

CLEARWATER TECHNOLOGY GROUP



**INTRODUCTION
TO SERVICES**



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1. SUMMARY

The forerunner of the Clearwater Technology Group of companies - CTG - was founded in 1997 to offer engineering consulting services to the global pulp and paper industry. The group has evolved and diversified since its inception and gone on to develop innovative and truly unique technological solutions. The success of the group has been based upon a combination of novel and innovative technology, highly experienced personnel, and excellent worldwide industry contacts.

CTG comprises; Clearwater Consulting Partners (CCP); Clearwater Power Technology (CPT); and Provaris

Clearwater Consulting Partners (CCP) has developed via the route of offering purpose designed process, machinery and project solutions to the global pulp & paper industry. Every paper machine is unique, so bespoke design capability is a highly valued necessity. The CCP teams enjoy a successful track record based on cumulative pulp and paper industrial experience equivalent to hundreds of man-years.

Clearwater Power Technology (CPT) was formed in direct response to accelerating customer demand for innovative and cost-effective solutions to the provision of energy to industrial users, particularly with respect to renewable energy sources such as biomass, hydro, wind, bio-fuels and high-rate biomass feedstock production.

As well as providing a vehicle for one-off developments outside of the normal scope of CCP and CPT, Provaris specialises in the delivery of major capital projects suitable for inclusion in the offset investment programmes of major defence contractors.

The fit of each of the group companies is excellent – with very little overlap of facilities, customer base or know-how. Each company has developed flexible, adaptive, and cost-effective operating structures and offer value to our clients. In certain critical areas, the group has a major competitive advantage in that it has unique in-house process and manufacturing dynamic modelling technology which is highly (and increasingly) valued by its customers – new and existing.



2. CLEARWATER CONSULTING PARTNERS



CLEARWATER CONSULTING PARTNERS “CCP” is an internationally-focussed engineering design & consulting business. The company is based in the UK and has access to an international office network. CCP is engaged on a broad variety of projects globally.

With the capital-intensive nature of the pulp, paper, construction board and continuous process industries and a highly competitive trading environment, manufacturers constantly seek opportunities to reduce cost, improve quality, and maximise output. CCP and our partners offer the range of resources, expertise and leading edge technologies to enable our clients to achieve their goals.

The company specialises in the provision of the full range of plant and process design, and project management services to the international pulp and paper, water treatment, and environmental control industries. CCP employs leading edge, computer-based mathematical modelling, simulation, drawing and design techniques and integrates them with extensive experience garnered over many years.

Clearwater Consulting has specialist knowledge in a number of key areas of technology, as well as know-how gleaned from a broad base of continuous process industry, experience and capabilities in all engineering fields relevant to a project. Above all, we believe that by being able to combine our extensive experience with targeted technology, we offer exceptional solutions to any challenge.



Integrated Clearwater process design in NY, USA



3. CLEARWATER POWER TECHNOLOGY



Clearwater Power Technology – “CPT” - is a company established specifically to develop new power generation and energy supply business in partnership with other investors.

Some themes common to each power-related project being developed by Clearwater Power are:

- Co-generation (CHP)
- 1MW to 120 MW generating capacity range
- High efficiency (for the fuel types used)
- Frequently using renewable fuel sources
- Low emissions & high environmental standards
- Lowest life cycle cost
- Optimum operating cost and profitability
- Build Own Operate Transfer (BOOT) projects becoming increasingly in demand.

CPT seeks to design and build each power project as, or in close alliance with, the EPC or turnkey contractor. It does not seek (other than in a minority capacity) to become the owner-operator of energy supply facilities.

Current Clearwater Power Technology projects include:

- ✓ 1 MW biogas generation scheme for Smurfit-Kappa in the UK
- ✓ 20 MW solid-fuel fired co-generation scheme for Jin Lun Fibres, China
- ✓ 22 MW gas/distillate-fired co-generation scheme for ADNIP, UAE
- ✓ 120 MW gas-fired co-generation scheme for Saudi Paper, KSA
- ✓ 180 MW “Bio-FGD” de-sulphurisation system for Syn-Fuels, Canada





4. PROVARIS

Provaris Ltd is a company initially formed to service the offset investment programme requirements of major defence contractors (BAE Systems and Agusta-Westland Helicopters). Initially, Provaris existed to facilitate the development of major global capital projects (pulp, paper, and related industries such as water treatment and power generation) in a way that enabled commercially viable projects to be supported and brought to fruition under the auspices of those companies requiring “offset” for their defence contracts.



The projects were those that CTG was already engaged upon, and were free-standing, commercially viable projects in their own right. Provaris provided a means of supporting the successful development of these projects through the initial, higher-risk phases (hence mitigating much of the risk and providing financial and political support).

More recently, Provaris has provided a vehicle for one-off development projects unconnected with offset programmes.

5. SERVICES TO INDUSTRY

Clearwater Technology Group’s capabilities are extensive and diverse, yet they share a common purpose: to provide engineering and scientific solutions for the process, plant, manufacturing, environmental and infrastructure challenges that our commercial, industrial and government clients face. Our services are grouped into the following areas:

- Feasibility Studies & Business Plans
- Process engineering
- Manufacturing Systems
- Conversion / Finishing Engineering
- Environmental Assessment and Regulatory Compliance
- Compact process water treatment systems
- Gaseous Emissions Abatement
- Process Waste Minimisation and Treatment
- Solid Waste Management
- Water, Wastewater and Water Resource Management
- Environmental Restoration
- Industrial Hygiene and Health & Safety
- Geographic Information Systems
- Electrical and Mechanical Engineering
- Transportation Systems
- Instrumentation control and Automation
- Construction-Related Services
- Biomass & bio-fuel energy projects
- Turnkey Operations (including EPC)

CTG, along with our partners, has offered many of these services to industry throughout our history. Dedication to finding the most cost-effective solutions to our clients’ individual needs, leading edge technology and an understanding of continually changing regulatory requirements have contributed to a growing list of satisfied, repeat customers.



Experience garnered through these long-term relationships has allowed us to refine our service areas into specific expertise pertinent to the process and environmental concerns of a wide range of businesses.

In addition, we access the resources of all of our offices to provide total capabilities – in consulting, process engineering, construction, environmental remediation and on-site industrial services – focused to address any challenge from start to finish, or at any point along the way.

Process

Clearwater designs processes that combine the client's knowledge with our skills and experience. We recognise that the key to a successful manufacturing business is a production line efficiency that delivers quality products with uniform consistency. This can be delivered with the use of process simulation products that have been developed by Clearwater. ("Pro-Sim"[™] and "VR-SIM"[™])

Functional Planning and Plant Layout

Clearwater uses Value Management and Value Engineering methodologies to deliver efficient and robust process design. Typically full consideration is given to the design of employee facilities and material flow within the plant. The building footprint is minimised through careful design.

Clearwater offers flexible service delivery options to enable clients to address short-term and long-term objectives as well as providing assistance where project funding is a requirement.

6. CLEARWATER IN CONTINUOUS PROCESS INDUSTRIES

CTG has a keen understanding of the needs and requirements of continuous process industry. By working closely with the Client's own project team we aim to understand the exact and specific requirements and goals of every project.

Clearwater specialises in this sector. Nearly all of each Clearwater team have direct experience of working in industry – i.e. at the sharp end of management, operations, engineering and technical.

Our partners have major resources and breadth of experience, coupled with in-depth experience of the pulp and paper, power generation and water treatment sectors.

Thus, Clearwater offers an unrivalled combination of powerful resources, experience and leading edge technology and innovation. There are no elements of any process related project of any scale that Clearwater cannot deliver.



7. SPECIALIST PROCESS SERVICES

Process design and simulation using: " [PRO-SIM](#) "™

Our expertise and the use of our unique dynamic process modelling and simulation techniques (Pro-SIM) enables us to achieve exacting levels of accuracy in all aspects of process design, from initial conceptual development through to final process equipment specification and verification prior to procurement.

This includes emulation of virtually all common process variables (mass, flow, consistency, temperature, ash, fines, pressure, level, pressure drop, dissolved solids, enthalpy, variable cost contribution) for every individual process stream, for every conceivable operating scenario.

We have used Pro-SIM for all manner of stock preparation, de-inking plant, stock approach (short loop), paper machine, backwater, broke, vacuum, effluent, and drying systems.

A powerful and high-fidelity cost of manufacturing module is available as an optional extra to our clients.

We are accustomed to completing this work as a part of a turnkey engineering service to the client, but also in the role of "owners engineer" whereby CCP acts as co-ordinator between the client and, for example, the primary equipment supply contractor.

Virtual Reality Simulation: " [VR-SIM](#) "™

For major new projects it can prove highly cost-effective to train operational teams using methods analogous to "flight training simulators" – i.e. Clearwater can deliver virtual reality simulations of the new plant, process, machine or even mill, that use the client's own process control system (DCS, PCS, SCADA, PLC based systems) driven by a developed form of the original Pro-SIM process simulation mathematical model.

Pro-SIM is normally used to optimise the process design for the project. This forms the basis for the real-time simulator which is embedded into a powerful control platform with universal communication protocol compatibility. The simulator takes its input from the client's process control system and provides corresponding output to the PCS/DCS.

Almost all aspects of plant control can be realistically simulated (including group starts, sequential starts, steady state operation, unplanned failure events, process excursions, and non-steady state operation). Even hard-wired interlock functions can be emulated (depending on the specification of DCS/PCS system), e.g. Siemens PCS7 system interlocks are replicated using SimbaPro PLC cards.

The advantages of employing Clearwater virtual reality technology are:

- Short, effective start-up learning curves
- Intensive pre-testing of control systems and control logic.
- Field extension of system FATs (factory acceptance tests).
- Off-line training capability for new operational personnel (post start-up).

For a major rebuild it is certain that VR-SIM can prove highly cost effective.

CLEARWATER



Predictive Control System: " PCS-SIM "™

Using advanced data-mining tools such as neural networks, Clearwater can generate the complex algorithms required to accurately forecast exact finished product qualities in real time before the sheet has even been formed. By embedding these algorithms into the VR-SIM simulation system and linking the client's DCS or PCS, Clearwater provide the means of achieving true systemic process control – i.e. actual process variables are measured in real time, fed into the PCS-SIM system which, in turn, provides output of any key product variable.

These values are compared to the ideal benchmark standards (defined by the client), and control changes automatically made to any combination of real process variable set-points within the DCS/PCS in order to continuously optimise the finished product qualities (and quantities) in the most effective way possible.

PCS-SIM offers the ultimate in process control.

Quality Efficiency Management System - " Q-EMS "™

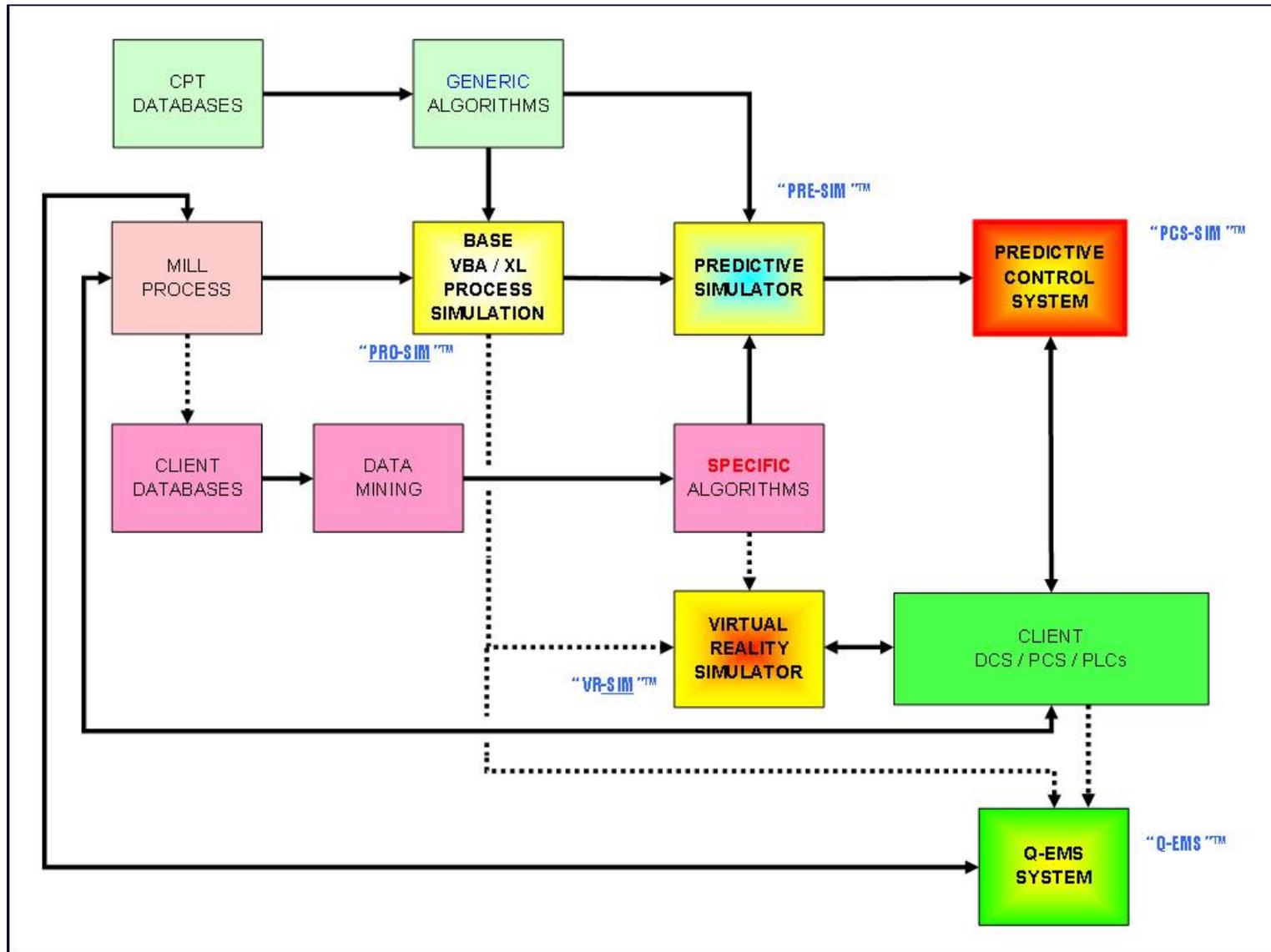
Q-EMS combines PCS-SIM predictive control technology with an array of transducers deployed on critical paper machine and stock approach system components. The result is a real-time, on-line monitoring and forecasting system that enables on-going optimisation and integration of the paper machine's component parts.

Sources of instability, or potential process excursions, are identified rapidly as root causes rather than symptoms, thus providing the data required for effective elimination of problems before they become detrimental to output, quality or cost.

Techniques such as TSA (Time Synchronous Averaging) are used to eliminate unwanted "noise". Q-EMS permits the accurate and effective identification of sources of pressure pulsation – hence MD weight variation, vibration, sheet breaks, draw variation, uneven pressing and felt conditioning, premature bearing failure, sub-optimal drying, etc. It provides a means of continuous monitoring and improvement.

The expenditure involved in major rebuilds or new machines provides an excellent opportunity to install Q-EMS and obtain accelerated achievement of full output potential.

SYSTEMS EVOLUTION





8. **CLEARWATER TECHNOLOGY GROUP RESOURCES**

CTG is a multi-disciplined engineering, project management and construction service provider. We are able to offer clients a very broad range of professional services, which include: -

- Technical due diligence assessments
- Transitional management
- Site and asset management
- Mechanical engineering
- Electrical engineering
- Process engineering
- Chemical engineering
- Automation and control
- Cost management
- Environmental services
- Health and safety
- Project management
- Procurement
- Turnkey process contracting
- Programme management
- Site implementation
- Process Simulation and Modelling

All the above disciplines are delivered to clients from in-house resources by a well qualified and competent staff resource pool.

9. **CTG CAPABILITY**

○ ***RESPONDING TO CHANGE***

Manufacturing industry is constantly evolving. Alternative project delivery methods are now common place, and the traditional design-build approach is no longer the preferred method. An increasing number of clients are requesting single source procurement of engineering and construction management services. They require cost effective integrated solutions, intelligent and sustainable assets.

At CTG, we recognise this need and are keen to assume overall responsibility for timely and cost effective delivery of complex projects.



○ **MEETING THE CHALLENGE**

Whether the client requires a single engineering discipline or the full range of chemical, process, mechanical, electrical, civil, and environmental engineering, our services are available through a single point of contact: a designated specialist project manager is key to our effective and efficient service delivery.

Project staff are drawn from the specialist disciplines and moulded into effective market sector teams. Both the project manager and team members are selected based on their individual skills and expertise in the project sector and/or their prior experience with the project client.

○ **CREATING SOLUTIONS**

We recognise that technology in itself has no value, only the benefits it brings create value. We strive to ensure that we understand a client's needs. By combining the science of innovation engineering with the art of creative problem solving, we provide project specific design solutions which are functional, flexible, efficient and cost effective.

CTG also provides clients with services in all disciplines through our specialist partners and in many areas of special expertise including:

- Equipment supply
- Structural Engineering
- Construction Management
- Water Recycling Engineering
- Green Power
- Standby Power
- Sustainable Design
- Smart Buildings
- Lighting Design
- Data and Communications
- Corrosion Protection Systems

○ **MECHANICAL**

Our mechanical engineering team is capable of design, installation and commissioning of process plant and equipment. The department has the ability to provide a comprehensive range of engineering and design services, which include:

- Plant survey
- Plant appraisal
- Conceptual and detailed design and engineering
- Operational and Control
- Works inspection and testing
- Equipment logging and asset management
- Design and specification
- Contract documentation
- Hazard and Operational studies



○ **SERVICES & UTILITIES**

Our services & utilities team has experience and capability in a wide range of activities. We undertake feasibility studies, asset survey and management plans, design, on-site services and testing.

The areas of our work and capability include:

- Air compressors and air services
- Air conditioning and mechanical ventilation
- Boiler and auxiliary plant
- Cold and chilled water services
- Co-generation / combined heat and power
- Renewable energy sources
- Distribution mains
- Electrical lighting, power, generation, systems, substations and switchgear
- Energy management systems including energy audits
- Life systems, including fire alarm and suppression systems, intruder alarms and security
- Heating, Ventilation and Air Conditioning (HVAC)

○ **ELECTRICAL ENGINEERING**

The CTG electrical engineering function also has a diverse and extensive capability. The department is able to offer electrical engineering design and associated services. These include: -

- Power systems
- Transformers
- HV and LV switchboards
- Motor Control Centres (MCC)
- Stand-by generation
- Process and analytical instrumentation
- Power, control and instrumentation cabling
- SCADA (Supervisory, Control and Data Acquisition) and ICA (Instrumentation, Control and Automation)
- Programme Logic Control (PLC)
- Distributed Control Systems (DCS)
- Systems maintenance
- Software coding
- Hardware and software specifications and applications
- Functional design specifications

○ **PROJECT MANAGEMENT**

At CTG, Project Management Services is a company-wide services group providing project management and construction management services for a variety of multi-discipline commercial, industrial and government projects worldwide. In concert with our design capabilities, we provide complete project/cost management services.



Our professionals apply focussed, pragmatic, technical, analytical and creative expertise to projects that include water supply and treatment, wastewater treatment, power and energy, waste management, transportation systems, airports, railways, ports, buildings and structures.

Project management services include: -

- Lead manager/Client's adviser/Owner's engineer
- Brief development
- Planning, feasibility and alternatives analysis studies
- Economic analysis and whole life cost studies
- Value Management
- Value Engineering and assessment
- Design coordination
- Cost estimating
- Program management
- Construction management
- Project cost and schedule control
- Facilities management
- Operations and maintenance planning

○ **CONSULTANCY SERVICES**

The main strength of CTG is the ability to focus on our clients, develop an understanding of their business needs and package the consultancy services to deliver the need. Involvement in the bidding and securing of EPC and BOOT projects has provided a further dimension in the understanding of client needs.

In order to deliver this service focus, a wide-ranging technical base is required. CTG has developed a broad based skill portfolio covering the paper industry, water industry, power sector, industrial sector, and commercial sector.

Skill areas range from pure consultancy in respect to feasibility studies, conceptual engineering, engineering reports and designs, through the provision of site supervision and monitoring services, to the drafting of the close down reports, operational manuals and training schedules. Experience of working in partnership and joint ventures with both the client and third parties has been extensively used to deliver projects to time, budget and quality.

To drive project costs down whilst complying with the legislative demands for safety, a pro-active approach to CDM, value engineering and risk assessment/management has been adopted. Senior exponents of the skills are actively involved at all levels of our service delivery.

Specialised services in respect to numerical modelling and simulation, (Pro-Sim, VR-SIM, ISS) together with Project Management tools, which integrate cost control with construction management, provide transparent project reports made available to our clients.

All projects are viewed from a holistic standpoint with the intent of focusing and managing the full range of Clearwater skills at all stages and levels of a project development to the benefit of the client.



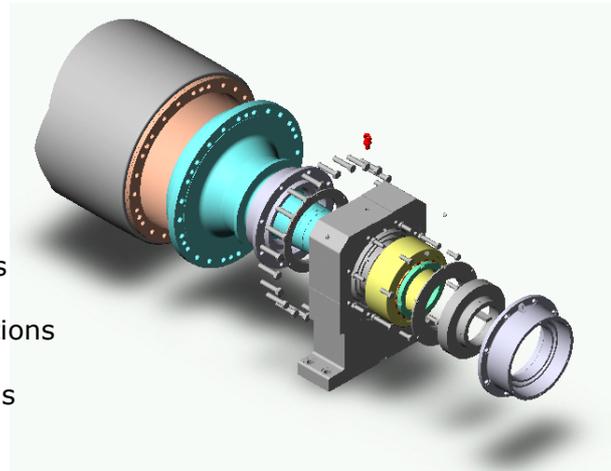
○ **ENGINEERING SERVICES**

- Engineering Reports
- De-bottlenecking studies and Performance Enveloping
- Project Management
- Strategic Studies
- Business Case Studies
- Safety Cases
- Regulation
- AutoCAD design (2D and 3D)
- 3D design and stress analysis
- Site Supervision/Monitoring
- Professional Staff Secondment

Civil and Structural Engineering

Through our partners we offer:

- Concept and Detail Design
- Site and Structural Surveys
- Asset Assessment
- Innovative Structural Solutions
- Numerical Analysis
- Historic and Listed Buildings
- Geo-technical Services

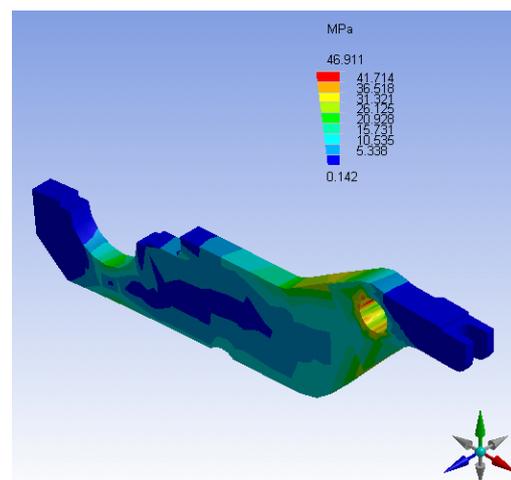


Modelling & Simulation

- Process Simulation ("Pro-Sim"TM)
- Virtual Reality Simulation ("VR-SIM")
- Process Engineering & Design
- Fluid Mechanics
- Hydraulic Design
- Pipeline Design
- Structural Analysis

MEICA

- Design Services
- Plant Commissioning
- Installation Supervision
- Asset Review
- Building Services
- Performance Reports
- Energy Efficiency



Process Engineering

- Physical Separation Design
- Biological Process Design
- Feasibility Studies
- Plant Optimisation and Upgrade Design
- Process Research Management



Associated Services

- Planning Supervision
- Expert Witnesses
- Quantity Surveying
- Cost Management
- Contract Advice

○ ***HEALTH AND SAFETY***

All of CTG's project and construction undertakings are carried out in accordance with recognised safety systems and procedures. Clearwater undertakes regular staff training and awareness to ensure all our staff, clients and the public are considered during all aspects of our project involvement.

Clearwater's philosophy is to work hand-in-hand with our clients to achieve a high standard of health and safety in every assignment, wherever the geographical location.

○ ***ENVIRONMENTAL SERVICES***

Management of the Environment

CTG has a wide range of expertise within the following waste management fields:

- Waste minimisation, reuse & recycling
- Incineration
- Gasification
- Pyrolysis
- Flue gas de-sulphurisation systems
- Energy from waste / Energy Management
- Consultancy services
- Waste disposal
- Treatment, storage
- Transfer and transport of wastes

With our partners CCP provides advice on suitable reuse of waste for landscaping, construction work and land reclamation. The consultancy service offered includes planning liaison, negotiation with regulatory authorities, design, waste management strategies, waste minimisation, and contamination assessment.

Significant savings have been made for clients on landfill costs and off-site disposal costs where excavated material, construction waste and filter media have been beneficially reused.

We can offer the following environmental services:

- Incineration and pyrolysis technology
- Environmental impact assessment (EIA)
- Environmental management
- Environmental permitting



- Due diligence auditing
- Air quality monitoring
- Pollution control trade effluent and wastewater management
- Solid waste management
- Regulatory advice
- Expert witness
- Emissions monitoring

Proven Track Record

We have a proven track record in delivering design and build, engineering, procurement, construction, commissioning and operational support as a seamless service to ensure safety, time, cost and quality to meet client requirements.

The core of project management, engineering and procurement activities are controlled centrally to ensure best practises are applied to all our projects.

Dedicated project managers and project engineers lead the project team from contract award to completion ensuring that customers' needs are understood and achieved.

An integrated suite of project tools enable the multi-disciplined teams to track time and costs to ensure that programmes and budgets are controlled and value for money achieved.

Our success relies on ensuring a clear understanding of the scope of work, employment of the resources best suited to carry out the function, clear understanding of roles and responsibilities of staff and the supply chain and the minimisation of risk.

10. APPROACH TO PROVIDING THE SERVICE

We recognise that to deliver our promise to the Client, our approach to any agreement must be one of addressed proactive teamwork. We assume responsibility to meet our commitment to the client, and will back this commitment with solid performance guarantees.

Our objectives are to: -

- Form partnerships / alliances with our clients
- Understand and share the Client's corporate, strategic and project objectives.
- Appropriately disseminate this thought to the project team.
- Provide proactive leadership.
- Cost, time and quality under routine scrutiny.
- Review team performance and maximise the skills available.
- Reinforce the team to eliminate weakness.
- Identify, select and use the most appropriate technology for the project.
- Identify and closely monitor cost sensitive sectors.
- Implement value engineering and management principles at all phases.
- Apply sound environmental practice.
- Apply the appropriate health and safety principles.



At an early stage, we can only provide an overview of our approach, however, we can assure any Client that, with the appointment of Clearwater, they will receive single source accountability - with the added promise that we will evaluate the Client's individual needs and constraints, then design a service delivery option that is tailored to meet those needs with optimum efficiency.

11. SUMMARY

We believe we have the capability, resources, expertise, experience and geographical compatibility to provide any element of the evaluation, design, build, operational and management requirements of the Client.

Clearwater Technology Group can provide a focussed, single source of expertise across a multi-discipline team environment.

Any information, in addition to this document, on CTG and our partners is readily available upon request.