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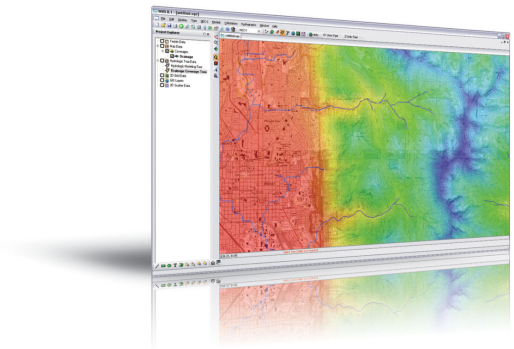

WMS

Introduction and Overview

Lesson 1

NHI

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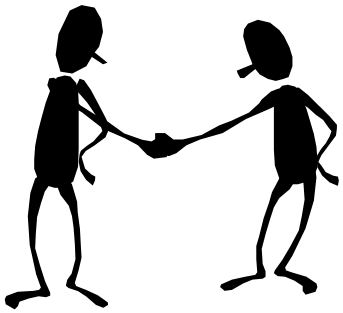
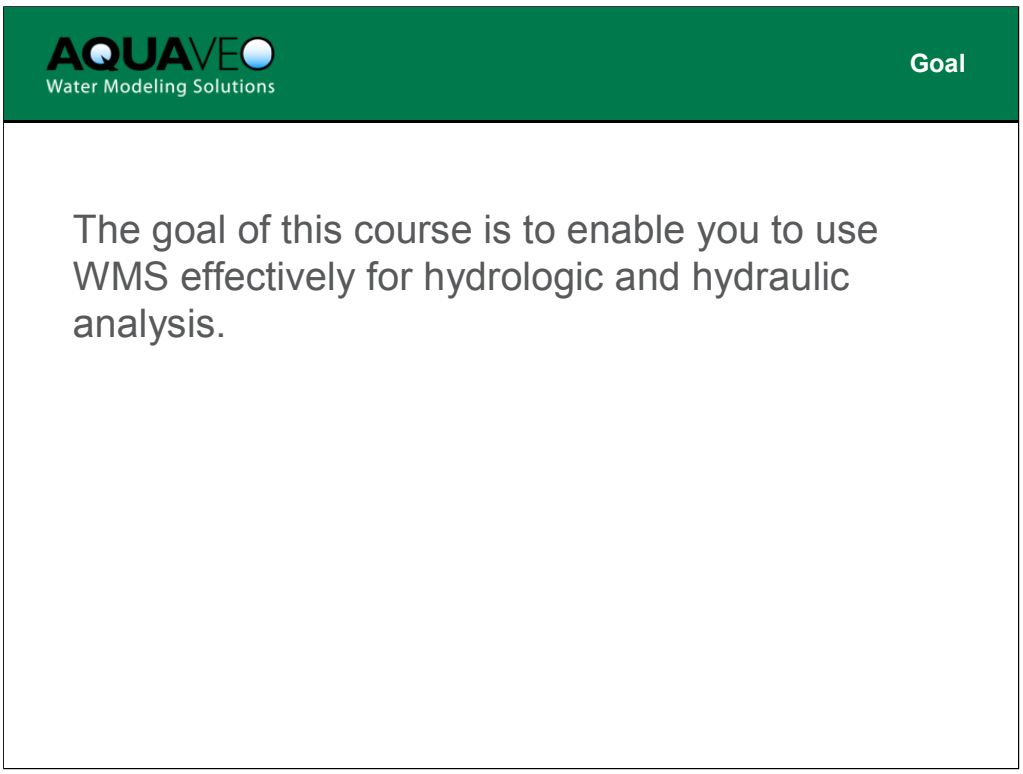
Introductions

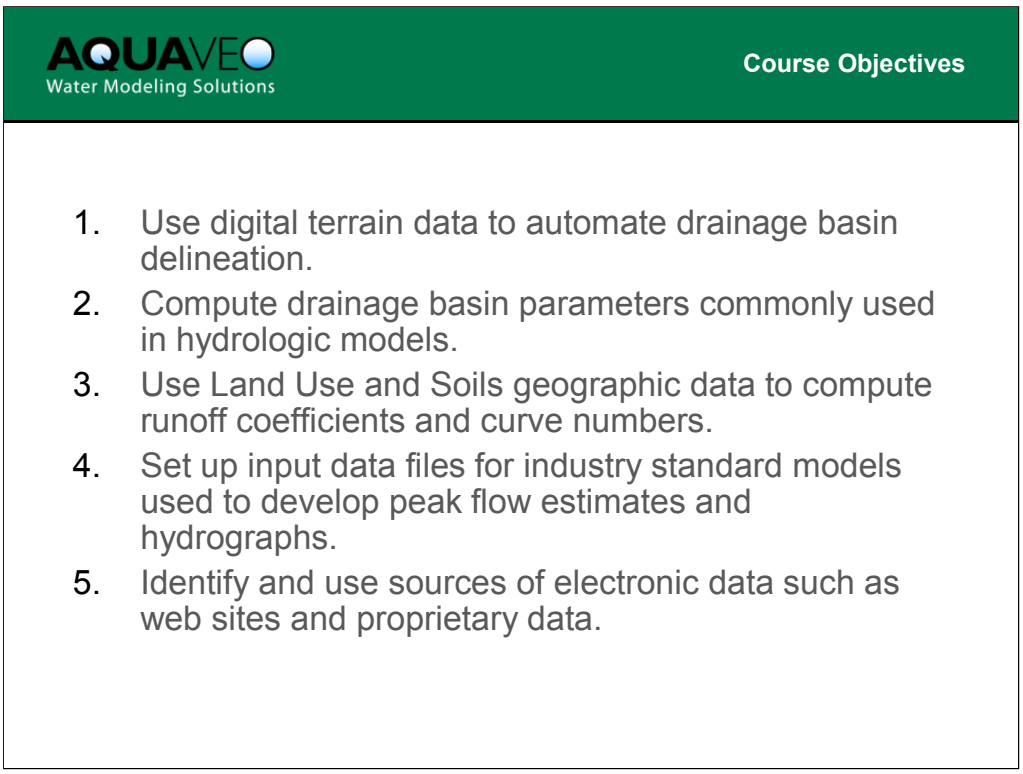
- Where are you from?
- Do you have experience using WMS?
- Experience with ArcView or GIS?
- What do you expect to learn?
- Something about yourself!



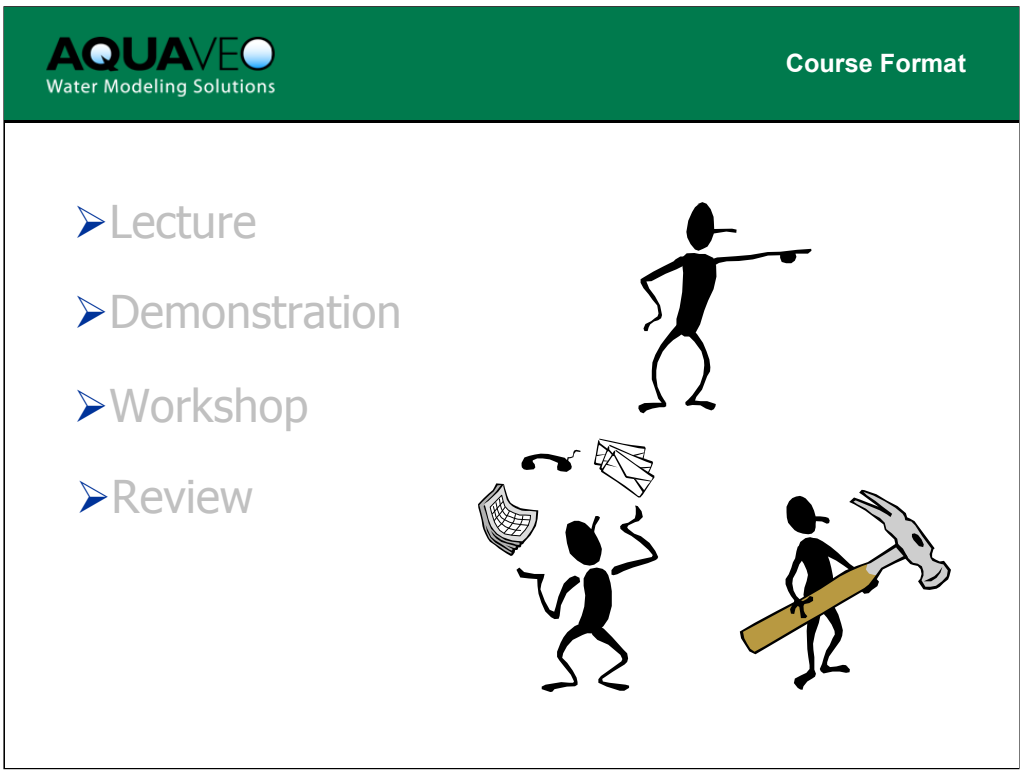
Please let us know a little bit about yourself and your expectations for this class. In particular, we would like to know if you have had experience with WMS or ArcView or other GIS programs (or even how you might be using CAD) that automate watershed delineation and hydrologic analyses.



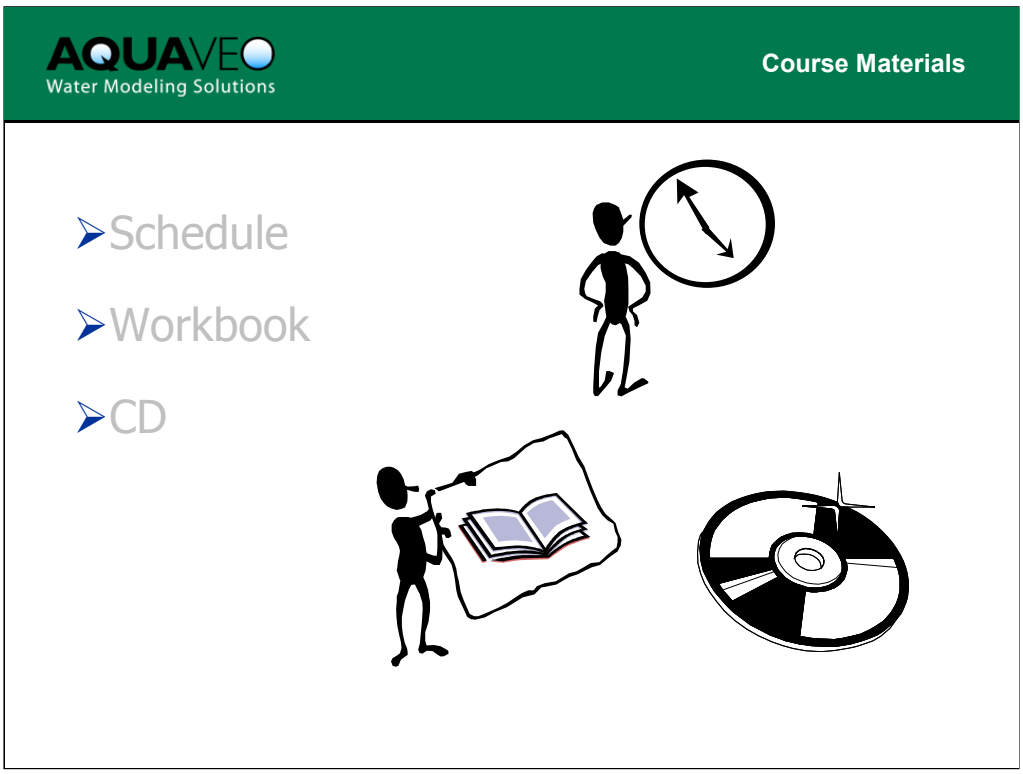
By the end of this course you will be able to identify several ways WMS can help in your tasks for design/analysis of hydraulic structures that require hydrologic calculations.



Specifically, you should be able to review these objectives and feel with confidence that you have learned and can now apply them.



Instruction in this course repeats the basic patterns of lectures using PowerPoint slides to discuss the main points, an interactive demonstration of WMS, followed by a hands-on workshop. The course outline is somewhat different depending on the needs/requests of the sponsoring agency. However, we will generally follow the outline shown above. The first half of the course concentrates on the basic tools available in WMS for developing hydrologic models, while the latter half focuses on their application.



Several materials have been provided for you for this course. The schedule for the course outlines the timeframe for the lectures and workshops. The workbook includes the lecture slides and notes, as well as the workshop guide for each lesson. Finally, the CD you have received contains the installation of WMS and data files for the workshops in each lesson.

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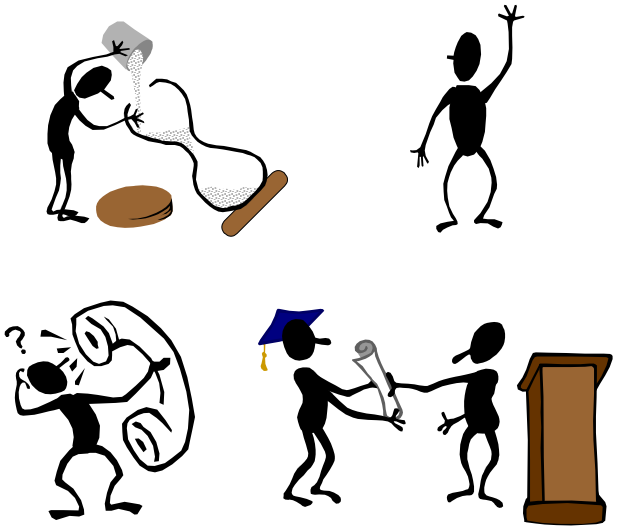
Ground Rules

- Punctuality
- Partners
- Questions
- Cell phones
- Computers
- CEU's



These are a few brief items so that everyone knows what to expect.

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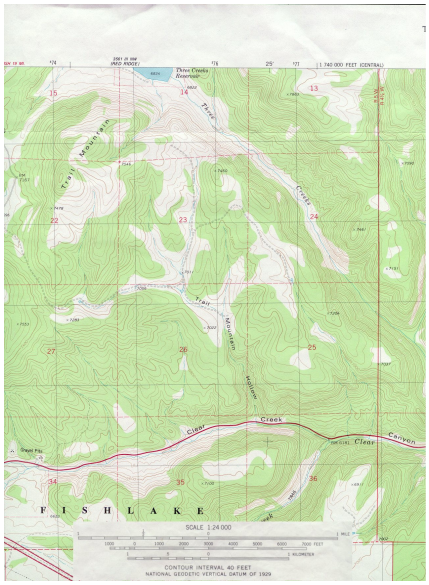
Current Practice?



Think about how you currently do your hydrology for highway drainage design projects. How do you determine watershed areas from topographic maps? How would you determine other parameters such as slope, time of concentration or lag time, and the average basin elevation?

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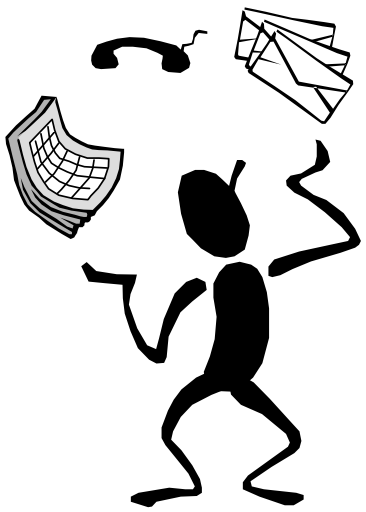
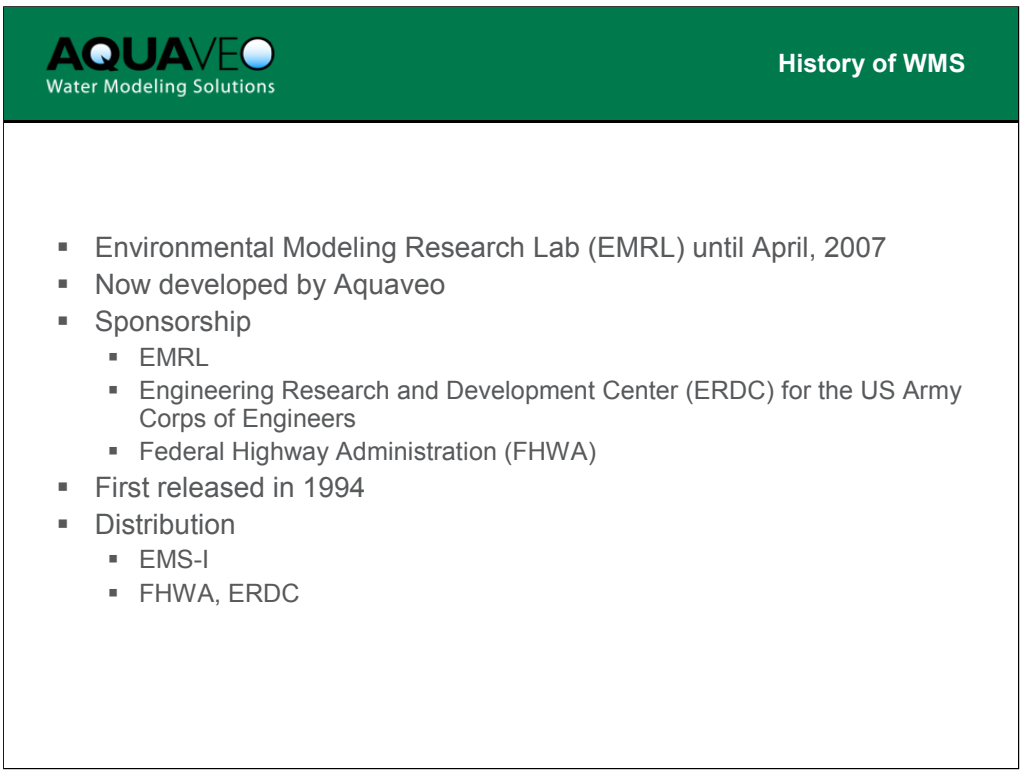
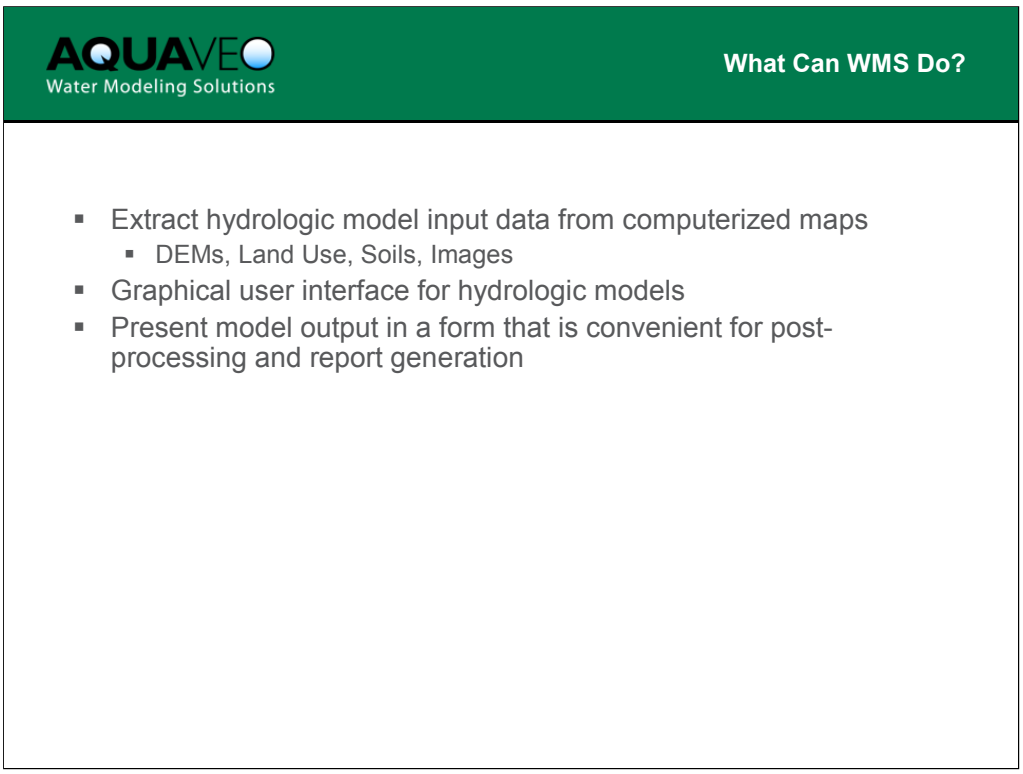
Demonstration



At this point we will very quickly show how WMS can be used to automate basin delineation and hydrologic calculations. The idea here is to introduce you to what WMS can do and motivate you to want to learn how to use it. Do not try to take notes or keep pace in anyway as we will come back and review the things demonstrated here in detail.



Research on WMS began in the late 1980's and early 1990's. WMS was developed by the Environmental Modeling Research Laboratory (EMRL) at Brigham Young University (BYU) until April 2007. At this time, development of WMS moved off-campus and the software is now developed by Aquaveo, LLC. Sponsorship of some portions of development has been provided by the Engineering Research and Development Center (ERDC) of the Army Corps of Engineers. The Federal Highways has sponsored the inclusion of several state DOT methods and provided licenses for all state DOTs. WMS was first released in 1994 (under the name of GeoShed). Distribution for state DOTs is handled through the FHWA, with all other commercial distribution being handled by Environmental Modeling Systems Inc. (EMS-I).



WMS is an integrated hydrologic modeling program that extracts key model input parameters from computerized maps. Complete graphical user interfaces to commonly used hydrologic models are a part of WMS, as well as the ability to display results from model calculations.

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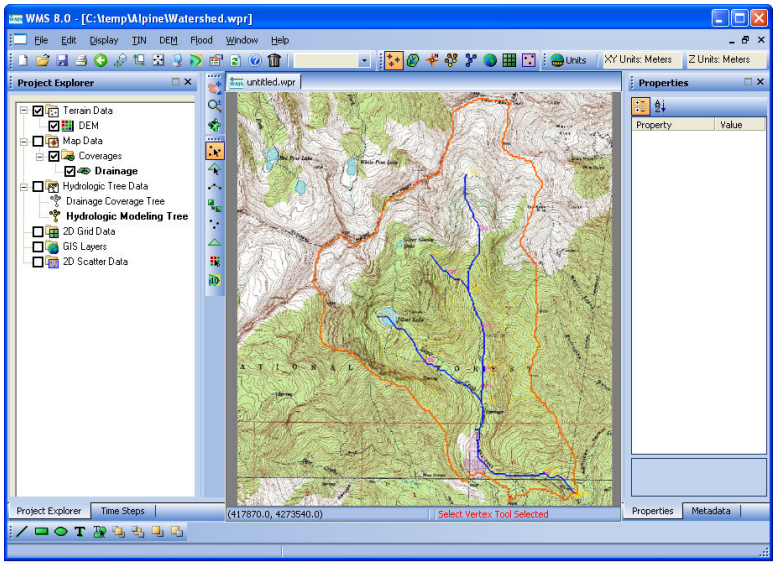
Watersheds From Computerized Maps



What is a computerized map? One form of a computerized map is a scanned USGS quadrangle, now commonly available over the Internet. These maps can be used to trace boundaries of streams, watersheds, land use, and soil data layers.

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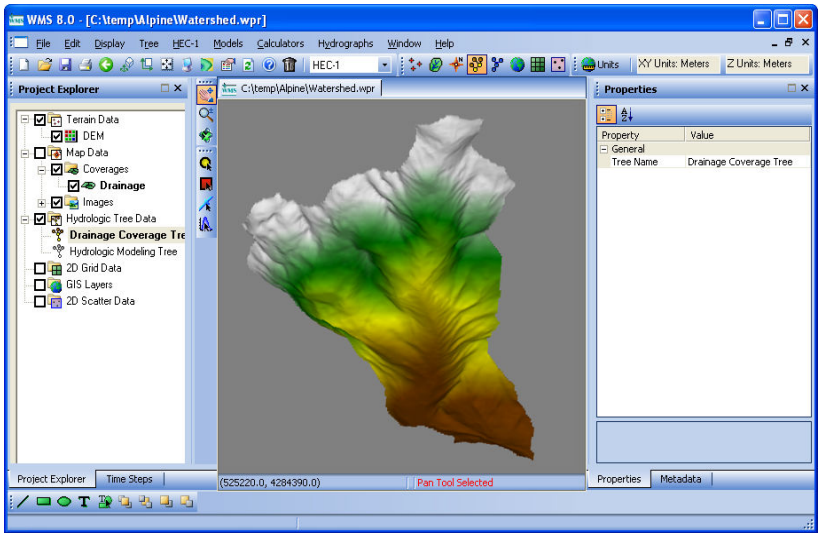
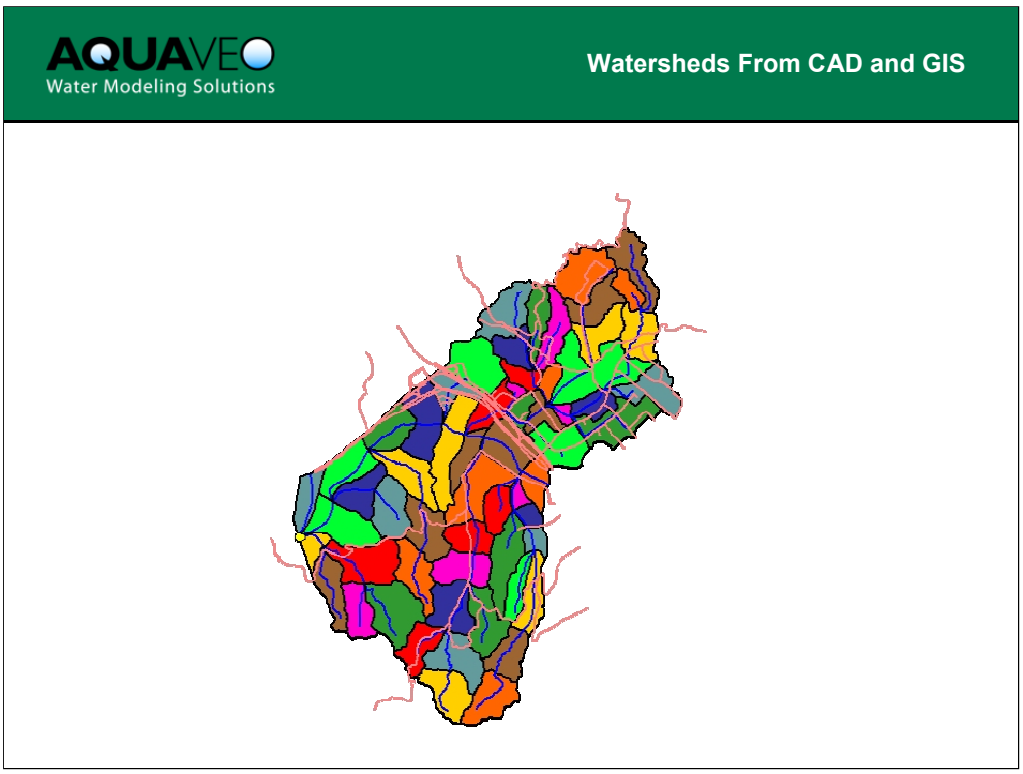
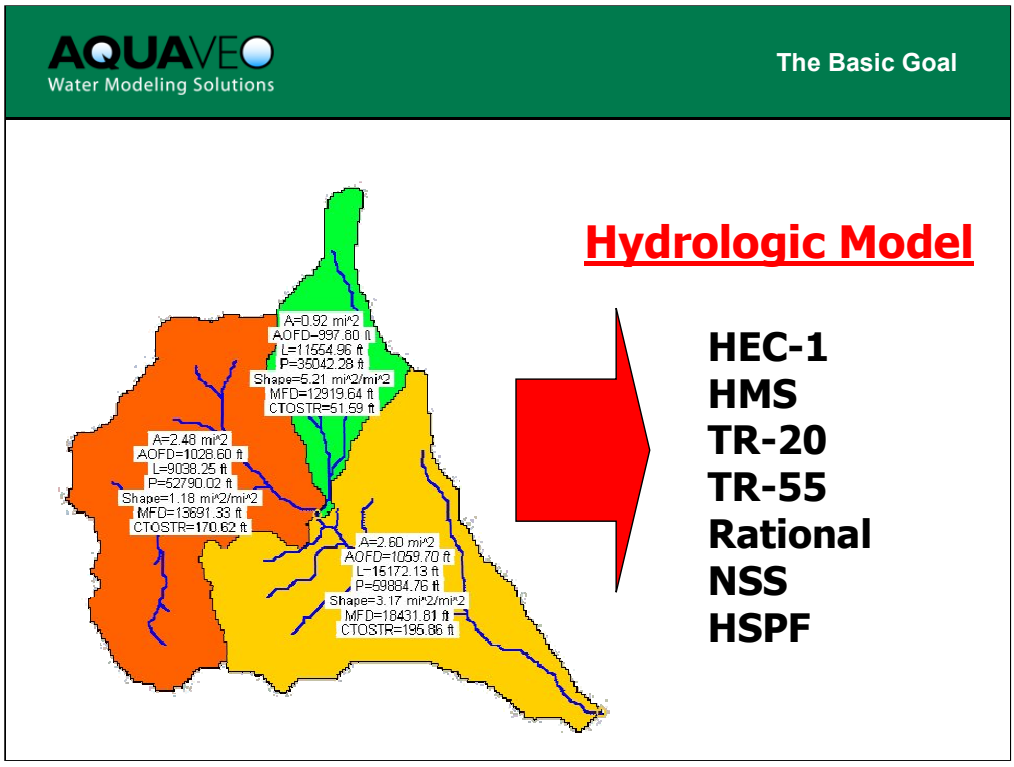
Watersheds From 3D Maps



Digital elevation data files commonly available for download can be used to automatically delineate watershed and sub-basin boundaries.



Watersheds previously delineated and stored in CAD, or GIS programs can be imported.



The basic objective of using WMS is:

1. Create a digital representation of a watershed (automatically generate topology).
2. Compute geometric parameters and other model parameters.
3. Run Hydrologic model (HEC-1, TR20, TR-55, Rational, NSS, others).

As a watershed is delineated from a map source, a corresponding topologic tree or schematic is automatically generated. Existing model input files may be opened to create the model schematic.

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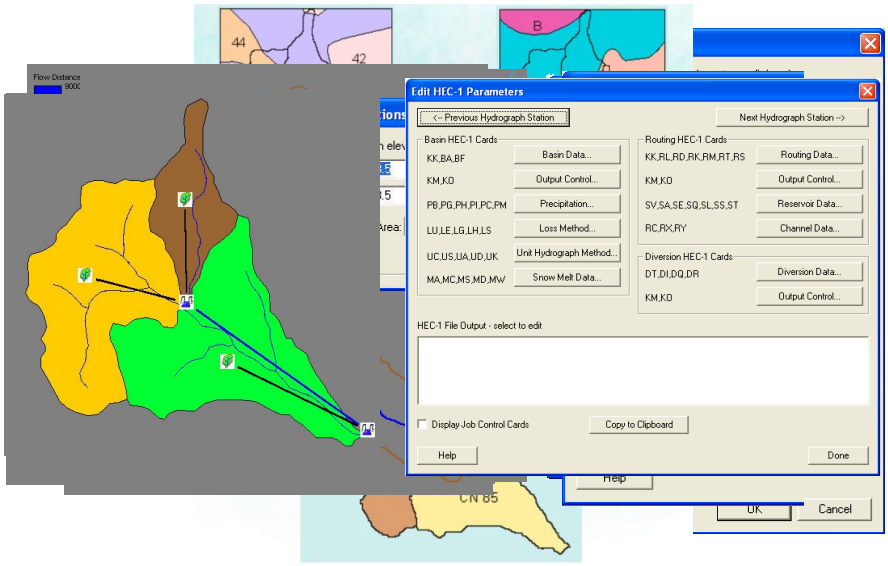
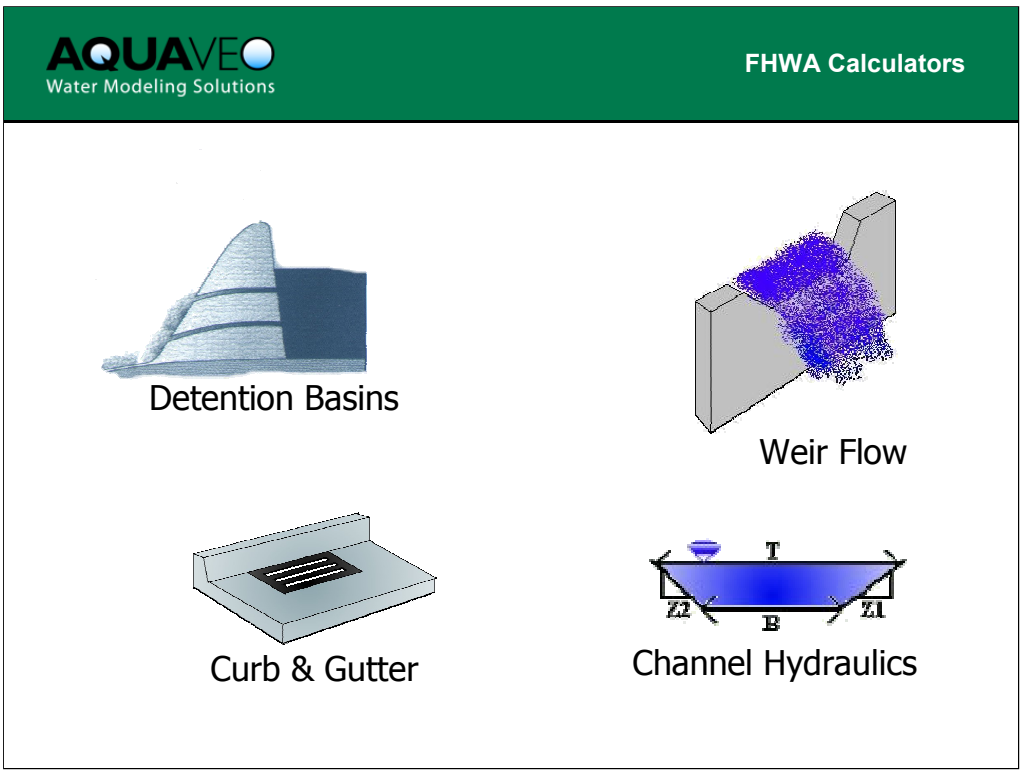
Parameter Calculations



Many of the hydrologic input parameters (area, curve number, lag time, etc.) can be computed directly from the digital terrain model. WMS includes a complete graphical user interface to view/edit these and all other model parameters. Properly formatted input files are written from WMS for model execution.



In addition to the commonly used hydrologic modeling programs such as HEC-1, and TR-20, WMS includes a variety of hydrologic/hydraulic calculators.

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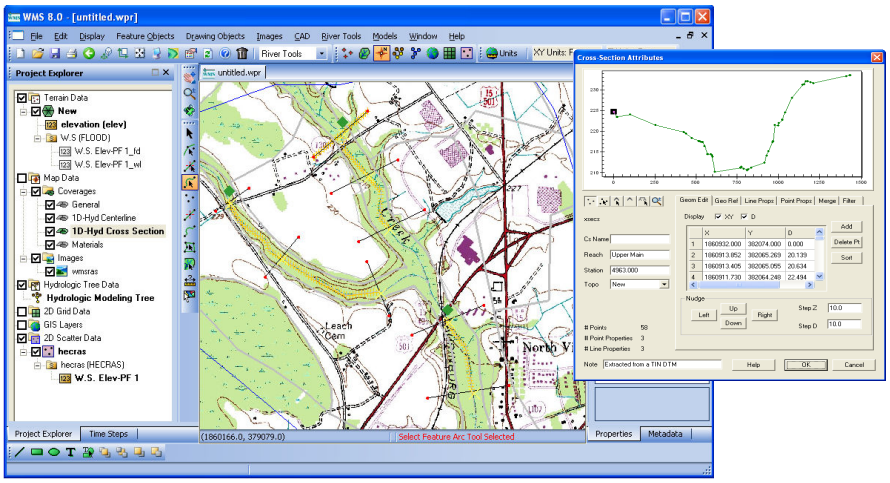
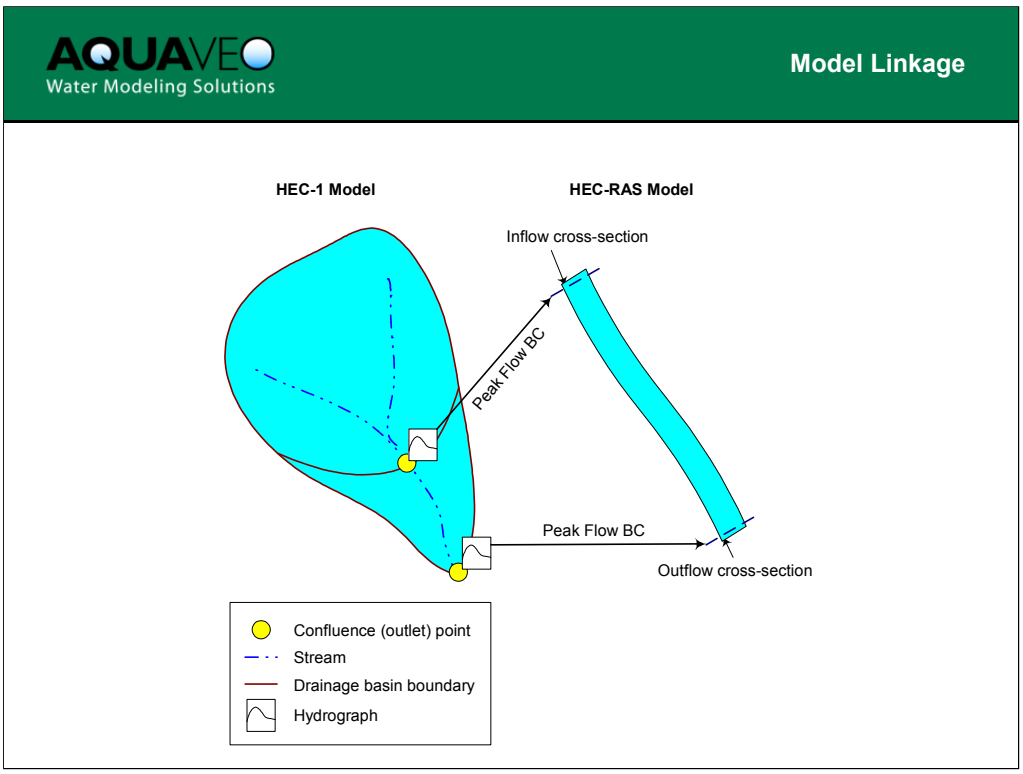
Extraction of Hydraulic Modeling Geometry



Hydraulic models can be developed from a conceptual model using geographic feature lines to represent centerlines and banks in one layer, and cross section lines in a second layer. A material's properties (Manning's roughness values) can be developed from land use or soils layers and then have cross sections extracted with important point (thalweg and banks) line (material zones) properties automatically mapped. This data can then be passed to HEC-RAS for construction of a complete hydraulic model.



You can link the results of a HEC-1 model with the flow rate boundary conditions of a HEC-RAS model. Modeling parameters such as precipitation, curve number, and Manning's roughness can then be varied and multiple models run in order to quantify the uncertainty in model results.

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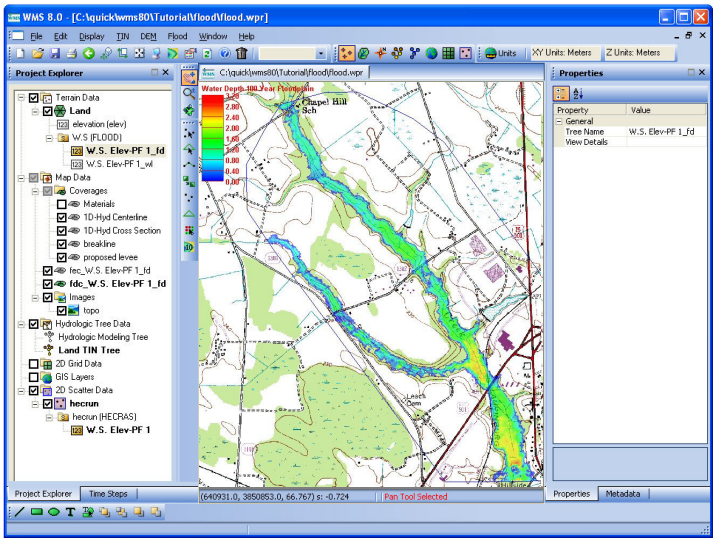
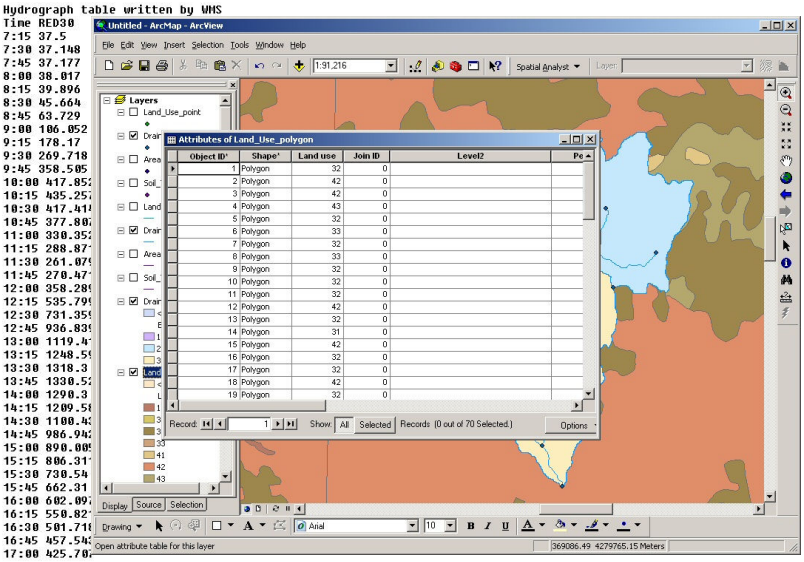
Floodplain Delineation



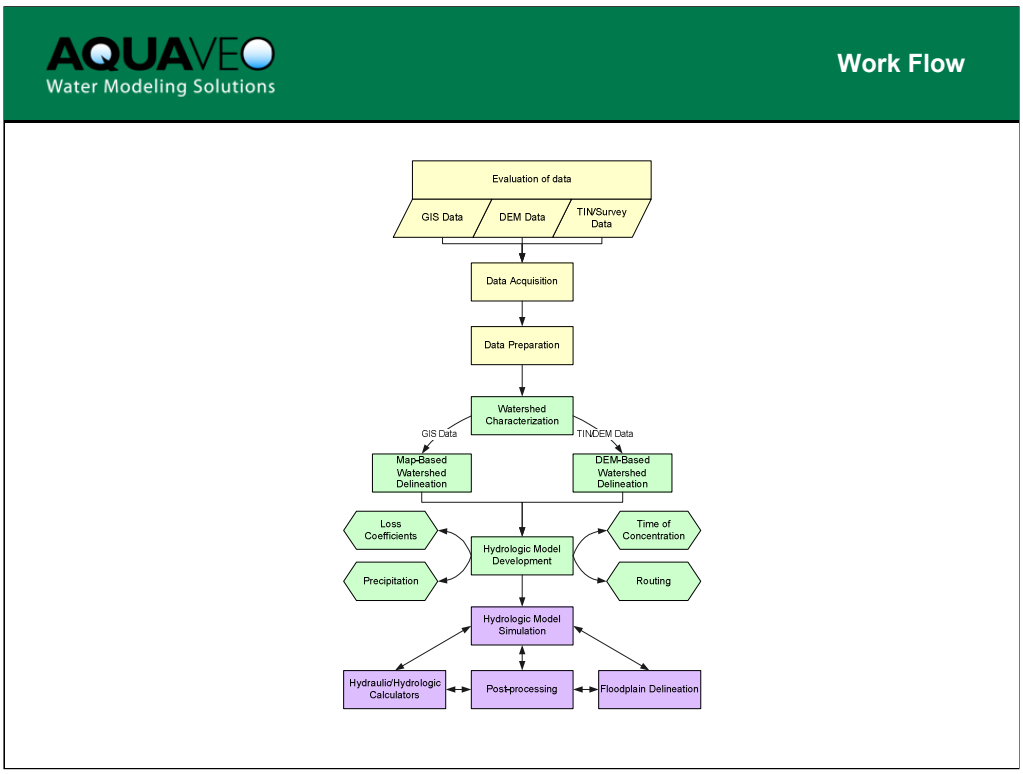
With computed water surface elevations floodplain extent and depth maps can be developed.



All of the interfaces supported produce hydrographs or peak flow data that can be graphed in WMS. Hydrograph and other data can also be exported for use in standard spreadsheet software.

Reports may also be created summarizing the results of an analysis. These reports can typically be exported to text (.txt) files or copied to the clipboard for inclusion in other documents.

One of the best ways to manage data used in hydrologic modeling is with a GIS. WMS includes a free extension to the popular ArcView® GIS software called WMSHydro. This extension can be used to prepare land use, soil, or elevation data for use by WMS and it can also be used to manage/view results produced by WMS.



This diagram illustrates the typical work flow for WMS projects. The work flow is divided into three separate parts:

1. Data evaluation, collection, and preparation
2. Watershed characterization and hydrologic parameter development from digital data sources
3. Hydrologic model simulation and post processing of results

WMS specializes in the second part and therefore most of the course will concentrate on the processes listed in these boxes. Individual lessons throughout the course will focus on one or two of the boxes in the work flow process; at the beginning of each lesson we will refer back to this diagram so that you can understand how the material in a given lesson fits into the overall WMS modeling process better.

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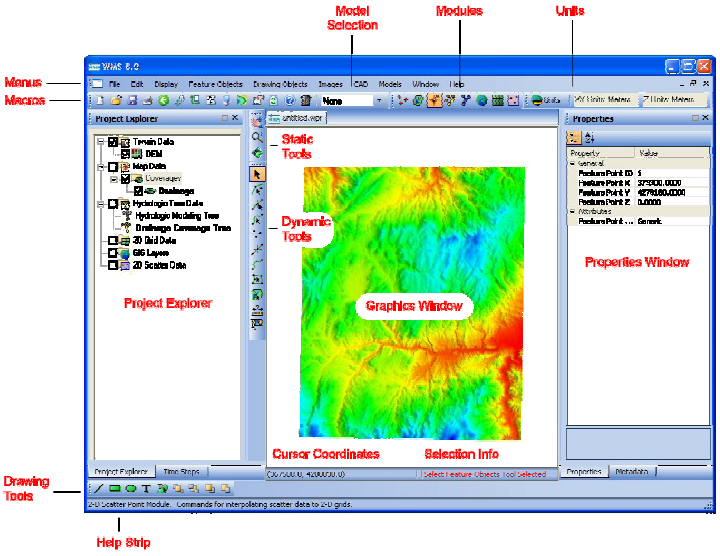
WMS Layout



The WMS graphical user interface (GUI) is outlined in this slide.

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Getting Around the GUI

- Menus
- Modules
- Project Explorer
- Tools
- Zoom/Pan/Rotate
- Display Options
- Contour Options
- Saving a Project File
- Documentation

A special section in the online help provides the necessary information and detail for getting around in the WMS GUI. This section is accessed by choosing the WMS Help command from the Help menu and locating the "Getting Around" page under the General book (it is also a hyper-link from the default page in the Help File).

The list items shown on this slide are all discussed on this page and will be reviewed in the next demonstration.

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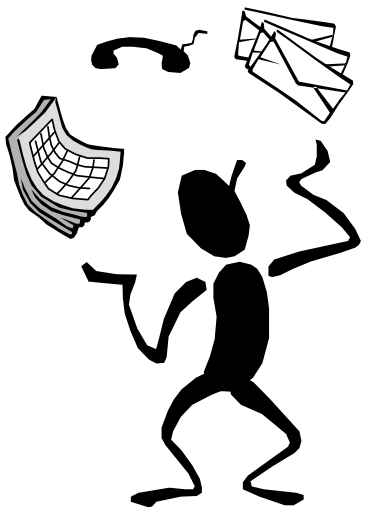
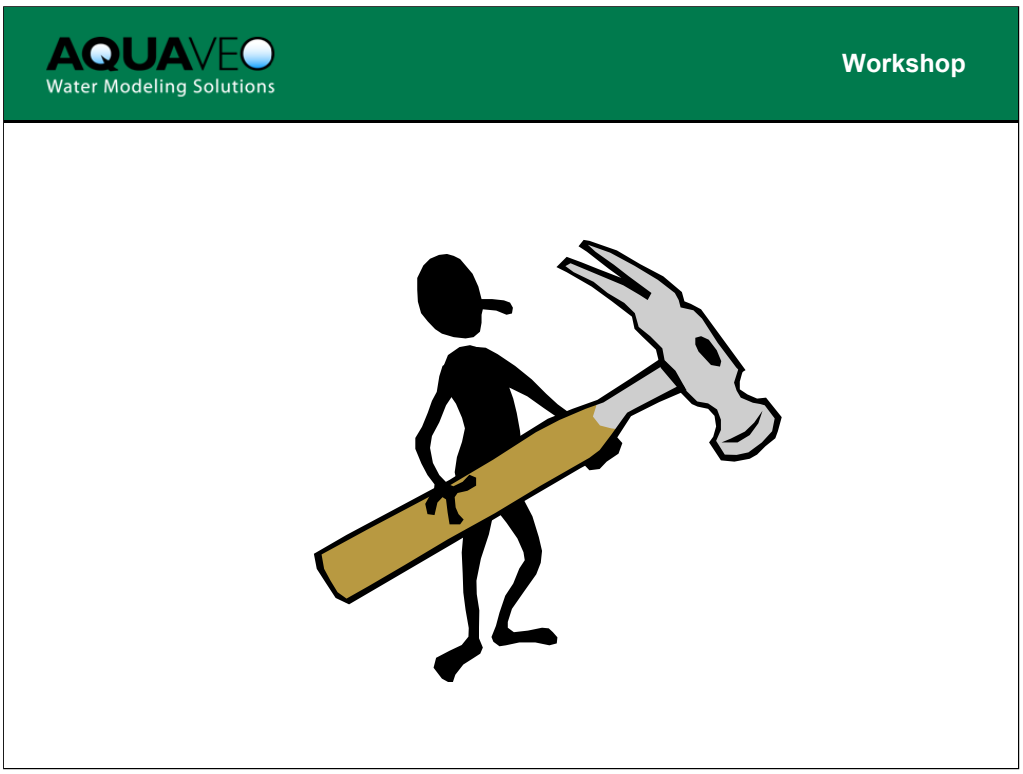
Demonstration



The previous slides reviewed some of the basics of the WMS GUI and during this demonstration we will try and illustrate them. Be sure and ask questions about things you do not understand or are curious about.



The files that will be used for this workshop can be found in the tutorials directory under **demdelin**.

- Objectives
  - List the advantages of automated watershed delineation using WMS
- Applications