

General Biographical Information

RICHARD N. PALMER

Professor and Head
 Department of Civil and Environmental Engineering
 University of Massachusetts Amherst
 222 Marston Hall
 130 Natural Resources Road
 Amherst, Massachusetts 01003
 (413) 545-2508, FAX (413) 545-2508 , Email palmer@ecs.umass.edu
 webpage: www.ecs.umass.edu

Academic Background

Ph.D.	Johns Hopkins University	1979
M.S.	Stanford University	1973
B.S.	Lamar University	1972

Professional History

Professor and Head, Department of Civil and Environmental Engineering, University of Massachusetts Amherst, March 2008 - Present.

Professor, University of Washington, Department of Civil and Environmental Engineering, 1990-2008.

Associate Professor, University of Washington, Department of Civil and Environmental Engineering, 1985-1990.

Assistant Professor, University of Washington, Department of Civil and Environmental Engineering, 1979-1985.

Intergovernmental Personal Assignment, Institute for Water Resources, US Army Corps of Engineers, Ft. Belvoir, Virginia, 1997.

Visiting Scholar, Centro de Estudios Avanzados de Blanes, Spain, and Visiting Senior Research Fellow, Department of Civil Engineering, Heriot-Watt University, Edinburgh, Scotland, 1987 - 1988.

Postdoctoral Fellow/Research Assistant/Ph.D. Candidate, The Johns Hopkins University, Department of Geography and Environmental Engineering, 1975-1979.

Hydrologist, Water Resources Division, U.S. Geological Survey, Reston, VA; Environmental Engineer, Interstate Commission on the Potomac River Basin, Bethesda, MD; Environmental Engineer, Environmental Protection Agency, Washington, D.C., 1973-1977.

Refereed Journal Publications

- Palmer, R.N., I.C. James, and R.M. Hirsch (1978) Comparative assessment of water use and environmental implications of coal slurry pipelines, *Hydrological Science Bulletin*, Vol. 23, No. 4, 455-469.
- Palmer, R.N., J.A. Smith, J.L. Cohon, and C.S. ReVelle (1982) Reservoir management in the Potomac River basin, *Journal of Water Resources Planning and Management Division*, ASCE, Vol. 108, No. 1, 47-66.
- Palmer, R.N. and D.P. Lettenmaier (1983) The use of screening models in determining water supply reliability, *Civil Engineering Systems*, Vol. 1, No. 1, 15-22.
- Palmer, R.N. and J.R. Lund (1985) Multiobjective analysis with subjective information, *Journal of Water Resources Planning and Management Division*, ASCE, Vol. 111, No. 4, 399-416.
- Palmer, R.N. and M.C. MacKenzie (1985) Optimization of water quality monitoring networks, *Journal of Water Resources Planning and Management Division*, ASCE, Vol. 111, No. 4, 478-493.
- Palmer, R.N. and R.M. Snyder (1985) Evaluation of instream flow requirements on water supply reliability, *Water Resources Research*, Vol. 21, No. 4, 439-446.
- Lund, J.R., and R.N. Palmer (1986) Subjective evaluation: Linguistic scales in pairwise comparison methods, *Civil Engineering Systems*, Vol. 3, No. 4, 181-186.
- Palmer, R.N., and J.L. Cohan (1986) Complexity as a measure of model appropriateness, *Journal of Water Resources Planning and Management Division*, ASCE, Vol. 112, No. 4, 453-468.
- Palmer, R.N. and J.R. Lund (1986) Drought and power production, *Journal of Water Resources Planning and Management Division*, ASCE, Vol. 112, No. 4, 469-484.
- Mar, B.W., R.R. Horner, J.S. Richey, R.N. Palmer, and D.P. Lettenmaier (1986) Cost-effective methods for obtaining data on water quality, *Environmental Science and Technology*, Vol. 20, No. 6, 545-551.
- Palmer, R. N., and R. M. Tull (1987) Expert system for drought management planning, *Journal of Computing in Civil Engineering*, ASCE, Vol. 1, No. 4, 284-297.
- Palmer, R.N. (1987) Editorial and introduction to journal of computing in civil engineering: Special Issue On Expert Systems, *Journal of Computing in Civil Engineering*, ASCE, Vol. 1, No. 4, 1-2.
- MacKenzie, M.C., R.N. Palmer, and S.P. Millard (1987) Analysis of statistical monitoring network designs, *Journal of Water Resources Planning and Management Division*, ASCE, Vol. 113, No. 5, 599-615.

Refereed Journal Publications, continued

Johnston, D. M., and R. N. Palmer, (1988) Application of fuzzy decision making: An evaluation, *Journal of Civil Engineering Systems*, Vol. 5, No. 2, 87-92.

Palmer, R. N., and K. J. Holmes, (1988) Operational guidance during droughts: An expert system approach, *Journal of Water Resources Planning and Management Division, ASCE*, Vol. 114, No. 6, 647-666.

Mishalani, N. R., and R. N. Palmer, (1988) Forecast uncertainty in reservoir operation, *Water Resources Bulletin.*, Vol. 24, No. 6, 1237-1245.

Palmer, R.N., and B.W. Mar, (1988) Expert systems software for civil engineering applications, *Journal of Civil Engineering Systems*, Vol. 5, No. 4, 170-180.

Mar, B.W., and R. N. Palmer, (1989) Does civil engineering need system engineering?, *Journal of Professional Issues in Engineering, ASCE*, Vol. 115, No. 1, 45-52.

Palmer, R.N., and B.W. Mar, (1989) The automation of civil engineers: Some observations, *Journal of Management in Engineering, ASCE*, Vol. 5, No. 3, 286-300.

Mar, B.W., and R. N. Palmer, (1989) Workstations for systems engineers, *Systems Practice*, Vol. 2, No. 2, 239-245.

Keyes, A. M., and R. N. Palmer, (1993) Development of a decision support system for the prioritization of multimedia dischargers, *Journal of Environmental Management*, 601-612.

Pacanovsky, D.L., C.T. Jahren, R.N. Palmer, R.R. Newman, and D. Howland, (1995) Decision support system to load containers to double stack rail cars, *Civil Engineering Systems*, Vol., 12, 247-263.

Jahren, C.T., S.S. Rolle, L.E. Spurgeon, R.N. Palmer, R.R. Newman, and D. Howland, (1995) Automatic assignment algorithms for loading double stack rail cars, *Transportation Research Record*, Vol. 151, 10-18.

Wood, A.W., D.P. Lettenmaier, and R.N. Palmer, (1997) Assessing climate change implications for water resources planning, *Journal of Climatic Change*, Vol. 37, No. 1, 203-228.

Wood, A.W., R.N. Palmer, and C. Petroff, (1997) An assessment of a zero rise floodplain ordinance, *Journal of Water Resources Planning and Management Division, ASCE*, Vol. 123, No. 4, 239-245.

Kim, Y.O., and R.N. Palmer, (1997) The value of seasonal flow forecasts in Bayesian stochastic programming, *Journal of Water Resources Planning and Management Division, ASCE*, Vol. 123, No. 6, 327-335.

Refereed Journal Publications, continued

Fisher, S., and R.N. Palmer, (1997) Managing water supplies during drought: Triggers for operational responses, *Water Resources Update*, Vol. 3, No. 108, 14-31.

Lund, J.R., and R.N. Palmer, (1997) Water resource system modeling for conflict resolution, *Water Resources Update*, Vol. 3, No. 108, 70-82.

Lettenmaier, D.P., A.W. Wood, R.N. Palmer, E. Wood and E.Z. Stakhiv, (1999) Water resources implications of global warming: A U.S. regional perspective, *Climatic Change*, Vol. 43, 537-579.

Palmer, R.N., A.G. Reese, and S.E. Nelligan-Droan, (2001) Tied by Water, *Civil Engineering*, Vol. 71, No. 2, 50-53.

Hahn, M.A., R.N. Palmer, M.S. Merrill, and A.B. Lukas, (2002) An expert system for prioritizing inspection of sewers, *ASCE Journal of Water Resources Planning and Management*, Vol. 128, No. 2, 121-129.

Harmsen, P., R.N. Palmer, and G. Turkiyyah, (2001) Development and application of an expert system for evaluation of scour and stream stability, *Civil and Environmental Systems*, 18 (3).

Jeong, S. M., J.H. Ryu, J.H. Lee, and R.N. Palmer, (2003) Development of a shared vision model for optimal water distribution, *Korean Society of Civil Engineers*, 23(3B), 191-199.

VanRheenen, N.T., R.N. Palmer, and R.N. Hahn, (2003) Evaluating potential climate change impacts on water resource systems operations: Case studies of Portland, Oregon and the Central Valley, California, *Water Resources Update*, Issue 124, 35-50.

VanRheenen, N. T., A.W. Wood, A.F. Hamlet, R.N. Palmer, and D.P. Lettenmaier, (2004) Potential implications of PCM climate change scenarios for Sacramento - San Joaquin River Basin hydrology and water resources, *Climatic Change*, 62(1-3), 257-281.

Payne, J. T., A.W. Wood, A.F. Hamlet, R.N. Palmer, and D.P. Lettenmaier, (2004) Mitigating the effects of climate change on the water resources of the Columbia River basin, *Climatic Change Climatic Change*, 62(1-3), 233-256.

Christensen, N. S., A.W. Wood, D.P. Lettenmaier, and R.N. Palmer, (2004) Effects of climate change on the hydrology and water resources of the Colorado River basin, *Climatic Change*, 62(1-3), 337-363.

Battin, J., Wiley, M.W., Ruckelshaus, M.H., Palmer, R.N., Korb, E., Bartz, K.K., and Imaki, H., (2006) Projected impacts of future climate change on salmon habitat restoration actions in a Puget Sound river, *Proceedings of the National Academy of Sciences*, 104:6720-6725.

Palmer, R.N. (2007) The Confluence of a Career: Virtual Droughts, Shared-Vision Planning, and Climate Change, *ASCE Journal of Water Resources Planning and Management*, 133 (4), 287-288.

Werick, W.J. and Palmer, R.N. (2008) It's Time for Standards of Practice in Water Resources Planning, *ASCE Journal of Water Resources Planning and Management*, 134 (1), 1-2.

Wiley, M.W., and Palmer, R.N. (2006) Estimating the Impacts and Uncertainty of Climate Change on a Municipal Water Supply System, *ASCE Journal of Water Resources Planning and Management*, accepted for publication, to appear May of 2008.

Refereed Journal Publications, submitted and under review

Palmer, R.N., Cardwell, H.E., Lorie, M.A., and Werick, W.J. (2006) Disciplined Planning, Structured Participation, and Collaborative Modeling: Applying Shared Vision Planning, *ASCE Journal of Water Resources Planning and Management*, accepted with revisions.

Ryu, J.H., and R.N. Palmer, (2006) System Optimization using Streamflow Forecasts During Droughts, *ASCE Journal of Water Resources Planning and Management*, submitted, June 2006.

Ryu, J.H., Palmer, R.N., Jeong, S., Lee, J, and Kim, Y.O., (2006) Creating Sustainable Water Resources Management in the Geum River Basin, Korea, *ASCE Journal of Water Resources Planning and Management*, July 2006.

Wiley, M.W., Palmer, R.N., and Salathe, E.P. (2006) The Development of GCM Based Climate Scenarios for use in Water Resource System Impact Evaluations, *ASCE Journal of Water Resources Planning and Management*, submitted, August 2006.

Abstract and Non-Refereed Conference Proceedings

Walker, W. and R.N. Palmer, Nutrient pollution from agriculture and forested lands, *Proceedings of the Spring Meeting of the Interstate Commission on the Potomac River Basin*, Cacapon, WV, November, 1974.

Wright, J., R.N. Palmer, J.L. Cohon, and C.S. ReVelle, Interactive computer simulation applied to reservoir management, *Proceedings of the Summer Computer Simulation Conference*, Seattle, WA, 507-512, August, 1980.

Cohon, J.L., C.S. ReVelle, S.J. Ratick, and R.N. Palmer, Approaches and techniques for resolution of conflict situations in regional water management, *Issues in Regional Water Resources Management*, Januz Kindler, ed., International Institute for Applied Systems Analysis, Luxenburg, Austria, 343-367, 1982.

Palmer, R.N., Evaluation of water supply lifelines using fuzzy sets, *Proceedings of the Workshop on Civil Engineering Applications of Fuzzy Sets*, C.B. Brown, J. Chameau, R.N. Palmer, and J.T.P. Yao, eds., Purdue University, 1985.

Palmer, R.N., A review of artificial intelligence, *Proceedings of ASCE Specialty Conference on Computer Applications in Water Resources*, Buffalo, NY, 591-600, June, 1985.

Abstract and Non-Refereed Conference Proceedings, continued

Palmer, R.N., K. J. Holmes, R. Menard, and D. Parkinson, An expert system for drought management, *Critical Water Issues and Computer Applications, Proceeding of the 15th Annual Water Resources Conference, ASCE* , Norfolk, VA, 1-4, June, 1988.

Palmer, R.N., A natural language database for a drought management expert system, Closing the Gap between Theory and Practice, *Proceedings of the Baltimore Symposium*, International Association of Hydrological Sciences, Publication no. 180, 233-246, May, 1989.

Palmer, R.N., and C. R. Jackson, Risk management and operational guidance for municipal water supplies, *Water Resources Planning and Management, Proceeding of the 16th Annual, ASCE* , Sacramento, California, 622-625, May, 1989.

Palmer, R.N., and L.R. Spence, A natural environment for a water resource management database, *Water Resources Planning and Management, Proceeding of the 16th Annual, ASCE*, Sacramento, California, 481-484, May, 1989.

Palmer, R.N, and L. R. Spence, INLET: Access to water resources management data through a natural language interface, *Proceedings of the NATO ASI: Optimization and Decision Support Systems in Civil Engineering*, Edinburgh, Scotland, 205-216, June 25-July 7, 1989.

Palmer, R.N., The development and application of an expert system for drought management, *Proceedings of the NATO ASI: Optimization and Decision Support Systems in Civil Engineering*, Edinburgh, Scotland, 177-188, June 25 - July 7, 1989.

Palmer, R.N., Approaches to risk management and operational guidance for municipal water supplies, *Proceedings of the NATO ASI: Optimization and Decision Support Systems in Civil Engineering*, Edinburgh, Scotland, 567-576, June 25 - July 7, 1989.

Nishida, S., R.N. Palmer, C. Slaughterbeck, and S. Walker, An expert system for control curve evaluation during drought, optimizing the resources for water management, *Proceedings of the 17th Annual National Conference, Water Resources Planning and Management Division of ASCE*, Ft Worth, Texas, 294-297, April, 1990.

Keyes, A.M., D.J. Jabs, and R.N. Palmer, Development of a prioritization tool for multimedia enforcement, *Proceedings of the 18th Annual National Conference, Water Resources Planning and Management Division of ASCE*, New Orleans, LA, 630-634, May 1991.

Palmer, R.N., and L.L. Holden, MORE-A multi-objective ranking environment for risk assessment, *Proceedings of the 18th Annual National Conference, Water Resources Planning and Management Division of ASCE*, New Orleans, LA, 489-493, May 1991.

Regan, T.M., P.A. Minderman, and R.N. Palmer, Network interactions and packaged software: A win-win opportunity, *Proceedings of the Conference on Frontiers in Education, IEEE/ASEE*, Nashville, Tennessee, 1991.

Abstract and Non-Refereed Conference Proceedings, continued

Palmer, R.N. and G. R. Miller, The use of computers as an aid to modular learning in Civil Engineering, *Proceedings of the 8th Annual National Conference on Computing in Civil Engineering*, Dallas, Texas, 634-637, June, 1992.

Vives, L., J. Carrera, and R.N. Palmer, An approach for incorporating inflows uncertainty in management models, *Proceedings the 19th Annual National Conference, Water Resources Planning and Management Division of ASCE*, Baltimore, Maryland, 84-89, August, 1992.

Keyes, A.M., and R.N. Palmer, Use of interactive simulation environments for the development of negotiation tools, *Proceedings the 19th Annual National Conference, Water Resources Planning and Management Division of ASCE*, Baltimore, Maryland, 68-73, August, 1992.

Karpack, L. M., and R.N. Palmer, Use of interactive simulation environments for evaluation of water supply reliability, *Proceedings of the 19th Annual National Conference, Water Resources Planning and Management Division of ASCE*, Baltimore, Maryland, 144-149, August, 1992.

R.N. Palmer, A.M. Keyes, S.M. Fisher and W J. Werick, Advances in computer simulation for water resources planning, Nile 2002 Conference, Aswan, Egypt, KN-IV-1-20, February, 1993.

Keyes, A.M., and R.N. Palmer, The role of object-oriented simulation models in the drought preparedness studies, *Proceedings of the 20th Annual National Conference, Water Resources Planning and Management Division of ASCE*, Seattle, Washington, 479-482, April 1993.

J.R. Stedinger, M. Karamouz, B. McCrodden, G.McMahon, R.Palmer, and J. Valdes, Using forecasts to improve reservoir operations, *Proceedings of the 20th Annual National Conference, Water Resources Planning and Management, Division of ASCE*, Seattle, Washington, 240-243, April 1993.

Palmer, R.N., A.M. Keyes, and S.M. Fisher, Empowering stakeholders through simulation in water resources planning, *Proceedings of the 20th Annual National Conference, Water Resources Planning and Management Division of ASCE*, Seattle, Washington, 451-454, April 1993.

Keyes, A. M., and R.N. Palmer, An assessment of shared vision model effectiveness in water resources planning, *Proceedings of the 22nd Annual National Conference, Water Resources Planning and Management Division of ASCE*, Cambridge, Massachusetts, 532-535, May 1995.

Keyes, A. M., and R.N. Palmer, Practicing for droughts, guidelines for virtual droughts exercises, *Proceedings of the 22nd Annual National Conference, Water Resources Planning and Management Division of ASCE*, Cambridge, Massachusetts, 1005-1009, May 1995.

Fisher, S.M., and R.N. Palmer, Managing water supplies during drought, The search for triggers, *Proceedings of the 22nd Annual National Conference, Water Resources Planning and Management Division of ASCE*, Cambridge, Massachusetts, 1001-1004, May 1995.

Abstract and Non-Refereed Conference Proceedings, continued

Palmer, R.N., J.M. Kersnar, and D. Choi, Estimating demand variability, *Proceedings of the 22nd Annual National Conference, Water Resources Planning and Management Division of ASCE*, Cambridge, Massachusetts, 997-1000, May 1995.

Adams, L., R.N. Palmer, and G. Turkiyyah, An expert system for evaluating scour potential and stream stability at bridges, *Proceedings of the 22nd Annual National Conference, Water Resources Planning and Management Division of ASCE*, Cambridge, Massachusetts, 786-789, May 1995.

Wood, A.W., D.P. Lettenmaier, and R.N. Palmer, Risk-based decision making in water resources, Y.Y. Haimes, D.A. Moser, and E.Z. Stakhiv, eds, 19-38, 1996.

Kim, Y-O and R.N. Palmer, The value of hydrologic information in the hydropower systems operations, *Proceedings of the 24th Annual National Conference, Water Resources Planning and Management Division of ASCE*, Houston, TX, 532-536, April 1997.

Palmer, R.N., A history of shared vision modeling in the ACT-ACF comprehensive study: A modeler's perspective, *Proceedings of Special Session of ASCE's 25th Annual Conference on*

Water Resources Planning and Management and the 1998 Annual Conference on Environmental Engineering, W. Whipple, Jr., ed., Chicago, IL, 221-226, June 1998.

Palmer, R.N., Modeling water resources opportunities, challenges, and trade-offs: The use of shared vision modeling for negotiation and conflict resolution, *Proceedings of the ASCE's 26th Annual Conference on Water Resources Planning and Management*, Tempe, AZ, June, 1999.

Hahn, M. A., R.N. Palmer, and G. Knot, Prioritizing sewer line inspection with an expert system, *Proceedings of the ASCE's 26th Annual Conference on Water Resources Planning and Management*, Tempe, AZ, June, 1999.

Marxen S, .R.N. Palmer, M.A. Hahn, W. Werick, and C. Rogers, Designing a web-based GIS to manage and monitor environmental programs, *Proceedings of the ASCE's 2000 Joint Conference on Water Resources Engineering and Water Resources Planning and Management*, Minneapolis, MN, August 2000.

Groome, A., R.N. Palmer, and S. Nelligan-Doran, Potential benefits of water supply regionalization: A case study of the Seattle and Everett water systems, *Proceedings of the ASCE's 2000 Joint Conference on Water Resources Engineering and Water Resources Planning and Management*, Minneapolis, MN, August 2000.

Myers, A., and R. Palmer, Incorporating long-term streamflow forecasting into Cascade regional yield simulation model, *Proceedings of the ASCE's 2000 Joint Conference on Water Resources Engineering and Water Resources Planning and Management*, Minneapolis, MN, August 2000.

Abstract and Non-Refereed Conference Proceedings, continued

Hahn, M. A., R.N. Palmer, M.S. Merrill, and A.B. Lukas, Sewer inspection prioritization with a regional expert system, *Proceedings of the ASCE's 2000 Joint Conference on Water Resources Engineering and Water Resources Planning and Management*, Minneapolis, MN, August 2000.

Palmer, R.N., A. Mohammadi, M.A. Hahn, J. Dvorak, and D. Kessler, Computer assisted decision support system for high level infrastructure master planning: Case of the City of Portland Supply and Transmission Model (STM), *Proceedings of the ASCE's 2000 Joint Conference on Water Resources Engineering and Water Resources Planning and Management*, Minneapolis, MN, August 2000.

VanRheenen, N.T., A.W. Wood, R.N. Palmer, J.T. Payne, and D.P. Lettenmaier, The effects of climate change on water management strategies and demands in the Central Valley of California, *Proceedings of the ASCE's 2000 World Water and Environmental Resources Conference*, Orlando, FL, May 20-24, 2001.

Hahn, M. A., R.N. Palmer, A.F. Hamlet, and P. Storck, Preliminary analysis of the impacts of climate change on the reliability of the Seattle water supply, *Proceedings of the ASCE's 2000 World Water and Environmental Resources Conference*, Orlando, FL, May 20-24, 2001.

Palmer, R.N., S.L. Kutzing, and A.C. Steinemann, Developing drought triggers and drought responses: An application in Georgia, *Proceedings of the ASCE's 2002 Conference on Water Resources Planning & Management*. Roanoke, Virginia, May 2002.

VanRheenen, N.T., and R.N. Palmer, Preparing for an uncertain future: Adaptive management strategies and alternative approaches to mitigate the impacts of climate change in California's Central Valley, *Proceedings of the ASCE's 2002 Conference on Water Resources Planning & Management*. Roanoke, Virginia, May 2002.

Hahn, M.A., and R.N. Palmer, Climate change impacts on municipal supplies: When are capital investments justified? *Proceedings of the ASCE's 2002 Conference on Water Resources Planning & Management*. Roanoke, Virginia, May 2002.

Palmer, R.N., J.H. Ryu, S. Jeong, and Y.O. Kim, An application of water conflict resolution in the Kum River Basin, Korea, *Proceedings of the ASCE's 2002 Conference on Water Resources Planning & Management*. Roanoke, Virginia, May 2002.

Palmer, R.N., and M.A. Hahn, An investigation of the potential hydrologic and management impacts of climate change, *Proceedings of the 2002 Seminar on Water Resources, Disaster Prevention Research Institution*, Kyoto University, November, 2002.

Palmer, R.N., and M.A. Hahn, Managing droughts in the future: The impacts of climate change on municipal water supplies, *Proceedings of the 83rd Annual Meeting of the AMS*, Long Beach, CA, February 2003.

Abstract and Non-Refereed Conference Proceedings, continued

VanRheenen, N.T., R.N. Palmer, D.P. Lettenmaier, and A.F. Hamlet, Climate change, fish, agriculture, and power: Impacts and implications for future Snake River water resources management, *Proceedings of ASCE's 2003 World Water Resources Conference*, Philadelphia, PA, June, 2003.

Miller, M.L., and R.N. Palmer, Developing an extended streamflow forecast for the Pacific Northwest, *Proceedings of ASCE's 2003 World Water Resources Conference*, Philadelphia, PA, June, 2003.

Ryu, J.H., R.N. Palmer, S. Jeong, and Y-O Kim, An optimization model to mitigate conflicts in the Kum River Basin, Korea, *Proceedings of ASCE's 2003 World Water Resources Conference*, Philadelphia, PA, June, 2003.

VanRheenen, N.T. and R.N. Palmer, D.P. Lettenmaier, and A.F. Hamlet, Incorporating Long-Lead Climate Forecasts into Risk-Based Management and Decision Analysis: A Case for the Snake River Basin, *Proceedings of ASCE's 2004 World Water and Environmental Resources Congress*, Salt Lake City, Utah, June, 2004.

Palmer, R.N., and W. Werick, When Should Shared Vision Planning Be Used? *Proceedings of ASCE's 2004 World Water and Environmental Resources Congress*, Salt Lake City, Utah, June, 2004.

Palmer, R.N., and M. Miller, Determining the Skill of Meteorological and Hydrological Forecasts in the Pacific Northwest, *Proceedings of ASCE's 2004 World Water and Environmental Resources Congress*, Salt Lake City, Utah, June, 2004.

Ryu, J.H., Palmer, R.N., Jeong, S., and Lee, J., Determining the Skill of Meteorological and Hydrological Forecasts in the Pacific Northwest, *Proceedings of ASCE's 2004 World Water and Environmental Resources Congress*, Salt Lake City, Utah, June, 2004.

Wiley, M., Palmer, R.N., and Ryu, J.H., Climate Based Streamflow Forecasts for Water Resource Managers, *Proceedings of the American Water Resources Association Specialty Conference on Adaptive Management*, Missoula, Montana, June 2006.

Ryu, J.H., Palmer, R.N., and Wiley, M., Mid-range Streamflow Prediction: An Application Using a Dynamic Climate Model, *Proceedings of the American Water Resources Association Specialty Conference on Adaptive Management*, Missoula, Montana, June 2006.

Books

Cohon, J.L., C.S. ReVelle, and R.N. Palmer (1981) Multiobjective generating techniques for risk/benefit analysis, in **Risk/Benefit Analysis in Water Resources Planning and Management**, Yacov Haimes, ed., Plenum Press, New York, 123-134.

Palmer, R.N. (1989) Chapter 7, Teaching expert systems to civil engineers: An opportunity for assessment, in **Expert Systems for Civil Engineers: Education**, American Society of Civil Engineers, 45-53.

Palmer, R.N. (1989) Chapter 10, Teaching expert systems short courses: A personal perspective, in **Expert Systems for Civil Engineers: Education**, American Society of Civil Engineers, 70-78.

Palmer, R.N. (1992) Chapter 7, Using Prolog to develop a natural language interface for water resources management data, in **Expert Systems for Civil Engineers: Knowledge Representation**, American Society of Civil Engineers, 149-160.

Wood, A.W., D.P. Lettenmaier and R.N. Palmer (1997) Assessing the water resources implications of global warming, in **Climate Change and Water Resources Planning Criteria**, K.D. Frederick, D.C. Major and E.Z. Stakhiv, eds., Kluwer Academic Publishers.

Editing and Other Scholarly Papers

Palmer, R.N., *Expert Systems for Civil Engineers*, Universitat Politecnica de Catalunya, Barcelona, Spain, 1988.

Review of the book, **Artificial Intelligence in Engineering** by Elsevier and Computational Mechanics Publications, edited by J.S. Gero, appearing in *Structural Engineering Review*, 1988.

Review of **Microcomputer Knowledge-Based Expert Systems in Civil Engineering**, proceedings of a symposium sponsored by the Structural Division of the American Society of Civil Engineers in conjunction with the ASCE National Convention, Nashville, Tennessee, May 10-11, 1988, ASCE, New York, NY, edited by Hojjat Adeli, appearing in *Structural Engineering Review*, Vol. 1, 179-184, 1988.

Mar, B.W., W.S. Miller, R.N. Palmer, and R.A. Carpenter, *Cost-Effective Data Acquisition, Guidelines for Surveying and Monitoring Watersheds*, East-West Environment and Policy Institute, Honolulu, Hawaii, 1987.

Review of the book, **Expert Systems for Civil Engineers: Technology and Application**, edited by M. L. Maher, appearing in *Structural Engineering Review*.

Special Issue on Expert Systems in Civil Engineering, *Journal of Computing in Civil Engineering*, ASCE, Vol. 1, No. 4 and Vol. 2, No. 1.

Sponsored Research

- 1982 Application of Interactive Simulation, Seattle Water Department, \$5,000/9 months (Co-PI with D. Lettenmaier), funded.
- 1983-85 Subjective Uncertainty in Civil Engineering, National Science Foundation, \$71,365/2 years (Co-PI with C. Brown), funded.
- 1983 Strategies for Coping with Droughts, Electric Power Research Institute, \$122,322/5 months (Co-PI with D. Lettenmaier), funded.
- 1983-84 Complexity as a Measure of Model Appropriateness, Office of Water Research and Tech, \$13,250/1 year (Co-PI with D. Lettenmaier), funded.
- 1982-83 Evaluation of Instream Flow Requirements, Office of Water Research and Tech, \$12,000/10 months (Co-PI with D. Lettenmaier), funded.
- 1983 Simulation Development for Climate Change, Battelle Northwest, \$31,506/5 months (Co-PI with D. Lettenmaier), funded.
- 1984-85 Identification of Potential Water Supply Ventures, Washington Water Research Center, \$19,266/1 year, funded.
- 1984-85 Hydrologic/Hydraulic Study of Walsh Lake, Seattle Water Department, \$26,627/10 months (Co-PI with D. Lettenmaier), funded.
- 1985-87 The Place of Fuzzy Sets in Civil Engineering, National Science Foundation, \$81,396/30 months (Co-PI with C. Brown), funded.
- 1985-86 System Engineering Management Workstations, Boeing Aerospace, \$92,000/1 year (Co-PI with B. Mar), funded.
- 1986-87 Computer Models for Water Conservation, Seattle Water Department, \$30,814/1 year, funded.
- 1987-88 System Engineering Workstations, Boeing, \$120,000/1 year (Co-PI with B. Mar), funded.
- 1988-89 An Expert System for Drought Planning, OWRT, \$15,261/1 year, funded.
- 1988 System Engineering Management, Boeing Aerospace, \$120,000/1 year (Co-PI with B. Mar), funded.
- 1989 Expert System for Rule Curve Development, NWWA, \$12,000/10 months, funded.
- 1989-90 Expert Systems for Systems Engineering, Boeing Aerospace, \$50,000/1 year, funded.

Sponsored Research, continued

- 1989-90 Expert System for Risk Analysis, Phases 1, 2, and 3, Environmental Protection Agency, \$80,000/18 months, funded.
- 1990-91 System Engineering Software for Management, Boeing Aerospace, \$100,000/1 year (Co-PI with B. Mar), funded.
- 1990 Water Supply Analysis Expert System, Graduate School Research Fund, \$7,998/6 months, funded.
- 1990-91 Double Stacked Planner: A Computerized Assignment Aid, TRANSNOW, \$96,300/16 months (Co-PI with C. Jahren and Schmitt), funded.
- 1991 Risk Prioritization Tool, Phases 1, 2, and 3, Environmental Protection Agency, \$10,000/3 months, funded.
- 1991-92 Intermodal Container Forecaster, Phase II, TRANSNOW, \$66,100/1 year (Co-PI with C. Jahren), funded.
- 1992-93 Using OOP Simulation for Drought Planning, ICPRB, \$73,498/20 months, funded.
- 1992 Simulation of Hydropower Performance Using OOP, Seattle City Light, \$21,500/8 months, funded.
- 1992-93 Double Stack Planner: Functional Version, TRANSNOW BN, \$105,000/1 year, (Co-PI with C. Jahren), funded.
- 1992-93 Using OOP Simulation for Drought Planning, Continuation, ICPRB, \$75,059/16 months, funded.
- 1992-94 Expert System for Stream Stability and Scour Evaluation, NCHRP, \$249,504/2 years (Co-PI with G. Turkiyyah), funded.
- 1994-95 Development of Shared Vision Model for ACF/ACT, US ARMY IWR, \$35,000/10 months, funded.
- 1994-95 Decision Support Tool for Bridge Inspection, WA DOT, \$70,000/14 months (Co-PI with G. Turkiyyah), funded.
- 1994-96 The Impact of a Zero Floodplain Rise Criterion on Bridge Design, WA DOT, \$70,000/20 months (CO-PI with C. Petroff), funded.
- 1994-95 Reservoir Reallocation on the Willamette River, Oregon Dept. of Water Resources, \$10,000/1 year, funded.

Sponsored Research, continued

- 1994-96 Development of Shared Vision Model for ACF/ACT, US ARMY IWR, \$143,000/17 months, funded.
- 1996-97 Expert System for Stream Stability and Scour Evaluation, Phase 2, NCHRP, \$250,000/2 years (Co-PI with G. Turkiyyah), funded.
- 1996 Application of Shared Vision Model, GA Envir. Div., \$74,000/7 months, funded.
- 1997 Intergovernmental Personnel Agreement, US ACOE IUR, \$12,000/2 months, funded.
- 1996 Reservoir Reallocation on the Willamette River, Phase 2, Portland Dist. COE, \$17,000/1 year, funded.
- 1998 Expert System for Stream Stability and Scour Evaluation, Phase 3, NCHRP, \$25,000 addition, (Co-PI with G. Turkiyyah), funded.
- 1999 Expert System for Sewer Evaluation, WERF, \$40,000, funded.
- 2000 Predictive Methodologies for Determining Peak Flows after Sanitary Sewer Rehabilitation, WERF, \$35,000 (funded)
- 2001 Modeling Water Quality in the King Abdullah Canal, CESAR, \$75,000 (Co-PI with M. Brett)
- 2002 Evaluating the Impacts of Climate Change on Seattle Water Supply, \$100,000 (15 months)
- 2002 An Internet Application of the Expert System for Stream Stability \$40,000 (Co-PI with G. Turkiyyah).
- 2003 An Evaluation of Computer Models for Conflict Resolution in the Kum River Basin, Korea, \$75,000 (18 months)
- 2003 Evaluating the Impacts of Climate Change on Tualatin Water Supply, \$49,000 (12 months).
- 2004 Using Climate Signals to Forecast Streamflows and Fish Needs \$60,000 (12 months)
- 2004 Columbia River Data Compilation Project I (\$71,250)
- 2004 Climate Change Impacts on Salmon (\$23,000)
- 2005 Using Climate Signals to Forecast Streamflows and Fish Needs \$30,000 (6 months)
- 2005 River Data Compilation Project II (\$74,759)

Sponsored Research, continued

- 2005 River Data Compilation Project III (\$25,363)
- 2004 Climate Impacts on Water Management (\$218,000)
- 2005 Climate Change Impacts on Salmon (\$8,000)
- 2006 Climate Impacts of Water Management II (\$291,674)
- 2006 Impacts of El Nino-Southern Oscillation (ENSO) Events on Chinese Rice Production and the World Rice Market, with R. Naylor, S. Rozelle, W. Falcon, and D. Battisti, \$650,000 over three years total, \$210,000 to the University of Washington, National Science Foundation.

Project reports (reports to sponsors)

Non-point sources of pollution in the Potomac River basin, Interstate Commission on the Potomac River Basin, ICPRB Technical Publication 74-2, 1974.

Potomac River basin water quality status and trend assessment, 1962-1973, Interstate Commission on the Potomac River Basin, ICPRB Technical Publication 75-1, 1975 (with W. Mason, D.P. Sheer, and B.A. Combs).

Critical areas in the Potomac River basin, A review of the water pollution control in 1975, Interstate Commission on the Potomac River Basin, ICPRB Technical Publication 76-4, 1976.

Comparative assessment of water use and environmental implications of coal slurry pipelines, U.S. Geological Survey, Open-File Report 77-698, 1977 (with I.C. James and R.M. Hirsch).

Policy analysis of reservoir operation in the Potomac River basin, Volumes I, II, and III, Water Resources Series Technical Report No. 59, University of Maryland, 1979 (with J. Wright, J.A. Smith, J.L. Cohon and C.S. ReVelle).

Water resource system reliability under drought conditions: The Seattle water supply system as a case study, Harris Hydraulics Laboratory Technical Report No. 72, University of Washington, 1981 (with S.H. Draper, D.P. Lettenmaier, and S.J. Burges).

An interactive simulation model for the Cedar/Tolt water supply system, Harris Hydraulics Laboratory Technical Report No. 73, University of Washington, 1982 (with K.A. Erickson and D.P. Lettenmaier).

Strategies for coping with drought Phase I: Problem identification, Electric Power Research Institute, 1983 (with D.P. Lettenmaier, K.M. Leytham, D.M. Johnston, and S.J. Burges).

Sampling design for aquatic ecological monitoring, Water Resources Series Technical Report No. 85, University of Washington, 1983 (with B.W. Mar, D.P. Lettenmaier, D.M. Eggars, R.R. Horner, G. Portele, J.S. Richey, E.B. Welch, G. Weins, and J. Yearsley).

Project reports (reports to sponsors), continued

Snyder, R.M., R.N. Palmer, and D.P. Lettenmaier, Effects of instream flow requirements on water supply reliability: The Cedar/Tolt system as a case study, Water Resources Series Technical Report No. 83, University of Washington, 1983 (with R.M. Snyder and D.P. Lettenmaier).

The water budget: A step towards balancing fish and power in the Columbia River basin, Water Resources Series Technical Report No. 81, University of Washington, 1983 (with J. Lawrence and K.N. Lee).

Sampling design for aquatic ecological monitoring, Final Report, Handbook and Programmers Guide, Electric Power Research Institute, Environmental Assessment Department, Project RP 1729-1, Palo Alto, CA, 1984 (with B.W. Mar, D.P. Lettenmaier, R.R. Horner, J.S. Richey, S.P. Millard and M.C. MacKenzie).

Strategies for coping with drought Part II: Techniques for planning and reliability assessment, Project Report, University of Washington, 1984 (with D.P. Lettenmaier, K.M. Leytham, J.R.Lund, and S.J. Burges).

Complexity as a measure of simulation model appropriateness: Columbia River conflict resolution as a case study, Water Resources Series Technical Report No. 89, University of Washington, 1984 (with J.L. Cohan and D.P. Lettenmaier).

Evaluation of the expansion of Walsh Lake, Water Resources Series Technical Report No. 96, University of Washington, 1985 (with R.W. Schanz).

System cooperation in regional water supply planning, Water Resources Series Technical Report No. 95, University of Washington, 1985 (with J.R. Lund).

Strategies for coping with drought, Vol. 1, Problem Identification, EPRI EA-4944, Project 2194-1, Final Report, Electric Power Research Institute, Palo Alto, CA, 1986 (with D.P. Lettenmaier, K.M. Leytham, D.M. Johnston, and S.J. Burges).

An expert system for drought management: Case study and demonstration, Water Resources Series Technical Report No. 104, University of Washington, 1987 (with K.J. Holmes).

Forecast uncertainty in reservoir operation: A case study, Water Resources Series Technical Report No. 107, University of Washington, 1987 (with N.R. Mishalani).

Strategies for coping with drought: Part 2- Planning techniques and reliability assessment, EPRI P-5201, Project 2194-1, Final Report, Electric Power Research Institute, Palo Alto, CA, June, 1987 (with D.P. Lettenmaier, K.M. Leytham, J.R. Lund and S.J. Burges).

A review of expert system software, GRIAL, Research Report 88/2, Centro de Estudios Avanzados de Blanes, Spain, January, 1988.

Project reports (reports to sponsors)

A rule based system for operating municipal water supplies during droughts: An expert system approach, GRIAL, Research Report 88/1, Centro de Estudios Avanzados de Blanes, Spain, January, 1988.

INLET, A natural language environment for a water resources database, Water Resources Series Technical Report No. 112, University of Washington, 1989 (with L.R. Spence).

Development and Application of FRESH: A Fuzzy Reasoning Shell, Water Resources Series Technical Report No. 119, University of Washington, 1989 (with S. Nishida).

Knowledge Acquisition for a Drought Management Expert Systems, Water Resources Series Technical Report No. 120, University of Washington, Seattle, Washington, 1990 (with C.D. Slaughterbeck).

The Ranking of Environmental Risk: A Multiobjective Approach, Water Resources Series Technical Report No. 122, University of Washington, Seattle, Washington, 1990 (with L.L. Holden).

Development of a decision support system for the prioritization of multimedia dischargers, Water Resources Series Technical Report No. 122, University of Washington, Seattle, Washington, 1991 (with A.M. Keyes).

Evaluation of a decision support system for the prioritization of multimedia facilities, Water Resources Series Technical Report No. 132, University of Washington, Seattle, Washington, 1991 (with J.J. Jabs).

Use of simulation modeling to evaluate effects of regionalization on water supply performance, Water Resources Series Technical Report No. 134, University of Washington, Seattle, Washington, 1992 (with L.M. Karpack).

Water Management Implications of Global Warming: 1. The Boston Water Supply System, Report to the US Army Corps of Engineers, Institute for Water Resources, Alexandria, VA, 1997 (with D.P. Lettenmaier, A.E. Keizur, S.M. Fisher and A.W. Wood).

Water Management Implications of Global Warming: 2. The Tacoma Water Supply System, Report to the US Army Corps of Engineers, Institute for Water Resources, Alexandria, VA, 1997 (with D.P. Lettenmaier, S.M. Fisher, S.P. Millard, J.P. Hughes, J.C. Sias and A.W. Wood).

Water Management Implications of Global Warming: 3. The Savannah River System, Report to U.S. Army Corps of Engineers, Institute for Water Resources, Alexandria, VA, 1997 (with D.P. Lettenmaier, A. Wood, S.P. Millard, J.P. Hughes, E.F. Wood, and S. Fisher).

Water Management Implications of Global Warming: 4. The Columbia River System, Report to U.S. Army Corps of Engineers, Institute for Water Resources, Alexandria, VA, 1997 (with D.P. Lettenmaier, D. Ford, B. Nijssen, S.P. Millard, J.P. Hughes, and S. Fisher).

Project reports (reports to sponsors)

Water Management Implications of Global Warming: 5. The Missouri River System, Report to U.S. Army Corps of Engineers, Institute for Water Resources, Alexandria, VA, 1997 (with D.P. Lettenmaier, D. Ford, E.F. Wood, and S. Fisher).

Water Management Implications of Global Warming: 6. The Apalachicola-Chattahoochee-Flint River Basin, Report to U.S. Army Corps of Engineers, Institute for Water Resources, Alexandria, VA 1997 (with D.P. Lettenmaier, E.F. Wood, M.K. Zion, A.W. Wood, and A. Hamlet).

CAESAR: An Expert System for Evaluation of Scour and Stream Stability, Palmer, R.N., and Turkiyyah, G., NCHRP Report Number 426, ISBN#: 0-309-06320-5

Invited Lectures and Seminars

Palmer, R.N., The confluence of a career: Structured Planning, Shared Vision, and Climate Change, ASCE Water Resources and Environmental Institute National Meeting, Omaha Nebraska, May 2006.

Palmer, R.N., Impacts of Climate Change on Municipal Water Supplies in Washington, King County Council, Seattle, Washington, October, 2005.

Palmer, R.N., Techniques for the evaluation of climate change, Department of Civil Engineering, Seoul Nation University, Seoul Korea, November 30, 2005.

Palmer, R.N., The Application of Shared Vision Planning to Drought Preparedness, The International Workshop on Drought Management, Seoul Korea, November 28, 2005.

Matthew W. Wiley, M.W., R.N. Palmer, and J.A. Ball, Incorporating Uncertainty in Water Resource Planning for Climate Change, American Water Resources Association 2005 Annual Water Research Conference, Seattle, Washington, November, 8, 2005.

Palmer, R.N., Impact of Climate Change on Water Supply in the Pacific Northwest: Is it an Issue?, Denman Lecture Series, Seattle, Washington, November 17, 2005.

Palmer, R.N., Rule base generation for expert systems, Centro de Estudios Avanzados de Blanes, Spain, October, 1987.

Palmer, R.N., Rule-base consistency in drought management, Norwegian Hydrotechnical Laboratory, Trondheim, Norway, September, 1988.

Palmer, R.N., SID- An expert system for drought management, Norwegian Institute for Water Research Oslo, Norway, September, 1988.

Palmer, R.N., Expert systems for rule curve development, NorthWest Water Authority,

Warrington, England, August, 1988.

Palmer, R.N., Seattle integrated drought management system, Coping with the 1988 drought, Bristol University, Bristol, England, July, 1988.

Palmer, R.N., An expert system for drought management, Case study, American Society of Civil Engineers, Water Forum, Norfolk, VA, June, 1988.

Palmer, R.N., Expert systems for water resource management, Heriot-Watt University, Edinburgh, Scotland, May, 1988.

Palmer, R.N., Unsisistema expert per tractar municipal d'agua durant uno seguera, de l'Escola Tecnica Superior d'Enginyers de Camins, Canals i Ports, Universitat Politecnica de Catalunya, Spain, March, 1988.

Presentations Given at Conferences

Walker, J., and R.N. Palmer, Nutrient pollution from agriculture and forested lands, Spring Meeting , Interstate Commission on the Potomac River Basin, Cacapon, W. VA, June, 1974.

Ratick, S., S. Boland, R.N. Palmer, and F. Berman, An evaluation of net energy analysis as a potential resource allocation tool, Atlantic Economic Conference, Washington, D.C., Oct., 1977.

Palmer, R.N., I.V. James and R.M. Hirsch, Comparative analysis of coal slurry pipelines and other energy transport alternatives, Symposium on Critical Water Problems and Slurry Pipelines, Washington, D.C., August, 1977.

Palmer, R.N., J.A. Smith, C.S. ReVelle and J.L. Cohon, Reservoir management in the Potomac River basin, TIMS/ORSA Conference, New Orleans, LA, May, 1979.

Wright, J., R.N. Palmer, J.L. Cohon, and C.S. ReVelle, Interactive computer simulation applied to reservoir management, Summer Computer Simulation Conference, Seattle, WA, Aug., 1980.

Palmer, R.N., and D.P. Lettenmaier, Indexing multiple site synthetic streamflow sequences using reliability indices, ASCE Specialty Conference, San Francisco, CA, August, 1981.

Palmer, R.N., and R.M. Snyder, Impacts of instream flow requirements on water supply reliability, AGU Fall Meeting, San Francisco, CA, December, 1983.

Palmer, R.N., and J.R. Lund, Impacts of drought on electric power production: Management options and strategies, AGU Fall Meeting, San Francisco, CA, December, 1984.

Palmer, R.N., Optimization techniques in decision-making, Systems Engineering and Project Management Symposium, Seattle, WA, October, 1984.

Palmer, R.N., Water resources planning, using linear programming, Symposium on Instructional Computing, Seattle, WA, November, 1985.

Presentations Given at Conferences, continued

Palmer, R.N., Water supply lifeline evaluations, NSF Workshop on Fuzzy Sets, Purdue University, West Lafayette, IN, October, 1985.

Palmer, R.N., Evaluation of water supply lifelines using fuzzy sets, International Symposium on Fuzzy Mathematics in Earthquake Research, Beijing, China, September, 1985.

Johnston, D.M., R.N. Palmer, and C.B. Brown, An application of knowledge base systems to waste water treatment processes, International Fuzzy Set Association Congress, Palma de Majorca, Spain, July, 1985.

Palmer, R.N., A review of artificial intelligence applications in civil engineering, Computer Applications in Water Resources, ASCE, Specialty Conference, Buffalo, NY, June, 1985.

Palmer, R.N. and D.P. Parkinson, Risk analysis applied to water supply management, American Society of Civil Engineers Spring Meeting, Seattle, WA, April 7-11, 1986.

Palmer, R.N. and R.M. Tull, An expert system approach to water supply management, American Society of Civil Engineers Spring Meeting, Seattle, WA, April 7-11, 1986.

Palmer, R.N., Expert systems, Potential in civil engineering, ASCE National Spring Convention and Energy Specialty Conference, Atlantic City, NJ, April, 1987.

Palmer, R.N. and R. Tull, An expert systems tutorial with water resources management applications, American Society of Civil Engineers, 14th Annual Water Forum, Kansas City, MO, March, 1987.

Palmer, R.N., The automation of rule curve generation, evaluation and implementation using expert systems, presented at the Sixth Conference on Computing in Civil Engineering, American Society of Civil Engineers, Atlanta, GA, September 11-13, 1989.

Palmer, R.N., A natural language interface for drought management, presented at the Sixth Conference on Computing in Civil Engineering, American Society of Civil Engineers, Atlanta, GA, September 11-13, 1989.

Palmer, R.N. and L. R. Spence, INLET: Access to water resources management data through a natural language interface, presented at the NATO ASI: Optimization and Decision Support Systems in Civil Engineering, June 25 - July 7, 1989, Edinburgh, Scotland.

Palmer, R.N., The development and application of an expert system for drought management, presented at the NATO ASI: Optimization and Decision Support Systems in Civil Engineering, June 25 - July 7, 1989, Edinburgh, Scotland.

Palmer, R.N., Approaches to risk management and operational guidance for municipal water supplies, presented at the NATO ASI: Optimization and Decision Support Systems in Civil Engineering, June 25 - July 7, 1989, Edinburgh, Scotland.

Presentations Given at Conferences, continued

Palmer, R.N. and L. R. Spence, A natural environment for a water resource management database, presented at the Water Resources Planning and Management 16th Annual Meeting, ASCE , Sacramento, California, May, 1989.

Palmer, R.N., and C. R. Jackson, Risk Management and Operational Guidance for Municipal Water Supplies, presented at the Water Resources Planning and Management 16th Annual , ASCE , Sacramento, California, May, 1989.

Palmer, R.N., J. Wright, and K. Strzepek, Workstations for teaching and research of water resources planning and management, presented at the 17th Annual National Conference, Water Resources Planning and Management Division of ASCE, Ft Worth, Texas, April, 1990.

Palmer, R.N., and Philippe Desroches, Introduction to object oriented programming applied to water resources, presented at the 17th Annual National Conference, Water Resources Planning and Management Division of ASCE, Ft Worth, Texas, April, 1990.

Nishida, S., R.N. Palmer, C. Slaughterbeck, and S. Walker, An expert system for control curve evaluation during drought, presented at the 17th Annual National Conference, Water Resources Planning and Management Division of ASCE, Ft Worth, Texas, April, 1990.

Palmer, R.N. and A.M. Keyes, An overview of water supply uncertainties, their identification, control, and management, presented at the 18th Annual National Conference, Water Resources Planning and Management Division of ASCE, New Orleans, LA, May, 1991.

Palmer, R.N. and L.L. Holden, MORE-A multi-objective ranking environment for risk assessment, presented at the 18th Annual National Conference, Water Resources Planning and Management Division of ASCE, New Orleans, LA, May, 1991.

Keyes, A.M., D.J. Jabs, and R.N. Palmer, Development of a prioritization tool for multimedia enforcement, presented at the 18th Annual National Conference, Water Resources Planning and Management Division of ASCE, New Orleans, LA, May, 1991.

Karpack, L. M. and R.N. Palmer, Use of interactive simulation environments for evaluation of water supply reliability, presented at the 19th Annual National Conference, Water Resources Planning and Management Division of ASCE, Baltimore, Maryland, August, 1992.

Keyes, A.M. and R.N. Palmer, Use of interactive simulation environments for the development of negotiation tools, presented at the 19th Annual National Conference, Water Resources Planning and Management Division of ASCE, Baltimore, Maryland, August, 1992.

Vives, L., J. Carrera, and R.N. Palmer, An approach for incorporating inflows uncertainty in management models, presented at the 19th Annual National Conference, Water Resources Planning and Management Division of ASCE, Baltimore, Maryland, August, 1992.

Presentations Given at Conferences, continued

Palmer, R.N. and G. R. Miller, The use of computers as an aid to modular learning in Civil Engineering, 8th Annual National Conference on Computing in Civil Engineering, Dallas, Texas, June, 1992.

Palmer, R.N., A.M. Keyes, and S.M. Fisher, Empowering stakeholders through simulation in water resources planning, presented at the Proceedings of the 20th Annual National Conference, Water Resources Planning and Management Division of ASCE, Seattle, Washington, April, 1993.

R.N. Palmer, A.M. Keyes, S.M. Fisher and W J. Werick, Advances in computer simulation for water resources planning, presented at the Nile 2002 Conference, Aswan, Egypt, February, 1993.

Adams, L., R.N. Palmer, and G. Turkiyyah, An Expert System for Evaluating Scour Potential and Stream Stability at Bridges, presented at the Proceedings of the 22nd Annual National Conference, Water Resources Planning and Management Division of ASCE, Cambridge, Massachusetts, May, 1995.

Palmer, R.N., J.M. Kersnar, and D. Choi, Estimating Demand Variability, presented at the Proceedings of the 22nd Annual National Conference, Water Resources Planning and Management Division of ASCE, Cambridge, Massachusetts, May, 1995.

Fisher, S.M. and R.N. Palmer, Managing Water Supplies During Drought, The Search for Triggers, presented at the Proceedings of the 22nd Annual National Conference, Water Resources Planning and Management Division of ASCE, Cambridge, Massachusetts, May, 1995.

Palmer, R.N. The maturing of the internet and its use in facilitating water resources planning, presented at the 24th Annual National Conference, Water Resources Planning and Management Division of ASCE, Houston, TX, April, 1997.

Kim, Y-O and R.N. Palmer, The value of hydrologic information in the hydropower systems operations, presented at the 24th Annual National Conference, Water Resources Planning and Management Division of ASCE, Houston, TX, April, 1997.

Palmer, R.N., A history of shared vision modeling in the ACT-ACF comprehensive study: A modeler's perspective, presented at the 25th Annual Conference on Water Resources Planning and Management, Chicago, IL, June, 1998.

R.N. Palmer, Modeling water resources opportunities, challenges, and trade-offs: The use of shared vision modeling for negotiation and conflict resolution, Keynote Invited Presentation, presented at the 26th Annual National Conference, Water Resources Planning and Management Division of ASCE, Tempe, AZ, June, 1999.

Werick, W., R.N. Palmer, and A. Wood, Conducting a virtual flood for Devils Lake, North Dakota, presented at the 26th Annual National Conference, Water Resources Planning and Management Division of ASCE, Tempe, AZ, June, 1999.

Presentations Given at Conferences, continued

Hahn, M., R.N. Palmer, and G. Knot, Prioritizing sewer line inspection with an expert system, presented at the 26th Annual National Conference, Water Resources Planning and Management Division of ASCE, Tempe, AZ, June, 1999.

Palmer R.N., D. Parkinson, S. Haddadin, D. Kessler, L. Stickel, and J. Dovorak, Evaluating alternatives for capacity expansion: Ensuring reliable water for the Portland, Oregon area, presented at the 26th Annual National Conference, Water Resources Planning and Management Division of ASCE, Tempe, AZ, June, 1999.

Marxen S., R.N. Palmer, M.A. Hahn, W. Werick, and C. Rogers, Designing a web-based GIS to manage and monitor environmental programs, Presented at ASCE's 2000 Joint Conference on Water Resources Engineering and Water Resources Planning and Management, Minneapolis, MN, August, 2000.

Groome, A., R.N. Palmer, and S. Nelligan-Doran, Potential benefits of water supply regionalization: A case study of the Seattle and Everett water systems, Presented at ASCE's 2000 Joint Conference on Water Resources Engineering and Water Resources Planning and Management, Minneapolis, MN, August, 2000.

Myers, A. and R.N. Palmer, Modeling the impacts of the endangered Species Act on water resources in the Puget Sound, Presented at ASCE's 2000 Joint Conference on Water Resources Engineering and Water Resources Planning and Management, Minneapolis, MN, August, 2000.

Hahn, M. A., R.N. Palmer, M. Merrill, and A. Lukas, Sewer inspection prioritization with a Regional Expert System, Presented at ASCE's 2000 Joint Conference on Water Resources Engineering and Water Resources Planning and Management, Minneapolis, MN, August, 2000.

Palmer, R.N., A. Mohammadi, M.A. Hahn, J. Dvorak, and D. Kessler, Computer assisted decision support system for high level infrastructure master planning: Case of the City of Portland Supply and Transmission Model (STM), Presented at ASCE's 2000 Joint Conference on Water Resources Engineering and Water Resources Planning and Management, Minneapolis, MN, August, 2000.

VanRheenen, N.T., A.W. Wood, R.N. Palmer, J.T. Payne, and D.P. Lettenmaier, The effects of climate change on water management strategies and demands in the Central Valley of California, *Proceedings of the ASCE's 2000 World Water and Environmental Resources Conference*, Orlando, FL, May 20-24, 2001.

Hahn, M. A., R.N. Palmer, A.F. Hamlet, and P. Storck, Preliminary analysis of the impacts of climate change on the reliability of the Seattle water supply, *Proceedings of the ASCE's 2000 World Water and Environmental Resources Conference*, Orlando, FL, May 20-24, 2001.

Palmer, R.N., S.L. Kutzing, and A.C. Steinemann, Developing drought triggers and drought responses: An application in Georgia, *Proceedings of the ASCE's 2002 Conference on Water Resources Planning & Management*. Roanoke, Virginia, May 2002.

Presentations Given at Conferences, continued

VanRheenen, N.T., and R.N. Palmer, Preparing for an uncertain future: Adaptive management strategies and alternative approaches to mitigate the impacts of climate change in California's Central Valley, *Proceedings of the ASCE's 2002 Conference on Water Resources Planning & Management*. Roanoke, Virginia, May 2002.

Hahn, M.A., and R.N. Palmer, Climate change impacts on municipal supplies: When are capital investments justified? *Proceedings of the ASCE's 2002 Conference on Water Resources Planning & Management*. Roanoke, Virginia, May 2002.

Palmer, R.N., J.H. Ryu, S.. Jeong, and Y.O. Kim, An application of water conflict resolution in the Kum River Basin, Korea, *Proceedings of the ASCE's 2002 Conference on Water Resources Planning & Management*. Roanoke, Virginia, May 2002.

Palmer, R.N., and M.A. Hahn, An investigation of the potential hydrologic and management impacts of climate change, *Proceedings of the 2002 Seminar on Water Resources, Disaster Prevention Research Institution*, Kyoto University, November, 2002.

Palmer, R.N., and M.A. Hahn, Managing droughts in the future: The impacts of climate change on municipal water supplies, *Proceedings of the 83rd Annual Meeting of the AMS*, Long Beach, CA, February 2003.

VanRheenen, N.T., R.N. Palmer, D.P. Lettenmaier, and A.F. Hamlet, Climate change, fish, agriculture, and power: Impacts and implications for future Snake River water resources management, *Proceedings of ASCE's 2003 World Water Resources Conference*, Philadelphia, PA, June, 2003.

Miller, M.L., and R.N. Palmer, Developing an extended streamflow forecast for the Pacific Northwest, *Proceedings of ASCE's 2003 World Water Resources Conference*, Philadelphia, PA, June, 2003.

Ryu, J.H., R.N. Palmer, S. Jeong, and Y-O Kim, An optimization model to mitigate conflicts in the Kum River Basin, Korea, *Proceedings of ASCE's 2003 World Water Resources Conference*, Philadelphia, PA, June, 2003.

VanRheenen, N.T. and R.N. Palmer, D.P. Lettenmaier, and A.F. Hamlet, Incorporating Long-Lead Climate Forecasts into Risk-Based Management and Decision Analysis: A Case for the Snake River Basin, *Proceedings of ASCE's 2004 World Water and Environmental Resources Congress*, Salt Lake City, Utah, June, 2004.

Palmer, R.N., and W. Werick, When Should Shared Vision Planning Be Used? *Proceedings of ASCE's 2004 World Water and Environmental Resources Congress*, Salt Lake City, Utah, June, 2004.

Palmer, R.N., and M. Miller, Determining the Skill of Meteorological and Hydrological Forecasts in the Pacific Northwest, *Proceedings of ASCE's 2004 World Water and Environmental Resources Congress*, Salt Lake City, Utah, June, 2004.

Presentations Given at Conferences, continued

Ryu, J.H, Palmer, R.N., Jeong, S., and Lee, J., Determining the Skill of Meteorological and Hydrological Forecasts in the Pacific Northwest, *Proceedings of ASCE's 2004 World Water and Environmental Resources Congress*, Salt Lake City, Utah, June, 2004.

Palmer, R.N., Wiley, M., and Mote, P., Preparing Pacific Northwest Water Resources for Climate Change, Urban Water Supplies and Climate Change in the West Meeting, Hosted by Southern Nevada Water Authority, Desert Research Institute, and Natural Resources Defense Council, Las Vegas, Nevada, September 2005.

Palmer, R.N., Impacts of Climate Change on Municipal Water Supplies in the West, presented at Climate Change and the Future of the American West, Exploring the Legal and Policy Dimensions, University of Colorado Law School, Boulder, Colorado, June 7-9, 2006

Palmer, R.N., Impacts of Climate Change on Municipal Water Supplies: A Time for Action, presented at the American Water Works Association's Annual Conference and Exposition, San Antonio, Texas, June 11-15, 2006.

Wiley, M., Palmer, R.N., and Ryu, J.H., Climate Based Streamflow Forecasts for Water Resource Managers, Proceedings of the American Water Resources Association Specialty Conference on Adaptive Management, Missoula, Montana, June 2006.

Ryu, J.H., Palmer, R.N., and Wiley, M., Mid-range Streamflow Prediction: An Application Using a Dynamic Climate Model, Proceedings of the American Water Resources Association Specialty Conference on Adaptive Management, Missoula, Montana, June 2006.

Palmer, R.N., Impacts of Climate Change on US Water Supplies, Managing Drought and Water Scarcity in Vulnerable Environments, Creating a Roadmap for Change in the US, The Geological Society of America, Longmont, Colorado, September, 2006.

Palmer, R. N. and Polebitski, A.S., Planning for the Impacts of Climate Change on Municipal Water Supplies, University Council on Water Resources, Boise, ID, July 2007.

Palmer, R. N. Creating Scenarios for Evaluating Climate Change, University Council on Water Resources, Boise, ID, July 2007.

Professional Licenses

Registered Professional Engineer in the State of Washington, Registration No. 0021154

Professional Society Membership

American Society of Civil Engineers
American Water Resources Association

Professional Society and Other Service

Chair of the session “Advances in Reservoir Operation Procedures” at the American Geophysical Union Annual Meeting, December, 1982.

Chair of the session “Instream Flow Requirements for Fish, Methodologies, Implementation and Impacts” at the American Geophysical Union Annual Meeting, December, 1983.

Chair of the session “Incorporation of Forecasts in Water Resources Systems Operation” at the American Water Resources Association Symposium on a Critical Assessment of Forecasting in Western Water Resources Management, June, 1984.

Chair of the session “Resource Management and Risk Analysis” at the American Society of Civil Engineers Spring Convention, Seattle, WA, April 7-11, 1986.

Chair of the session “Advances in Hydropower Operations” at the American Society of Civil Engineers Energy 87 Conference, Atlantic City, NJ, April, 1987.

Chair of the session “Expert Systems in Water Resources” at the American Society of Civil Engineers, Water Forum, Norfolk, VA, June, 1988.

Chair of the session “Successful Application of Expert System in Water Resources” at the American Society of Civil Engineers, Water Forum, Fort Worth, Texas, April, 1990.

Chair of the session “Planning Uncertainties in Municipal Water Supplies” at the American Society of Civil Engineers, Water Forum, New Orleans, LA, April, 1991.

Chair of the session “National Engineering Education Coalitions, Progress to Date” at the 19th Annual National Conference, Water Resources Planning and Management Division of ASCE, Baltimore, Maryland, August, 1992.

Served on Mini Symposium, National Drought Study at the 20th Annual National Conference, Water Resources Planning and Management Division of ASCE, Seattle, Washington, April, 1993.

Associate Editor, *Journal of Water Resources, Planning and Management*, ASCE, 1989-1993

Editor, *Journal of Water Resources, Planning and Management*, ASCE, from 1993-1997

Editorial Board, *Civil Engineering Systems*

Served as member on Expert Systems Committee, ASCE

Served as Control Group Member, Water Resource Systems, WRPM Division, ASCE

Professional Society and Other Service, Continued

Served as Control Group Member, Computing in Civil Engineering, Education Committee of The Technical Council on Computer Practices, ASCE

National Research Council, Committee on Endangered and Threatened Species in the Platte River Basin (2003)

National Science Foundation, Engineering Controls for Ballast Water Discharge: Workshop to Develop Research Needs (2003)

Awards and Honors

ASCE Julian Hinds Award, 2006.

Service to the Profession Award, Water Resources Planning and Management Division, American Society of Civil Engineers, 1998.

Certificate of Recognition, American Society of Civil Engineers, Editing Excellence, 1997

Huber Award for Research Excellence, American Society of Civil Engineers, 1992

Best Practice-Oriented Paper of the Year, American Society of Civil Engineers, Water Resources Planning and Management Division, 1988-1989.

Member of Research Team that was a Finalist in American Society of Civil Engineers for Engineering Achievement of the Year, 1983.

Teaching (courses taught at the University of Washington)

Course	Quarter	Students	Course Title	Combined
CIVE 491	A89	30	Deterministic Systems	
CIVE 559	A89		Water Resources Systems Mgt.	
CIVE390	Sp90	80	Civil Engineering Systems	
CIVE599	Sp90		Special Topics: Water & Air Res.	
CIVE 491	A90	30	Deterministic Systems	
CEWA 559	A90		Water Resources Planning	
CIVE 390	Sp91	80	Civil Engineering Systems	
CEWA 520	Sp91		Seminar	
ENGR 210	Su91		Statics	
CIVE 491	A91	22	Deterministic Systems	
CEWA 559	A91	7	Water Resources Planning	
ENGR 210	W92	45	Statics	
CIVE 390	Sp92	80	Civil Engineering Systems	
CIVE 491	A93	36	Deterministic Systems	
CEWA 559	A94	17	Water Res. Systems Mgmt.	
CEWA 557	W94		Water Resources Mgmt.	
CIVE 491	A94	22	Deterministic Systems	
CEWA 557	W95	22	Water Resources Mgmt.	4.0
CIVE 390	Sp95	68	Civil Engineering Systems	3.0
CEWA 559	A95	8	Water Res. Systems Mgmt.	3.8
CIVE 491	A95	19	Deterministic Systems	3.0
CEWA 520	W96	35	Seminar	
CEWA 557	W96	11	Water Resources Mgmt.	3.8
CIVE 390	Sp96	44	Civil Engineering Systems	3.0
CEWA557	A97	14	Water Resources Mgmt.	3.8
CIVE390	W98	40	Civil Engineering Systems	2.6
CIVE390	Sp98	23	Civil Engineering Systems	2.7
CEWA559	Sp98	8	Water Res. Systems Mgmt.	3.6
CEWA557	A98	24	Water Resources Mgmt.	3.5
CIVE491	A98	26	Deterministic Systems	3.1
CEWA559	Sp99	9	Water Res. Systems Mgmt.	4.2
CEWA557	A99	25	Water Resources Mgmt.	4.1
CIVE491	A99	26	Deterministic Systems	
CEWA520	W00	36	Seminar	
CEWA559	Sp00	12	Water Res. Systems Mgmt.	3.9
CEE576	A00		Water Resources Planning	3.7
CEE390	A00		Water Resources Planning	3.3
CEE390	W01		Civil Engineering Systems	3.0
CEE578	Sp01		Water Res. Systems Mgmt.	4.1

Teaching (courses taught at the University of Washington), continued

CEE576	A01	Water Resources Planning	3.6
CEE390	W02	Civil Engineering Systems	3.5
CEE578	Sp02	Water Res. Systems Mgmt.	4.3
CEE576	A02	Water Resources Planning	3.2
CEE491	A02	Civil Engineering Systems	3.9
CEE390	W03	Civil Engineering Systems	3.1
CEE578	Sp03	Water Res. Systems Mgmt.	3.9
CEE491	A03	Deterministic Systems	4.6
CEE576	A03	Water Resources Planning	3.3
CEE390	W04	Civil Engineering Systems	2.6
CEE578	Sp04	Water Res. Systems Mgmt.	4.1
CEE491	A04	Deterministic Systems	3.7
CEE576	A04	Water Resources Planning	3.7
CEE390	W05	Civil Engineering Systems	2.5
CEE390	Sp05	Civil Engineering Systems	3.2
CEE578	Sp05	Water Res. Systems Mgmt.	3.9
CEE576	A06	Water Resources Planning	3.5
CEE390	W07	Civil Engineering Systems	3.5
CEE390	Sp07	Civil Engineering Systems	3.0
CEE578	Sp07	Water Res. Systems Mgmt.	4.6

Short Courses, Workshops, and Other Educational Programs

Organizer of University of Washington Professional Engineer Review Course for Civil Engineering, 1983-1993 taught biannually

Systems Engineering and Trade Studies, for the Boeing Aerospace Company, 1986-present, taught biannually

Systems Engineering Overview, for the Boeing Aerospace Company, 1986-1987, taught biannually

Expert Systems for System Engineers, for the Boeing Aerospace Company, 1987-present, taught biannually

Expert Systems in Water Resource Planning, a two day short course, sponsored by the Norwegian Institute of Water Research, Oslo, Norway, September 12-13, 1988.

Expert Systems for Civil Engineers, a four day short course, sponsored by the Universidad Politecnica de Catalunya and Centro Internacional Metodos Numericos en Ingenieria, Barcelona, Spain, June 20-23, 1988.

Short Courses, Workshops, and Other Educational Programs, continued

Expert Systems in Water Resources, a four day short course, sponsored by the University of Belgrade, Department of Civil Engineering, Dubrovnik, Yugoslavia, June, 1989.

Complex Decision Making for Managers, for Engineering Continuing Education, 1992

An Introduction to Drought Planning for the Institute for Water Resources, US ARMY Corps of Engineers, 1994

Managing For Droughts, for the American Water Works Association, 2003.

Chaired Doctoral Degrees

Jay Lund	1986
Douglas Johnston	1986
Young-Oh Kim	1996
Jae Hyun Ryu	2006
Nathan VanRheenen	(2007)
Michael Miller	(2007)

Chaired Master Degrees

Peter Jowise	1982
Regina Snyder	1983
Gary Wiens	1983
Jody Lawrence	1983
Doug Berschauer	1984
Julia Cohan	1984
Mary MacKenzie	1985
Robert Schanz	1985
Robert Tull	1986
Nabeel Mishalani	1987
Paul Berkshire	1988
John Holmes	1988
Lynn Spence	1989
Carol Slaughterbeck	1989
Shinji Nishida	1989
Mark Holt	1990
Linda Holden	1990
Allison Keyes	1991
Donna Jabs	1991
Larry Karpack	1991
Diana Allen	1992
Donna Pacanovsky	1993
Keith Rivenbark	1993
Lawrence Spurgeon	1993
Selene Fisher	1993
Lise Johannesen	1995
Lea Adams	1995
Andrew Wood	1995
David Meyer	1995
Jon Ford	1995
Kjersti Dagestad	1996

Chaired Master Degrees, Continued

Diane Owen	1996
Alan Hamlet	1996
Joe Trungale	1996
Sumaya Haddadin	1996
Holly Coccoli	1996
Erik Hagen	1996
Paul Harmsen	1997
Dennis Mekkers	1997
Katherine Hilton	1998
Victoria Ballard	1998
Tom Camp	1998
Diane Robertson	1999
Sherrill Nelligen-Doran	1999
Amy Groome	1999
Margaret Hahn	2000
Amie Myers	2000
Sara Marxen	2000
Seshagirirao Vaddey	2000
Sandy Kutzing	2001
Jeff Payne	2001
Kari Vigerstol	2003
Ani Kameenui	2003
Matthew Wiley	2004
Kasey S. Kudamik	2004
Andre Ball	2005
Erin Clancy	2005
Liz Korb	2006
Quentin Donnelly	2006
Austin Polebitski	2006
Lee Traynham	2007
Kathleen King	2007

Other Student Supervision (service on graduate degree committees)**Ph.D. Committees**

Malcolm Leytham, John Yearsley, Kyoung-Doo Oh, Andrew Wood, Edwin Mauer, Alan Hamlet,

M.S. Committees

Thomas Kwiat, Kathleen Faris, Colin Wagoner, Jeffrey Sterling, Joseph Simpson, David Buhr, Alan Gay, Thomas Post, Joan Abbott, Mark Ewbank, Ken Peterson, Cameon Geyer, Alan Keizur, Carolyn Whitten, Warren Perkins, Barbara Fisher, Anna Zimmer

Departmental Service

1985-91	Chair, Civil Engineering Computer Committee
1991-94	Program Director, Environmental Engineering and Science Program
1998	Tenure Review Committee

1998- 1999 Search Committee, Transportation and Bioremediation
 2004 Chair, Civil Engineering Computer Committee
 2005 Chair, Hydrology Search Committee
 2007 Chair, Strategic Hiring Committee

College Service

Search Committee, Mechanical Engineering Chair
 Search Committee, Electrical Engineering Chair

University Service

1983-87 MITE (Minority Introduction to Engineering) Program
 1984-87 Faculty Senate
 1985-87 Faculty Council on Instructional Quality
 1986-87 Provost's Ad Hoc Committee on Student Computing Fees
 1990 University Academic Computing Advising Subcommittee
 1992-1994 Faculty Senate Committee on Continuing Education
 1996 Vice Chair, Site Programming Committee for EE&CS
 1998-2001 Faculty Council and University Relations

Student Service

1980-87 Faculty Advisor, Chi Epsilon

Community Service

1985-87 Vice Chairman, City of Seattle, Mayor's Forecast Committee for Energy Needs
 1990-95 Seattle Water Department, Citizens Advisory Committee

National Service

National Research Commission, Platte River Study, 2003

Consulting Experience

Bureau of Indian Affairs

Muckelshoot Indian Tribe

Portland Comprehensive Water Supply, Portland Water Bureau

Flood Control Operations, Seattle Water Department

Water Supply Reliability, Seattle Water Department

Hydropower Production in the Umpqua River Basin, Northwest Hydraulic Consultants, Inc.

Interactive Simulation Model of Seattle/Tacoma Water Supplies, Corps of Engineers

Development of Project Ranking Methodology, Corps of Engineers

City of Seattle, Review of Yield Analysis Model and Ground water Interactions

Peer Review of EPA Hazardous Waste Engineering Research Laboratory, Expert Systems Program.

City of Seattle, Seattle Water Department, Development of interactive, optimization programs for yield analysis.

URS Corporation, Seattle, Washington, Development of large scale, linear programming models for water supply.

U.S. Army Corps of Engineers, Baltimore Office, Development of computer models of Washington D.C. metropolitan area water supply and training of Corps personnel.