



Established in 1989, Water Management Consultants (WMC) is an independent international consulting company.

We specialise in integrated, sustainable development and management of water for economic and social development.

Our role is to guide and assist institutions and stakeholders in the water sector to develop their capacity to manage water jointly in an equitable, efficient and sustainable manner so that demands for water are satisfied using available resources whilst at the same time protecting water-dependent environments.

Our services to governments focus on providing technical assistance, training and building capacity in institutions to:

- ~ Strengthen policy, legal and regulatory frameworks
- ~ Strengthen water sector reform processes
- ~ Improve the provision of water supply and sanitation services
- ~ Improve the participatory planning and management of water resources and water demand
- ~ Improve the assessment of water resources
- ~ Improve flood management and hazard reduction.

Our services to donor agencies and non-governmental organisations include:

- ~ Project management
- ~ General and specialist advice
- ~ Technical assistance
- ~ Project and programme design
- ~ Monitoring and evaluation
- ~ Sector studies and research.

The principals and senior staff have between them extensive experience in:

- ~ Africa
- ~ Asia
- ~ Caribbean
- ~ Europe
- ~ Latin America.

We can provide senior advisers and consultants to work as integrated members of the client's team or we can tailor an interdisciplinary project team to develop innovative, cost-effective and sustainable approaches together with clients and key stakeholders.

Our offices are located in:

- ~ Australia
- ~ Canada
- ~ Chile
- ~ Peru
- ~ United Kingdom
- ~ USA.

A high level of communication and teamwork between each office ensures that activities are coordinated and that each company has access to the global resources available within the group.

We are proud of the high quality of our work, our professional approach, our ability to respond to the needs of our clients and to deliver sustainable outcomes.

Our strengths

Water Management Consultants is recognised for its flexible, innovative approach which places emphasis on working in close partnership with local institutions and key stakeholders to build capacity to manage water in an integrated manner from a river basin perspective.



Water Management Consultants has proven ability to work effectively with project partners. Our commitment to building stakeholder relationships has been key to successful project implementation.

We are committed to quality and excellence. Continued staff training and close links with universities and research organisations worldwide help us to maintain the highest standards.

We place emphasis on communication skills, the sharing of knowledge and language ability. Many of our staff and associates are fluent in a number of languages.

Water Management Consultants maintains a network of close links with experienced consultants in a variety of disciplines in both developed and developing countries. We are therefore able to offer a comprehensive range of international and local expertise and experience to meet the needs and challenges of a variety of project types.

The staff and associates at Water Management Consultants have been involved in many different projects in all types of social and cultural settings and with widely varying objectives, from providing a safe water supply to isolated communities, to resolution of inter-sectoral conflicts over limited water resources.

We strive to remain abreast of both technological advances and development thinking, whilst being aware of practical, logistical and cultural aspects at the local level. This places Water Management Consultants in the position of being able to integrate advanced methods, new approaches and appropriate technology to achieve reliable, low cost solutions for sustainable, integrated development.

An integrated approach to water resources management



A people-centred approach to water resources planning and management

Water Management Consultants has developed an innovative and participatory framework for the integrated management of water resources with the broad aim of achieving efficient, sustainable and equitable development of water resources.



Learning together leads to improved capacity in water resources management.

We believe that if water resource management is to be sustainable, it must be based on a rigorous problem situation analysis.

We adopt a people-centred and demand-led approach which works back from a management vision to a detailed analysis of problems and their causation to what needs to be done to solve them.

Using this 'bottom up' approach we can build up an integrated "big picture" of the important linkages and interactions involved in addressing issues in water resource management in any particular project location.

Stakeholder analysis as an effective tool for water resource management

Using an interdisciplinary approach, we use participatory, analytical and transparent processes based on understanding, reflecting on and balancing diverse stakeholder interests.

Stakeholder analysis is a powerful tool for managing the challenge of multiple interests and objectives and increasing the chances for successful intervention. It has considerable potential in water resource planning and management due to the complexity of issues, including the multiple uses and users of water, unclear or open access rights to ownership and use of water resources and imperfect water markets.



Developing a shared vision amongst stakeholders.

An integrated approach to water resources management

Improving access to a safe water supply for poor people

Given that over 1 billion people around the world lack access to a safe water supply, improving the access to and management of scarce water resources is a vital contribution to poverty alleviation strategies in developing countries.



Improved access to water is vital for poverty alleviation.

The identification and inclusion of poor and marginalized groups in decision-making processes around water resource management is a critical keystone in enabling poor people to lead healthier and more productive lives.

An interdisciplinary focus integrating key social, economic and technical disciplines

We have developed a robust teamworking methodology integrating key technical, social development and economic disciplines to achieve efficient, sustainable and equitable management of water resources to meet diverse human and environmental needs.

Towards greater economic well-being

Building an integrated vision of water resource management is not solely an environmental conservation issue. It contributes to women's and men's needs for good quality water now and in the future. It is pivotal to the efficient use of water resources, generating improvements in economic well-being and contributing to poverty alleviation.

Our strength lies in building human resource capacity within counterpart organisations, particularly in important managerial and social science areas. Training in effective teamworking and project management skills has enabled us to work successfully in partnership with Southern counterparts on water management projects.



Robust rural livelihoods depend on enough water being available at the right times for all people.

Water Management Consultants' approach reflects our awareness of a range of cross-cutting themes such as gender, sustainable livelihoods, environment and human rights. We advocate the use of a flexible framework, providing iterative feedback mechanisms and emphasising the importance of learning by doing.

**WATER
MANAGEMENT
CONSULTANTS**

Experience in improving water resources management



Colombia: Integrated Groundwater Management Pilot Project

Client: Ministry of Environment/UK Department for International Development.

Water Management Consultants provided technical assistance to the Government of Colombia to build institutional capacity to take an integrated, participatory approach to the management of groundwater.

Working with the Ministry of Environment at national level and CVC in the Cauca Valley and CORALINA on San Andres Island at regional level, replicable approaches to water resources management which are socially equitable, economically viable and environmentally sustainable were established.



Colombia: education of people on the importance of water should start at an early age.

Training was given in areas such as stakeholder analysis, socio-economic impact evaluation, formulation of communication strategies, planning and working as effective teams as well as in the technical fields of groundwater and solid waste management. A replication strategy developed during the project is currently being implemented.

Tanzania: Sustainable Management of the Usangu Wetland and its Catchment

Client: Ministry of Water and Livestock Development/UK Department for International Development.

The aim of this project, based in the headwaters of the Rufiji river basin, was to sustainably develop local capacity to manage water and other natural resources (land, livestock, fisheries and wildlife) for the maintenance and improvement of rural livelihoods.

Competition for scarce water resources exists between large and small scale irrigation schemes and domestic use upstream and ecological demands downstream.

Working in association with HTS Development Ltd, Water Management Consultants was responsible for building government capacity in water resources management at regional, river basin and district levels. Investigations to understand the hydrological functioning of the catchment have contributed to the basis of a strategy for managing water resources at local level that will be developed by stakeholders in the catchment and downstream.



Tanzania: the Usangu wetland exerts a demand on the water resources of the catchment.

Experience in improving water resources management



Brazil: Planning and Environmental Management for the Pirapama River Basin, Pernambuco

Client: CPRH/UK Department for International Development.

Water Management Consultants has been working with ERM to build the capacity of CPRH (the environmental regulatory agency in Pernambuco state) and stakeholder institutions in the city of Recife, northeast Brazil, to take a participatory approach to planning and management of river basins. Water Management Consultants provided technical assistance and training in water resources assessment, water resource modelling, water quality assessment, formulation of river water quality objectives and a framework for carrying out baseline studies which would form a basis for strategy formulation.



Cities in the developing world are placing unprecedented pressure on local water resources making water conservation and demand management real priorities.

The Bahamas: Development of Regulatory Framework for Integrated Groundwater Management and Pollution Control

Client: Water and Sewerage Corporation.

Water Management Consultants was commissioned to develop the principles for groundwater policy in the Bahamian context and a regulatory framework for groundwater abstractions and pollution control.

Services provided by WMC included reviews of the natural resources system, the socio-economic system, the administrative and institutional system, water policy and legislation. The exploitation and pollution status of groundwater was assessed, technical measures for protection were evaluated and 15 existing and proposed regulatory instruments were presented. Options for institutional arrangements were identified and assessed.

Recommendations were made for a new regulatory agency, mechanisms to ensure efficient allocation of water, monitoring and enforcement, and an implementation strategy. Legal, administrative and technical guidelines for developing an integrated strategy to manage groundwater and control pollution were provided. Recommendations were made for strengthening the Water and Sewerage Corporation as an organisation. The work was completed within eight months.

Experience in water resources assessment and development



Canada: Capilano, Seymour and Coquitlam Watersheds Water Source Capacity Study

Client: Greater Vancouver Regional District

Water Management Consultants was commissioned to assess the water supply capability of a system of linked lakes and reservoirs that supply Vancouver and to determine their current and potential capacity in the light of increasing demands and potential climate change.

The services provided included a detailed study of the hydrology of the watersheds and of current and projected demand for water under conditions of water shortage. WMC developed a spreadsheet-based multiple reservoir simulation model and assessed the reliability of the reservoir system under a range of hydraulic constraints and potential climate change. Options for increasing the supply capacity were identified.

The study and the model will assist the GVRD Planning Department to plan for future delivery of reliable water supplies and maximise the use of existing sources before additional sources are developed.



Optimisation of existing water resources should precede investment in new infrastructure.

Chile: Monturaqui Aquifer Investigation and Development

Client: Minera Escondida Ltda

Water Management Consultants was appointed to manage and implement a comprehensive investigation of the groundwater resources of a recently discovered aquifer in the arid Region II, northern Chile, and to design and install a production wellfield. WMC specified and managed extensive electromagnetic and magnetic geophysical surveys and the drilling of 35 groundwater observation/monitoring wells, 8 wireline core holes and 40 test production wells.



Because it is out of sight, groundwater is often a poorly understood resource.

More than 45 wells were tested to determine aquifer parameters, production pumping rates, establish pump installation depths and provide pump selection criteria. A site laboratory was established for core testing and analyses, lithological logging, sieve analysis and field water quality testing.

A numerical groundwater flow model was developed to quantify the effect of abstraction and optimise the location and design of the production wellfield so that resource usage is maximised, and operation costs and impacts on groundwater levels in a wetland 60 km down gradient are minimised. WMC has managed the monitoring of the impact of exploitation on groundwater levels in the aquifer and in the wetland since 1995.

Experience in water resources assessment and development



USA: Artificial groundwater recharge *Client: Metropolitan Domestic Water Improvement District, Arizona*

Water Management Consultants was appointed to develop an innovative approach to quantify the potential recharge resulting from natural floods in normally dry river beds. This work formed part of a study of the feasibility of a \$30M in-channel artificial recharge project. In contrast to previous approaches WMC proposed a method that focuses on the vadose zone and unsaturated flow dynamics. The method tracks the wetting front and changes in soil saturation. This information is used to calibrate a 2-dimensional variably saturated flow model that can quantify infiltration and lateral downstream flow in the aquifer. The method allows for better quantification of pilot project results and improves estimates of recharge from full scale recharge facilities, and could aid in developing optimal recharge strategies.

UK: The hydrological impact of river basin management on fresh water flows into the Severn estuary conservation area

Client: The Environment Agency

Under the European Union's Habitat's and Bird's Directives the Environment Agency is responsible for demonstrating the impact of its permissions on statutory conservation areas. The Severn basin covers 11,000 km² and is regulated by two major reservoirs. The basin's water resources are heavily utilised for public water supply and a range of other uses and the estuary is both a Special Area of Conservation and a Special Protection Area under European and UK law.

Water Management Consultants was retained by the Agency to develop an approach that is acceptable to the statutory conservation authority for the assessment of the impact of over 4,500 water abstraction and effluent discharge permissions on the flow of fresh water into the Severn estuary.

The approach developed by WMC was based on hydrological analyses and modelling of the complex water resources system in the lower part of the basin to synthesise estimated actual and naturalised 23-year historic flow series at the entrance to the estuary using only the most significant permissions in the basin. Statistical comparison of the two flow series allowed assessment of the impact of river management on flows into the estuary.



The ecological requirement for fresh water flows in estuaries is an area of considerable uncertainty.

Experience in water resources assessment and development



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.

Guinea: Koundara Water Supply Project

Client: Société Nationale des Eaux de Guinée.

Water Management Consultants was commissioned to undertake an investigation to assess the feasibility of supplying the town of Koundara from groundwater. Services provided included geophysical surveys, supervision of exploration drilling and computer modelling of the aquifer to assess the sustainability of the resource.

Guinea: Seven Towns Water Supply

Client: Ministère des Ressources Naturelles, de l'Energie et de l'Environnement

This project developed detailed designs for water supply systems for seven secondary towns. Four towns were to be supplied from groundwater and three, Labé, Koundara and Dinguiraye, from new reservoirs. Water Management Consultants was commissioned by the project consultants to evaluate the surface water resources to size the three reservoirs.

A digital rainfall-runoff catchment model was calibrated to nearby gauged watersheds and then transposed to the dam sites to generate long synthetic flow records at each site using observed rainfall and evaporation records. Flow measurements made at the dam sites were used to quality control the synthesised records. Behavioural storage-yield analyses were undertaken using the synthetic records to estimate the reservoir storage capacities necessary to maintain supplies through the 1:50 year drought. Allowance was made in the storage calculations for reservoir sedimentation and climate change.

WMC also estimated peak floods for design of the spillways. A regional flood frequency relationship and an analysis of local extreme rainfalls were combined with the unit hydrograph method to generate design flood hydrographs. Proposals were made for instrumenting the watersheds and monitoring inflows, storage and outflows from the reservoirs.

Experience in water resources assessment and development



The Gambia: Coastal Groundwater Resources Assessment

Client: Ministry of Natural Resources and the Environment

Water Management Consultants was appointed to develop a regional numerical groundwater model of the Kombo District coastal aquifer. The model was to assess available groundwater resources over a 10-year predictive period and the risk and extent of saline intrusion under variable recharge/abstraction scenarios for supply to the capital Banjul.

WMC designed the model for use as a resource management tool and for efficient technology transfer. It can be expanded easily as more data becomes available from further investigations.

Recommendations were made for wellfield location and pump schedules to reduce the risk of saline intrusion and the deterioration of groundwater quality.

Western Samoa: Water Resources Master Plan, Phase 1

Client: Western Samoa Water Authority

A series of high volcanic islands located in the South Pacific, Western Samoa has a humid tropical climate. Comprehensive water resources assessments had not been carried out previously. Water Management Consultants provided water resources expertise to the consultant's team for the groundwater component of the study.

All existing data were collated and reviewed. An inventory of boreholes and their characteristics was prepared and operational pumping tests were carried out to assess hydraulic performance and the risk of saline intrusion.

A detailed programme was designed and costed for surface geophysical investigations to map saline intrusion, drilling of exploration and monitoring boreholes, pumping tests and numerical modelling for assessment of groundwater resources. Planned development facilities were appraised and recommendations were made for safe yields.

Training was delivered to government staff in groundwater monitoring. An assessment of further training needs was made and a training programme was designed and costed.



Western Samoa: groundwater overexploitation can result in salinization of water supplies.

Libya: EIA, Great Man Made River

Client: Great Man Made River Authority

Water Management Consultants provided expertise for the hydrogeological aspects of the EIA of Phase 2 of the project, the Western Jamahiriya System. The work involved the assessment of the impact on the groundwater system of two wellfields of 484 wells in the Hamada al Hamra basin in the Sahara Desert and of 2.5 Mm³/day delivered to the Jeffara Plain in the north, 80% of which is to be used for large scale irrigated agriculture surrounding Tripoli.

Experience in improving access to water supplies and sanitation



Mauritius: Environmental Sewerage and Sanitation Project

Client: Ministry of Public Utilities, Waste Water Authority

Water Management Consultants was commissioned to undertake an environmental impact assessment of the disposal of treated wastewater via borehole injection at Montagne Jacquot treatment works as part of a scheme to improve the sewerage system of Port Louis, the capital of Mauritius.

It was proposed that effluent should be injected into highly permeable volcanic formations near the coast as a cost effective alternative to constructing a conventional long sea outfall.

This study involved hydrogeology, marine biology, oceanography and wastewater treatment, and assessed the potential impact on marine benthic communities and coral reefs in the area of the disposal point. Recommendations were made for design and construction of the works, treatment processes, mitigation measures and a monitoring programme.



Mauritius: without careful management, human activities can destroy the sensitive ecosystems of lagoons and coral reefs.

Western Samoa: Design of Four Rural Water Supply Schemes

Client: Western Samoa Water Authority

Water Management Consultants was commissioned to provide the hydrogeological input to the detailed design of four schemes to provide safe water to 25% of the population of Western Samoa.

Nigeria: Rural Water Supply Project, Niger State

Client: Niger State Water Board

Water Management Consultants managed the programme of well drilling and testing on this turnkey rural and urban water supply project involving 49 separate sites throughout Niger State, supplying 159 communities and over one million inhabitants.

Nigeria: Jigawa State Urban Water and Sanitation Project

Client: UK Department for International Development

This project will strengthen the Government of Jigawa State to provide improved WSS services and will provide new, rehabilitated and extended piped water supply infrastructure to poor communities in five urban centres within a period of 24 months.

Working with the various government agencies in Jigawa State, Water Management Consultants has been appointed to provide technical assistance and training in hygiene education, financial management of utilities, commercial management and strategic planning. WMC is also advising on the development of policy and a strategic framework for urban water supply and sanitation, and on the development of strategies for advocacy on sanitation that are based on formative research.

Experience in improving access to water supplies and sanitation

Ghana, Tanzania and Zambia: Small Scale Private Sector Participation in the Rural Water Supply Sector

Client: UK Department for International Development

Water Management Consultants, in association with Intermediate Technology Consultants, has been commissioned to produce country-specific and generic best practice guidelines to assist reform of the rural water sector in Africa and elsewhere.

For use by governments and donors, the guidelines aim to transform existing legal, institutional and financial frameworks and enable greater participation of rural based private service providers in the rural water sector, thereby contributing to poverty reduction as well as improving access to rural water supplies.

Teams from the governments of Ghana, Tanzania and Zambia and WaterAid are addressing legal, institutional and financial aspects of the enabling environment for the private sector in each country. The process of investigation and enquiry is enabling the governments to lead the process of sector reform.

Services provided by WMC include design of the study, project management, expert assistance to the country teams, synthesis of generic guidelines and dissemination of outputs to an international audience. Outputs are available from the project website www.ruralwaterpsp.org.



Improved water supplies can have a dramatic effect on people's health

Nigeria: Borehole Drilling in Africa: a Case Study in Nigeria

Client: World Bank Water and Sanitation Division

This study, commissioned by the Water and Sanitation Division of the Infrastructure and Urban Development Department, surveyed and assessed the technical and managerial capacity of the Nigerian drilling industry, in both the public and private sectors, for the execution of groundwater supply projects.

The study determined the main constraining factors in the industry that were preventing efficient delivery of affordable water supply schemes and identified the causes of the high variation in the cost of providing water supplies from groundwater.

The study made recommendations for the development strategy of the RUSAFIYA project in the provision of water supply points and made recommendations for the improvement of the capacity of the water well drilling industry in Nigeria in general.



Affordability and ease of maintenance are key factors determining the design of water supply and sanitation systems

**WATER
MANAGEMENT
CONSULTANTS**

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

Experience in flood hazard management

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

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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)

Experience in flood hazard management



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.

Experience in flood hazard management



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.

Experience in providing support to donors



Tanzania: Project Design

Client: UK Department for International Development, East Africa

Water Management Consultants provided a hydrologist to the three-person project design team on this integrated natural resources management project. WMC was responsible for the design of the hydrological and water resources component of the project. The project Sustainable Management of the Usangu Wetland and its Catchment was subsequently funded by DFID with an allocated budget of £3 million.



Involvement of stakeholders at the planning stage greatly increases the chances of project success.

Colombia: Project Design

Client: UK Department for International Development

Water Management Consultants was commissioned to design this project to improve the management and sustainability of groundwater resources in Colombia. WMC worked closely with the Government of Colombia and involved key stakeholders from the start. The Integrated Groundwater Management Pilot Project was subsequently funded by DFID with an allocated budget of £811,000.

UK: Evaluation of Research in Groundwater

Client: UK Overseas Development Administration, Engineering Division

Water Management Consultants was commissioned to evaluate groundwater research funded by ODA (now DFID) since 1980 under R&D and TDR funding programmes. Research was evaluated in terms of coverage of groundwater issues in developing countries, geographical distribution of activities, roles of local collaborating institutions, dissemination of results and ODA's aims and objectives.

Sri Lanka and southern Africa: ex-Post Project Evaluation

Client: UK Overseas Development Administration, Engineering Division

Water Management Consultants was commissioned to undertake a review and evaluation of four research programmes on collector wells in southern Africa (Zimbabwe, Malawi, Botswana) and Sri Lanka which had been funded by ODA since 1980. A field evaluation was carried out of a collector well development project in Sri Lanka which had been funded by ODA in the late 1980s. The evaluation examined the long term performance of the wells, assessed socio-economic benefits accruing to farmers and the economic viability and sustainability of collector well development.

Experience in providing support to donors



Africa region: Bank Study on Water Resources Development and Management

Client: African Development Bank

Water Management Consultants was contracted to carry out a study of the water resource sector in Africa and to develop a strategy on water resources development and management for the African Development Bank. The study comprised an assessment of the status of water resources management in Africa by means of a questionnaire sent to selected regional member countries and a field mission to the countries. An international workshop was convened in Abidjan where issues in water resources management were discussed in open forum. A policy document was written comprising an overview of the sector, a review of the Bank's experience in the sector, a policy statement, an action plan for the Bank and a series of technical and operational environmental guidelines for use by Bank staff and regional member countries.



Owing to shortages of financial and human resources, hydrological services are not able to collect the information necessary for reliable water resources assessment.

Yemen: Project Evaluation

Client: United Nations Development Programme

Water Management Consultants was commissioned to evaluate the Northern Regional Agricultural Development Project which provided support to the Government of Yemen's efforts in improving water resources management, irrigation and agricultural practices in the northern region. The evaluation reviewed and assessed water management plans, preliminary designs, cost estimates and economic analyses of multipurpose dams, demonstration farms, a hydrometric network, a wadi development study and an operation and maintenance study.



Sustainable management of water resources requires the active participation of a wide range of stakeholders.

The following are some of the key staff and associates of Water Management Consultants who are involved in international development work.

[Peter Baur](#)

Peter Baur is one of WMC's founding members. He has a background in integrated rural development and small-scale water development in semi-arid areas in east Africa. He has 20 years of experience in surface water and groundwater resource development and management and he has managed interdisciplinary teams on water resources and river basin management projects. His experience spans South America, Africa, Middle East, Asia and the Pacific and includes institutional and water resources policy development.

[Richard Boak](#)

Richard Boak is WMC's Operations Manager in the UK office. He is a groundwater specialist with 20 years of experience. He has a background in agricultural engineering and has worked with NGOs managing community water supply, sanitation and integrated rural development projects. He has experience in water resources planning, groundwater protection and assessment of the effects of groundwater abstraction. He has mainly worked in Africa and Indian Ocean region.

[Ron Dickson](#)

Ron Dickson is a specialist in institutional development and strengthening. He has 36 years of experience focusing on the training and human resource development aspects of development and capacity building processes at all institutional levels. He has advised a wide variety of institutions in the public and private sectors in Africa, Middle East, South East Asia and South America. He has worked with institutions at national and regional level to build capacity to manage groundwater resources.

[Robin Grimble](#)

Robin Grimble is a natural resources economist with over 30 years experience in the agriculture and natural resource sectors and specialises in the environment and development. He has led work on groundwater degradation and its socio-economic causes and impacts and has recently developed a people-centred approach for water resources planning and management. He has worked in Africa, Asia, Europe, South and Central America.

Key people



[Oonagh O'Brien](#)

Oonagh O'Brien is a social anthropologist specialising in HIV and a lecturer in International health at the Centre for International Health Studies at the Queen Margaret University College, Edinburgh. She has 15 years of experience in working in international and reproductive health, women's health and migration. She also has expertise in participatory appraisal and evaluation, sustainable development and gender analysis. She has worked in Nepal, Tanzania and South America.

[David Sellars](#)

David Sellars has 30 years of experience in water resources planning, flood management, river engineering and irrigation water management. He has worked in South America, the Caribbean, Africa and the Pacific Rim. In 1998 he was awarded the Distinguished Service Award from the Canadian Water Resources Association for outstanding contributions to the development and management of water resources.

[Alison Thomas](#)

Alison Thomas is an environmental scientist with 15 years of experience assisting government institutions to develop capacity in environmental management, environmental audits, impact assessments and management of solid and liquid industrial and domestic waste. She has worked in Africa, Central America and Europe.

[Samantha Wade](#)

Samantha Wade is a social development specialist with experience in training, gender issues, stakeholder analysis, participatory consultation processes and environmental education. She has 14 years of experience of working in international development in the forestry, agricultural and water sectors in South East Asia and South America. This includes developing a participatory vision in the Colombian Government at national and regional level towards wide stakeholder consultation in groundwater resource planning.

[Richard Wilson](#)

Richard Wilson is a chartered civil engineer specialising in water supply and environmental health engineering. He has 33 years of experience in Africa, Asia and Middle East. He has worked in senior engineering positions in the governments of Lesotho and Seychelles. He has been a consultant to UN organisations, the World Bank and NGOs on rural and urban water supply, sanitation and institutional development and he has participated in project identification, supervision and evaluation missions. He has also worked in relief operations, providing water and sanitation for refugee camps.

[Melvin Woodhouse](#)

Melvin Woodhouse is a specialist in international and comparative water law and policy. He also has 20 years of experience in the provision of water supplies in rural, urban and emergency settings for non-governmental, governmental, bilateral and multi-lateral organisations in Africa. He has developed programmes and projects that enable effective community participation and which safeguard environmental health. Over the past five years he has assisted governments to develop new water policy instruments and interpret them as effective funding and service delivery mechanisms.



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