CASE STUDY

LAKE AWOONGA -

SEWAGE TREATMENT PLANT

TRUEWATER AUSTRALIA

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Kubota

The Gladstone Area Water Board (GAWB) own and operate the Sewage Treatment Plant (STP) at Lake Awoonga. Lake Awoonga is located approximately 30 km south of Gladstone, Central Queensland. The STP currently services Lake Awoonga Caravan Park, a workshop, 5 residential houses, a kiosk, and a toilet block at the picnic area located at the boat ramp.

The STP is located to the north-west of the caravan park in a restricted access area with two designated land application areas to the south of the treatment plant.

Figure 1 – Public spaces at the Gladstone Area Water Board owned and operated Lake Awoonga

With over 35 years of operation, the existing STP servicing the Lake Awoonga Caravan park and nearby Gladstone Area Water Board (GAWB) Depot was deemed to have reached the end of its operational life. The system required significant attention and management to maintain treatment processes and had ongoing difficulty achieving compliant performance. Due to the increasing operational burden and the decline in compliant performance, a replacement treatment system was sought.

Key Project Considerations

Key elements of consultancy and regulatory approval were undertaken by GHD. The system was required to manage daily flows of 40kL.

Hydraulic Flows

Flows vary significantly with seasonal influxes of visitors, therefore the STP must be capable of reliably managing and treating varying flow volumes.

Reliability

The Lake Awoonga STP must conform to the GAWB and the Qld Department of Environment and Science operational expectations The STP must be highly reliable and include contingency and safe guards to ensure continuity of service at all times, including during peak usage and power outages.

Environmental Impact

In accordance with the GAWB's operational 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 – Lake Awoonga Aerial View

Figure 3 – Aerial View – Lake Awoonga Recreation Area and Boat Ramp

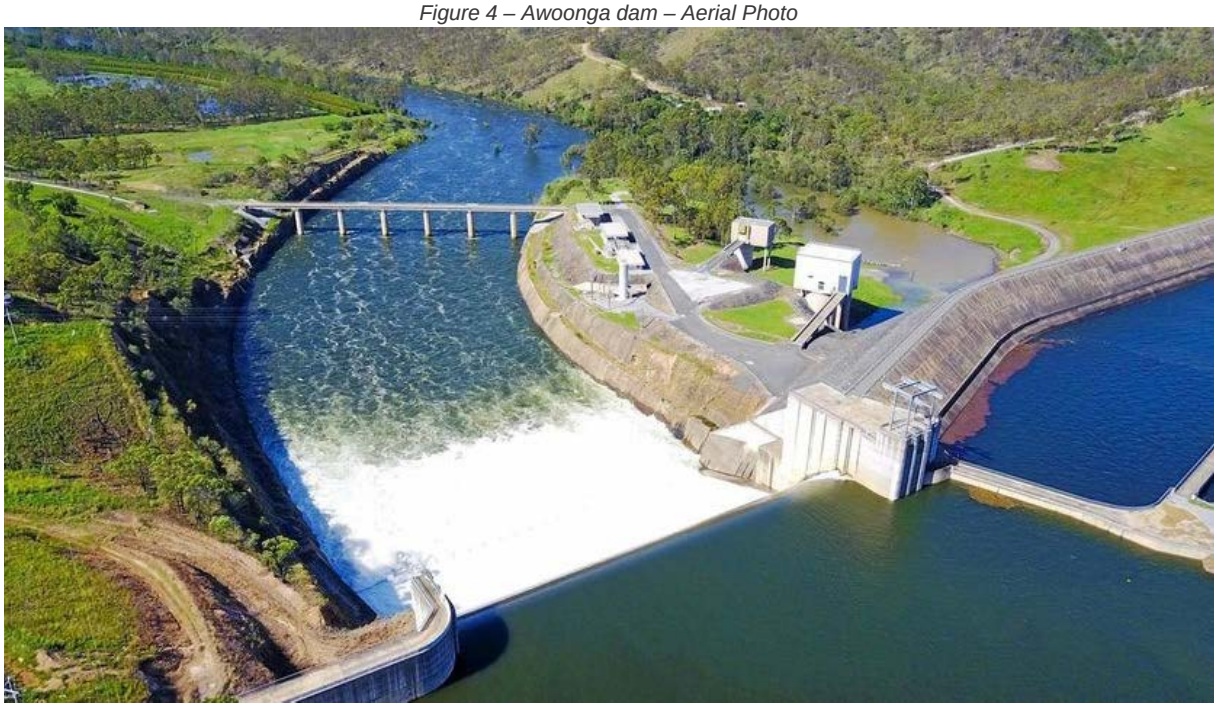
Gladstone Area Water Board (GAWB)

Established in 1973, the GAWB ensures the short and long term water needs of current and future customers are met in ways that are environmentally, socially and commercially sustainable.

The GAWB achieves this through thoughtful forward planning for the region's needs and developing, operating and maintaining the infrastructure required in a sustainable manner, while minimising the impact its operations have on the environment.

The GAWB owns and operates Awoonga Dam on the Boyne River along with a network of delivery pipelines, water treatment plants and other bulk water distribution infrastructure in the Gladstone region in Central Queensland. From this network of infrastructure, the GAWB supplies up to 78,000 Megalitres of potable water each year.

Figure 4 – Awoonga dam – Aerial Photo



Assessment of STP Options

The Gladstone Area Water Board, in conjunction with GHD, undertook an extensive tender and assessment process to find the best outcome for the project. The assessment involved investigation into multiple treatment solutions, evaluating factors such as performance history, company background and operational practices.

When considering site constraints, longevity, life cycle management and the potential future increase in demand, it was concluded the only solution that met the project requirements was the STP and Land Application system proposed by True Water Australia.

Operational security was a key consideration and it was agreed the supply of a scalable 40kL Kubota sewage treatment plant provided the highest level of reliability and operational security, with minimal operational cost burden.

True Water Australia was then engaged to undertake design, manufacture, installation and provide ongoing operational management.

Project Delivery

Tender

The tender design indicated an above ground containerised or similar rotating biological contactor packaged plant. True Water identified the Kubota treatment system would be capable of providing improved project outcomes and was awarded the project based on a proposed Kubota K-HC-T STP.

Design

Concept and detailed design, including system configuration, is completed for each True Water STP to ensure the STP is suited to project specific requirements. For the Lake Awoonga project third party consultants provided a high level concept design which formed part of the tender specification. True Water then refined the design of each component of the system to provide the best cost and operational outcome.

Kubota Corporation mass produce three series of onsite STP's under ISO:14001 & ISO:9001 certification. The three series of STP can be applied to various applications globally and provide certainty through proven operation and surety of manufacture. 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 Awoonga Dam specification.

The final design demonstrates a best practice outcome for a commercial sewage treatment plant. This means the system balances technical specification, operational performance and technology complexity to achieve compliance treatment performance over the long term with a financially viable solution.

Manufacturing and Fabrication

The MBBR STP was manufactured by Kubota Corporation under ISO:14001 & ISO:9001 certification. All components including controller, pumps and blowers are manufactured to Kubota Corporations specifications by global manufactures to specifically satisfy the Kubota STP design. 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.

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.

Installation

Following factory manufacture and assembly, installation of the STP is completed promptly and efficiently. The STP is installed below ground to eliminate visual and odour impacts, minimise temperature fluctuations and reduce deterioration caused by exposure to weather. Design drawing and installation photographs are provided on the following pages.

All Kubota Treatment Plants are manufactured in accordance with:

Design

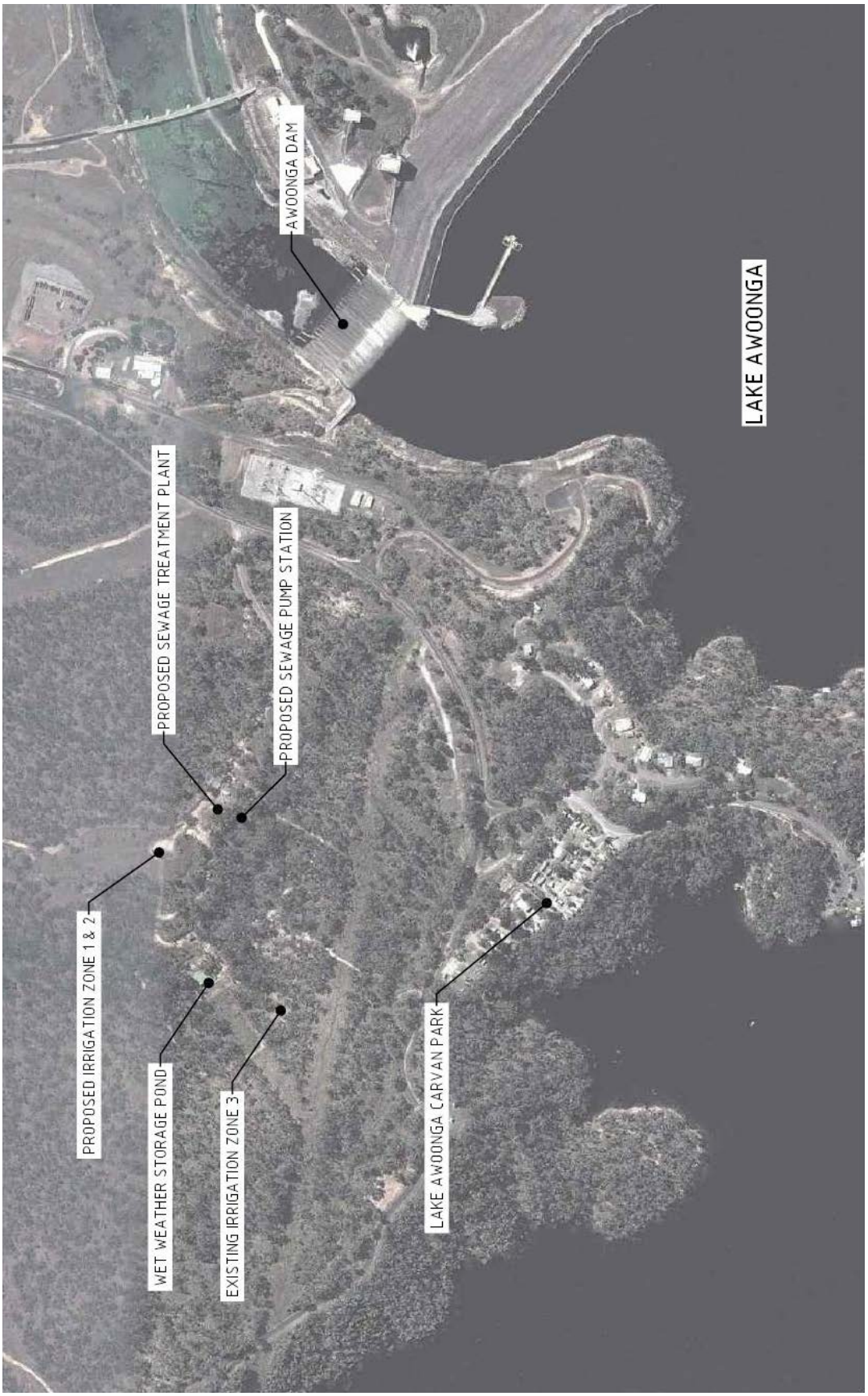


Figure 5 – STP Location Relative to Lake Awoonga

Figure 6 – Final Site Plan – Lake Awoonga STP

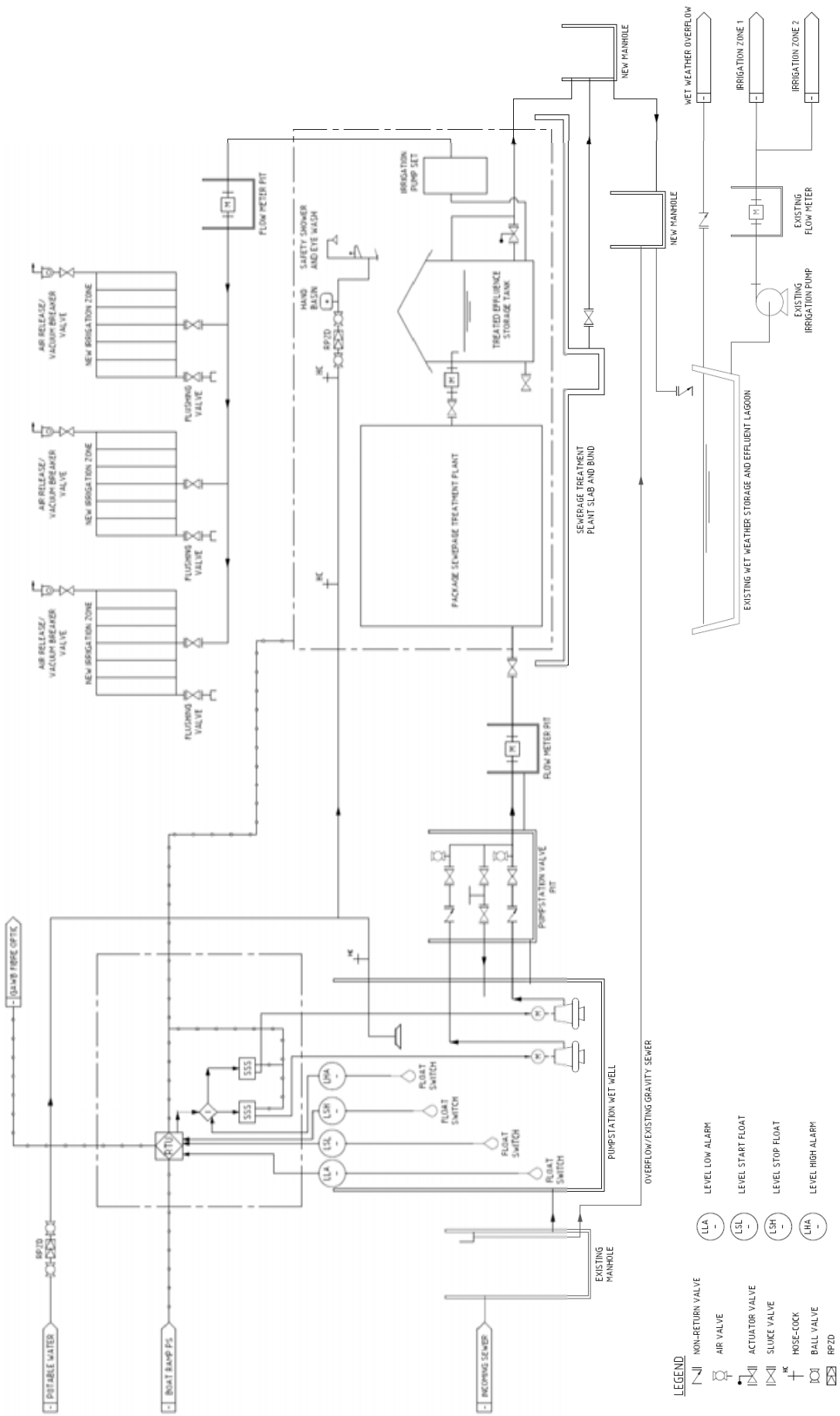


Figure 7 – P & ID - Tender Design

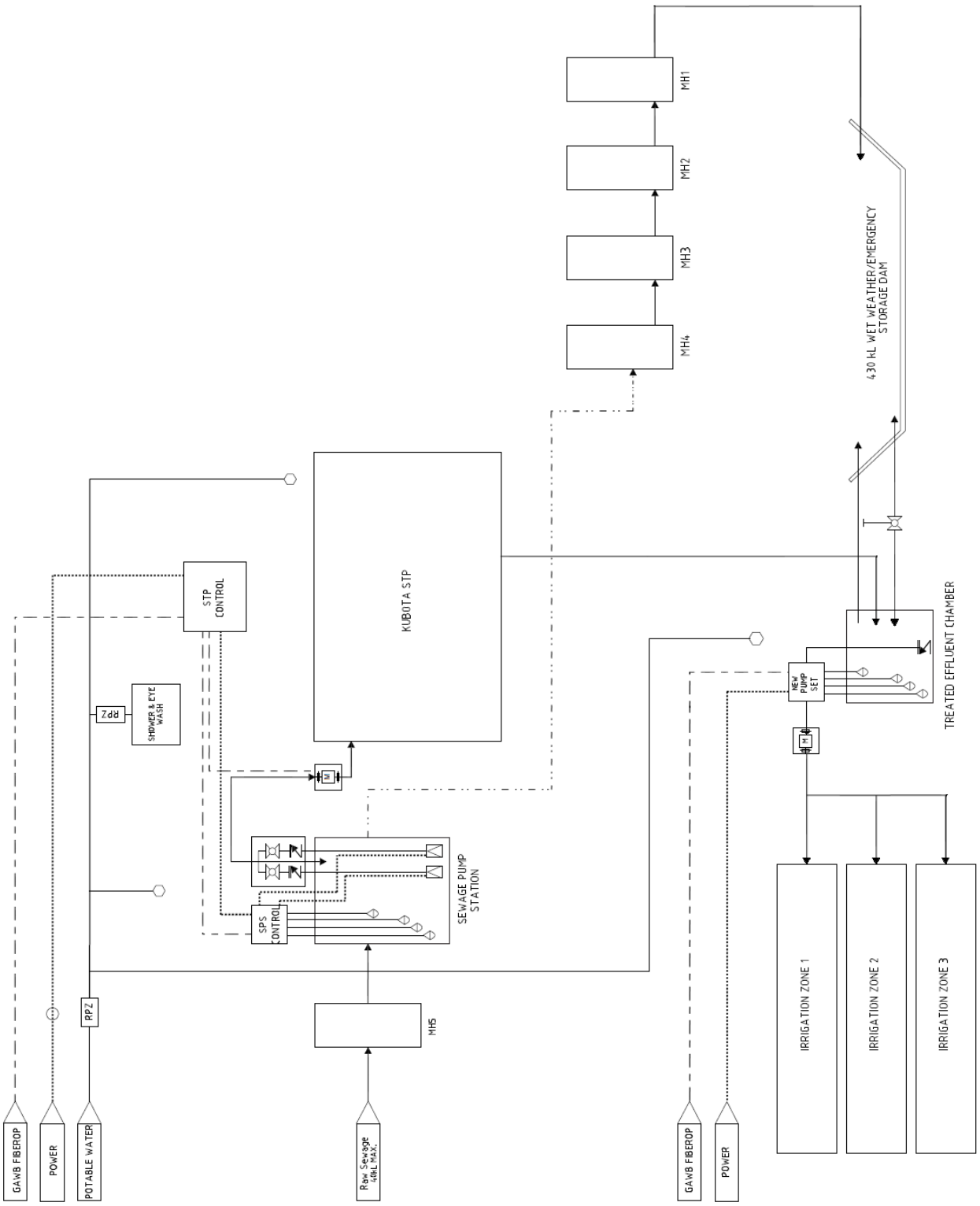


Figure 8 – P & ID – Final Design

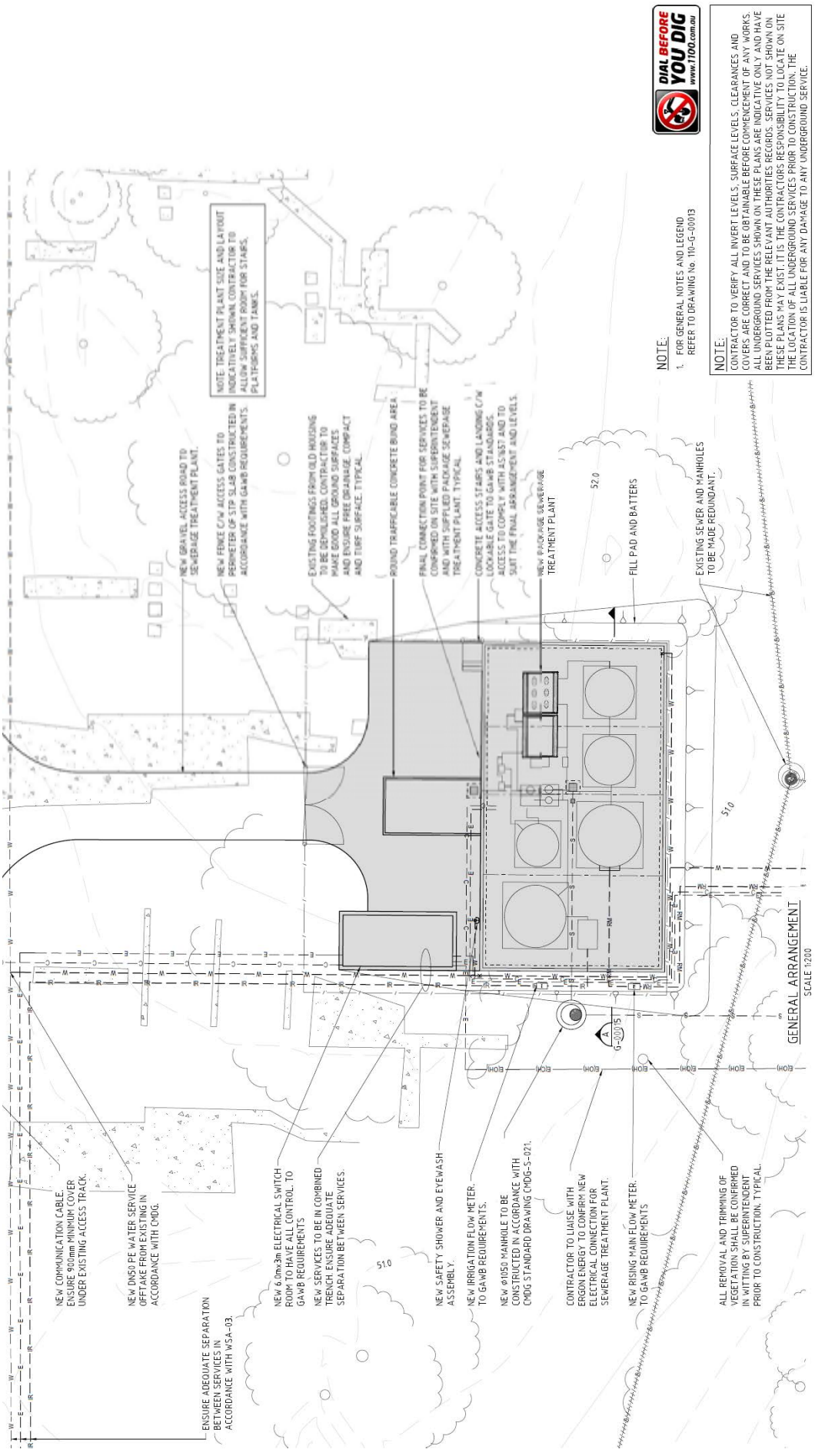


Figure 9 – General Arrangement – Tender Design

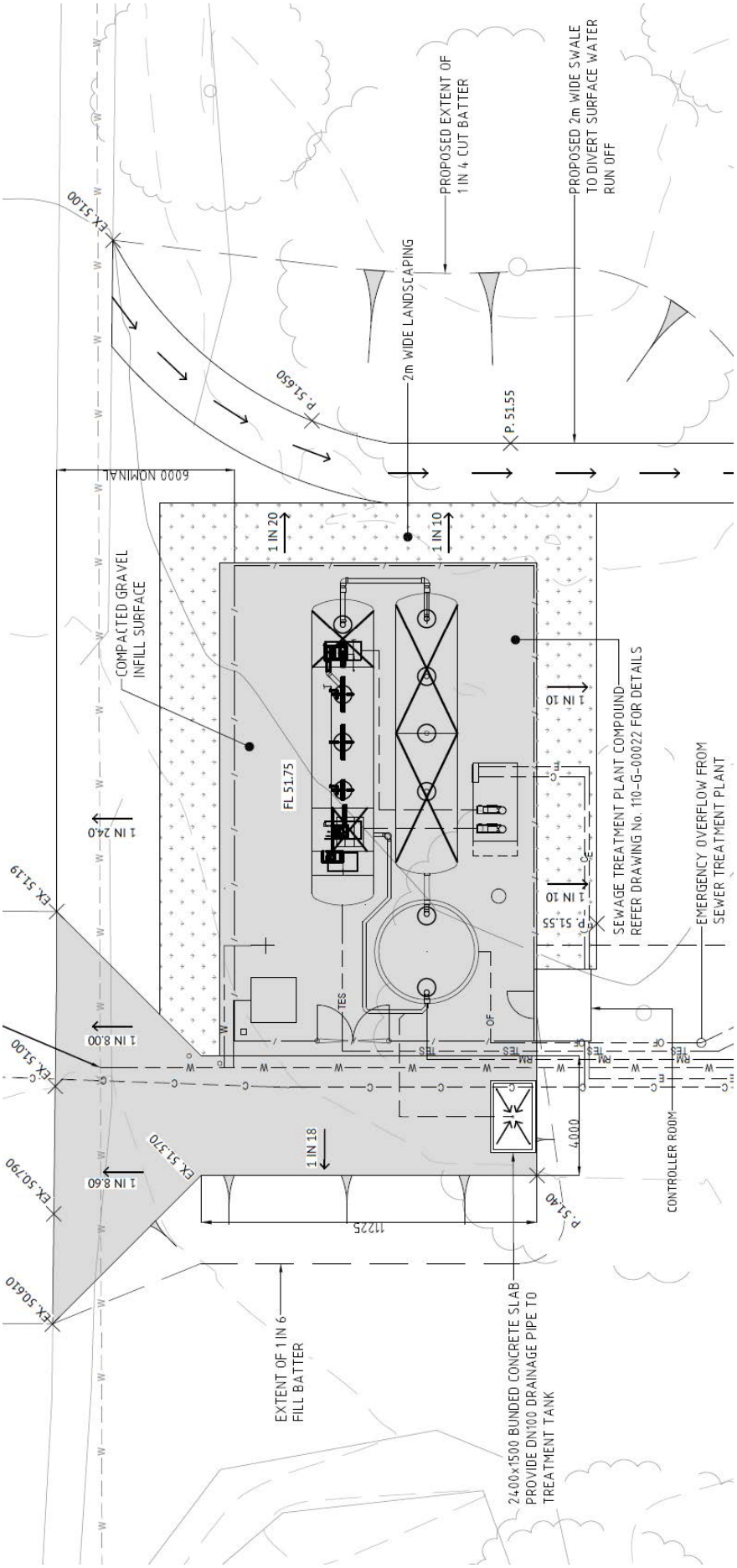


Figure 10 – General Arrangement – Final Design

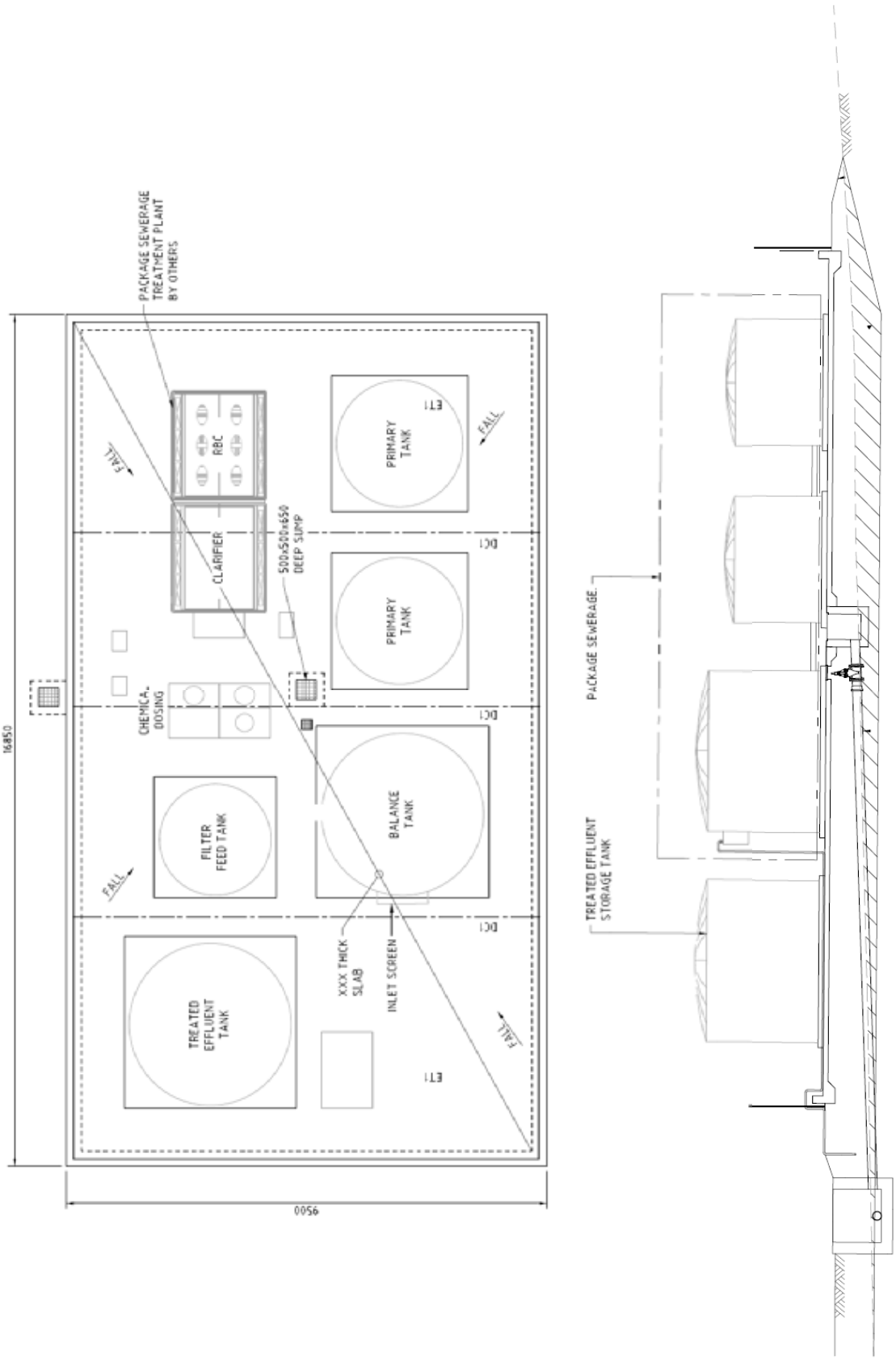


Figure 11 – Proposed System Configuration – Tender Design

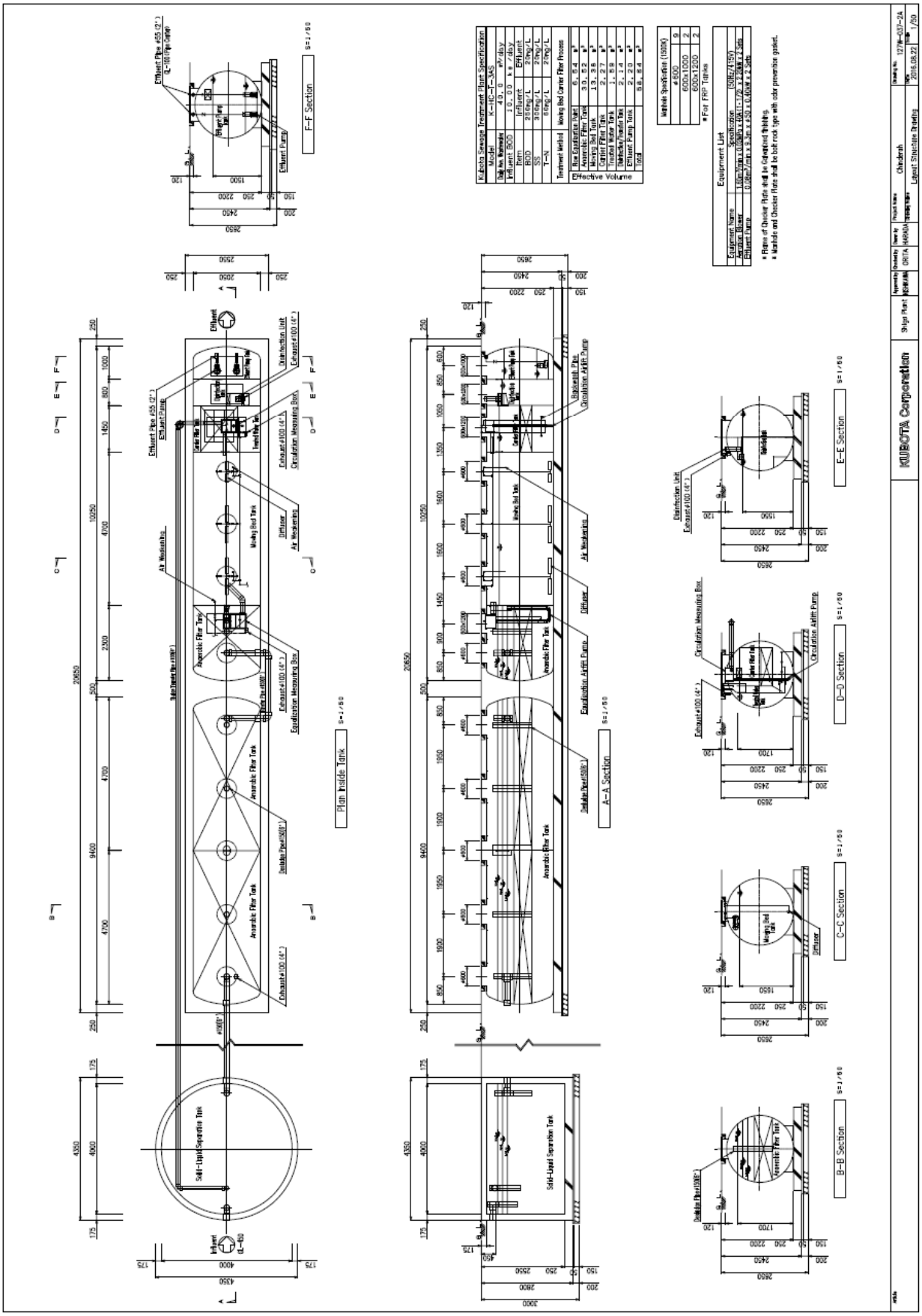


Figure 12 – Kubota STP Schematic – Lake Awoonga STP

Sewage Treatment Plant

The Sewage Treatment Plant selected for the Awoonga Dam is a 40kL Kubota K-HC-T STP.

The Kubota treatment process if detailed in *Figure 13* below.

Treatment Design and Process

Influent Flow

Influent flow	40m^3/day	General Influent time	14 hours
Peak flow factor	4		

Specifications

Treatment Method: Moving Media Bed process

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

Structure and Material: Solid Liquid Separation – Reinforced Concrete (RC)

STP Body – Fibre Reinforced Plastic (FRP)

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

Aeration Strength (Moving Bed Chamber) – 1.6m^3/m^3/hr

Airlines – Stainless and UPVC

Piping – Stainless and UPVC

Process Flow Diagram

Figures 7 and 8 detail the treatment process employed within the Kubota STP.

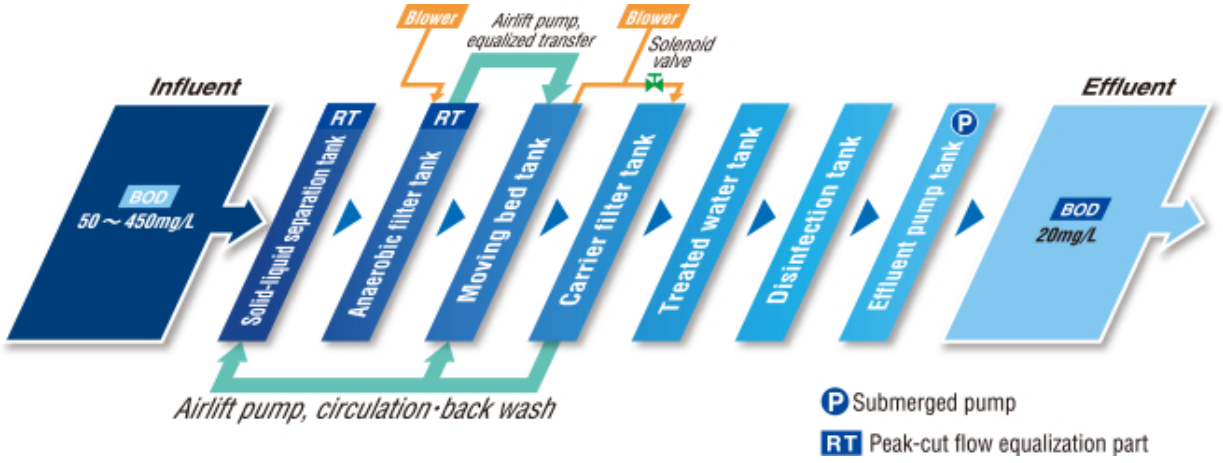


Figure 13 – Kubota K-HC-T Treatment Process Flow

Installation Photos

Figure 14 – Select material is levelled and compacted to form the foundation for the Kubota STP

Figure 15 – The Kubota STP is lifted into place

Figure 16 – Kubota STP prior to backfill

Figure 17 – Kubota STP with partial backfill

Figure 18 – Kubota STP with complete backfill

Figure 19 – STP compound with finishing

Figure 20 – Delivery Sewage Pump Well finished slab, prior to fencing

Figure 21 – Servicing trenching with partial cover

Figure 22 – Services trenching with select material cover

Figure 23 – Irrigation pump housing at Irrigation Pump Well

Figure 24 – Installation of sub-surface drip irrigation

Figure 25 – Completion of Sub-surface irrigation field

Figure 26 – Sub-surface irrigation area eight weeks post installation

Figure 27 – Spray irrigation area post day of installation

Figure 28 – Spray irrigation area eight weeks post installation

Figure 29 – Wet weather storage dam mid clean out, included removal of liquid waste and sludge

Figure 30 – Wet weather storage dam post clean out and lining with select material

Sewage Treatment Plant Overview

Collection

Sewage and wastewater are collected from the caravan park and the GAWB depot and transferred through to the Sewage Pump Well within a gravity drainage network.

Sewage Pump Well

A 4kL sewage pump well is located downslope of the new Kubota STP. Two submersible grinder pumps are located within the sewage pump well and transfer all sewage from the pump well to the first chamber of the Kubota STP, the Solid Liquid Separation Chamber.




Solid Liquid Separation Tank

The Solid Liquid Separation Tank is a reinforced Concrete 20kL chamber which collects all influent entering the STP. Solids are separated during a settling process. The chamber is sealed gas tight, then is vented with a charcoal filter to prevent odour.


Anaerobic Filter Chamber

The anaerobic filter chamber is aerated via timer at 30 minute intervals using a mixing blower. Water moves though this chamber and is transferred via gravity flow to the Aerobic Media Chamber.

Aerobic Media Chamber (Moving Bed)

Wastewater flows from the Mixing Box to the Aerobic Media Chamber. Access to this chamber is via three inspection openings. The chamber contains cylindrical Polyethylene skeleton type media cubes which provide filtration of wastewater.

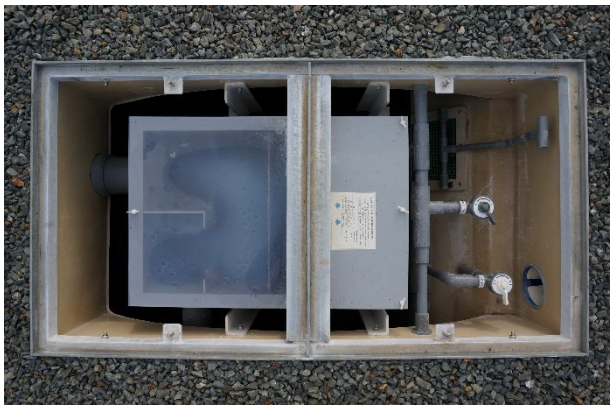
Circulation Chamber

The Circulation Chamber provides a continuous circulation of wastewater back to the solid separation tank. Recirculation automatically adjusts to suit incoming flows. This chamber includes a suction tube used to collect floating objects and return them to the Sludge Tank.

Carrier Filter Chamber

The Carrier Filter Chamber contains caged media in the centre of the chamber. Water must pass through this small media as it flows through to the next chamber for disinfection.

The Carrier Filter Chamber is aerated each night between 12am and 2am to degas media.



Disinfection Water Chamber

Water passes through a chlorine contact chamber eliminating any residual pathogens as it enters the Treated Water Chamber.

Treated water flows to the Irrigation Tank for transfer to land application.

Treated Water Chamber

The Treated Water Chamber is the final chamber in the Kubota Treatment plant. Treated water transfers from this chamber to the Irrigation Pump Well via gravity main.

Irrigation Pump Well

A 10kL irrigation pump well is located approximately 280m downslope of the Kubota STP. As the treatment process is sealed, all waters passing through the STP flow through to the irrigation areas.

The pump well utilises two dry-mount KSB pumps in a duty standby configuration. The pumps are activated by four float switches inside of the pump well and includes an emergency overflow to the adjacent wet weather storage dam.

Wet Weather Storage Dam

Any overflow from the irrigation pump well transfers through to the wet weather storage dam. The dam also has an equalisation pipe to the bottom the irrigation pump well which remains closed until stored treated water must be discharged (during dry weather).

Land Application – Sub-surface Drip Irrigation and Spray Irrigation

Treated water is discharged from the irrigation pump well and distributed to one of three irrigation zones. Total application area was increased during the design process to ensure compliance and ecologically friendly release of treated water.

The resulting design included approximately 5,000m^2 of subsurface drip irrigation (Zones 1 and 2) and approximately 2,400m^2 of above ground spray irrigation (Zone 3).

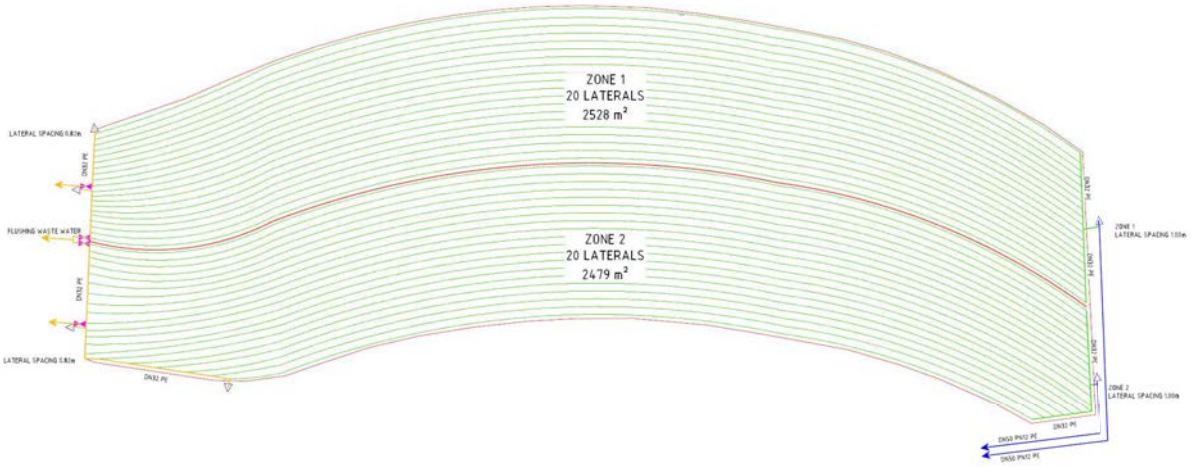


Figure 31 – Lake Awoonga STP – SDI Irrigation – Zones 1 & 2

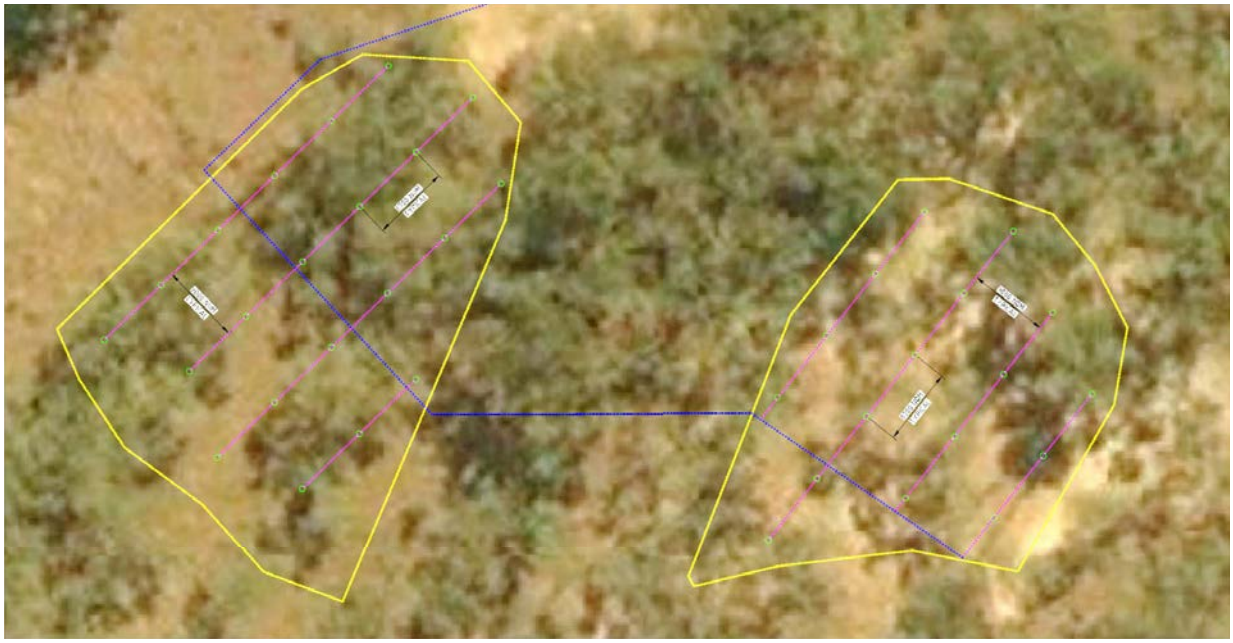


Figure 32 – Lake Awoonga STP – Surface Irrigation – Zone 3

Other STP Components

Control Room

The Control room is a pre-fabricated Evo Portable. The room was delivered to site complete and ready for installation ensuring high build and finish quality.

Control Panel

The control panel used was manufactured by Matalec in Australia. The control panel is user friendly, incorporating a simple touchpad connected to the PLC, and monitors all operation and faults for the STP.

Telemetry

The STP includes real time monitoring through the integration of a 3G telemetry module.

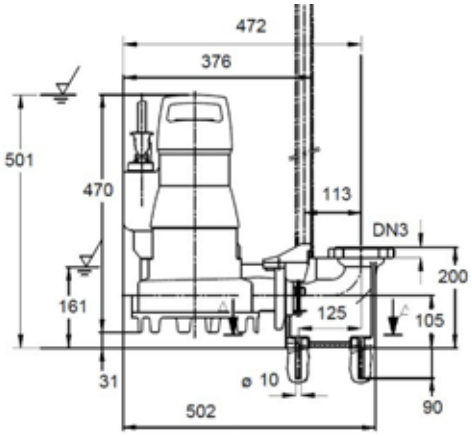
The telemetry module reports operation, alarms and faults as they occur. Data collected by the module may also include operation of blowers, pump, power, backwash flows and daily flow information.

Blowers

The STP uses two Tohin, rotary vein oil lubricated blowers, in a duty standby configuration, for aeration and air lift. The blowers are specified due to their low operating cost, simplicity and longevity. The blowers are housed within a powder coated aluminium housing to stop noise and allow easy access.

Raw Effluent Delivery Pumps

The STP utilises KSB submersible cutter pumps in a duty/standby configuration. The dual pump controller alternates between each pump for even wear. The delivery pumps transfer raw effluent from the Sewage Pump Well to the Solid Liquid Separation Chamber.



Irrigation Pumps

The STP utilises Grundfos centrifugal pumps in a duty/standby configuration. The dual pump controller alternates between each pump for even wear. The irrigation pumps transfer treated water from the Irrigation Pump Well top the Irrigation zones.

Project Management

The Lake Awoonga STP project included multiple lifecycle stages; infrastructure design, project delivery and infrastructure management. The Gladstone Area Water Board and True Water held weekly meetings to ensure project objectives were satisfied and the project remained on track during each stage of the process.

Figure 33 – Executive management of the Gladstone Area Water Board, Prizm Engineering and True Water Australia

Project Outcomes

Parameter	Methods reference	Sample GAWB-TW 15/04/19	Environmental Authority Limit
pH	APHA 4500-H^+-B	7.19	6 ~ 9
Conductivity (EC) (dS/m)	APHA 2510-B	0.51	1.6
Total Suspended Solids (mg/L)	GFC equiv. filter - APHA 2540-D	2	30
Biochemical Oxygen Demand$_5$ (mg/L O_2)	APHA 5210-B	1.0	20
Total Nitrogen (mg/L N)	In house method W4	10.7	30
E.Coli (cfu/100 ml)	** ColiBlue Membrane Filtration	<1	10,000

Figure 34 –Treated Water sample laboratory

"We have a responsibility to deliver high quality infrastructure to the people of Gladstone, and we have achieved that."

"With due diligence and after a careful selection process, we appointed the project to True Water Australia. Their partnership as the Australian distributor for Kubota products, combined with their team's knowledge and expertise in delivering sustainable and effective installations meant they were the right fit for our project."

Darren Barlow, Gladstone Area Water Board, CEO

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