Job Title:

Postdoctoral Fellow in Reservoir Simulation for Hydroelectric Operations and Long-Term Planning

Project Description:

The aim of this research is to re-regulate historical streamflow records within the Saskatchewan River Basin using reservoir simulation software, accounting for changes in upstream operations and water use. Water availability and drought risk for the basin under current and future climate will be explored under various water use scenarios.

This research is part of a larger Manitoba Hydro project titled *Corporate Flow Record Improvement* (CFRI). The outcomes from this project will provide key datasets, models, and information to update Manitoba Hydro's assessment of the dependable flow case of 1940/41 and re-assess historical water supply variability and drought risk. Additional project background is provided at the end of this posting.

Responsibilities:

- Review existing water management models for the Saskatchewan River Basin and synthesize relevant inputs for RTC-Tools model development.
- Update consumptive use estimates for the Saskatchewan River Basin based on a review of current literature and collection and analysis of available data.
- Develop and calibrate an RTC-Tools model for the Saskatchewan River Basin based on current regulation and water use.
- Conduct a scenario analysis of historical and future climate-affected streamflows under present-use regulation.
- Supervise an undergraduate student throughout Summer 2026.
- Prepare a summary report and draft manuscript for publication.
- Assist with the development of research funding proposals, and perform other duties as assigned.

Nature of Work:

This work is largely computer–based and the post-doctoral fellow (PDF) will split their time approximately 50% at the University of Manitoba and 50% at Manitoba Hydro, gaining valuable industry experience. The PDF will report to Dr. Masoud Asadzadeh in the Department of Civil Engineering and staff at Manitoba Hydro in the Hydrology and Climate Section.

Subject matter experts from the University of Manitoba's Civil Engineering Department, University of Saskatoon's School of Environment and Sustainability, and Manitoba Hydro's Energy Operations and Water Planning and Energy Resource Planning Departments will contribute technical support and guidance.

The PDF will gain exposure to various engineering-related areas of Manitoba Hydro, offering a comprehensive understanding of Manitoba Hydro's system operations. Through this work, the successful candidate will obtain advanced knowledge of water resources management in the Saskatchewan River Basin, and further their skills in the areas of advanced data processing, reservoir simulation and optimization models (RTC-Tools and MODSIM), and scenario analysis including assessing the impacts of climate change on water supply.

Qualifications and Conditions of Employment:

Essential:

- A PhD in civil engineering, water resources engineering, environmental sciences, or a related field is required at the time of appointment.
- Applicants must be within 6 years of graduating from their PhD.
- Demonstrated expertise in water resources modelling and optimization, including hydrology, hydraulics, and/or water management.
- Strong quantitative skills, including data management, hydrological data analysis, and statistical analysis.
- Excellent oral and written communication skills in English.

Desired:

- Strong writing skills and a track record of peer-reviewed publications.
- Proficiency with tools such as R, Python, MODSIM, RTC-Tools, or other similar software.
- An understanding of prairie hydrology and Canadian transboundary water management.
- Demonstration of contributions to successful funding applications.
- Experience in training of HQP (highly qualified personnel).
- Experience in industry or working on applied research projects with industrial partners.

Duration and Stare Date:

The full-time position (40 hours/week) is a 20-month term, with a target start date of January 5, 2026.

Salary and Benefits:

The position offers a salary of [$75,000] per annum, inclusive of benefits and net of applicable deductions, equating to [$125,000] for the full 20-month term.

How to Apply:

The University of Manitoba is strongly committed to equity and diversity within its community and especially welcomes applications from women, racialized persons, Indigenous peoples,

persons with disabilities, persons of all sexual orientations and genders, and others who may contribute to the further diversification of ideas. All qualified candidates are encouraged to apply; however, applicants who are legally entitled to work in Canada (e.g., Canadian citizens, permanent residents, or individuals with a valid Canadian work permit) will be given priority.

Interested applicants must include the following in their application, collated into a single PDF document:

- A cover letter outlining your relevant experience and interest in the position.
- A CV including publication record and description of your contribution to each publication.
- Names and contact information for two academic or industrial referees.

Closing Date: October 31, 2025, or until the position has been filled.

To submit your application or to obtain more information on this opportunity, please contact Masoud Asadzadeh at masoud.asadzadeh@umanitoba.ca.

Additional Project Background:

Founded in 1961, Manitoba Hydro (MH) is a provincial Crown corporation and one of the largest integrated electricity and natural gas distribution utilities in Canada. On average, over 97 per cent of electricity generated in Manitoba is from hydropower produced at 16 hydroelectric generating stations on the Nelson, Winnipeg, Saskatchewan, Burntwood and Laurie Rivers; a watershed with a contributing drainage area of over 1.4 million km^2. Research and innovation are an important part of MH's business, and the corporation has a long-standing R&D partnership with the University of Manitoba in the areas of water resources engineering, HVDC, environmental science, and other related fields.

Manitoba Hydro's Corporate Flow Record (CFR) is a historical time series of estimated inflow to key locations within the Nelson-Churchill watershed from 1912 to present-day. MH relies on the CFR for energy supply planning, operational decision-making, and financial forecasting, among other uses. Despite advancements in data availability, computational methods, and changes in flow regulation policies and water use, the CFR has not undergone a comprehensive review and methodology update in nearly three decades. This lack of reassessment poses financial risks for MH and updating and refining the CFR are necessary to ensure more robust and reliable water resource management.

Changes in upstream regulation and water use have necessitated an update of the CFR for various basins, including the Saskatchewan River Basin (SRB). A significant portion of the flows arising within the SRB come from outside of Manitoba and human intervention upstream, such as operation of dams and reservoirs, diversions, and water withdrawals, likely has significant impacts to the timing and magnitude of streamflows entering Manitoba along the Saskatchewan River. Additionally, changes in climate will alter the availability of water supply and increase the occurrence of extreme events. "Re-regulation" of inflows to reflect current upstream regulation and water use will enable MH to re-evaluate inflows during the critical drought of record

(1904/41) and under future changes in climate; a planning exercise that is paramount to assessing dependable energy from hydropower and the need for future energy developments.

To improve reservoir simulation capabilities, MH is moving towards Real-Time Control Tools (RTC-Tools), a reservoir simulation and optimization model from Deltares that is fully integrated with MH's Forecasting System (FEWS). This project will build off previous work completed by Ali Shah in 2019, whereby a water management model for the SRB was developed using MODSIM software. Model inputs and lessons learned from this work will be applied to development and application of an RTC-Tools model for the SRB, and an inter-model comparison will provide a second level of validation for RTC-Tools within this basin. A scenario analysis will be carried out to better understand the complexities of the system, and the implications that changes in operation and allocation policies and future changes in climate may have on inflows to Manitoba, including during the critical drought of record.

The proposed research is part of a broader Corporate Flow Record Improvement (CFRI) project. MH has a vested interest in maintaining and updating the CFR because it is relied upon by several critical business operations including:

- planning and optimizing plant designs, managing hydraulic system generation assets.
- forecasting export generation costs and revenues required for long term financial analyses and economic optimization.
- planning for energy security, capacity adequacy, including for future Integrated Resource Plans.
- supporting environmental assessments, licensing and regulatory processes, etc.