

Experience in flood hazard management



Canada: Floodplain Mapping Guidelines and Specifications, British Columbia

Client: Fraser Basin Council

Water Management Consultants was selected to prepare guidelines, criteria, standards and specifications for floodplain mapping projects in British Columbia and in the Lower Fraser Valley in particular.

The scope of work included developing procedures for estimating flood construction levels in complex floodplain situations where the presence of dikes increases flood levels. Guidelines were prepared for dike breach modelling to determine floodproofing elevations in floodplains protected by dikes. Detailed specifications were prepared for high resolution topographic mapping and developing Digital Elevation Models using both photogrammetry and Light Detecting and Ranging (LIDAR) technologies.

Canada: Coquitlam River Flood Mitigation, British Columbia

Client: City of Port Coquitlam, City of Coquitlam

Water Management Consultants was responsible for an analysis of the operations of BC Hydro's Coquitlam Reservoir to estimate the 200-year flood outflow. A reservoir routing model was developed incorporating the BC Hydro reservoir operating rules and outflows determined based on a probabilistic analysis of reservoir levels. A water surface profile was calculated for the Coquitlam River using the hydrodynamic module in HEC-RAS and the adequacy of dike freeboard was assessed. Floodplain mapping was prepared for the cities of Coquitlam and Port Coquitlam. Alternative flood mitigation strategies were also addressed including a sediment management plan, gravel excavation, dike raising and modified reservoir operations.



Coquitlam River in flood

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Canada: Dam Safety Flood Studies

Client: BC Hydro

Water Management Consultants is responsible for a major update of Probable Maximum Precipitation (PMP) for 16 BC Hydro dams in Southwestern British Columbia. The scope of work includes regional storm maximisation, transposition analyses, using hydro-meteorological methods, and developing region-wide point PMP values.

Extensive use is being made of GIS methods for developing depth-area relationships and isohyetal patterns for design PMP storms for the 16 watersheds.

Canada: Flood Hazard Mapping for the Skeena River at Terrace

Client: City of Terrace

Water Management Consultants was retained by the City of Terrace, British Columbia, to prepare flood hazard mapping for floodplain areas within the city.

The scope of work included setting up a MIKE 11 hydrodynamic model and determining depths of flooding, erosion rates and potential avulsion paths. A hazard evaluation rating was prepared for floodplain zones and a colour-coded flood hazard map prepared.

Appropriate development guidelines for each hazard area were recommended.

Madagascar: Water Resources Planning for the QMM Project

Client: QIT Madagascar Minerals

Water Management Consultants provided water resources planning expertise for the QMM project in Madagascar for flood control, water supply and environmental assessment.

The work included hydrological and meteorological data collection, assessment of groundwater and surface water resources, watershed studies, probabilistic analysis of inflows, identification of dam and storage opportunities, stochastic analyses of storage alternatives, and hydrodynamic modelling of flood flows and water quality.

A detailed flood inundation map of the estuary area was prepared. Training and technology transfer for water monitoring was an important component of the project.

Water Management Consultants developed a preliminary design and cost estimate for a salinity control structure comprising a dam across an estuary and a spillway capable of passing the Probable Maximum Flood. The salinity control structure will provide freshwater conditions in the estuary upstream for mine water supply and water supply for the community of Fort Dauphin.



The policy of fail-safe (never fails) flood protection systems is now giving place to safe-fail (safe in failure).

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Canada: Fraser River Flood Control

Client: Government of British Columbia

Water Management Consultants was retained to carry out a study of the feasibility of dredging a pilot channel in gravel sediments and using the power of the river to enlarge the channel over time, thereby providing enhanced protection from overtopping of existing extensive flood control dykes during the design event.

A particular task was to determine the effects on sediment scour and deposition in the river. The sediment transport module of the hydrodynamic model MIKE 11 was used to simulate scour and deposition. The channel changes over a 16 year period were modelled with and without the pilot channel to determine the technical feasibility of the concept.

The scope of work included mapping of the proposed area for the pilot channel, river morphological studies, detailed sediment transport modelling and an environmental assessment, focused on the potential effects on migratory fish.

USA: St Vincent Highway Hydrodynamic Modelling Study

Client: Minnesota Department of Transportation

Water Management Consultants carried out a hydrodynamic modelling study of the effects of raising the St Vincent Highway. The work included set up of the MIKE 11 hydrodynamic model, simulation of alternative highway grades and assessment of impacts on upstream and downstream water levels. Water Management Consultants also designed waterway openings for mitigation of flood levels including bridges and culverts. The results were presented at a public meeting in St Vincent, Minnesota.



An effective flood preparedness system requires a combination of structural and non-structural approaches.

Canada: Red River Dykes Cumulative Impact Assessment

Client: Manitoba Natural Resources

Water Management Consultants completed a cumulative dyke impact assessment for Manitoba Natural Resources. The work included evaluation of 14 community ring dykes in the Red River Floodplain and 2600 individual floodproofing projects.

The purpose of the evaluation was to determine whether the proposed projects would collectively have an unacceptable impact on water levels. The impact of the St. Mary's Road Dyke was investigated with and without the other projects, as it is located immediately opposite the Red River Floodway Inlet.

A MIKE 11 model of the Assiniboine and Red Rivers was used to model the floodplain flow processes, with and without the proposed dykes.

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Canada/USA: Transboundary Flood Management

Client: International Joint Commission

The lower Pembina River crosses from Manitoba, Canada into North Dakota, USA and floods frequently. The flooding is the cause of an international dispute between the two governments. Water Management Consultants was commissioned by the International Red River Basin Task Force of the International Joint Commission to carry out a detailed hydrodynamic modelling study of the river in order to determine the causes.

The MIKE 11 model was set up using topographic data collected by the US Army Corps of Engineers and extends from the Red River to upstream of the town of Neche. The model was used to investigate flooding under natural and existing conditions.

WMC developed a comprehensive hydrodynamic model covering a 280 km stretch of the river to simulate the movement of the flood wave through the complex floodplain topography with flow over dykes, roads and railway embankments and operation of a floodway inlet control structure to protect the city of Winnipeg.

The client's staff were trained by WMC to use the model and the model is now being used by the Government of Manitoba for real time flood forecasting and assessment of proposed flood control projects.

Canada: Dyke Impact and Red River Floodway Intake Modifications

Client: Acres International Ltd

Following the 1997 flood on the Red River, Manitoba Natural Resources is planning to construct a dyke around a community situated just upstream of the Winnipeg Floodway.

Water Management Consultants analysed the impacts of dyke construction on water levels in the area using the MIKE 11 hydrodynamic model of the Assiniboine and Red Rivers developed for the International Joint Commission.

Alternative dyke alignments were evaluated to determine the alignment with the least impact on water levels. Mitigation measures investigated included modifications to the Floodway Intake to reduce water levels upstream.



Flood control benefits include reduced flood damages and maintaining transportation links.

Canada: Real Time Flood Forecasting

Client: International Joint Commission

Flood damage in the United States and Canada was in excess of a billion dollars following the 1997 flood on the Red River, Manitoba. Water Management Consultants was commissioned by the International Joint Commission to develop planning tools for future flood management.