



WorleyParsons

resources & energy

EcoNomics™

Water & Wastewater

Capability and Experience





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“There is no task so important or urgent in our business, or a customer’s business, that it overrides the need to work safely...”

John Grill, WorleyParsons CEO

Zero Harm is our corporate vision for health, safety and the environment (HSE).

We are committed to our vision; it applies to all of our operations, at all times, in all locations, and at all levels of responsibility.

We will actively work to align our expectations and behaviors with those required to achieve our vision through a dedication to continuous improvement.

The launch of our HSE framework, OneWay™, enables us to further align and consolidate our global systems and procedures and continue to work with our personnel to reinforce a culture that underpins our drive to achieve our corporate differentiator of industry leadership in the HSE performance.

OneWayTM
to zero harm

Corporate Overview

WorleyParsons is a leading global provider of professional services to the resources & energy sectors, and the complex process industries.

We cover the full asset spectrum, both in size and lifecycle, from the creation of new assets, to services that sustain and improve operating assets.

Our business has been built by working closely with our customers through long term relationships, anticipating their needs and delivering inventive solutions through streamlined, proprietary project delivery systems. Strong growth continues to characterize our performance both through organic development and through strategic acquisition as we strive to provide tailored services wherever our customers need us.

- Power
- Minerals & Metals
- Hydrocarbons
- Infrastructure & Environment

40
countries

137
offices

29,100
personnel

EcoNomicsTM Delivering profitable sustainability

EcoNomics™ is our range of services and technologies that profitably embed environmental, social and financial sustainability into project delivery, across the asset lifecycle. It is a seamless extension of our established project delivery capability in the key areas of Assessment, Efficiency and Treatment & Mitigation. We are committed to working with our customers to turn their sustainability objectives into good business practice.

Water & Wastewater

WorleyParsons' team of committed and empowered water professionals are at the forefront of managing the total water cycle to meet growing demands from the public and industry and to provide improved environmental protection.

We provide services for:

- Municipal water and wastewater, including work for both public sector organizations and private sector providers
- Industrial and commercial customers, looking at all aspects of the Total Water Cycle
- Integrated infrastructure for owners and developers, including comprehensive solutions for:
 - Industrial parks and similar large developments
 - Resource and energy developments, in challenging locations around the world from mining projects in remote desert areas to resource developments within the arctic circle.

Our services span the entire project lifecycle including:

- **Select**, our specialist front-end division that assists our customers through services including project identification, planning, options analysis, business case development, conceptual designs, pre-feasibility and feasibility studies
- **Deliver**, our full service project delivery capabilities, via Engineering, Procurement and Construction Management (EPCM) and Program or Project Management Contracting (PMC). We combine our substantial water design and engineering capabilities with our internationally proven project delivery system, the WorleyParsons Project Management Process (WPMP)
- **Improve**, our specialist offering to assist customers in optimizing the performance and reliability of existing facilities. This offering combines our water industry specific skills (e.g. leakage management, network modeling and Geomatics); with expertise gained from over 120 long-term contracts with major asset owners across a wide range of industries worldwide

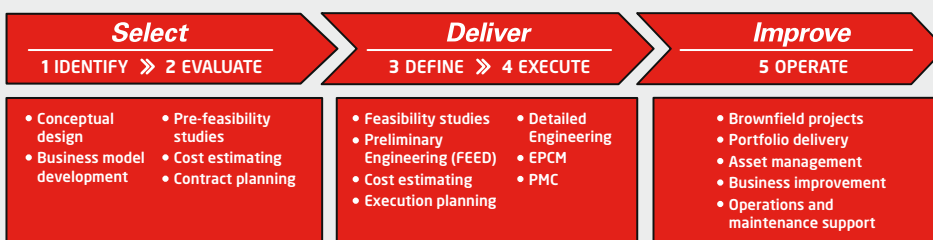
We work in a collaborative manner with our customers leading to the establishment of long-term partnerships. Our focus is on performance, on world class capabilities, sustained by attracting, developing and retaining highly skilled engineers and scientists, supported by proven systems.

2000+
water projects

2000+
wastewater projects

5000+
water resources projects

WorleyParsons Project Phases



WorleyParsons' experience covers all five phases of the asset lifecycle. In each of these phases we understand the critical issues and apply our specialist business lines, *Select*, *Deliver* and *Improve* to enable our customers to achieve their business objectives.

Our phased approach enables consistent project delivery worldwide and WorleyParsons' project systems are fully aligned to this process.



Capability Overview

Water Cycle Solutions

WorleyParsons specializes in providing integrated solutions to the management of water. We apply our expertise in the fields of water resources, water quality and treatment processes to identify all potential sources of water and match these with demands to develop reliable and sustainable solutions at optimized costs for our customers. We work at both a regional level to develop Integrated Water Management Plans for government and industrial complexes and with individual industries including mines, power stations and manufacturing facilities.



Water Treatment

WorleyParsons has over 40 years experience in the planning, design and delivery of potable water systems covering raw water extraction, treatment and product water distribution. Our expertise encompasses a full range of water treatment processes covering conventional processes for treating surface and groundwater sources, micro and ultra filtration systems and desalination. We provide appropriate technical solutions for situations ranging from small and remote communities through to large city water supplies.



Industrial Water Management

WorleyParsons' Water Treatment experience includes hundreds of treatment solutions delivered to customers in a wide range of industries around the world. We offer a full range of physical, chemical and biological processes. WorleyParsons provides customers with robust, cost-effective solutions across their entire water cycle encompassing identification of alternative water sources, integrated management of all water and waste streams within a facility and identification of value added opportunities for liquid streams exiting the facility. We assist our customers to minimize water consumption and improve securities of water supplies.



Wastewater Treatment

WorleyParsons works with our customers to identify optimal solutions for a wide range of wastewater treatment for reuse or for the safe discharge to the environment. WorleyParsons' expertise spans the full range of physical, chemical and biological processes used in wastewater treatment options. Our services include option identification and evaluation, project planning, concept and detailed design and project management services. We also assist customers with regulatory compliance and reporting.



Water Reuse and Recycle

WorleyParsons provides water recycling solutions to both public and private sector customers. We conduct risk assessments to identify appropriate levels of treatment and redundancy for each situation and develop effective technical solutions.

WorleyParsons' experience ranges from high levels of treatment for indirect potable reuse and managed aquifer recharge to less complex solutions for irrigation and process use. We support our customers in managing the regulatory and stakeholder issues arising from reuse and recycling.



Pipelines and Networks

As expected from one of the worlds largest pipeline engineering companies, WorleyParsons has the capability to plan and design major pipelines for challenging applications. These include projects involving remote locations, difficult terrain and underwater crossings; and managing the restricted access and stakeholder management challenges of working in urban communities.

We plan, model and design water distribution and wastewater collection systems for both public utilities and industrial facilities.



Outfalls and Intakes

Combining cutting edge technologies with over 25 years of experience, WorleyParsons delivers economically viable and constructible outfall and intake projects throughout the world. Our team has extensive experience and worldclass expertise in all aspects of intake and outfall design enabling us to provide our customers with complete and integrated solutions. We assist our customers with environmental and regulatory approvals through plume and dredge spoil dispersion modeling, and coastal impact studies.



Dams and Hydraulic Structures

WorleyParsons provides innovative, cost effective and practical solutions to real-world engineering challenges by combining advanced analysis techniques with sound engineering judgment. WorleyParsons' Advanced Analysis Group (AAG) offers customers a wide range of modeling capabilities for the analysis of dams, appurtenant and hydraulic structures. Our specialist engineers and analysts utilize state-of-the-art computing resources to understand the behavior of a system, and to develop, assess and rank remedial concepts and designs.





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Water Cycle Solutions

WorleyParsons specializes in providing integrated solutions to the management of water. Water security and reliability is a major concern for industry and government, whilst a well managed water cycle can improve the sustainability of a business or community.

We apply our expertise in the fields of water resources, water quality and treatment processes to identify potential sources of water and match these with demands to develop reliable and sustainable solutions.

We work at both a regional level to develop Integrated Water Management Plans for government and industrial complexes and with individual industries including mines, power stations and manufacturing facilities. Our solutions provide cost benefits by minimizing water consumption whilst simultaneously minimizing the waste produced.

WorleyParsons has powerful systems, tools and capabilities that assist our customers to develop a sound business case to effectively communicate with their stakeholders and the wider public.

WorleyParsons utilizes EcoNomics™ to undertake a rigorous financial, environmental and social cost/benefit analysis. We provide definitive and transparent evaluations that minimize subjective comparisons.

WaterRIDE™ is our suite of applications that turns data into useful information through analysis and simple yet powerful visualization and presentation capabilities for effective communication between key stakeholders.

80+

Years of water experience

500+

Water professionals



Project: New Doha International Airport**Customer: Arabian Bemco Co Ltd****Phases:** IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

Qatar

The New Doha International Airport is a major development covering over 2000 ha of which 60% is reclaimed land.

WorleyParsons undertook the detailed design and provided procurement and construction support for all elements of the water and utility systems. This included the water distribution system, potable water/fire water tanks, airport wide underground distribution system, wastewater collection system, 42 pumps stations, treatment plant (28 ML/day) and reclaimed water distribution for irrigation. WorleyParsons provided a complete solution for all utilities on site. The scope of supply also included 66 KV/11 KV power distribution, telecommunications and the central utilities plant.

**Project: Life Cycle Costing of Water Supply Augmentation Options for Greater Adelaide****Customer: Office for Water Security (South Australia)****Phases:** IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

Australia

WorleyParsons was engaged by the Office for Water Security (OWS) to undertake a lifecycle cost analysis of various water supply augmentation options under consideration for the provision of a secure water supply for South Australia to 2050. This analysis used WorleyParsons' EcoNomics™ processes to provide a fully monetised assessment of financial, social and environmental aspects of the options.

The project was delivered in a compressed timetable, in close contact and co-operation with the OWS and with significant interaction with stakeholders to ensure support for the outputs from all stakeholders.

**Project: Municipal Recycled Water Use in Industrial Cooling Towers****Customer: City of San Jose, CA, USA****Phases:** IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

USA

The South Bay Water Recycling (SBWR) Program aim to develop a program to add new customers that are located adjacent to the existing recycled water pipeline infrastructure, and who have industrial cooling towers. WorleyParsons is providing an outreach program to potential SBWR cooling tower customers, professional engineering advice, engineering evaluation reports, detailed drawings and P&ID's, and assisted in the engineering of connections to the recycled water system. Led by WorleyParsons, the customer outreach program consists of seminars, onsite visits, and customized materials citing the benefits to the industrial customer of utilizing recycled water. The services will address 3 broad areas; chemical, mechanical, and operational issues.

**Project: Integrated Water Cycle Management Plans****Customer: Yass Valley Council****Phases:** IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

Australia

The town of Yass faced a number of challenges in relation to the management of its water supply including poor quality, an unreliable supply and a failing sewerage system. WorleyParsons prepared an Integrated Water Cycle Management (IWCM) strategy to overcome these problems and prepare the town for future growth.

The strategy identified the best set of options to overcome these in a cost effective, socially responsible and environmentally sound manner. It included a forecast of future water demand, an analysis of alternative water sources including treated effluent and rainwater tanks, and an analysis of various short and long term IWCM scenarios using a triple bottom line approach.





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Water Treatment

Continuity of operation and appropriate risk management are critical water treatment issues.

WorleyParsons has over 80 years experience in the planning, design and delivery of potable water systems covering raw water extraction, treatment and product water distribution.

Our expertise encompasses a full range of water treatment processes covering conventional processes for treating surface and groundwater sources, micro and ultra filtration systems and desalination. Our services also covers thickening and dewatering of treatment by-products. Our design processes ensure that we maintain a strong focus on safety and environmental issues through the entire project lifecycle.

We provide appropriate technical solutions for situations ranging from small and remote communities through to large city water supplies, enabling our customers to meet their obligations under a variety of challenging conditions.

Our extensive track record in comprehensive technical, financial and economic analysis of options goes beyond simple Net Present Value (NPV) analysis. WorleyParsons evaluates all relevant aspects in order to identify and quantify sustainable solutions for our customers.

250+

Water treatment projects

80+

Years experience



Project: Perth Seawater Reverse Osmosis Desalination Plant
Customer: Multiplex Degremont (for Water Corporation WA)

Phases: IDENTIFY >> EVALUATE >> DEFINE >> EXECUTE >> OPERATE

Australia

This is the first large seawater desalination plant in Australia producing potable water for one of Australia's capital cities.

WorleyParsons was selected as the engineering consultant by the Multiplex Degremont JV to initially develop the technical proposal and thereafter the detailed engineering for a 140 ML/d seawater reverse osmosis plant to produce potable water for Perth, Western Australia. The scope also incorporated seawater intake and brine outfall, pre-treatment, stabilization, disinfection and treated water pumping. This plant is one of the largest seawater reverse osmosis plants in the world and provides 17% of Perth's water demand.



Project: Jessie I Project

Customer: Rhodia

Phases: IDENTIFY >> EVALUATE >> DEFINE >> EXECUTE >> OPERATE

China

WorleyParsons was commissioned for the preliminary and detailed engineering of the waste water treatment station built for RHODIA JESSIE I PROJECT requirement. This system consists of waste water collect section, waste water treatment section and sludge-treatment section. The main building and equipments are incident tank, WWTU feed tank, coagulation tank, flocculent tank, effluent settling tank, settled material storage tank, outfall water tank, pumps, agitator, and related electrical, instrument, piping, valves, flanges & accessories.



Project: Harding Dam Water Treatment Plant

Customer: Water Corporation WA

Phases: IDENTIFY >> EVALUATE >> DEFINE >> EXECUTE >> OPERATE

Australia

Water drawn from Harding Dam in north-western Western Australia requires treatment to produce potable quality water to deal with a number of water quality problems (especially after cyclones, bad storms and dam inversions). These include high suspended solids, turbidity, alkalinity, dissolved organic carbon, disinfection by-products, and taste and odor issues. WorleyParsons' scope included the supply, installation and commissioning of a 45 ML/d ultra-filtration membrane treatment plant, with enhanced (high dose rate PAC) coagulation, flocculation pre-treatment and chloramination and pH correction (caustic soda) post treatment. The plant was designed for minimal operator attendance as well as complete remote access and control.



Project: Harris Dam Water Treatment Plant

Customer: Water Corporation

Phases: IDENTIFY >> EVALUATE >> DEFINE >> EXECUTE >> OPERATE

Australia

WorleyParsons has developed this project for the Water Corporation from concept design through process trials and selection to a business case, and in the near future detailed design. The project, a new 70 ML/d water treatment plant in the south-west of Western Australia is in an environmentally sensitive area. The treatment process has been selected to be DAF/Filtration with Biologically Active Carbon (BAC). The plant is designed to cope with significant seasonal raw water quality variation. Sustainability considerations include the maximization of recycling of wastewater, both minimizing water consumption and the plant footprint, and onsite processing of backwash sludges/lime inerts to remove the need for sludge drying beds.





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Industrial Water Management

Water is the lifeblood of industry. WorleyParsons understands that sustainable solutions in managing the water cycle are needed for a growing business.

As a leading global service provider to the power, hydrocarbons, mineral processing and complex processes industries, WorleyParsons has the capability to develop integrated solutions that go well beyond 'end of pipe' treatment.

WorleyParsons' experience includes hundreds of treatment solutions delivered to customers in a wide range of industries around the world. Our solutions are leading edge in the management and treatment of produced waters from the hydrocarbons industries, including expertise relating to heavy oil, oil sands, coal seam and coal mine methane projects.

For the power industry we provide water management that ranges from the design of complete zero discharge systems, specific process engineering using membrane and ion exchange technologies for make-up and polishing, and specialist services for the management of corrosion in cooling and steam circuits.

We offer a full range of physical, chemical and biological processes. WorleyParsons provides customers with robust, cost-effective solutions across their entire water cycle encompassing identification of alternative water sources, integrated management of all water and waste streams within a facility and identification of value added opportunities for liquid streams exiting the facility. We assist our customers to minimize water consumption and improve securities of water supplies.

Our capability in analysis covers all technical, financial and economic sectors. Our skill in environmental economics is coupled with technical expertise to develop sustainable solutions for our customers.

300+
Treatment solutions

100+
Industrial water plants designed



Project: Conceptual Water Treatment Design**Customer: Husky Sunrise Oil Sands****Phases:** IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

Canada

As part of conceptual engineering activity on the project's Energy Island plant, WorleyParsons delivered a unique approach to integrated water management. The water treatment strategy designed by WorleyParsons for this large 200,000 bpd thermal in-situ heavy oil project involving Steam Assisted Gravity Drainage (SAGD) recommended replacement of conventional de-oiling with ceramic membrane de-oiling and falling film evaporation using Mechanical Vapour Compression (MVC) for treatment of high-pressure drum boiler feedwater. WorleyParsons' personnel modelled and addressed several critical process and chemistry issues including maximum water re-use, volatile silica & organics carry-over, polymerization of organics, MVC blowdown pre-treatment design, off-gas constituents and handling, downhole connate water compatibility with disposal wastewater, and solids management.

**Project: Kwinana Industrial Area Water Planning Study****Customer: Kwinana Industries Council****Phases:** IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

Australia

The Kwinana Industrial Area Water Planning Study was conducted for an association of major industries in the Kwinana Industrial Area (KIA). The study assessed all water sources within a 20 Km radius (scheme water, seawater including desalination option, groundwater drainage and reclaimed wastewater); application of a no-treatment, desalination, partial softening treatment options, disposal via ocean discharge, thickened land fill disposal, or on-site storage/evaporation. The financial analysis compared total water cycle management options to identify the preferred water source, treatment and wastewater disposal generically applicable to industries of the KIA. The study recommended preferred water sources for industrial cooling applications to progress regulatory approval processes under national water reform implementation.

**Project: Qarn Alam Water & Steam Project****Customer: PDO (Petroleum Development Oman)****Phases:** IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

Oman

WorleyParsons MEG, at the time Macdonald Engineering Group, was selected through an international tender process to execute the FEED for this project. The Qarn Alam steam injection project is planned to recover 300 million barrels over 30 years. It will be a brown field site but no surplus capacity is available in the existing equipment. The expectation is to drill 10 gas lifted production wells, which will produce a total of around 4000 m3 of oil per day, and 20,000 m3 of produced water per day. The water treatment and steam injection facilities will be designed to deliver around 10,000 tonnes per day of steam to the reservoir at 6000 kPa.

**Project: Muja Power Station - Water Treatment Plant****Customer: Western Power Corporation****Phases:** IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

Australia

The Muja Power Station Water Treatment Plant was a project completed by WorleyParsons for Western Power Corporation. The project involved all stages from process development to operation, and was performed as an EPCM contract. The system developed comprises clarification and filtrations system, brackish water reverse osmosis plant and a brine concentrator. The system is designed to treat approximately 10 ML per day of wastewater with a recovery of up to 97.5%. The scope of the project included civil work, buildings, the process plant, electrical supply and controls, commissioning, operation and maintenance. WorleyParsons has subsequently been engaged in a number of contracts to lower the operational cost of the plant.





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Wastewater Treatment

WorleyParsons works in close partnership with its customers to identify optimal solutions for a wide range of wastewater treatment options, including reuse and the safe discharge to the environment.

WorleyParsons' expertise covers both domestic and industrial wastewaters. For domestic wastewaters we offer solutions incorporating biological nutrient removal processes, with or without chemical addition, to meet stringent discharge limits for nitrogen and phosphorous. Our experience covers both intermittent and continuous processes. For higher strength industrial wastewaters we offer both aerobic and anaerobic treatment solutions.

Our capability covers the full range of physical, chemical and biological processes found in wastewater treatment. Our extensive experience with membrane technologies includes tertiary treatment to produce high quality effluent for recycling or discharge to highly sensitive environments.

WorleyParsons' experience in the management of solid residual from treatment processes range from the engineering of thickening, dewatering and stabilizing systems through to complete biosolid management programs. Our biosolids expertise includes the development and implementation of beneficial reuse, whether this be through land application, or harvesting the calorific value through waste-to-energy.

20+

Years experience

100+

Wastewater plants designed



Project: Brisbane Water Enviro Alliance (BWEA)**Customer: Brisbane Water****Phases:** IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

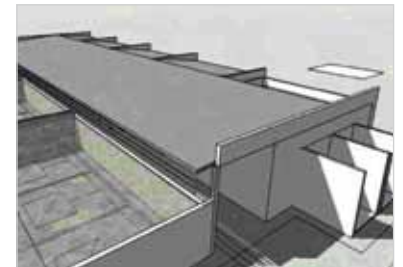
Australia

WorleyParsons was part of the BWEA responsible for the upgrade of the Sandgate (25 ML/d), Oxley Creek (65 ML/d) and Wacol (9 ML/d) wastewater treatment plants in the rapidly growing city of Brisbane. The plant upgrades targeted a 50 percentile TN standard of 5 mg/L with consequential phosphorus removal and with provision for biological P removal to be easily retrofitted to achieve a TP concentration of 2 mg/L. The project was extended to include the design, construction and commissioning of the Wynnum WWTP (7 ML/d) and WRP (4.5 ML/d) using Micro-Filtration and Reverse Osmosis (MFRO) technology to supply recycled water to the nearby Caltex oil refinery. The project also includes the provision of thermal hydrolysis treatment of biosolids at Oxley Creek.

**Project: Jurong Water Reclamation Plant Proposed 15MGD Membrane Bio-reactor****Customer: Hydrochem (Hyflux Singapore)****Phases:** IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

Singapore

Singapore's Public Utilities Board (PUB) requires the existing Jurong Water Reclamation Plant (WRP) to be retrofitted with membrane bioreactor (MBR) facilities under Phase 1 design and build contract. This MBR plant shall have a net permeate production capacity of 15mg/d. The product water shall be pumped to an industrial water services reservoir to supply to Jurong Island industries needs. WorleyParsons provided the client Hyflux with engineering services in architectural, civil and structural, geotechnical, mechanical and electrical detailed design of the MBR plant.

**Project: Zirku Island Water and Wastewater Project****Customer: Zadco****Phases:** IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

Abu Dhabi

Zakum Development Company (Zadco) has awarded WorleyParsons a contract to provide a concept level study and design of their potable water and wastewater treatment facilities at Zirku Island, located 80km offshore from Abu Dhabi.

WorleyParsons will deliver a complete concept design package allowing Zadco to proceed to the FEED phase of the project, as it looks to expand its oil production facilities and corresponding staff support facilities on Zirku Island.

**Project: Sunset Coast Water Alliance****Customer: Water Corporation WA****Phases:** IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

Australia

As part of an alliance, WorleyParsons was awarded the AUD 133 million program of works to define, design and construct four wastewater treatment plants and two wastewater pumping stations in the Mandurah and Kwinana areas of Western Australia. All wastewater treatment plants use oxidation ditch technology to produce high quality secondary treated effluent with low suspended solids and nutrients. With a strong focus on sustainability, treated effluent is infiltrated to groundwater aquifers for local reuse. Waste activated sludges are thickened by dissolved air flotation and then dewatered in centrifuges before being delivered to composting facilities for blending into high value composts.





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Water Reuse and Recycling

WorleyParsons' water reuse and recycling experience ranges from the high levels of treatment for indirect potable reuse and managed aquifer recharge to less complex solutions for irrigation and process use. WorleyParsons provides water recycling solutions to public and private sector customers.

WorleyParsons plans, designs and delivers schemes to recycle water from secondary and tertiary wastewater treatment plants for a range of uses. These include irrigation, industrial use and indirect potable reuse. We also manage and treat other sources of water such as stormwater and industrial process water.

WorleyParsons has the tools to undertake the risk assessments needed to identify appropriate levels of treatment and redundancy for each situation. Once the level of treatment is identified we have the expertise to develop the right technical solution.

Our portfolio in membrane technologies is extensive, incorporating both micro and ultra filtration and reverse osmosis. We have hands-on experience with multiple membrane products to make certain that we provide knowledgeable and impartial advice therefore ensuring the most efficient and cost-effective solution for our customers. WorleyParsons is not tied to any equipment vendor.

Our expertise covers both greenfield projects and brownfield upgrades, replacements and retrofits.

WorleyParsons assist customers with troubleshooting and optimization of their water infrastructure. We have over ten years experience in the operation and maintenance of complex treatment plants for industrial customers and draw upon the vast industrial experience in the hydrocarbons, power, minerals and metals and complex industries in our global network of expertise.

90B

Litres of water recycled annually

ZLD

Plants designed and operated



Project: Western Sydney Recycled Water Initiative**Customer: Sydney Water****Phases:** IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

Australia

This major initiative known as the Replacement Flow Project is designed to increase the supply of potable water available from the Warragamba Dam using highly treated effluent to provide environmental flows to the Hawksbury Nepean river, downstream of the dam.

The project involved redirecting effluent from 3 tertiary STP's to a new 50 ML/d Advanced Water Treatment Plant (AWTP) capable of producing water of potable equivalent standard with exceptionally low nutrient levels. WorleyParsons' involvement was from inception to strategy development and tender documentation, and evaluation. Expertise provided included water quality, brine release modeling and health risk assessments.

**Project: Select Feasibility Study for Pulau Seraya Power Station Rain Water Recovery Scheme****Customer: PowerSeraya****Phases:** IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

Singapore

WorleyParsons was commissioned to assess the feasibility of capturing rainwater and surface water run-off at the Seraya Power Station site for use in the station's water needs. With water costs expected to continue rising, the study was important to help the client control costs for the future. Therefore, innovative water storage options were developed to cost effectively maximise water recovery.

Water treatment options were identified to bring the recovered water to plant feedwater standard. The results of the study were overwhelmingly positive, showing that a significant percentage of daily plant water needs could be met through the proposed water recovery and treatment system. Capex and opex were also estimated and there was considerable annual savings in water costs. Recouping the investment in the water recovery system is anticipated to take between 2-3 years..

**Project: Gibson Island Advanced Water Treatment Alliance****Customer: Western Corridor Recycled Water Pty Ltd****Phases:** IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

Australia

WorleyParsons forms part of the Alliance delivering the Gibson Island Advanced Water Treatment Plant (AWTP). Gibson Island AWTP is one of three treatment plants that, together with the associated delivery pipeline system, forms the Western Corridor Recycled Water Project (WCRWP), the largest recycled water project in the southern hemisphere. The combined output of the scheme is 232 ML/d of purified recycled water of which 100 ML/d is from Gibson Island. This equates to approximately 30% of Brisbane's demand. WorleyParsons is providing key members of the project leadership team, detailed design of mechanical, electrical, and civil works in addition to pilot plant operation, construction management expertise, and commissioning expertise.

**Project: Northern Shoalhaven Regional Effluent Management Scheme****Customer: Department of Public Works and Services (DPW&S) and Shoalhaven Council****Phases:** IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

Australia

DPW&S and Shoalhaven Council commissioned WorleyParsons to undertake the concept design for the preferred option of this scheme. The project included design of the major engineering elements (30 km of 600 to 750 mm diameter pipelines, pumping systems and bulk storages of up to 2000 ML capacity), management of specialist agricultural, silvicultural, estuarial, oceanic and geotechnical sub consultancies and an extensive program of community consultation. The overall capital cost was estimated as AUD 72 million with a design horizon to 2030 and an estimated design population of 137,000 EP. The preferred option maximized the land application of treated effluent from various STPs with discharge of excess effluent to the ocean.





Pipelines & Networks

From large-diameter, long-distance transmission pipeline systems to small bore gathering and distribution systems, WorleyParsons has designed and managed the construction of over 90,000 Km of pipelines and pipeline related facilities the world over.

As one of the world's leading pipeline engineering service providers, WorleyParsons relies on best-in-class technical and project management personnel to deliver safe, consistent, on-time and on-budget projects for our customers.

With over 1,000 pipeline specialists and multi-discipline personnel, WorleyParsons has the expertise and capability to work with our customers to develop projects, undertake all phases and levels of studies, provide expert input to solve problems, or to execute multi-billion dollar projects.

WorleyParsons' pipeline expertise for the water sector covers both water and sewage networks, including both new works and rehabilitation. WorleyParsons WaterRIDE™ tools provide effective real-time asset condition management for geographically disbursed assets. We specialize in leakage management and the minimization of non-revenue water.

In providing total solutions to the pipelines industry, our customers can be assured that:

- All available options are considered
- The solution chosen will support the ultimate business objective
- Solutions are managed with responsibility and accountability
- A clear focus will be maintained on critical issues such as HSE, budget, schedule, quality, and technical integrity

90,000
Km pipelines designed

1,000
Pipeline specialists

Project: Sydney Desalination Project - Water Delivery Alliance

Customer: Sydney Water

Phases: IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

Australia

This project, valued at approximately AUD 600 million, is currently under construction and will supply desalinated water from what will be the largest seawater desalination plant in Australia, into the Sydney Water Supply System.

The Alliance will provide a delivery system, comprising a pumping station and delivery pipeline that will run under Botany Bay producing up to 500 ML/day seawater desalination facility at Kurnell, Sydney. Key areas being undertaken by WorleyParsons staff are design of the land based sections of the delivery pipeline, design of the pipe laying barge, all coastal engineering and dredging advice, structural design and geotechnical analysis and design.



Outfalls & Intakes

Outfall and intake design challenges range from structural engineering to marine environmental protection. WorleyParsons has the in-house capability to address all issues and deliver an optimized solution.

Utilizing cutting edge technologies and personnel with over 25 years of experience, WorleyParsons delivers economically viable and constructible outfall and intake projects throughout the world.

The successful delivery of outfall and intake projects requires experience and an understanding of all areas associated with project delivery, from open cut excavations, coffer dams, hydraulics and pipe material selection through to outfall dispersion, coastal erosion and environmental approvals. Our team has extensive experience and world class expertise in all aspects of intake and outfall design enabling WorleyParsons to provide our customers with complete and integrated solutions.

WorleyParsons also assist customers with environmental and regulatory approvals by providing:

- Detailed studies on near and far field plume dispersion modeling of outfalls using state-of-the-art computer software to aid in site selection and allow final satisfaction of environmental dilution criteria
- Dredging method and dredge spoil dispersion studies to minimize impact on local marine habitats
- Coastal impact studies to assess short and long term effects of erosion and intake/outfall installation
- Liaison with all relevant environmental and government bodies

25+

Years of outfall and intake experience

Projects executed in

11+

countries

Project: Al Seeb Wastewater Project

Customer: Parsons International / Haya Water

Phases: IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

Muscat

The Al Seeb Wastewater Project forms part of the overall Muscat Wastewater Scheme and consists of planning, design and construction of much needed wastewater infrastructure for the Muscat Governorate. The overall development plan is planned to serve 90% of the Muscat population by the end of year 2017.

WorleyParsons have been awarded the investigation, marine modelling and pipeline engineering design for the outfall of the Al Seeb Wastewater Project. WorleyParsons evaluated options including, tunneled multirizer outfalls, immersed tube outfalls and tunneled outfalls with buried conduit diffusers. WorleyParsons developed configurations, evaluated hydraulic performance under multiple normal and emergency scenarios, and developed a construction methodology.





Dams and Hydraulic Structures

WorleyParsons provides innovative, cost effective and practical solutions to real-world engineering challenges by combining advanced analysis techniques with sound engineering judgment.

WorleyParsons' Advanced Analysis Group (AAG) offers customers a wide range of modeling capabilities for the analysis of dams, appurtenant and hydraulic structures. Our specialist engineers and analysts utilize state-of-the-art computing resources to understand the behavior of a system and to develop, assess and rank remedial concepts and designs. A diverse range of expertise such as seismic response of dam structures, heat of hydration of mass concrete, flood water discharging over spillways or hydraulic performance of multi-level outlet or fishways, can be analyzed.

Our dedicated team of expert engineers and analysts perform highly nonlinear multi-dimensional static and dynamic Finite Element Analysis (FEA), Computational Fluid Dynamics (CFD), and coupled CFD-FEA analysis, as deemed appropriate to individual problems.

All our analysis results are validated to ensure modeling correctness and a high confidence level in the numerical prediction. Analyses are performed in accordance to the National Agency For Finite Element Methods and Standards (NAFEMS) guidelines for best FEA/CFD practice, ISO 9001 for quality assurance, and applying first principle scientific knowledge, prudent engineering judgment and well recognized national and international guidelines, codes and standards for all aspects of engineering assessment.

WorleyParsons has pioneered the application of numerical modeling technology for evaluating hydraulic performance of spillways, intake structures and fishways in Australia. This has benefited many dam engineers, owners and marine biologists by providing them with a profound understanding of flow behavior for dam upgrade projects, and innovative fishway designs for our waterways.

15+

CFD spillway models

20+

FEA models of dams, gates and intake towers

Project: Warragamba Dam Spillway Analysis

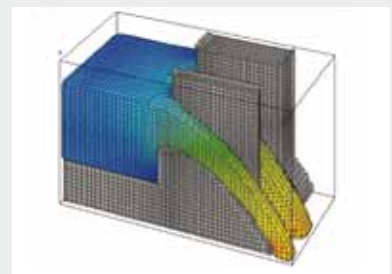
Customer: NSW Department of Commerce

Phases: IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

Australia

The revised flood levels over the central spillway at Warragamba Dam in Sydney could generate excessive negative pressure over the crest potentially causing an adverse effect on the drum gate.

WorleyParsons applied CFD analysis to model the spillway and quantify the suction pressure on the drum gate which, in turn enabled design engineers to ensure suitable remedial options. This was the first time this type of analysis had been carried out in Australia. The analysis results showed excellent agreement with published and test data and proved this technology as a viable alternative to the traditional physical scale modeling.





WorleyParsons

resources & energy

Our Vision

WorleyParsons will be the preferred global provider of technical, project and operational support services to our customers, using the distinctive WorleyParsons' culture to create value for them and prosperity for our people.

Leadership

- Committed, empowered and rewarded people
- EcoNomics™ - Delivering profitable sustainability
- Integrity in all aspects of business
- Energy and excitement
- Minimum bureaucracy

Agility

- Smallest assignment to world scale developments
- Local capability with global leverage
- Responsive to customer preferences
- Optimum solutions customized to needs

Relationships

- Rapport with all stakeholders
- Open and respectful
- Collaborative approach to business

Performance

- Zero harm
- Results for our customers and other stakeholders
- Creating wealth for our shareholders
- World-class resources, capability and experience



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EcoNomics™

For further information about
our global capability email:
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