

CLEANER SEAS ALLIANCE

CLIENT : Cairns Regional Council Water & Waste
ALLIANCE PARTICIPANTS : United Group Infrastructures
CEC Group
Sinclair Knight Merz
GHD
COMPLETION : JUNE 2010
PROJECT VALUE : \$188 Million

KEEPING THE GREAT BARRIER REEF'S WATERS CLEAN AND CLEAR

Managing upgrade works at four waste water treatment plants simultaneously with cyclone season around the corner meant the Cleaner Seas Alliance (CSA) team had no time to waste. To beat the wet and also meet EPA license conditions and deadlines, they pulled off the incredible feat of designing as they went along, and delivered better outcomes through strategic plant modifications and foresight in their procurement processes.

The upgrades are designed to improve the quality of waste water discharged to the Great Barrier Reef. The WWTPs must handle extreme conditions - up to 90 per cent humidity and 39 degree wet season maximum temperatures, in addition to cyclonic winds and monsoonal downpours. The soils include acid sulphate areas, which have now been logged, and the surrounding vegetation ranges from melaleuca forest to mangrove swamps - prime crocodile habitat.

The CSA was an evolution of the original EPCM contract between Cairns Regional Council (CRC) and the partnership of CH2M Hill and SKM. Concerns had arisen over the ability of the original delivery method to meet EPA license conditions by the deadline, due to the limited construction sector resources available to tackle projects in FNQ. Also, the works involved high technology, and a seamless integration of new and existing (remain operational throughout) plant systems at four different sites. To resolve these constraints, a collaborative approach was proposed.

“The Alliance selection process was a proven model used extensively where parties with complimentary skill sets are contractually and commercially

attached and incentivised to deliver and exceed on the expectations. The proponents respond to EOI and RFP documentation, and following both a technical and commercial evaluation a preferred proponent was selected and invited to prepare target outturn cost (TOC) budgets for each plant following a preliminary design, optioneering and review process. It is during this process where many risks are assessed evaluated and mitigated using the expertise of all the alliance partners and in particular CRC,” explained CSA Project Manager, Sam Quagliatta.

“In order to miss the oncoming wet season, the Alliance was asked to undertake “Early Works” while the TOC phase was still in progress. This resulted in construction starting concurrently with detailed design. In the early phases of the project it was a significant challenge to keep the detailed design up to the construction timeframes, however with close coordination and open communication between the Design and Construction teams works were able to progress without significant delays.”

The CSA Alliance included Cairns Regional Council (Plant Operations and Commissioning), United Group Infrastructure (Alliance and Construction Management, E,I & C design), CEC (a Local Civil contractor, providing Civil construction services, plant and equipment), SKM (Process, Mechanical & Electrical Design and construction support), GHD (Civil & Structural design and construction support).

In addition to the alliance partners there were many smaller local specialist companies who provided input to the success. The involvement of many subcontractors from the Cairns region minimised the number of

commuting specialists, and gave an extra benefit to CRC through skills transferred during design and construction, plus an ongoing benefit for the local subcontractors who will service the plants for decades to come. Working across four sites simultaneously had a number of benefits, including economies of scale in procurement, flexibility in assigning labour to minimise downtime, lower mobilisation costs for out of area specialists, an ability to apply lessons from one site to the others (especially during commissioning), and a condensed program resulting in overall reduced Project overhead cost.

There were also, naturally, challenges in managing multiple sites. These included commencing design and construction concurrently, and managing the design review and progress required to meet schedule. Informed risk-taking was required in the procurement of key mechanical equipment, as supply lead times meant orders were made before detailed design was finalised.

Time was a strict task master: bulk earthworks had to be completed before the Wet Season, and overall construction programs maintained so as not to pressure commissioning in meeting the fixed EPA licence dates. With so much work around in less isolated locations, attracting the right people – and keeping them on site and motivated – was an ongoing process, as was ensuring the implementation of consistent Health, Safety and Environmental standards and processes across the four sites. Part of the Alliance’s people management task was also to keep operators of the four plants fully informed throughout, and ensure they received sufficient training to capably manage the plants post-handover. Designing was a combined

effort, with SKM handling process and mechanical engineering, GHD undertaking the civil and structural design, and United Group Infrastructure developing electrical systems, instrumentation and controls.

Erosion prevention is a feature of the earthworks, with the decommissioned trickling filter structure rock fill redeployed for slope and dam wall bolstering to prevent rain event run off and consequent erosion. All supervisory staff and key personnel attended workshops conducted by the CRC Environmental Protection Unit to gauge the impact of construction activity and mitigation of environmental best practice process.

New, Greener, technology now produces not only better waste water, but high class recycled water for industry, business, and non-potable domestic uses. Eco-friendly friendly features include enhanced biological phosphorus removal (EBPR); UV Disinfection at Marlin Coast and Edmonton WWTPs; and aerobic sludge digestion. “A key outcome of the project has been the adoption of submerged membrane filtration (SMF) at the Northern and Southern WWTPs.

EXPERTISE DELIVERING BETTER WATER OUTCOMES



Over decades of experience in essential services and infrastructure joined the Cleaner Seas Alliance in the form of UGL Infrastructure's expertise. UGL provided Alliance and construction management, electrical, instrumentation and control design, and also mechanical and electrical construction labour.

More than 70 of their highly skilled personnel worked across all four sites, supported by technical experts in the company's Sydney office. Water is one of UGL's core focus areas, with the company committed to creating and implementing solutions which meet both present and future needs for impeccable management of this vital resource.

As one of Australia's largest integrated engineering construction, industrial maintenance and facilities management businesses, they provide services from initial scoping and feasibility studies, through to turn-key solutions which have been fully performance tested to determine their ability to meet both the client need and best practice engineered outcomes.

Their talents have been utilised in both urban centres and remote regional locations for design, construction and upgrades to waste-water

treatment plants. This body of knowledge is specifically valuable for situations such as the Cairns region, where controlling environmental contaminants, nutrient loads and suspended solids is of critical importance for the marine ecosystem.

UGL have developed specific techniques and methods which manage those substances which pose unacceptable risks. Their capabilities allow them to provide environmental solutions which reduce the solids, phosphorus, nitrogen loadings and odour emissions associated with waste water treatment plants which have caused ecological harm in the past, giving promise of a cleaner future.

In their contribution to the Cleaner Seas project, UGL's step-by-step approach to the problem at hand gave the Alliance certainty that the necessary outcomes could be achieved. This approach also ensured that the challenge of working on multiple sites, with concurrent design and construct at all four plants, would be successfully managed.

With the recent shift in Australia towards greater focus on appropriate respect for water resources, UGL had to compete with numerous

other projects nation-wide in terms of attracting and keeping the best people on the job. The need to manage succession in key roles such as project management while remaining on track with the project and minimising disruption to the Alliance as a whole is a testament to their ability to manage change within the organisation without losing sight of achieving the agreed goals.

Having the Cairns Regional Council as a key player on the Alliance team ensured clear client communication throughout, and CRC staff were integrally involved in the commissioning process for all four plants. This ensures more effective long-term management of these essential assets, and a smooth handover process on completion.

UGL needed to consider a diversity of environmental imperatives in their design and construction implementation. They also had to plan for the extreme weather events which are a feature of the region.

"Given Cairns is in a high rainfall area, erosion and sediment control is important information, and this was included in the Safety induction all personnel attended before being allowed to work onsite," said Project Manager Victor Archer.

"All supervisory staff and key personnel attended workshops conducted by CRC Environmental Protection.

"There was a cyclone preparation plan that was implemented in the Alliance every cyclone season.

"A number of sites were prone to flooding during the wet season, and a plan was developed to cater for this during the construction phase. On one occasion the structures were filled with water to prevent damage."

Other aspects of the sites which required careful consideration were the high ground water which is a feature of the mangrove-fringed coastal region, and acid sulphate soils requiring careful management to prevent harm to the marine ecosystem through inadvertent leaching of acid sulphate into the ocean surrounding the highly pH sensitive reef area.

Despite all the various hazards including crocodiles which the four sites presented, UGL's labour force demonstrated the value of the company's OH&S and safety policies by achieving 590 days of LTI free construction works, equivalent to over 632,000 man-hours.



“UGL had the opportunity to really work closely with our partners Cairns Regional Council, SKM, GHD, and CEC in delivering an outstanding outcome for all, as well as to apply our comprehensive in-house Engineering and SCADA and Control capabilities,” said Terry Schubach, General Manager Water – Northern Region.

“This Alliance has provided a platform for all partners to be part of a high performance team.” As a team, the Alliance delivered a quality outcome for Cairns Regional Council, and has also provided substantial environmental benefits to the regional community. As the Great Barrier Reef is a World Heritage listed living organism, UGL’s endeavours in improving the quality of effluent discharge into this sensitive ecosystem is also of inestimable benefit for future generations.

“This project continued UGL’s success in delivering complex, fast track wastewater treatment plant upgrade solutions to key clients in Australia particularly using the Alliance delivery model,” said Tim O’Hearn, UGL Infrastructure’s Executive General Manager Water.

“The Cleaner Seas Project uses state-of-the-art submerged membrane filter (SMF) technology, the largest of its kind in Australia and one of ten in the world. The use of high-tech filters produces exceptionally

clean water for non-potable re-use. UGL has extensive experience in wastewater Treatment Plant upgrades in all parts of Australia in addition to New Zealand and South East Asia, including design, construction and operations and maintenance.”

The Great Barrier Reef Marine Park is not the only iconic Australian marine area to benefit from UGL’s expertise. Bondi Beach, at one time fairly infamous for the problems associated with the old ocean outfall, had its sewerage treatment plant upgraded in 2007, with UGL contributing a solid core of expertise to the Reliability, Improvement, and Modernisation program (RIAMP) Alliance under an Alliance contract.

This project required works including tunnelling, design and installation of new plant, mechanical and electrical systems, and installation of a SCADA system to enable full automation.

On the Gold Coast, UGL contributed their design and construct energies to the Pimpama Coomera Waterfuture Master Plan for the Gold Coast City Council and Gold Coast water. This two stage project comprised the design and construct of a new state-of-the-art Sewerage Treatment Plant, and the design and construction of a new recycled

water plant capable of delivering Class A+ quality water. Recycled Water is a growing focus for integrated water management planning in Australia, and UGL are at the forefront of developments in this area.

They designed and constructed the Homebush Integrated Water Recycling Plant which was built to meet the needs of the Olympics site and also to serve the adjoining residential area, and are contracted for the operation and maintenance of the plant until 2025.

UGL was this year selected nominated by Melbourne Water Corporation as preferred construction partner, in Joint Venture with Baulderstone, for the planned upgrade of the Eastern Treatment Plant in Carrum. This project has a major goal a vast improvement in the quality of water discharged into Bass Strait.

UGL and Baulderstone have formed an Alliance with Black & Veatch, KBR and Melbourne Water to undertake this \$380 million project, which has an expected completion date of the end of 2012.

UGL and the Alliance partners will be providing both design and construct services, and also undertake a two year operations and maintenance phase with Melbourne Water Corporation. In all of

their water projects around the world, UGL implements rigorous sustainability and environmental protection criteria, applying their engineering intellect to delivering future-friendly solutions which adhere to an ISO14001 certified environmental management system.

For the seas which surround us, this translates both into reduction of harm in the short term, and long-term promise of better protection of our irreplaceable marine environment and the habitat it represents.



UGL INFRASTRUCTURE
Level 6, 40 Miller Street
Locked Bag 903
North Sydney NSW 2060
t. 02 8925 8925
f. 02 8925 8926
e. infrastructureinfo@ugllimited.com
www.ugllimited.com



MORE THAN SIXTY YEARS PROTECTING THE GREAT BARRIER REEF

GHD can rightly claim to be the authority when it comes to the Waste Water Treatment Plants (WWTPs) of the Cairns area. After all, they built the inaugural Cairns sewerage system and waste water treatment systems sixty years ago, and have maintained a constant involvement since.

Most recently, GHD provided solid a core of experience and skills for the Cleaner Seas Alliance, responsible for upgrading the four main WWTPs servicing Cairns and its immediate environs. “We saw the desirability of a strong local presence in the project as it moved forward from its planning phase to its implementation phase. As result, we developed an association with the pre-eminent local contractor, CEC, and this developed into more comprehensive association between CEC, United Group and GHD. Ultimately this lead to the development of the full Alliance with SKM and of course Cairns Regional Council,” explained GHD Manager for North Queensland, John Gersekowski.

“One of the key factors to the success of the project was that each of the members of the Alliance brought specific strengths that mutually complemented the strengths of the other participants. It provided the Alliance with access to a great range of resources both locally in Cairns and globally.” GHD’s responsibilities included design of the civil and structural components of the project. Most of this work was undertaken by the experienced staff of GHD’s Cairns office, with additional design and documentation contributed by teams at six different locations within GHD’s global organisation in order to meet the demanding construction schedule.

“From a civil/structural perspective, perhaps the most challenging element was the design of the fully post-tensioned bio-reactor structures. The need for innovation in its design was really driven by the tight timeline and was able to be realized by the close collaboration with the construction teams. This allowed us to develop staging strategies that allowed construction to proceed as quickly as possible,” explained John Gersekowski.

“The geotechnical conditions presented some challenges and represented a potential risk to program. However our local experience both in Cairns and more specifically on the wastewater treatment plant sites, built up over decades, allowed us, in close collaboration with the construction teams, to put in place effective solutions that met the tight timeline and budget demands of the project. “

Since GHD’s initial works in the Cairns region, they have continued to seek innovative solutions and improvements. Some of the innovations developed over those years include designs and methodologies for traversing the mangrove areas and other soft ground condition in Cairns; one of the first large scale uses of the oxidation ditch format; and the development of an economical foundation system at the treatment plant that addressed the soft ground conditions at those sites.

“The critical environmental issues during construction centred on the protection of the mangrove wetlands abutting all of the sites. This required rigorous erosion and sediment control. However more critical was the management of acid sulphate soils, particularly during the excavation and

dewatering phases of construction,” said John Gersekowski. “We are proud to have been part of this project and therefore able to contribute to its successful outcomes. It is particularly important for our Cairns staff as they are part of the local community that will benefit from the project.

“GHD’s work in North Queensland is best characterized by our long-term partnerships with our clients that span decades, as well as our continual refinement of solutions that reflect innovation and technical leadership. Our water supply and sewerage projects illustrate this – initially the focus was directed to overcoming the remoteness and ruggedness of the environment – this progressed to meeting the demands of a rapidly developing community. The company’s emphasis is now on working with our clients in delivering economically viable and environmentally sustainable outcomes. Our current water projects embody integrated water cycle management principles to reduce demand and optimise opportunities for reuse of water resources and advanced treatment processes to minimize environmental impacts.”

Warren Traves is GHD’s Global Leader for Water, and is involved with projects around the world, including three treatment plants on Chesapeake Bay in the USA, another sensitive marine ecosystem where rigorous water quality standards must be applied. GHD is also working on the Western Corridor Recycled Water Pipeline at Brisbane, the Water Matters Alliance in Townsville, Alkimos WWTP in Perth, a desalination plant in California, and ongoing WWTP projects in the Middle East, Malaysia, the Philippines, Vietnam, China, Canada and New Zealand.

“Cleaner Seas is a significant project for GHD in terms of scale, and also in terms of the quality of effluent; the testing has to be spot on,” he said.

“The delivery model for Cleaner Seas was very much a collaborative model, it works more effectively. Designers, owners and constructors are working for the one goal together. There is maximum input from the owner, maximum input from the builder on buildability, and the proper checks and balances,” said Warren Traves.

“The savings are in the end product. Alliances typically use more design resources than the traditional model; a value process is applied to what is designed, redesigned and built, and more time is consumed in design, but for the constructed asset there is a better outcome. The involvement from us is higher, which is putting an appropriate value on design.

“We have plenty of experience in upping the ante. There is a tendency to expect best practise from waste water treatment plants, and it is quite difficult to establish the limits (in effluent quality) for long term sustainability. It is very important to not only be putting in the technology, but to monitor over time in sensitive environments.”

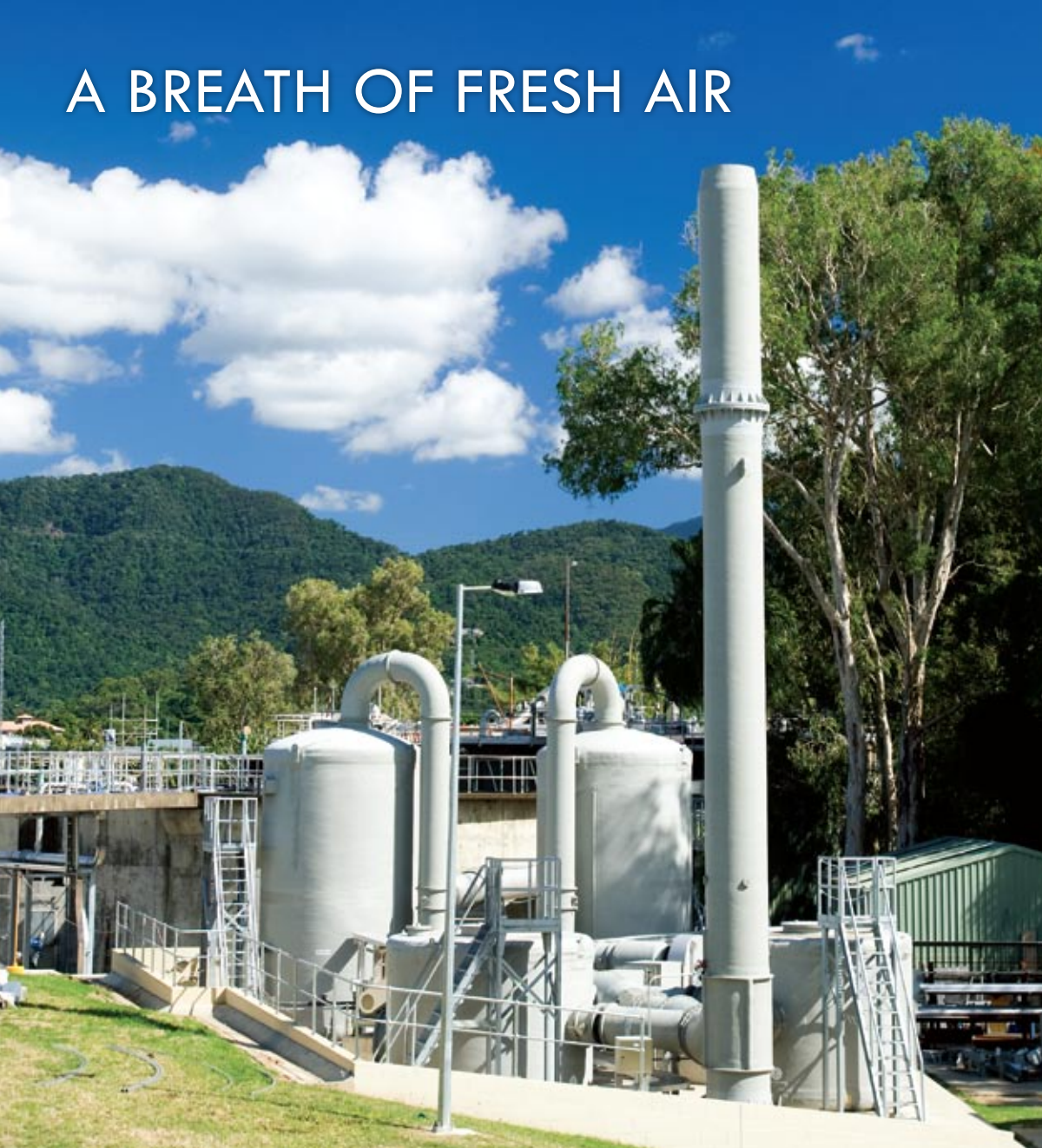
Since the company first began delivering water engineering solutions in 1928, GHD has embraced change, often creating it itself.

“The real driver of change in water management today is environmental impact, and an understanding we as a community can do better by the environment by managing effluent quality,” said Warren Traves.

He pointed out that a decade ago it really sank in that water is a finite resource in Australia. GHD has been investing their know-how in producing recycled water which is ‘fit for purpose’ under a multitude of standards, whether it be for irrigating lettuce or reticulation through the subdivisions of South East Queensland by projects such as the Coomera Scheme on the Gold Coast. The evolving urban water management paradigm, which sees a mixture of rainwater tanks, potable water and recycled water supply, is part of balancing the needs of the community with the capacity of the environment to meet them.

GHD
Level 15, 133 Castlereagh Street
Sydney 2000
t. 02 9239 7100
f. 02 9239 7199
e. sydmall@ghd.com
www.ghd.com

A BREATH OF FRESH AIR



Waste Water Treatment Plants can get awfully whiffy; fortunately, when the balmy tropical breeze blows around Cairns, technology by Aromatrix ensures there's no unpleasant odours from the newly upgraded Marlin Coast, Northern or Southern WWTPs. Aromatrix engineer leading edge odour control technologies based on bacterial action and activated carbon, rather than harsh chemicals. This approach makes their process an ecologically safe choice for the adjoining Great Barrier Reef Marine Park.

A combination of mechanical, civil, electrical and chemical engineering expertise in house, combined with manufacturing associates in Asia, meant Aromatrix had the capability to handle the full brief of design, supply, install and commissioning for three odour control systems to extract hydrogen sulphide, mercaptans, VOCs and other bad smells from the inlet works of these facilities, and other minor sources around the plants. Post-scrubbing, the resulting odorless compounds are discharged to the treatment works, incorporated into the sludge mass and thence removed.

Extensive research into airflow, odour dispersal patterns and detectable levels of odour in neighbouring locations preceded the design phase, in order to maximise effectiveness and meet or exceed EPA targets for air quality. One of the challenges from a site perspective was the need for facilities at Marlin Coast and Northern to be constructed on a raised

platform to prevent damage during flooding. Another design parameter was the extreme weather, including heat, humidity and cyclonic winds which are par for the course in the Tropics.

Work on design and manufacture commenced in 2008, followed by on site works including the installation of plant, electrical and civil works. All systems were delivered for installation as entire units, including PLCs, ductwork, fans, and signage. The systems then had an acclimatization phase of six weeks, which allows the bacterial process which oxidizes H₂S (Hydrogen Sulphide) to establish itself. "For odour control, traditional chemical scrubbing uses harsh chemicals such as sodium hypochlorite and caustic soda," explained Aromatrix Managing Director, Gary Finke.

"Our systems for these three plants combine bioscrubbers and activated carbon filters. The bacteria, Thiobacillus, in the bioscrubber does what chemicals would; these bacteria love H₂S. They remove the sulphur based compounds, and the resulting solution is around pH 2, roughly equivalent to vinegar. It is a much more environmentally friendly, biological process.

"Biological treatment has been around since the 1950s, when someone found you could purify air by passing it through soil. We knew bacteria can absorb certain gases, and there was a need to craft the right

process to use them. Our R&D is constant, and our technology has won multiple awards. "Aromatrix Australia, backed by regional offices throughout Asia, is a leading provider of innovative solutions to air quality and odour related problems. We provide complete engineering services for the design and construction of advanced odour control technologies such as our award winning biotrickling filters, biofilters, chemical scrubbers and activated carbon filters.

"Our services include odour sampling, testing using approved olfactometry methods, and consultancy services dealing with odour reduction strategies, sulphide and air dispersion modeling."

Aromatrix Australia have been in operation since 2004, and have rapidly established themselves as capable of providing mitigation measures for any odour source connected with either waste water or a process unit. Their approach is to work closely with clients from the earliest stages, and where needed, provide front end advice for feasibility studies, concept design, and tender documentation, before following through with building, installing and performance testing the agreed solution.

Other major installations currently being completed by Aromatrix include a chemical scrubbing facility for Moreton Bay Regional Council at Murrumbah, capable of treating 67,000m³ of air per hour; and a Carbon Absorption System for Beenypup Waste Water

Treatment Plant in Jindaloo, Western Australia, which will deodorise up to 150,000m³ of air an hour. In addition to dozens of successful systems installed around Australia at municipal waste water treatment facilities, Aromatrix have supplied their technology to multiple plants in Singapore, the USA and China. Their systems are suitable for new residential developments which incorporate water recycling and waste treatment facilities, and are also in use for odour control at Da Dou Soy Bean Project Oil processing operation in China, Walfertan Tannery in Australia and Sembawang Utilities Terminal, a waste collection and disposal service in Singapore.

Currently the company has in development a package plant, which can be containerised for transport to remote or under-serviced sites. With a design which has been proven and independently verified to deliver effective results, the real beauty of it from a project point of view is the whole turn-key package requires only ducting to commence operation.

AROMATRIX AUSTRALIA PTY LTD
Unit 3A 17 Boniface Street
Archerfield 4108 Queensland
t. 07 3277 1190
f. 07 3277 1189
e. aaploffice@aromatrix.com.au
www.aromatrix.com.au



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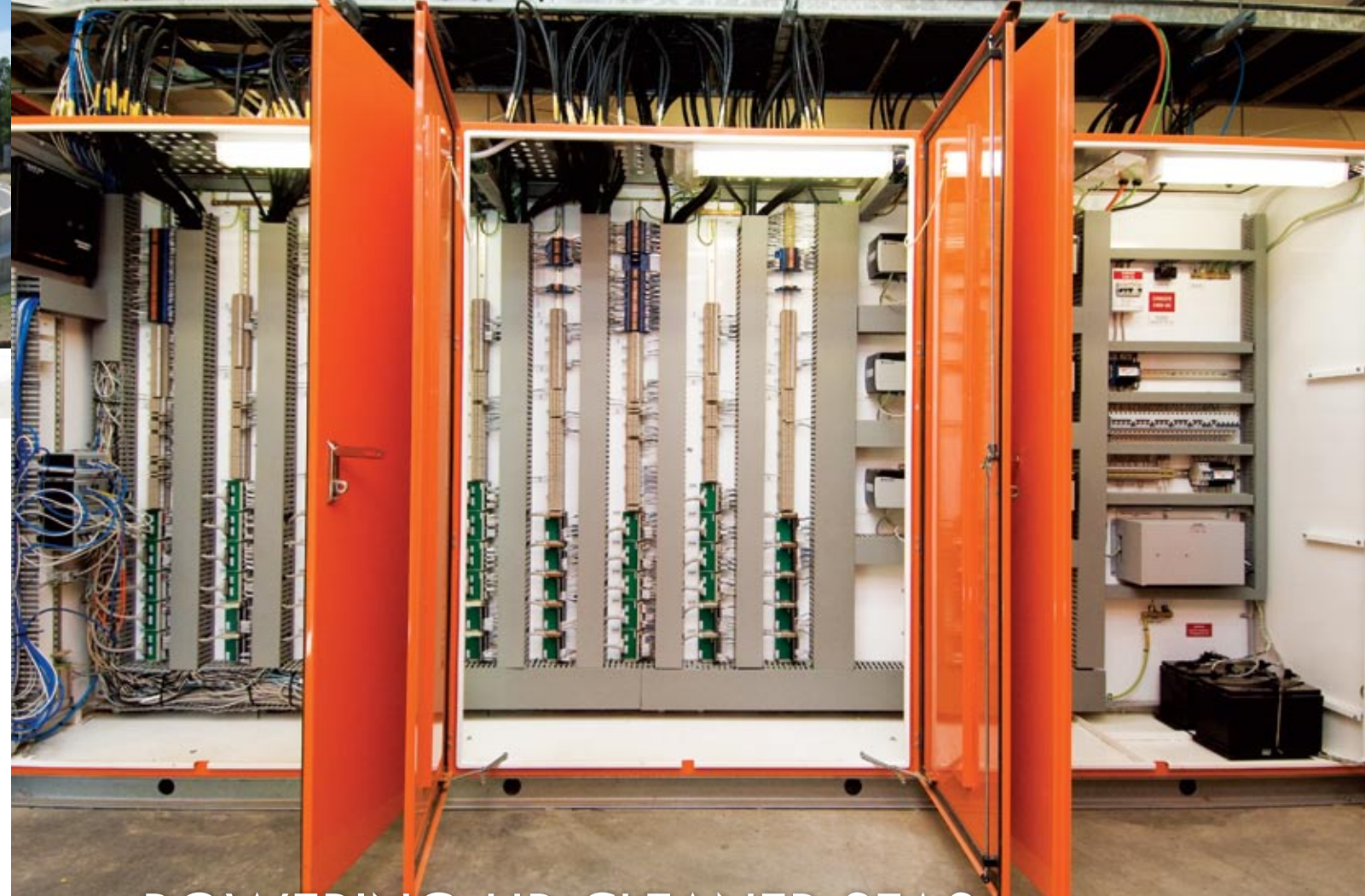
EPSCO Australia has many decades of experience engineering and installing waste water treatment technologies, and special expertise in remote and environmentally sensitive locations such as the Great Barrier Reef Marine Park. They supplied all the sludge scraping mechanisms for the upgrades of Northern and Marlin Coast Wastewater Treatment Plants, and installed them with their own team of trade qualified fitters.

As with all equipment engineered by EPCO, the sludge scrapers have been third party quality certified to ISO 9001. Specifications were developed during the design phase, with EPCO contributing their expertise and ongoing R&D to the process, ensuring the best possible waste water clarifying equipment.

“The Cleaner Seas project continues EPCO’s long involvement with North Queensland and the Tablelands, which has been ongoing since the 1960s,” said EPCO Managing Director, Grant Cobbin.

EPCO waste water treatment technology ranges from package plants capable of being installed in remote areas such as mine sites or island based Indigenous communities, through to the kind of systems needed by urban areas. Murrumba Downs WWTP being constructed by John Holland, is installing their sludge scrapers, four machines are being installed for Townsville’s Mt St John WWTP, and two units at Gibson Island Brisbane. EPCO has completed projects in all states and territories of Australia, in addition to supplying their equipment to South East Asia, Fiji, Hong Kong, Papua New Guinea and the Middle East.

EPCO AUSTRALIA
PO Box 111
Sumner Park QLD 4074
t. 07 3279 3276
f. 07 3279 4250
e. info@epco.com.au
www.epco.com.au



POWERING UP CLEANER SEAS



Cleaner Seas, Cairns QLD

When the new systems at the four upgraded Cairns Waste Water Treatment Plants are switched to go, the work of WES Switchboards ensures everything does in fact, go. They manufactured and supplied the eleven Automation Control Panels which house the electrical and electronic nerve centres of the Marlin Coast, Northern and Southern WWTPs. These panels incorporate Programmable Logic Controllers, which automate the plants. Working in conjunction with United, who undertook the designs, programming and commissioning, WES Switchboards’ trade qualified electricians spent months on the fit out of the enclosures, including assembly of components and complex wiring. They tested all units prior to despatch and arranged delivery to site.

“This is one of the biggest projects we’ve worked on, it stretched us,” said Project Manager, Greg Waterhouse. “It took intensive work to get eleven panels in and out of our workshop in the required timeframe, but this is the kind of job we do well. Everything we do is built to Australian standards, and where required, we perform follow-up site visits for any necessary advice on maintenance, spare parts, repairs, or testing.”

WES Switchboards have been supplying civil infrastructure and industrial manufacturing projects with industrial switchboards, control panels and motor control centres since 1980. Their core staff have over 85 years combined experience in electrical engineering and electronics, and the company has long term relationships with consultants who contribute expertise in engineering, CAD, PLC programming and commissioning services on a subcontract basis.

One of the company’s longest term clients is Sydney Water. They have also completed substantial contracts with Memcor (a division

of Siemens), United Group, Network Electrical Engineering, Outotec Pty Ltd, Aqua Quality Consultants and GE Infrastructure. In 2007, CSE-Uniserve contracted the company for manufacture and supply of 4 X 280 kW, 5 X 315 kW and 6 X 450 kW VSD cabinets for Leighton Contracting, as part of the Liverpool-Ashfield Sewerage Pipeline.

In addition to the Cleaner Seas project, WES Switchboards are supplying panels of even larger dimensions for another United Group project, the Westdale WWTP in Tamworth. WES Switchboards pride themselves on responding quickly and professionally to their customer’s needs. As a small company with a hands-on approach, they have the flexibility to deliver fuss-free solutions, and become a strong link in a project’s supply chain.



WES SWITCHBOARDS
Unit 1, J6 Jubilee Avenue
Warriewood NSW 2102
t. 02 9979 1127
f. 02 9997 2255
e. info@permagroup.net.au
permagroup.net.au

