

## EDUCATION

B.Sc. in Civil Engineering, University of Birmingham, U.K., 1971

S.M. in Water Resources, Massachusetts Institute of Technology, 1974

Ph.D. in Hydrology, University of Washington, 1982, specialized in stochastic modeling of large scale droughts.

## GENERAL

Dr. Leytham has wide experience as an engineering hydrologist primarily with specialist consulting engineering organizations. He has worked on projects throughout North America and in South America, the Caribbean and the Far East. He has particular expertise in the analysis and synthesis of hydrologic data and in the development and application of catchment hydrology models for such uses as estimation of design floods, for flood forecasting, for seasonal snowmelt forecasting, and for the design of urban stormwater management facilities.

## CHRONOLOGICAL EXPERIENCE

*January 1987 - Present:* Principal with Northwest Hydraulic Consultants. Responsible for hydrology studies in the Seattle office.

*March 1986 - December 1986:* Senior Hydrologist with Northwest Hydraulic Consultants. Responsible for hydrology studies in the Seattle office.

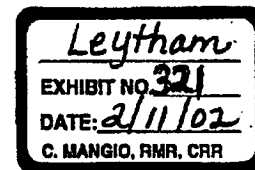
*August 1985 - March 1986:* Senior Hydrologist with Ott Water Engineers Inc., Bellevue, Washington. Responsible for hydrology studies in the Northwest regional office.

*January 1983 - August 1985:* Self-employed consultant providing services primarily in the area of deterministic catchment modeling and the development of computer models for flow forecasting.

*May 1982 - January 1983:* Senior Hydrologist with Crippen Consultants Inc., Seattle, Washington. Responsible for hydrology work related to hydropower developments.

*September 1979 - May 1982:* Ph.D. program at the University of Washington. Research into the stochastic generation of multi-site precipitation data for modeling large-scale droughts.

KML-GEN.LNG



nhc

AR 020478

*August 1975 - May 1979:* Hydrologist with Hydrocomp Inc., Palo Alto, California. Involved in a wide variety of hydrology projects, including development of simulation models, catchment hydrology studies and analysis of hydrologic and meteorologic data.

#### SELECTED PROJECT EXPERIENCE

**PMF Studies for Travers and McGregor Dams:** Conducted a probable maximum flood study for Travers and McGregor Dams in the Carseland – Bow River Headworks system of southern Alberta.

**Snohomish County Drainage Needs Reports:** Hydrology technical lead for County-wide analyses of storm drainage problems and development of capital improvement projects for Snohomish County, Washington. Developed hydrology protocols to ensure County-wide consistency of study approach, and resolved technical problems in hydrologic and hydraulic analyses over the course of the study.

**Dai Ninh Hydroelectric Project:** Hydrology specialist for review and update of hydrologic data for the final design of the Dai Ninh Hydroelectric Project, Vietnam.

**Mullen Slough CIP Study:** Project manager for HSPF hydrologic modeling of the Mullen Slough basin in south King County, Washington. The basin has a history of flooding associated with urban development. Multiple scenarios were modeled to determine the impacts of alternative land use on stream flows and to evaluate alternative approaches to storm water management.

**Lewis River Project Relicensing Studies:** Project manager for flood management aspects of relicensing studies for Swift, Yale, and Merwin Dams on the Lewis River, Washington. Investigated the flood management benefits of alternative project operating policies, including development of inundation maps for the Lewis River from Merwin Dam downstream to its confluence with the Columbia River (ongoing).

**Kelsey Dam Safety Review - Hydrologic and Hydraulic Aspects:** Participated in the hydrologic and hydraulic aspects of a dam safety review for Kelsey Generating Station on the Nelson River, Manitoba. Responsible for reviewing estimates of the Inflow Design Flood.

**Travers Dam PMF Review:** Undertook a comprehensive review of the PMF estimated for Travers Dam on the Little Bow River, Alberta.

**Mill Creek, Salem, Flood Reduction Study.** Project manager for development of hydrologic and hydraulic models of Mill Creek, Salem, Oregon for use in the investigation of system improvements to reduce urban flooding through the city of Salem. Hydrologic modeling was done using HEC-HMS. Hydraulic modeling was done using an unsteady flow UNET model to represent complex multiple flow breakouts, flow

splits, and flood storage facilities. Both models were calibrated to data from the major flood of February 1996.

**Nechako Reservoir Inflow Analysis.** Directed analyses of inflow data for Nechako Reservoir, British Columbia, to determine the best way of forecasting average annual inflows for a reservoir expansion study. The current record of inflows exhibits a cyclicity with inflows above or below the long-term average for extended periods of time. The analysis found a relatively strong relationship between reservoir inflows and the Pacific Decadal Oscillation (PDO), a long-lived (decadal) bimodal pattern of climate variability in the North Pacific. Estimates of average reservoir inflows for an approximately 25 year planning horizon were provided on the basis of a recent phase change in PDO.

**Black Butte Dam Rainfall-Runoff Model and PMF Estimate.** Project manager for development of a HEC-HMS rainfall-runoff model of the Stony Creek basin above Black Butte Dam, Northern California. The calibrated model was subsequently used to develop Probable Maximum Flood (PMF) estimates at the dam site. Probable Maximum Precipitation (PMP) estimates used as input to the PMF analysis were obtained from the National Weather Service HMR58 guidelines.

**Masonry Dam Flood Control Operations Study:** Project manager for the investigation of alternative flood control operating policies for Masonry Dam on the Cedar River, Washington. Work included development of alternative operating policies and assessment of the impacts of those policies on flood damage, hydropower generation, water supply safe yield, and downstream fisheries production.

**Shillapoo Lake Ecological Restoration:** Project manager for hydrologic and hydraulic studies for the proposed restoration of Shillapoo Lake, an approximately 900-acre area in the Columbia River floodplain, Washington. Analyzed alternative means for re-establishing hydraulic connections between Shillapoo Lake and the Columbia River to restore ephemeral wetland conditions. Produced conceptual level designs for the preferred alternative including: levees, water control structures, conveyance systems, and pump station.

**South Heart River Dambreak Studies:** Directed the performance of dambreak simulations using the U.S. National Weather Service FLDWAV model to determine the required spillway capacity of a dam on the South Heart River, Alberta, under the Incremental Hazard Evaluation methodology.

**Walker River Hydrology Studies:** Project manager for comprehensive hydrologic studies of the Walker River Basin; a 4,000 square mile closed basin in eastern California and western Nevada.

**Seven Mile Dam PMF Review and Characterization of Extreme Floods:** Reviewed the PMF for Seven Mile Dam on the Pend Oreille River, British Columbia and performed

detailed flood frequency analyses to estimate the magnitude and frequency of extreme floods for use in risk analyses undertaken by others.

**Lewis River Flood Study:** Project manager for an investigation of the severe flooding which occurred in February 1996 along the Lewis River, Washington, downstream from Merwin Dam. Work involved field identification of high water marks, reconstruction of natural (i.e. unregulated) flows, development of a hydraulic model of the Lewis River from the dam to its confluence with the Columbia River, and determination of flood profiles and areas of inundation for actual and hypothetical project operations.

**Iron Gate PMF Study:** Project manager for the determination of the probable maximum flood at Iron Gate Dam on the Klamath River, California.

**Lake Chelan Hydroelectric Project PMF:** Project manager for the determination of the probable maximum flood for the Lake Chelan Hydroelectric Project on the Chelan River, Washington.

**Juri River Flood Warning System:** Provided advice and assistance in the evaluation of a low-cost flash flood warning system on the Juri River in northeastern Bangladesh. The work involved the design and implementation of a network of rainfall and streamflow gauges, analysis of hydrometeorologic data, and conceptual level design of the flood warning system and flood disaster management program.

**Snoqualmie Ridge Parkway:** Reviewed the design of temporary erosion control facilities for the construction of the Snoqualmie Ridge Parkway, Washington.

**Evaluation of Rainfall - Runoff Models:** Conducted an evaluation of rainfall-runoff models for the Northwest Region, National Rivers Authority, U.K.. The study included an interview program with agency staff to determine needs, review of models potentially suitable for adoption by the agency, and test case application of selected models to several catchments.

**Mill Creek (Auburn) Flood Control Plan:** Technical lead for the development of the Mill Creek Flood Control Plan, a multi-objective, multi-jurisdictional effort to develop and implement a comprehensive flood control and environmental restoration plan for the Mill Creek Basin, Auburn, Washington. As technical lead, managed all technical input to the project, provided direction to and coordinated the work of wetland, fisheries, water quality, and hydraulic and hydrologic modeling specialists, developed and analysed conceptual flood control alternatives consistent with the project's environmental goals, provided technical liason with project stakeholders, and advised on stakeholder selection of a preferred flood control alternative.

**North Umpqua River Flow Forecasting Model:** Project manager for the development of seasonal and short-term flow forecast models for use in the operation of hydro-electric generation facilities on the North Umpqua River, Oregon.

**Hydrologic Analysis and Modeling for Remedial Works on Mt. Pinatubo:** Project manager for development of hydrometeorologic database and estimation of design flows for use in the planning and design of sediment and flood control measures on the eight major water courses affected by the 1991 eruption of Mt. Pinatubo, Philippines.

**Northridge Master Drainage Plan:** Project manager for the conceptual design of stormwater management facilities for a proposed 1500 acre mixed-use (commercial and residential) development in King County, Washington.

**Beaverdam Master Drainage Plan:** Project manager for hydrologic monitoring, hydrologic analysis, and conceptual level design of stormwater control facilities for a residential golf course development in an environmentally sensitive area in western King County, Washington.

**Snoqualmie Ridge Master Drainage Plan Review:** Project manager for detailed technical review of the analysis and design of stormwater control facilities for a proposed 1300 acre mixed use development in the City of Snoqualmie, Washington.

**Small-Scale Flood Control Structure Operation and Maintenance Mission:** Participated in a mission to design and develop a program for improving the operation and maintenance of small-scale flood control structures throughout Bangladesh.

**Mill Creek Upper Detention Pond Operation Study:** Conducted hydrologic studies to develop an optimal operating policy for a regional stormwater detention facility at the head of Mill Creek Canyon, Kent, Washington.

**Sammamish River Multi-Objective Corridor Management Plan:** Project manager for hydraulic modeling aspects of a study to enhance fishery and recreational use of the Sammamish River corridor, King County, Washington. Responsible for developing a water surface profile model for the river and for evaluating the effects of proposed environmental enhancements on flood levels along the river corridor.

**East Side Green River Drainage Study:** Project manager for hydrologic modeling aspects of a study to alleviate local flooding associated with the East Side Green River drainage system in the lower part of the Green River valley, Washington.

**BWDB/CIDA/AIT Training Course:** Developed and taught the hydrology component of a two-month training course for water resources engineers from the Bangladesh Water Development Board.

**Issaquah Creek HSPF Model Calibration:** Project manager for calibration of an HSPF hydrologic simulation model to streamflow and rainfall data from the Issaquah and Tibbetts Creek catchments in King County, Washington.

**City of Lynnwood Flood Plain Mapping Study:** Project manager for a flood plain mapping study on Scriber Creek in the City of Lynnwood, Washington.

**City of Lynnwood Stormwater Modeling:** Performed detailed hydrologic analyses of stormwater runoff in the City of Lynnwood, Washington.

**Highwood River/Little Bow River PMF Study:** Conducted hydrologic modeling and dambreak analyses for estimation of the probable maximum flood and the spillway design flood for a proposed dam on the Little Bow River, Alberta. The PMF is generated by a major flood on the neighboring Highwood River, which spills over a low topographic divide into the headwaters of the Little Bow River. Dambreak simulations were performed using the U.S. National Weather Service DAMBRK model.

**Kent Lagoons Hydraulic Design:** Project manager for the conceptual hydraulic design of a regional off-channel stormwater detention facility in Kent, Washington.

**Miller Creek Regional Stormwater Detention Facility Design:** Performed hydrologic modeling for the design of two regional stormwater detention facilities in the Miller Creek basin, King County, Washington.

**Lilliwaup Creek Hydropower Review:** Reviewed power production potential of a small hydropower facility on Lilliwaup Creek, Washington.

**Scriber Creek Watershed Management Plan:** Project manager for hydrologic modeling (using the EPA's HSPF continuous simulation model) for the Scriber Creek Watershed Management Plan, Snohomish County, Washington. Work included model calibration, simulation of flows for future land-use conditions, and simulation and analysis of various strategies for stormwater control in this rapidly developing suburban watershed.

**Small Scale Water Control Structures:** Developed hydrologic criteria to meet both engineering and agro-economic goals for the design of small scale water control structures in Bangladesh.

**Surface Water Design Manual Review:** Project manager for detailed technical review of proposed design manual for surface water and stormwater management facilities to be built in King County, Washington.

**Tony Creek Hydrology Study:** Conducted hydrologic studies for the design of a small hydropower plant on Tony Creek, Montana.

**Mill Creek Regional Stormwater Detention Study:** Project manager for a detailed study of a proposed regional off-channel stormwater detention facility in Kent, Washington, including collection of hydrologic data, hydrologic modeling (using EPA's HSPF model), and analysis of the system's performance.

**Black and Fannegusha Creek Watersheds Hydrologic and Hydraulic Analyses:** Project manager for hydrologic and hydraulic studies on Black and Fannegusha creeks, Mississippi for the design and evaluation of a system of flood water retarding structures.

**Clear Creek Hydrology Study:** Performed field work and hydrologic analyses for a fish farm on Clear Creek, Washington to identify and document the causes of high stream turbidity believed to have resulted from upstream urban development.

**Licorice Fern Stormwater Management and Erosion Control Study:** Project manager for conceptual design of stormwater management and erosion control facilities for a 170-acre residential development on steep terrain in King County, Washington.

**Skagit River Flood Forecast Model:** Project manager for the development of a flood forecast model for the Upper Skagit River basin, Washington.

**Wabamun Lake Water Level Simulation Study:** Developed monthly water balance model of Wabamun Lake, Alberta, and performed long-term simulation of lake levels to evaluate various proposed modifications to the lake outlet control structure.

**Lake Washington Basin Runoff Model:** Project manager for development of a daily water balance model for Lake Washington.

**Leach Creek Hydrology and Geomorphology Study:** Performed hydrologic studies on Leach Creek, Washington to document the effects of urban development on the stream's hydrologic regime and to identify the causes of severe stream bank and bed erosion.

**Washington Basin Climatic Data Base:** Project manager for the development of a data base of daily and monthly hydrologic and climatic data for Lake Washington and the surrounding area.

**Similkameen River Flood Control Study:** Project manager for a flood study for a proposed dam on the Similkameen River, Washington.

**Dissolved Nitrogen Modeling for the Columbia and Snake Systems:** Developed a system simulation/optimization model for deriving reservoir operating policies which would minimize nitrogen supersaturation levels below 13 major dams on the lower Snake and Columbia rivers while meeting power production constraints.

**Veazey Quarry Master Drainage Plan:** Project manager for the conceptual design of stormwater and sediment control facilities for a major rock quarry in Washington.

**Nisqually River PMF Study:** Project manager for the estimation of probable maximum floods at Alder and LaGrande dams on the Nisqually River, Washington.

**Snowmelt Forecasting for the Skokomish, Cowlitz and Nisqually Rivers:** Developed and implemented a seasonal snowmelt forecasting model for the operation of hydroelectric generation facilities on the Skokomish, Cowlitz and Nisqually rivers, Washington.

**Surface Water Appraisal Study:** Conducted a field appraisal of surface water supply potential for a resort development on the island of Lanai, Hawaii.

**Coal Creek Basin Plan:** Provided advice and assistance in the application of an HSPF hydrologic simulation model for the development of the Coal Creek Basin Plan. Responsible for designing the overall modeling approach, directing model calibration, providing training, and assisting in the design and interpretation of production runs for future land use scenarios.

**Green River Low Flow Study:** Managed a study to develop alternative low flow operating policies for the Hanson Dam on the Green River, Washington, to enhance downstream water quality and fisheries.

**Strategies for Coping with Drought:** Participated in research into the effect of drought on hydro- and thermal-electric power production. Developed techniques for evaluating the spatial characteristics of widespread drought.

**Flood Forecasting for the Salt and Verde Rivers, Arizona:** Developed and implemented a real-time flood forecasting model for the operation of a system of reservoirs on the Salt and Verde rivers in Arizona.

**Iskut River PMF Study:** Estimated the probable maximum flood for three dams on the Iskut River in northern British Columbia. Special consideration was required for runoff from heavily glacierized areas of the basin.

**Hydropower Reconnaissance Studies:** Performed numerous hydrologic studies related to the development of small-scale hydroelectric projects on Burlington Northern land holdings throughout the northwestern U.S.A., including estimation of flow duration and flood frequency curves for both gaged and ungaged catchments, preliminary sizing of equipment, and assessment of energy production.

**Water Supply Studies for Homer, Alaska:** Conducted hydrologic simulation studies to determine the water supply yield of several small streams in the vicinity of Homer, Alaska.

**Sunset Falls Hydroelectric Study:** Conducted flood studies and conceptual design of flood control works for a proposed hydroelectric project on the South Fork Skykomish River, Washington.



**Transmigration Project Village Water Supplies:** Conducted reconnaissance level hydrologic studies and yield analyses for village water supplies in Sumatra, Indonesia.

**Hurricane Modeling for Probable Maximum Precipitation (PMP) Estimates, Dominican Republic:** Developed a computer model of hurricane-generated rainfall for PMP estimates for spillway design studies for dams on the Rio Blanco, Dominican Republic.

**Paranaiba River Hydrology and PMF Studies, Brazil:** Performed extensive hydrology studies for hydroelectric development on the Paranaiba River, Brazil, including estimation of PMF at three dam sites, stochastic generation of long flow sequences and training of Brazilian personnel.

**Sediment Transport Modeling:** Developed mathematical models for simulating sediment transport in river systems and for predicting soil loss from agricultural lands.

#### SELECTED PUBLICATIONS

Jackson C.R., S.J. Burges, X. Liang, K.M. Leytham, et al. "Development and Application of Continuous Hydrologic Modeling for Drainage Design and Analysis." Land Use and Watersheds: Human Influence on Hydrology and Geomorphology in Urban and Forest Areas, Water Science and Application 2, American Geophysical Union, Washington DC, 2001.

Karpack, L.M. and K.M. Leytham. "A Simple Short-Term Flow Forecast Model For Small Hydropower Systems." Mountain Hydrology: Peaks and Valleys in Research and Application, Canadian Water Resources Association, 1995.

Peck, H.W., K.W. Eriksen, M.L. Pearson, and K.M. Leytham. "Post Eruption Hydrology and Hydraulics of Mount Pinatubo, The Philippines." Tech. Rep. 9L-94-16, Waterways Experiment Station, U.S. Army Corps of Engineers. May 1994.

Leytham, K.M. "A Joint Rank Test for Assessing Multivariate Normality in Hydrologic Data", Water Resources Research, 23 (12):2311-2317, 1987.

Leytham, K.M., D.P. Lettenmaier and E.G. Altouney. "Widespread Drought and the Hydroelectric Industry", Hydro Review, VI(V):26-31, 1987.

Tangborn, W.V., J.L. Keane and K.M. Leytham. "Application of Streamflow Forecasts to Operating a Multi-Reservoir System in Central Arizona", in A Critical Assessment of Forecasting in Western Water Resources Management, Technical Publication TPS-84-1, American Water Resources Association, 1984.

Leytham, K.M. "Maximum Likelihood Estimates for the Parameters of Mixture Distributions", *Water Resources Research*, 20(7):896-902, 1984.

Leytham, K.M. "Scale Problems in the Synthesis of Multi-Site Precipitation" in Proceedings of the International Symposium on Hydrometeorology, Denver, CO., June 1982, American Water Resources Association, 1983.

Tangborn, W.V. and K.M. Leytham. "Snowmelt Forecasting for Peak Flow Rates and Runoff Volumes in Mountainous Areas", WMO Technical Conference on Mitigation of Natural Hazards Through Real Time Data Collection and Hydrological Forecasting, Sacramento, CA., 1983.

Leytham, K.M. "Physical Considerations in the Analysis and Synthesis of Hydrologic Sequences" Tech. Rep. No. 76, Charles W. Harris Hydraulics Lab., Dept. of Civil Engineering, University of Washington, Seattle, WA., June 1982.

Leytham, K.M. and D.D. Franz. "Techniques for the Generation of Long Streamflow Sequences" in "Improved Hydrologic Forecasting: Why and How" Proceedings of the Engineering Foundation Conference, Asilomar, CA., May 1979, ASCE, New York, 1980.

Leytham, K.M. and R.C. Johanson. "Watershed Erosion and Sediment Transport Model" Environmental Research Laboratory, U.S. Environmental Protection Agency, Athens, GA, March 1979.

Johanson, R.C. and K.M. Leytham. "Modeling Sediment Transport in Natural Channels" in Watershed Research in Eastern North America: A Workshop to Compare Results, D. Correll, Ed. Chesapeake Bay Center for Environmental Studies, Smithsonian Institute, 1977.

Fleming, G. and K.M. Leytham. "Real-Time Forecasting for Southern California" Symposium on Weather Radar and Water Management, Water Research Centre, Berkshire, England, December 1975.

Leytham, K.M. "A Search Technique for Formulating Improved Water Resource Configurations" in Systematic Approach to Water Resource Plan Formulation, J.C. Schaake Jr., Ed. Tech. Rep. No. 187, Ralph Parsons Laboratory for Water Resources and Hydrodynamics, MIT, July 1974.

## PROFESSIONAL AFFILIATIONS

Registered Professional Engineer in the States of Washington and Oregon  
Registered Professional Hydrologist, American Institute of Hydrology  
American Geophysical Union  
American Society of Civil Engineers

