CASE STUDY

IGAM BARRACKS SEWAGE TREATMENT PLANT

LAE, PAPUA NEW GUINEA

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Kubota

The Papua New Guinea Defence Force own and operate the Sewage Treatment Plant (STP) at Igam Barracks in Lae. Igam Barracks is located close to Lae in Papua New Guinea. The STP services the military barracks, offices and a localised township of 2,500 to 3,500 people.

The STP is located to the southwest of the barracks and township in a restricted access area.

Figure 1 - Members of the PNG Defence Force Engineer Battalion, Australian Army and Australian Air Force on the parade ground at the Igam Barracks in Lae.

As part of an Australian and Papua New Guinea Government agreement to refocus aid and better deliver essential services and infrastructure, True Water was engaged to design and deliver a 250m^3 Sewage Treatment Plant for the community of Lae in Papua New Guinea. The delivery of the Sewage Treatment Plant through the Australian Defence Force resulted in the direct provision of infrastructure without unnecessary cost.

True Water worked closely with the Australian Army to deliver the aid project in a coordinated effort that provides amenity and public health benefits through the delivery of the community sewage infrastructure. Detailed planning and experienced logistical coordination saw the treatment plant installed within three weeks of arriving in Papua New Guinea.

The 250m^3 Kubota Sewage Treatment Plant was manufactured by Kubota under its strict Quality Assurance processes. Due to refined manufacturing process and detailed quality management system, Kubota sewage treatment plants are of the highest quality and include design and engineering features we have come to expect from multinational Japanese corporations such as Toyota, Honda or Nissan and Kubota.

Igam Barracks

The Igam Barracks were officially opened on 30 September 1968 by the then Minister for the Army, Mr Phillip Lynch. At the time of the official opening, Igam Barracks provided accommodation for a number of Army units of the Papua New Guinea Defence Force.

The Australian Defence Force has continued to maintain close ties with the PNGDF since independence with Australian forces often based at the barracks to take part in training exercises and conduct community outreach programs.

As well as providing accommodation and training facilities for the PNGDF, the Igam Barracks are the centre of a community who are able to enjoy the benefits of the infrastructure.

Key Project Requirements

Key project requirements shaped the design and delivery of a fit for purpose solution for Igam Barracks.

Reliability

To ensure minimal interruption of operation, the STP is highly reliable and includes contingency and safeguards to ensure continuity of service at all times, including during peak usage and power outages.

Scalability

True Water immediately identified the potential need for future expansion to meet growing hydraulic loads and growth at the site. The STP was designed with the capability to have capacity easily expanded to meet any future demand. Scalability ensures the STP is always sized to meet daily flows and reduces overall capital costs.

Local Engagement

Engagement and upskilling of the local workforce was a key element in the delivery of the Igam STP. Local staff were involved in each stage of STP construction, installation and commissioning.

Influent Strength

The STP receives influent generated by ablutions and amenities within the barracks. Generally, the influent is of a domestic nature. However due to the variations experienced by the site, the STP must be capable of handling influent with contaminant concentrations beyond domestic levels.

Environmental Impact

In accordance with ADF's performance mandate, the infrastructure must not negatively impact the environment. This aligned well with True Water's vision for all STP's to provide a neutral or beneficial impact to the environment.

Figure 2 - Aerial View – Igam Barracks in Lae, Papua New Guinea

STP Overview

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Kubota 250m³ STP

Igam Barracks Sewage Treatment Plant - Papua New Guinea

Quick Facts:

Location: Lae, PNG

Client: AUSAID, ADF

Product: 250kL K-HC-R STP

Sector: Aid/Government

Australian Government

"True Water's innovation, attention to detail, focus on quality, dedication and customer service are above reproach. I am extremely happy with the quality and professionalism displayed by the company and its employees"

"Throughout the project True Water's dedication and customer service was outstanding. They diligently supported the requirements of the Army in their ongoing maintenance with a dependable, reactive and programmed service regime."

B. Matthews
Warrant Officer Class Two, AUSTRALIA
DEPARTMENT OF DEFENCE

Foreign Aid Community Infrastructure

- Provide vital services to the Lae community, via Australian Aid Investment
- Collaboration between Australian and PNG Governments
- Local trade and workforce engagement

Key Challenges

- Project located in foreign country requiring export management
- Capital and operating expenses to meet Aid budget requirements
- Simple operation and training of local workforce for maintenance
- Intermittent power source and varying hydraulic flows
- Harsh tropical climate, wet and corrosive conditions

The Solution

- Kubota K-HC-R Advanced Treatment Plant
- High quality, effluent treatment
- Safe below ground installation
- Installation completed within 4 week window
- Training of local workforce for day to day management

Design - Igam Barracks - Sewage Treatment Plant

System design and configuration is completed with care for each True Water STP to ensure the STP is suited to project specific requirements. True Water refines the design of each component of the system to provide the best cost and operational outcome.

After considering the scale of the project, the strength of influent and the quality of treated water the most suitable STP is chosen and the size and scale of the plant confirmed. A Moving Bed Biological Reactor (MBBR) type STP was best suited treatment process for the Igam Barracks specification.

The final design demonstrates a best practice outcome for Igam Barrack's wastewater needs. The system balances technical specification, operational performance and technology complexity to achieve robust treatment performance over the long term with a minimal financially burden.

The Sewage Treatment Plant selected for Igam Barracks was a 250kL Kubota K-HC-R STP.

Treatment and Process

Influent Flow

Influent flow	250m^3/day	General Influent time	12 hours
Peak flow factor	4		

Water Quality

Item	Average Influent	Discharge
pH	6-8.5	6-8.5
BOD (mg/L)	200	<30
SS (mg/L)	250	<20
E. coli (cfu/100ml)	-	<1000
EC (µs/cm)	<1800	<1600

Specifications

Treatment Method: Moving Media Bed process

Moving Bed Media – Polyethylene skeleton type (28mmØ x28mmH)

Structure and Material: STP Body – Fibre Reinforced Plastic (FRP)

Submersible pump - vortex type.

Submersible pump casings - stainless and plastic compound

Submersible pump impeller – plastic

Aeration Blower – Rotary Vein (3phase 415V, 50Hz)

Aeration Strength (Moving Bed Chamber) – 4m3/m3/hr

Backwash Strength (Carrier Filter Chamber) – 8m3/m3/hr

Airlines – Stainless and UPVC

Piping – Stainless and UPVC

Process Flow Diagram

Figures 3 and 4 detail the treatment process employed within the Kubota STP.

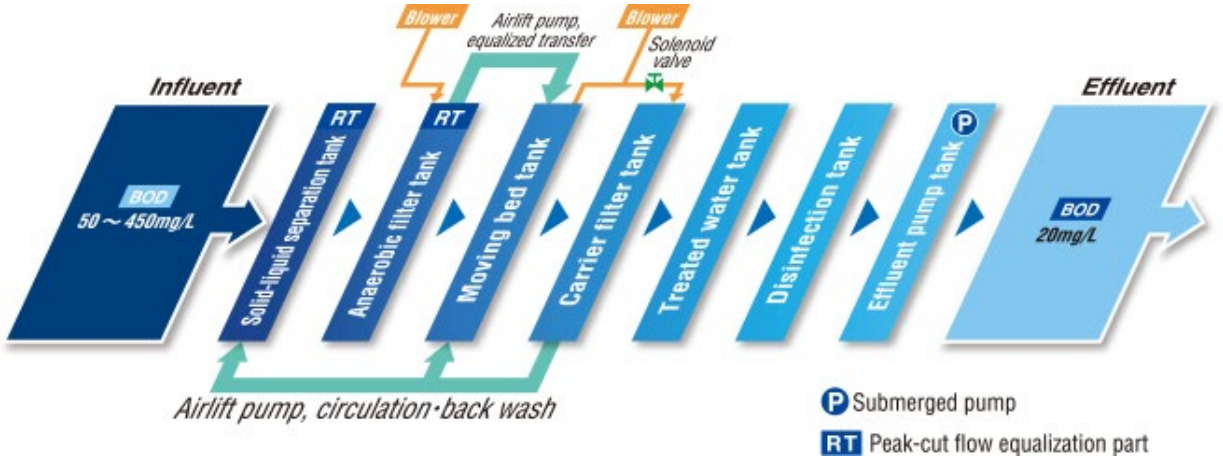


Figure 3 - Kubota K-HC-T Treatment Process Flow

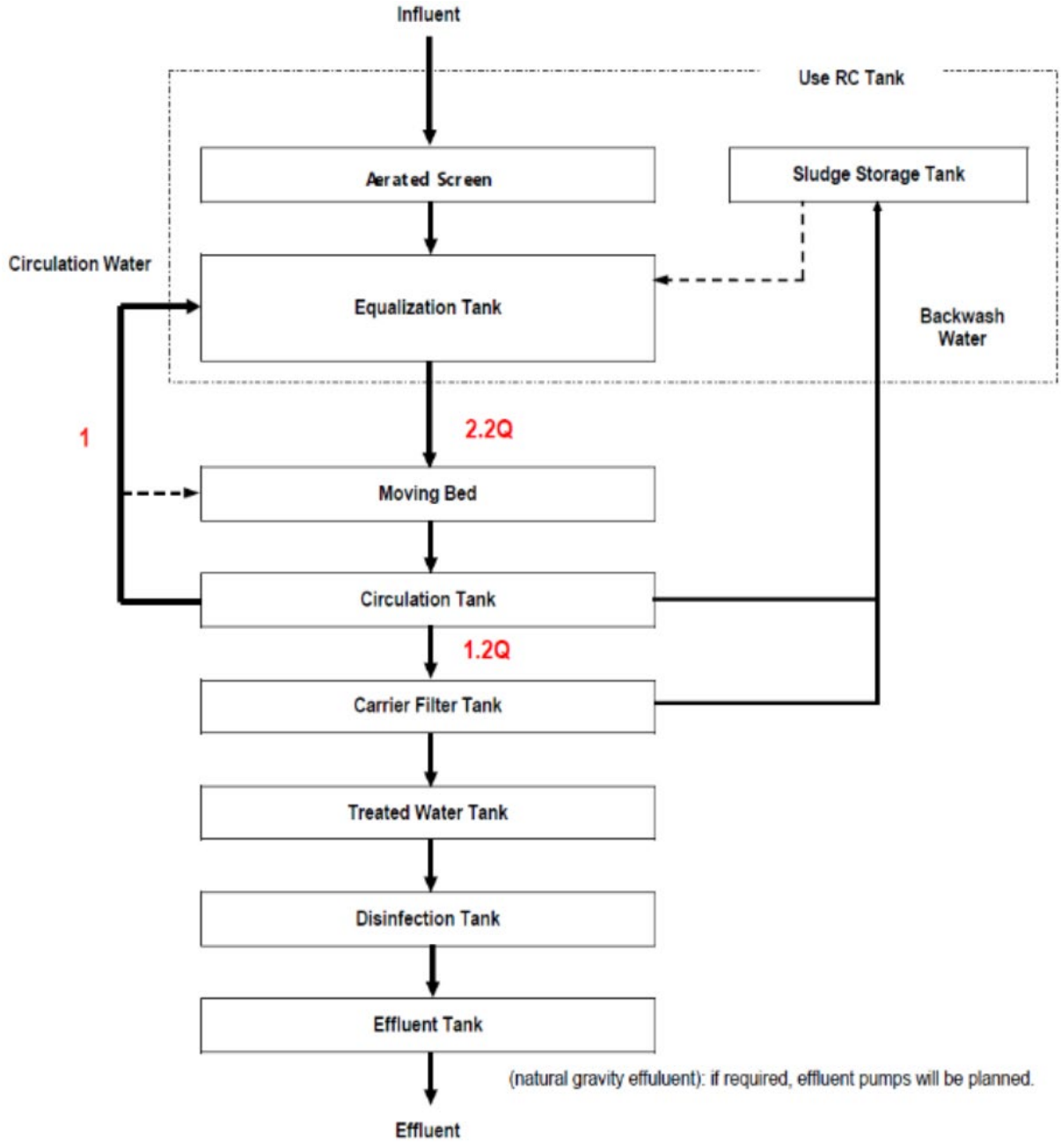
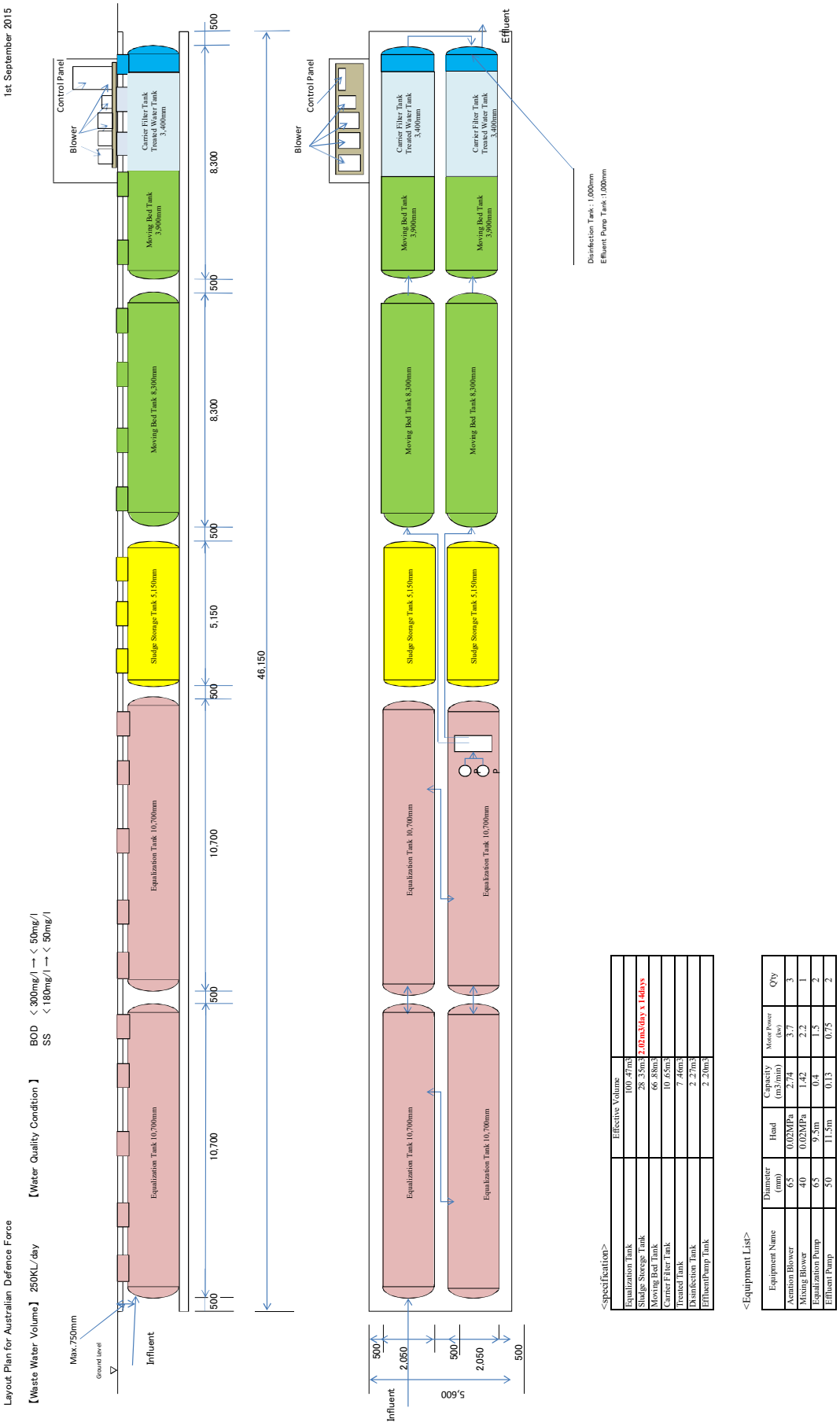


Figure 4 - Treatment Process – Kubota K-HC-R STP



<specification>

	Effective Volume	
Equalization Tank	100.47m3	
Sludge Storage Tank	28.35m3	2.02m3/day x 14days
Moving Bed Tank	66.88m3	
Carrier Filter Tank	10.65m3	
Treated Tank	7.46m3	
Disinfection Tank	2.27m3	
EffluentPump Tank	2.20m3	

<Equipment List>

Equipment Name	Diameter (mm)	Head	Capacity (m3/min)	Motor Power (kw)	Qty
Aeration Blower	65	0.02MPa	2.74	3.7	3
Mixing Blower	40	0.02MPa	1.42	2.2	1
Equalization Pump	65	9.5m	0.4	1.5	2
Effluent Pump	50	11.5m	0.13	0.75	2

Figure 5 - Layout Plan – Australian Defence Force, Igam Barracks

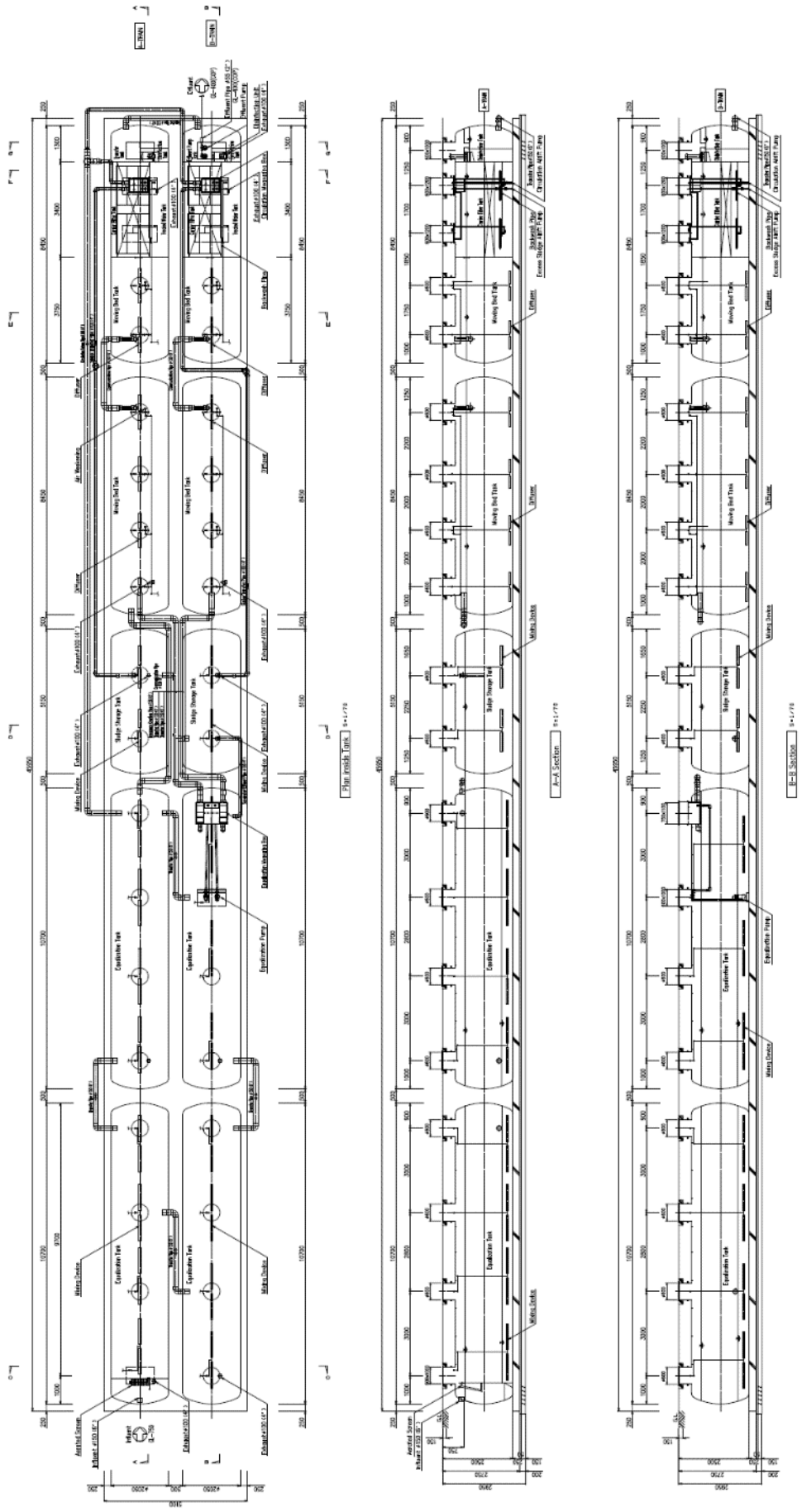


Figure 6 - Kubota STP Schematic

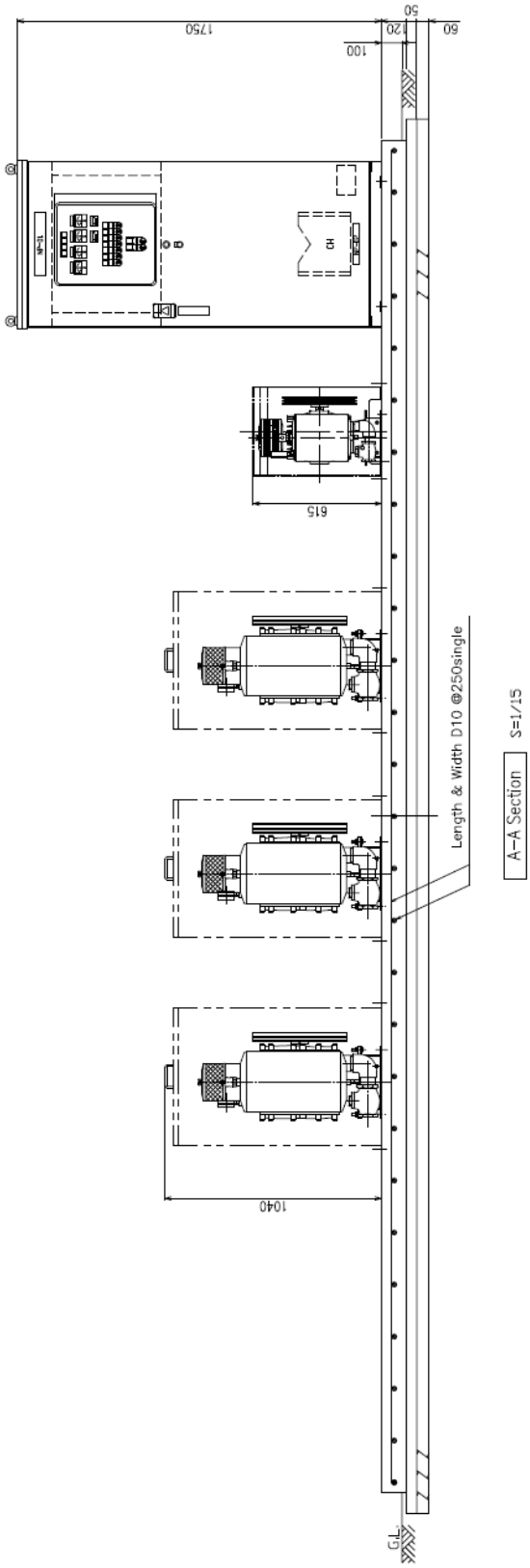


Figure 7 - Control Panel and Aerator Arrangement

Manufacture, Fabrication and Delivery

Upon sign off of final design, the STP was manufactured by Kubota Corporation under ISO:14001 and ISO:9001 certification. Mass production, standardisation, and uniformity provide surety of operation. Kubota therefore provide a strong warranty covering the entirety of the STP and a Performance Guarantee covering operation and performance.

Following factory manufacture and assembly, the Kubota systems were shipped directly from Japan to the port in Lae.

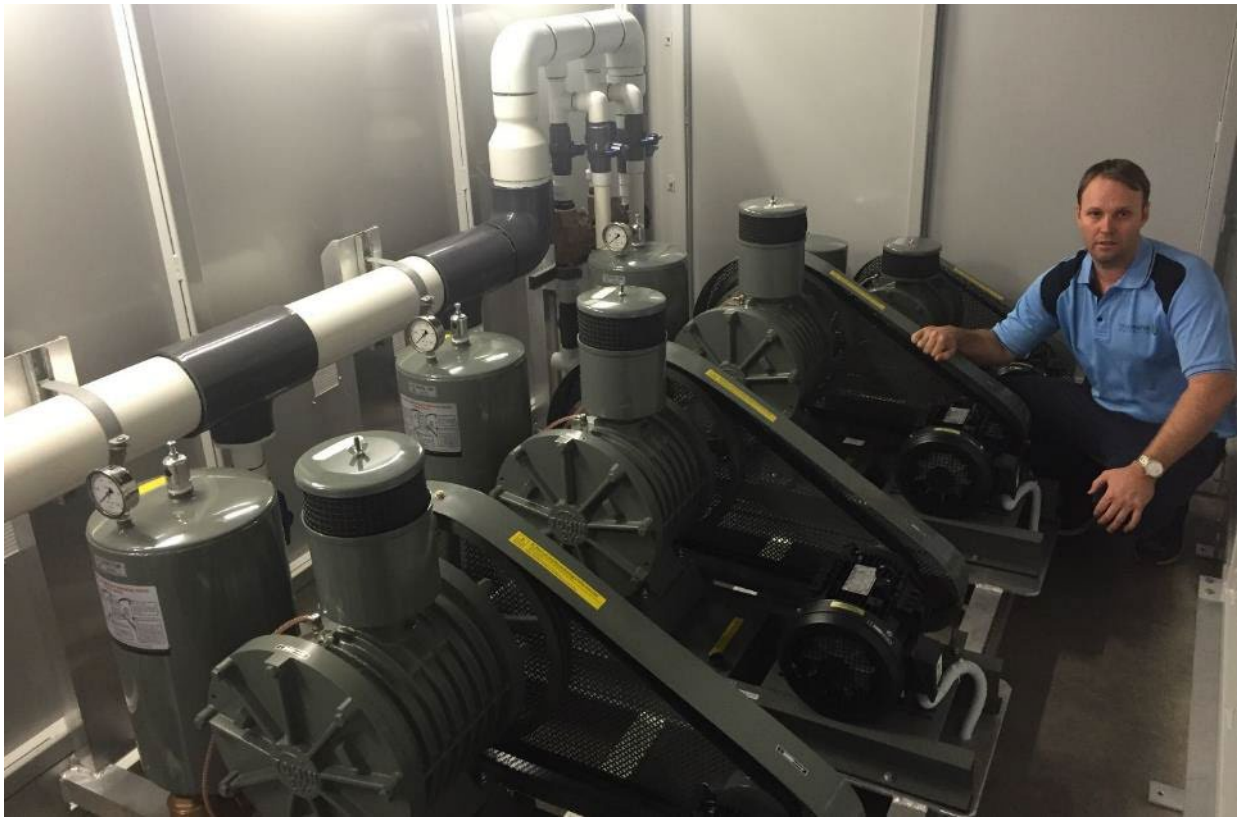


Figure 8 - Blower assembly and manufacture completed in Australia before shipping to the site.

All components including controller, pumps and blowers are manufactured to Kubota Corporations specifications by global manufactures to specifically satisfy the Kubota STP design.

True Water fabricate and assemble all additional componentry including STP controller, telemetry, airlines, transfer piping and pump sets prior to dispatch to site. Manufacture and assembly were completed adhering to strict quality assurance processes, minimising risks associated with onsite fabrication.

Once completed, all components along with the materials, specialist tools and parts required for onsite installation were carefully packed and shipped to Papua New Guinea.

All Kubota Treatment Plants are manufactured in accordance with:

Certified System Environment ISO 14001 | MS JAB CM008 | Certified System Quality ISO 9001

Installation

Due to manufacture and assembly prior to delivery, installation is completed quickly and efficiently. The STP is installed below ground to eliminate visual impact and minimise temperature fluctuations.

Testing, commissioning and sign off occurs once the system commences operation and involves quality assurance assessment of installation, testing of componentry and redundancies.

Figure 9 – The Kubota STPs and all components were transported in shipping containers and delivered to site.

Figure 10 - The ground for installation was pre prepared to the specifications provided by True Water.

Figure 11 – Collaboration with onsite personnel and local contractors was essential in the smooth installation of the STP.

Figure 12 – The Kubota STP modules were installed in a treatment chain to specific design parameters.

Figure 13 - Kubota STP in place and ready for the next stage of installation.

Figure 14 – STP modules in position and level prior to interconnection and anchoring.

Figure 15 – STP modules anchored in position to prevent movement during extreme weather conditions.

Figure 16 – STP modules connected in a treatment chain and partially backfilled.

Figure 17 - Concrete slab preparation for Control Room.

Figure 18 – Control Room and components were premanufactured in Australia and shipped to site.

Figure 19 – Connection of the Control Room to the Kubota STP was completed with assistance from local trades.

Figure 20 – Every aspect of the infrastructure is designed to ensure a quick and problem free installation onsite.

Figure 21 – Backfill of the system being completed with a gravel bed for adequate drainage around the inspection lids.

Figure 22 – Commissioning of the system was completed in conjunction with hands on training of onsite personnel.

Figure 23 – All aspects of the STP that may require day to day maintenance are explained to ensure safety of onsite personnel, encourage and sense of ownership and responsibility for end users and guarantee continuity of service.

Figure 24 – The collaboration formed strong bonds between the True Water technicians and onsite personnel.

Figure 25 – The existing holding ponds for the treated wastewater were in good condition.

Figure 26 – The STP treatment chain ends in this storage pond.

Figure 27 – The Control Room was designed to withstand the tropical climate and constructed out of powder coated steel.

Figure 28 – Top dressing of the STP compound with gravel to aid in surface water drainage.

Project Management

The Igam Barracks STP project included multiple lifecycle stages; infrastructure design, project delivery and infrastructure management. True Water worked with the Australian Defence Force, PNG Defence staff and local contractors to ensure project objectives have been satisfied at every stage and the project has remained on track during delivery.

High quality management has continued through the ongoing management and maintenance of the sewage treatment infrastructure. Regular scheduled servicing is completed by True Water certified technicians. During service visits, training of onsite personnel is undertaken with a focus on the day to day maintenance and operation of the plant as well as hands on training in the replacement of general spares such as oils and filters.

Remote telemetry monitoring by True Waters Australia's technicians enables immediate and accurate identification of any issues or faults. True Water technicians can be mobilised and onsite within 72hrs if ever required (travel restrictions permitting). However, the nature and design of the plant has not needed an unscheduled visit in the 4years the STP has been operating.

Figure 29 – A True Water technician conducts onsite training during a scheduled maintenance visit.

Training and the development of local knowledge has been vital for the continuous operation of the STP during the COVID pandemic. True Waters specialist technicians have not been able to visit site and this has transferred the responsibility to local and PNG based tradesmen. True Water have provided remote training and support to ensure the STP operation is maintained.

Figure 30 – The blowers and control panel undergoing a routine inspection as part of the asset management program.

Figure 31 – Onsite personnel that have been trained by True Water technicians inspecting the chambers of the STP modules.

Figure 32 – The inspection lids allow access to the separate chambers of each STP module.

Figure 33 – Onsite personnel completing air pump maintenance training.

Project Outcomes

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To Whom It May Concern

Truewater Australia in 2016 supplied, installed and commissioned a municipal type Kubota Sewage Treatment Plant in Igam Barracks Lae, Papua New Nuigini (PNG). Truewater currently successfully manages the systems maintenance and sustainment.

Truewater Australia is a trusted and proven service provider to the Defence Cooperation Program PNG. They have held contracts with the DCP PNG for the past four years as a result of high performance. Observed Truewater attributes are as follows:

- They are capable and able to operate in remote areas abroad unsupervised
- They are trusted and hold international accredited STP certification
- They employ a vast amount of highly trained and technical personal
- They have demonstrated the ability to harvest indigenous entities to partner in their deliverables. (Nation Building)
- They are sensitive to diverse cultural environments abroad
- Their provision of goods and services are at the highest standard, meeting equipment and user life cycle needs.
- They produce comprehensive and accurate reporting
- Their customer service, response time, quality of maintenance services and professionalism is excellent.

Truewater have been selected in accordance with the Australian Commonwealth Procurement Rules (CPR) under a Micro Works Contract international. Their results from the CPR objectives presents very good value for money. Truewater are classified as a Tier 1 service provider for the ADF in PNG. Tier 1 Service providers, produce goods and or services at or above relevant AS/NZ standards. They honor guarantees and have proven to deliver fit for purpose work on time and to budget.

The quality and performance of the current treatment plant is exceptional. Truewater treatment capability and system designs are ideal for high security locations with extreme climatic conditions. The system has operated well under duress for over 4 years, during which time operating conditions have exceeded design parameters.

Matthew Tritton
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DEFENCE COOPERATION PROGRAM

System Expansion

The Igam Barracks Sewage Treatment Plant (STP) continues to deliver high quality effluent and reliable operation, despite consistent flows well above the designed rate and minimal management. The ADF recently undertook a review of the current population of the community, as well as the infrastructure serviced by the Kubota STP. It was found that the current population was greater than 3,000 and the future requirement for the STP would be to service a population of between 6,000 – 8,000 people.

True Water delivered a scalable treatment plant so the capacity of the plant could be increased in step with population growth. The existing Kubota STP installed in 2016, is designed to treat approximately 250,000L of sewage per day. Scalability ensures the STP can be expanded as required to meet population growth.

To service the increased population, it is recommended the system be scaled up to an 800,000L per day sewage treatment capacity. The system could still be further expanded in the future to allow for increasing flows. This will provide a long-term, cost-effective solution for Igam Barracks and ensure wastewater generated by the barracks and the surrounding community is properly managed.

Operational Requirements

Consideration has been given to project requirements across the operational lifecycle. The Kubota system has been designed to minimise lifecycle costs while guaranteeing long term operational and environmental security.

Security

All components for treatment of sewage and wastewater are installed below ground. Below ground installation prevents damage or impact from unauthorised personnel.

Safety

The expanded sewage treatment plant will provide improved biological treatment and a consistent highly treated effluent for discharge directly to the environment.

As the treatment plants are modular, if a single module is damaged, it can by bypassed while repairs are completed, or a new module is installed. This means that while the capacity of the plant may be reduced, a level of treatment can still be maintained while repairs are undertaken.

The current infrastructure includes a storage pond intended for storing treated wastewater before dispersal to the environment. As the system is accepting a daily volume that is much larger than it was designed for, the storage pond is often impacted by partially treated wastewater.

Expansion of the existing system would remove the need to divert excess flows (beyond 250kL/day) and ensure that all discharge to the pond and the environment is properly treated before discharge.

Climate Resilience

The chosen Kubota sewage treatment plant is a fibre reinforced plastic system. All of the components required for treatment of the wastewater are contained within the plant and installed below ground. This results in a regulated treatment environment that is unaffected by fluctuations in temperature and weather.

The simple but highly technical design of the system includes very few moving parts. If the system is ever inundated due to extreme weather events (such as flood, cyclone or tsunami), the individual modules can be washed out, reseeded and back in use within a very short period of time and with little cost.

Local Engagement

True Water has collaborated with onsite personnel and local trades throughout the installation and management of the Igam Sewage Treatment Plant. The ongoing training and personal interaction has developed a strong local knowledgebase the STP and its management. This has been central to system management and operation, particularly during the COVID pandemic travel restrictions.

Figure 34 – Local ownership, knowledge and pride are clear outcomes from the collaborative project.

Figure 35 – The Igam Barracks sewage treatment plant five years after delivery.

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