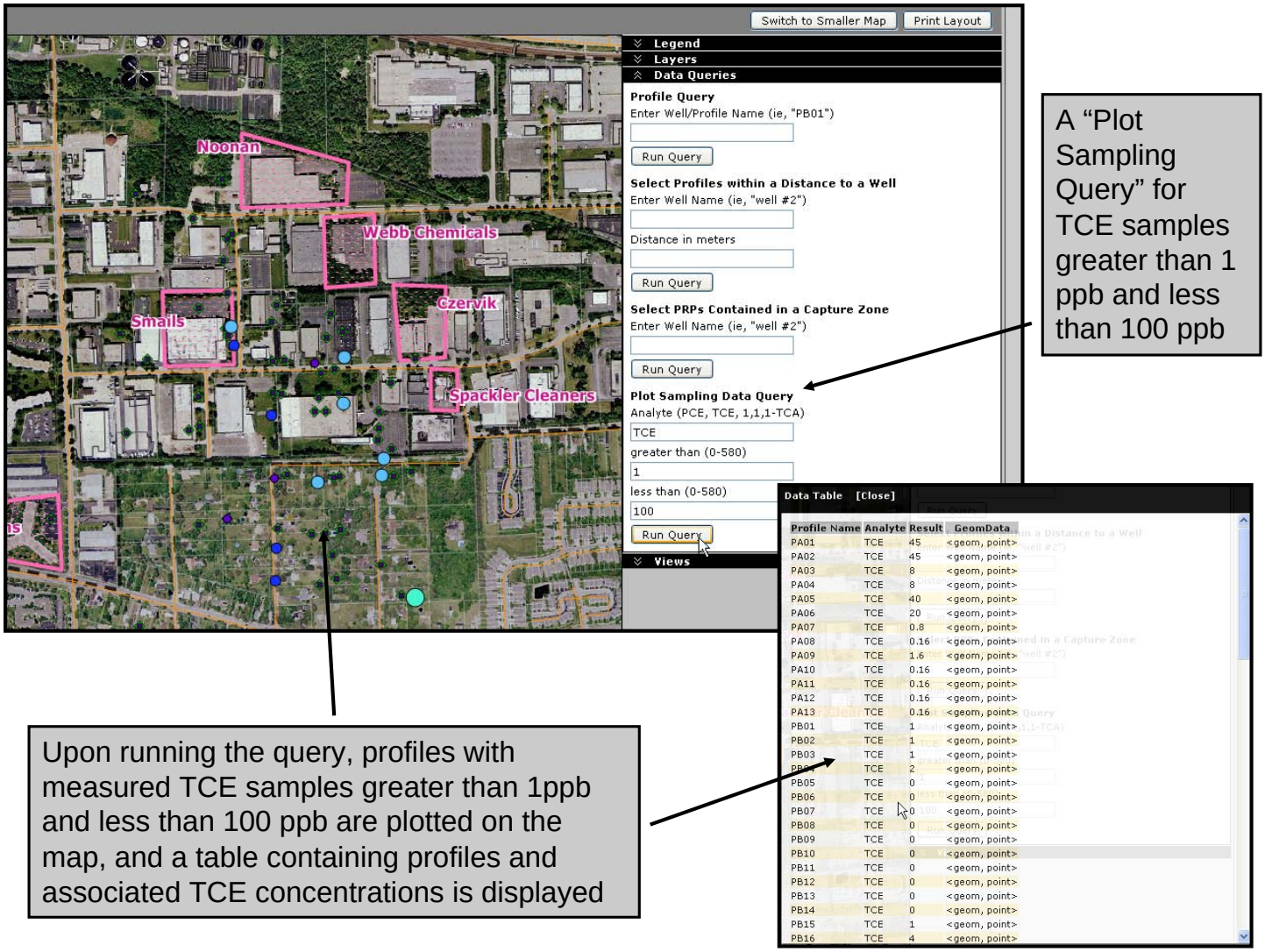
Map Layers

Several layers of data were incorporated into the project map, including parcel information, aerial photography, well and profile locations, water level contours, pumping well capture zones, and particle tracking results. Depending on the analysis being conducted, layers could be turned on or off as desired. Furthermore, as new data was made available, layers were added and/or modified as needed.



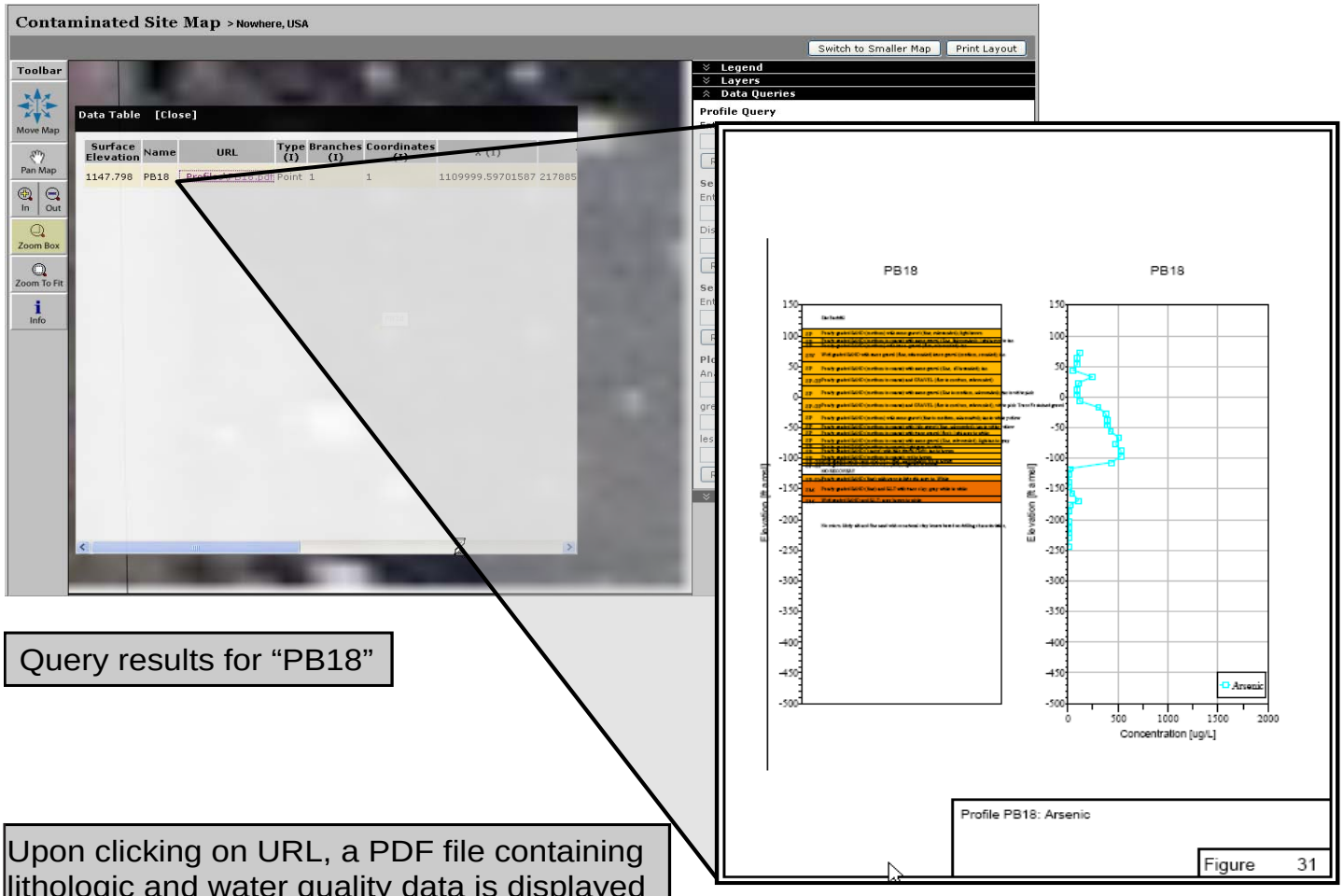
Queries

By communicating the needs of the workgroup to the GIS technicians, the project manager was able to have custom queries built in order to allow for expedited access to desired data, facilitate data analysis, and provide the client with a highly useful, intuitive search tool. While the number and types of queries that can be utilized for a particular project are limited only by the data available, for this project, queries were added which allowed members of the workgroup to locate and obtain information for specific profiles, conduct searches for profiles within a specified distance, and find PRPs within a specified pumping well's capture zone.



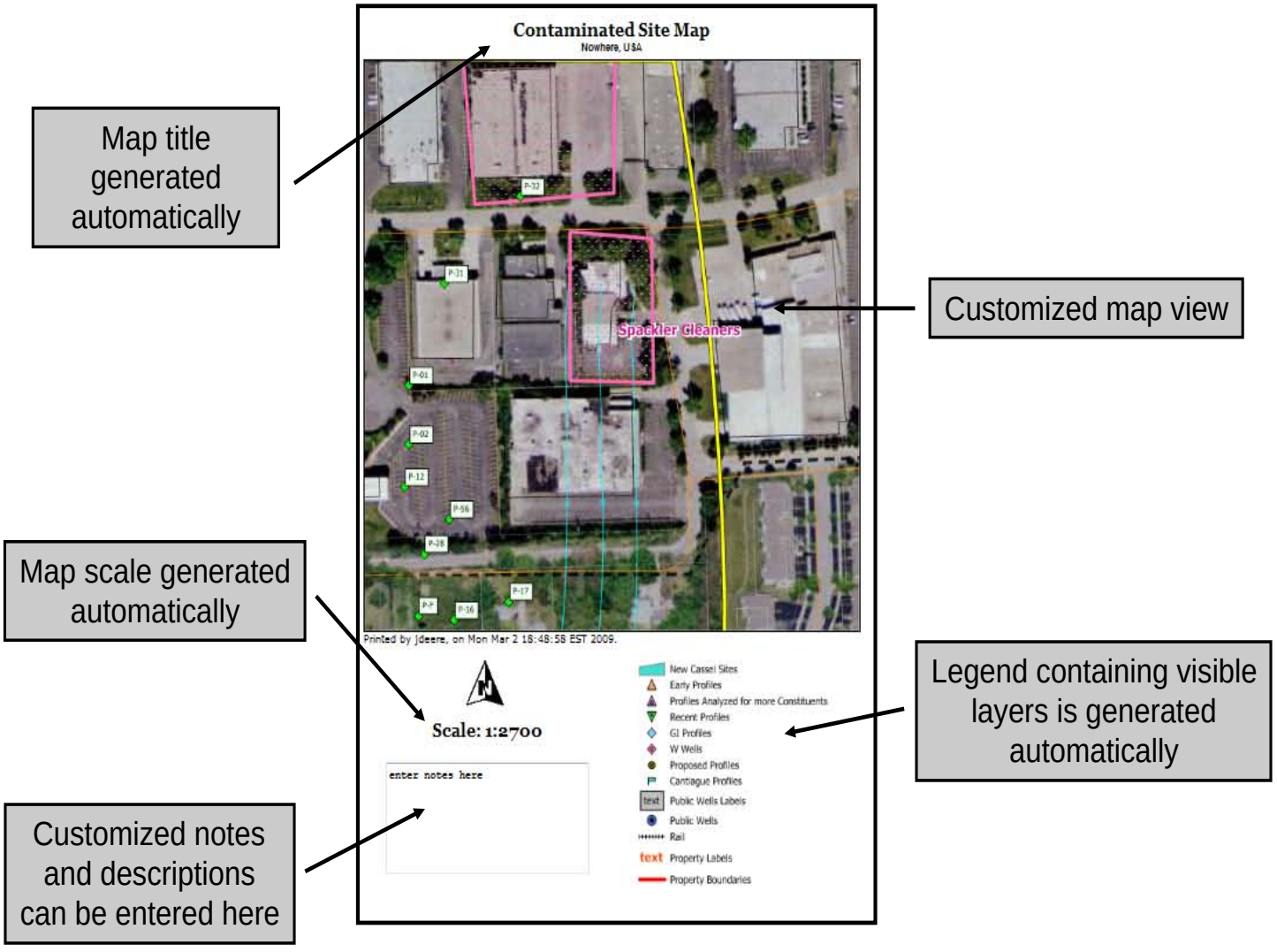
Linked Data and Information

By selecting certain map layers using the "Info" tool, or upon obtaining results of a query run, workgroup members were able to access additional data and document files, such as lithologic logs, water quality data, and current and historical facility descriptions. By grouping together and linking these documents and information according to spatial location or feature, members of the workgroup were able to access data for a desired location or feature on the fly, without having to sift through voluminous site data.



Printing Maps

One of the most useful features available to the workgroup was the ability to customize and print an unlimited number of maps. Once the desired map layers were turned on and the optimum view was obtained, users could simply click the "Print Layout" button, opening a printable version of the map in a new window. The workgroup member could add notes or descriptions of the map being printed, which proved to be especially helpful when multiple maps were being printed. Furthermore, the print layout could be customized by the GIS technicians to meet the specific needs of the workgroup.



V. CONCLUSIONS

Hosted web based mapping services provide environmental professionals with a vital tool which can be used to manage projects, communicate more effectively with clients, reduce costs, and increase efficiency and productivity. Specific benefits to using a hosted web based mapping service include:

1. Hosted web-based maps make project work easier and better:

Save Time
Increase Efficiency
Increase Productivity
Manage Resources
Improve Workflow
Facilitate Collaboration

- Provides for a centralized location for all project maps which prevents duplication of effort.
- Allows rapid distribution of project maps and data which moves the project along more quickly.
- Allows a smaller map preparation team to meet the needs of a larger and more widely distributed project team.
- Provides fast internet channels for the transmission of data to the map team and distribution of intelligent interactive maps back to the project team to speed project workflow and completion.
- Facilitates collaboration between various team members, disciplines and functions for the exchange of data, spatial analyses, and specialized maps (i.e. maps specifically produced for one project task or activity upon which multiple team members are working).
- Allows team members to explore and test different map views without the inefficient "chain of command" process that accompanies paper map production.
- Members of the work group are able to produce similar looking map products, with consistent symbols, colors, labels, and fonts, which helps with the quality control process in map making.
- Members of the work group can work directly with data that has been quality checked in a system that they can help design themselves, without having to learn sophisticated GIS software.

2. Hosted web-based map technology results in a better map and data work product:

Increase Accuracy
Reduce Errors
Enhance Quality Control

- Provides a central repository for project maps and data. These data and images, when they are received from the data collection activities within the project, can be QA/QC'd in a manner that is not possible with maps and data that reside in multiple files and locations throughout the project.
- A Map's design, cartography, feature sets and function can be controlled from a single project department, thereby preventing errors that may creep in when maps and data are modified by users distributed throughout the project.
- Any errors or required modifications identified by map users can be reported to a central GIS department, corrected immediately on the "benchmark" set of maps residing on the server, and redeployed to the project team with no loss of time, and no need to track down and recall or destroy all previous versions of that map.
- Allows members of the work group or project team to find answers quickly and to double check locations, names, numbers, etc. so that they do not have to rely on memory or approximations when they cannot readily find or access a hard copy map.

3. Hosted web-based maps help you communicate/ explain your project work to your audience (client, regulators, stakeholders, etc.) which maximizes the usefulness/usability of your work; this makes your client perceive added value in your work, and aids others in understanding and "buying in" to the project:

Enhance Communication
Enhance Value

- A picture is worth a thousand words, and a map is a picture. A map communicates vital project information among team members.
- A map helps explain project status and results to your client, enhancing the value they perceive in your efforts.
- A map helps present your plans, status, findings, or results to stakeholders and the public, thereby facilitating project understanding and acceptance/ approval.

4. Web map provides everyone with the same set of information in a timely fashion to enhance project understanding and support decision making:

Build Info Base
Support Decision Making

- Allows project team members working on a task to gain rapid access to spatial data needed to make the right decision at key points in a project.
- Allows the project director to access data and maps for various portions of the project with the confidence of knowing that this is the "up to the minute" project data, and make important project decisions.
- Provides regulators and stakeholders access to a broad body of maps and data at key points in the project, and at project completion, to inform, to address concerns, and to facilitate timely and favorable approval of project plans, permits, milestones, and final project sign-off.
- Allows for the integration of historic and recent information so that all data can be visualized at once.

5. A hosted web-based mapping system saves you and your client money and can increase revenues and profit margins:

Manage Costs
Increase Profits
Budget Benefits
Reduced Costs
Generate Revenue

- Provides a centralized framework for map and data production, review, and distribution. This makes budgeting of this project function much easier and more accurate.
- Meets map and data needs across the project from a central location which reduces software, hardware and labor costs.
- Reduces or eliminates reproduction and printing costs.
- Members of the project team are not burdened with the costs associated with the purchase, installation, and maintenance of sophisticated GIS software.
- Streamlines project dataflow and workflow, and facilitates workgroup collaboration. This saves time and money which has numerous benefits including: meeting project deadlines; reducing errors, duplicated effort and delays; avoiding penalties; and earning award fees or other schedule-based awards all of which enhance project profitability.
- Allows you to provide, and generate revenues from, a new service to clients by granting them access to selected project maps and data from the comfort and convenience of their office computer. This service, especially if out-sourced to a low-cost internet map hosting service provides a substantial benefit-to-cost add-on for any project.

For more information on how McLane Environmental, LLC and Mapserving.com, LLC can help with your environmental consulting projects by integrating complex environmental and geospatial data with hosted web-based mapping services, please visit us on the web via the links below, or contact us at info@mclaneenv.com and info@mapserving.com.

LINKS:

McLane Environmental
http://www.mclaneenv.com/
Integrating science, strategy and innovation for today's environmental challenges.

Mapserving.com
http://www.mapserving.com/
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AltasAlive on demand
http://aa.mapserving.com/
A mapping service offered by MapServing.com that provides full-featured GIS funcitionality on the web.

MapServing Free Trial
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MapServing video resources
http://www.mapserving.com/Resources.asp?M=Resources
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