



W.A. ROZEBOOM, M.B.A., P.E.

EDUCATION

B.Sc. in Civil Engineering (with Distinction), University of Alberta, 1978.

M.B.A., University of Alberta, 1986.

GENERAL

Mr. Rozeboom has 20 years' experience in water resources management and water resources engineering. He has broad technical expertise in surface water hydrology and hydraulics developed through substantive experience in the areas of streamflow gaging, sediment sampling, data processing, physical hydraulic model studies, hydrologic analyses and modeling to design stormwater and flood control facilities, and hydraulic modeling for inundation mapping and river crossing designs. Mr. Rozeboom also has broad expertise in the regulatory aspects of water rights administration in Washington and Hawaii and of Puget Sound stormwater quantity and quality controls and best management practices. While employed by the Hawaii Water Commission, Mr. Rozeboom helped establish the institutional framework for implementing the 1987 Hawaii Water Code. With NHC, Mr. Rozeboom's work has resulted in numerous client commendations.

CHRONOLOGICAL EXPERIENCE

November 1992 - Present: Hydrologist and senior engineer with Northwest Hydraulic Consultants, Seattle office.

June 1988 - November 1992: Hydrologist with the State of Hawaii Commission on Water Resource Management. Responsible for implementing new programs for water rights certification and dispute resolution under the 1987 State Water Code.

September 1986 - May 1988: Self-employed. Provided engineering and management consultant services for various projects, including two water supply development assignments in the West Indies.

September 1984 - August 1986: Full-time MBA student and graduate assistant. During summer employment with Alberta Environment Hydrology Branch, conducted field and office research studies of carriage losses from natural channels.

January 1979 - May 1984: Project engineer with Northwest Hydraulic Consultants, Edmonton office. Responsible for managing and conducting projects involving field inspections, river surveys, scale model design, construction, and testing, hydrologic and river engineering assessments, and development of computer models.

Summers, 1976 - 1977: Water survey technologist with Alberta Environment Water Survey Section. Responsibilities included flow meter measurements of river discharges by bridge and wading methods, integrated depth sampling of suspended sediments, data reduction, development of rating curves, and servicing of hydrometric gaging stations.

analyses based on HEC-1 modeling, regional analysis, and a 90-year archival record of flooding from local newspaper reports. Performed hydraulic analyses with the Federal Emergency Management Agency's FAN alluvial fan model. Study results led to an 80% reduction of the regulatory flood hazard zone, relieving more than 500 property owners from the need to purchase federal flood insurance.

North Fork Issaquah Creek Floodplain Mapping: Updated an existing HSPF hydrologic simulation model of the North Fork basin to determine flood quantiles for current land use conditions, and developed a HEC-2 hydraulic model to determine floodplain boundaries for 1.2 miles of channel ending at the confluence with the main stem Issaquah Creek. Flood flows and floodplain boundaries in the lower portion of the study reach were determined to be influenced significantly by inter-basin flood flows originating from the main stem channel and which overtop a ridge between the basins during major floods.

Nevada Flood Insurance Hydrology Studies: Updated hydrology studies and determined design flows for FEMA floodplain mapping of three mountain streams in Washoe County near Reno, and the North Las Vegas Wash Flood Control Project near North Las Vegas, Nevada. Design flows for the Washoe County streams were determined from a regional analysis to be governed by a population of relatively rare (about 50-year and higher return periods) cloudburst events accompanied by high sediment and debris loads. Existing HEC-1 models for the North Las Vegas Wash were reviewed and updated to more accurately predict 500-year flows. Methodologies used in the previous North Las Vegas Wash analyses were found to have substantially underestimated 500-year flows by overlooking the loss of peak flow control which will result when the 100-year design capacity of a major flood control detention facility is exceeded.

Watershed Assessments: Conducted surface water assessments of the Deschutes, Snohomish, and Walla Walla Water Resource Inventory Areas under a statewide program of initial watershed assessments for the Washington State Department of Ecology (DOE). The purpose of this work was to characterize the "health" of the surface water resources in each watershed to facilitate decision-making by DOE on water rights applications. Examined available flow data in relation to established instream flow regulations, and conducted time-series assessments of streamflow and precipitation data to determine whether there were indications of declining minimum or average annual flows unrelated to natural climatic fluctuations.

Cowlitz River Flood Analysis: Reviewed the controlled flow releases from the Cowlitz River Mossyrock Dam during flood events in November 1995 for compliance with FERC license requirements. Assessed alternative reservoir operating scenarios to determine the extent to which operating practices contributed to downstream flood damages.

Snoqualmie Ridge Parkway Plan Reviews: Reviewed Stormwater Management Plans, Temporary Erosion and Sediment Control Plans, and related construction drawings for stormwater aspects of the 3.2-mile long Snoqualmie Ridge Parkway. Principal stormwater facilities include water quality/detention ponds, biofiltration swales, and a large-diameter high-flow bypass pipeline. The high-flow bypass pipeline is sized to convey excess flow from the Parkway and the adjoining Snoqualmie Ridge and Falls Crossing sites for direct

discharge into the Snoqualmie River. Plans and drawings were reviewed for technical accuracy and for compliance with the King County Surface Water Design Manual, City of Snoqualmie ordinances, and project MDP and EIS documents. Coordinated subconsultant reviews of water quality and wetlands issues and facilities.

Mount Pinatubo Regional Hydrologic Analysis: Conducted a regional analysis of rainfall and streamflow data for the Mount Pinatubo region, assessed data reliability, prepared isopluvial maps of 2- through 500-year rainfall amounts for 24-hour through 5-day durations and, through HEC-1 modeling, developed flow duration and flood frequency curves for 39 potential sediment and flood control project sites on major streams affected by the 1991 eruption of Mount Pinatubo. Study results were published in COE Technical Report GL-94-16, Post Eruption Hydrology and Hydraulics of Mount Pinatubo, The Philippines.

Mount Vernon Regional Drainage Analyses: Used HSPF simulation models of current and future land use conditions in the City of Mount Vernon to identify drainage problems along main stem channels throughout the city. Developed designs and costs for proposed alternative solutions including pump stations, regional detention pond facilities, and culvert replacements.

Falls Crossing Master Drainage Plan (MDP) Review: Reviewed Draft MDP hydrologic analyses and flood impact analyses submitted to the City of Snoqualmie for approval of a development partially located within the Snoqualmie River floodplain. Coordinated reviews of water quality and wetlands issues by subconsultants.

Clarewood Development Review: Assessed drainage patterns and flood risk for properties located downstream of the proposed Clarewood development in Pierce County. Provided expert testimony at a development hearing on the uncertain performance of infiltration facilities to be constructed immediately upslope of an area with past flooding problems, and the downstream flood impact risk associated with the development as proposed.

Cedar Hills Gaging Services and Data Processing: Responsible for operation of a six-station gaging network at the Cedar Hills landfill for a period of one year to identify and eliminate persistent data discrepancy problems. Conducted field tests and theoretical reviews which positively identified two principal problems: control elevations which had been incorrectly reported on "as-built" drawings, and inaccuracies in the technical manual used to derive theoretical rating curves for multiple-orifice outlet structures. Developed revised stage-discharge relationships which eliminated the data discrepancies, and provided training to client staff in data processing and reporting practices.

Snoqualmie Ridge Master Drainage Plan (MDP) Review: Reviewed Draft MDP hydrologic analyses and conceptual facility designs submitted to the City of Snoqualmie for mixed use development approval. Reviewed hydrologic analyses for adequacy of HSPF model calibration and measures proposed to deal with uncertainty in the analyses. Reviewed conceptual facility designs for feasibility and compliance with applicable development standards. Coordinated reviews of water quality and wetlands issues by subconsultants.

Myrtle Creek Flood Study Review: Reviewed flood hydraulics and floodplain mapping studies for the Town of Myrtle Creek located at the confluence of Myrtle Creek and the South Umpqua River. The work was undertaken on behalf of the Federal Emergency Management Agency to resolve a 4-foot discrepancy in the 100-year flood elevation as reported by two other federal agencies. The discrepancy was resolved by identification of an error in one of the earlier analyses.

Snoqualmie Parkway EIS and SMP Reviews: Managed a multidisciplinary review of water quantity, water quality, and wetlands elements of Environmental Impact Statement materials and supporting documents submitted to the City of Snoqualmie for the proposed Snoqualmie Ridge Parkway. Subsequently reviewed the Stormwater Management Plans (SMP) and construction drawings for compliance with applicable standards and representations made in the environmental impact process. The work was undertaken for the City of Snoqualmie under the direction of the Director of Community Development.

Evans Creek HSPF Model Calibration: Calibrated the EPA's Hydrologic Simulation Program - Fortran (HSPF) to streamflow and wetland water level data collected at four sites in the Evans Creek West catchment of the proposed Northridge/Redmond Ridge Urban Planned Development in King County.

Water Use Inventory: Implemented Hawaii State Water Code legislation requiring registration of all wells and stream diversions statewide, declaration of water use, and monthly reporting of water use. Gave public workshops on water code requirements, developed systems, procedures, and databases to analyze and manage the contents of 7,300 declarations of water use, acted on all declarations, and coordinated field survey activities for verification of water facilities and uses.

Bank Protection Research: Conducted a comprehensive review of alternative methods of streambank protection, seeking those that might provide cost-effective alternatives to conventional riprap protection for highway bridges in Alberta. Computed present value project life costs of promising alternatives, considering allowable velocities, maintenance costs, local availability of materials, and transportation costs.

Database Development: Developed computer databases to track processing of Hawaii well and stream diversion works construction permits, to inventory wells, stream diversions, and water uses statewide, and to target specific groups by geographic area and/or activity for mailings of notices and informational materials.

Water Rights and Dispute Resolution: Administered the first contested case hearing before the Hawaii Commission on Water Resource Management, including mediating discussions between opposing expert witnesses, preparing the Findings of Fact, and drafting the Commission's Decision and Order. Prepared the Findings of Fact report which led to the designation of the Island of Molokai as a Water Management Area. Prepared Departmental testimony to the Legislature on proposed amendments to the State Water Code.

Satellite-Linked Water Resources Data Collection: Initiated and developed a pilot program for collecting real-time precipitation and other water resources data via satellite from remote areas in Hawaii.

Water Utility Privatization Study: Determined rate structures and impact on consumers which would result from the privatization of water and sewerage facilities for small municipalities.

Montserrat, W.I., Integrated Resource Development Project: Provided specialist water resources input on a five-person multidisciplinary mission in Montserrat, W.I. for the Canadian International Development Agency. Determined design and construction specifics and costs for small dam and irrigation projects to facilitate agricultural self-sufficiency.

Cedar Hills Hydrologic Data Review: Reviewed the accuracy of rain and flow data being collected at the Cedar Hills landfill to determine downstream impacts and for future calibration of a hydrologic model. Identified erroneous records through double-mass analysis, reviewed implications of stage measurement and theoretical rating curve errors, and recommended measures for improving data accuracy.

Supermall Downstream Impact Assessment: Developed current and future land use HSPF simulation models for the proposed Supermall of the Great Northwest to identify downstream impacts. Linked hourly HSPF simulation results to a finite difference unsteady flow model, FEQ, and assessed water level impacts through a complex system of wetlands, ditches, and culverts leading to the downstream receiving channel.

City of Yellowknife Municipal Financial Assessment: Assessed the impact of the City's 5-year capital improvements plan on financial stability and tax rates.

Jasper Park Lodge Water System Analysis: Conducted computer analysis of recirculating water system for Jasper Park Lodge; identified causes and recommended solutions to problems of low water pressure and fluctuating water temperatures.

St. Lucia W.I. Roseau River Carriage Loss Assessment: Determined water losses which would result from using a natural channel to transmit water from a proposed water storage reservoir to downstream agricultural users.

St. Lucia W.I. Roseau Basin Water Development Program: Provided hydrologic input towards site selection for a water supply reservoir in St. Lucia, W.I. Reviewed reliability of available hydrometric data and extended streamflow records using rainfall records and computer modeling techniques. Estimated low-flow sequences to determine reservoir storage needs, and design floods for spillway sizing. Conducted on-the-job training with local personnel for computer use and hydrologic techniques.

School Financial Planning Model: Refined a prototype computer model to project finances over a 5-year horizon, based on scenarios of economic and demographic growth,

required facilities, debt structure, salary rates, and programs of government financing.

Ross Creek Basin Surface Water Supply: Developed a computer simulation model which accounted for varying precipitation, evaporation, runoff and water consumption within the Ross Creek Basin in southern Alberta. The model was used to develop a 50-year sequence of natural runoff conditions and to assess alternative water supply management proposals.

Peace River Basin Surface Water Supply: Determined surface water supply characteristics from limited streamflow records based on regional correlations and frequency analyses, and computed reliable water supplies for 22 communities in northwest Alberta based on intake characteristics, current and projected water consumption, and existing reservoir facilities.

Pipeline River Crossings: Conducted field surveys and determined hydraulic design parameters of scour, bank erosion and 1:100 year high water levels at 32 river crossings of the Alaska Highway Gas Pipeline and 7 river crossings of the Alberta Deep Basin Pipeline.

Gull Lake Regulation Study: Developed and calibrated a computer simulation model to determine causes of historical declines in lake levels and assessed the effectiveness of alternative lake management scenarios on the basis of historical hydrological conditions.

Carriage Loss Investigations: Designed and coordinated a field research study to monitor carriage losses over 60 km of natural channel in Southern Alberta; analyzed field data to determine the magnitude, uniformity, and causes of losses. Reviewed and evaluated all previous studies conducted to assess carriage losses in natural channels in Alberta and Saskatchewan, and developed techniques to predict carriage losses which affect reservoir release flows into natural channels.

Isle Lake - Lac Ste. Anne Stabilization: Developed and implemented a computer simulation model to examine proposals to stabilize lake water levels.

Alaska Highway Gas Pipeline Route Hydrology: Six-month in-house assignment with the Yukon Pipeline Design Joint Venture design team; provided hydrotechnical input on small basin hydrology, and for development of drainage and erosion control criteria.

Berry Creek Channel Losses: Determined channel losses affecting reservoir release flows over 12 km of natural channel in southern Alberta.

Willow Creek Water Supply: Determined causes of winter water supply shortage at communities drawing water from Willow Creek below Chain Lakes Reservoir in southern Alberta.

Little Bow Basin Water Supply: Assessed basin water supplies as affected by internal runoff and inter-basin water diversions.

Whitford Lake Basin Management: Developed a comprehensive study program to establish an engineering data base and methodologies to evaluate drainage and flood control projects in the Whitford Lake Basin in central Alberta.

Buffalo Bay - Horse Lakes Management Program: Developed a computer simulation model to assess water levels and discharges in the Buffalo Bay - Horse Lakes complex in north-central Alberta under alternative management schemes.

Rat Creek Bridge Crossings: Conducted field surveys, determined hydraulic design parameters, and designed abutment armoring for two single-span bridge crossings in central Alberta.

McLeod River Bank Stabilization: Conducted field surveys and designed rip-rap armoring for bank stabilization at a railway bridge in central Alberta.

Channel Ice Surveys: Conducted winter ice and breakup surveys at 52 river crossings encountered along the British Columbia segment of the proposed Alaska Highway Gas Pipeline.

Red Deer River Floodplain Development: Determined open water and ice jam design flood levels and developed measures for floodplain development in Red Deer, Alberta.

St. Mary Canal Sedimentation: Conducted field sedimentation studies to assess sources and mechanisms of canal sedimentation in southern Alberta.

Dickson Dam Diversion Tunnel Model Study: Constructed a 1:54 scale physical model of dual 5.5 m diameter diversion tunnels: assessed and optimized intake and outlet flow patterns, minimized transition losses, and assessed outlet scour. Supervised construction of a 1:70 scale model of the 60 m wide, 190 m long service spillway for the dam project.

Port McNeill Harbour Breakwater Model Study: Constructed a 1:100 scale physical model of the Port McNeill harbour region in British Columbia. Developed a breakwater design to shelter a proposed harbour expansion from ocean waves.

Elbow River Channel Improvement: Conducted field surveys and designed channel improvements to increase side-channel flows in the City of Calgary, Alberta.

Harvey Creek Channelization Model Study: Constructed 1:15 and 1:25 scale physical models of a steep 12 degree channel in British Columbia. Determined the stability of 1.0 m boulders under flood conditions, and assessed flow patterns through transitions and curves in a channelized reach of channel.

Cooling Pond Circulation Model Studies: Constructed and tested physical scale models of cooling ponds formed in natural topography for three thermal generating stations in central Alberta: the Calgary Power Ltd. Keephills Thermal Plant, the Edmonton Power Genesee Power Project, and the Alberta Power Ltd. Sheerness Generating Station. Assessed alternative dike arrangements to optimize circulation patterns under conditions including thermally stratified flow and adverse wind shear.

Sundance Helper Cooling System Model Study: Developed 1:12 scale model of a 20 m long sump bay with a 2.1 m diameter, 100,000 GPM pump intake: designed baffles to produce smooth intake flow conditions, and determined intake energy losses.

Field Surveys: Conducted hydrometric surveys over two summers of more than 100 rivers and lakes throughout the Province of Alberta. Responsibilities included surveying of seasonal lake level elevations, streamflow gaging by wading and bridge crane methods, sampling of suspended sediment at bridge and cableway sites, hydrographic soundings and mapping of lake bottom contours, field servicing and repair of strip-chart water level recorders, and assisting in the construction and installation of housings and equipment for stream gage stations.

PROFESSIONAL REGISTRATION

Washington
Alberta

ASSOCIATIONS

American Water Resources Association
Northwest Regional Floodplain Managers Association
Washington State Water Resources Advisory Committee
Washington State Water Use Measurement Technical Advisory Group

AWARDS

National Science and Engineering Research Council Postgraduate Scholarship, 1978.

RELEVANT PUBLICATIONS

"Use of a Scale Model to Improve Pond Circulation," Proceedings of the Specialty Conference on Computer and Physical Modeling in Hydraulic Engineering; Chicago, Illinois; August, 1980.

"Carriage Losses in Natural Channels in Southern Alberta," with S.J. Figliuzzi.
"Proceedings of The 1986 Canadian Hydrology Symposium on Drought: The Impending

Crisis?"; Regina, Saskatchewan, June 1986.