**Geospatial Communication of Aboriginal Values in Resource Management:**

**A Technical Guide to Installing and Utilizing the GVS**

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## A. Introduction

### 1. Introduction to the Geographic Valuation System (GVS)

Maps and Geographic Information System(s) (GIS) are designed to represent the world schematically for specific applications. These approaches reflect the values, perceptions, and priorities of a Western Scientific worldview. This worldview can be very different from a traditional Aboriginal worldview. The current approaches used by mapping, GIS and related geospatial technologies fail to include Aboriginal values without manipulating and altering the content and context of Traditional Environmental Knowledge (TEK). Maps and GIS may actually hinder the communication of traditional Aboriginal worldviews to resource managers and planners.

This collaborative project involving Halfway River First Nation (HRFN) and researchers at the University of Northern British Columbia (UNBC) had the goal of evaluating and enhancing the capacity to incorporate a traditional Aboriginal worldview in modern resource management and planning using innovative geospatial approaches. We have been successful in creating the Geographic Valuation System (GVS), a system which is designed to enable First Nations to participate in resource management planning and decisions in a way that is simultaneously a) consistent with the mapping and Geographic Information System-based approaches of government and industry resource managers and b) accommodates traditional Aboriginal values and approaches in resource management deliberations and decisions. The system facilitates and streamlines resolution of resource management issues that relate to First Nation's interests because it enables First Nations to participate as they choose in resource management and planning in ways meaningful to them and consistent with their traditional values. The GVS is not a one-off, HRFN-only system. It is designed and structured to be useful to any First Nation that wishes to use it. We have planned the system so that it could be freely and openly available as Open Source software, a key factor contributing to its utility to other First Nations.

Application of the GVS involves a method developed with First Nations for First Nations. Thus, the GVS as a system and approach exceeds the software package. This technical document, designed as a guide to software installation, offers an introduction to the utilization of the GVS. You are encouraged to review this document and if you are interested in applying the GVS, please contact one of the three primary GVS project partners: Alex Hawley (alex@unbc.ca), Roslyn Pokiak (Halfway River First Nation), and/or Nancy Elliot (nelliot@unbc.ca) . Alex or Nancy will be pleased to put you in contact with Roslyn (her number is her personal phone number and as such it is not appropriate to publish it here). A User Mailing List has been created on the web as a forum for reference and support: GVS mailing list (http://www.freelists.org/lists/gvs). To subscribe, fill in your email address and select 'Subscribe' as the 'User Option' at the bottom of the webpage.

The GVS employs the Flexible Internet Spatial Template (FIST) as its software foundation. The FIST is an open-source application under development in the UNBC GIS lab and by contributors to the FIST User's Community (www.freelists.org/lists/fist-users). The FIST began in January 2004 as an undergraduate project undertaken by Aaron Koning for his Honours thesis, under the supervision of Scott Emmons, Senior GIS Lab Instructor and Roger Wheate, UNBC GIS

Coordinator. Beginning in the fall of 2004, Aaron Koning was contracted in order to support development of the FIST and to mentor Nancy Elliot in FIST operation, PHP: Hypertext Preprocessor (PHP) scripting and miscellaneous tasks. Scott Emmons has also continued to provide support.

The FIST is registered under the 'GNU's Not Unix' (GNU) Public License (GPL). The GVS uses the FIST and it is made freely available for other First Nations to acquire and use, and to also modify for their own needs and to better reflect their own culture. If you use the GVS and FIST you are obligated to publish the copyright and the warranty disclaimer (see www.gnu.org/copyleft/gpl.html). In addition, we ask that you recognize the work of the project team, Roslyn Pokiak, Alex Hawley, and Nancy Elliot, Halfway River First Nation project participants, FIST creator Aaron Koning, and team member Scott Emmons.

## 2. Document Organization

This document is formatted in four sections to provide readers with the technical knowledge to install, operate and maintain a Geographic Valuation System (GVS). Section A introduces the GVS and discusses the various components that are involved. Section B provides documentation on how to install and test your GVS. Sections C and D provide tutorials for Internet mapping and Geographic Valuation System Mapping using the GVS.

This document is a working document, in that user experiences may provide additional and useful information. As well, users may find that an additional tip or two in the right place would have saved them some grief! Project member Nancy Elliot has volunteered to update copies of this manual. She can be contacted at elliotn@unbc.ca .

**\*\*TIP\*\***

Tips appear where appropriate extra guidance may provide assistance.

**GVS** This indicates an area where comments and tips may be relevant to First Nation use.

**GVS**

**Why the Moose?**

You may be asking yourself – Why the Moose? in the GVS logo – The moose is the most significant animal in the Beaver culture of the Halfway River First Nation (HRFN) and in recognition of HRFN members who are project participants the moose has been used as a logo.

**3. Decision-Making Using the Geographic Valuation System (GVS)**

Industrial development has placed the resources of the Traditional territory of the HRFN under cumulative pressures. The GVS was developed to provide HRFN with an interactive tool that accommodates Traditional Aboriginal values and approaches in resource management deliberations and decisions. TEK and complementary data, expressed through multi-media and other information elements, promotes HRFN discussion around proposed development. The Values Discovery Tool (VDT) provides access to TEK in a way meaningful to community members. The GVS provides output consistent with the mapping and GIS-based approaches of government and industry resource managers.

The GVS incorporates provincially standard geospatial data with TEK including but not limited to (Figure 5a):

- Roads;
- Seismic lines;
- Oil and Gas wells;
- Forest Cover;
- Habitat Suitability polygons;
- Biogeoclimatic Index.

Community members assess how proposed development may impact TEK (Figure 5b). The VDT utilizes a legend developed with HRFN participants to highlight information from Elders who are knowledgeable about certain areas. The VDT links this information to multi-media files and other sources of information.

Each element is georeferenced spatially but reflects values extending beyond the confines of its x and y coordinate. Multi-media elements and other sources of information include (Figure 5c):

- *HRFN Knowledge*, such as medicinal and edible plant uses, provides specific information on significant cultural elements (Figure 1);



Link to textual information on plant use.
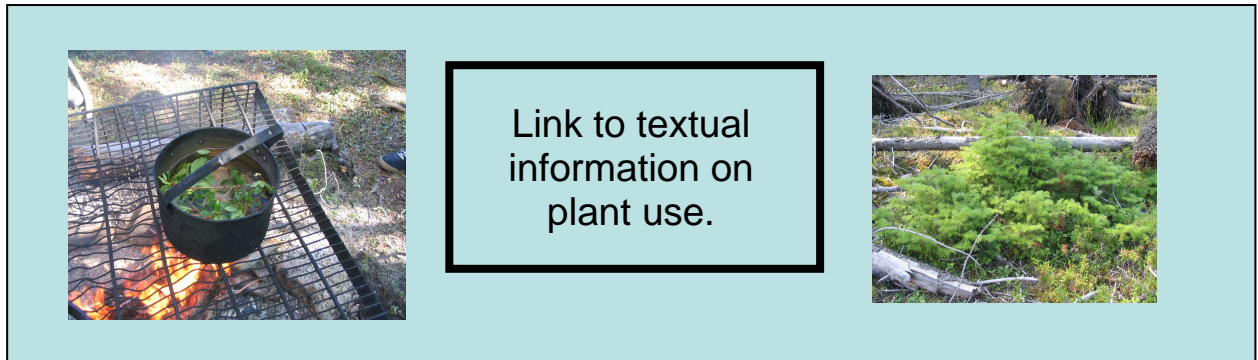
**Figure 1 - HRFN Knowledge**

- *Video and sound recordings* of Elders bring to life the Elders' experience and knowledge (Figure 2);

- *Photographs and video* illustrating significant places, experiences, and activities allow HRFN members to more easily recall certain events and points (Figure 2);



'Life on the Land'

Significant Places

Other Activities

**Figure 2 – Photographs, video and sound recordings**

- *Aerial photos, satellite images, orthophotos and hillshades* provide landscape-level portrayals of HRFN traditional territory and aid HRFN users in envisioning elevation (Figure 3);
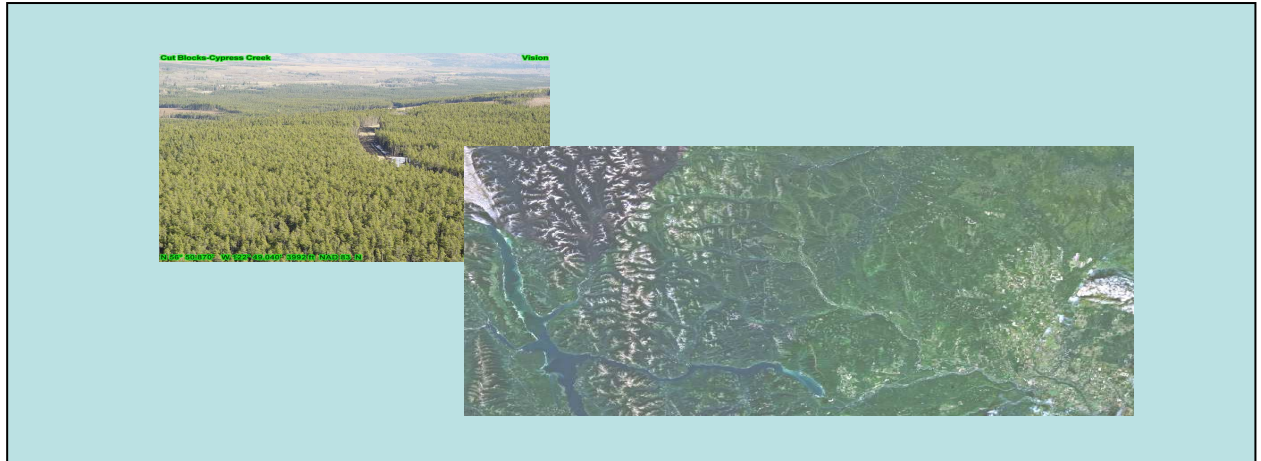


**Figure 3 - Landscape-level Portrayals**

- Significant views are identified using *viewsheds* and accompanying photographs or video (Figure 4).



**Figure 4 - Views and Viewsheds**

When a company proposes a seismic line, HRFN users identify areas of concern that incorporate values important to HRFN (Figure 5c). A paper map or geospatial file can be provided to industry and government. Control over recorded TEK remains with the community. Non-confidential data, including rivers, lakes and habitat suitability, can be plotted out as reference.

a)



b)

Beaver language audio descriptor

English language audio descriptor

Photograph of Elder knowledgeable about area or subject

Link to interview transcript

Symbol indicates sound recording. Other symbols indicate photographs or videos.
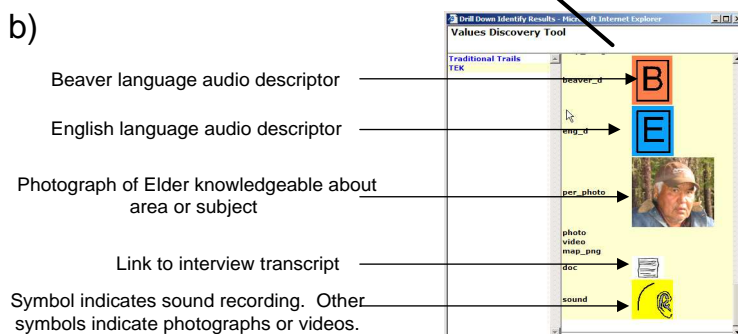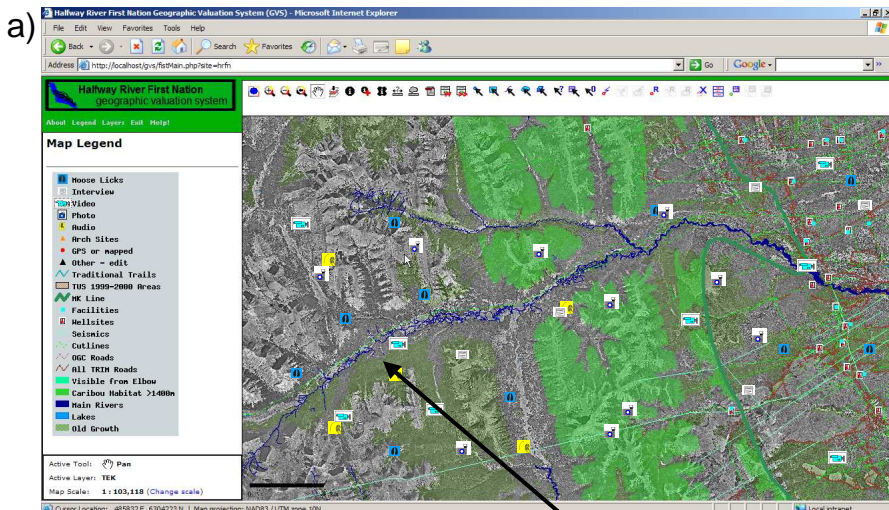


*The VDT is shown using a photograph of Billy Fox, a HRFN Elder who contributed to the success of this project.*
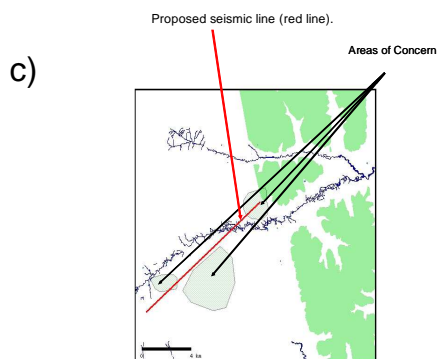
c)

Proposed seismic line (red line).

Areas of Concern



When a company proposes a seismic line, HRFN users identify areas of concern that incorporate values important to HRFN. Non-confidential data, including rivers, lakes and habitat suitability, can be plotted out as reference. 'Areas of Concern' are provided to industry and government on a paper map or as digital files.

**Figure 5 - Halfway River First Nation GVS Used in Decision-Making**

## 4. GVS Components

A functional GVS installation contains four main components: a web server, a map server, a database containing mapping data, and a web-mapping interface. The four components are licensed as Open Source software. Open Source licenses allow software to be used for free and developed further, which encourages sharing of knowledge amongst developers and users (http://www.opensource.org/). Specifically the GVS components are:

- Web Server => Apache Web Server;
- Map Server => University of Minnesota MapServer (UMinn MapServer);
- Database => PostGreSQL/PostGIS;
- Web Mapping Interface => Flexible Internet Spatial Template (FIST).

Each component is described below.

### 4.1 Apache Web Server

A web server is a computer program that serves web pages to a web browser over the Internet. The GVS uses the Apache Web Server to interpret HTML code to serve web pages (http://httpd.apache.org/) (Figure 6). The Apache Web Server also contains a module that interprets PHP code and translates it into web pages before serving it to a web browser (http://www.php.net/).
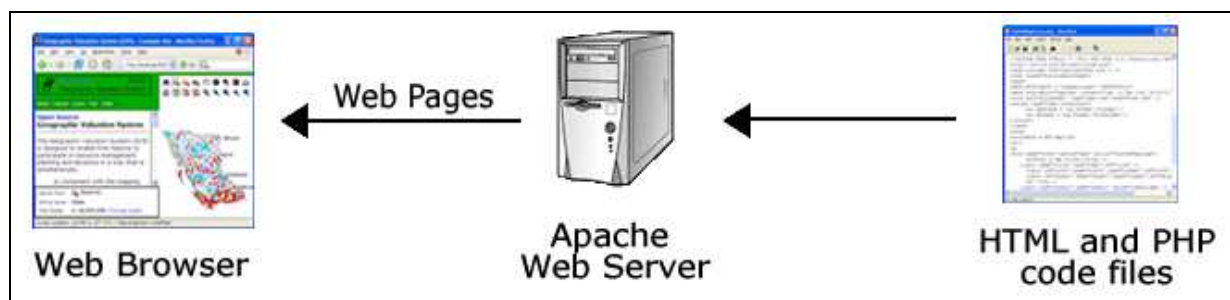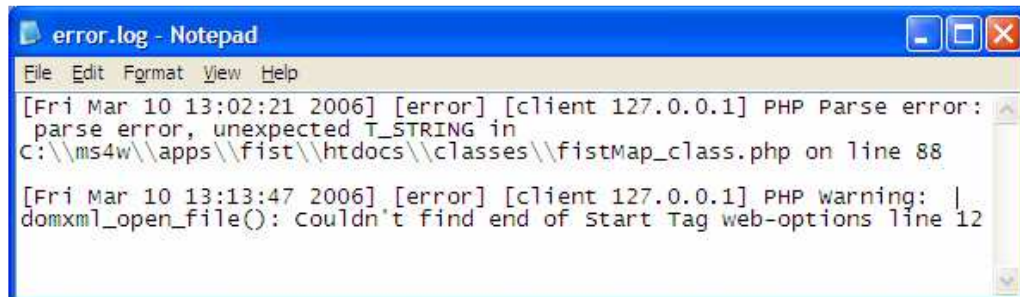


A Web Server interprets HTML and PHP code and then serves web pages to a web browser.

**Figure 6 - Web Server**

### 4.1.1 Apache Web Server Error File

Sometimes a web page will have an error. The web page will act strangely, such as displaying a white screen. When this happens, the Apache Web Server will record the error in an error log. In the GVS setup this log file is located at **c:\ms4w\Apache\logs\error.log** and can be opened using WordPad. The error log may contain many messages, so you must scroll to the bottom to see the newest errors ( **\*\*TIP\*\*** The messages are dated at their start!). When the GVS behaves strangely, it is important to check this error file because it may provide insightful information (Figure 7). There is more on this under section B, Installation and Testing.

A portion of an Apache Web Server error log located at c:\ms4w\Apache\logs\error.log. The first error indicates that there was a computer programming error in the c:\ms4w\apps\fist\htdocs\classes\fistMap_class.php PHP code file on line number 88. The second error indicates that one of the FIST XML configuration files is invalid (section 2.4.1-2.4.3). Either of these errors would cause the FIST (section 2.4) to display a white screen instead of the web-mapping interface.

**Figure 7 - Introducing the Apache Web Server Log**

**\*\*TIP\*\***

One way to troubleshoot an error in the error.log is to use Google to search for terms mentioned in the log.  You can also view or post a message to the GVS or FIST users lists (see Introduction) to receive support from other users.

## 4.2 UMinn MapServer

A map server is a computer program that generates digital maps from mapping data. The GVS uses the University of Minnesota MapServer (UMinn MapServer) to generate digital maps (http://mapserver.gis.umn.edu/). UMinn MapServer can use mapping data from a wide variety of sources including: PostGIS layers, Shapefiles, Orthophotos, and Web Mapping Server (WMS) layers.

### 4.2.1 UMinn MapServer MapFile

In order to display mapping data, UMinn MapServer needs to be told where the data are located and how to display it. UMinn MapServer uses a MapFile to perform this function. The MapFile consists of a number of variables that define map properties including: map projection, map legend, scalebar, layers, layer colors and symbols, etc. A MapFile Reference is attached as Appendix 3 and is also available on the Internet at: http://mapserver.gis.umn.edu/docs/reference/mapfile/.

**\*\*TIP\*\*** MapFile uses color spelled without a 'u', so this document has spelled the word color following this pattern.

MapFiles can be tricky to get working and it is helpful to have a small program that can test them. There is a program in $ROOT/sbin/ called mapfile_tester that can be used to test the validity of a MapFile.  See Section 4.4.5 to see how this works.

## 4.3 PostGreSQL / PostGIS

PostGreSQL is a database similar to Microsoft Access and Oracle (http://www.postgresql.org/). PostGIS is a module that allows mapping data to be stored inside of a PostGreSQL database (http://postgis.refractions.net/). Points, lines, polygons, and text attributes can thus be represented in a PostGIS layer just like they can in a Shapefile. The GVS uses PostGIS layers as the mapping data when performing Geographic Valuation System Mapping (described in Section D).

## 4.4 Flexible Internet Spatial Template (FIST)

A web-mapping interface combines the functionality of a web server and map server to generate digital maps and server them to a web browser over the Internet (Figure 8). One such web-mapping interface, the Flexible Internet Spatial Template (FIST), provides a set of HTML and PHP code files that are interpreted by the web server, which in turn requests digital maps from the map server (http://datashare.gis.unbc.ca/fist/). The web server then serves digital maps and interactive web pages to a web browser, collectively known as a web-mapping interface.
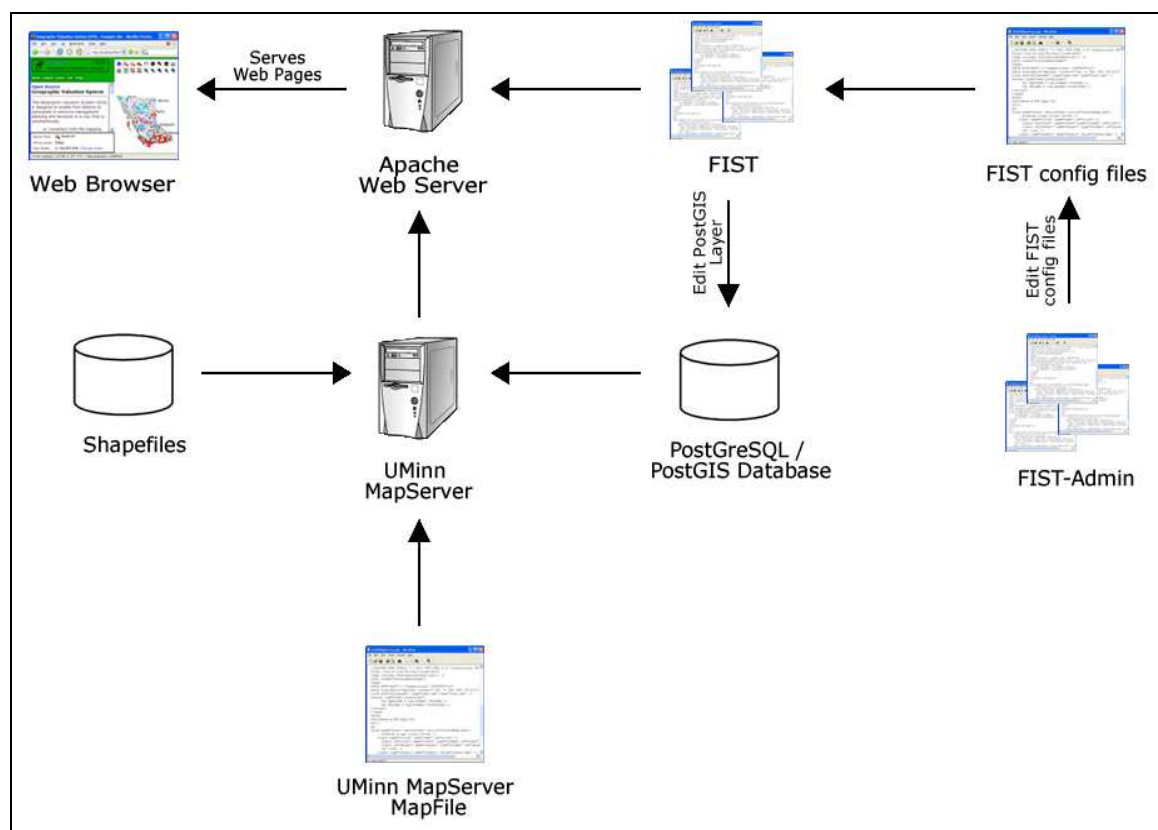


A diagram of the components making up the GVS.
Note the integration of a web server, map server, web-mapping interface, database, and web browser.

**Figure 8 - Components of the GVS**

In order to display the web-mapping interface, FIST needs to have information on its computer environment and the maps it's going to produce. Three XML configuration files are required to provide this information:

- Map-Service Configuration File;
- Site Configuration File;
- Layer Configuration File.

The Site and Layer Configuration files can be edited by an easy-to-use web interface called the FIST-Admin (or in a text file) while the Map-Service Configuration is edited in a text file. This guide contains details for each in subsequent sections.

### 4.4.1 Map-Service Configuration File

The Map-Service Configuration File is a XML file that FIST uses to determine the following information:

- the location where digital maps are stored;
- the URL of the FIST site;
- the location of the FIST on the file system;
- the location of the MapServer MapFile that will be used;
- the location of the Site and Layer Configuration files.

This file can be opened in WordPad and edited. All XML files are validated by FIST since sometimes they contain small errors that are difficult to detect. There is a program in $ROOT/sbin/ called xml_dtd_validate that can be used to test a XML files validity. This program aids you in finding the errors and is described more fully in Section B.

A reference for this configuration file is attached as Appendix 4 and is also available over the Internet at: http://datashare.gis.unbc.ca/fist/docs/0.3/map_service_config_xml_ref.php.

### 4.4.2 Site Configuration File

The Site Configuration File is a XML file that FIST uses to determine the following information:

- the web page title, colors and logo;
- the map projections to use;
- the area of the map;
- the tabs to display;
- the map tools to display.

This file can be opened in WordPad and manually edited or it can be edited with an easy-to-use web interface called the FIST-Admin (Section 2.4.3). All XML files are validated by FIST since sometimes they contain small errors that are difficult to detect. There is a program in $ROOT/sbin/ called xml_dtd_validate that can be used to test a XML files validity.

A reference for this configuration file is attached as Appendix 5 and is also available over the Internet at: http://datashare.gis.unbc.ca/fist/docs/0.3/site_config_xml_ref.php.

**4.4.3 Layer Configuration File**

The Layer Configuration File is a XML file that FIST uses to determine which map layers it will display from the MapServer MapFile. This file can be opened in WordPad and manually edited or it can be edited with an easy-to-use web interface called the FIST-Admin (Section 2.4.3). You can validate the format of the Layer Configuration File with the xml_dtd_validate program.

A reference for this configuration file is attached as Appendix 6 and is also available over the Internet at: http://datashare.gis.unbc.ca/fist/docs/0.3/layer_config_xml_ref.php.

**4.4.4 FIST-Admin**

The FIST-Admin is an easy-to-use web interface that can be used to edit the Site and Layer Configuration Files (Section 2.4.2 and 2.4.3). It automatically validates XML files and automatically saves the previous versions of a XML file for recovery at a later date if required.
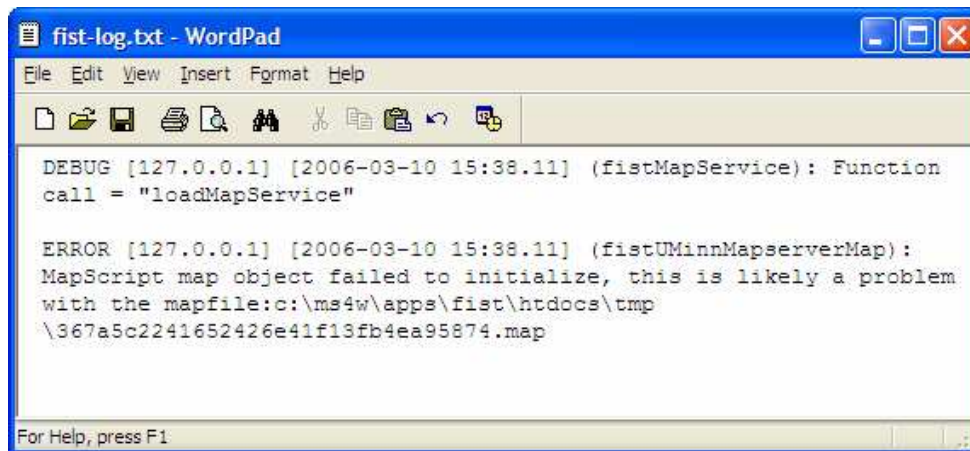

The FIST-Admin was created so that it would be a little more straight-forward and easier to edit Configuration Files (as opposed to using a text editor). We have found, through the literature and our experiences, that often the person running the GVS or related geospatial tools in a First Nation may have other jobs as well. In addition, they may spend part of their time out on the land. It is hard to remember all the details of setting up the Configuration Files when users only do it once or twice and don't spend all day using the GVS. Hopefully, the FIST-Admin clarifies these tasks!

In addition, extensive HELP files and videos were created with the HRFN covering basic to more complicated tasks of GVS operation. The videos were used in support of the strong oral tradition within the HRFN community. These cannot be shared directly since they contain confidential information, but we would be glad to share our experiences or help you set up your own HELP system.

**4.4.5 Error File**

Sometimes the FIST will have an error that causes the web page to display a blank web page or perform strangely. When this happens, FIST will record the error in an error log. In the GVS setup this log file is located at c:\ms4w\apps\fist\htdocs\tmp\fist-log.txt and can be opened using WordPad. The error log will contain many errors and warnings from previous days, so you must scroll to the bottom to see the newest errors. When the GVS performs in unexpected ways it is important to check the error file because it may provide relevant information (Figure 9).

A portion of a FIST error log located at c:\ms4w\apps\fist\htdocs\tmp\fist-log.txt.
The error indicates that the UMinn MapServer MapFile is invalid.

**Figure 9 - More Error Files! Fist-log.txt**

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**\*\* TIP \*\***

1. You can also view or post a message to the GVS or FIST users lists (see Introduction) to receive support for problems you see posted in the Fist-log.txt.

2. You can change the name of Fist-log.txt to something else, like mylog.txt or band-GVS-log.txt …. It is set in the classes/fistMap_class.php file (for example, var $errorHandlerFile = 'c:\ms4w\apps\gvs-utm\tmp\gvs-log.txt';). PHP files can be opened in WordPad or an editor like Dreamweaver. Be sure to make a backup copy before editing the PHP file so you can roll it back if you make a mistake!

## B. Installation and Testing the GVS Components

### 1. Installing and Testing Apache Web Server, MapServer and FIST

The GVS-Installation CD contains a custom MS4W package that includes the FIST, the FIST-Admin, and an example site. The Apache Web Server and MapServer can be installed quite easily using the MS4W package (also available from its source: http://www.maptools.org/ms4w/).

To install the custom MS4W package, complete the following steps:
1. Copy the MS4W directory from the CD to the c:\ drive.
2. Double click the file c:\ms4w\apache-install.bat to install the Apache Web Server as a system service.

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**\*\*TIP\*\***

You may see a message from Windows XP SP2 asking if it is safe to unblock the firewall to allow the Apache HTTP Server service to access your computer. Press the 'unblock' button.

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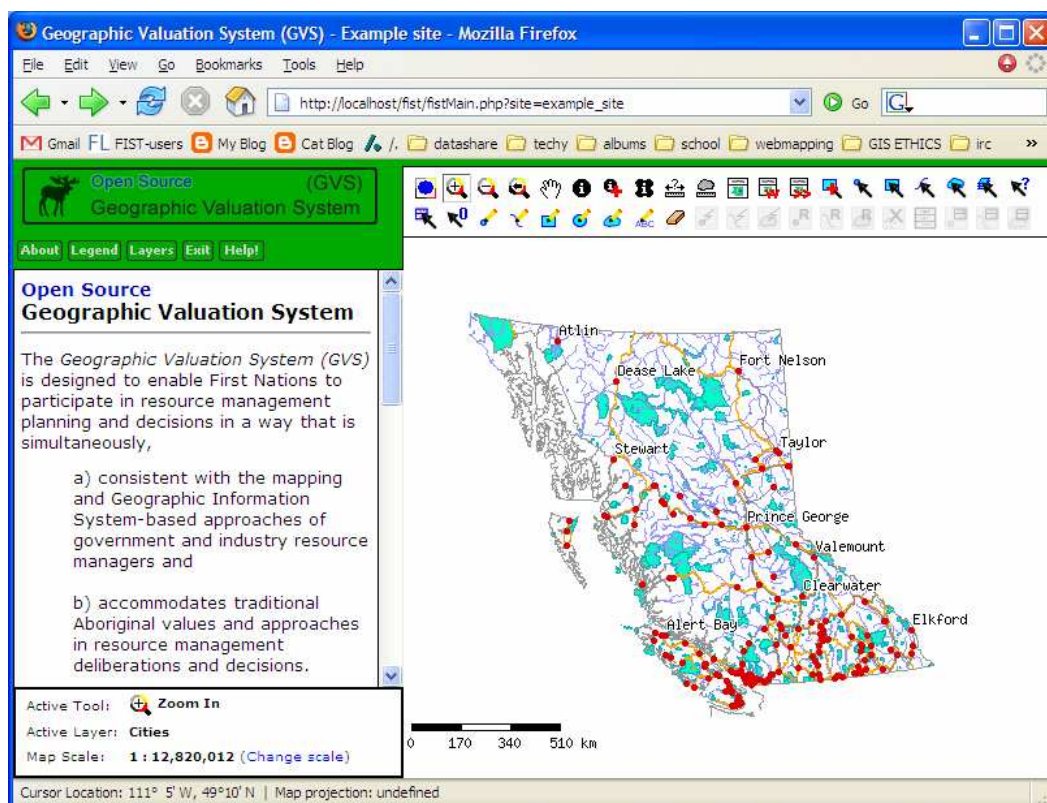


The GVS example site installed by the custom MS4W package available on the GVS-Installation CD.

**Figure 10 - GVS Example Site**

Check to see if the installation was successful by opening a web browser and loading the following URL into the browser:

- http://localhost/fist/fistMain.php?site=example_site

If the web browser displays the GVS example site (see Figure 10), then the installation was successful!

## 2. Installing and Testing PostGreSQL / PostGIS

### 2.1 Installation

The PostGreSQL database and PostGIS module can be installed with an easy-to-use installer. To install PostGreSQL/PostGIS, double click the installation file on the CD: d:\PostGreSQL\postgresql-8.1.msi, then complete the following steps:

**\*\*TIP\*\***
Optional: On the first install screen, check the 'Write detailed installation log …' so if you have any problems you can post the end of the log on the web mailing list. Also see the end of this section for notes on potential errors identified to date.

1. At the first 'Welcome' window, click the 'Start' button.
2. At the second 'Welcome' window, click the 'Next >' button.
3. At the 'Installation Notes' window, click the 'Next >' button.
4. At the 'Installation Options' window (Figure 11), left click the 'PostGIS Spatial Extensions' icon (under Database Server, third choice down) and select 'Will be installed on local hard drive' from the drop down menu. Then click the 'Next >' button.
5. At the 'Service Configuration' window, click the 'Next >' button.
   a. A popup titled 'Account Error' will appear; click the 'Yes' button.
   b. A popup titled 'Password' will appear; click the 'OK' button.
6. At the 'Initialise database cluster' window (Figure 12), enter a password into the 'Password' boxes and write down the password. Then click the 'Next >' button.
7. At the 'Enable procedural languages' window, click the 'Next >' button.
8. At the 'Enable contrib modules' window, click the 'Next >' button.
9. At the 'Enable PostGIS' window (Figure 13), click the 'Enable PostGIS in template1' checkbox. Then click the 'Next >' button.
10. At the 'Ready to Install' window, click the 'Next >' button. PostGreSQL and PostGIS should now be installed.
11. When the installation is complete, the 'Installation complete!' window will appear, click the 'Finish' button to complete the installation process.
12. Double click the following file, from the GVS-Installation CD, to install PostGreSQL as a system service:
       d:\PostGreSQL\postgresql_install_service.bat
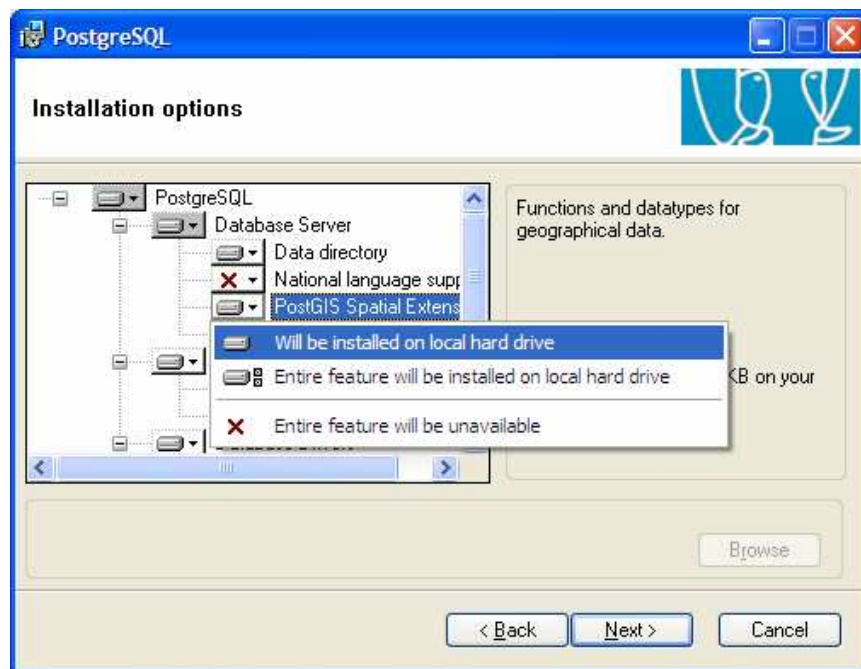
The PostGreSQL installer's 'Installation Options' window. Click the 'PostGIS Spatial Extensions' button/icon and select 'Will be installed on local hard drive' from the drop down menu. Then click the 'Next >' button.

**Figure 11 - PostGreSQL Installation Illustration 1**



The 'Initialise database cluster' window. Enter a password into the 'Password' boxes, write down the password, click the 'Next >' button.

**Figure 12 - PostGreSQL Installation Illustration 2**
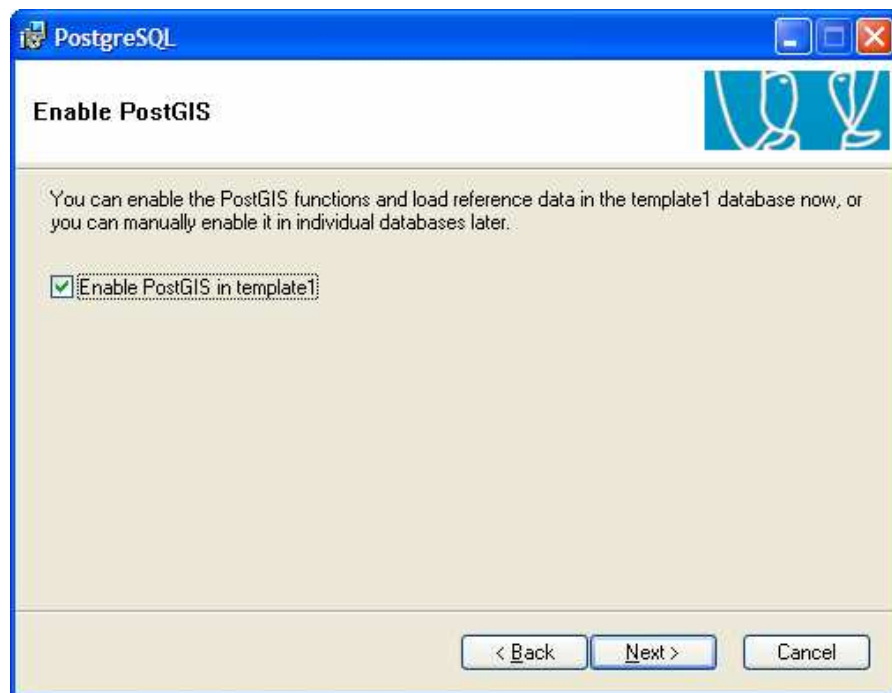
The 'Enable PostGIS' window. Click the 'Enable PostGIS in template1'

checkbox and then click the 'Next >' button.

**Figure 13 - Enable PostGIS in PostgreSQL**

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**\*\* TIP \*\***

Potential error messages:

1.  If you see this error, "The PostgreSQL must be on a NTFS formatted volume", then refer to http://pginstaller.projects.postgresql.org/faq/FAQ_windows.html . Note that you will have to convert your drive from FAT32 to NTFS or install PostgreSQL through a DOS window (Google for more information on each option).

2.  If you try and install PostgreSQL to Windows XP using the installer and a previous user message appears (from a previous installation of PostgreSQL or an abandoned installation), there is a bug with PostgreSQL. Follow these steps:

    -   Click Start, Run and type **Regedit.exe**
    -   Navigate to the following key:
        HKEY_LOCAL_MACHINE \ SOFTWARE \ Microsoft \ Windows NT \
        CurrentVersion \ Winlogon \ SpecialAccounts \ UserList
    -   Right-click in the right pane and select New DWORD Value.
    -   Type-in **postgres** as the value.
    -   Double-click **postgres**, and assign a value of **1**
    -   Close Regedit

Postgres will now appear as a user on your login screen. Login in your normal account and then delete user Postgres.

**2.2 Testing**

Check to see if the installation was successful by completing the following steps:

1. Open a web browser and load the following URL into the browser:
   http://localhost/postgis_installation_test.php
2. On the web page, enter the password you created in step 6 of the PostGreSQL/PostGIS installation (section 2.1).
3. Click the 'Submit' button.
4. The installation is successful if the web page displays the text 'The PostGreSQL/PostGIS installation test was successful!'.

## C. Creating a GVS web-mapping site (Tutorial)

This tutorial will show how to create a basic GVS web-mapping site using the web mapping interface the FIST. We will make reference to GVS files that are used by the FIST but are specific to the GVS; for example, layer-config.xml used by the FIST will be referred to as the GVS layer-config.xml. You will be able to modify the site's appearance, add/remove map tools, and add/remove map layers. The aim is to show you enough to get a site up and modify it, but not to overload you with information. When you need more information than this tutorial and document can provide, you should visit the following sites for more information and help:

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**⁕⁕TIP⁕⁕ Additional sources of Help!**
- GVS mailing list (http://www.freelists.org/lists/gvs).
- FIST mailing list (http://www.freelists.org/lists/fist-users ).
- FIST online documentation (http://datashare.gis.unbc.ca/fist/documentation.php).
- UMinn MapServer documentation (http://mapserver.gis.umn.edu/docs/).
- UMinn MapServer mailing list (http://mapserver.gis.umn.edu/community/mailinglists/mapserver-users/).
- PostGreSQL online documentation (http://www.postgresql.org/docs/).
- PostGIS online documentation (http://postgis.refractions.net/docs/).

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### 1. Initialize a GVS site

A GVS web-mapping site can be set up by writing new configuration files, but it is often easier to copy files from an existing site and then modify those files for your needs. This is the approach used here.

### 1.1 Copy files from the example site

To set up the GVS, we need copies of the FIST configuration and MapFile files so that we can modify our new web-mapping site and not damage the existing example web-mapping site. Complete the following steps to copy the files:

Copy existing mapfile:
1. In Windows Explorer, go to c:\ms4w\apps\fist\mapfiles.
2. Make a copy of the example.map file and rename it to mygvs.map (result will be C:\ms4w\apps\fist\mapfiles\mygvs.map).

Copy existing sites directory (and its files; you will edit the copies):
3. Go to C:\ms4w\apps\fist\htdocs\sites.
4. Make a copy of the example folder/directory and rename it to mygvs (result will be C:\ms4w\apps\fist\htdocs\sites\mygvs).

### 1.2 Add the site into the map-service configuration file

In order for the web-mapping interface to allow people to use the new site, we need to add a map-service entry into the map-service configuration file. A map-service entry defines the name

of the site, the location of the MapFile the site will use and the locations of the site and layer configuration files.

Complete the following steps to add the site into the map-service configuration file:
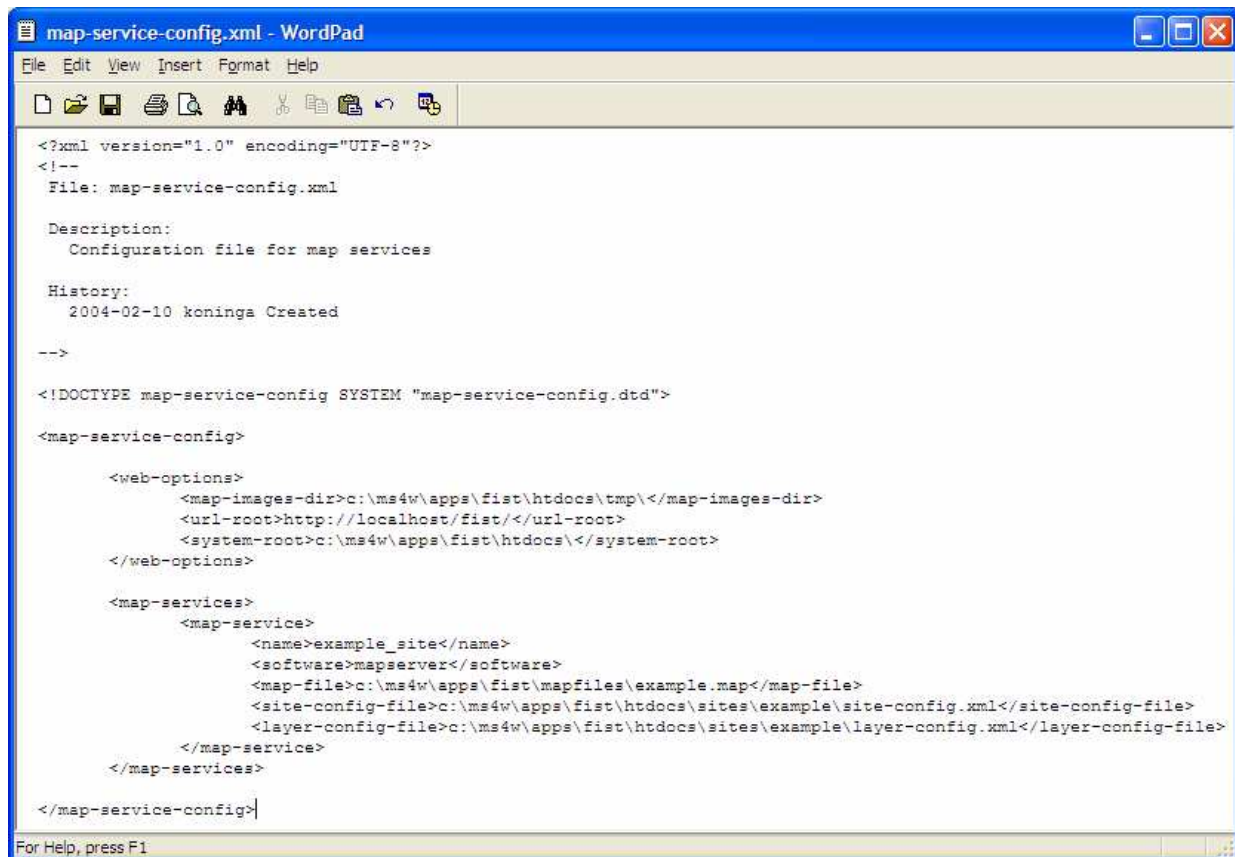
1. In Windows Explorer, go to c:\ms4w\apps\fist\htdocs.
2. Make a copy of the map-service-config.xml and rename it map-service-config_backup.xml . It is important to create a backup of the file in case the file gets corrupted when we edit it.

> **\*\* TIP \*\***
>
> You may choose to make a folder/directory called 'backups' and copy to a backup the map-service-config.xml each time you edit or access the file.  It is easier to rollback to your backup than to deal with a corrupted file!

3. Open the following file with WordPad: C:\ms4w\apps\fist\htdocs\map-service-config.xml (Figure 14).
4. Each site has a map-service entry in this file. Copy the example_site's map-service XML tag and paste it underneath (Figure 15).
5. Now we need to change a few of the XML tags for our new site (the values are shown in Figure 15).
   a. Change the XML tag 'name' so that it contains the text 'mygvs'. This name will appear in the URL when we access the site through a web browser.
   b. Change the XML tag 'map-file' so that it contains the text 'c:\ms4w\apps\fist\mapfiles\mygvs.map'.
   c. Change the XML tag 'site-config-file' so that it contains the text 'c:\ms4w\apps\fist\htdocs\sites\mygvs\site-config.xml'.
   d. Change the XML tag 'layer-config-file' so that it contains the text 'c:\ms4w\apps\fist\htdocs\sites\mygvs\layer-config.xml'.

The map-service XML configuration file. There is only one map-service in this file,
so only one web-mapping site will be accessible.

**Figure 14 - Map-service-config.xml**
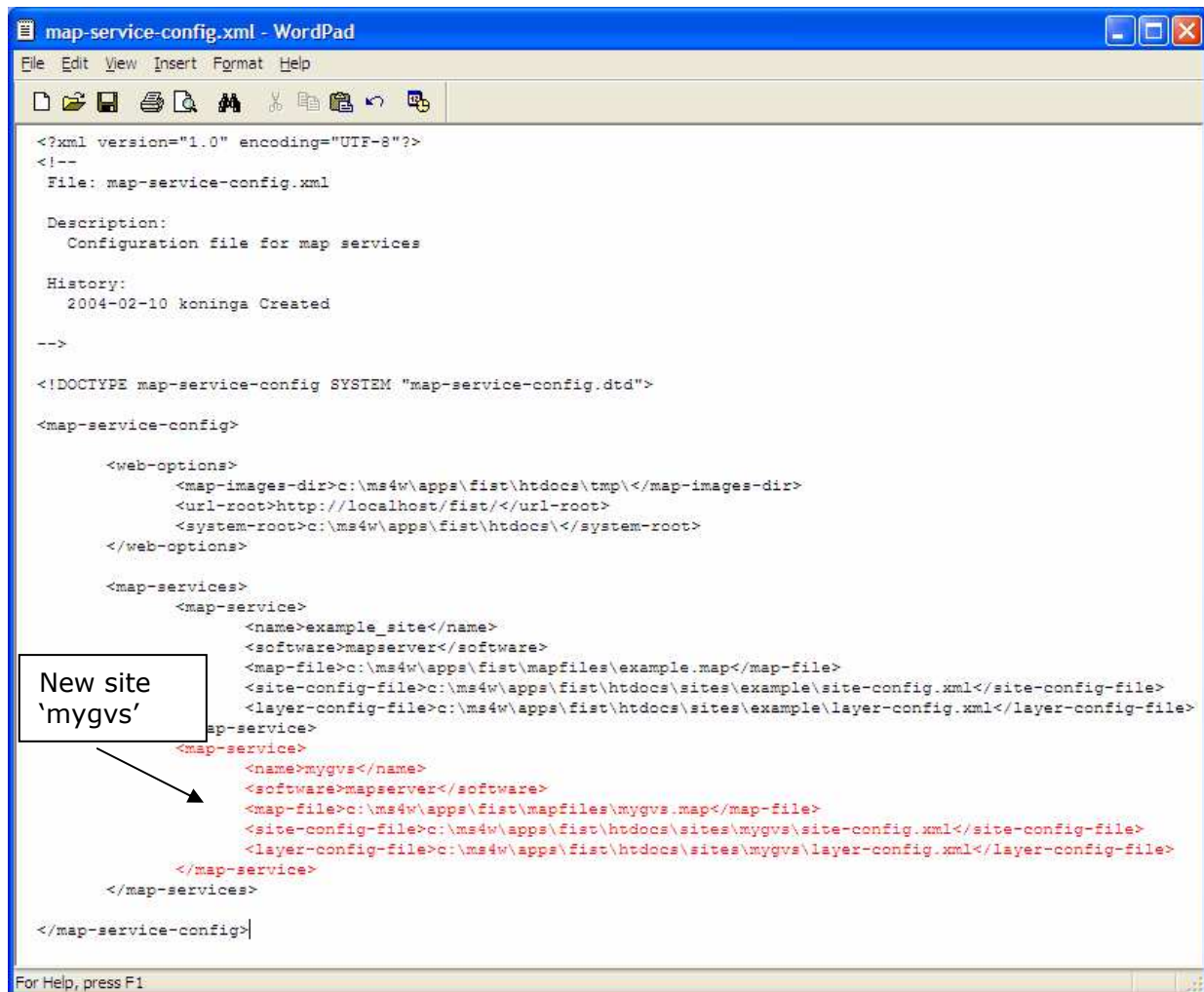
The modified map-service XML configuration file. A new map-service has been added and there are now two web-mapping sites that can be accessed.

**Figure 15 - Modified Map-service-config.xml**

## 1.3 Validate the map-service configuration file
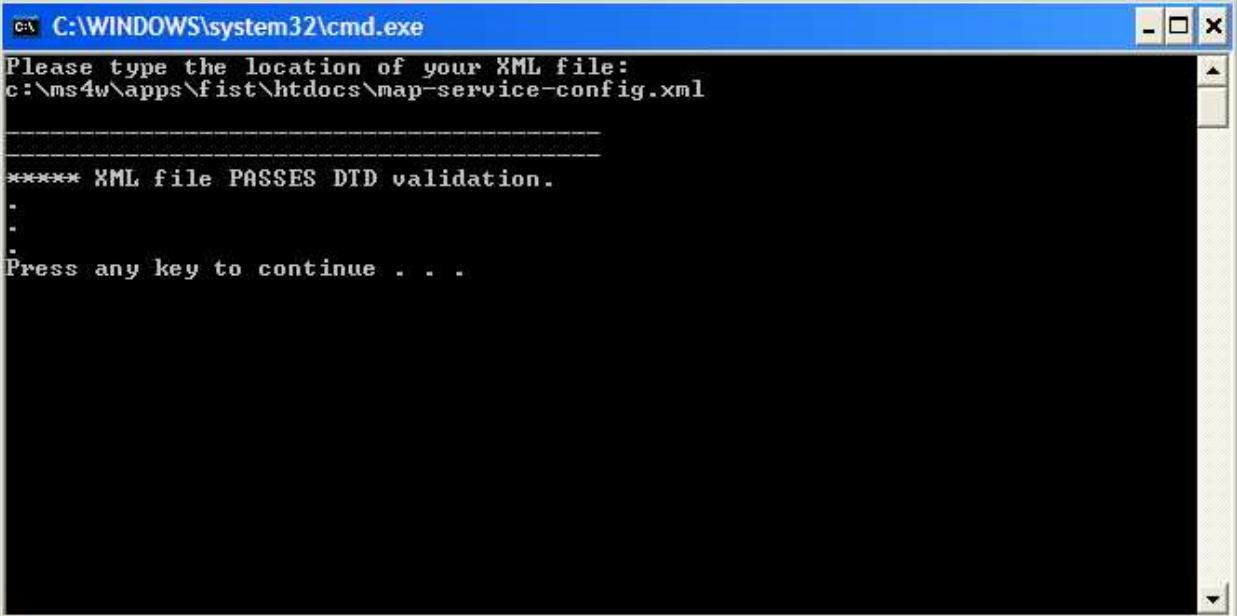
The map-service configuration file uses a XML format that needs to be validated before it can be loaded into the FIST. It is easy to make small mistakes in this file that will cause the file to fail validation. Therefore, we should test/validate the file before loading the web-mapping site, using the xml_dtd_validate program. Complete the following steps to test the file:

1. Double click the C:\ms4w\apps\fist\htdocs\sbin\xml_dtd_validate.bat file. A window will appear asking for the location of your XML file.
2. Type the location of your map-service configuration file into the window and press enter: C:\ms4w\apps\fist\htdocs\map-service-config.xml.
3. The window will then display the results of the validation.
   - If the file is valid, you will see the window shown in Figure 16.

- If the file is not valid, you will see a window like those shown in Figures 17 and 18.
4. If the XML file is not valid, examine the error messages and try to fix the problem. If you can't seem to fix the problem, you should delete the file, restore it from the backup and try again:

**\*\*TIP\*\*** See, you needed that backup!

    a. In Windows Explorer, go to c:\ms4w\apps\fist\htdocs.
    b. Delete the map-service-config.xml file.
    c. Copy the map-service-config_backup.xml file and rename it to map-service-config.xml.
    d. Go back to Section 1.2 of this document and follow those steps again.



The result of running the xml_dtd_validate.bat file on a map-service-config.xml file shows that this XML file is valid.

**Figure 16 - Valid Map-service-config.xml**

The result of running the xml_dtd_validate.bat file on a map-service-config.xml file shows that this XML file is not valid. The error indicates that the program couldn't open the XML file. Notice that the file name the user entered was incorrect so the program couldn't find it.

**Figure 17 - Error Example 1**



The result of running the xml_dtd_validate.bat file on a map-service-config.xml file shows that this XML file is not valid. The error indicates that some of the XML tags in the XML file don't match up.

**Figure 18 - Error Example 2**

## 1.4 Test the new site

Now that you have set up your new GVS web-mapping site, load it in the browser to see if it

works. Load the following URL in your web browser:

- http://localhost/fist/fistMain.php?site=mygvs

If the web browser displays your web-mapping site (same as Figure 10), then the setup was successful.

**GVS**

The 'localhost' in the address above refers to the fact that the site is running on your machine and unless you link it to the outside your site and its contents cannot be accessed by someone browsing through the web from another location. This is one approach to ensuring that confidential data and information remain within the community. You may decide to post all information or partial information (as a restricted user) at a later date.

## 2. Appearance and Map Basics

Once you have created/set up your GVS web-mapping site, you can adjust its appearance so that it better matches your organization and/or personal taste. In this section you will be shown how to change the site's color, logo, title and the initial web page that appears in the web-mapping interface's side-menu. These settings are located in the GVS site configuration file and will be edited using the FIST-Admin web interface.

### 2.1 Open the FIST-Admin

Open the FIST-Admin by loading the following URL in your web browser:

- http://localhost/fist/fist-Admin/

The FIST-Admin needs to be pointed to the location of the site and layer configuration files and the URL and system paths to the FIST htdocs directory. Complete the following steps to start editing your sites configuration files:

1. Click 'Select site' on the FIST-Admin side-menu.
2. Enter the following in each of the four input boxes and then click the 'Begin editing' button (Figure 19):

   a. Type 'c:\ms4w\apps\fist\htdocs\' in the 'System root path' input box.
   b. Type 'http://localhost/fist/' in the 'URL root path' input box.
   c. Type '$ROOT/sites/mygvs/site-config.xml' in the 'Site configuration file path' input box.
   d. Type '$ROOT/sites/mygvs/layer-config.xml' in the 'Layer configuration file path' input box.
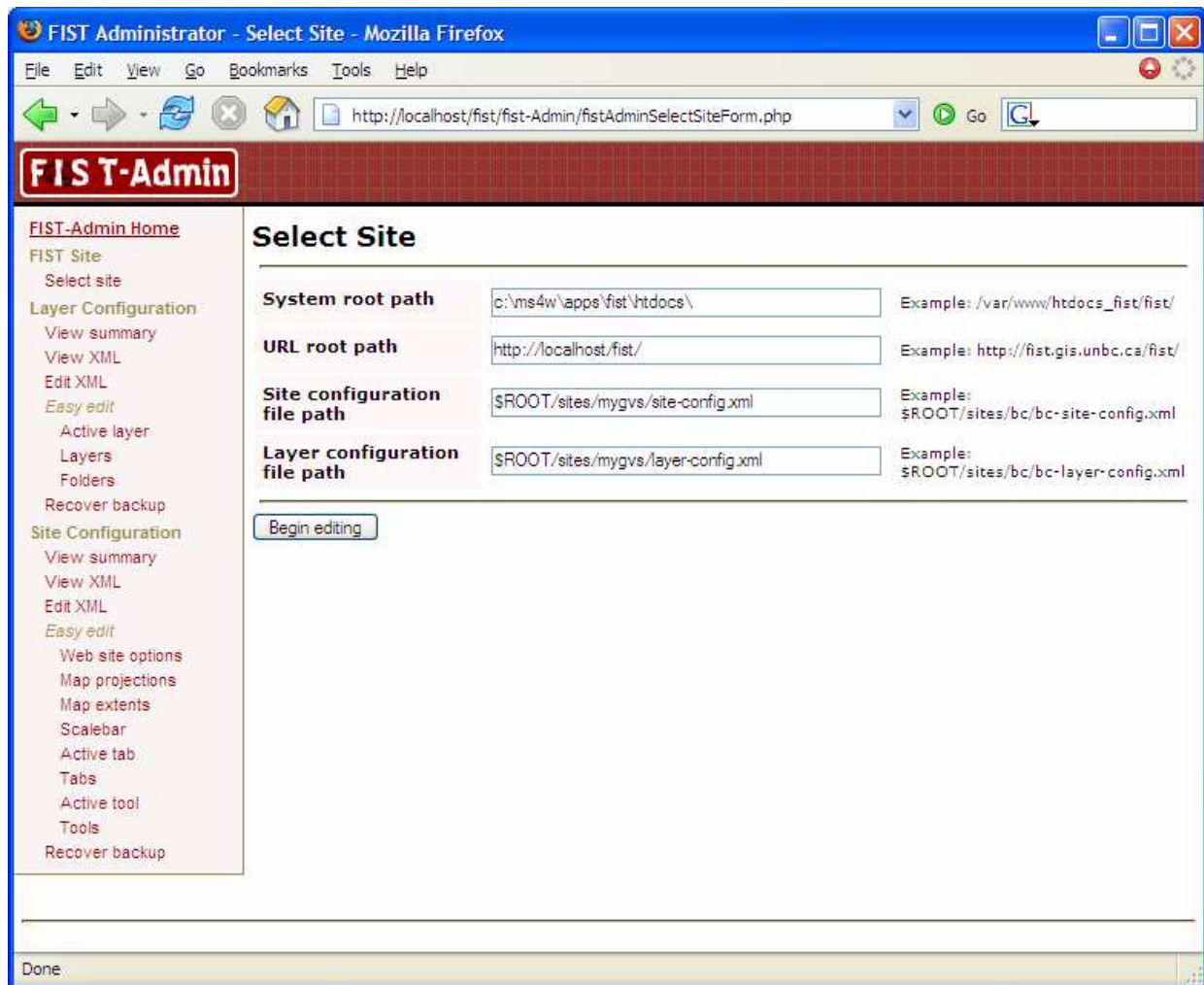
Selecting the FIST site and layer configuration files to edit in the FIST-Admin web interface.

**Figure 19 - FIST-Admin allows GUI supported changes**

## 2.2 Changing the site title, logo, and color

The site's title, logo, and color can be changed by clicking 'Web site options' on the FIST-Admin side-menu. If you change the site's color, you will probably want to change the colors of the site logo and the color of the tab images. Make sure you save your logo and tab images in the C:\ms4w\apps\fist\htdocs\sites\mygvs\ directory. Then you can use FIST-Admin to change the images that appear on the web-mapping interface.

---

**\*\*TIP\*\***

1.  When changing logo and tabs it is best to make a backup by renaming the original files (C:\ms4w\apps\fist\htdocs\images\logo and \tabs).  Also, you can create directories in your sites directory to hold your new images (C:\ms4w\apps\fist\htdocs\sites\mygvs\images etc.).

2.  You can edit the logo and tabs in any paint or graphics program.  Use a copy of the original logo and tabs so that you get the size right from the beginning!

---

## 2.3 Modifying the sidebar web pages and tabs

The sidebar in the GVS web-mapping interface is used to display web pages that provide information and receive input from users. Tabs (such as the About, Legend and Layers tabs) are buttons that, when clicked, load a web page into the sidebar (these buttons can perform other actions as well). When a user loads a GVS site, the first web page that appears in the sidebar usually provides them with information about the purpose of the web-mapping site.
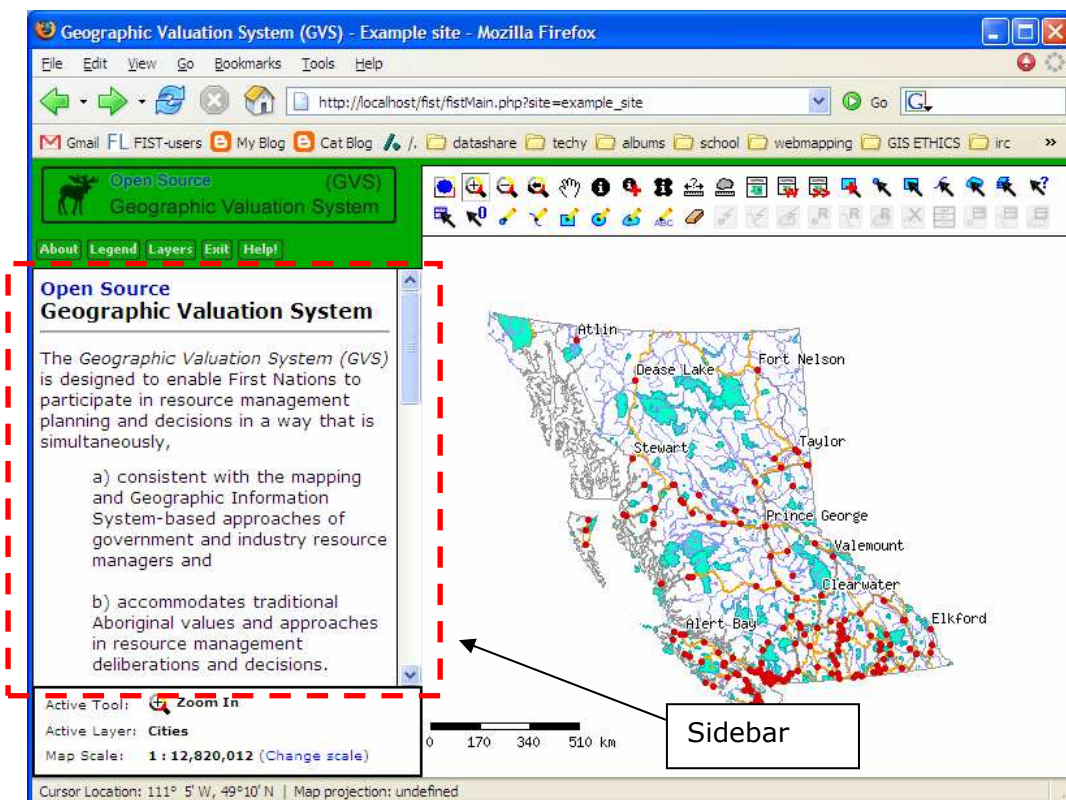


GVS Sidebar 'ABOUT' tab opens with information about the GVS.
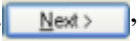
**Figure 20 - GVS ABOUT Sidebar**

In this case we are going to use the FIST-Admin to modify the 'About' tab (Figure 20), which references the default GVS sidebar web page. Since you may want to change the welcome message and description on this web page to better reflect your project, we need to use a different web page.

---

**GVS**

The FIST is registered under the GNU Public License (GPL).  The GVS uses the FIST and it is made available for other First Nations to get and use, and also to modify for their own needs and to reflect their own culture.  If you use the GVS and FIST, you are obligated to publish the copyright and warranty disclaimer (see www.gnu.org/copyleft/gpl.html).  In addition, we ask that you recognize the work of the project team, Roslyn Pokiak, Alex Hawley, Nancy Elliot, Halfway River First Nation participants, FIST creator Aaron Koning, and team member Scott Emmons.

---

Complete the following steps to modify the tab:

1. Click 'Tabs' on the FIST-Admin side-menu.
2. Click 'Modify a tab' on the 'Tabs' web page.
3. Choose the 'About' tab from the 'Select a tab' dropdown menu and click the ' Next > ' button.
4. Change the 'URL' text box so that it reads:
   - $ROOT/sites/mygvs/php/gvsAbout.php.
5. Click the 'Save' button.

Now you just need to open up the C:\ms4w\apps\fist\htdocs\sites\mygvs\php\gvsAbout.php web page and edit the HTML in this web page. For more information on editing HTML go to the following web site, which has a great tutorial on HTML.

- http://www.w3schools.com/html/

Also, try searching Google (http://google.com) for other sites.

---

**\*\* TIP \*\***

When you are finished editing your About page, load up your mygvs site (http://localhost/fist/fistMain.php?site=mygvs) and then load up in another browser window the example site (http://localhost/fist/fistMain.php?site=example_site ).  Compare the two and you will see that your site is starting to look unique.

---

## 2.4 Setting the map extents

The map extents can be set through the FIST-Admin. You can use the following steps to change the map extents:

1. Click 'Map extents' on the FIST-Admin side-menu.
2. Enter the coordinates that make up the extents.
3. Click the 'Save' button.

*We won't bother changing the map extents at this point, because we want to see all of British Columbia for the rest of this tutorial.*

## 3. Map Tools

Map tools are specified in the site configuration file and can be added and removed using the FIST-Admin web interface. The site you have just created has all of the predefined map tools loaded by default, but we will go over how to remove and add map tools. In addition, tools can be set up so that they are unavailable to certain layers using context tags. Context tags can also be through the FIST-Admin.

One reason to reduce the number of tools present in the GVS mapping interface may be so that different users feel more comfortable using the software. For example, Elders who are using the GVS to view information may only require some basic movement buttons, like the zoom in and out, and the Values Discovery Tool. Others, including school children, may want to search and/or to add new information, and will thus benefit from a fuller suite of tools. You may choose to ask different people in your community what they prefer!

### 3.1 Removing tools

The following steps show how to remove a map tool from your GVS web-mapping site using the FIST-Admin. You will apply these steps in the paragraph immediately following:

1. Click 'Tools' on the FIST-Admin side-menu.
2. Click 'Remove a tool' from the 'Tools' web page.
3. Select a tool from the drop-down menu on the 'Remove Tool' web page.
4. Click the 'Save' button.

Try removing the 'Zoom Initial', 'Measure Distance', and 'Pan' tools using the steps above. Reload the GVS web-mapping site in your web browser. These three map tools should have disappeared.

### 3.2 Adding predefined tools

The GVS comes with 40 predefined map tools that can be added using the FIST-Admin. The following steps show how to add predefined tools. You will apply these steps in the paragraph immediately following:

1. Click 'Tools' on the FIST-Admin side-menu.
2. Click 'Add a predefined tool' from the 'Tools' web page.
3. Select a tool from the drop-down menu on the 'Add Predefined Tool' web page.
4. Click the 'Save' button.

Try adding the 'Zoom Initial', 'Measure Distance', and 'Pan' tools using the steps above. Reload the GVS web-mapping site in your web browser. These three map tools should now appear at the end of the toolbar in the GVS web-mapping interface (Figure 21).
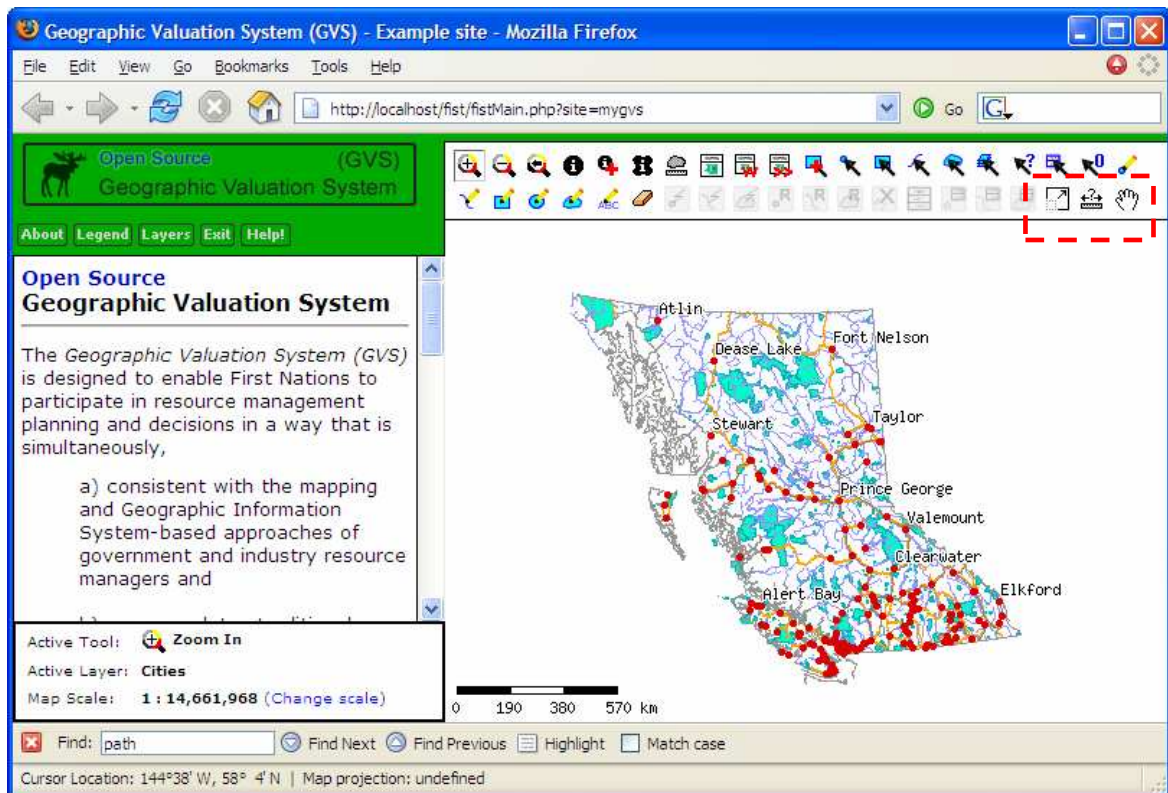
The 'Zoom Initial', 'Measure Distance' and 'Pan' tools appear at the end of the toolbar
after being added using the FIST-Admin.

**Figure 21 - Adding Pre-Defined Tools**

**\*\* TIP \*\***

As the number of users of the GVS and FIST grows, there will likely be more tools created by
users. By subscribing to the GVS and FIST mailing lists, you can track changes and contribute
your own work!

**GVS**

Some of the tools, including the approach to reading new data and information in through the use
of .csv files, were developed specifically within the FIST in response to needs expressed by the
Halfway River First Nation. Similarly, output tools were created so that maps showing 'Areas of
Concern' could be communicated to outside resource managers and planners (see Introduction,
Part 3, Decision-Making with the GVS). Another First Nation may identify different
requirements and new tools may be created to meet those needs.

### 3.3 Reordering tools

The map tools that appear in the GVS toolbar can be reordered using the FIST-Admin. The
following steps show how to reorder the tools. You will apply these steps in the paragraph
immediately following:

1. Click 'Tools' on the FIST-Admin side-menu.

2. Click 'Reorder tools' on the 'Tools' web page.
3. On the 'Reorder Tools' web page, select a tool from the list of tools and click the up or down buttons to reorder it.
4. Click the 'Save' button.

Try adding reordering the map tools so that the 'Zoom Initial' tool is above the 'Zoom In' tool, the 'Measure Distance' is above the 'Measure Area' tool and the 'Pan' tool is above the 'Identify' tool. These three map tools should now appear in the GVS toolbar in the order you specified.

## 4. Map Layers

Adding map layers to the GVS web-mapping interface involves two files: the UMinn MapServer MapFile (Part A, Section 2.2.1) and the layer configuration file (Part A, Section 2.4.3). The layer configuration file can be edited using the FIST-Admin web interface, but the MapFile must be edited manually. We will use WordPad to edit the MapFile.

## 4.1 Put mapping data in place

When using the GVS, it is common practice to place mapping data (e.g. GIS data, orthophotos) into a directory within the FIST directory. For this tutorial there are some mapping data on the CD that we will copy and use in the GVS web-mapping interface. Complete the following steps to copy the mapping data to the FIST, data directory:

1. In Windows Explorer, go to d:\ (or the appropriate drive letter on your computer).
2. Copy the 'mapping_data' directory.
3. Go to c:\ms4w\apps\fist\data\ .
4. Paste the 'mapping_data' directory.
5. Rename the 'mapping_data' directory to 'mygvs'.

## 4.2 Importing data into PostGIS

Mapping data are often stored in 'shapefiles', which actually consist of three or more files. Alternatively, PostGIS stores mapping data in a database (PostGreSQL), which allows the data to be modified using an easy-to-use database language (SQL). Also, FIST has editing tools that can modify PostGIS mapping data, as you will see in Part D of this document.

---

**\*\* TIP \*\***

The GVS can *view* and *access* data stored in shapefiles (and other formats), but *edits* data stored in PostGreSQL (through PostGIS). So, if you want to edit data in a certain file, you will need to load and store it in PostGreSQL. Keep Reading!

---

Most of Section 4 uses PostGreSQL computer programs that can be found at C:\Program Files\PostgreSQL\8.1\bin . In the future, you may wish to experiment with these programs outside of this tutorial.

### 4.2.1 Creating a database
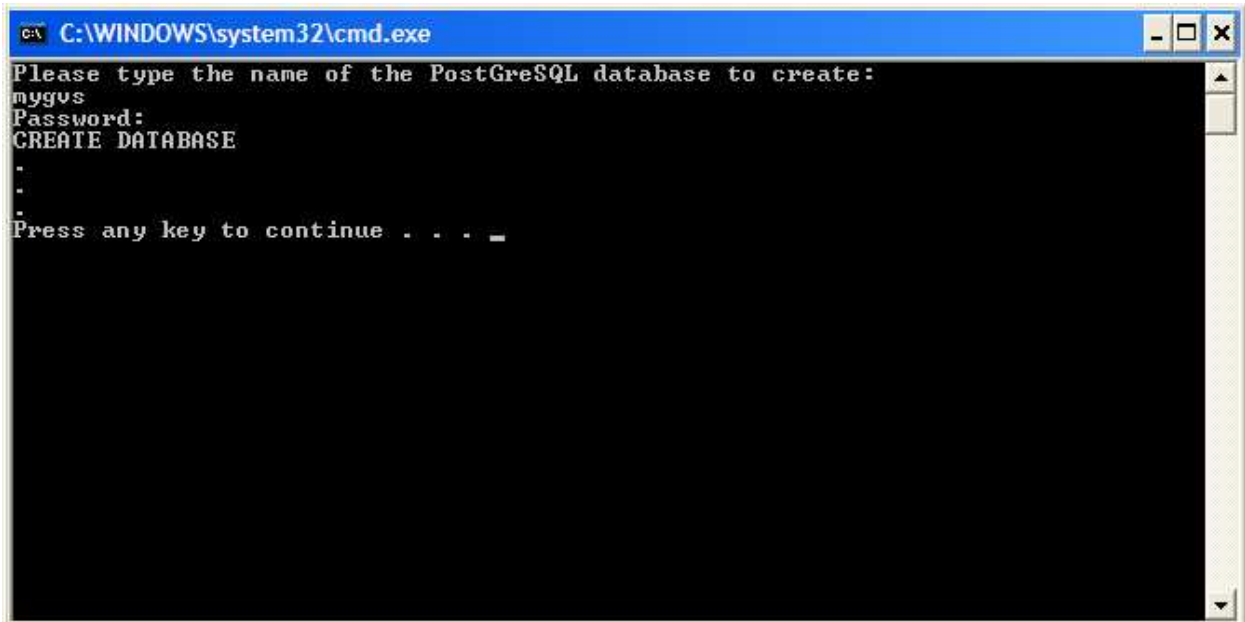
Before PostGIS layers can be stored, a PostGreSQL database needs to be created to store them. One database can hold many PostGIS layers. In the future you may find it convenient to create more than one database to separate PostGIS layers, but for this tutorial we will use a single database.

To create the 'mygvs' database, complete the following steps:

1. Double click c:\ms4w\tools\PostGreSQL\create_database.bat file. A window will appear asking for the name of the database to create.
2. Type the name of the database to create, 'mygvs', in the window and press enter.
3. The window will then ask you for a password. ***Enter the password you created in step 6 of the PostGreSQl/PostGIS installation (Part B, Section 2.1).***
4. The window will then display the results of the database creation.
   - If the database was created successfully, you will see the window shown in Figure 22.
   - Database creation may fail because the password was typed incorrectly, as shown in Figure 23.

---

**\*\*TIP\*\***

The create_database.bat file, which provides a simple interface for creating databases, is actually just a simplified version of the createdb.exe program located at 'C:\Program Files\PostgreSQL\8.1\bin'.

---



A PostGreSQL database, named 'mygvs', was created successfully using the create_database.bat file.

**Figure 22 - Successful Creation of Database**
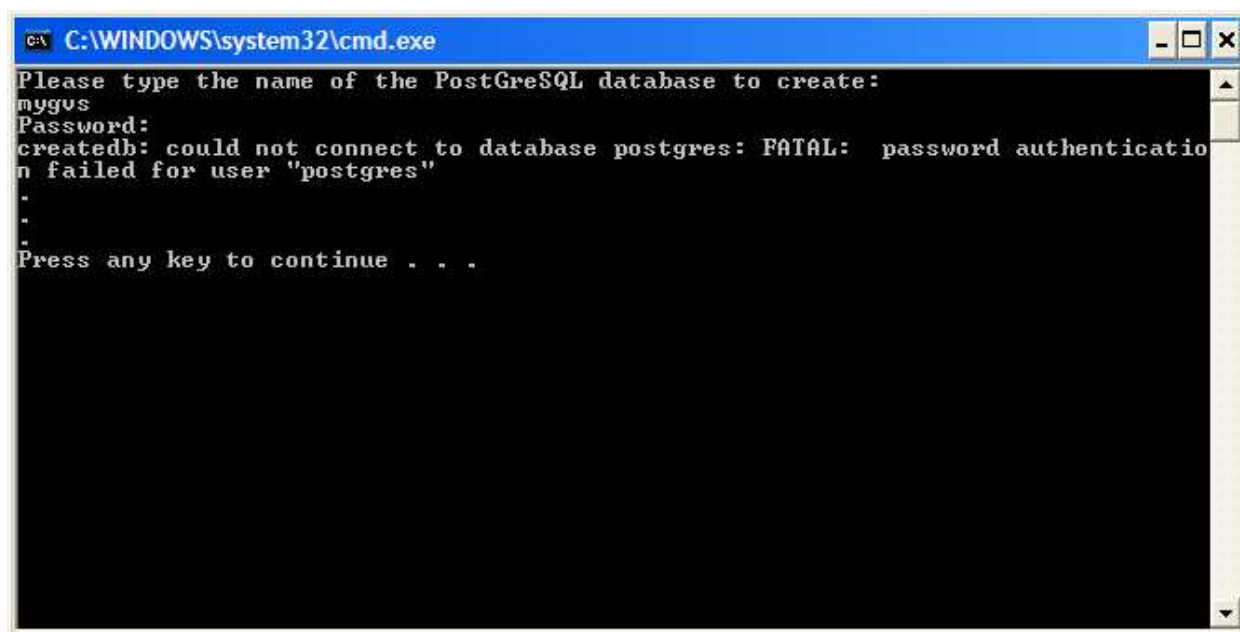
The create_database.bat file failed to create the 'mygvs' database, because the password was typed incorrectly.

**Figure 23 - Error When Creating Database**

### 4.2.2 Creating database users

In this section you will create two database users that will be used to access and modify mapping data stored as PostGIS layers. The first user, named 'gvsedit', will be used to import and modify PostGIS layers. The second user, named 'gvsread', will be used for accessing data, but not modifying the information. **Having one user that can modify data and one user that can't allows us to limit the permissions of users accessing the PostGIS layers.** This allows control over editing and will prevent people from accidentally adding or erasing data and information. In the MapFile and GVS web-mapping interface this allows us to specify which layers can be edited and which layers can't.

The following steps show how to add database users. You will apply these steps in the paragraph immediately following:

1. Double click the c:\ms4w\tools\PostGreSQL\create_user.bat file.
2. A window will appear asking you to 'enter name of role to add', which means that you enter the user name that you want to create.
3. Type the user name and press enter.
4. The window will then ask you to 'enter password for new role', which means that you should enter a new password for the user you are creating.
5. Type a new password, write the down the password and press enter.
6. The window will then ask you to 'enter it again', which means you should reenter the password you wrote down in step 5.
7. Type the password and press enter.
8. The window will then ask you for a password. **This is a different password than the**
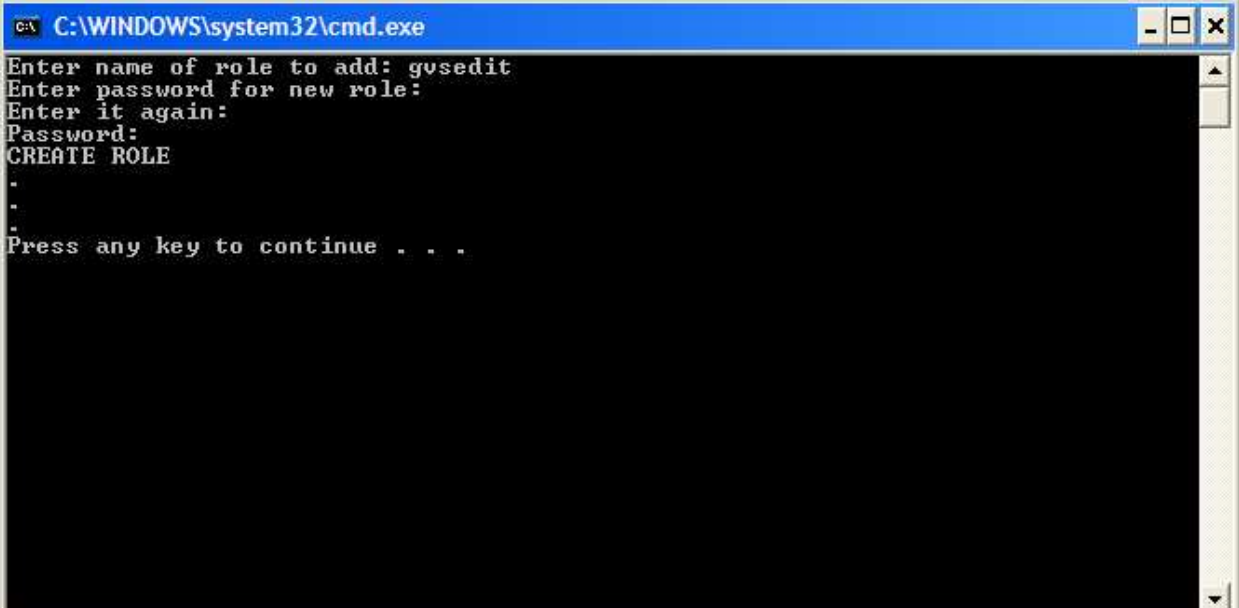
**one used in step 5 and 7. The password you need is the one you created in step 6 of the PostGreSQl/PostGIS installation** (Part B, Section 2.1).
9. The window will then display the results of the database user creation (Figure 24).

Now, create the 'gvsedit' and 'gvsread' database users using the steps above. These users will be utilized later on.

---

**\*\*TIP\*\***

The create_user.bat file, which provides a simple interface for creating users, is actually just a simplified version of the createuser.exe program located at 'C:\Program Files\PostgreSQL\8.1\bin'.

---



The 'gvsedit' PostGreSQL database user was created successfully by the create_user.bat file.

**Figure 24 - Creating a New Database User**

### 4.2.3 Allowing a user to import mapping data
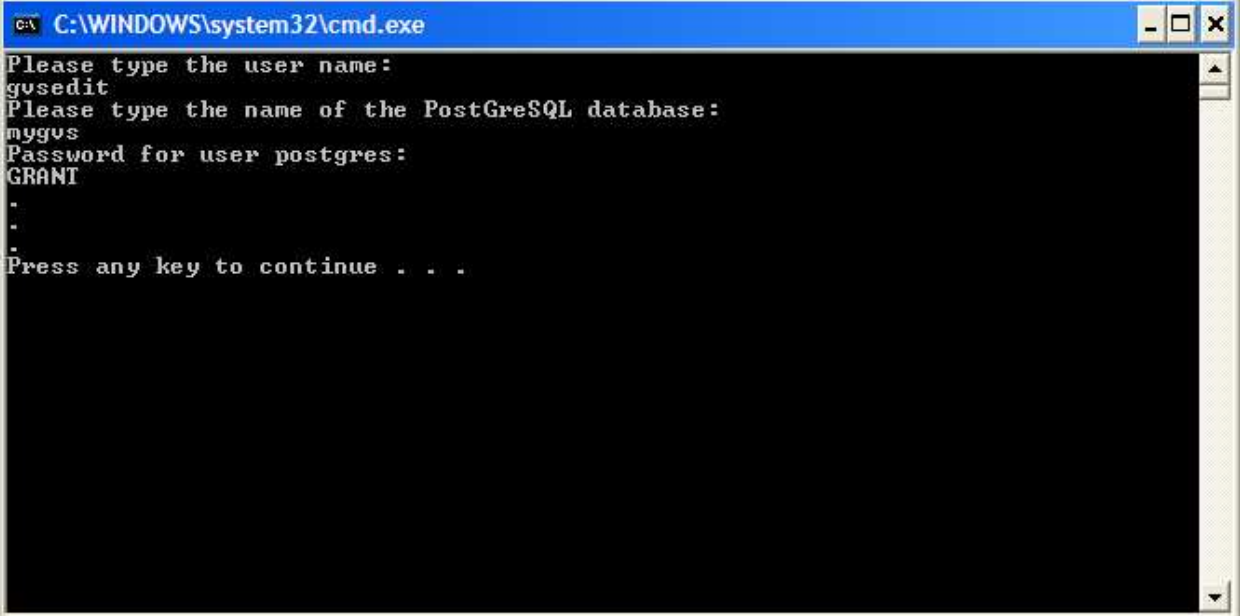
Before we can import mapping data into the PostGreSQL database we need to allow the 'gvsedit' user to add PostGIS layers to the database. Complete the following steps to allow the 'gvsedit' to import mapping data into the 'mygvs' database:

1. Double click the c:\ms4w\tools\PostGIS\allow_user_to_import.bat file. A window will appear asking you to enter the user name.
2. Type 'gvsedit' and press enter.
3. The window will then ask you for the name of the database. Type 'mygvs' and press enter.

4. The window will then ask you for the password of the postgres user. Enter the password you created in step 6 of the PostGreSQl/PostGIS installation (Part B, Section 2.1).
5. The window will then display the results.
   - If the user is now allowed to import mapping data, you will see the window shown in Figure 25.
   - If the database name is mistyped, the process will fail (Figure 26).

---

**\*\* TIP \*\***

The allow_user_to_import.bat file uses the 'C:\Program Files\PostgreSQL\8.1\bin\psql.exe' and a simple SQL GRANT statement to allow the user to import mapping data.

---



The 'gvsedit' PostGreSQL database user is now allowed to import mapping data into the 'mygvs' PostGreSQL database. This is the result of the allow_user_to_import.bat file.

**Figure 25 - Allowing Users to Import Data**
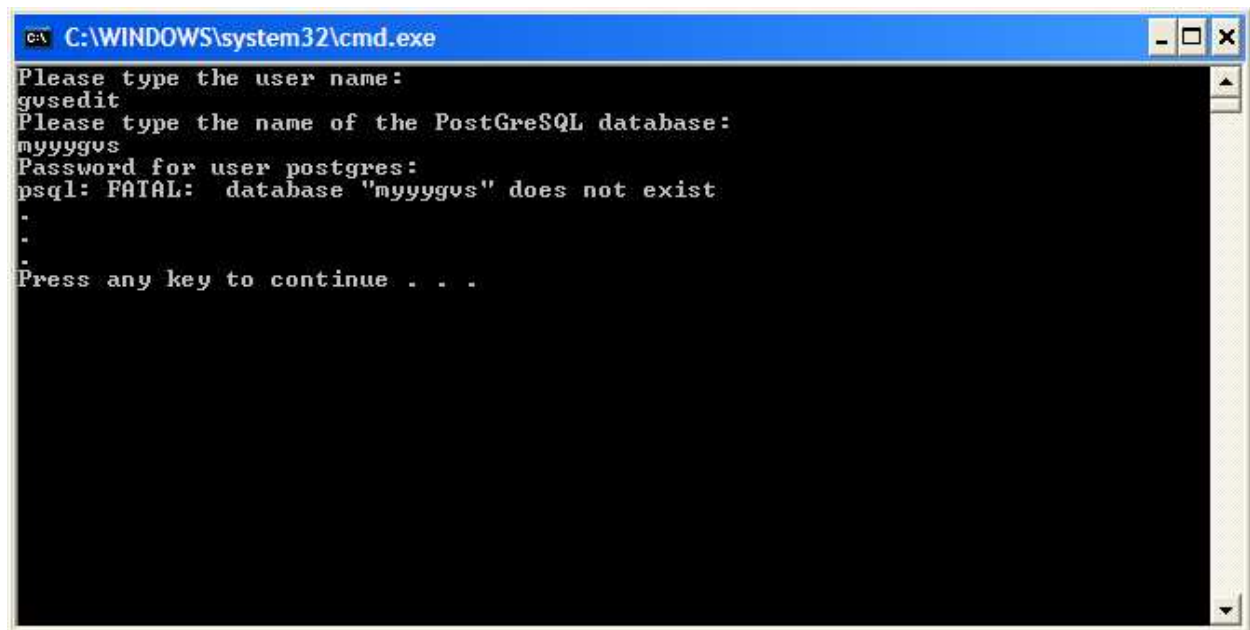
The allow_user_to_import.bat file failed, because the PostGreSQL database name was mistyped.

**Figure 26 - Error Message When Setting Up User Access**

### 4.2.4 Importing data

In this section, we will import mapping data (stored as a shapefile) into a PostGreSQL database (to be stored as PostGIS layers). Complete the following steps to import a shapefile. You will apply these steps in the paragraph immediately following:

1. Double click the c:\ms4w\tools\PostGIS\import_shapefile.bat file. A window will appear asking you to type the location of the shapefile.
2. Type the location of the shapefile and press enter.
3. The window will then ask you to type the name of the PostGIS layer to create. Type a name and press enter.
4. The window will then ask you to type the name of the PostGreSQL database to import into. Type the database name and press enter.
5. The window will then ask you to type the name of the database user that will import the layer. This user must be allowed to import mapping data (see Section 4.2.3). Type the name of the database user and press enter.
6. The window will then ask you to type the password of the database user that will import the mapping data. You would have recorded the password in step 5 of Section 4.2.2. Type the password and press enter.
7. The window will then display the results:
   - If the mapping data has been imported successfully, you will see the shapefile records importing (Figure 27).
   - If the location of the shapefile is typed incorrectly the import will fail (Figure 28).

Now, import the following shapefiles into PostGIS layers in the 'mygvs' PostGresSQL database using the 'mygvs' database user. Follow the steps above when importing the mapping data.

- Import 'C:\ms4w\apps\fist\data\mygvs\wells_bc.shp' into 'wells_bc'.
- Import 'C:\ms4w\apps\fist\data\mygvs\bwtr_bc.shp' into 'rivers_2mil_bc'.
- Import 'C:\ms4w\apps\fist\data\mygvs\brlw_bc.shp' into 'water_2mil_bc'.
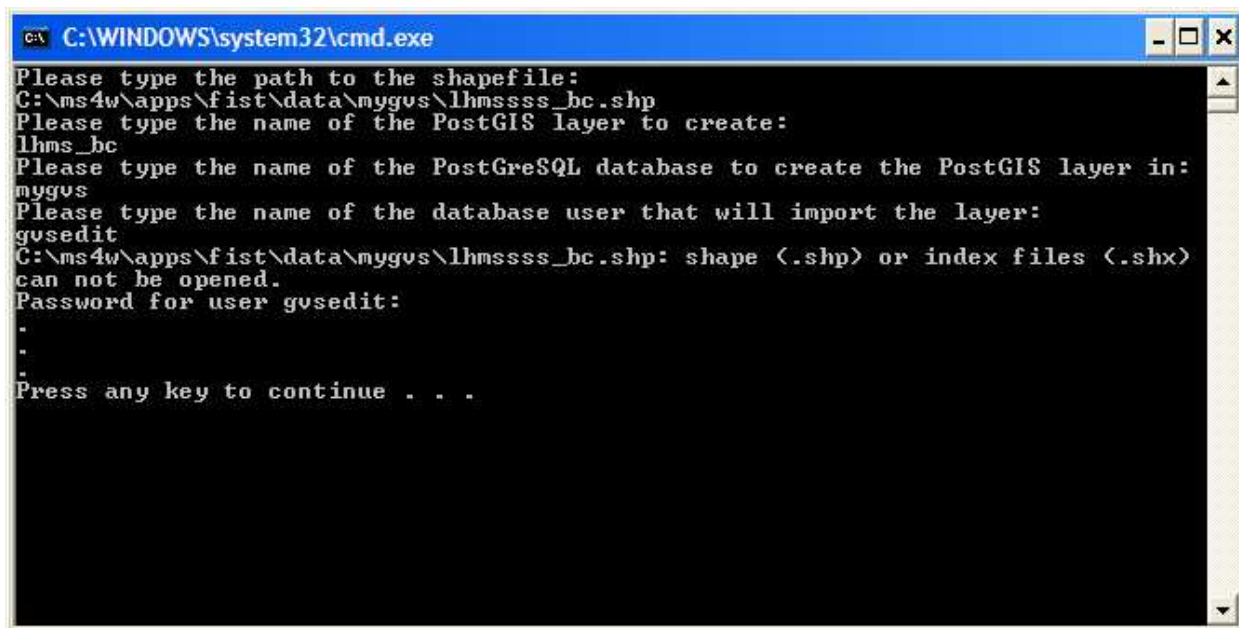
> **\*\* TIP \*\***
>
> The import_shapefile.bat file uses the 'shp2pgsql.exe' and 'psql.exe' programs located in 'C:\Program Files\PostgreSQL\8.1\bin\' to import shapefiles into PostGIS layers in PostGreSQL.



The wells_bc.shp shapefile was imported successfully into the wells_bc PostGIS layer using the import_shapefile.bat file.

**Figure 27 - Importing Shapefiles**

The import_shapefile.bat file failed because the shapefile couldn't be found, due to the fact that the location of the shapefile was entered incorrectly.

**Figure 28 - Importing Shapefiles - Error**

## 4.3 Previewing map data

Prior to adding mapping data to your GVS web-mapping site, you will probably want to see what it looks like. Previewing may help you discover how to display the mapping data and it may also help determine if the data are appropriate for your GVS site. Included on the GVS-installation CD are two programs that can help you preview your mapping data.

The first program, called ArcExplorer, is a free mapping data viewer provided by ESRI, which allows you to view ArcInfo Coverages, shapefiles, and images. This program is very stable and very quick to load. For more information on this mapping program, see the product web site: http://www.esri.com/software/arcexplorer/about/arcexplorer2.html . You can install the program by double clicking the installation program on the GVS-installation CD:

- D:\ArcExplorer\ae2setup.exe

Secondly, Quantum GIS (QGIS) is an open source GIS/mapping program which interacts with PostGIS through an import tool and allows you to view and use data from shapefile, ArcInfo coverage, MapInfo, and a variety of raster sources. Through its use of GRASS, you can create buffers.  To connect with the QGIS community, you can go to the QGIS homepage at http://qgis.org. You can install the program by double clicking the installation program on the GVS-installation CD:

- D:\QGIS\qgis-0.7.3-setup.exe

Finally, uDIG, is an open source GIS/mapping program provided by Refractions Research, which allows you to view mapping data provided in a wide variety of formats including: shapefiles, images, PostGIS layers, WMS/WFS layers, and more. This program is less stable and

slower than ArcExplorer, but it allows you to perform more advanced GIS and mapping tasks. For more information on this mapping program, see the product web site: http://udig.refractions.net/. You can install the program by double clicking the installation program on the GVS-installation CD:

- D:\uDig\udig-1.0.6.exe

**GVS**

One of the barriers to First Nation use of GIS and mapping programs is the requirement to renew expensive software licenses.  Using an Open Source package, either as a compliment to your existing licensed software or on its one, allows you to maintain or extend your GIS/mapping capabilities.

**4.4 Adding data as map layers to the MapFile**

Now that you have your mapping data in place, we can add it to a MapServer MapFile as a layer. Adding layers to the MapFile is required so that MapServer knows where to access the mapping data and how to display it. The first few sections will introduce the MapFile layer variables and Sections 4.4.4 and 4.4.5 will get you to add your own layers. Figure 29 shows an example of a layer in a MapFile shown in WordPad.  Just a note: this tutorial addresses more challenging topics from here on!

**\*\*TIP\*\***

1. The order in which you specify your map layers in your MapFile dictates which layers are displayed on your map first and which layers show up afterwards. The layer closest to the top of the file is displayed first and the next layers show up on top of the previous layers, until finally the last layer in the MapFile is displayed on top of all of the other layers on the map. In general, you want to place your image map layers at the top of the MapFile, followed by your polygon map layers, followed by your line map layers, and then followed by your point map layers (which would then show up on top).

2. It is wise to create a backup of the existing MapFile before editing it, so that you go back to it if the MapFile gets corrupted.

We will be working with the MapFile you referenced in step 5.b of Section 1.2 (c:\ms4w\apps\fist\mapfiles\mygvs.map).

*Please note that you can do much more advanced mapping with the MapFile than is shown in this tutorial. Appendix 3 provides additional information as does the MapServer website: (http://mapserver.gis.umn.edu/).*
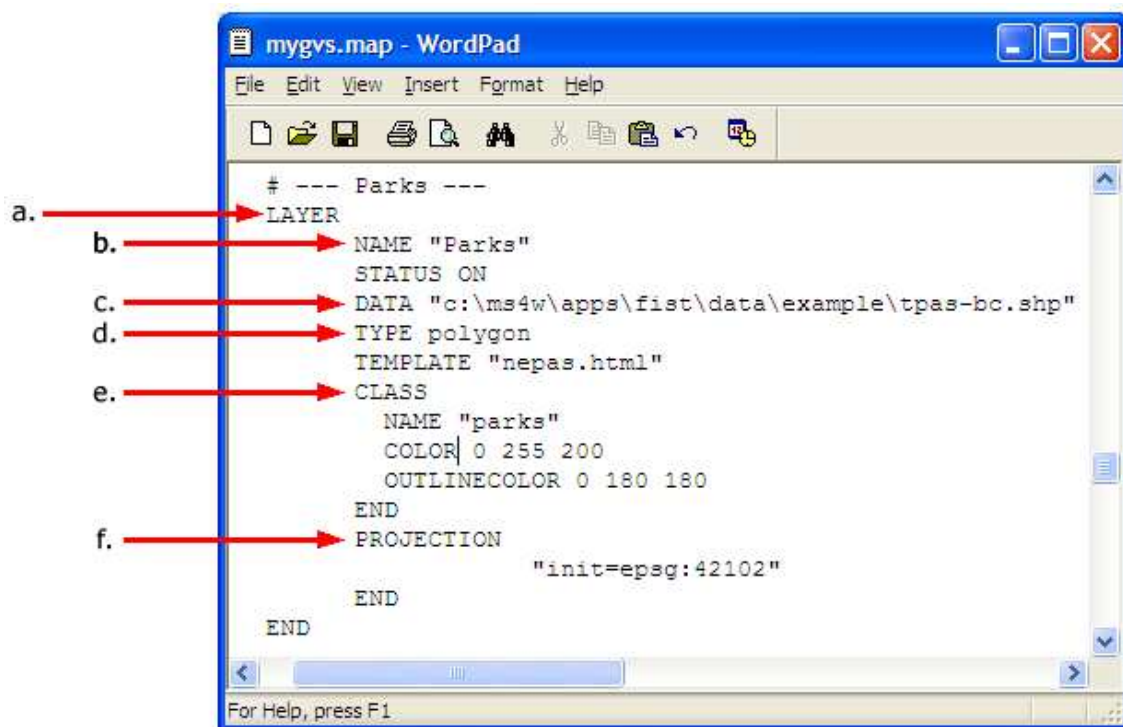
A MapFile map layer definition for the tpas-bc.shp shapefile.
Note that the LAYER variable (a) has a corresponding END line. Data variable (c) shows the location of the data, in this case a shapefile. The TYPE variable indicates type of data (d). Also, the CLASS variable (e) and PROJECTION variable (f) have corresponding END lines.

**Figure 29 - Introducing MapFiles**

### 4.4.1 Layer Syntax (LAYER Variable)

Map layer definitions in a MapFile have a specific syntax that must be followed in order for the MapFile to work correctly (Figure 29). Each layer definition is composed of a number of variables. The LAYER variable is the starting point for a layer definition and has a corresponding END line that finishes the layer definition. Within the LAYER variable (between LAYER and END) variables include: NAME, STATUS, DATA, TYPE, TEMPLATE, CLASS, PROJECTION, and others.

***The NAME variable (Figure 29.b) is important, because it will be used in the FIST layer configuration XML file (Section 4.5).*** The STATUS and TEMPLATE variables don't need to be modified. The TYPE variable (Figure 29.d) tells MapServer what geographic features are contained in the mapping data. The options are:

- POINT.
- LINE.
- POLYGON.
- RASTER.

The PROJECTION, DATA, and CLASS variables will be discussed in Sections 4.4.2-4.4.4.

### 4.4.2 Layer Projections (PROJECTION Variable)

On the ground, the earth has three dimensions, but on a map, the earth is represented in two dimensions. Therefore, all mapping data have a projection, which defines how the geographic features are represented on a map in comparison to how those features appear on the ground (Figure 30). One of the problems with projections is that there are a lot of them to choose from with some representing certain areas of the globe better than others. MapServer needs to know what projection your mapping data are in so that they can be displayed correctly.

A projection definition is made up of a number of parameters that are not all that fun to remember. Thankfully, EPSG codes allow you to specify a map layer's projection without inputting all the details of the projection. In British Columbia there are three main projections that are used: BC Albers Equal Area Conic projection, UTM, and Geographic (lat/long).

If your mapping data are in BC Albers projection, then you should specify EPSG code 42102 in the layer definition (Figure 31.a). If your mapping data are in the Geographic projection, then you should specify EPSG code 4269 (Figure 31.b). If your mapping data are in UTM, then you have to determine which UTM zone your mapping data is in (Figure 31.c). Five UTM zones cover BC and their EPSG codes are (from west to east):

- UTM zone 7 EPSG code: 26907.
- UTM zone 8 EPSG code: 26908.
- UTM zone 9 EPSG code: 26909.
- UTM zone 10 EPSG code: 26910.
- UTM zone 11 EPSG code: 26911.
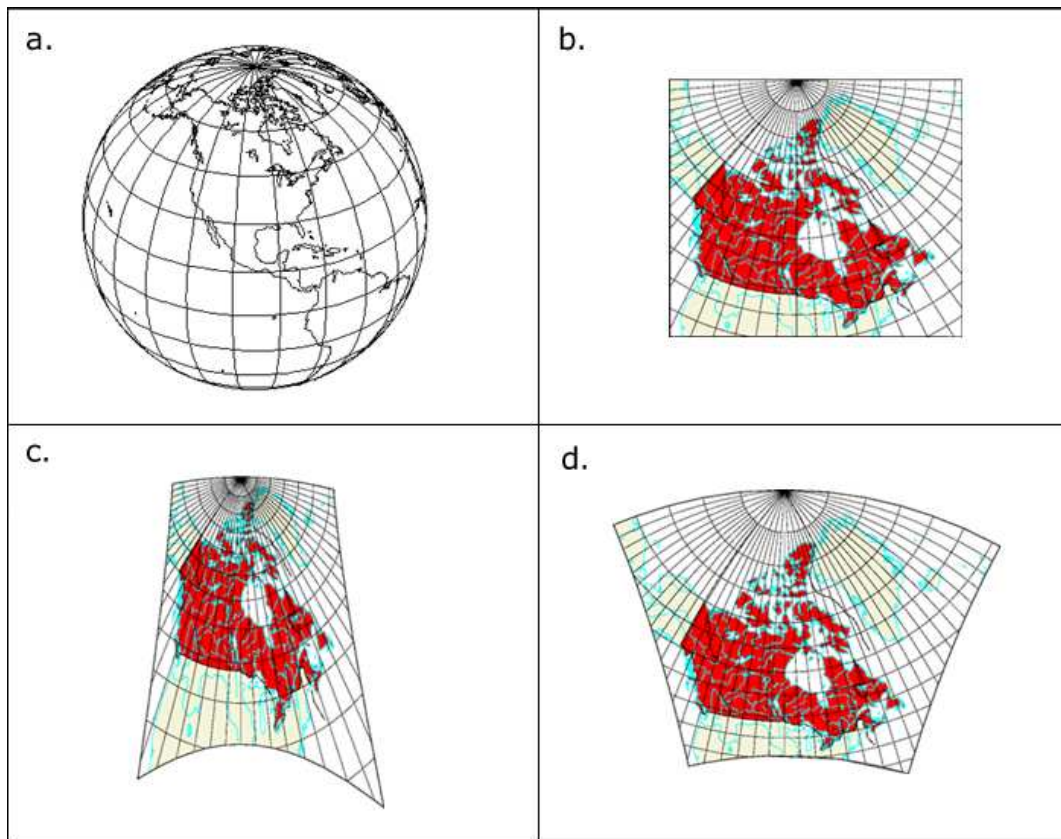
The earth exists in three dimensions (a), but maps have only two dimensions, so a projection is required to make the conversion. Here Canada is projected using three different projections: (b) Lambert Conformal Conic Projection, (c) Gnomonic Azimuthal Projection, and (d) Transverse Mercator Projection.
Source: Atlas of Canada – tinyurl.com/lckpu

**Figure 30 - Projections**

| a. | b. | c. |
|---|---|---|
| PROJECTION<br>  "init=epsg:26907"<br>END | PROJECTION<br>  "init=epsg:4269"<br>END | PROJECTION<br>  "init=epsg:26910"<br>END |

Three different projections are specified in these MapFile PROJECTION variables: (a) the BC Albers Equal Area Conic projection, (b) the Geographic projection, and (c) the UTM Zone 10 projection.

**Figure 31 - MapFile Projection Variables**

### 4.4.3 Data Formats (DATA Variable)

Mapping data are often made available in a wide variety of formats. MapServer can read a wide variety of formats, but here we will concentrate on three commonly used ones:

- Shapefile.
- PostGIS.

- Image (Orthophoto / Hillshade / Satellite Image).

Shapefile

Mapping data stored in shapefile format can be added to a MapFile LAYER using the DATA variable. It is as simple as specifying the location of the shapefile (Figure 29.c).

PostGIS

Mapping data stored in PostGIS format can be added using the DATA variable and two other variables: CONNECTION and CONNECTIONTYPE (Figure 32). The DATA variable must specify the PostGIS layer using the following format:

- DATA "the_geom FROM public.PostGIS_Layer USING UNIQUE gid USING srid=42102"

***Replace the text 'PostGIS_Layer' with the name of the PostGIS layer that you entered in step 3 of Section 4.2.4. Replace the number 42102 with the EPSG code that you choose in Section 4.4.2***

The CONNECTIONTYPE variable needs to be set to POSTGIS:

- CONNECTIONTYPE POSTGIS

The CONNECTION variable requires a database connection string in the following format:

- CONNECTION "host=localhost dbname=PostGreSQL_database user=PostGreSQL_user password=PostGreSQL_password"

***Replace the text 'PostGreSQL_database' with the name of PostGreSQL database you created in Section 4.2.1.***

***Replace the text 'PostGreSQL_user' with one of the users you created in Section 4.2.2.***

If you will be editing the PostGIS layer, then you need to specify the user that imported the mapping data (in our case, 'gvsedit'). If you just want to view the PostGIS layer, then you need to specify a user that doesn't have permission to edit the layer (in our case, 'gvsread').

***Replace the text 'PostGreSQL_password' with the password of the PostGreSQL user you chose above.***
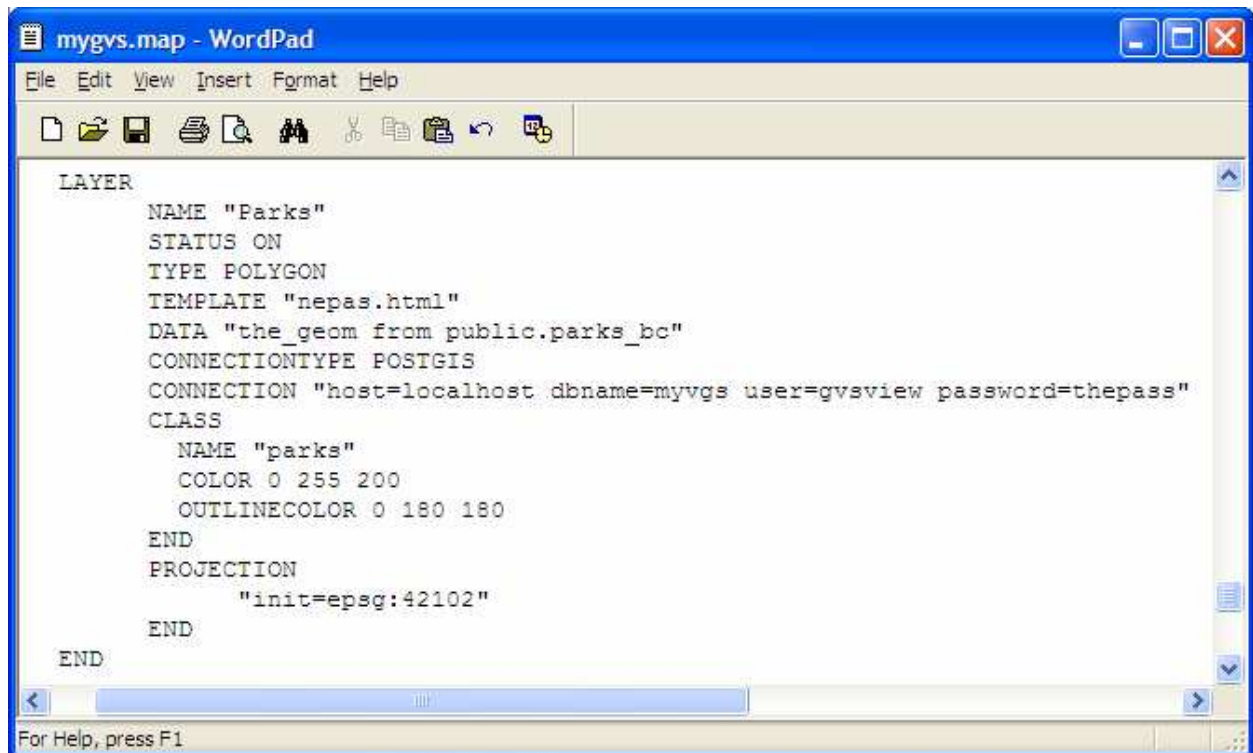
This screenshot shows a MapFile map layer definition for the parks_bc PostGIS layer. Note that the 'gvsview' user is accessing the 'mygvs' database in the CONNECTION variable.

**Figure 32 - Using CONNECTION and CONNECTIONTYPE**

Image

Mapping data stored in images (AKA: raster data) can be added to a MapFile LAYER using the DATA variable and the TYPE variable. Specify the location of the image in the DATA variable and change the TYPE variable (Figure 29.d) to RASTER:

- TYPE RASTER

### 4.4.4 Theming (CLASS Variable)

Theming a map layer refers to choosing the colors, symbols, and labels that map features will be displayed with. In a MapFile, theming is handled by the CLASS variable (Figure 29.e). Only point, line, and polygon TYPE map layers can be themed. Raster TYPE map layers have their own theming information and therefore can't be themed. In order to theme some features of the map layer different than others, you can include more than one CLASS variable and add EXPRESSION variables to the CLASS variable.

SYMBOL types are defined earlier in the MapFile and you can add more at anytime. The predefined SYMBOL types are:

- Circle.

- Triangle.
- Square.
- Diamond.
- Octagon.

---
**\*\* TIP \*\***

Search the web for methods other people have used to create symbols and create your own! The MapServer homepage is a good place to start.

---

### Point and Line

Theming a point or line TYPE map layer consists of selecting a name for the features, choosing a symbol to use, deciding on a size for the symbol, and selecting the color (Figure 33.a). The colors are specified in RGB format. For more information about RGB colors try searching Google (http://www.google.ca).

---
**\*\* TIP \*\***

RGB is expressed as hexadecimal (e.g. 0066FF) or decimal (255,0,0). The site-configuration uses hexadecimal for site colours and the mapfile uses decimal for feature theming.

---

### Polygon

Theming a polygon TYPE map layer can be done two ways: as an outline only or as a filled polygon. With an outlined polygon you specify the name, symbol, size and outline color (Figure 33.b). Whereas, with a filled polygon, you specify the name, outline color and fill color (Figure 33.c).

### Labeling

In order to add labels to a map layer, you must determine which field in the mapping data will be used for the labeling. Then you need to define a LABELITEM variable that has the fields name (Figure 34.a). Next, add LABEL variable inside of the CLASS variable. Within this LABEL variable, you must add a COLOR and SIZE variable. The SIZE variable uses names to specify the size and the options are:

- SIZE tiny.
- SIZE small.
- SIZE medium.
- SIZE large.
- SIZE giant.

### Expressions

If you wish to theme some features of the map layer differently from others, you can include more than one CLASS variable in a LAYER variable and add an EXPRESSION to each class

(Figure 34.b).

<table>
<tr><td>

**a.**
```
     CLASS
       NAME "Cities"
       SYMBOL "circle"
       SIZE 5
       COLOR 220 0 0
     END
```

</td><td>

**b.**
```
     CLASS
       NAME "Parks"
       SYMBOL "circle"
       SIZE 1
       OUTLINECOLOR 220 0 0
     END
```

</td></tr>
<tr><td>

**c.**
```
     CLASS
       NAME "Parks"
       COLOR 220 0 0
       OUTLINECOLOR 220 0 0
     END
```

</td><td></td></tr>
</table>

Theming of (a) point, (b) outlined polygon and (c) filled polygon TYPE map layers in CLASS variables.

**Figure 33 - Theming Polygons in Mapfiles**

<table>
<tr><td>

**a.**
```
     LABELITEM "city_name"

     CLASS
       NAME "Cities"
       SYMBOL "circle"
       SIZE 5
       COLOR 220 0 0
       LABEL
         SIZE small
         COLOR 0 0 0
       END
     END
```

</td><td>

**b.**
```
     CLASS
       NAME "Roads"
       SYMBOL "circle"
       SIZE 3
       COLOR 255 165 0
       EXPRESSION ('[TYPE]' = 'road')
     END

     CLASS
       NAME "Railway"
       SYMBOL "circle"
       SIZE 2
       COLOR 255 100 100
       EXPRESSION ('[TYPE]' = 'rail')
     END
```

</td></tr>
</table>
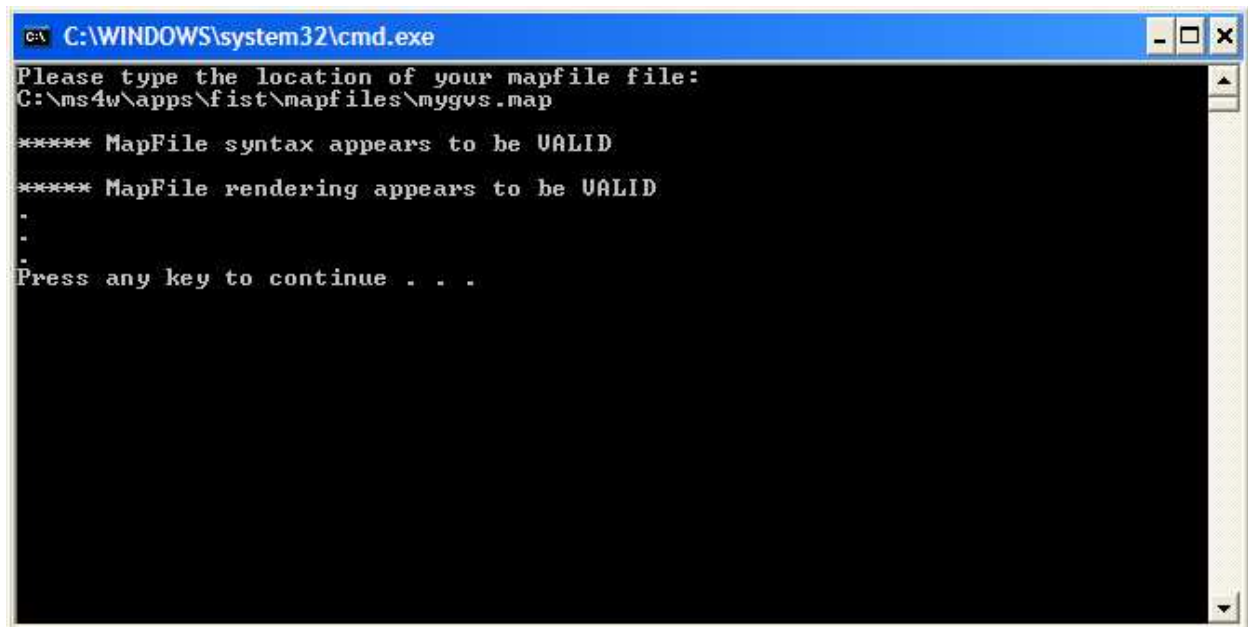
(a) A point TYPE map layer is themed with labels, using the LABELITEM and LABEL variables. (b) A line TYPE map layer is themed with two different CLASS variables and two different EXPRESSION variables, in order to show map features in different colors (in this case roads and railways).

**Figure 34 - Theming Points and Lines in Mapfiles**

### 4.4.5 Testing the MapFile

MapServer requires that MapFiles have a certain syntax, otherwise MapServer will crash. Unfortunately, it is easy to make small mistakes in the MapFile that will cause this crash. Therefore, we should test the MapFile before adding the MapFile layers to the GVS. When you have added a layer to the MapFile, complete the following steps to test its syntax:

1. Double click the C:\ms4w\apps\fist\htdocs\sbin\mapfile_tester.bat file. A new window will appear asking you for the location of your MapFile.
2. Type the location of your MapFile and press enter.
3. The window will then display the result of the test:
    - If the MapFile is valid, you will see the window in Figure 35.
    - If the MapFile syntax is invalid, you will see the window in Figure 36.
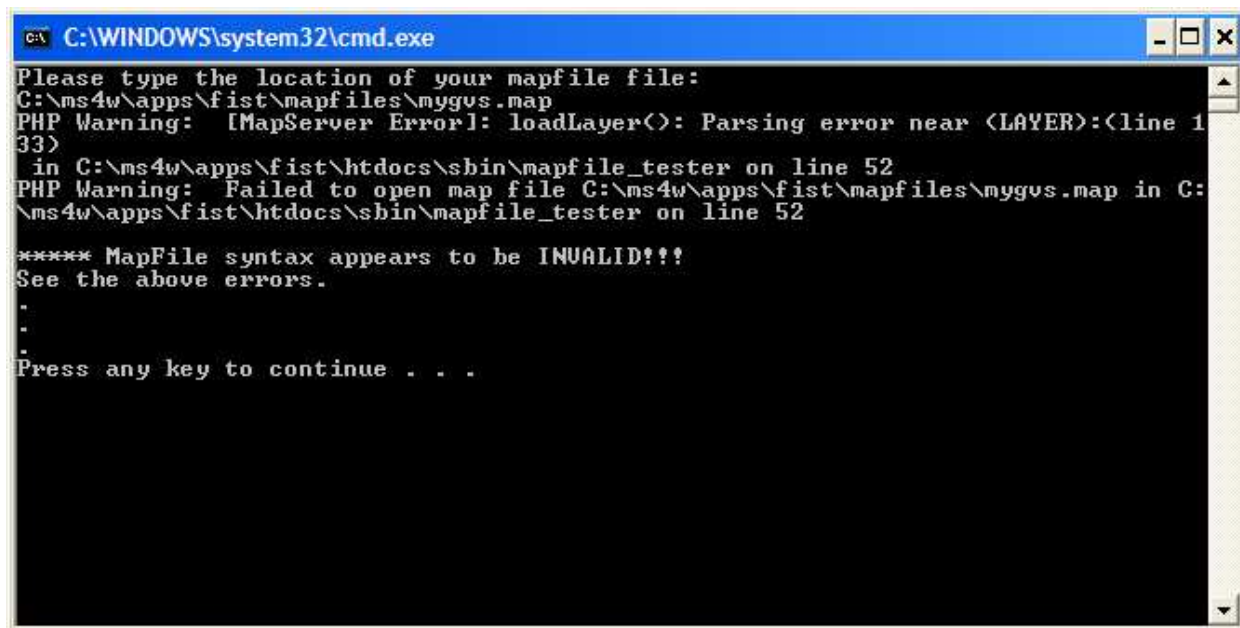


The 'mygvs.map' MapFile was tested by mapfile_tester.bat and it appears valid.

**Figure 35 - Valid Mapfile**

The 'mygvs.map' MapFile was tested by mapfile_tester.bat and the syntax is invalid. There appears to be a problem on line 133 inside of a LAYER variable.

**Figure 36 - Invalid Mapfile**

### 4.4.6 Try adding a layer

When you go to add a layer to a MapFile, make sure you refer to all of Section 4.4. You should follow these steps to add a layer to a MapFile:

1. Backup the MapFile.
2. Add the layer to the MapFile.
3. Test the MapFile using mapfile_tester.bat.

Now we will try adding the following layers in this order (images -> polygons -> lines -> points – Remember, order affects how they appear relative to each other!):

- hillshade.jpg.
- water_2mil_bc.
- rivers_2mil_bc.
- btrn_bc.shp.
- tfds_bc.shp.
- wells_bc.

The projection is for each of these layers is EPSG code 42102, BC Albers.

hillshade.jpg

The 'hillshade.jpg' layer is a raster image located at C:\ms4w\apps\fist\data\mygvs\. Try adding it to the MapFile.

Figure 37.a. shows the full layer definition, but try it on your own first!

water_2mil_bc

The 'water_2mil_bc' layer is a PostGIS layer that you imported in Section 4.2.4. It is a polygon layer. This layer contains rivers and lakes, but it also contains land. We just want to display the rivers and lakes, so we must use an EXPRESSION variable to select only those features. We only need one class, because we want both the rivers and lakes to be the same color. Try adding this layer to the MapFile using the following criteria:

- 'Water' is the NAME.
- COLOR is '175 175 255'.
- OUTLINECOLOR is '150 150 255'.
- there is no SIZE or SYMBOL variable displays filled polygons.
- EXPRESSION is: ('[TAG]' = 'lake' OR '[TAG]' = 'river').
- the database user doesn't need to edit the layer.

Figure 37.b. shows the full layer definition, but try it on your own first!

rivers_2mil_bc

The 'rivers_2mil_bc' layer is a PostGIS layer that you imported in Section 4.2.4. It is a line layer. Try adding it to the MapFile using the following criteria:

- 'Rivers' is the NAME.
- 'circle' is the SYMBOL.
- SIZE is 1.
- COLOR is '150 150 255'.
- The database user doesn't need to edit the layer.

Figure 37.c. shows the full layer definition, but try it on your own first!

btrn_bc.shp

The 'btrn_bc.shp' layer is a shapefile located at 'C:\ms4w\apps\fist\data\mygvs\'. It is a line layer. Try adding it to the Mapfile using the following criteria:

- 'Transportation' is the NAME.
- 'circle' is the SYMBOL.
- SIZE is 2.
- COLOR is '155 165 100'.

Figure 37.d. shows the full layer definition, but try it on your own first!

<u>tfds_bc.shp</u>

The 'tfds_bc.shp' layer is a shapefile located at 'C:\ms4w\apps\fist\data\mygvs\'. It is a polygon layer containing the current BC Forest Districts. Let's add labels to the layer when we add it to the MapFile:

- 'Forest Districts' is the NAME.
- 'circle' is the SYMBOL.
- SIZE is 2.
- There is no COLOR variable (displays outlined polygons).
- OUTLINECOLOR is '0 0 0'.
- LABELITEM is 'org_name'.
- LABEL, SIZE is 'medium'.
- LABEL, COLOR is '0 0 0'.

Figure 37.e. shows the full layer definition, but try it on your own first!

<u>wells_bc</u>

The 'wells_bc' layer is a PostGIS layer that you imported in Section 4.2.4. It is a point layer. Try adding it to the MapFile using the following criteria:

- 'Wells' is the NAME.
- SYMBOL is 'triangle.
- SIZE is 5.
- COLOR is '255 100 100'.
- The database user doesn't need to edit the layer.

Figure 37.f. shows the full layer definition, but try it on your own first!

```
a.
    LAYER
            NAME "Hillshade"
            STATUS ON
            DATA "c:\ms4w\apps\fist\data\mygvs\hillshade.jpg"
            TYPE raster
            PROJECTION
                    "init=epsg:42102"
            END
    END
```

```
b.
    LAYER
            NAME "Water"
```

```
            STATUS ON
            TYPE polygon
            DATA "the_geom FROM public.water_2mil_bc USING UNIQUE gid USING
    srid=42102"
            CONNECTIONTYPE POSTGIS
            CONNECTION "host=localhost dbname=mygvs user=gvsread password=*****"
            TEMPLATE "nepas.html"
            CLASS
                  NAME "Water"
                  COLOR 175 175 255
                  OUTLINECOLOR 150 150 255
                  EXPRESSION ('[TAG]' = 'lake' OR '[TAG]' = 'river')
            END
            PROJECTION
                  "init=epsg:42102"
            END
    END
```

**c.**

```
    LAYER
            NAME "Rivers"
            STATUS ON
            TYPE line
            DATA "the_geom FROM public.rivers_2mil_bc USING UNIQUE gid USING
    srid=42102"
            CONNECTIONTYPE POSTGIS
            CONNECTION "host=localhost dbname=mygvs user=gvsread password=*****"
            TEMPLATE "nepas.html"
            CLASS
                  NAME "Rivers"
                  SYMBOL "circle"
                  SIZE 1
                  COLOR 150 150 255
            END
            PROJECTION
                  "init=epsg:42102"
            END
    END
```

**d.**

```
    LAYER
            NAME "Transportation"
            STATUS ON
            DATA "c:\ms4w\apps\fist\data\mygvs\btrn_bc.shp"
            TYPE line
            TEMPLATE "nepas.html"
```

```
                CLASS
                        NAME "Transportation"
                        COLOR 255 165 0
                        SIZE 2
                        SYMBOL "circle"
                END
                PROJECTION
                        "init=epsg:42102"
                END
        END
```

**e.**
```
    LAYER
            NAME "Forest Districts"
            STATUS ON
            DATA "c:\ms4w\apps\fist\data\mygvs\tfds_bc.shp"
            TYPE polygon
            TEMPLATE "nepas.html"
            LABELITEM "org_name"
            CLASS
                    NAME "Forest Districts"
                    OUTLINECOLOR 100 100 100
                    SIZE 2
                    SYMBOL "circle"
                    LABEL
                            SIZE medium
                            COLOR 50 50 50
                    END
            END
            PROJECTION
                    "init=epsg:42102"
            END
    END
```

**f.**
```
    LAYER
            NAME "Wells"
            STATUS ON
            TYPE point
            DATA "the_geom FROM public.wells_bc USING UNIQUE gid USING
    srid=42102"
            CONNECTIONTYPE POSTGIS
            CONNECTION "host=localhost dbname=mygvs user=gvsread password=*****"
            TEMPLATE "nepas.html"
            CLASS
                    NAME "Wells"
```

```
            SYMBOL "triangle"
            SIZE 5
            COLOR 255 100 100
      END
      PROJECTION
            "init=epsg:42102"
      END
  END
END
```

This figure shows the map layer definitions for the layers in Section 4.4.6.

**Figure 37 - Adding Layers and Symbolizing - Trial Set**

**\*\*TIP\*\***

In the above figure you will have to replace the \*\*\*\*\* in password= with the appropriate password.

## 4.5 Adding map layers to the GVS

Now that the map layers have been added to the MapFile and the MapFile has been tested, you can now add the layers to the GVS web-mapping site using the FIST-Admin (Section 2.1 shows you how to open the FIST-Admin). Adding layers to a GVS site consists of two parts:

1. Adding the layer to the map.
2. Adding the layer to a folder.

### 4.5.1 Adding the layer to the map

The following steps show you how to add a map layer to your GVS site using the FIST-Admin. You will apply these steps with the layers listed after the instructions:

1. Click 'Layers' on the FIST-Admin side-menu.
2. Click 'Add a new layer' from the 'Layers' web page. The 'Add Layer' page will appear with a number of text boxes.
   a. In the 'Name' text box, *you must enter the same name that you used in the NAME variable in the MapFile (Section 4.4.6).*
   b. In the 'Alias' text box, you must enter a name for the layer (this can be the same as the 'Name' textbox or different). The 'Alias' is displayed in the GVS site instead of the 'Name'.
   c. If you want the layer to be visible when the GVS site is loaded, set the 'Visible' dropdown box to True. If you want the layer to be turned off when the GVS site is loaded, set the 'Visible' dropdown box to False.
   d. You can set the scales at which point the layer will appear and disappear using the 'Maximum scale' and 'Minimum scale' text boxes. To keep it simple, enter '1000000000' for 'Maximum scale' and '1' for 'Minimum scale'.
   e. If you want the layer to be editable, you must enter 'edit' into one of the 'Context modes' textboxes.

3. Click the 'Save' button.

Now try adding the map layers to the GVS site that we added to the MapFile in Section 4.4.6) (Make all the layers visible):

1. Hillshade.
2. Water.
3. Rivers.
4. Transportation.
5. Forest Districts.
6. Wells.

Once you have finished adding the layers to your GVS site, load it in the browser to see if it works:

- http://localhost/fist/fistMain.php?site=mygvs

---

**\*\* TIP \*\***

You can also add one layer at a time and try your site. If an error appears after adding one particular layer, then you have isolated your problem from the start. Otherwise, you can try commenting out each layer block and folder block (4.5.3) in the layer-config file (open as a text file).

If you add a layer to layer-config.xml and it isn't in the Mapfile, then there will be an error (the GVS will appear blank).

---

If the web browser displays your web-mapping site, then the layers were added successfully. If the browser displays a white screen or an error than it may be that the name of the GVS layer doesn't match the name of the MapFile layer. Check the GVS error log and/or Apache web server error log to confirm this (Figures 38 and 39).

- The GVS error log is located at c:\ms4w\apps\fist\htdocs\tmp\fist-log.txt.
- The Apache web server error log is located at c:\ms4w\Apache\logs\error.log.
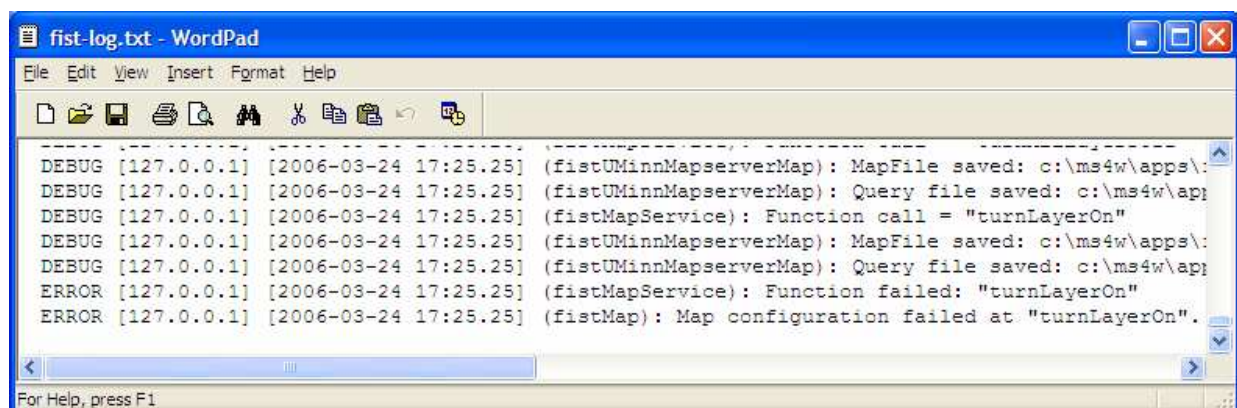
A portion of the c:\ms4w\apps\fist\htdocs\tmp\fist-log.txt error log. The lines that start with 'ERROR' indicate that FIST couldn't turn a layer on, which is likely because the MapFile layer name was mistyped when the FIST layer was entered using the FIST-Admin.

**Figure 38 - Using the FIST Error Log**
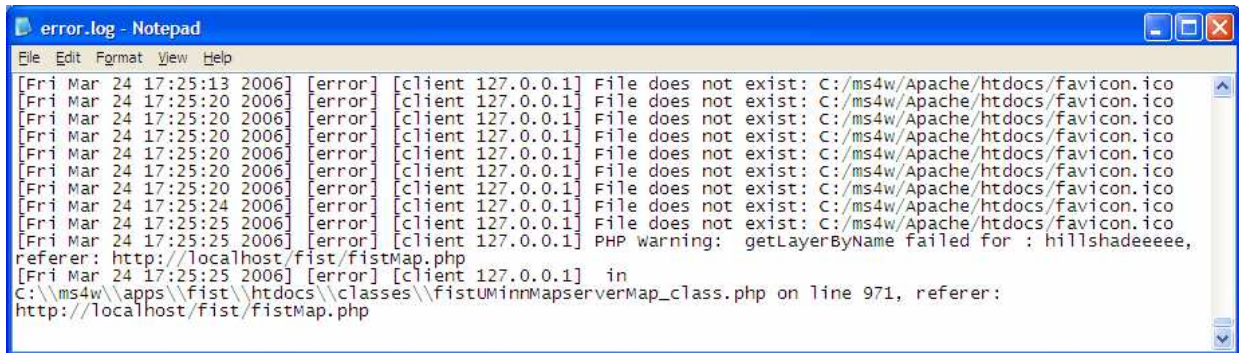


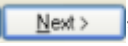A portion of the c:\ms4w\Apache\logs\error.log Apache web server error log. The bottom few lines indicate that MapServer tried to find a layer named 'hillshadeeeee' in the MapFile, but couldn't. This is likely because the MapFile layer name was mistyped when the FIST layer was entered using the FIST-Admin.

**Figure 39 - Using the Apache Error Log**

## 4.5.2 Modifying layer definition

You may wish to modify a GVS map layer definition in order to change its Alias, Visibility or another definition parameter. The following steps show you how to modify a layer using the FIST-Admin. You will apply these steps with the data listed after the instructions:

1. Click 'Layers' on the FIST-Admin side-menu.
2. Click 'Modify a layer' from the 'Layers' web page.
3. Select a layer from the 'Select layer' dropdown menu on the 'Modify layer' web page and click '  Next >  '. The 'Modify Layer' page will appear with a number of text boxes.
4. Make the necessary changes and click the 'Save' button.

Now if you've followed all of the steps in Part C so far, you should have the following layers in your GVS site:

- Parks.
- Base Information.
- Cities.
- Hillshade.
- Water.
- Rivers.
- Transportation.
- Forest Districts.
- Wells.

The 'Base Information' layer contains transportation lines and rivers at a smaller scale (less

detail) than the 'Water', 'Rivers' and 'Transportation' layers. If we leave all four of these layers visible, they will overlap and look odd. Instead, try modifying the 'Base Information' layer so that it is not visible using the steps above.

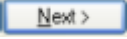You can reload your 'mygvs' site and view the change.

### 4.5.3 Folders

In order for layers to show up in the 'Map Layers' web page (Figure 40), you must create a folder and add layers to it or add layers to an existing folder.

To create a new folder complete the following steps using the information after the instructions:

1. Click 'Folders' on the FIST-Admin side-menu.
2. Click 'Add a new folder' from the 'Folders' web page.
3. Enter the name of the folder and use the arrows to choose layers to include and to order the layers.
4. Click the 'Save' button.

To modify a folder complete the following steps with the data that appears below:

1. Click 'Folders' on the FIST-Admin side-menu.
2. Click 'Add a new folder' from the 'Folders' web page.
3. Select a folder from the dropdown menu on the 'Modify Layer' web page and click the ' Next > ' button.
4. Make the changes you would like.
5. Click the 'Save' button.

In Section 4.5.1 and 4.5.2 we added the MapFile layers to the GVS. Now we need to put them into folders so that they can be displayed on the 'Map layers' web page. Try the following:

- Create a new folder called 'Images'.
    o Add the 'Hillshade' layer to this folder.
- Create a new folder called 'Industry'.
    o Add the 'Wells' layer to this folder.
- Create a new folder called 'Administrative'.
    o Add the 'Forest Districts' layer to this folder.
- Modify the 'Base Information' to include the 'Water', 'Rivers' and 'Transportation' layers.

Once you have finished adding the folders to your GVS site, load it in the browser and click the 'Layers' tab to see if the folders show up correctly (Figure 41):
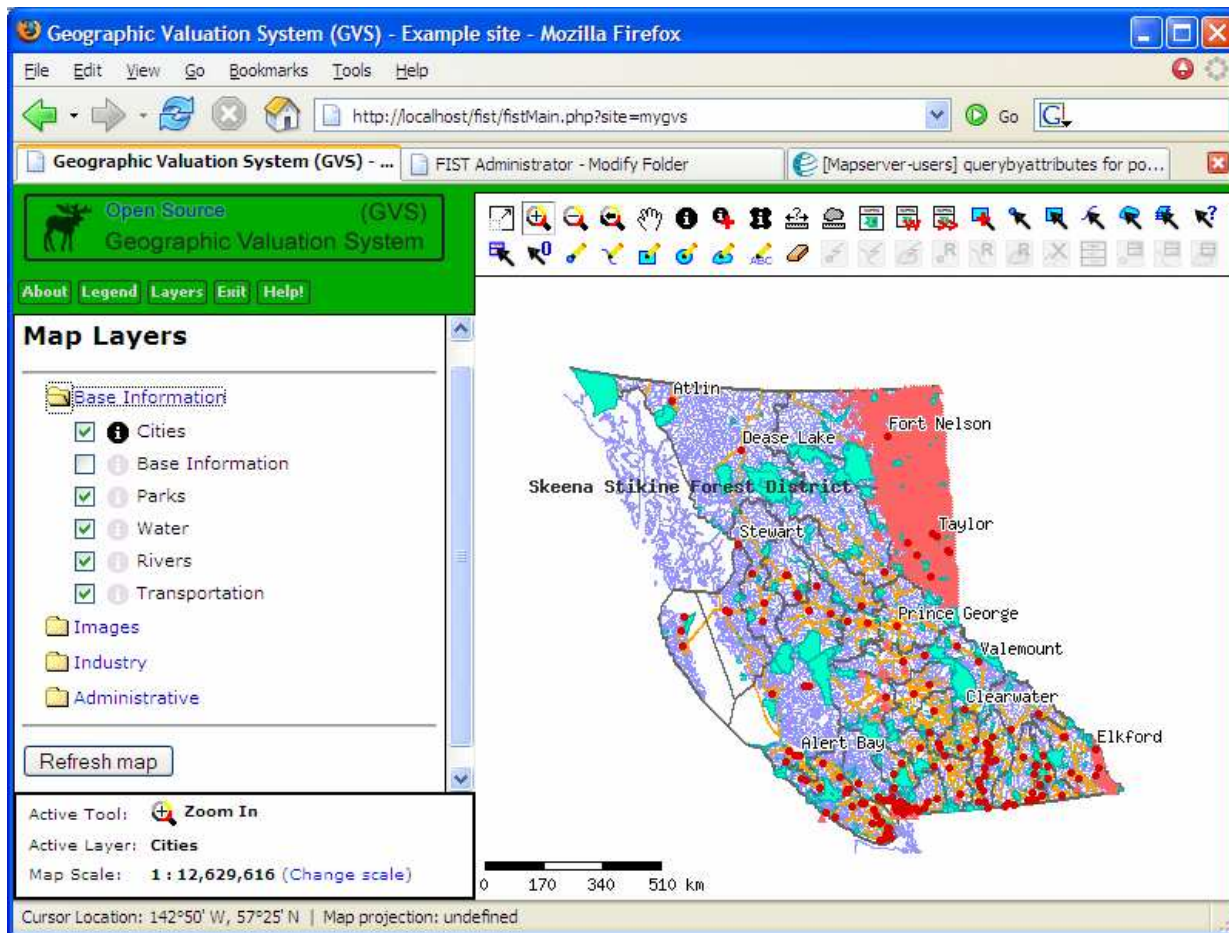
- http://localhost/fist/fistMain.php?site=mygvs
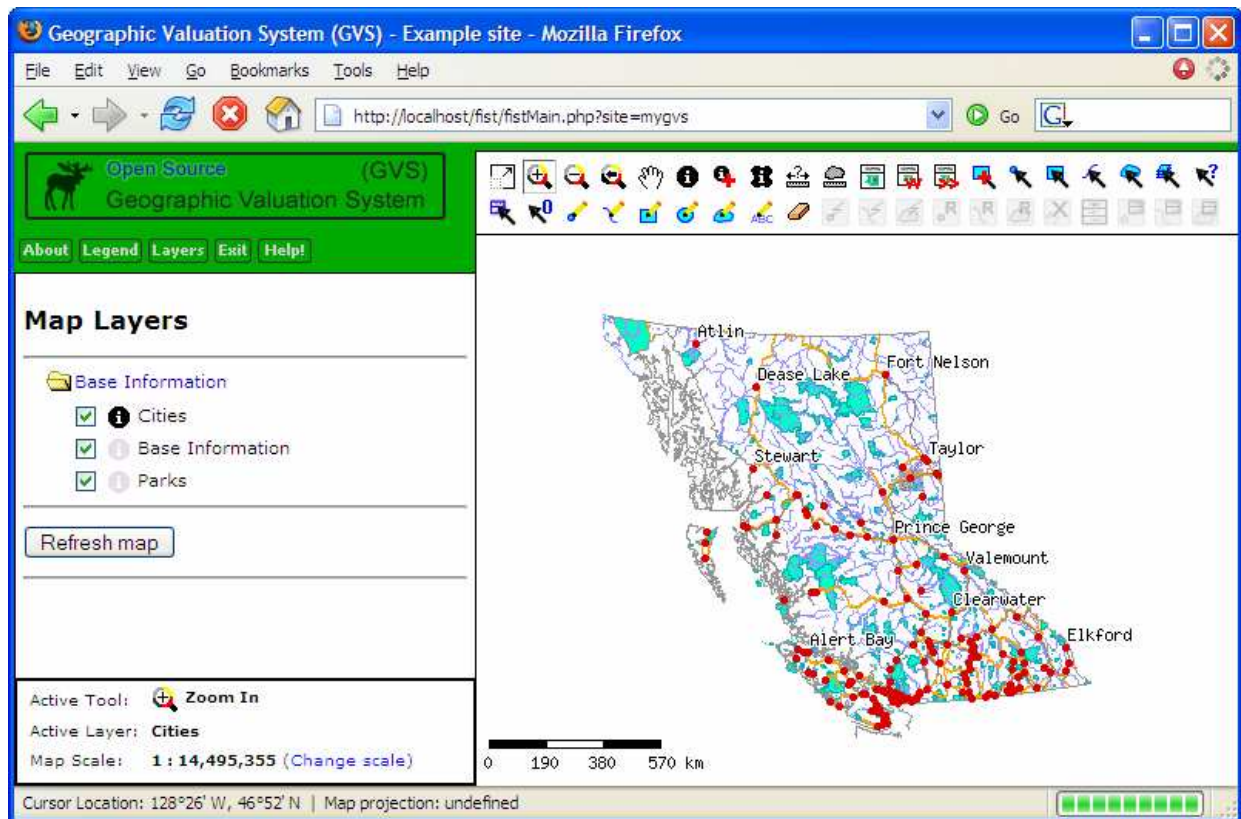
The 'Layers' tab was clicked, which displays the Map Layers web page in the GVS sidebar. There is one folder defined with three layers within it.

**Figure 40 - Adding Folders to the GVS Site**

The 'Layers' tab was clicked, which displays the Map Layers web page in the GVS sidebar. The new MapFile layers have been added to the GVS and placed in folders. Note that the 'Base Information' layer is turned off (unchecked) by default.

**Figure 41 - New Folders and New Layers Added to GVS**



One way to customize your GVS site is to replace standard symbology with symbols that reflect a greater sense of your culture. For example, Halfway River replaced the standard open and closed folders with a drum:



You can even design/redesign the main tool symbols if you want!

**D. Geographic Valuation System Mapping (Tutorial)**

**1. Outline**

This tutorial will show you how to include value-descriptors (video, pictures, documents, etc.) in your GVS. Geographic Valuation System Mapping involves collecting value-descriptors, mapping geographic location, and linking the locations (features) to the value-descriptors. When this process is complete, people can utilize the value-descriptors by clicking the location where they appear in the GVS.   Then you can begin to use the GVS as a tool to facilitate communication of TEK!  (Refer to the decision-making section in the main introduction, A.3).

This tutorial is a continuation of the tutorial in Part C. Therefore, it is assumed that the mapping data in that tutorial has been added to the GVS and that the PostGreSQL database has been created.

**Disclaimer:**
We have used geographic data for Chetwynd and area, an area chosen arbitrarily for tutorial purposes.  The value-descriptor data shown does not represent actual values.

**2. Tutorial Sample Area**

First we need to change our map extents so that we focus in on our new area.  Follow the steps in Part C, Section 2.4 to change the map extents to the following coordinates (Figure 42):

- Minimum X: 1235000.
- Minimum Y: 1152000.
- Maximum X: 1320000.
- Maximum Y: 1235000.

Reload the GVS site to see the change (Figure 43):
  o http://localhost/fist/fistMain.php?site=mygvs
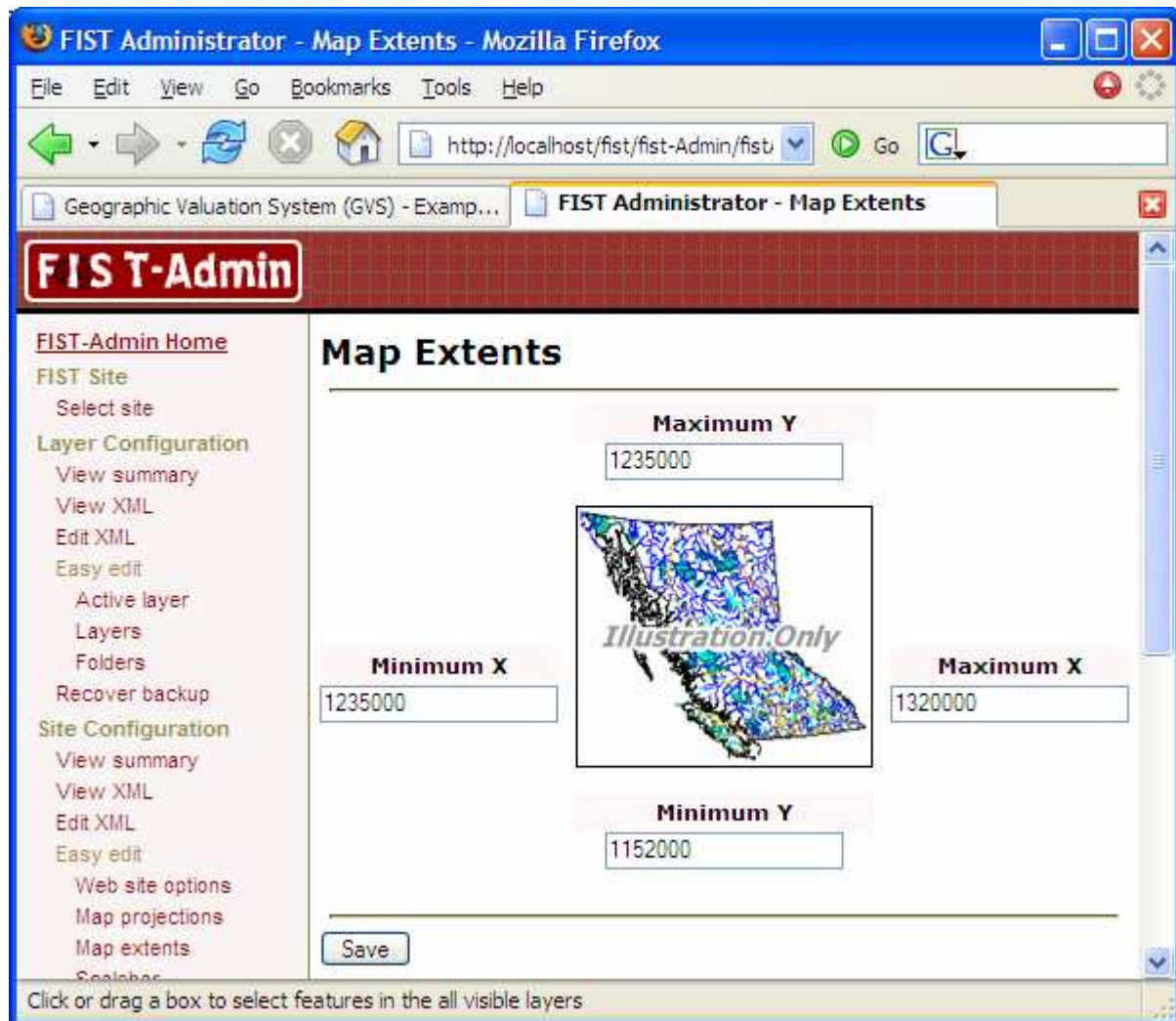
The map extents are set using the FIST-Admin.

**Figure 42 - Tutorial Map Extents**

The map extents were set using the FIST-Admin to focus on the Chetwynd area.
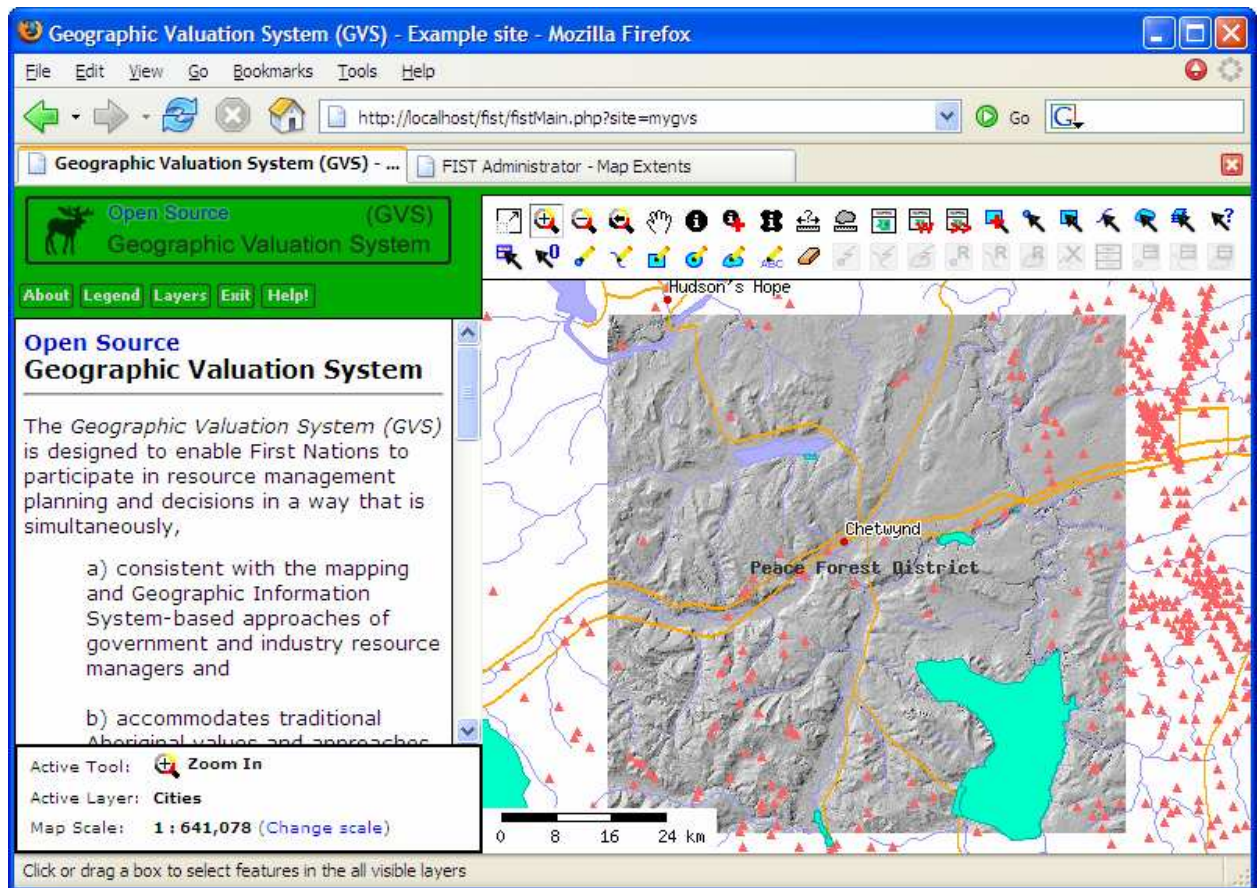
**Figure 43 - GVS Tutorial Area**

## 3. Setting Up the GVS Mapping Layers/Tools
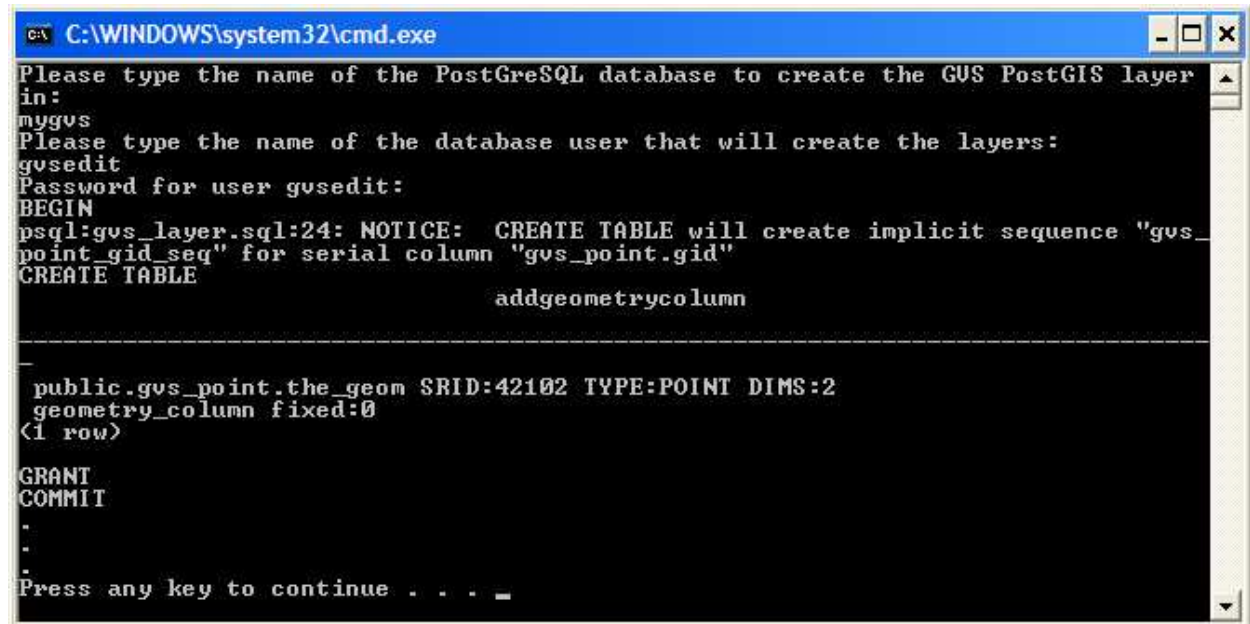
### 3.1 Create GVS layers

Before we can start Geographic Valuation System Mapping, we need to create the GVS PostGIS point layer that will be used. In section 3 we will look at the attributes of these layers and see how to link values to the layers.

Complete the following steps to create the GVS PostGIS point layer:

1. Double click the C:\ms4w\tools\GVS\create_gvs_layer.bat file. A new window will appear asking you for the name of the PostGreSQL database to create layers in.
2. Type the database name and press enter.
3. The window will then ask you for the name of the database user that will create the layers. Type the user name and press enter.
4. The window will then ask you to type the password of the database user that will create the layers. You would have recorded the password in step 5 of Part C, Section 4.2.2. Type the password and press enter.

5. The window will then show the results of the create layer process (Figure 44).



The create_gvs_layer.bat file has successfully created a GVS POINT layer called 'gvs_point'.

**Figure 44 - Creating Tutorial Point Layer**

## 3.2 Add GVS layers to the MapFile

Before we can add the GVS layer to the GVS site, we need to add it to the MapServer MapFile. Review Part C, Section 4.4 of this document to refresh your memory of how layers are added to a MapFile. We will be adding the layer to the MapFile you referenced in step 5.b of Section 1.2 (c:\ms4w\apps\fist\mapfiles\mygvs.map).

The basic process for adding a layer is:

- Make a backup of the MapFile.
- Add the layer definition to the MapFile.
- Test the MapFile with the mapfile_tester.bat file.

Now add the GVS PostGIS layer (created in Section 3.1) to the MapFile using the following definitions. We want to be able to edit this layer, so remember to use the 'gvsedit' user in the CONNECTION variable:

gvs_point

This layer contains point features. Try adding it to the MapFile. The following criteria will get you started (remember that this layer will be edited, so that will determine which user is specified in the CONNECTION variable):

- 'GVS Points' is the NAME.

- 'diamond' is the SYMBOL.
- SIZE is '15'.
- COLOR is '200 75 200'.

Figure 45 shows the full layer definition, but try it on your own first!

```
LAYER
      NAME "GVS Points"
      STATUS ON
      TYPE point
      DATA "the_geom FROM public.gvs_point USING UNIQUE gid USING srid=42102"
      CONNECTIONTYPE POSTGIS
      CONNECTION "host=localhost dbname=mygvs user=gvsedit password=*****"
      TEMPLATE "nepas.html"
      CLASS
            NAME "GVS Points"
            SYMBOL "diamond"
            SIZE 15
            COLOR 200 75 200
      END
      PROJECTION
            "init=epsg:42102"
      END
END
```

This figure shows the map layer definition for the GVS point layer in Section 3.2.

**Figure 45 - Tutorial MapFile**

## 3.3 Add map layers to GVS

### 3.3.1 Map Layers

Next we need to add the MapFile layer to the GVS. Follow the steps in Part C, Section 4.5.1 of this document to add the layer to your GVS site using the FIST-Admin:

- The layer should be visible.
- The layer should have a 'edit' context mode (Figure 46), which will allow us to edit this layer in the GVS.
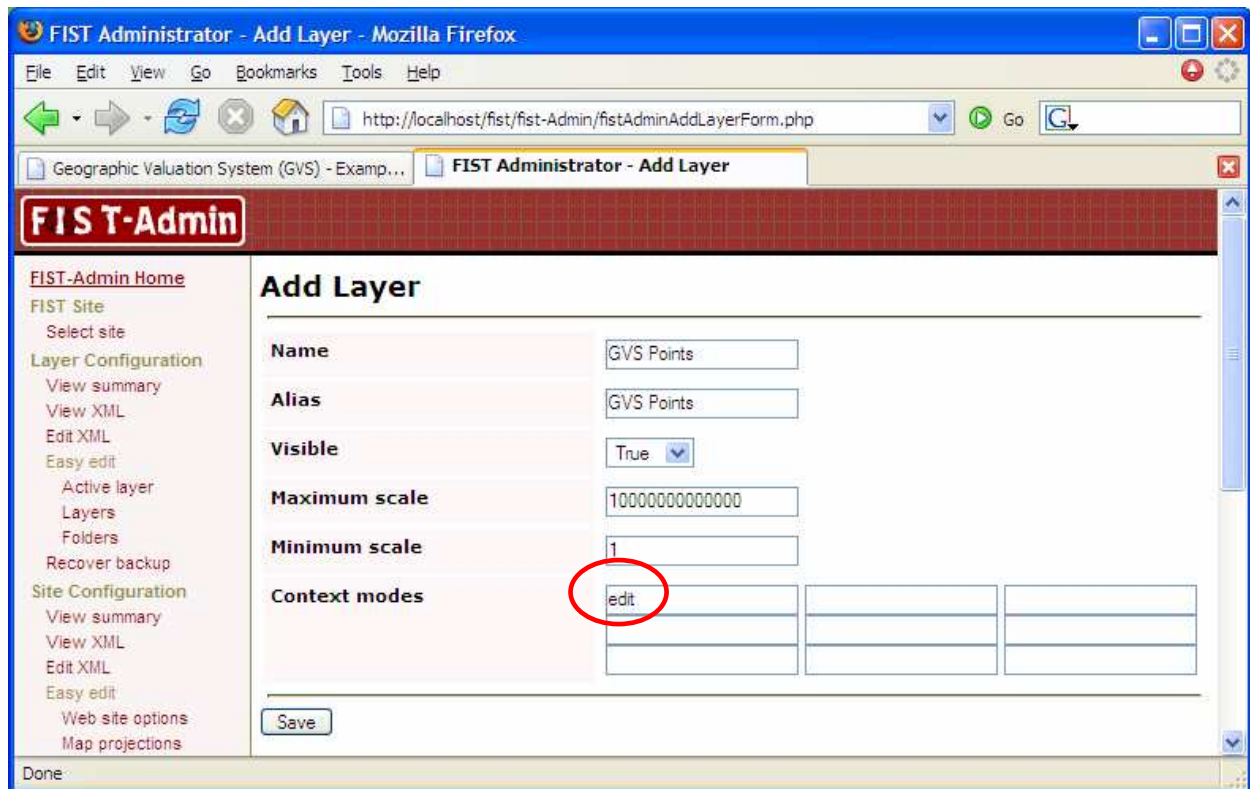
The 'GVS Points' layer is added to the GVS site. Note that the layer has a context mode called 'edit', which allows the layer to be edited.

**Figure 46 - Adding Layer to GVS Layer-Configuration**

### 3.3.2 Folder

Also, we want to place the 'GVS Points' layer into a folder. Using the steps in Part C, Section 4.5.3, create a folder called 'GVS layers' and add the layer to this folder (Figure 47).
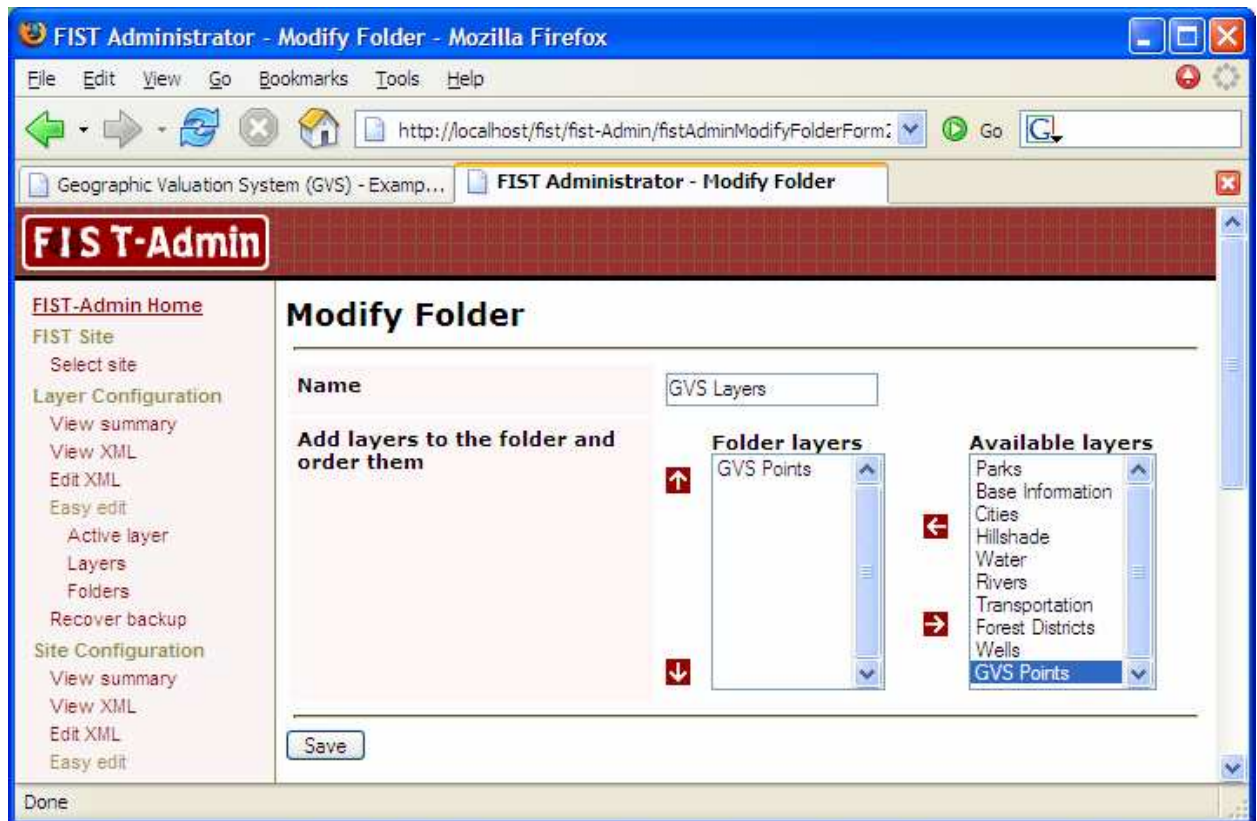
The folder 'GVS Layers' being created will contain the 'GVS Points' layer.

**Figure 47 - Tutorial Folder**

## 3. Adding Geographic Values to GVS

In this section, we will be using six different tools for adding, importing, modify, deleting and viewing map value-descriptors (Figure 48). Hold your cursor over a tool and a tool tip will popup, giving you the name of the tool.

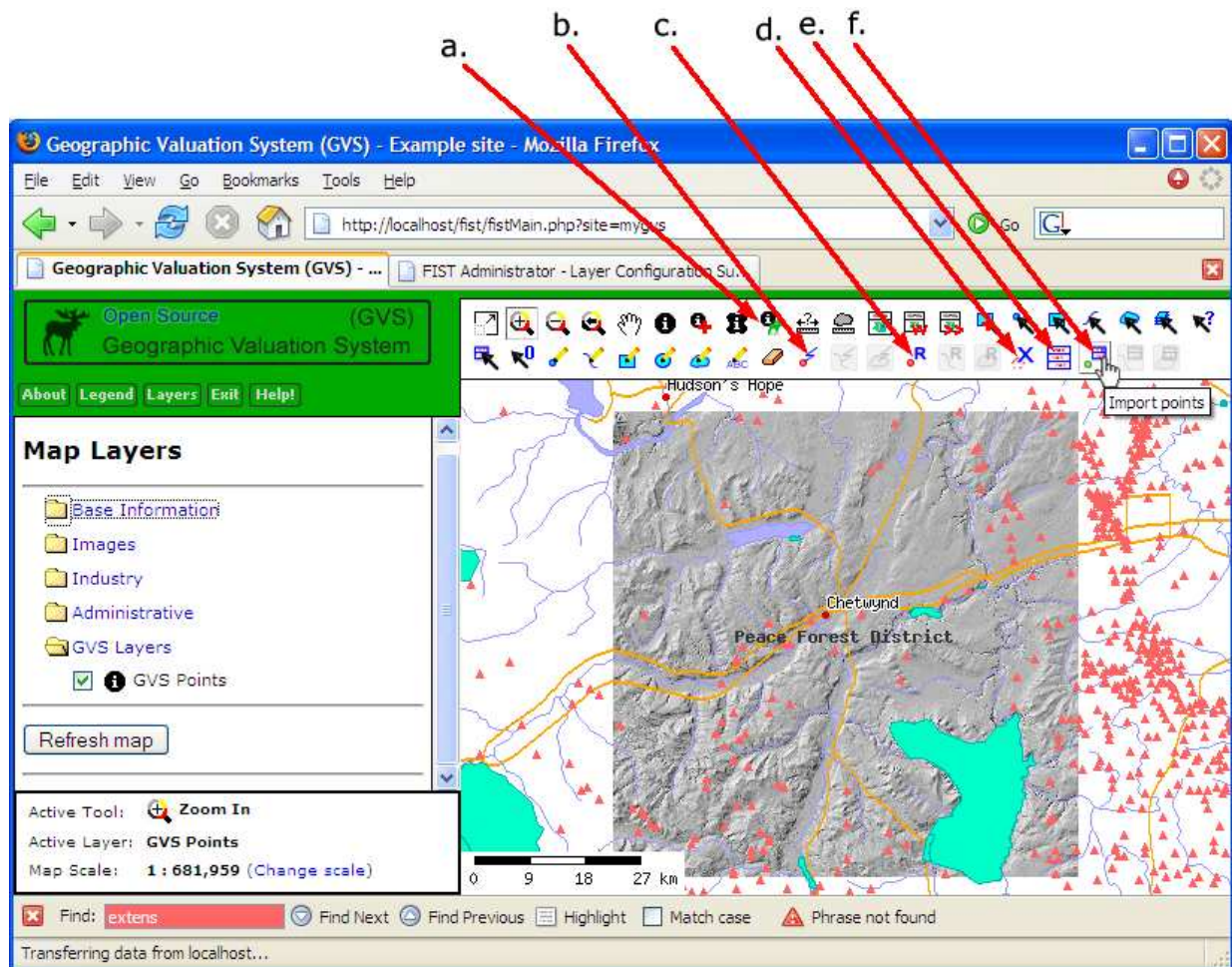The tools used for Geographic Valuation System Mapping are: (a) Values Discovery, (b) Digitize point, (c) Replace point, (d) Delete features, (e) Modify Attributes, and (f) Import points tool. Note that the cursor is held over the Import points tool and a tool tip has shown up. Also, note that on the GVS sidebar, the 'GVS Points' layer has been selected, which is the reason the tools are un-grayed and accessible.

**Figure 48 - Tools Used in Tutorial Mapping**

### 3.1 Place multimedia in your GVS site

Before we can add multimedia value-descriptors to our map, we need to place the multimedia files within the GVS site. Copy the whole d:\multimedia directory and place it in the c:\ms4w\apps\fist\htdocs\sites\mygvs\ directory.

### 3.2 Adding point map features
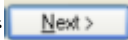
Open up the GVS site. Ensure that you have made the 'GVS Points' layer active:

1. Click the 'Layers' tab. The 'Map Layers' web page will appear on the GVS sidebar.
2. Click the 'GVS Layers' folder on the 'Map Layers' web page.
3. Click the 'i' button next to the 'GVS Points' layer to make it active. Notice that the tools described in Figure 48 become un-grayed and accessible.

Let's add our first point to the map in the GVS:

1. Click the 'Zoom in' tool. Then, zoom in to the lake that's North of Chetwynd.
2. Click the 'Digitize point' tool (Figure 48.b). Then, click on the map at the river near the east end of the lake.
3. The 'Digitize Point' web page will appear on the GVS sidebar. Click the ' Next > ' button on the 'Digitize Point' web page.
4. Next the GVS sidebar displays a web page with a number of text boxes (Figure 49).
5. Enter the following into the text boxes:
   - site_description: Fishing on a river North of Chetwynd
   - contributor: Nancy
   - contributor_photo: /fist/sites/mygvs/multimedia/nancy.png
   - contributor_description: researcher from UNBC
   - contributor_status: researcher
   - keywords: fishing river
   - multimedia_1: /fist/sites/mygvs/multimedia/fishing.gif
   - description_1: people fishing information by Elder
   - date_recorded_1: 1950
   - multimedia_2: /fist/sites/mygvs/multimedia/fishing.mpeg
   - description_2: people fishing information by Elder
   - date_recorded_2: unknown
   - multimedia_3: /fist/sites/mygvs/multimedia/smoke_house.gif
   - description_3: a smoke house at the river site recorded information by Elder
   - date_recorded_3: 1952
6. Click the 'Add point to layer' button.
7. A web page will then appear, letting you know that the point was added to the active layer. The point should now show up as a purple diamond.  If an error message appears, check the error logs.

Click the 'Zoom to initial map extents' button. Now try adding another point.  This time add it near the park east of Chetwynd. Use the following information in the textboxes:
   - site_description: A pit house near the Pine River Breaks Provincial Park.
   - contributor: Roslyn
   - contributor_photo: /fist/sites/mygvs/multimedia/roslyn.png
   - contributor_description: chief 2003 to 2005
   - contributor_status: leader
   - keywords: pit house

- multimedia_1: /fist/sites/mygvs/multimedia/pit_house.gif
- description_1: Photo taken by my grandfather
- date_recorded_1: June 18, 1946



The text boxes that appear when adding/digitizing a new point or modifying a point. You can enter five pieces of multimedia per point. Note that you CAN'T use commas in any of the text boxes or the point won't be added.

**Figure 49 - Tutorial Attributes**
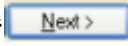
### 3.3 Importing map features

If you have a large number of sites to add, you can place them into a Comma Separated Values File (.csv file) and import them en masse instead of adding them one by one. To understand the how .csv files work, take a look at the example C:\ms4w\apps\fist\htdocs\sites\mygvs\multimedia\sites.csv using WordPad.

Let's import the points stored in the C:\ms4w\apps\fist\htdocs\sites\mygvs\multimedia\sites.csv file:

1. Make sure the 'GVS Points' layer is active.
2. Click the 'Import points' tool (Figure 48.f).
3. The 'Import Points File' web page will appear on the GVS sidebar. Click the 'Browse' button.

4. A new window called 'File Upload' will appear. Navigate to the C:\ms4w\apps\fist\htdocs\sites\mygvs\multimedia\sites.csv file. Click the file and then click the 'Open' button'.
5. Click the '![Next >]' button.
6. A web page with a number of checkboxes and dropdown menus will appear. Check on the 'Layer Fields' that you are importing information for:
    - site_description
    - contributor
    - contributor_photo
    - contributor_description
    - contributor_status
    - keywords
    - multimedia_1
    - description_1
    - date_recorded_1
7. Next select the 'CSV File Fields' from the drop down menus for each 'Layer Field' you checked on in step 6 (Figure 50).
8. Click the 'Import points' button.
9. A web page will then appear, letting you know that the points from the .csv file were imported into the active layer. If an error message appears, check the error logs. There should be two new purple diamond symbols on the map (West and South of Chetwynd) (Figure 51).
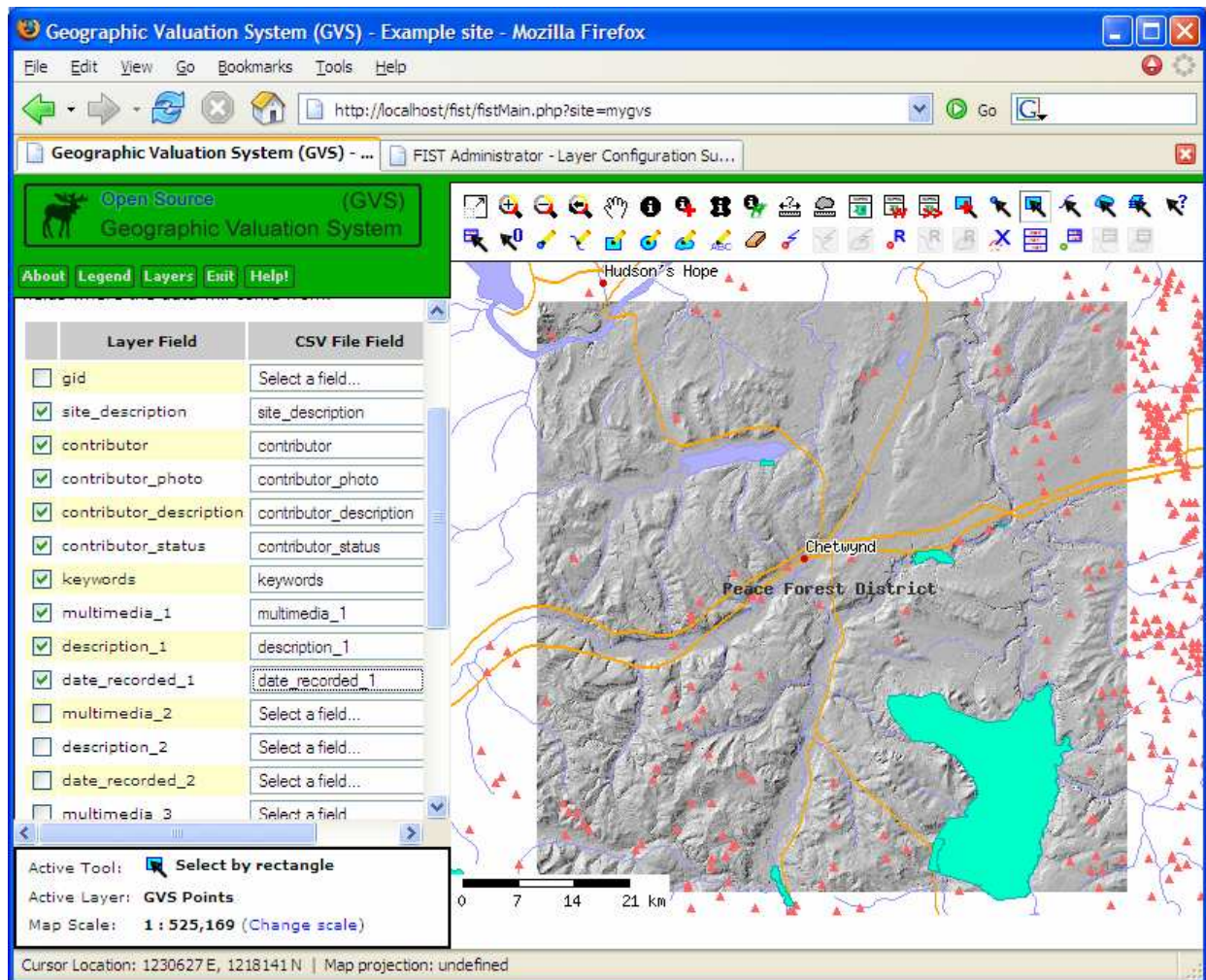
The 'CSV File Fields' corresponding to the 'Layer Fields' have been selected from the dropdown menus.

**Figure 50 - Adding Data through .csv File**
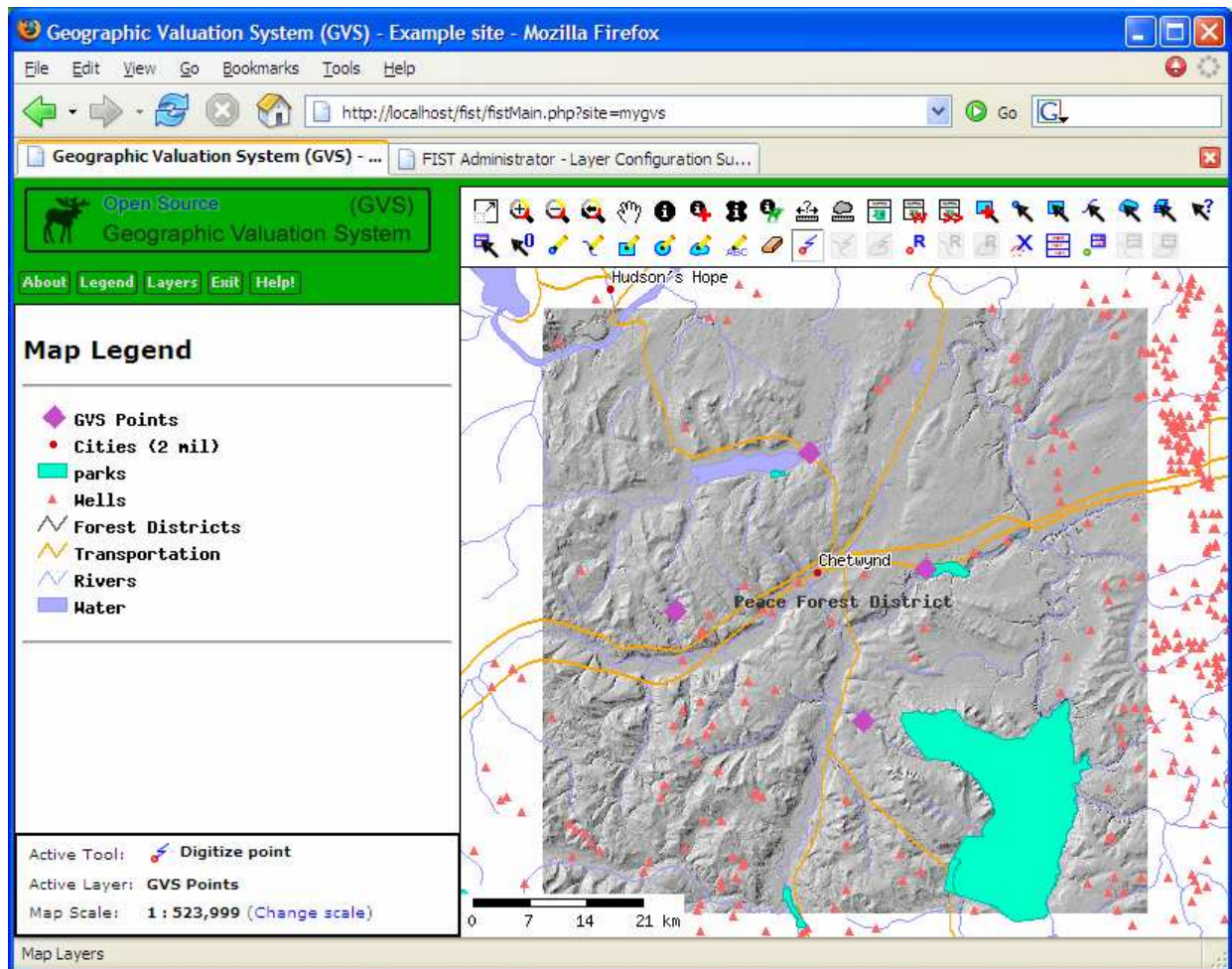
Four GVS points are shown on the map North, East, South, and West of Chetwynd. These points were added in Sections 3.2 and 3.3. Also, note that the 'Legend' tab was clicked and the map's legend is displayed in the GVS sidebar.

**Figure 51 - Four Sample Points**

> **\*\* TIP \*\***
>
> Loading of existing data can also be done straight from a shapefile format or edited in a database and then loaded. Attribute categories, once defined with community members, can be edited within a shapefile .dbf using Excel. Saving the .dbf file as a .csv will create a .csv which can be loaded following the above steps. Alternatively, the .csv can be imported as a shapefile in ArcMap and then imported into PostGreSQL.

### 3.4 Using the Values Discovery Tool

Using the Values Discovery Tool is easy:

1. Click the 'Values Discovery' tool (Figure 52.a). 
2. Click and drag a box around the four sites you have just added (purple diamonds).
3. A window called 'Values Discovery Results' will appear (Figure 52).

4. You can click on the multimedia links to view the multimedia containing knowledge associated with this site.
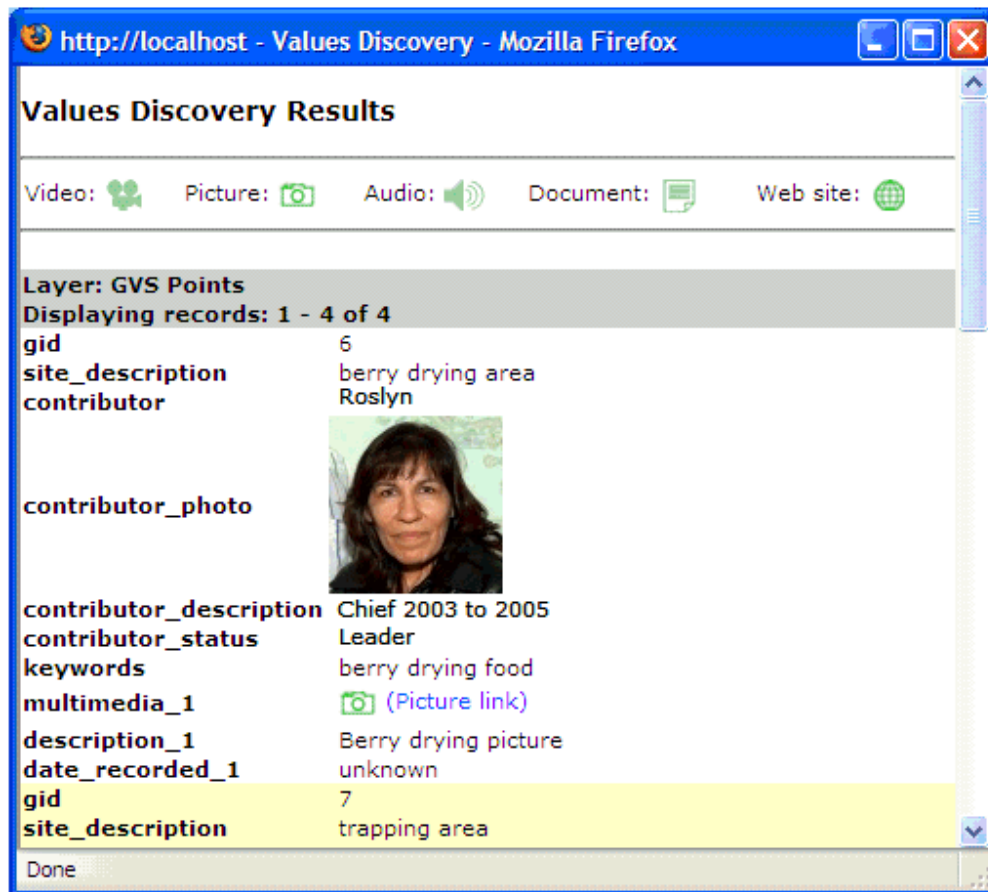


The 'Values Discovery Tool found four sites. Note the camera icon by 'multimedia_1'. You can click this icon to see an image related to the site.

**Figure 52 – Generic Values Discovery Tool**

---

**A Brief Note on the images used:**

No, we are not trying to be vain … we just had to use images that wouldn't compromise Halfway River First Nation TEK confidentiality!

You can substitute your own images, collected on the land, on the reserve, in schools, etc. in your own database!  Please see the section on Decision-Making Using the GVS (A.3).

---



For the Halfway River First Nation GVS we used animated gifs for each of the multimedia symbols.  You can create your own!

## 3.4 Selecting features

In order to modify or delete sites/points you must select the points you want. Let's try selecting the point north of Chetwynd:

1. Make sure the 'GVS Points' layer is the active layer.
2. Click the 'Select features by rectangle' tool.
3. Click and drag a box over the point North of Chetwynd.
4. The point turns yellow indicating that it is selected.

Now that the feature is selected, you may replace, modify, or delete features.

## 3.5 Modifying map features

### 3.5.1 Replace points

If you click the wrong site when adding a point, you can replace the point with another one using the 'Replace point' tool. Let's replace the point North of Chetwynd with a point slightly west of the current point:

1. Make sure the 'GVS Points' layer is the active layer.
2. Select the point North of Chetwynd.
3. Click the 'Replace point' tool (Figure 48.c).
4. Click on the map where the replacement point should be placed.
5. The 'Replace Point' web page will appear on the GVS sidebar.
6. Click the 'Replace point' button.
7. A web page will then appear, letting you know that the point was replaced and you will see it on the map.

### 3.5.2 Modify attributes

If you enter the wrong attributes in the textboxes or the import .csv file had an error in it, you can change the attributes of the point using the 'Modify attributes' tool. Let's modify the point West of Chetwynd:

1. Make sure the 'GVS Points' layer is the active layer.
2. Select the point West of Chetwynd.
3. Click the 'Modify attributes' tool (Figure 48.e).
4. The 'Modify attributes' web page will appear in the GVS sidebar.
5. Change the 'date_recorded_1' field from 'unknown' to '1967'.
6. Click the 'Modify attributes' button.
7. A web page will then appear, letting you know that the attributes of the selected feature were modified.

If you select more than one point, the 'Modify attributes' tool becomes a bulk modify attribute tool and will change the attributes of all the points.

## 3.6 Deleting map features

If you add a point and you decide later that the point is invalid, you can delete it using the 'Delete point' button. Let's delete the point East of Chetwynd, near the park:

1. Make sure the 'GVS Points' layer is the active layer.
2. Select the point East of Chetwynd.
3. Click the 'Delete features' tool (Figure 48.d).
4. The 'Delete features' web page will appear in the GVS sidebar.
5. Click the 'Delete selected features' button.
6. A web page will then appear, letting you know that the selected features were deleted. Also, the point will no longer appear on the map.

**Appendix 1 – Halfway River First Nation Geographic Valuation System**

RESEARCH UNITES ABORIGINAL WORLDVIEWS WITH STATE-OF-THE-ART TECHNOLOGY

A revolutionary system for combining Aboriginal perspectives of the land with predominant techniques for mapping and resource management has been developed by researchers at the University of Northern British Columbia and the Halfway River First Nation. The development could usher in a new era of Aboriginal participation in resource management decision-making and communication of traditional Aboriginal knowledge.

The new system is called a Geographic Valuation System (GVS) that incorporates traditional Aboriginal values and uses of the land into an Internet-based, multimedia application. From a computer-generated view of the landscape, clickable icons allow community users to access traditional knowledge associated with geospatial data (latitude/longitude, wildlife habitat, roads, and rivers, etc). Halfway River has already catalogued traditional knowledge and uses in documents, photos, audio clips, and videos and so far, more than 4000 of these materials (including 120 videos) are in the GVS. They can now be accessed by the community for day-to-day decision-making.



"The GVS has at least two main advantages for our Nation," says Halfway River Chief Roslyn

Pokiak, who has been the community's lead participant in the development of the system. "First, it will allow us to effectively communicate with government and industry in discussions about the potential effects of resource management decisions, such as the expansion of oil and gas exploration. Secondly, and perhaps more importantly, it will be a tool for educating our future generations about our traditional practices and make our landscape literally come alive, even if some of the Elders who are captured in photos or videos have already passed away."

Joining Chief Pokiak in developing the GVS has been Alex Hawley, a professor in the UNBC Ecosystem Science and Management program, and PhD student Nancy Elliot, a GIS specialist.

"The GVS enables Elders and other community members to participate in land use decisions, such as a proposal to establish a seismic line, without compromising their values. It also forms the foundation for an educational approach that fosters the incorporation of traditional Aboriginal values in community development," says Dr. Hawley. "It has been a challenge – and incredibly rewarding – to emphasize the oral tradition as a vital component of land management processes. Our western map-making tradition has never been very successful in doing this," adds Nancy Elliot.

Halfway River First Nation has a population of 135 people on the reserve, which is located 35km west of the Alaska Highway and about 90km north of Fort St. John. One of northeastern BC's richest oil and gas regions is located within their traditional lands.

High-resolution photos of Chief Pokiak and the research team are available upon request.

www.unbc.ca/releases/2005/08_03halfway.html

**Appendix 2 – Terminology and Sources for Further Information**
(where appropriate source of definition is provided)

$ROOT
- A variable representing the URL Root, set in map-service-config.xml.

Apache Web Server
- An open source Hyper Text Transfer Protocol (HTTP) web server that requests and transmits files, including webpages and components, over the internet.
- http://http.apache.org

BC Albers Equal Area Conic projection
- Used by the British Columbia government as its official projection. It allows the entire province to be represented within one projection with minimal distortion.
- http://srmwww.gov.bc.ca/gis/bceprojection.html
- www.gis.unbc.ca/courses/geog205/lectures/map_project/index.php
- http://tinyurl.com/lckpu

Comma Separated File (.csv file)
- Values of a table are stored as a series of ASCII text lines separated by commas.

Configuration file
- XML files allowing the user to readily set up values interpreted by FIST scripts. Separate configuration files exist for the over-all webpage components (map configuration), map layers and folders (layer configuration), and site set-up (site configuration). Information entered into these files configures the GVS and FIST.

EPSG codes
- A numeric code representing the definition of projections (datum and projection).
- www.epsg.org

Error log
- A file where error information is written when a program runs. The information can be accessed through a text editor.

FIST
- Flexible Internet Spatial Template, a Web Mapping Interface created at UNBC.
- Koning, Aaron. 2004. Developing an Open Source Internet Geo-Mapping Framework. http://datashare.gis.unbc.ca/fist/docs/ugrad_thesis/unbc_undergrad_thesis_presentation.pdf
- http://datashare.unbc.ca/fist/index.php
- FIST Users www.freelists.org/lists/fist-users

Geographic (lat/long).
- A georeferencing system using latitude and longitude for reference.

- www.gis.unbc.ca/courses/geog205/lectures/map_project/index.php
- http://tinyurl.com/lckpu

Geographic features
- A user-defined geographic phenomena that can be modeled or represented using geographic datasets (www.gisdevelopment.net/glossary/g.htm ).

Geographic Valuation System (GVS)
- The Geographic Valuation System (GVS) was developed to provide First Nations with an interactive tool that accommodates Traditional Aboriginal values and approaches in resource management deliberations and decisions. The prototype was created with the input and participation of Halfway River First Nation members.
- Elliot, Nancy. (Forthcoming 2006). Including Aboriginal Values in Resource Management Through Enhanced Geospatial Communication. Thesis in Partial Fulfillment of the Requirements of the Degree of Doctor of Philosophy in Resource and Environmental Studies. University of Northern British Columbia. elliotn@unbc.ca
- www.unbc.ca/NRES

HTML
- Hypertext Markup Language (HTML) is a markup language used extensively to structure text and multimedia documents and to set up hypertext links between documents (www.answers.com)
- www.w3.org

Mailing list
- User subscribed website where users view, post, and receive comments pertaining to the subject of the website

Map extents
- Minimum and Maximum X and Y coordinates defining the extent of spatial data.

Map features
- Physical or cultural features appearing on a map.

MapFile variable
- Variables (changing entities) are substituted for parameters within a mapfile resulting in presentation and theming of data.

Mapping data
- UMinn MapServer can use mapping data from a wide variety of sources including: PostGIS layers, Shapefiles, Orthophotos, and Web Mapping Server (WMS) layers. Mapping data consists of geographic and descriptive information.

MapServer
- The GVS uses the University of Minnesota MapServer (UMinn MapServer) to generate digital maps (http://mapserver.gis.umn.edu/). The MapServer is a one type of map

server.

Map server
- A map server is a computer program that generates digital maps from mapping data.

MS4W
- MapServer package for Windows.

Open Source
- "Open source describes practices in production and development that promote access to the end product's sources" (en.wikipedia.com).
- "Refers to software that is created by a development community rather than a single vendor" (www.answers.com ).
- The FIST and its derivative products are registered under the GNU Public License (GPL) (www.gnu.org/copyleft/gpl.html).

PHP
- PHP (PHP: Hypertext Preprocessor) is a scripting language used to create web pages. It is embedded in HTML pages for server side execution.

Projection
- Mathematical models projecting the 3-dimensional globe onto 2-dimensional representations.

RGB
- The RGB (Red Green Blue) colour model uses the additive model in which red, green, and blue light (or visible light) are combined in various ways to create other colours (www.answers.com).
- RGB is expressed as hexadecimal (e.g. 0066FF) or decimal (255,0,0). The site-configuration uses hexadecimal for site colours and the mapfile uses decimal for feature theming.

Shapefiles
- A data-type developed for use with ArcView. It is read by many other products. A shapefile does not have topographical relationships. A shapefile is made up three central files:
    1. .shp – contains feature geometry.
    2. .shx – index file of feature geometry.
    3. .dbf – database file containing attribute information.

Theming
- Theming a map layer refers to choosing the colors, symbols, and labels that map features will be displayed with.

UTM
- UTM (Universal Transverse Mercator) uses grids to plot spatial locations referencing a

series of zones based on Transverse Mercator projections.
- www.gis.unbc.ca/courses/geog205/lectures/map_project/index.php
- http://tinyurl.com/lckpu

URL
- URL (Uniform Resource Locator) is an internet address.

Value-descriptor
- A value-description is an entity used by the GVS to capture and communicate First Nations values. A value-descriptor may consist of multimedia files (audio, documents, video, picture) or any other other file determined by a First Nation to represent their values.

Web Browser
- "A web browser is a software application that enables a user to display and interact with text, images, and other information typically located on a web page at a website on the World Wide Web or a local area network" (http://en.wikipedia.org ).

Web Mapping Server
- A Web Mapping Server (WMS) "produces maps of spatially referenced data dynamically from geographic information as a digital image file suitable for display on a computer screen" (http://en.wikipedia.org ).

Web Pages
- "A web page … is a resource on the World Wide Web, usually in HTML/XHTML format (the file extensions are typically htm or html) and with hypertext links to enable navigation from one page or section to another. Web pages often use associated graphic files to provide illustration, and these too can be clickable links. A web page is displayed using a web browser" (http://en.wikipedia.org ).

Web Server
- A web server is a computer program that serves web pages to a web browser over the Internet.
- The GVS uses the Apache Web Server to interpret HTML code to serve web pages.
- http://httpd.apache.org/

WFS layer
- A Web Feature Server (WFS) publishes XML encoded spatial data (containing both geometry and attributes) to the web.
- http://mapserver.gis.umn.edu/docs/howto/wfs_client

WMS layer
- Web Map Server (WMS) layer is a map layer connected to a remote internet site through a WMS connection. Within a MapFile you can reference an external WMS through the parameter CONNECTIONTYPE.
- http://mapserver.gis.umn.edu

WordPad
- Document processor standard with Windows OS (under Accessories) that supports complex document formatting.

XML
- Extensible Markup Language is a "metalanguage written in SGML that allows one to design a markup language, used to allow for the easy interchange of documents on the World Wide Web" ([www.answers.com](www.answers.com) ).

XML tag
- Nested elements in a XML file containing either attribute or content descriptors. For example, <title> text here </title> is a XML tag for insertion of the text of the title.

**Appendix 3 – Data and Information Sources**

Spatial data used for the generic GVS was converted to shapefiles from e00s and .csv formats using publicly available data.  The following sources will have the most current data.

**Ministry of Environment**
ftp://ftp.elp.gov.bc.ca/dist/arcwhse/
http://srmwww.gov.bc.ca/gis/arcftp.html

**Oil and Gas Commision**
https://quoll.ogc.gov.bc.ca/generic_ogc/Ext_Accnt.Logon

**Appendix 4 - MapFile Reference**

Located on GVS disc at \Utilizing the GVS\Appendix 4 – Mapfile Reference. PDF or online:
http://mapserver.gis.umn.edu/docs/reference/mapfile

**Appendix 5 - Map-Service Configuration XML File Reference**

Located on GVS disc at \Utilizing the GVS\Appendix 5 – Map-Service Configuration. PDF or online: http://datashare.gis.unbc.ca/fist/documentation/0.3/map_service_config_xml_ref.php

**Appendix 6 - Site Configuration XML File Reference**

Located on GVS disc at \Utilizing the GVS\Appendix 6 – Site Configuration. PDF or online:
http://datashare.gis.unbc.ca/fist/documentation/0.3/site_config_xml_ref.php

**Appendix 7 - Layer Configuration XML File Reference**

Located on GVS disc at \Utilizing the GVS\Appendix 7 – Layer Configuation. PDF or online:
http://datashare.gis.unbc.ca/fist/documentation/0.3/layer_config_xml_ref.php

**Appendix 8 – Introduction to Creating and Defining Your Own GVS Attributes**

**GVS**

The script C:\ms4w\tools\GVS\create_gvs_layer.bat file, used to create the default gvs_point layer in Section 3.1, uses C:\ms4w\tools\GVS\gvs_layer.sql as a default.  If you open gvs_layer.sql (in Wordpad or Notepad) you will see how the defined attributes for gvs_point appeared in the gvs_point layer.

To make your own layer, you can edit the list of attributes.  Also edit this line:
SELECT AddGeometryColumn('public', 'gvs_point', 'the_geom', '42102', 'POINT', '2');
so that 'gvs_point' is the name of your layer, '42102' is the projection ESPG, and 'POINT' refers to the proper type.  These values are read by the MapFile in the CONNECTIONTYPE variable.

Next, in the C:\ms4w\apps\fist\htdocs\gvsValuesDiscovery.php change the default 'GVS Points' on line 3: $layer='GVS Points'; so that it reads the name of your new values layer.  This name of course needs to be same name as your new layer in your GVS layer-config.xml.  Alternatively you could create another tool for each GVS layer or change the PHP page so that it processes a number of layers (loops around).
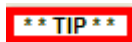
**\*\* TIP \*\*** You may want to backup or copy these files before you experiment.