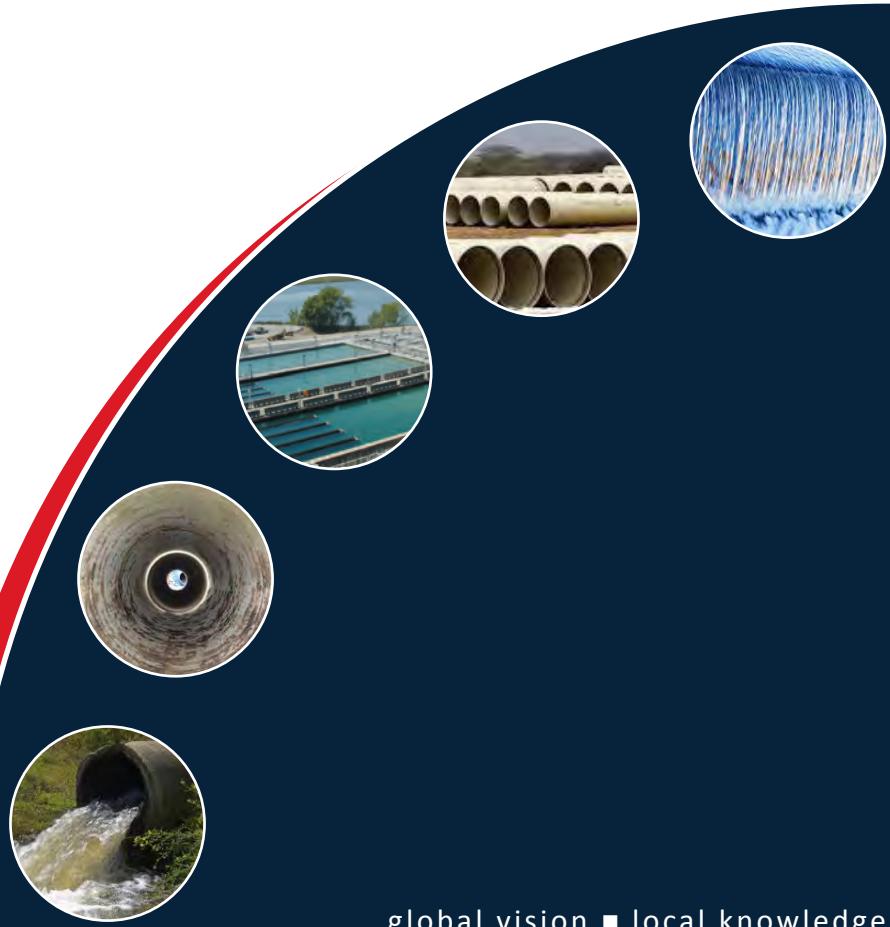




## water supply and sanitation



global vision ■ local knowledge

# introduction

For over 60 years we have successfully delivered numerous physical and social infrastructure solutions, and engineering design projects to our clients in Africa, Asia, Europe, Latin America, Middle East, the Caribbean, and the Pacific.

Our dedicated and experienced staff are key to the successful delivery of the services we provide. As a result we have earned an enviable reputation for innovation, efficient and cost effective design solutions and project delivery.

Our mission is to be a leading consultancy, exceeding Client expectations through staff innovation, staff development and financial stability.

Our independence ensures a personal business relationship with Clients. We recognise that the key elements of service include:

- Sound technical knowledge of the services involved
- A high level of co-operation, co-ordination and communication with both Client representatives and end users
- Fast and effective response
- Development and implementation of cost effective solutions to the diverse problems that may be encountered
- Ensuring that all works are carried out to programme and within budget
- Maintaining the highest standards throughout the project life time
- In-depth understanding of complex specifications and project environments



# who are we?

An independent organisation founded in 1952, Roughton has built a reputation for efficiency, value for money, innovation and timely project delivery.

Excellent client relationships and long term fostered business partnerships worldwide have made Roughton a unique brand.

In the UK our public sector client list includes numerous NHS trusts, local authorities and ministries. Banks and major construction contractors are found amongst our growing private sector list.

Further afield, Roughton has successfully delivered projects funded by all the major IFIs. Projects include; urban development project in Lagos in Nigeria, asset management projects in Uganda, development of the Jamaica Inner City Basic Services, Institutional Strengthening projects for the Frontier Highways Authority of Pakistan, the China to Europe highway in the Republic of Kazakhstan, various infrastructure projects in India, Sri Lanka and over 100 other countries.

We are providing Transaction Advisory services on PPP and PFI projects for several governments and private developers in a number of countries including Georgia, Nigeria and India.

Our experience in the water sector extends across the following disciplines:

- Water supply
- Water resources
- Water quality
- Water treatment
- Water demand
- Water distribution
- Sewerage systems
- Sewage treatment
- On-site sanitation technology
- Maintenance and operation of water utilities



# water supply

A clean water supply is the single most important determinant of public health. Roughton has extensive experience of water development projects throughout the world in both developed and developing economies and provides specialist technical assistance at all stages of the project cycle.

We have experience in the design and construction of new water supply systems or extensions to existing systems. We make allowances for the skill level of the local labour force and adopt various forms of contract reflecting the ability and understanding of local contractors.

The following is an abridged list of some of the projects we have carried out since the 1970s:

- The Belize River Valley Project
- Water Supply Schemes for 6 Towns, Tanzania
- Nkwene School Water Supply, Swaziland
- Nyanza Salt Mine Water Supply Project, Tanzania
- Nyamira Water Supply Scheme, Kenya
- Hotels and Safari Lodge Water Supply, Tanzania
- Port Vila Urban Development Project, Vanuatu
- Ogun State Community Based Urban Development Project, Nigeria
- Management and Site Supervision of Works financed under PHARE 2003 ESC, Romania
- Engineering Support Project for European Commission, Worldwide
- Inner City Basic Services Project, Jamaica
- RAF Wyton - Water Supply and Sewerage Systems, UK
- Infrastructure for Ha Nyenye Industrial Area, Lesotho

- Kismayo Infrastructure Rehabilitation, Somalia
- Mogadishu Infrastructure Project, Somalia
- Safa and Masrooq Water Supply, Oman
- Agricultural Development Programme, Gambia
- Urban Water Supply, Treatment and Sewerage System for Housing Estate, Kenya



# water resources

In order to identify potential sources of water we undertake various desktop studies and site surveys.

Principle sources of water are:

- river abstraction
- river impounding
- boreholes
- desalination

In determining the most appropriate source, we examine location, environmental impact and ability to be naturally replenished. From the analysis we can develop:

- Design and renovation of water storage systems
- Process design to suit a multitude of water quality needs
- Design river and groundwater intake works



## water quality

The quality standards for safe, clean drinking water are constantly changing. There is a need to meet the challenge of ensuring that water supplied to a population is delivered to the required regulatory standards in an efficient and cost-effective manner. In collaboration with local and international associates, Roughton can offer a comprehensive consultancy service covering the following aspects of water treatment:

- Desalination/reverse osmosis
- Refurbishment of existing water treatment plants
- Micro, ultra and nano membrane filters
- Rapid gravity filters and dual media filters
- Ion exchange plants
- UV plants
- DAF plants
- GAC plants
- Disinfection methods



# water treatment

We have experience in the design and commissioning of water treatment plants, both in the UK and overseas. This experience includes:

- Conventional treatment for ground and surface water
- High-tech treatment for brackish water, pesticide removal and effluent reuse
- Plumbosolvency Control by treatment for Lead
- Risk assessments
- Cryptosporidium oocysts, Arsenic, Nitrate, Manganese, Iron and Uranium removal
- HAZOP studies
- Treatment process optimisation

## water demand

Our engineers are fully experienced in determining both the current and future demands for water which reflect the cultural and socio-economic profiles of specific communities.

All water demands are assessed including domestic, industrial/commercial, agricultural and public services requirements. We are experts in determining the 'effective demand' which is an important critical step in the economic analysis of water supply projects.



# water distribution

The demand for water varies throughout the day. We would assess the maximum demand and design the hydraulic capacity of the distribution system to meet this demand. The following considerations are key to the successful outcome of distribution system projects:

## **Service Reservoirs**

Service reservoirs provide the storage capacity to ensure continuity of supplies for a number of days. They also ensure that the hydraulic operating pressure on the system is maintained. Our hydraulic capacity and demand analysis determines the requirement and capacity of reservoirs in the water supply zone for Water Utilities or Corporations.

## **Fire Fighting**

In urban areas it is usual to provide fire-fighting facilities in compliance with the requirements of the local municipality. These requirements can dictate the size of the local network, these factors are considered in any demand forecast or requirements carried out by our team of experts.

## **Network Modelling**

We compile a mathematical model of the distribution system using WATNET, Infoworks, EPANET, or StruMap, depending on the requirement of the scheme, complexity of the network, client requirement and resource availability for system design or operation.



## **Leakage Control**

We provide leakage analysis and control measures to meet the required target of the Water Utility supplier. The services provided include night flow measurement, pressure control design, pipeline rehabilitation techniques and metering.

## **Optimisation of Supply System**

Keeping pace with rising standards in technology and increased availability of information, Roughton ensures that all data collected and analysed is used to enhance the efficiency of existing systems. Our wide-ranging portfolio of specialist skills places us in an excellent position to serve clients when it comes to interpreting data, identifying obstacles and then tailoring solutions to accommodate both engineering and budgetary constraints. This is significantly enhanced as a result of our local knowledge of the countries we operate in.



# sewerage systems

Roughton has successfully provided consultancy services on numerous sewerage system projects, conducting investigations into existing systems and providing analysis and design solutions for a wide variety of industrial, transportation, institutional, and commercial clients, encompassing the following:

## Foul Flows

From our analyses of water consumption figures we assess the per capita volume of foul water generated by the residential population. Discharges from commercial, institutional and industrial development are also assessed.

## Infiltration Water

With extensive structural decay there is the potential for the ingress of groundwater into the system. Infiltration water can be significant and we make due allowance in designs.

## Storm Water Flows

By design or accident sewerage systems may need to cater for both foul water and surface water run-off. Surface-water volumes are likely to far exceed the maximum volume of sewage. Storm water over-flows are often provided but discharges must be examined with respect to volume and possible pollution of the receiving waters.

## System Modelling

We compile a mathematical model using computer software such as WALRUS, simulating the hydraulic performance of the system. The results are used to develop designs for sewerage rehabilitation projects.



## Pumping Stations

It is often necessary for flows to be pumped forward. We examine operational requirements when selecting the type of pump including the provision of standby capacity and give particular attention to sump design. All pump operations are generally automatic and we design switchgear incorporating the necessary controls to initiate automatic start-up and close-down. Consideration is given to variable flow operations that can make savings in power, capital and mining costs.

## Design and Construction

Pipe gradients are selected to generate self-cleansing velocities and manholes are located to provide easy access for maintenance crews. Where retention times are prolonged, there is a danger of septic sewage generating hydrogen sulphide and a corrosive environment requiring careful selection of materials.

## Rehabilitation

We can prepare detailed inventories of the general condition of sewerage systems from man-entry visual inspections or close circuit television (CCTV) surveys. Following detailed inspections and hydraulic analyses, we can prepare designs for the rehabilitation of trunk sewerage systems.

Rehabilitation of underground pipework in urban areas can cause great disruption to the public. Consideration is given to the latest trenchless technology, enabling savings to be made in capital costs and social impacts.



# sewage treatment

Roughton adopts the sewage treatment method most appropriate to the environmental and budgetary constraints of each project. The following are some typical approaches taken:

## **Settlement**

A reduction in suspended solids is required prior to biological treatment. Various settlement tank designs are adopted as appropriate based on horizontal flow, radial flow or upward flow as appropriate with sludge withdrawn under hydrostatic head.

## **Biological Treatment**

Biological treatment is achieved by the activity of micro- organisms oxidising the sewage. This is achieved either by distribution onto filters or, for large urban populations, using the "activated" sludge process. For relatively small communities treatment in reed beds is a very efficient and environmentally friendly treatment process.

## **Sludge Disposal**

By reducing the high moisture content of raw sludge handling and disposal is made more economic. The most common method is by anaerobic digestion followed by discharge onto drying beds or farmland. Where the volumes of sludge are large mechanical methods of de-watering are often adopted. Today sludge is considered as a resource enabling the generation of power and the production of fertiliser.

## **Stabilisation Ponds**

In hot climates the technology of symbiotic action of algae and bacteria used in waste stabilisation ponds is often more appropriate for treating sewage. Our designers ensure designs are simple and operational requirements minimal.

## **Package Plants**

Various technologies have been adapted in the development of prefabricated sewage treatment plants. Generally they are used to serve small communities but some of the technology can be used in large plants.

# on-site sanitation technology

## Socio-cultural Assessment

We give full consideration to all socio-cultural factors prior to adopting any on-site sanitation options. Proposals must be perceived as an improvement on existing facilities but having minimal cost implications and being sustainable.

## Appropriate Technology

The term appropriate technology is broadly used to mean a technology that is simple to use, culturally acceptable, adapts to prevailing local conditions and is cost effective.

## Technology Selection

We use algorithms to identify the most appropriate technology. These take into account the availability of water, ability to pay, topography, hydrogeology and socio-cultural attitudes.



# maintenance and operation of

## Legislation

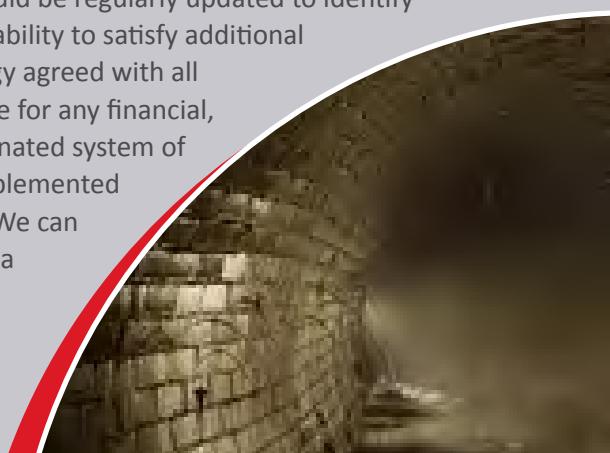
It is essential that any public utility authority is empowered legally to administer the utility infrastructure and maintain service provision. These powers include:

- control water abstraction
- impose user restrictions in emergencies
- regulate industrial and commercial water usage
- minimum standards of water quality
- regulate connections to a public water supply
- regulate connections to a public sewerage system
- regulate industrial discharges to a public sewerage system

We can assist and give guidance to water utilities on drafting legislation necessary for effective and efficient operation of public systems.

## Planning

A water utility must plan effectively for the future to ensure service levels are maintained. Demographic analyses should be regularly updated to identify future demand and requirements. The ability to satisfy additional demand must be analysed and a strategy agreed with all interested parties making due allowance for any financial, legal, or technical constraints. A co-ordinated system of keeping up-to-date records must be implemented with inspections to monitor condition. We can assist in establishing and implementing a coordinated planning policy.



# water utilities

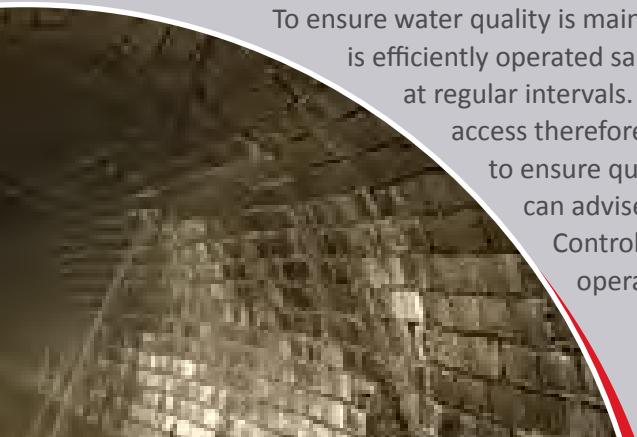
## Tariff Development and Revenue Generation

The sustainability of a public water utility is linked to an appropriate tariff structure and collection of revenues. Sufficient funds to pay for operational and maintenance expenses and repay borrowings is essential. We have extensive experience of revenue generation initiatives and are able to undertake:

- tariff studies to finance infrastructure investments
- review central and local government taxation policies
- studies to identify scope for increasing revenue
- review revenue billing and collection procedures

## Systems Maintenance

Careful management of resources is essential. Procedures are required to deal with routine maintenance and emergencies. There must be an appreciation of the precautions necessary to prevent contamination of water supplies and the dangers of working in live sewers or sewage treatment works. When dealing with repairs it is necessary to have access to a stock of materials and fittings, which must be maintained.



To ensure water quality is maintained or a sewage treatment works is efficiently operated samples must be taken and tested at regular intervals. A public water utility must have access therefore to a properly equipped laboratory to ensure quality control is exercised. Roughton can advise on the introduction of Quality Control procedures to enable systems to be operated efficiently and cost-effectively.

# water and sanitation services

- As-built documentation
- Condition surveys
- Corrosion protection design
- Data collection and analysis
- Desk top studies
- Detailed design
- Environmental management
- Geotechnical surveys
- Hydro-geological surveys
- Network modelling
- Pipeline design
- Pre-feasibility studies and appraisals
- Project and programme management
- Public health engineering
- Quality assurance
- Rehabilitation and strategic planning
- Route selection and EIA
- Safety supervision and CDM
- Site investigations
- Topographic surveys
- Transaction advisory
- Water demand forecasting
- Water resource identification



# other roughton services

- Air quality
- Asset management
- Bridge engineering
- Building services
- Construction supervision
- Contract administration
- Due diligence
- Drainage design
- Economic feasibility
- Environmental impact
- Expert witness
- Feasibility studies
- Flood risk assessments
- Geotechnical investigations
- Highway engineering
- Hydrological studies
- Infrastructure design
- Intermodal appraisal
- Landscape architecture
- Masterplanning
- Pavement engineering
- Planning
- PPP & PFI
- Programme management
- Project management
- Quantity surveying
- Rail engineering
- Risk management
- Secondment of professional staff
- Structural engineering
- Transportation planning
- Wastewater
- Water





# offices

**Head Office**  
A2 Omega Park  
Electron Way  
Chandlers Ford  
Hampshire  
SO53 4SE  
United Kingdom  
T: 02380 278600  
E: info@roughton.com

**London Office**  
Centurion House  
37 Jewry Street  
London  
EC3N 2ER  
United Kingdom  
T: 020 7553 8070  
E: uk@roughton.com



[www.roughton.com](http://www.roughton.com)