waterloo hydrogeologic
SOFTWARE · CONSULTING · TRAINING

WHI E-News
Waterloo Hydrogeologic Inc.

2004 September Edition

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» Contaminated Site Risk Assessment and Groundwater Modeling
» Finite Element Groundwater Modeling
» The Human Health Risk Assessment Course
» GIS Data Management for Groundwater Modelers
» Regulatory Review of Hydrogeology Studies
» The Remediation Course
» Natural Attenuation Risk Assessment & RBCA
» The New MODFLOW Course

Tips & Tricks

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Waterloo Hydrogeologic, Inc. is a recognized leader in the development and application of environmental software and services.

Click here to get your copy today!

We want your articles! Please send your groundwater related article to us today!

Product News

Waterloo Hydrogeologic presents...
FEFLOW - Advanced Finite Element Modeling

The Modeling Challenge...

Many models, including the USGS's MODFLOW and MODPATH, and the popular contaminant transport program MT3D, have become almost worldwide standards. However, when faced with projects involving complex topography, complicated geology, fractures, unsaturated flow, density-dependent flow, or thermal convection, these models have proven to be less than ideal.

The Solution...

FEFLOW is an advanced 3D finite element modeling program ideally suited to handle the complex modeling environments, such as those found in India, Spain, U.S.A, Japan, Australia and New Zealand. Our Australian clients, including professional consultants, government agencies, and educational institutions, are currently applying FEFLOW to the following types of projects:

- **Studying seawater intrusion**
- **Determining the effects of mine dewatering**
- **Delineating wellhead protection areas**
- **Estimating contaminant migration pathways**
- **Designing groundwater remediation systems**

For a FREE demo, or to order your copy of FEFLOW, please contact a Waterloo Hydrogeologic Sales Representative today!

Maintenance & Upgrades are available.
Please call for details!

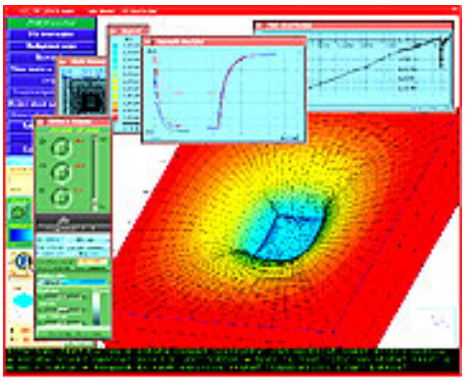
Order Today!

Call us at 519-746-1798
Or order online

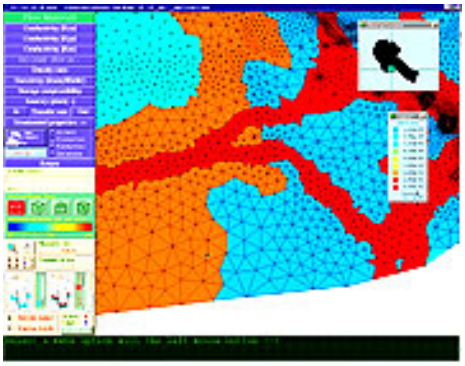
ORDER NOW

WHI Signs New Distributor in Mexico

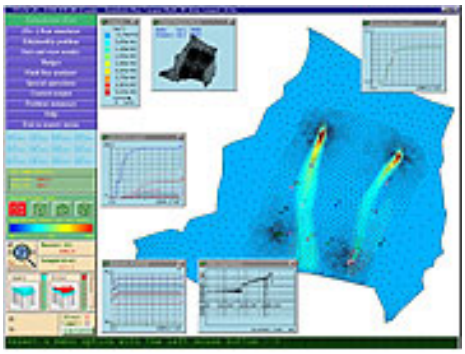
Waterloo Hydrogeologic, Inc. (WHI) is proud to announce the addition of **Grupo LDI, S.A. DE C.V.** as an authorized distributor of WHI Software in Mexico. Grupo LDI has been serving the software and hardware needs of the Mexican marketplace since 1997. Presently, Grupo LDI is diversifying to include the distribution, promotion and sale of specialty software products for the environmental industry in Mexico. We anticipate that with their combination of computer software and hardware knowledge, and excellent market reach, Grupo LDI will be very successful in distributing environmental software products to the



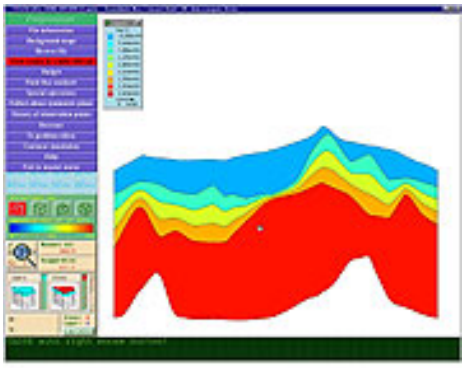
Mine Dewatering



Model Properties



Contaminant Plumes



Complex Geology

Mexican market.

To find out more about Grupo LDI, please visit their website www.ldi.com.mx . You may also contact Dario Moya by phone at 01152-55-5234-0909, or by email at idario@ldi.com.

If you are interested in becoming an authorized WHI Distributor, please contact Phil Stefanoff by phone at +1-519-746-1798, or by email at pstefanoff@waterloohydrogeologic.com.

For more information about **FEFLOW**, visit our website or contact us:
http://www.waterloohydrogeologic.com/software/feflow/index.htm

For more information about our software, please visit our website or contact us today:
Website: http://www.waterloohydrogeologic.com/software/software_main.htm
Email: sales@waterloohydrogeologic.com
Phone: (519) 746-1798

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Consulting News

Source Water Protection Initiatives Gain Momentum

Waterloo Hydrogeologic's consulting staff are providing clients with innovative and effective solutions that are key to the success of source water protection initiatives. The focus of several current projects includes:

- **Characterizing groundwater resources**
- **Water budget quantification and future scenario assessment**
- **Delineating wellhead protection areas around municipal wells**
- **Mapping of aquifers that are susceptible to contamination**
- **Water quality data management**
- **Identifying potential point and non-point sources of groundwater contamination**

GIS Mapping to Support Land Use Policy Development.

Groundwater characterization and GIS/modeling analyses developed by

our staff have advanced the level of understanding of groundwater resources at a watershed scale, and defined wellhead protection areas at local scales. The results of these studies are supporting the development of environmental and land use policies, and local and regional groundwater protection strategies. As source water protection initiatives gain momentum, our consulting staff is establishing a solid reputation for providing clients with the required technical analyses and innovative graphics to support such initiatives.

WHI's team of dedicated professional consultants includes geologists, hydrogeologists, and engineers, with specialties ranging from physical and geochemical hydrogeology to complex numerical modeling, and expertise in:

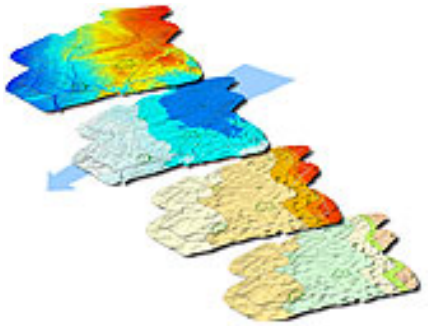
- **GIS and Environmental Data Management**
- **Watershed Management and Source Protection**
- **Site Characterization and Risk Assessment**
- **Contaminated Site Solutions**
- **Environmental Solutions for Mining**
- **Model Review and Litigation Support**
- **Advanced Groundwater Modeling**

Our consulting team would be glad to discuss how we can help with your source protection, watershed management, and groundwater modeling requirements. Please see our contact information below.

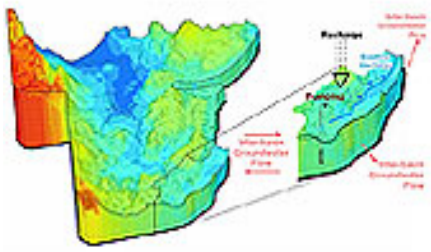
Attention Canadian Groundwater Professionals

The recently published document titled "Canadian Framework for Collaboration on Groundwater" is being distributed to groundwater professionals across Canada. A National Ad Hoc Committee - with the leadership of the Geological Survey of Canada - developed this document, which identifies goals and outlines strategic directions toward an interagency framework for collaboration. It is intended to form the basis for securing the fundamental information necessary to manage and protect groundwater resources, and for obtaining the collaborative insight, participation, and guidance of partners and stakeholders to develop the key ideas, concepts, and programs that can be strategically implemented over time.

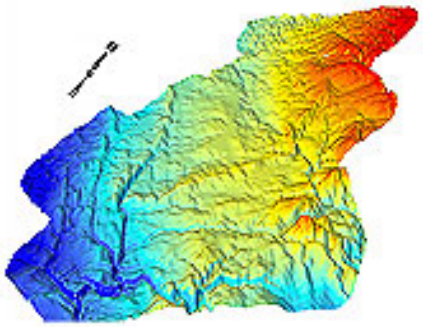
The document is being distributed to public and private sector groundwater professionals through various channels. It is available from Geological Survey of Canada offices and on their website at www.gscq.nrcan.gc.ca/cgsi. If you are a groundwater consultant you can obtain a copy from WHI by contacting Bill Banks in our Consulting Division by telephone at (519) 746-1798 ext. 285 or by e-mail at consulting@waterloohydrogeologic.com. Bill was a member of the extended National Ad Hoc Committee as a representative of the consulting industry. He welcomes comments from fellow consultants related to this document and the proposed national initiative.



GIS Data Integration



Sub-basin Water Budget Assessment



3D Visualization to Emphasize Important Features

Canadian Framework for
Collaboration on Groundwater

Click here to get your copy today!

For more information related to this topic, or if you would like more information about WHI's Consulting activities and capabilities, please visit our website or contact us today:
Website: www.waterloohydrogeologic.com/consulting/consulting_services.htm
Email: consulting@waterloohydrogeologic.com
Phone: (519) 746-1798

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Training News

WHI's Line-Up of Environmental & Groundwater Modeling Courses!

The 2004 Waterloo Hydrogeologic Open Enrollment schedule has been set. In response to comments from groundwater professionals who have taken our Groundwater Modeling Courses in the past, and those who would like to attend courses in the future, WHI has combined the strengths of our previous Groundwater Modeling, Advanced Groundwater Modeling, and Model Calibration courses into one Applied Groundwater Flow & Contaminant Transport Modeling course. This course includes updated lecture material, as well as new hands-on laboratories to support the new course material. WHI has also created a new short course entitled GIS Data Management for Groundwater Modelers, which teaches the theory and hands-on application of GIS data integration and interpolation to support groundwater modeling efforts, as well as 3-dimensional visualization of modeling results in both the Visual MODFLOW and GIS environments.

Click on the titles below and see which courses are appropriate for you!

» Applied Groundwater Flow & Contaminant Transport Modeling - **NEW**
» Groundwater Contamination & Remediation - **UPDATED**
» Finite Element Groundwater Modeling - **UPDATED**
» Aquifer Test Analysis - **NEW**
» Unsaturated Zone Modeling and Evaluation of Landfill Impacts - **UPDATED**
» The Human Health Risk Assessment Course - **NEW**
» Water Quality Data Management & Modeling - **UPDATED**
» Regulatory Review of Hydrogeology Studies - **UPDATED**
» GIS Data Management for Groundwater Modelers - **NEW**

Who Can Benefit?

» Experienced hydrogeologists with no prior groundwater modeling experience
» Regulators who review modeling reports
» Managers who want to understand what the modelers are doing
» Experienced modelers who want to enhance their skills
» Students who want to acquire new skills
» Lawyers who want to understand some of the technical issues
» Industry professionals who want to understand more about what their consultants are telling them

For further details on any of these courses, please visit our website, or contact Miln Harvey, WHI Training Manager, at (519) 746-1798 x233.

Can't make one of our Open Enrollment Courses? Call us about our On-Site Custom courses designed to suit your specific needs!

Course Title	Dates/Locations
APPLIED GROUNDWATER FLOW & CONTAMINANT TRANSPORT MODELING  **Theory and Hands-on Applications using MODFLOW-2000, MODPATH, MT3D & WinPEST** Simple to complex applications of groundwater flow and contaminant transport models are covered in this 4-day hands-on course. Groundwater resource topics include model development and calibration to groundwater heads and flows, new well development, capture zone delineation, well interference, and stream impact investigations. Contaminant transport topics include model development and calibration to contaminant concentration, source area design, concentration boundary choice, solver comparison, and 3D visualization of flow and transport results. This course is ideally suited for hydrogeologists and modelers with some field investigation and modeling experience who wish to advance their modeling knowledge, and whose responsibilities include model development, review, planning, and project management. **Course Objectives and Benefits** » Apply Visual MODFLOW Pro to 3D groundwater flow and contaminant transport projects » Use MODFLOW-2000 to develop several groundwater flow models » Calibrate your groundwater models to observed field data » Use MODPATH particle tracking features to determine preferential flow paths and delineate capture zones » Use ZoneBudget to assess subregional water budgets within your groundwater model » Simulate 3D contaminant transport using RT3D, MT3DMS & MT3D99 » Use WinPEST to improve model calibration and understand model uncertainty	Waterloo, Ontario Canada Sept 14 - 17, 2004 Santiago, Chile Oct 5 - 8, 2004 Kraków, Poland Oct 11 - 14, 2004 NGWA - AFTM Princeton, NJ Oct 25 - 28, 2004 Braunfels, Germany Oct 26 - 29, 2004 Tokyo, Japan Oct 26 - 29, 2004 Rome, Italy Oct 26 - 29, 2004 Sicily Nov 2 - 5, 2004 Adelaide, Australia Nov 23 - 26, 2004 Juarez, Mexico Nov 23 - 26, 2004 Register Now

CONTAMINATED SITE RISK ASSESSMENT AND GROUNDWATER MODELING

Transport Processes, Natural Attenuation and Risk Assessment

This course provides a more complete understanding of groundwater contamination and remediation, and the use of fate and transport models and risk assessment software for analysis. Topics that will be covered include contaminant source area characterization, the risk assessment process, the fundamentals of natural attenuation, and risk-based corrective action. This course is suited for groundwater modelers and risk assessors who wish to develop a better understanding of groundwater contamination and remediation, the risk assessment process, and the use of groundwater models to assess risk-based site-specific standards and contaminant remediation.

Course Objectives and Benefits

» Define the Risk Assessment process and Risk-Based Corrective Action
» Enhance your understanding of contaminant transport and natural attenuation processes
» Detail how to quantify the potential risks of exposure to chemical contaminants
» Link fate and transport models to risk-based decision making models
» Quantitatively assess human health and ecological risk from environmental contaminants
» Define site-specific target levels (SSTLs) for site clean-up goals

Ostrava, Czech Republic
Sept 7 - 10, 2004

Gent, Belgium
Oct 26 - 29, 2004

Madrid, Spain
November 16 - 19, 2004

Register Now

FINITE ELEMENT GROUNDWATER MODELING

Advanced Applications for Saturated/Unsaturated Flow & Transport, Density-Dependent Flow, and Heat Transport

Advanced applications of groundwater flow and contaminant transport models using the Finite Element method are covered in this 4-day hands-on course. This course provides a more complete understanding of the use and applicability of finite elements in groundwater modeling, and includes such topics as groundwater flow and transport modeling, principles of unsaturated flow, fracture flow modeling, thermal transport, and density-dependent flow modeling. This course is ideally suited for groundwater modelers who wish to advance their modeling knowledge, and apply finite elements-using FEFLOW- to more complex modeling designs.

Course Objectives and Benefits

» Understand when to use finite-element vs. finite-difference modeling
» Apply FEFLOW to 3D groundwater flow and contaminant transport problems
» Simulate unsaturated zone flow using FEFLOW
» Simulate density-driven groundwater flow (e.g. saltwater intrusion) using FEFLOW
» Simulate fracture flow modeling using FEFLOW, and compare to a research case study
» Introduce the Interface Manager and the concept of model calibration to observed field data

Waterloo,Canada
Nov 2 - 5, 2004

Register Now

THE HUMAN HEALTH RISK ASSESSMENT COURSE

Practical Approaches to Estimating Risk & Developing Site-Specific Target Levels

An introduction to the use of RISC Workbench for completing human health risk assessments is covered in this 2-day course of lectures and hands-on exercises. Topics that will be covered include hazard identification, exposure assessment, dose-response assessment, and risk characterization. Lectures and exercises will be presented in partnership with Lynn Spence, the developer of RISC Workbench. This course is suited for risk assessors who wish to develop a better understanding of the risk assessment process and the use of groundwater models and RISC Workbench software for completing a human-health risk assessment.

Course Benefits

» Learn the fundamentals of accepted risk assessment protocols
» Acquire lots of hands-on experience using the RISC Workbench software
» Understand the practical aspects of conducting a risk assessment
» Learn from an experienced risk assessment professional with worldwide experience

Cambridge, UK
Sept 28 - 29, 2004

Auckland, New Zealand
Nov 18 - 19, 2004

GIS DATA MANAGEMENT FOR GROUNDWATER MODELERS

Understanding Data Sources, Data Analysis and Visualization

This 3-day hands-on course presents an introduction to the management and analysis of groundwater data for Visual MODFLOW modelers. Topics include the data types used in groundwater models, the coordinate systems, datums and map projections in a GIS, the interpolation of data within the GIS (kriging, natural neighbor analysis, …), the development of model layers (cross-sectional analysis of site hydrogeology) and parameter fields for groundwater model construction, and the import and export of different types of data from the GIS system to the groundwater model and back to the GIS system. Other topics that will be covered include 2-D and 3-D visualization of model input and model output. This course is ideally suited for groundwater modelers who wish to develop a comprehensive understanding of the sources of data that are used in groundwater models, the interpolation of this data for modeling, and the interchange of information between the groundwater model and the GIS system.

Course Objectives and Benefits

» Understand the integration between the GIS system and Visual MODFLOW
» Assess the applicability of MapInfo, Surfer and HydroAnalyst for developing a GIS
» Use HydroGeo Analyst to develop model cross-sections and layer interfaces

Waterloo, Canada
Dec 14 - 16, 2004

» Use HydroGeo Analyst to interpolate layer elevations and export them to Visual MODFLOW
» Export Visual MODFLOW results to GIS and prepare report figures
» Develop animation files of Visual MODFLOW results and insert them into client presentations

REGULATORY REVIEW OF HYDROGEOLOGY STUDIES

Approaches and Insights for Reviewing Modeling Reports

The overall objective of this course is to give regulators a greater understanding of how models work, and what to look for when reviewing a modeling report. Specifically, the objectives are as follows:

» To understand the uses and applications of numerical models
» To understand the uses and applications of the analytical WHPA model
» To have a practical basis for reviewing models
» To identify the points of focus for reviewing a modeling study
» To recognize when review by a specialist is required

The content of this course will be applicable to the following areas:

» Alternatives for landfill or septic system design
» Prediction of contaminant movement and impact from landfills, septic systems, and contaminated sites
» Selection of remediation alternatives
» Delineation of well capture zones and groundwater protection areas
» Assessment of impacts from large groundwater extractions, and pit and quarry development in the context of the Permit To Take Water Program (PTTW) and groundwater interference investigations

These applications could include review of modeling studies submitted by consultants, evaluation of workplans submitted by owners/proponents, and specification of modeling requirements for tendering hydrogeological studies.

Waterloo, Canada
Sept 21 - 24, 2004

Register Now

THE REMEDIATION COURSE

Princeton Groundwater's Remediation Course is the most comprehensive course on remediation available. Every aspect of this important subject is covered, from three-dimensional hydrogeochemical characterization, through practical details of all remediation technologies, to computer-simulated remedial alternatives such as Natural Attenuation, Pump & Treat, Funnel & Gate, Interceptor Trenches, and complete Hydraulic Containment using barriers and capping. The course also covers many essential topics, which are not found in any other courses or books. The Remediation Course uniquely integrates the topics of heterogeneous geohydrology, aquifer/source/plume characterization, remediation technologies/strategies/designs, and computer simulation software.
The result is the premier course on remediation.

Course Objective
The objective of this course is to teach remediation from the key methodologies to collect hydrogeochemical data, through selecting and designing remediation systems based on

Oct. 4 - 8, 2004
Orlando, FL

Register Now

geological and biological effects and air/water carriers. In addition, participants will use computers to simulate remediation hydrology, groundwater pathways, capture zones, mass transport, natural attenuation, and alternative remediation designs

Who Should Attend
The course is designed for groundwater geologists, engineers, hydrologists, and microbiologists working as project managers, regulators, or consultants to industry or government. Some technical background and experience in groundwater contamination problems is presumed.

Natural Attenuation Risk Assessment & RBCA

Analysis and Decision Making Through Applied Ground Water Modeling

Course Description
This course will comprehensively review and apply the major software packages that have applications in risk assessment, natural attenuation, and risk-based corrective action (RBCA). The theory underlying the software will be taught by the leading instructors in the field. The data needs for the models and the field methods to obtain them will also be covered. Practical applications will be emphasized, with the software treated as a technical tool to be applied with professional analysis, interpretation and judgment. The recognized standard multi-dimensional numerical and analytical models will be used in the handson computer laboratory sessions of the course to solve problems based on actual consulting case histories. Model applicability and limitations in analysis and decision making for natural attenuation and risk assessment problems will be shown. A major goal of the course program is obtaining a working knowledge of each software package and applying it in a hands-on computer session to obtain practical results that you would use on a typical project.

Who Should Attend

- Ground water hydrologists
- Risk assessors
- Regulators
- Remediation engineers
- Project managers
- Environmental consultants

Sept. 20 - 24, 2004
San Diego, CA

Register Now

To register for this course you must be a member of the NGWA, if you are not please call NGWA Customer Service at 800.551.7379, or email customerservice@ngwa.org.

The NEW MODFLOW Course

The MODFLOW Course Theory & Hands-on Applications using MODFLOW-2000, MODPATH, MT3D & WinPEST

Course Description

The course begins with an introduction to the ground water modeling process, providing lectures and hands-on exercises in topics that range from data sources and evaluation, conceptual model development, numerical model implementation and model calibration and prediction. Presentations alternate between the theory behind each course topic and practical exercises to implement the concepts using Visual MODFLOW Pro. This course is a hands-on course. Attendees will spend 2 ½ days of the 4-day course using the computer to complete exercises.

New exercises have been developed to show the attributes of MODFLOW-2000, MODPATH, ZoneBudget, MT3D and RT3D, and how they can be used as part of a hydrogeologic modeling analysis. The course then looks at automated parameter estimation using WinPEST to evaluate the quality of model calibration using error statistics to help decide when a model is calibrated. The course goes beyond these introductory topics and provides advice on how to develop a model efficiently, and how to choose appropriate parameter distributions and boundary conditions to effectively represent the groundwater flow system that is being modeled.

October 25-28, 2004
Princeton, New Jersey

Register Now

To register for this course you must be a member of the NGWA, if you are not please call NGWA Customer Service at 800.551.7379, or email customerservice@ngwa.org.

For our full 2004 training schedule, click here!

To request your free 2004 Training Course Schedule Catalog, click here!

For more information about our course offerings, visit our website or contact us today:
Website: www.waterloohydrogeologic.com/training/training.htm
Email: training@waterloohydrogeologic.com
Phone: (519) 746-1798

Tips & Tricks

Time Series Plots in AquaChem 4.0

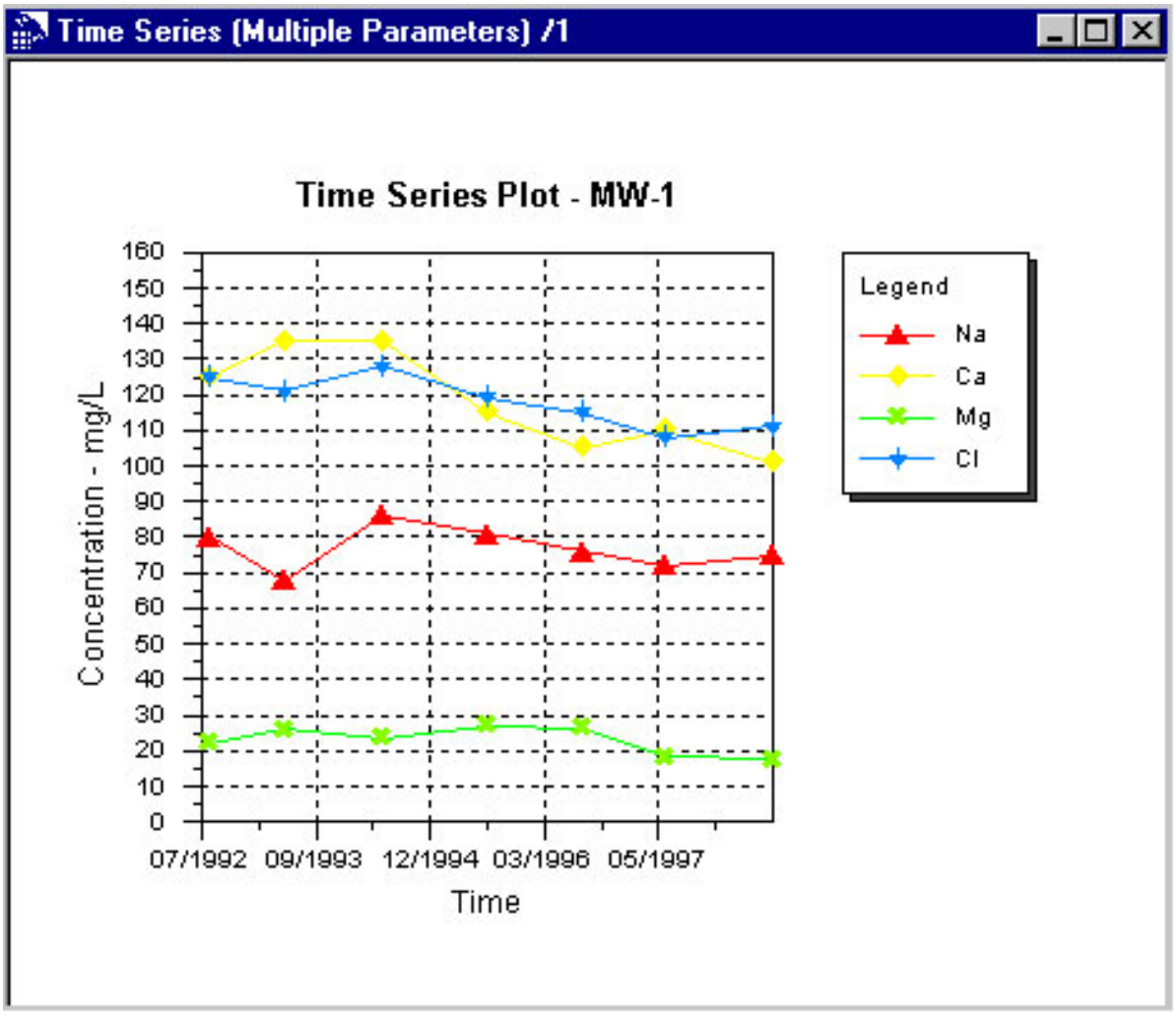
AquaChem is well known for its ability to effectively manage and analyze water quality data, and create popular geochemical plots including Piper, Durov, Stiff, and many others. But did you know that AquaChem can also be used to create Time Series plots?

The ability to demonstrate trends in chemical concentrations is a crucial part of any site investigation. In AquaChem there are two types of Time Series plots available:

- Concentrations of multiple chemicals over time, at a single sampling location (New in v.4.0)
- Concentration of a single chemical over time, at multiple sampling locations.

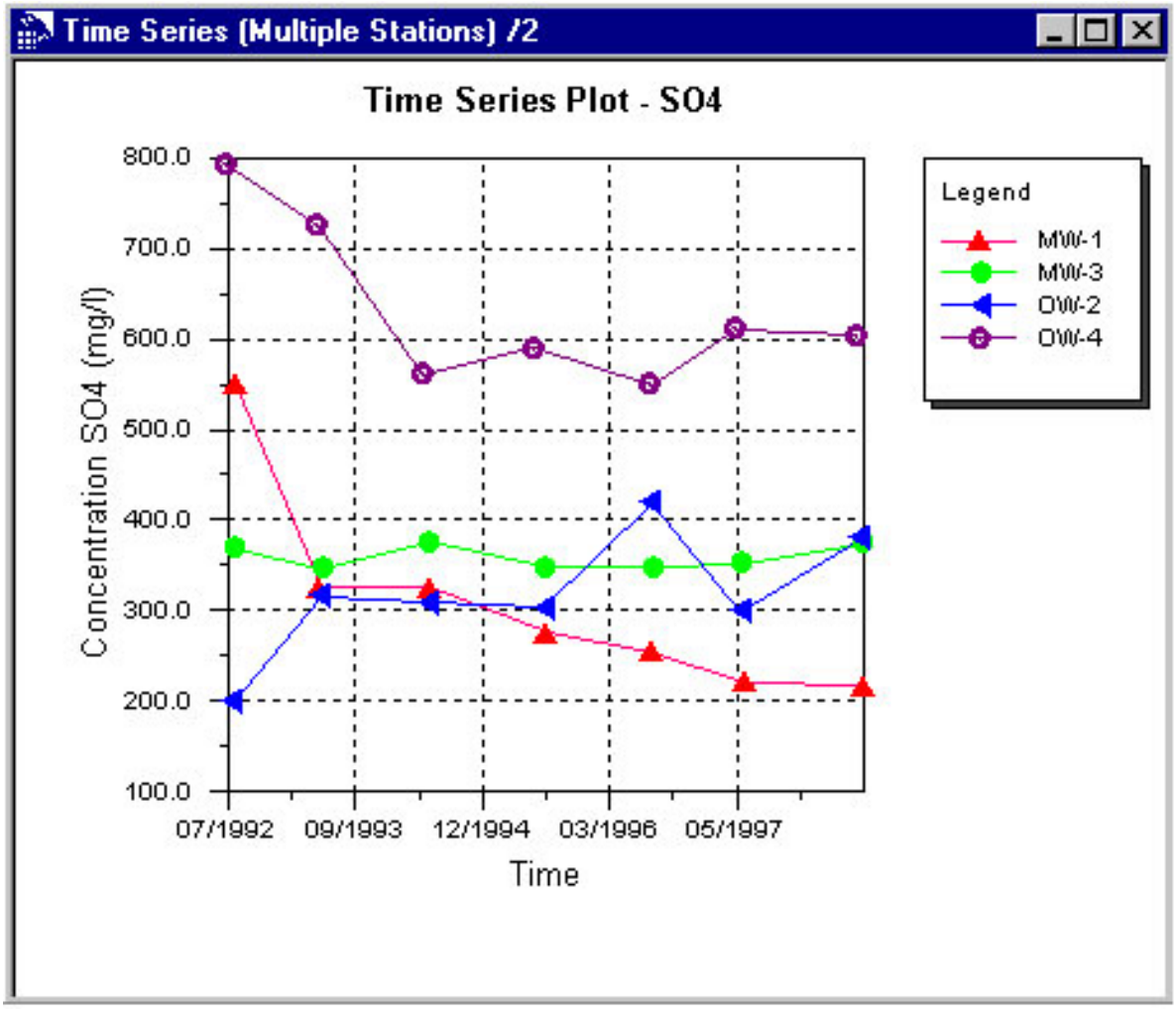
An example of each type is demonstrated below:

Time Series Plot 1: Multiple chemicals (Na, Ca, Mg, Cl) at one station (MW-1)



This example demonstrates chemical trends of some major ions, at one monitoring well, during the sample period 1992 - 1998.

Time Series Plot 2: One chemical (SO4) at multiple stations MW-1, MW-3, OW-2, OW-4



This example demonstrates chemical trends of SO4, at all the site sampling stations, during the sampling period 1992 - 1998.

If you are interested in learning more about Aquachem's capabilities, please browse to our website, or contact our Sales department.

For more information about this tip, contact us at:
Email: techsupport@waterloohydrogeologic.com

For more information about **AquaChem 4.0**, visit our website or contact us today:
Website: http://www.waterloohydrogeologic.com
Email: sales@waterloohydrogeologic.com
Phone: (519) 746-1798

Correction Notice

Please Note: The August 2004 E-News Tips and Tricks article was originally distributed with an error in its text.

The text (part of Problem #5) should read:

The distribution coefficient (λ, or sometimes called K, with units of 1/day), is typically obtained from half-life values, converted into appropriate units using the following relationship:

$\lambda = \ln(2)/t1/2$

Where t1/2 = half-life of the compound

The error was corrected on our Website immediately, however we apologize for any confusion this error may have caused our readers who received the newsletter via email.

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Thank you for reading this month's edition of WHI E-News! For more information about our products and services please use the links below!

Visit our Website - See what Waterloo Hydrogeologic Inc. has to offer!

Software Division - Check out our groundwater modeling software.

Consulting Division - Visit our Consulting Division on the web to see how we can help you.

Training Division - Visit our Training Division on the web to find a course in your area.

Equipment Division - WHI is now selling groundwater monitoring equipment.

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waterloo hydrogeologic
SOFTWARE · CONSULTING · TRAINING

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