

Final Report
for the

Galveston Bay
Geographic Information System (GIS)
Data Clearinghouse Project

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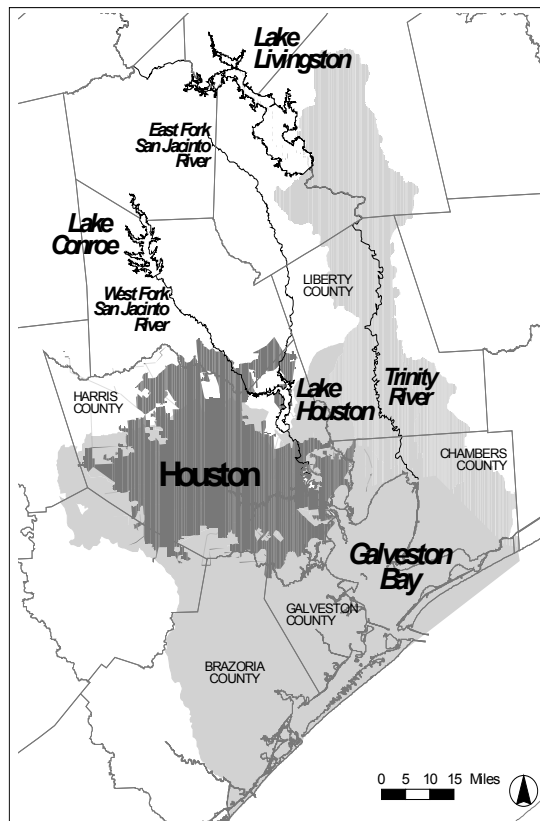
Executive Summary

The Galveston Bay GIS Data Clearinghouse is an internet-based resource of digital data and information relating to the Lower Galveston Bay Watershed. From geographic or location-based data to regional environmental data collected by those monitoring in the Bay, this resource provides a single point of access to those data sets.

Project Objective

The objective of this project is to continue the development and maintenance of the Galveston Bay GIS Data Clearinghouse located on the World Wide Web at <http://gbep.tamug.tamu.edu>.

The Data Clearinghouse, and to a greater extent the Program's Data and Information Management System (DIMS), will continue to be an integral part in communicating the results of the Regional Monitoring Program for the *Galveston Bay Plan*. At the same time, the primary purpose of the Data Clearinghouse is to provide data that can assist in establishing the link between management goals and objectives and environmental results.



Description of Study Area

The study area for this project is the Lower Galveston Bay Watershed (shown in a light gray-shade on the map to left) and the five surrounding counties that make up the GBEP Program Area - Brazoria, Chambers, Galveston, Harris and Liberty.

Project Description and Introductory Information

The Galveston Bay Geographical Information System (GIS) Data Clearinghouse Project is designed to meet the requirements of the Regional Monitoring Program of the *Galveston Bay Plan*. Over 20 local, State and Federal monitoring entities contribute data to the Galveston Bay estuary monitoring system. Types of data include water and sediment quality (physical and chemical), and living resources (i.e., shrimp, fish, shore birds) population and diversity.

Individual entities maintain different data bases and reporting formats. Data bases and reporting formats encountered during this project ranged from a standard, common databases and spreadsheets, to raw, unformatted text files and traditional paper files. As a result, acquisition and evaluation of data from individual entities was time consuming and challenging. Prior to the development of the Data Clearinghouse, no centralized data management system existed that would facilitate detailed analysis of regional data to assess trends in ecosystem health.

To alleviate this problem, the Galveston Bay Estuary Program (GBEP) began development of the Data and Information Management System (DIMS) for Galveston Bay. As part of the DIMS, H-GAC developed a centralized GIS Data Clearinghouse. The GIS Data Clearinghouse provides a single point of access to Galveston Bay monitoring data.

As part of this project, H-GAC is responsible for the development and administration of the DIMS Database and Application server. This server is linked to the GBEP Web Site (via the Internet). In addition, H-GAC completed the following work program:

- Create a GIS Clearinghouse Task Force to assist in directing the development of the GIS Clearinghouse.
- Ensure long-term integrity, storage, and accessibility of data collected by Regional Monitoring Programs.
- Support graphical, spatial analysis, and mapping of monitoring data.
- Allow multiple levels of user access to raw monitoring data, data quality information, summary statistics, and maps.

Methodology

The methodology for this project followed a simple and succinct course, including:

- Develop a formal mechanism for acquiring and providing access to quality data
- Acquire and/or compile historical monitoring data.
- Continue to provide access to the Data.

Developing the QAPP

The Quality Assurance Project Plan (QAPP) provided a formal mechanism for acquiring and providing access to quality data. A requirement for US Environmental Protection Agency (EPA) supported projects, the QAPP process ensures that specific steps will be followed in the acquisition and management of data. In addition, the confidence of data quality is determined and described for each data set.

Project staff realized that few GIS Data-oriented Data Acquisition QAPP's had been developed, so there was an understanding that the approval process might take more resources than expected. Which then in turn delayed implementation and ultimately how much data was acquired and/or converted.

The project focus was on quality-assured data, data with thorough metadata or data compiled under a QAPP or other accepted QA/QC document.

At the same time, project staff formulated Data Submission and Sharing guidelines and an online user guide to provide assistance or technical support during the development of the Data and Mapping Resource.

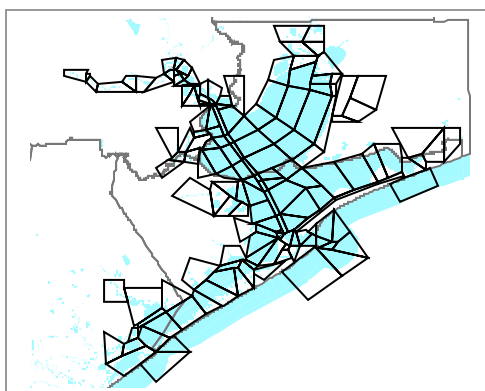
Acquiring, Compiling and Converting Data

To acquire, compile and convert historical monitoring data. What does this mean? Simply, this can be a converting of older, historical data sets with current data management tools, and placing the data in a current standard format such as Microsoft Access or Excel. Or simply in a comma or tab-delimited format, where each data field or column of data are delimited or separated with a Comma or Tab, making it easily importable to other software programs.

With the exception of a few corrections, additions and updates to the data were not performed. Due to the limited project resources it was not possible to scan, error-check or update any of the data acquired.

One of the major undertakings of this project was the compilation and integration of the Water and Sediment Quality data from the early 1990's (Ward and Armstrong). All of this data was provided to TNRIS, H-GAC and GBEP in the mid 1990's but was not placed on the internet until this project.

This data was a significant part of the current Status and Trends analysis being conducted by the TSU Spatial Systems Laboratory, in Houston, TX. This data was in raw, ASCII format. It was converted to MS Access according to the specifications of TSU. The Segmentation Scheme for GBEP was re-built then integrated within the Status and Trends data. Once this was completed, the data was zipped and forwarded to TSU for analysis.



GBEP Segmentation Scheme, 2000, shown with the Galveston Bay hydrography and county boundaries.

Partial list of Data sets available through the Data and Mapping Resource

Ambient Water Quality
 NOAA Galveston NMFS Habitat
 GBF Habitat Conservation Blueprint
 GBEP Segmentation Scheme
 Digital Orthophoto Quarter Quadrangle
 US ACE Dredge and Fill Permit Locations
 Freshwater Inflow
 USDA NRCS Soil Survey SSURGO
 Small WWTP Self-reporting Data
 Ambient Sediment Quality
 Ambient Surface Water Quality (Texas CRP Assessment Basins 9,10,11 & 13)
 US Fish and Wildlife Service National Wetland Inventory
 Lambert True Color Imagery
 NOAA Galveston NMFS Marsh Sites
 Non-Point Sources and Loadings Data
 Ambient Surface Water Quality (Galveston County)
 Ambient Surface Water Quality (Texas CRP Assessment Bays, Estuaries & Gulf)

Providing Access to the Data

Provide access to the Data. What does this mean? The primary means of access to this data is (and will continue to be) via the Internet. Although in the original Regional Monitoring Plan (1994), it was discussed that a proprietary wide area network of agencies and organizations would be developed to support the development and access to Galveston Bay related data. With the web revolution, it was an easy choice to make this information accessible primarily via the Internet.

The World Wide Web Interface for the Data and Mapping Resource

The presentation of data is made possible through the Data and Mapping Web Interface. To access the Data and Mapping Resource on the GBEP Web Site (<http://gbep.tamug.tamu.edu>), you must first click on the words "Data and Mapping" which are shown on the left, vertical navigation bar. This will load the Data Component page, which is the default location when coming from the main page of the GBEP Web Site.

Shown across the top is a dark green navigation bar for the Data and Mapping Resource. Listed left to right are the four components of the Data and Mapping Resource, *Data*, *Mapping*, *About Data & Mapping (D&M)* and *Help*.

Data Component

The *Data* Component is subdivided into three sections, top, lower left and lower right. The top section provides a brief introduction to the Data Component, along with a graphic informing visitors of What's New! The lower left section shows all data that are available for download. The lower right section provides supportive information for the Data component, such as technical support, the QAPP and User Guide.

Welcome to the Data Component of the GBEP Data and Mapping Resource. This resource has undergone many changes, we hope that it is easier and more beneficial to use. The goal is to encourage and enhance access to data relating to Galveston Bay. This is a dynamic page with monthly changes. To help us, we would appreciate your comments about any aspect of this resource. Press the Data Help button to the right to connect with those responsible for content management and development.

Name	Date	Description	Format	Confidence Level
Ambient Water Quality	6/1/93	Historical monitoring data compiled in 1993	Access	Click here
NOAA Galveston NMFS Habitat	7/6/00	Galveston Bay Wetland Habitat Data	GIS	Click here
GBF Habitat Conservation Blueprint	7/21/99	Galveston Bay Foundation	GIS	Click here
GBEP Segmentation Scheme	5/1/92	Hydrodynamic Segmentation for Bays and Streams	GIS	Click here
Digital Orthophoto Quarter Quadrangle	12/31/95	2.5 Meter Resolution Color Infra-red Imagery	GIS	Click here
US ACE Dredge and Fill Permit Locations	1/1/92	Prior to 1993	Access	Click here
US ACE Dredge and Fill Permit	1/1/92	Prior to 1993	Access	Click here

The Data Component, 2001.

The lower portion provides a listing of all data sets available. At the top of the list, there are three sets of buttons to organize or view the data per your liking. The left set displays all data, while the middle and right set show only Geographic or Data tables separately. Name, Date, short description, Format and Confidence Level are shown for each data set.

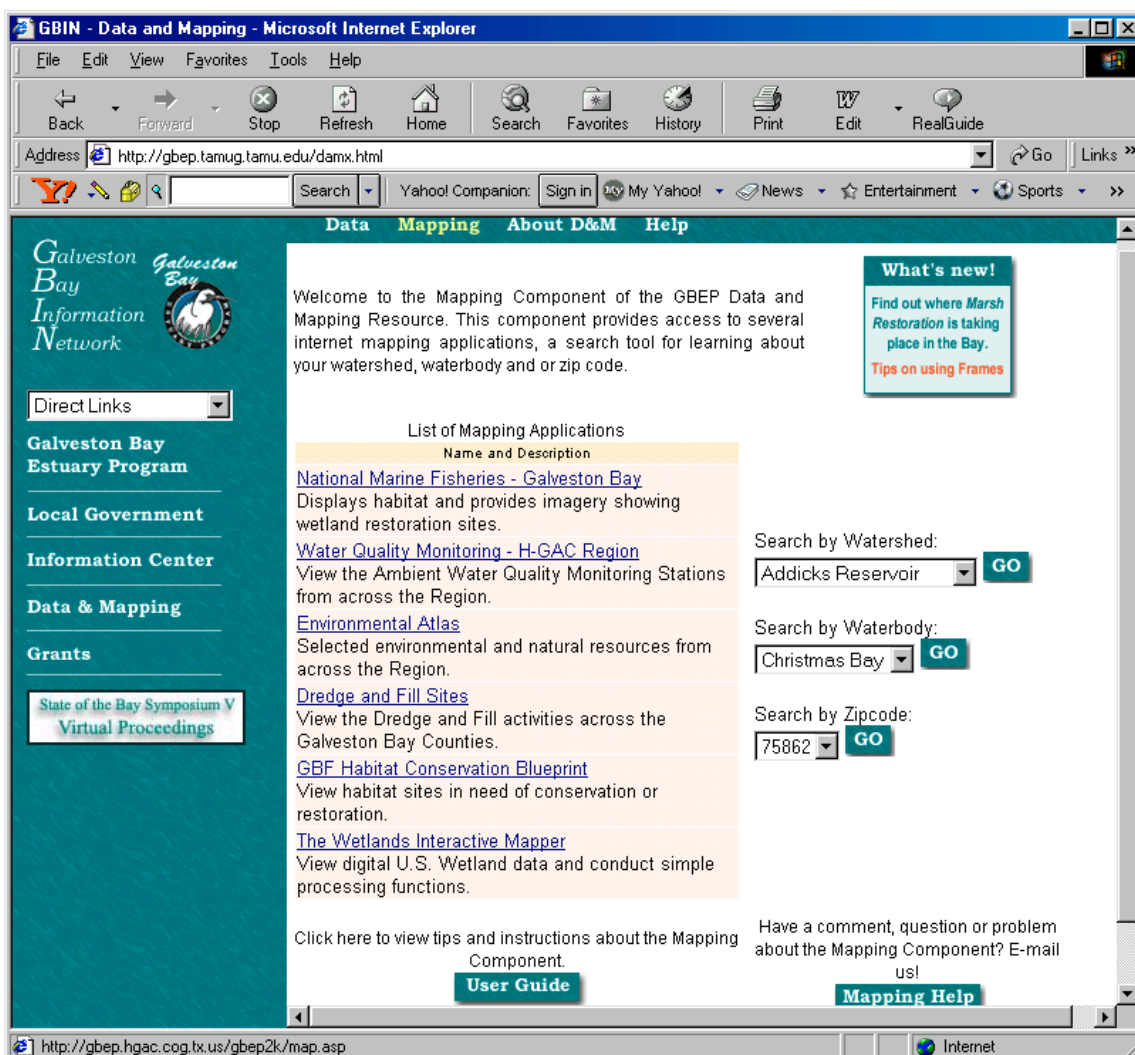
To the right, you can find information about getting technical support, the User Guide, the QAPP, and QAPP Confidence Levels. There is also an informal poll where web visitors can tell us where they are accessing these web pages. The topic of the informal poll would change on a regular basis. The informal poll increases interaction and interest in the site. At the same time, GBEP and Project staff can learn more about whom is visiting the site and what interests them. Since it's inception, poll results have shown that over 45% of all visitors are from a "Galveston Bay" County, while nearly 33% from another county, 18% outside of Texas and 2% outside of the U.S.

Mapping Component

The *Mapping* component is accessible by pressing the Mapping link on the horizontal navigation bar at the top. The Mapping Page provides direct access to

the Interactive Mapping functions. The lower portion provides a listing of all mapping applications available. Press a link to activate the internet mapping application. This component provides access to several internet mapping applications, a search tool for learning about your watershed, waterbody and or zip code.

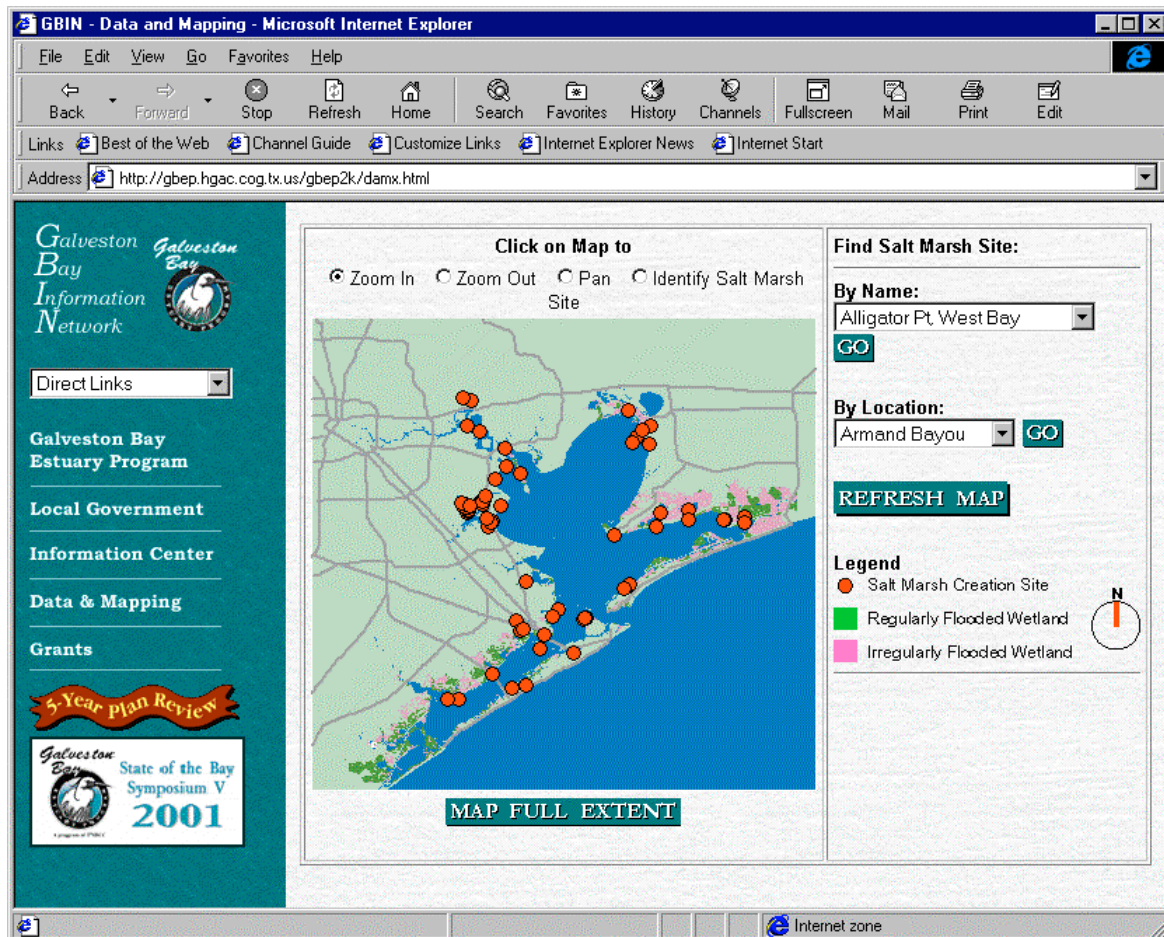
Using the three drop-down menus to the right, geographic data sets can be viewed by *Watershed*, *Waterbody* and/or *Zip Code*. Select a watershed or waterbody name, or enter your 5 digit zip code, and press the **GO** button. For now, only those Zip Codes falling within the Galveston Bay Watershed are valid.



The Mapping Component, 2001.

The links at the bottom of the page enable the user to view the User Guide, submit comments and questions about the Resource or receive technical support.

Map Objects Applications (MO Apps), are a set of tools (written with Visual Basic) that enable a application developer to build real-time interfaces to geographic data. The user can view and query geographic features. Map Objects software is a collection of embeddable mapping and GIS components. Developers can use Map Objects to create applications that include dynamic live maps and GIS capabilities.



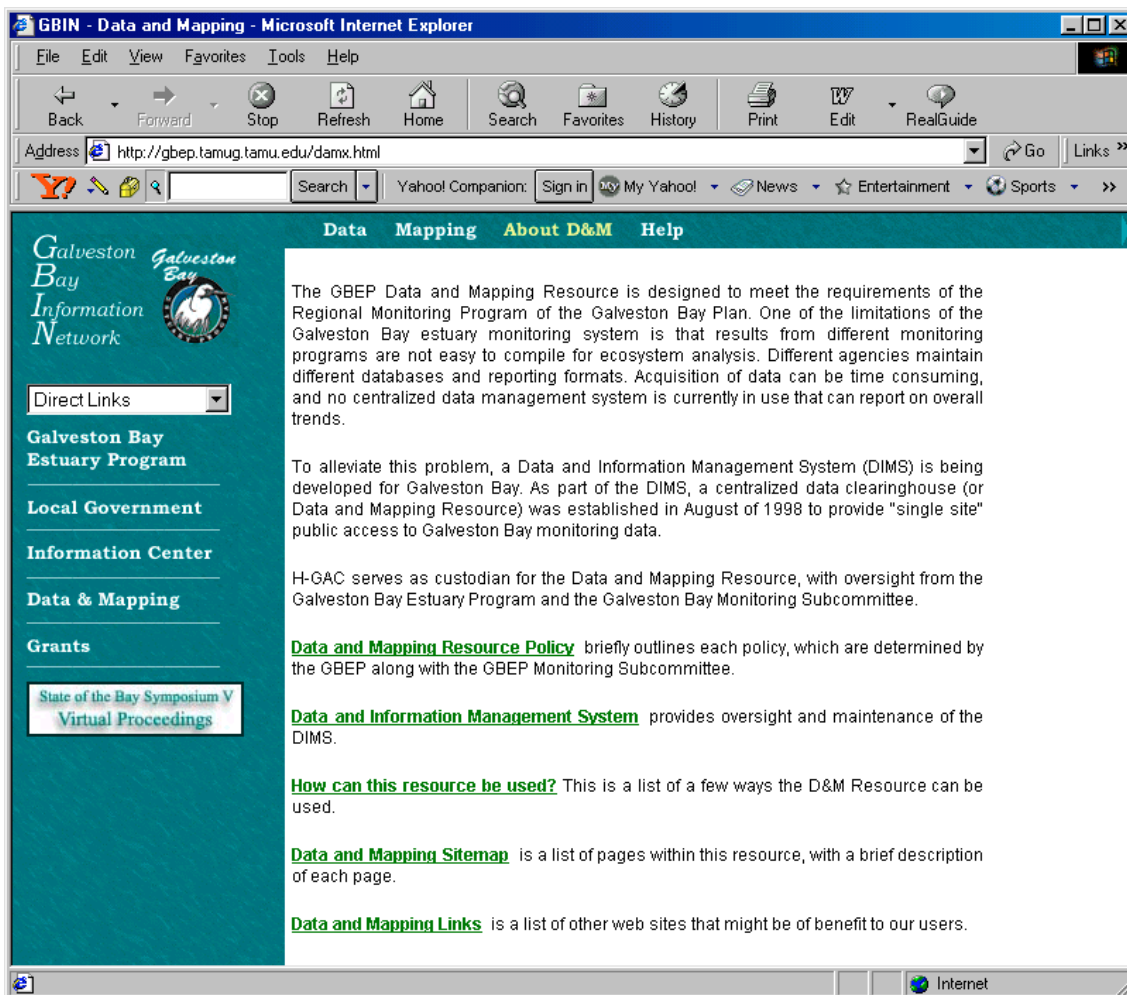
Example MapObjects Application, 2001.

This is an example of the MO Application developed for the NOAA National Marine Fisheries Service (NMFS) in Galveston, TX. This application enables the web visitor query and display Marsh Restoration sites across the Bay. In addition, the web visitor can view imagery of most of the restoration sites.

About D&M (Data & Mapping)

The *About D&M* component of the Data and Mapping Resource, is the component where you will find background information about this resource. *About D&M* component (about.asp) provides information about Data and Mapping Resources. What is the DIMS? What are the roles in the development

and maintenance of the D&M Resource, What are some of the Policies? and how do you contact those involved. The About D&M page provides access to background information about the Data and Mapping Resource. Such as, What is the purpose of this resource? Who supports it? Who are the contacts?

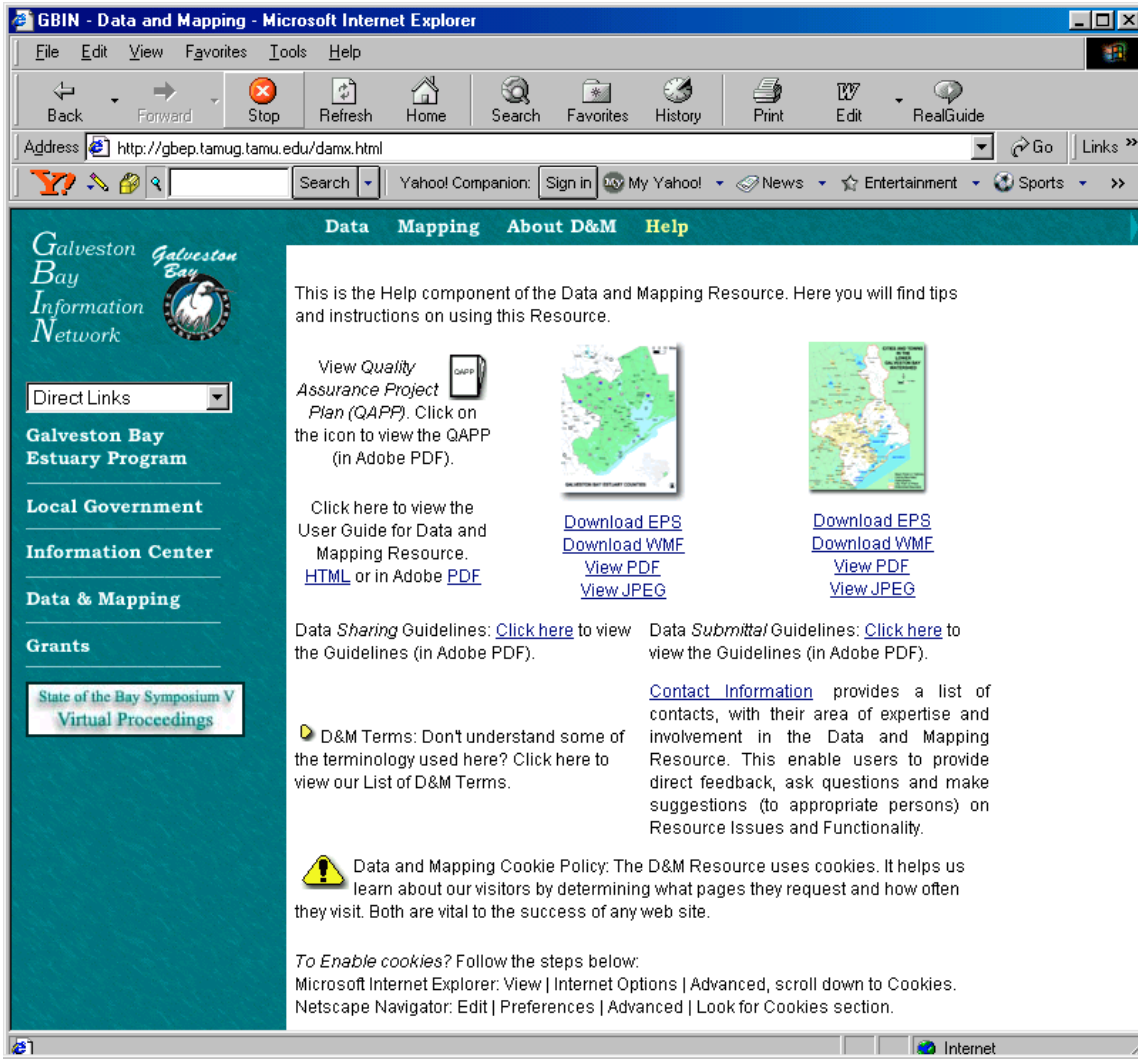


The About D&M Component, 2001.

Help

The *Help* component of the Data and Mapping Resource provides tips and instructions on using this Resource. The Help component (help.asp) provides access to several resources that help you learn or gain a better understanding of the D&M Resource. Help provides one-click access to all the supportive information you might need, when using the D&M Resource. View the User Guide online, in Hypertext Markup Language (HTML) or Adobe Portable Document File (PDF) format. View the Quality Assurance Project Plan (QAPP). If you are not sure about some of the terminology, check out the list of D&M Terms. The Data Sharing and Submittal Guidelines, and D&M Cookie Policy are listed at the bottom.

The Data Sharing and Submittal Guidelines provide a brief outline of the intent of the D&M Resource for the sharing of data, and what required steps must be taken prior to submitting data to this site.



The *Help* Component, 2001.

Technical Support

The Technical Support interface enables the user to communicate with development staff directly, submitting focused questions via email. The Technical Support mechanism is available for both the *Data* and *Mapping* components, and is launched by pressing the "support" button. The Technical Support interface differs depending on where the user calls it. For example, if the user requires help while in the Mapping Component, the form is altered to suit mapping-related issues. The User can choose from several predefined topics or submit a question on a topic of their choosing. Response time is quick, development staff

know where the internet user is working and can respond succinctly. Technical Support requests typically average 2-3 per month.

Online Technical Support Form

The Development of Web Interface

The Web Interface represents the second step in the evolution of the GBEP Data and Mapping Resource. The initial development involved solely, static web pages requiring constant checking and maintenance. With a limited project budget, Project Staff decided the only reasonable and successful next step was to develop an application that would ease content management.

The development of a content management system for the D&M Resource was accomplished. Written with Active Server Pages application technology (both Visual Basic Script and JavaScript program code), all of the web pages with dynamic content are

maintained using several Microsoft Access databases served to the Internet, in conjunction with a few template HTML pages.

After the Internet user requests a specific web page, a specific database is called to respond. The database responds by supplying the content back to the template HTML page for the visitor's perusal. Instead of updating or maintaining many (20 or more) static HTML pages, the administrator can alter a database record and the content (made available to the Internet) are current for each of the HTML pages that call the database. This approach streamlines and simplifies content management, while maintaining content currency.

The Monitoring Subcommittee and the Data Analysis Working Group (DAWG)

The Clearinghouse was not able to display the efforts of, or an end product of the Status and Trends Analysis during the project. It is H-GAC's understanding that that the results of the Status and Trends Analysis Project will be available through the TSU Spatial Systems Laboratory in the near future.

In place of a formal task force, project staff relied the Monitoring Subcommittee and the Data Analysis Working Group for comments and direction. The DAWG

was comprised of TSU, H-GAC, GBIC, City of Houston and GBEP Staff. It reported to the Monitoring Subcommittee on the availability and status of data for the Status and Trends Analysis. TSU, along with GBEP Staff and Monitoring Subcommittee members were integral in the data acquisition process.

DIMS Hardware and Software

The Data Clearinghouse resides on a Compaq Proliant Single processor Server with Microsoft NT 4 Server and Internet Information Server (IIS). The server is configured with 320 megabytes (mb) of random access memory (RAM) and 50 gigabytes (gb) of hard disk storage. Considering the age of this server, Project staff understand the utility of this server can be used for another 2-3 years.

ESRI ArcView GIS software, Microsoft Excel Spreadsheet and Access Database software were used to support project efforts. Manufactured by Environmental System Resources Institute (ESRI), MapObjects Internet Map Server (IMS) Software serves the MapObjects-based applications found on this web site.

As of the writing of this report, an upgrade from the MapObjects software to the ArcIMS was undertaken. This is the next generation in Internet Mapping Software. As with H-GAC, other Galveston Bay Partners are developing and implementing more capable interactive mapping applications with ArcIMS.

Minimum recommended end user hardware and software configuration

In this situation more is always better. The minimum recommended end user configuration for accessing the GIS Data Clearinghouse is an Intel Pentium II processor (or equivalent), 64mb of RAM, 56kbps Internet connection, 15" monitor, mouse and keyboard, with MS Internet Explorer or Netscape Navigator Version 4 installed. Recommended Data Management software is MS Excel and/or Access.

While some data sets may be too large to efficiently download with a 56kbps connection, it is possible. However, a faster connection to the Internet such as ISDN, T-1, DSL, or Cable Modem is recommended.

Results and Conclusions

There is greater awareness for the DIMS effort within the GBEP community. At the same time, there is more desire to participate in the development of this resource. Also, there is a greater sense of how consistent, annual data acquisition and access will ease any future Status and Trends Analysis.

There were several challenges encountered during the duration of this project. The greatest of which was the creation (and receiving formal approval) of the Project QAPP. With little or no experience with EPA QAPP's, Project staff were able to rely on the vast resources of information and experience at GBEP, TNRCC and EPA to overcome this challenge. Once this was accomplished there was an assuredness that future project tasks of data acquisition would be sound and transferable.

The second greatest challenge was the digital processing of large amounts of historical monitoring data. Project results supported the TSU's efforts of evaluating Galveston Bay Status and Trends of Water Quality, Species and Habitat.

There are issues of functionality with any online resource. The Data and Mapping Resource is no different. With assistance from the Regional Monitoring Work Group, which is responsible for overseeing the implementation of the DIMS, and program partners, comments were provided enhancing web page layout and utility.

Recommendations

Provide Constant Care

The GIS Data Clearinghouse has been a point of discussion for several years with development of this online resource to a point where it is seen and utilized as an important part of the GBEP DIMS. Like the bay, this resource should be considered as a living and breathing organism, requiring constant care and attention.

With the Internet revolution, online technologies have made great strides in: providing access to, the displaying of, the querying of geographic and tabular data sets. It is easy to foresee greater abilities to integrate dissimilar and similar data sets in a way to answer or create new questions relating to the health and future of the Galveston Bay.

With the Texas Estuaries Act, larger data collection entities are more freely providing access to their data (whether it is in summary or raw format). There are more entities making their data available online, where the D&M Resource can simply direct you to the location of the data rather than periodically "grabbing" the data off the originator web site and storing it locally. The advantages to a system that points or directs users to the source of the data has many advantages including reducing the potential for tampering or modification of data during or after transfer, ensuring that data sets are updated in a timely fashion, and allowing data to be maintained by those who are primarily responsible for their collection and use.

Incorporate a Data Search Engine

A graphical interface could be developed to provide the general user with greater analytical capabilities. Similar to a search engine, the graphical interface would allow users to enter a date and a theme (data set) and receive a list of recommended locations to seek out the requested data.

Develop an Online Map Gallery

Develop an online Map Gallery, where maps relating to the Galveston Bay are placed in multiple common formats (Adobe PDF, EPS, Microsoft WMF, etc.) allowing Internet users to both download and upload map graphics. Internet users could search through a database, view thumbnails images of the maps that meet user search criteria. The Map Gallery would consist of Base and Thematic maps. As previously discussed, this tool would provide pointers to other maps that are accessible online.

Develop a List Server

Develop a List Server where internet users can learn about new data sets that are now available, be notified of enhancements in mapping application technology or changes in the DIMS on a regular basis.

Alternative Data File Formats

Incorporate more flexible and non-proprietary data file formats when providing data and information to the Internet. With the development of the Extensible Markup Language or XML (a markup language for describing and formatting data for the Internet), it is possible to display and describe data in a manner that offers great flexibility.

The flexibility of XML enables the end user to handle or process the data in a manner or system that suits their needs. Since XML-formatted data contains the structure of (or the intelligence behind) the data set, the user is able migrate or re-use the data in different environments without losing content in the process.

Unlike HTML, XML's strength is the structure and description of the data. Not how the data is displayed on the web page. The User is able to integrate other XML formatted data sets into their own applications, while providing a greater number of choices when deciding on a data management or analysis system. This allows the same XML document to be used and reused in different environments.

Encourage all Bay monitoring programs to offer their Internet-based data stores in XML format. With the goal of expanding access to, and integration with other data sets in user-defined software programs and applications. This alternative is flexible, intelligent, and gives control to the data user.

Integrate More Robust Mapping Technology

Integration of more robust interactive mapping technology. Currently at H-GAC, and other Galveston Bay partners, ArcIMS applications are being developed, tested and implemented. Current applications are limited in capability and usability, but over the next 6-18 months will evolve to provide powerful query and display of geographic-based data and information.

Also consider developing the GBEP web site as a portal to GBEP Partner's Mapping Applications, or consider developing a "geographynetwork.com" Site based on the Galveston Bay and built by the Bay Partners. Although the Houston-Galveston Area Council (H-GAC) is responsible currently for the administration of the Data and Mapping Component within the DIMS, this should not preclude other entities from sharing their mapping applications with the GBEP audience.

Develop a system of redundancy

Develop a system of redundancy. With ever-falling price of hardware and software, it becomes easier for Bay Partners to participate in the providing of applicable data and information via the internet. At the same time, back up systems in case of downtimes (access to the internet) such as encountered during Tropical Storm Allison (June 2001) would be minimized if other servers were available to provide data.

Conform to American Disabilities Act (ADA) Standards

Remove HTML Frameset and make the web site American Disabilities Act (ADA) compatible. Although it is not noticeable to the average internet user, the Data and Mapping Resource is served from a separate server than that which serves the web site. Cosmetically it appears nice and neat, it does not properly help those that “bookmark” web pages or are disabled and require assistance to view a web site. ADA provides standard for making web sites disabled-friendly.

Interface with National Estuary Programs

Although GBEP Staff work closely with the Coastal Bend Bays and Estuary Program (in Corpus Christi, TX), greater emphasis should be placed on working closer with additional NEP's in the country. There are 27 other Estuary Programs within the EPA's National Estuary Program (NEP), not including Chesapeake Bay. Most of which have a web presence. Topics could be general Data and Information Management issues, or specific technical issues of developing and managing a GIS Data Clearinghouse.

Provide Consistent Funding

Providing a consistent funding source on an annual basis would sustain development and maintain site currency. This is an issue with any Information Management effort, Project Staff recommends the DIMS and Data and Mapping Resource become a standard line item in the budget.

Glossary and Acronym List

ASCII - American Standard Code for Information Interchange, considered the simplest and most consistent for the interchange of information between different computing systems.

ASP - Active Server Pages is a Microsoft NT-based service that enables a web server to handle and process requests made by web users through Visual Basic Script and Javascript applications.

Cable Modem - is a non-dedicated two-way pipeline to the Internet that typically transmits data in the 2 to 4 mbps range. As of Fall 2001, Cable Modem is not offered in all geographic areas, but is becoming a more popular means of connecting to the Internet.

CBBEP - Coastal Bend Bays and Estuary Program covers a 12 county area surrounding Corpus Christi, known as the Texas Coastal Bend. More information can be found at <http://tarpon.tamucc.edu/>.

DIMS - Data and Information Management System. A centralized data and information management resource for acquiring, managing and analyzing data and information relating to the Galveston Bay. More information can be found at <http://gbep.tamug.tamu.edu>.

DSL - Digital Subscriber Line is a dedicated one-way pipeline to the Internet that transmits data in the 2 mbps range. As of Fall 2001, DSL is not offered in all geographic areas, but is becoming a more popular means of connecting to the Internet.

ESRI - Environmental Systems Resource Institute, Redlands, Ca.. ESRI provides GIS Software and solutions for a spectrum of needs. More information can be found at <http://www.esri.com>.

GBIC - Galveston Bay Information Center, housed at Texas A&M University Galveston, Tx. A member of multiple GBEP Subcommittees and Web site contractor. More information can be found by clicking on the "Information Center" link at <http://gbep.tamug.tamu.edu>.

Geography Network - The Geography Network is a global network of geographic information users and providers. It provides the infrastructure needed to enable the sharing of geographic information between data providers, service providers, and users around the world. The Internet is used to deliver geographic content to the user's browser and desktop. Through the Geography Network, you can access many types of geographic content including live maps, downloadable data, and more advanced services. The Geography Network content is

distributed at many locations around the world, providing you access to the latest information available directly from the source. More information can be found at <http://www.geographynetwork.com>.

GIS - a geographic information system is comprised of digital data, software, hardware, personnel and a purpose or problem to solve.

H-GAC - Houston-Galveston Area Council, is the 13 county regional council of governments for the Lower Galveston Bay Watershed. A member of multiple GBEP Subcommittees and Data Clearinghouse contractor. More information can be found at <http://www.hgac.cog.tx.us>.

HTML - Hypertext Markup Language, is the common method of presenting data and information on the world wide web. More information can be found at <http://www.w3c.org>.

ISDN - Integrated Services Digital Network, a faster alternative to 56kbps phone modems providing 128 kbps transfer speeds.

NEP - National Estuary Program, which is administered in the EPA's Office of Water and was established in 1987 by amendments to the Clean Water Act to identify, restore, and protect nationally significant estuaries of the United States. More information can be found at <http://www.epa.gov/nep/>

NOAA NMFS - National Oceanic and Atmospheric Administration National Marine Fisheries Service in Galveston, Tx. A member of the GBEP Monitoring Subcommittee and Data provider. More information can be found at <http://galveston.ssp.nmfs.gov/galv/>

QAPP - Quality Assurance Project Plan, is a formal EPA document that assures quality is maintained during project efforts. More information can be found at <http://www.epa.gov>.

T1 – transmission rate in the range of 1mbps. T1 is typically used for entities where there is a high number of users and moderate traffic volume.

TNRIS - Texas Natural Resources Information System, a division of the Texas Water Development Board, is the state's clearinghouse for natural resources data. TNRIS serves as a distribution center for U.S. Geological Survey maps and has numerous other map collections available for in-house use or reproduction. Digital data available through TNRIS pertain to water resources, geology, Census, and other natural resources spatial data. More information can be found at <http://www.tnr.is.state.tx.us>.

TSU - Texas Southern University Spatial Systems Laboratory, Houston, Tx. The Status and Trends Analysis Contractor to GBEP. More information can be found at <http://www.tsu.edu>.

XML – based on the same technology as HTML, Extensible Markup Language is becoming a standard for the interchange of structured data in Internet applications. XML allows data and information to be described and formatted on the Internet making it readily accessible and easily integrated with other web-based data technologies. XML separates the structure of the data from how it is displayed. This allows the same XML data to be used and reused in different environments.

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