

### Detailed Design Production

#### Coast Protection Works at Suffolk and North Wales, UK – 1986 to 1987



*Additional open-stone asphalt apron and toe cut-off to existing defences at Y Ffrith Beach, Prestatyn*

Roger Williams spent some of his formative years as a design engineer on marine works, and as part of the construction supervision staff for the coast protection schemes at Felixstowe and Aldeburgh in Suffolk.

At Prestatyn, North Wales, Roger was involved in the assessment of longshore drift; design of revetments, calculations for rock armour and groynes; wave run-up analysis and overtopping predictions.

#### Drainage Study and Implementation, North Weald, Essex – 1987 to 1988



*Side weir conveys storm flows along bypass to storage reservoir formed by earth embankments*

Roger conducted the hydrological analysis for river catchments that contributed to flooding of properties in the town of North Weald Bassett. The client was Epping Forest District Council.

He derived hydrographs using catchment descriptors and techniques based on the UK Flood Studies Reports. He constructed a hydraulic model for the drainage area to analyse the network of open channels, pipes and culverts, before making recommendations for downstream storage of floodwaters within a detention reservoir with spillway.

He then developed the tender documentation and specifications for the subsequent construction works.

Similar hydrological assessments were undertaken by him for analysing design storm events and river inflows for reservoirs in Wales and for conducting flood routing analysis to assess available spillway provisions.

#### Design Engineer of Road Geometry and Pavement Details, UK - 1989



- Geometrical design of highway and junction layout for the Battlesbridge link from A1245/A130 road to Rawreth, Essex.
- Structural design for road pavement. Road alignments derived from digital ground model strings, as well as created by traditional means using railway curves.

#### Thames River Radial Gate Structure, Kings Weir, Oxford – 1996



*Vertical gates at Kings Weir, Oxford required replacement with radial gates*

Assignments undertaken included the design of hydraulic structures (siphons, gates, reservoirs & spillways); and sediment scour analysis of channels by computational fluid hydraulics using FLUENT® software.

Radial gated river structures along the River Thames at Oxford, such as at Kings Weir, for client EA are an example where Roger Williams was the civil/structural designer and hydraulic designer. He conducted the following main tasks:

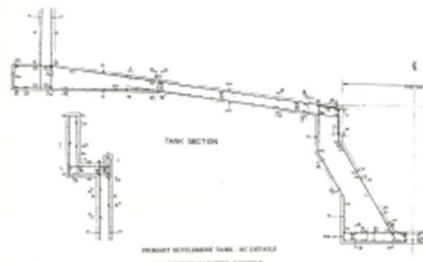
- Hydraulic design of the stilling basin; defining the river training works and bank protection required
- Structural design of main superstructure, incorporating the mechanical design inputs for the gate loadings
- Management of environmental impacts assessment, including liaison with EA Fisheries on fish pass requirements

## Detailed Design Production

### Structural designer of elements in Concrete, Steel, Masonry and Timber – 1986 to 1997



*Precast concrete segments to form central hopper of a new settlement tank*

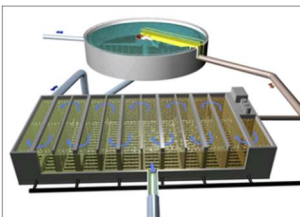


*Tanks at wastewater plants in East Anglia designed as water retaining concrete structures to BS8007*

Roger Williams' design work involved structures in concrete, steel, masonry, plus some structural timber design.

- During a posting in Oman, Middle East in 1987 he was responsible for the design and construction supervision of concrete retaining walls. He also designed various concrete structural elements for a villa complex and highway gateway structures in Muscat
- Another interesting concrete structure that he designed was the wet well-dry well configuration for a major pumping station at Zanzur in Tripoli, Libya. He also interfaced with mechanical and electrical teams for the pump control provisions.
- Structural design of water-retaining concrete structures for wastewater treatment plants in Lancashire, Cumbria and East Anglia, operated by United Utilities or Anglian Water.
- Design checks for EA on anchored sheet piled walls of River Thames to withstand earth and water pressures
- He carried out structural design of steel frames and concrete foundations of industrial units during his first assignment as a graduate engineer in Liverpool; In more recent years, he applied the same design skills for preparing masonry, concrete and steel design using excel calculations and TEDDS software, for residential housing units in 2015.

### Process Design of Wastewater Treatment Systems, UK – 1991, 1997



- Process design of water and wastewater treatment facilities operated by Anglian Water to address compliance needs under the new asset management plan AMP1
- Process design of wastewater treatment plants in Lancashire & Cumbria operated by United Utilities to meet improvement performance targets under AMP2

### Wastewater Master Planning for Indah Water, Malaysia – 1997 to 1999



*Review of existing treatment assets. Aerated systems and Imhoff tanks were operated by IWK.*

Indah Water Konsortium (IWK) was the concession holder for all wastewater distribution and treatment services in Malaysia.

Roger was responsible for undertaking sewerage master planning schemes across several townships, including Sepang, Kuala Langat, Kuantan, Segamat, Muar and Penang. He assessed existing assets, potential sites for new facilities and estimated future loading on the sewer and treatment systems.

Improvements were tested against whole life cycle costs in a feasibility study report prepared by Roger. He also presented the findings and recommendations to the client.

### Design Management and Tender Review, Jawhara City, Lusail, Doha, Qatar – 2011



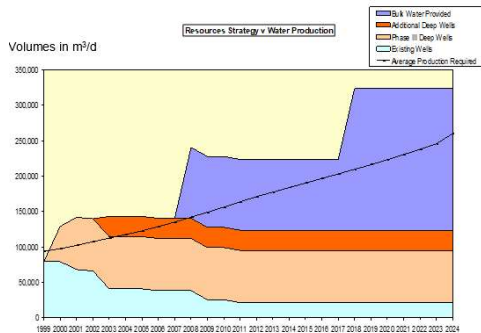
*Infrastructure systems designed for healthcare buildings and specialised medical facilities, Qatar*

Al Jawhara City in Lusail aimed to provide urban living with world-class healthcare and medical facilities, supported by mixed use development and residential housing.

Roger Williams managed design works and tender documents for infrastructure works. He assisted with the tender evaluation and award process, prior to the contractor's mobilisation.

## Key Projects in East Asia & South-East Asia

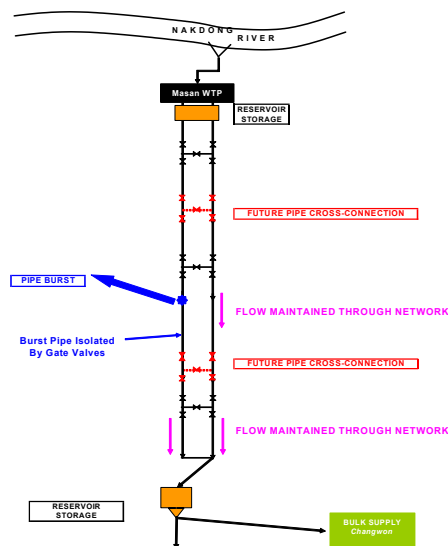
### Technical Design Review of Water Supply Systems for Veolia Water – 1997 to 2007



Resource strategy to meet future water demands based on bulk supplies (blue) supplementing groundwater wells



Review of operations and performance at raw water pumping, Yangzi Petrochemicals Company, Nanjing



Simulation of pipe burst along dual transmission main (and contingent storage required) at Masan City, Korea

Roger Williams oversaw design of water supply networks, intakes, groundwater wells, transmission lines across mountainous terrains and local booster pump systems.

- During his work in the Philippines from 1997 to 2000, Roger negotiated BOT water supply agreements, and tackled a variety of water supply schemes tapped from groundwater sources or river intakes. He developed optimised water supply strategies to meet demands over 100 MLD, with associated capital investment for upgrading treatment and network facilities that exceeded 100M USD.
- For the Bulacan Bulk Supply project, north of Manila, the WB-funded Sierra Madre scheme (Angat Dam) was progressing too slowly to meet the short-term water supply needs of communities. Roger was made acutely aware of the constraints from this type of multi-lateral development funding during political discussions held with affected water districts. The BOT proposal he was involved with provided bulk supplies from lateral intakes on the Angat River and from groundwater wells to meet the interim water demands.
- The groundwater resource strategy proposed by Roger for Laguna Water District was formulated from a preliminary examination of the aquifer water balance. The sustainable abstraction solution was compared with estimated recharge rates to the aquifer system. However, he also recommended that a detailed groundwater model study of the aquifer extent should be undertaken to obtain a more accurate picture.
- Roger prepared proposals for reduction of Non Revenue Water (NRW) in existing water supply networks in Kimchon City and Masan City, Korea. The solution to reduce network leakage to a practical level focused on:
  - the creation of network districts (with district meters)
  - the provision of adequate detection (pressure gauges, acoustic correlators, dataloggers)
  - reduced pressure zones (using PRV installations).
- For the NRW study at Masan, problems were compounded by a future risk of a burst in the 18km of 1.3m dual transmission pipe due to the lack of cross connections and contingent storage. The poor chemistry imbalance of treated flows from the Chilseo WTP facility was considered a contributory factor to the leakage due to damage by corrosion, as well as high operating pressures in the network.



### Key Projects in East Asia & South-East Asia

#### Technical Design Review of Water Treatment Facilities for Veolia Water – 1997 to 2007



*Operational review of water treatment facility at Yangzi Petrochemical Company, Nanjing, 2007*



*New lamella settlement (multiflo®) troughs at a water treatment facility in China*



*Typical groundwater well encountered in Philippines, and poor condition of chlorination equipment*



*Chilseo WTP, Pusan, Korea: raw water monitoring essential for holistic process management*

Roger Williams managed technical process and operational performance reviews of water treatment plants. These were part of a due diligence to acquire assets or to identify potential risks from investing in an existing water business entity. The projects ranged from industrial complexes in China; city water supplies in Korea, to local facilities in Philippines and Taiwan.

Projects included:

- Operational review for Tze Tan Water Treatment Plant – Sludge De-watering plant in Taipei, comprising 28m thickeners (2% solids) and filter presses. Cake was good quality, despite there being no sludge conditioning permitted due to ban on polymer use
- Review of water resource development in Laguna Bay, near Manila for potential sources as bulk supply to adjacent projects managed by Veolia Water. This also considered an initial concept design for settlement and RO desalination based on maximum admissible raw water parameters in Laguna Bay
- Design overview for an intake and water treatment plant along the Panay River, supplying 19 MLD of potable water to Roxas City, Philippines. Treatment stages included coagulation/flocculation, settlement, rapid gravity filters, pH balancing and disinfection
- Concept proposals for new groundwater wellfield at Bustos, Bulacan, including radial collectors (ranney wells) for water infiltration from river basin
- Groundwater supply proposals for PPP offers to local water districts in Philippines: at Roxas City in Panay; Cavite in Luzon; and Cagayan de Oro in Mindanao. Deep wells yielded production rates between 2 MLD and 9 MLD. The project at Cagayan de Oro also involved bulk water supply from River Bubunawan in the adjacent province of Bukidnon
- Roger managed the technical review and operational performance of the 400 MLD Chilseo WTP supplying water to Masan City, west of Pusan in Korea. This facility comprised traditional processes supplemented with pre-/post-ozonation and activated carbon filters

For the large treatment facility at Chilseo WTP, turbidity control and settlement were critical for effective disinfection, such that microorganisms would not attach themselves to suspended particles. Disinfection by overdosing with ozone and chlorine was typical for dealing with unknown pollution risks, with the ozone dosage fixed regardless of incoming raw water quality.

The problems with ozone generation included inadequate control of ozone residual and high dosage due to an oversized unit. Poor working practice and emergency procedures were identified, particularly if excess ozone was released to the atmosphere, or following water quality incidents.

### Key Projects in East Asia & South-East Asia

#### Technical Design Review of Wastewater Treatment Facilities for Veolia Water – 1997 to 2007



*Operational review of a WwTP in Korea, based on analysis of existing controls and process data, 2002*



*Operational review for Chung Shing Brewery, Taichung, Taiwan 2000*



*Operational review of industrial wastewater plant at Yangzi Petrochemicals Company, Nanjing, 2007*



*Janglim WwTW, Pusan City, Korea – A typical facility reviewed for its operational performance, 2002*



*Su Tze Tou pumping assets in Taipei assessed for taking over existing operations contracts, 2000*

As part of a potential offer for outsourcing of wastewater services or for a BOT proposal or asset acquisition, Roger Williams was handed responsibility by Veolia Water to assess the performance at existing wastewater treatment plants.

These plants were managed by industrial clients such as pulp and paper mills or chemical industries; or operated by local municipalities in Korea, Philippines and Taiwan. The wastewater treatment facilities were neglected at worse, but generally in need of investment as they were in a poor condition.

General observations and analysis from the existing operations revealed the need for better power utilisation, particularly for aerated systems (traditional activated sludge process) and the sludge management balance regarding the degree of return of activated sludge.

- Excessive costs were spent on an inefficient biological process that was controlled by incoming pollution loadings rather than dissolved oxygen levels in tanks.
- The aeration tanks received very high polluting loads from excess sludge not handled at sludge treatment stage were redirected to the aeration tanks, thus imposing a significant impact on the treatment capacity of the aeration stage.

The other common fault lay with the lack of a maintenance regime applied by the plant management:

- Reactive maintenance only and insufficient monitoring points and data analysis
- By adopting a more preventative approach to maintenance, existing staff could be trained to undertake these repairs
- In this way, costs would be reduced and the output from staff would be greatly enhanced

The typical procedure for assessing the existing operations of wastewater treatment facilities would include the steps below:

- Following his inspection of the condition and function of the equipment, Roger would collect relevant operating data for subsequent analysis
- He worked with his teams to develop strategies for any operational savings, opportunities for improved practices and to evolve technical solutions for the supply of wastewater services
- The capital costs and operational costs would then be assembled by Roger as a CAPEX-OPEX model, which then interfaced with the financial modelling to calculate projected investment returns
- This culminated into the commercial offer to clients, which Roger presented and negotiated a final offer.



## Desalination Systems & Membrane Filtration for Industrial Water

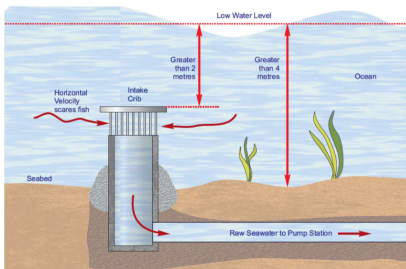
### Technical Design Review of Reverse Osmosis/Membrane Systems – 2004 to 2007 and 2012



Membrane (Ultra-filtration, Reverse Osmosis) Systems for De-Mineralized Water & Industrial Water



Nanofiltration membrane trains as part of industrial water process for micro-electronics industry



Simulation of flushing in the Red Sea indicated that intake point and outlet canal (via DRI steel plant) at the KAEC desalination plant to be 300m apart



Roger Williams' experience in Asia providing outsourced services to petrochemical and micro-electronic industries for ultra-pure water involved design and installation of membrane technologies (and mixed bed filters) up to 30 MLD capacity.

Clients included: Hynix Semiconductors, Wuxi, China; Nanjing Chemicals, Nanjing, China; Sinopec, Yangshan Plant, Beijing, China; and Yangzi Petrochemical Company (YPC), Nanjing, China

A potential offer may include acquisition of existing plant as well as construction of new facilities. Roger would be involved in the assessment of existing demineralised water treatment assets.

He worked with his teams to develop strategies for any operational savings, opportunities for improved practices and to evolve technical solutions for the supply of water services.

The capital costs and operational costs would then be assembled by Roger as a CAPEX-OPEX model, which then interfaced with the financial modelling to calculate projected investment returns. This culminated into the commercial offer to clients, which Roger presented and negotiated a final offer.

In preparation for Roger's successful negotiation of one of the largest industrial outsourcing deals in Asia during 2007, he was part of the discussions to secure a water supply to Bohai Chemicals' LinGang Industrial Park in Tianjin. This involved Roger's assistance in liaising with the Tianjin Dagang Desalination Facility (100 MLD), and in reviewing the terms of the supply agreement for industrial water.

For other specific desalination plant projects in Asia, Roger developed planning strategies for design, procurement & material management and construction management.

- he reviewed investment risks in 2006 for a large SWRO desalination plant to supply a petrochemical park at Dalian, China for the Dalian Shide petrochemical company. This involved developing a technical position on the viability for pre-treatment options and RO systems.
- He helped establish operating regimes for appropriate staffing or training needs, and develop operational procedures, documentation, and safety or environmental control measures.

Conversant with the complex commercial dynamics for water treatment investments, Roger provided the right advice in 2012 to Emaar for their mega-project at King Abdullah Economic City (KAEC), on the Red Sea, Saudi Arabia.

- Emaar was responsible for developing the new city's water supplies. Roger was the overall infrastructure lead for the 700ha industrial zone of KAEC (comprising a desalination plant, the 20M TEU port, DRI steel plant and power plant).
- He provided key advice to Emaar on planning for the future 100 MLD desalination plant (ph 1), including raw water analysis, permit needs and treatment process options. He identified constructability options for the intake and outfall works, based on varying skills of local contractors.