ALBERTA INNOVATES

ONE HEALTH

ENVIRONMENTAL INNOVATION

WATER INNOVATION

FUNDING DETAILS

Monthly and Seasonal machine learning-based streamflow forecasts for Alberta

The project will develop machine-learning (ML) based monthly and seasonal streamflow forecast tools for three hydrological stations in Alberta: the Athabasca River at Whitecourt, the Bow River at Calgary, and the Oldman River at Lethbridge. The ML tools will provide monthly forecasts for March-September (7 predictions per season) and can be updated periodically for use by Alberta Environment and Protected Area's (EPA) River Forecast Centre (RFC) after project completion and evaluation of the product.

RECIPIENT:
University of Alberta
Dr. Evan Davies

PARTNERS:
Alberta Environment & Protected Areas

TOTAL BUDGET:
$194,000

AI FUNDING:
$65,000

PROJECT DATES:
FEB 2025 – MAR 2026

APPLICATION

Streamflow prediction models will be developed using machine learning methods for the Athabasca, Bow, and Oldman Rivers in Alberta. Pending successful validation in the Alberta's River Forecast Centre's operational environment, these models are expected to support monthly and seasonal water supply predictions published in the *Water Supply Outlook*.

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PROJECT GOALS

The River Forecast Centre (RFC) under the Government of Alberta's Ministry of Environment and Protected Areas (EPA) publishes the Water Supply Outlook from February to August each year, providing information for Albertans, the GOA, and transboundary partners. This report includes monthly river flow-volume forecasts for the March to September period. Currently, these forecasts rely on PCA-based statistical models developed approximately a decade ago that have recently performed inadequately, particularly in abnormal water years (extreme dry/wet). The project will develop replacement machine learning-based models and will build on earlier research that developed seven seasonal XGBoost models for the Oldman and Red Deer rivers by evaluating the performance of additional ML algorithms, including ANN, SVM, ELM, RBF and LSTM for the Athabasca and Bow Rivers.

BENEFITS TO ALBERTA

By improving predictions of monthly and seasonal water availability, the research will support efforts by the Government of Alberta to manage its water resources sustainably to support population growth and socio-economic development in Alberta, as well as a healthy aquatic environment. The streamflow forecasts developed through this project can be incorporated into Alberta Environment and Protected Areas' Water Supply Outlook and shared publicly through the internet to benefit communities, irrigators and industries, and to drive wider adoption of machine learning applications to streamflow forecasting by the research community.

2 Publications

5 Students Trained

1 Project Jobs

1 New Products/Services

CURRENT STATUS

JUNE 2025

In the first milestone, the project team collected and quality-controlled local climate and hydrometric station, snow and soil moisture, and global teleconnection data, and developed monthly models for the Bow River Basin. Model methods included XGBoost, Random Forest, Radial Basis Function, Support Vector Regressor, Artificial Neural Network, and Long Short-Term Memory, and linear regression for comparison. Phase two of the project has kicked off.