

## USGS Training Resources for Ground-Water Hydrology

**Resources listed include reports, videotapes, and self-study manuals.**

### I. General

1. Heath, R.C., 1983, Basic ground-water hydrology: U.S. Geological Survey Water-Supply Paper 2220, 84 p. (available on the Internet at <http://pubs.usgs.gov/wsp/wsp2220/>)
2. Franke, O.L., Reilly, T.E., Haefner, R.J., and Simmons, D.L., 1990, Study guide for a beginning course in ground-water hydrology: part 1-- course participants: U.S. Geological Survey Open-File Report 90-183, 184 p. (available on the Internet at <http://pubs.usgs.gov/of/ofr90-183/>)
3. Franke, O.L., Reilly, T.E., Buxton, H.T., and Simmons, D.L., 1993, Study guide for a beginning course in ground-water hydrology: part 2-- instructor's guide: U.S. Geological Survey Open-File Report 92-637, 128 p. (available on the Internet at [http://pubs.usgs.gov/of/ofr\\_92-637/](http://pubs.usgs.gov/of/ofr_92-637/))

### II. Ground-Water Hydraulics

1. Bennett, G.D., 1976, Introduction to ground-water hydraulics — A programmed text for self-instruction: Techniques of Water-Resources Investigations of the United States Geological Survey, Book 3, Chapter B2, 172 p. (available on the Internet at <http://pubs.usgs.gov/twri/twri3-b2/>)
2. Franke, O.L., Reilly, T.E., and Bennett, G.D., 1987, Definition of boundary and initial conditions in the analysis of saturated ground-water flow systems--An introduction: U.S. Geological Survey Techniques of Water-Resources Investigations 3-B5, 15 p. (available on the Internet at <http://pubs.usgs.gov/twri/twri3-b5/>)

### III. Aquifer Tests and Radial-Flow Simulation

1. Videotapes by USGS on "Determining Aquifer Properties"
  - #1. Burns, A.W., 1997, Aquifer Test Design, 15 min.
  - #2. Weeks, E.P., 1997, The Theis Equation, 39 min.
  - #3. Weeks, E.P., 1997, Theis Recovery Methods, 22 min.
  - #4. McLean, J.S., 1997, Aquifer Boundaries and the Theory of Images, 34 min.
  - #5. Riley, F.S., 1997, Leaky Aquifer Methods, part 1 - 46 min., part 2 - 38 min.
  - #6. Moench, A.F., 1997, Unconfined Methods, 48 min.
  - #7. Belitz, K.R., 1997, Slug Tests, 35 min.

Copies are available for purchase from the National Ground Water Association ([www.ngwa.org](http://www.ngwa.org)).

2. Barlow, P.M., and Moench, A.F., 1999, WTAQ—A computer program for calculating drawdowns and estimating hydraulic properties for confined and water-table aquifers: U.S. Geological Survey Water-Resources Investigations Report 99-4225, 74 p. (available on the Internet at [http://ma.water.usgs.gov/publications/WRIR\\_99-4225/index.htm](http://ma.water.usgs.gov/publications/WRIR_99-4225/index.htm))
3. Bennett, G.D., Reilly, T.E., and Hill, M.C., 1990, Technical training note in ground-water hydrology: Radial flow to a well: U.S. Geological Survey Water-Resources Investigations Report 89-4134, 83 p. (available on the Internet at <http://pubs.er.usgs.gov/pubs/wri/wri894134>)
4. Bentall, Ray (compiler), 1963, Methods of determining permeability, transmissibility and drawdown: U. S. Geological Survey Water-Supply Paper 1536-I, p. 243-341. (available on the Internet at <http://pubs.er.usgs.gov/pubs/wsp/wsp1536I>)
5. Ferris, J.G., Knowles, D.B., Brown, R.H., and Stallman, R.W., 1962, Theory of aquifer tests: U. S. Geological Survey Water-Supply Paper 1536-E, 174 p. (available on the Internet at <http://pubs.usgs.gov/wsp/wsp1536-E/>)
6. Lohman, S.W., 1972, Ground-Water Hydraulics: U. S. Geological Survey Professional Paper 708, 70 p.

#### **IV. Ground-Water Flow Simulation**

1. Franke, O.L., Bennett, G.D., Reilly, T.E., Laney, R.L., Buxton, H.T., and Sun, R.J., 1991, Concepts and modeling in ground-water hydrology -- A self-paced training course: U.S. Geological Survey Open-File Report 90-707, 416 p. (available on the Internet at <http://pubs.er.usgs.gov/pubs/ofr/ofr90707>)  
(A little outdated because of the units used and the references provided, but still a useful training document.)
2. Hsieh, P.A., 2001, TOPODRIVE and PARTICLEFLOW—Two computer models for simulation and visualization of ground-water flow and transport of fluid particles in two dimensions: U.S. Geological Survey Open-File Report 01-286, 30 p. (available on the Internet at <http://water.usgs.gov/nrp/gwsoftware/tdpf/tdpf.html>)  
(These programs are not intended to be comprehensive modeling tools, but are designed for modeling at the exploratory or conceptual level, for visual demonstration, and for educational purposes.)
3. Reilly, T.E., 2001, System and boundary conceptualization in ground-water flow simulation: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 3, Chapter B8, 26 p. (available on the Internet at [http://pubs.usgs.gov/twri/twri-3\\_B8/](http://pubs.usgs.gov/twri/twri-3_B8/))

## V. Data Collection

1. Koterba, M.T., 1998, Ground-Water data-collection protocols and procedures for the National Water-Quality Assessment Program: Collection, documentation, and compilation of required site, well, subsurface, and landscape data for wells: U.S. Geological Survey Water-Resources Investigations Report 98-4107, 91 p.
2. Lapham, W.W., Wilde, F.D., and Koterba, M.T., 1997, Guidelines and standard procedures for studies of ground-water quality: Selection and installation of wells, and supporting documentation: U.S. Geological Survey Water-Resources Investigations Report 96-4233, 110 p. (available on the Internet at <http://water.usgs.gov/owq/pubs/wri/wri964233/>)
3. National Field Manual for the Collection of Water-Quality Data: Techniques of Water-Resources Investigations of the United States Geological Survey, Book 9 (available on the Internet at <http://water.usgs.gov/owq/FieldManual/>)
4. Shuter, Eugene, and Teasdale, W.E., 1989, Application of drilling, coring, and sampling techniques to test holes and wells: Techniques of Water-Resources Investigations of the United States Geological Survey, Book 2, Chapter F1, 97 p. (available on the Internet at <http://pubs.usgs.gov/twri/twri2-f1/>)

## VI. Geophysical methods

Online training in selected geophysical methods is available at the Geophysical Technology Transfer (G2T) web site at <http://water.usgs.gov/ogw/bgas/g2t.html>

Online modules are available on the Geophysical Technology Transfer (G2T) web site for:

1. Borehole imaging
2. Vertical-Radar profiling (VRP)
3. 2D-Resistivity
4. Electromagnetic Induction
5. Continuous Seismic-reflection profiling
6. Continuous-Resistivity Profiling

## VII. Some classic USGS publications on selected topics that may be dated but are excellent foundational documents.

Brown, R.H., 1963, The cone of depression and the area of diversion around a discharging well in an infinite strip aquifer subject to uniform recharge: in Shortcuts and special problems in aquifer tests, Ray Bentall (compiler): U.S. Geological Survey Water-Supply Paper 1545-C, p. C69-C85.

Cooper, H.H., Kohout, F.A., Henry, H.R., and Glover, R.E., 1964, Sea water in coastal aquifers: U.S. Geological Survey Water-Supply Paper 1613-C, 84 p. (available on the Internet at <http://pubs.er.usgs.gov/pubs/wsp/wsp1613C>)

Ferris, J.G., Knowles, D.B., Brown, R.H., and Stallman, R.W., 1962, Theory of aquifer tests: U. S. Geological Survey Water-Supply Paper 1536-E, 174 p. (available on the Internet at <http://pubs.usgs.gov/wsp/wsp1536-E/>)

Konikow, L .F., and Grove, D.B., 1977, Derivation of equations describing solute transport and dispersion in ground water: U. S. Geological Survey Water-Resources Investigations 77-19, 30 p. (available on the Internet at <http://pubs.er.usgs.gov/pubs/wri/wri7719>)

Lohman, S.W., 1972, Ground-Water Hydraulics: U. S. Geological Survey Professional Paper 708, 70 p.

Lohman, S.W., and others, 1972, Definitions of selected ground-water terms – Revisions and conceptual refinements: U.S. Geological Survey Water-Supply Paper 1988, 21 p. (available on the Internet at [http://pubs.usgs.gov/wsp/wsp\\_1988/](http://pubs.usgs.gov/wsp/wsp_1988/))

McDonald, M.G., and Harbaugh, A.W., 1988, A modular three-dimensional finite-difference ground-water flow model: Techniques of Water-Resources Investigations of the United States Geological Survey, Book 6, Chapter A1, 586 p. (available on the Internet at <http://pubs.usgs.gov/twri/twri6a1/>)

Slichter, C.S., 1899, Theoretical investigations of the motion of ground waters: U.S. Geological Survey 19<sup>th</sup> Annual Report, Part II, p. 295-384.

Theis, C.V., 1940, The source of water derived from wells: Civil Engineering, v. 10, no. 5, p. 277-280.

## **VIII. Regional Summaries**

Back, William, Rosenshein, J.S., and Seaber, P.R. (eds.), 1988, The Geology of North America, Volume O-2, Hydrogeology: The Geological Society of America, Boulder, Colorado, 524 p.

Heath, R.C., 1984, Ground-Water regions of the United States: U.S. Geological Survey Water-Supply Paper 2242, 78 p. (available on the Internet at <http://pubs.usgs.gov/wsp/wsp2242/>)

Miller, J.A., ed., 2000, Ground Water Atlas of the United States: U.S. Geological Survey Hydrologic Atlas 730, Chapters B-N published separately (available on the Internet at <http://capp.water.usgs.gov/gwa/>).

**IX. Recent USGS Circulars that provide an initial overview on selected topics**

- Alley, W.M., Reilly, T.E., and Franke, O.L., 1999, Sustainability of ground-water resources: U.S. Geological Survey Circular 1186, 79 p. (available on the Internet at <http://pubs.usgs.gov/circ/circ1186/>)
- Barlow, P.M., 2003, Ground water in freshwater-saltwater environments of the Atlantic coast: U.S. Geological Survey Circular 1262, 113 p. (available on the Internet at <http://pubs.usgs.gov/circ/2003/circ1262/>)
- Focazio, M.J., Reilly, T.E., Rupert, M.G., and Helsel, D.R., 2002, Ground-water vulnerability assessment: An overview of approaches and scientific credibility: U.S. Geological Survey Circular 1224, 33 p. (available on the Internet at <http://pubs.usgs.gov/circ/2002/circ1224/>)
- Franke, O. Lehn, Reilly, Thomas E., Pollock, David W., and LaBaugh, James W., 1998, Estimating areas contributing recharge to wells – Lessons from previous studies: U.S. Geological Survey Circular 1174, 14 p (Third printing, 1999). (available on the Internet at <http://water.usgs.gov/ogw/pubs/Circ1174/>)
- Galloway, D. L., Alley, W.M, Barlow, P.M., Reilly, T.E., and Tucci, P., 2003, Evolving issues and practices in managing ground-water resources – Case studies on the role of science: U.S. Geological Survey Circular 1247, 73 p. (available on the Internet at <http://pubs.usgs.gov/circ/2003/circ1247/>)
- Galloway, D.L., Jones, D.R., and Ingebritsen, S.E., eds., 1999, Land subsidence in the United States: U.S. Geological Survey Circular 1182, 175 p. (available on the Internet at <http://pubs.usgs.gov/circ/circ1182/>)
- Winter, T.C., Harvey, J.W., Franke, O.L., and Alley, W.M., 1998, Ground water and surface water – A single resource: U.S. Geological Survey Circular 1139, 79 p. (available on the Internet at <http://pubs.usgs.gov/circ/circ1139/>)

**X. Non-USGS Textbooks**

- Ahlfeld, D.P., and Mulligan, A.E., 2000, Optimal management of flow in groundwater systems: San Diego, Calif., Academic Press, 185 p.
- Anderson, M.P., and Woessner, W.W., 1992, Applied groundwater modeling: Academic Press, San Diego, Calif., 381 p.
- Bear, Jacob, 1979, Hydraulics of groundwater: New York, McGraw-Hill Inc., 569 p.

- Bear, Jacob, 1988, Dynamics of fluids in porous media: Toronto, Dover Publications Inc., (reprint edition, originally published 1972, New York, American Elsevier), 764 p.
- Bouwer, Herman, 1978, Groundwater hydrology: McGraw-Hill, New York, NY, 480 p.
- de Marsily, Ghislain, 1986, Quantitative hydrogeology--Groundwater hydrology for engineers: Orlando, Florida, Academic Press, 440.
- Deming, David, 2002, Introduction to hydrogeology: McGraw-Hill, New York, NY, 468 p.
- Domenico, P.A., and Schwartz, 1998, Physical and chemical hydrogeology (Second edition): John Wiley and Sons, New York, 506 p.
- Driscoll, F.G., 1986, Groundwater and wells (Second edition): Johnson Division, St. Paul, Minnesota, 1089 p.
- Fetter, C.W., 2000, Applied hydrogeology (Fourth edition): Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 691 p.
- Freeze, R.A., and Cherry, J.A., 1979, Groundwater: Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 604 p.
- Ingebritsen, S.E., and Sanford, W.E., 1998, Groundwater in geologic processes: Cambridge, United Kingdom, Cambridge University Press, 341 p.
- Kruseman, G.P., and de Ridder, N.A., 1990, Analysis and evaluation of pumping test data (Second edition): International Institute for Land Reclamation and Improvement, Wageningen, The Netherlands, 377 p.
- Todd, D.K., 1980, Ground-water hydrology (Second Edition): John Wiley and Sons, New York, 535 p.
- Todd, D.K., and Mays, L.W., 2005, Ground-water hydrology (Third Edition): John Wiley and Sons, New York, 636 p.
- Zheng, Chunmiao, and Bennett, G.D., 2002, Applied contaminant transport modeling (Second edition): John Wiley and Sons, New York, 621 p.