Treble Cone

Domestic Onsite

Wastewater Treatment Plant

OPERATION & MAINTENANCE MANUAL

Prepared by: INNOFLOW TECHNOLOGIES (NZ) LTD

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- Vent Fan Assembly Date Sheets
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B3 Flow Meter and UV

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1. KEY CONTACT DETAILS

1.1. *EMERGENCY ADVICE AND SERVICING:*

For emergency callout services, contact:

S3 ltd (wholly owned service company of innoflow technologies nz ltd)

Phone: 0800 735 464 / (09) 426 0281

1.2. *EMERGENCY PUMP OUT OF TANKS:*

S3 ltd

Phone: (09) 426 1027

1.3. *DETAIL ON DESIGN, EQUIPMENT, INSTALLATION AND COMMISSIONING*

Innoflow technologies nz ltd

Phone: (09) 426 1027

2. WHAT IS IN THIS DOCUMENT

This management plan goes on from the original manual and incorporates detail of recently added components to the plant. These include

- A new mag meter
- A new filtrate return pump and
- A new carbon dosing system

This management plan outlines the system equipment installed at the treatment plant site and land application area, and how the treatment process works. It also offers specific componentry details and design data on the system.

In addition, this document also details the specific preventative maintenance tasks and activities required to ensure the system is operated and maintained in good working order. Some troubleshooting and remedial maintenance tasks are also covered in the Operation and Maintenance section.

The last sections of the management plan outline the monitoring and reporting tasks and procedures, to satisfy the requirements of the Resource Consent.

The appendices provide additional technical data on the system componentry installed in the form of submittal data sheets and manufacturers' instruction manuals where applicable.

3. SYSTEM COMPONENT OVERVIEW

The wastewater layout can be broadly categorised in the following order

PRIMARY TREATMENT

The components related to primary treatment of wastewater are as follows;

- 2 x 70m³ septic tanks with outlet Biotube effluent filter

The septic tanks provide primary treatment of raw wastewater, and are designed to provide sufficient hydraulic retention (i.e. more than 3 x daily flow in volume) for maximum BOD and total suspended solids (TSS) removal. At the outlet of the septic tank, incoming BOD and TSS expected to be reduced by 50%.

SECONDARY TREATMENT AND NUTRIENT REMOVAL

The existing system is a “2-stage” system which is designed for enhanced nitrogen removal. The components related to secondary treatment of wastewater are as follows;

- 1 x 70m³ stage 1 recirculation tank with filtrate return line
- Lift station pumping filtrate from stage 1 recirculation tank to post anoxic tank
- 6 x stage 1 AdvanTex AX100 packed bed reactor pods
- 1 x 23m³ post anoxic tank
- 1 x 23m³ stage 2 recirculation tank
- 2 x stage 2 AdvanTex AX100 packed bed reactor pods
- Alkalinity dosing system (at facility buildings, not at wastewater treatment plant)
- Carbon dosing system

TERTIARY TREATMENT AND TREATED EFFLUENT OUTLET

For tertiary treatment, the following components are incorporated;

- 1 x CP8 Gravity UV disinfection unit
- Pump chamber with treated effluent discharge pumps

4. DESIGN SUMMARY

4.1. DESIGN INFLUENT HYDRAULIC LOADING

The wastewater treatment plant and land application system has been designed for the following peak daily flow.

Source	Peak Daily Design Flow
Ski resort toilets	40,000 L/day

4.2. DESIGN INFLUENT ORGANIC AND NUTRIENT LOADING

Influent wastewater generated from the site shall be domestic strength in nature, with the following combined maximum influent strengths.

Constituent	Raw Wastewater (maximum)
BOD_5	<450 mg/l
TSS	<350 mg/l
TKN	<140 mg/l
Fats Oil and Grease	<35 mg/L
Alkalinity	710 mg/L

4.3. DESIGN EFFLUENT QUALITY

Based on the influent parameters, the system has been designed to meet the following target effluent quality.

Constituent	Treated Effluent Quality (average)
BOD_5	20 mg/l
TSS	20 mg/l
TKN	25 mg/l

4.4. TOXICITY

The assumption has been made that the influent strength detailed in the table above is domestic in nature and does not contain concentrations of toxic substances that may adversely affect the performance of the biological processes required for the system to operate, these typically include but are not limited to:

Toxic Compound(s)	Example	Result
Heavy Metals	Copper, Nickel, Zinc, Cadmium, Chromium	Stop ammonia oxidation (reversible)
Metal-binding compounds	Sodium Sulfide	Stop ammonia oxidation (reversible)
Bind heme and proteins	Ethyl xanthate (mining industry)	Stop ammonia oxidation; cell death
Hydrazine (H_2N_2)	Rocket fuel	Stop ammonia oxidation
Chlorination		Cell death
Uncouplers of oxidative phosphorylation and inhibitors of electron transport	DNP (2, 4-Dinitrophenol) MCCP (m-Chlorocarbonyl-cyanize phenylhydrazone)	Cell death
Short-chain alcohols and amines	Methanol, Ethanol, n-butanol	Cell death
Phenol[2]		Stop ammonia oxidation; cell death
Nitrous oxide (N_2O)	Aerosol propellants	Stop ammonia oxidation
High levels of nitrite (NO_{2-})		Stop ammonia oxidation
Quaternary amines	Disinfectant, surfactant, fabric softeners, shampoo	Cell death
UV light		Stop ammonia oxidation

Toxic Compound(s)	Concentration resulting in 50% inhibition (mg/L)
L-Histidine	0.5
Thiosemicarbazide	0.9
Nitrourea	1
Allylthiourea	1.2
8-Quinolinol	1.5
L-Arginine	1.7
L-Valine	1.8
Diethyldithiocarbamate	2
L-Threonine	3.6
L-Lysine	4

Quinacrine	5
Diphenylthiocarbazone	7.5
L-Methionine	9
o-Phenanthroline	9
Phenazine methosulfate	10
Dicyclohexylcarb-diimide	10
2-Chloro-6-trichloromethyl-pyridine	11
Ethyl xanthate	12
Dipryidyl	16
2,4-Dinitrophenol	37
3-Aminotriazole	70
Aminoguanidine	74
Methanol	160
Dichlorophenolinde-phenol	250
Hydrazide	300
Methylamine	310
Trimethylamine	590
Tetremethylammonium Chloride	2200
Ethanol	4100
Acetone	8100
N-Butanol	8200
Aminoehtanol	12000
Ethyl Acetate	18000
N-Propanol	20000

5. WASTEWATER TREATMENT PLANT COMPONENT SPECIFICATIONS

5.1. INLET MAG METER

Model	Promag 10L1H, DN100 4"
Inlet Meter Size	100 mm

5.2. SEPTIC TANKS

Tank Manufacturer	Ross Tanks Limited
Precast Concrete Tank Volume	72,000 litres (total volume)
Number of Tanks	2 (in series)
No of Compartments	1 each
Interconnecting Pipe	150 mm SN16
Construction	*Insitu* Concrete Plaster
External Dimensions	5.9 m Diameter x 2.85 m ext height
Biotube Type	Orenco FT1554 (380mm diameter x 1372 mm high)
Number of Biotubes	2 (Stage 1)
Materials of Construction	PVC Vault with Polypropylene and Polyethylene cartridge
Biotube Cartridge Height	915 mm
Screen Area	4.69 m^2 each
Biotube Access Riser	3 x RR24-36 (Stage 1 and proposed stage 2)
Biotube Access Riser Lid	3 x FL24g.4B (Stage 1 and proposed stage 2)
Pumpout Access Risers	2 x RR24-36
Pumpout Access Riser Lids	2 x FL24g.4B

Splitter Valve Access Riser	RR24-36
Splitter Valve Riser Lids	FL24g.4B
Discharge to Treatment Plant	100mm PVC

5.3. RECIRCULATION TANKS AND FILTRATE RETURN PUMP

STAGE 1 RECIRCULATION TANK	
Tank Manufacturer	Ross Tanks Ltd
Tank Volume	72,000 (total volume)
Number of Tanks	1
No of Compartments	1
Construction	*Insitu* Concrete Plaster
External Dimensions	5.9 m diameter x 2.85 m high
Screened Pump Vault Type	Orenco PVU84-36 (300 mm diameter x 2130 mm high)
Number of Pump Vaults	3 at Stage 1
Materials of Construction	Polyethylene Vault with Polypropylene Screen
Biotube Cartridge Height	915 mm
Screen Area	3.12 m^2 each
Recirculation Pump Model	OSI P501052 High Head Turbine, 0.75 kW, 230V, Single phase
Number of Recirculation Pump	6 at Stage 1, 11 total after Stage 2
Recirculation Pump Performance	Max Flow 13.6 m^3/hr Max Head 24 m
Recirculation Pump Operating Spec	11.35 m^3/hr at TDH of 11.41m
Recirculation Pump Discharge Size	50 mm BSP
Float Assembly	MF3A
Hose and Valve Assembly	HV200BC-H

Filtrate Return Pump Model	OSI P300512 High Head Turbine, 0.65 kW, 230V, Single phase
Number of Filtrate Return Pump	1
Filtrate Return Pump Performance	Max Flow 7.5 m^3/hr Max Head 21 m
Filtrate Return Pump Operating Spec	6.35 m^3/hr at TDH of 11.41m
Filtrate Return Pump Discharge Size	32 mm BSP
Float Assembly	MF3A
Hose and Valve Assembly	HV125BC-H
Control Panel	Custom Remote Telemetry Panel
Float Controls	Redundant Off/Low Lev, Timer On/Off, Timer Override, High Lev
Pumps	Pump operating and monitoring (run times, cycles, flow rate)
Power Supply	Monitors power outage
Fan Operation	Monitors fan fail

STAGE 2 RECIRCULATION TANK	
Tank Manufacturer	Existing (unknown)
Tank Volume	23,000 (total volume)
Number of Tanks	1
No of Compartments	1
Construction	*Insitu* Concrete Plaster (assumed)
External Dimensions	3.9 m diameter x 2.85 m high (assumed)
Screened Pump Vault Type	Orenco PVU84-36 (300 mm diameter x 2130 mm high)
Number of Pump Vaults	3 at Stage 1
Materials of Construction	Polyethylene Vault with Polypropylene Screen
Biotube Cartridge Height	915 mm
Screen Area	3.12 m^2 each

Pump Model	OSI P501512 High Head Turbine, 1.73 kW, 230V, Single phase
Number of Pump	1
Pump Performance	Max Flow 13.5 m³/hr Max Head 24 m
Pump Operating Spec	12.5 m³/hr at TDH of 11.41m
Pump Discharge Size	50 mm BSP
Float Assembly	MF3A
Hose and Valve Assembly	HV200BC-H
Control Panel	Custom Remote Telemetry Panel
Float Controls	Redundant Off/Low Lev, Timer On/Off, Timer Override, High Lev
Pumps	Pump operating and monitoring (run times, cycles, flow rate)
Power Supply	Monitors power outage

5.4. RECIRCULATION STAGE 1 LIFT STATION TO POST ANOXIC TANK

RECIRCULATION STAGE 1 LIFT STATION TO POST ANOXIC TANK	
Pump Chamber Manufacturer	OSI
Tank Volume	1,200 (total volume)
Number of Tanks	1
No of Compartments	1
Construction	PVC ribbed riser
External Dimensions	0.8 m diameter x 2.1 m high
Pump Model	OSI P501052 High Head Turbine, 0.75 kW, 230V, Single phase
Number of Pump	6 at Stage 1, 11 total after Stage 2
Pump Performance	Max Flow 13.6 m³/hr Max Head 24 m
Pump Operating Spec	11.35 m³/hr at TDH of 11.41m
Pump Discharge Size	50 mm BSP
Float Assembly	MF3A
Hose and Valve Assembly	HV200BC-H

Control Panel	Custom Remote Telemetry Panel
Float Controls	Redundant Off/Low Lev, Timer On/Off, Timer Override, High Lev
Pumps	Pump operating and monitoring (run times, cycles, flow rate)
Power Supply	Monitors power outage

5.5. POST ANOXIC TANK AND MIXING PUMP

Tank Manufacturer	Existing (unknown)
Precast Concrete Tank Volume	23,000 litres (total volume)
Number of Tanks	1
No of Compartments	1
Construction	*Insitu* Concrete Plaster (assumed)
External Dimensions	3.9 m diameter x 2.85 m high (assumed)
Pumpout Access Risers	2 x RR24-36
Pumpout Access Riser Lids	2 x FL24g.4B
Pump Model	OSI P300552 High Head Turbine, 0.65 kW, 230V, Single pha
Number of Pump	1
Pump Performance	Max Flow 2.73 m^3/hr Max Head 58 m
Pump Operating Spec	11.35 m^3/hr at TDH of 11.41m
Pump Discharge Size	32 mm BSP
Float Assembly	MF3A
Hose and Valve Assembly	HV150BC-H
Control Panel	Custom Remote Telemetry Panel
Float Controls	Redundant Off/Low Lev, Timer On/Off, Timer Override, High L
Pumps	Pump operating and monitoring (run times, cycles, flow rate)
Power Supply	Monitors power outage

5.6. RECIRCULATING PACKED BED REACTOR

Pod Manufacturer	Orenco Systems Incorporated
Pod Dimensions	4.85 m x 2.4 m x 1.08 m
Number of Pods	8 in total
Lids	4 lids per pod - insulated
Construction	Fibreglass Resin Mould
Media Type	OSI Textile Fabric
Loading Rate	416 l/m²/day at peak design flow
Pod Inlet Vent	2 x 80 mm PVC
Fan Assembly	80 Watt fan (with heater)
Carbon Filter	Activated carbon granule in RR24-18 Riser and FL24g.4b Lid
Carbon Type	Grade YA04/10, 5 litres per filter
Number of Carbon Filters	2

5.7. UV DISINFECTION UNIT

UV Manufacturer	Davey Water Products
UV Model	CP8
Number of lamps	8
Chanel Type	Stainless steel gravity channel
Housing	AdvanTex AX20 concrete pod and lid

5.8. CARBON SOURCE AND DOSING PUMPS

Carbon Source	MicroC 2000
Pump Model	Grundfos Alldos Dosing Pumps, DDA 7.5-16 AR
Number of Pumps	2
Pump Discharge Size	50 mm BSP

6. FUNCTION OF SYSTEM COMPONENTS

6.1. SEPTIC AND POST ANOXIC TANK

2 x 70,000 L concrete septic tanks are installed to provide primary treatment of wastewater. 50% of incoming BOD and TSS are expected to occur in the septic tanks via anaerobic digestion. A Biotube® effluent filter is installed at the outlet of the septic tank. This filter enhances the primary treatment process by dramatically reducing the total suspended solids exiting the tank (average 30 mg/L TSS) as well as protecting the down-line components. The post anoxic tank, which is installed after the recirculation stage 1 tank, provides an anaerobic zone for converting nitrates from the stage 1 aerobic process to nitrogen gas (i.e. denitrification). Carbon is dosed into the post anoxic tank via carbon dosing pumps to maintain the carbon to nitrogen ratio (minimum of 4:1) required for complete denitrification.

6.2. SLUDGE MANAGEMENT OF SEPTIC TANKS

As solids are retained and digested in the septic tanks, at some point, these tanks will have to be pumped out. To ascertain the point at which to pump out the tank sludge, measure the level of sludge using a sludge meter or sludge gauge. This sludge meter will reflect the layers formed in the septic tank- scum layer, clear zone and sludge layer. See below for the range of scum, clear and sludge layers expected in the primary tanks. If the clear zone is less than the recommended height (below) or the scum and sludge layers exceed the recommended heights, then it is time to pump out the primary tanks. This section also includes the layer height ranges of the remaining tanks in the wastewater treatment plant of which when in exceedance, we recommend a pump out. This test is done at every scheduled service and provides the basis of whether the service report recommends a pump out of the septic tank. It’s recommended all waste/sludge which is taken away from septic tank or other aspects of the treatment plant should be then disposed of at an approved dumping location.

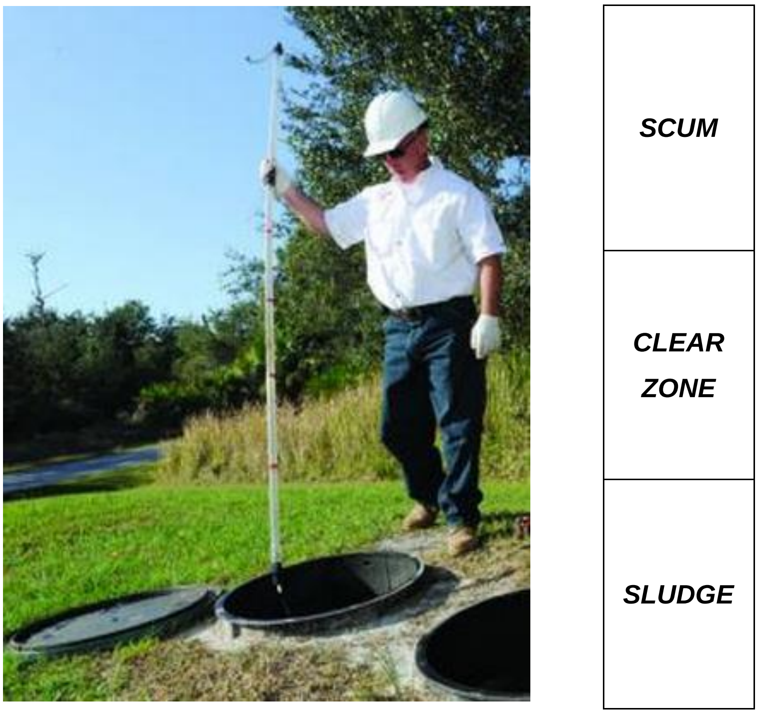


Figure 1. *Photo of sludge meter and layers created in a septic tank*

Tank	Recommended Scum (Sc)-Clear Zone (CZ)- Sludge (Sl) Layers
Septic Tank 1	Sc- 1200 mm, CZ-1200 mm, Sl-3000 mm
Septic Tank 2	Sc- 1000 mm, CZ- 1000 mm, Sl-2500 mm

6.3. RECIRCULATION TANKS

Screened effluent from the septic tanks and post anoxic tank received in the recirculation tanks (stage 1 and 2 respectively). Effluent in the recirculation tank is dosed over packed bed reactor in a micro-dosed, timer controlled fashion using submersible pumps fitted inside screened pump vaults. The recirculation tank ensures that the packed bed reactor receives a continuous source of oxygen and food during periods of little or no flow, ensuring that the micro-organisms are maintained at peak condition, ready to receive shock or varying loads. Splitter valves are installed in the recirculation tank and are constructed in a manner which ensures the optimal recycle ratio is maintained at all times, i.e. effluent is dosed over the textile 4 times and splitting to the treated effluent chamber 1 time. In this way, the splitter valve maximises treatment efficiency for a consistently high quality effluent.

6.4. MANAGEMENT OF RECIRCULATION TANKS

The recirculation tanks include screened pump vaults, a set of floats, recirculation pumps and splitter valves (1 valve in each tank). Therefore managing the recirculation tank centres around ensuring the pumps, floats and splitter valves are in good condition and are functioning correctly. Refer to the relevant parts of this document for operational requirements of pumps, floats and valves.

6.5. MANAGEMENT OF RECIRCULATION PUMP FLOAT SWITCHES

All tanks with pumps include a 3-float switch assembly. The float switch assembly provides low current control and alarm signals to the control panel. The mechanical three float switches are normally open and close in the UP position. The operating range is around 3mm. They are signal rated floats and do not switch the pumps directly but rather send low current signals to the controller at the control panel, which in turn switches the high current pump motor contactors. They are classified by the manufacturer as Type "A" floats. When the top float is raised, the high level visual and audible alarm is raised. Once the middle float is raised, the pump runs on 'override timer settings; where the pump flows effluent more frequently. The bottom float should be raised at all times, if it is lowered, the pump ceases operation and the low level audible and visual alarm is raised.

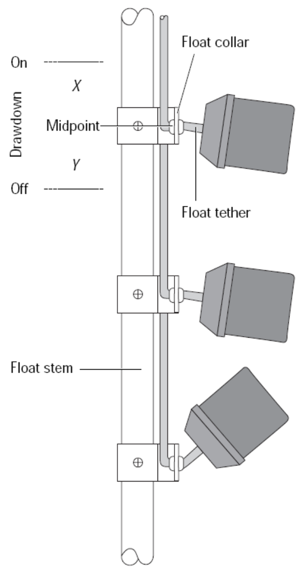


Figure 2. *The triple float switch assembly*

The functions of the float switches in the configuration are detailed in the following table:

Float	Float Function
Top Float	High Level Alarm
Middle Float	Timer Override
Bottom Float	Redundant off and Low level alarm

6.6. REMOVING & REPLACING INOPERATIVE FLOATS

If floats are not activating/deactivating pumps and alarms as they should, then this may indicate a faulty float.

IMPORTANT! Before doing any work on either the wiring to the level control floats and pump or in the pump control panel, switch off the power to the system at the service entrance panel, set the circuit breakers in the panel to their "OFF" positions.

1. Remove the float assembly from the vault. There is no reason to move the settings of the floats to remove and replace a float. After noting the tether length, snap the inoperative float out of the holding collar.

2. Check the external Splice box on the outside of the riser. Remove the screw lid on top of the splice box. If the splice box was submerged, or if there is a crack in the conduit, there may be water in the splice box. If this is the case, remove water with a syringe or other appropriate method. Loosen the cord grip at the splice box and identify the appropriate splice for the float. Cut out the splice and, if using a watertight wire nut for the common wires, remove the appropriate common.

3. Remove the inoperative float and replace it with a new one. Push the float cable through the watertight cord grip into the electrical splice box. Leave an adequate length of electrical cord coiled inside the riser to allow for easy removal of the float assembly. Do not remove the coloured markers or the paper tags from the float cords, and do not try to thread the markers and tag through the cord grip. Tighten the cord grip by hand, not by tool, then test the tightness of the cord grip by tugging on the cord. A cord is secure when the cord grip is tight enough to prevent slippage. An adequate length of cord should be left within the splice box to allow for future disconnecting and re-splicing

4. Splice the float wires to the wires from the control panel following the wiring schematics available from Innoflow. Attach the common wire with the other commons using the waterproof wire nut. It may be necessary to replace this wire nut with a new watertight wire nut. Always use watertight wire nuts or heat shrink splice kits for all connections.

5. Replace the float in the collar, using the same tether length, and return the assembly to the pump vault.

6. Reconnect power and test the unit per the instructions provided in the Start Up & Operation section of this manual.

6.7. RECIRCULATION PUMPS AND DISCHARGE ASSEMBLIES

Pumps installed in the stage 1 and 2 recirculation tanks are referenced in the specification tables in earlier sections. The pump utilised are proprietary long-life, high-head, low-flow, multi-stage turbine pumps. The pumps are rated for over 1,000,000 start-ups and have an expected lifetime of over 20 years. The installed pump are rated for up to 300 starts per day and the current programmed dosing cycle results in 86 starts per pump per day during peak flows. All pumps have a 3mm dead-head orifice in the check valve assembly built in to the pump. This prevents pump damage should the pump be turned on against a dead-head.

Additionally, pressure gauge nipples are fitted to the top of the discharge assembly for easy measurement of pump pressures. The discharge assembly incorporates a section of flexible hose to minimise mechanical stress on the assembly during pump start-up.

Figure 3. The Orenco Turbine Pump

Figure 4. The Discharge Assembly

6.8. SIGNS OF FAILING OR BLOCKED RECIRCULATION PUMPS

Under normal operation, the pumps should operate in the following;

- When tested at the panel, the running amps of the stage 1 recirc pumps should be 7.0-7.8 amps and the running amps of the stage 2 recirc pumps should be 10-11 amps
- The flow rate of the recirculation pumps should be between 4.2-4.8 L/second
- The flow from **all** the spray nozzles in the AX100 pods are evenly distributed and start and stop at all the time

Signs of a failing or blocked pump therefore may result in;

- Consistently very low or high running amps (less than 5 amps or greater than 12 amps)
- The flow rate of the recirculation pumps much less or much greater than 4.2-4.8 L/second
- The flow from the spray nozzles AX100 pods are uneven or generally weak in force
- The recirculation tank is consistently in high level

In this case, clean out the pump screen with a hose and the AX100 pod manifolds to clear any potential blockages. If the pump still seems to operate outside the normal measures, the pump may require replacement.

6.9. REMOVING & REPLACING INOPERATIVE PUMPS

IMPORTANT! Before doing any work on either the wiring to the level control floats and pump or in the pump control panel, switch off the power to the system at the service entrance panel, set the circuit breakers in the panel to their "OFF" positions.

1. Close the ball valve on the discharge plumbing assembly, disconnect the union, and carefully remove the pump and attached plumbing from the tank. Disconnect the pump from the discharge plumbing assembly.

2. Check the external Splice box on the outside of the riser. Remove the screw lid on top of the splice box. If the splice box was submerged, or if there is a crack in the conduit, there may be water in the splice box. If this is the case, remove the water with a syringe or other appropriate method. Loosen the cord grip at the splice box and identify the appropriate splice for the pump. Cut out the splices and label the wires.

3. Remove the inoperative pump and replace it with a new one of the same type. Push the pump cable through the watertight cord grip into the electrical splice box. Leave an adequate length of electrical cord coiled inside the riser to allow for easy removal of the pump. Tighten the cord grip *by hand, not by tool*, and then test the tightness of the cord grip by tugging on the cord. A cable is secure when the cord grip is tight enough to prevent slippage. An adequate length of cord should be left within the splice box to allow for easy removal for future disconnecting and re-splicing.

4. Splice the pump wires to the appropriate wires from the control panel following the wiring schematics provided by the control panel supplier. Always use watertight heat shrink splice kits for all connections.

5. Reattach the discharge plumbing assembly and carefully lower the pump into the flow inducer alongside the Biotube® pump vault. Be careful not to lower the pump by the cable or to pinch the cable when lowering it into the flow inducer. Reconnect the union and open the ball valve.

6.10. EXTERNAL SPLICE BOXES

All of the pump cables and float cords are wired into the control panel via electrical splice boxes, similar to the one shown in the photo below. These splice boxes ensure that the wiring connections are isolated from moist/wet conditions & offer ease of use

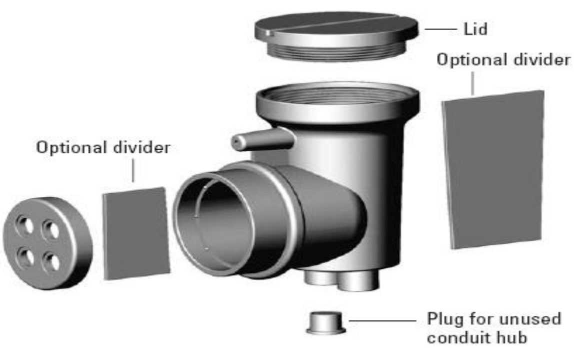


Figure 5. *External splice box exploded view & Example of external splice box on an access riser*

6.11. FRESH AIR VENTILATION AND ODOUR

All AX100 units are ventilated through an active fan system, designed to allow air ventilation throughout the hanging textile. An active form of venting through the AX100 pods which involves drawing fresh air through the inlet at the end of each pod, through the textile sheets, and out through an activated carbon filter/fan is achieved through an active carbon fan vent, model: CF1818. The fan used to circulate the fresh air is a small 60 watt “ducting type” CF1818 fan, designed for continuous operation. In order to maintain a steady state in each pod, the fan will operate continuously. Since the fan is small, the airflow is only slight and simply required to prevent stagnant conditions. Odours do not generally permeate unless there is a serious issue. To help control and scrub any air that is forced out of the plant, carbon filters are included on access lids to allow the balancing and diffusion of air as water levels rise and fall within the tanks.

6.12. FAILING FAN ALARMS

If the fan ceases to operate, it is likely due a burnt or faulty fan motor. At this point, it is suggested the unit is replaced. In the event of a fan failure, and alarm is generated and Innoflow is alerted.

6.13. ADVANTEX AX100 PACKED BED REACTOR PODS

Stage 1 includes 6 x AX100 pods and stage 2 includes 2 x AX100 pods. The AdvanTex® rtPBR is essentially a bed of highly specialised textile nestled in a pre-made pod to which the effluent is uniformly dosed through a pressure distribution system using a timer controlled dosing regimen. These small precise doses at multiple point sources across the reactor bed ensure thin film application of the effluent maximising retention times within the reactor for renovation.

The AdvanTex® Pods are manufactured using a resin transfer fibreglass process providing strength and durability, including protection from UV rays. Each filter Pod contains a tamper proof fibreglass lid, providing a weather proof seal for the filter medium and minimising potential vandalism to the equipment. This also means that the Pods have very low visual impact. Unlike other packed bed reactors open to air, rainfall on the Pods does not add to the hydraulic loading on this system because these lids protect the textile from intercepting any rainfall.

The Pod lids have hydraulic struts for ease of lifting and the spray nozzles provide even distribution over the textile as well as aerating the applied effluent The Pod has 8 spray nozzles, 2 on each lateral. Each lateral can be isolated with a ball valve if needed. Ensure the isolation ball valve is open for normal operation. There is also a ball valve at the end of each lateral for flushing the laterals before system start-up and during operation and maintenance. Ensure the flushing ball valve is closed for normal operation.

Figure 6. *Spray nozzle inside AX100 Pod*

6.14. MANAGEMENT OF AX100 PODS

Very little is required to manage the pods. The following is recommended for the management of the AX100 Pods;

- Ensure the lids are easily accessible for servicing
- Ensure lid bolts are tight after opening pods to maintain watertightness
- Inspect laterals and spray patterns of the nozzles and ensure distribution is even.
- Clean out laterals once every 3 months

The AX100 Pod textile filters can also be used to indicate overloading or poisoning. A light brown coloration of the textile will occur after several months of operation. This is normal and indicates a healthy film of microbes on the textile fibres. This growth should NOT extend across the gap between textile sheets. If this occurs, contact your designated servicing company. This may be an indication of overloading of the textile, toxic poisoning, or inadequate air circulation through the textile Pods (due to fan failure for example).

Figure 7. *An AdvanTex® AX100 Filter textile after several years of operation*

For short durations the AdvanTex® process is able to handle fluctuating loads (within the design parameters specified) and shock loads with little or no degradation in treatment performance. This is because incoming flows are buffered in the recirculation tank and the doses on to the pod are (largely) independent of the incoming flows. Also the inherent properties of the textile medium contribute to this relative insensitivity to flow variation. The textile pod can be loaded at up to twice their design loading for short time periods (in the order of weeks) with minimal effect on treatment performance.

6.15. POST ANOXIC TANK AND CARBON DOSING

From the outlet of the recirculation tank 1 splitter valve, highly treated secondary effluent low in BOD, high in DO and with approximately 50 mg/L total nitrogen, enters a single 25,000 L post anoxic tank. At this stage, it is expected to reduce TN of effluent by up to 90%. The post anoxic pump contains a PF300552 pump and doses effluent to the second stage recirculation tank. Supplemental carbon is added to this tank based on a timer setting set in the control panel. The carbon dosing tank is a 1,000 L tote which is placed in the control shed. The carbon dosing tank includes a PF300552 pump as a mixer to stir the contents of the tank and thoroughly mixes the added carbon with the treated effluent.

6.16. CARBON DOSING AND SUPPLEMENTATION

Carbon (in the form of MicroC) is stored in the 1,000 L carbon tote placed inside the control shed. Dosing of the carbon in the post anoxic tank is done automatically based on influent flows registered in the panel from the influent mag meter. In this way, the carbon dosing pumps pump carbon into the system proportional to the flow coming into the system. These timer settings can be changed by Innoflow remotely if an under or over dosing of carbon is required.

- Since there is no floats in this tote, it is important to ensure that the carbon dosing tank is always at least half full.

6.17. SIGNS OF FAILING OR BLOCKED POST ANOXIC & CARBON PUMPS

The post anoxic tank includes a flow inducer tower and a PF300552 mixing pump. The carbon dosing pumps are a pair of Grundfos Alldos metering pumps. Under normal operation, the pumps should operate in the following manner;

- When tested at the panel, the running amps of the mixing pumps should be 4.1 amps
- Carbon dosing pumps, being metering pumps will show activity on controller screens

Signs of a failing or blocked pump therefore may result in;

- Mixing pump consistently very low or high running amps (less than 2 amps or greater than 7 amps)
- Carbon dosing pump controller is beeping or no longer pumping
- The post anoxic tank and carbon storage tote is consistently in high level

In this case, clean out the pump screen with a hose and test the flows for 24 hours. If the pump still seems to operate outside the normal measures, the pump may require replacement. Refer to section 5.4 for information on replacing inoperative pumps.

6.18. UV DISINFECTION UNIT

A gravity UV unit is installed at the outlet of the system to provide tertiary treatment of treated effluent. Because the expected effluent quality generated from the system is high, wastewater passing through the UV lamps are expected to very low in BOD and suspended solids, allowing for maximum UV penetration and disinfection bacteria and viruses. Factors affecting the UV lights ability to penetrate the wastewater, such high suspended solids, or scum build up in the UV lamps, will result in reduced disinfection of the treated effluent.

6.19. MANAGEMENT UV DISINFECTION UNIT

Aside from treating effluent quality, UV lamps shall be cleaned with acid (or solution as per manufacturers recommendations) every 3 months as a minimum. UV lamps shall also be replaced once per year.

6.20. WATER METER

A 50mm pulse water meter has been installed post the treated effluent tank which has an accuracy of plus or minus 5%. This pulse water meter records flows on a daily basis and is recorded on the telemetry control panel.

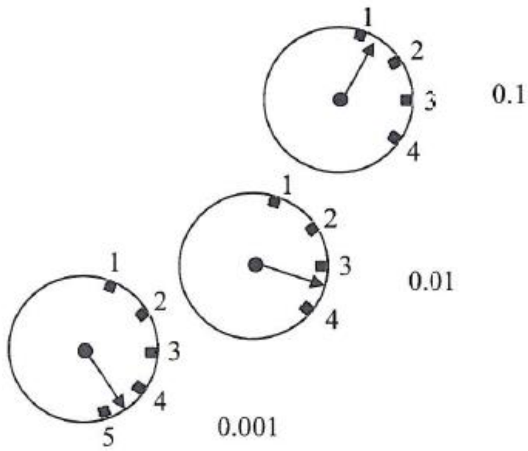
6.21. HOW TO READ THE WATER METER

The installed TCOM control panel logs flows every 24 hours, in cases where a manual water meter reading is required, the instructions on how to read a water meter to the nearest litre is as below.

1. The screen reads in cubic meters e.g if the screen reads “724” then the actual reading is 724 cubic meters of 724,000 L. Three smaller dials exist around the main screen, which register flows per hundred, ten and one litre.
2. At the same time each day, record and date the wastewater flow on the water meter
3. Calculate and record the flow (i.e the difference) since the previous reading.
4. Note If there is/has been an abnormal event leading to big differences in water meter readings
5. If the daily discharge exceeds 50,000 L a day, contact Innoflow Technologies NZ Ltd

How to Read the Meter:

0	0	7	2	4	M^3



The example meter reading is:
724.134 m^3

Figure 8. *Schematic of water meter reading*

6.22. LEAK DETECTION USING THE WATER METER

Under normal conditions, the water meter will register once the treated effluent tank pump is activated, and ceases to register flows once the pump stops. If there is a leaking non-return valve in the pump **or** upstream of the water meter the water meter dial will seem to be going backwards. To test weather this is the case, turn off al taps and pumps. If there is movement, then there is a leak. Attempt to isolate the leaking tap and inform Innoflow immediately for further investigation.

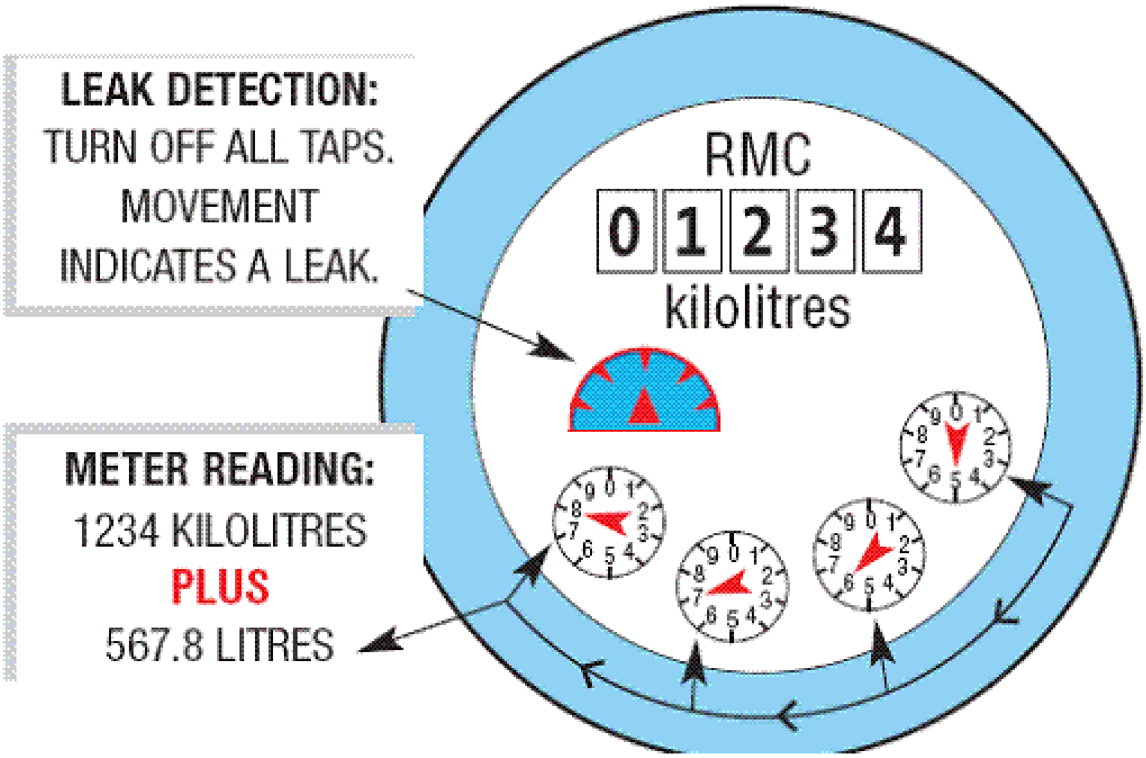


Figure 9. Schematic of water meter reading going backwards during a leak

6.23. EFFLUENT FLOW RECORD

At the wastewater treatment plant, the effluent discharge volumes are captured continuously & logged on a daily basis by a water meter installed which has a +/- 5% accuracy. For this site, all wastewater flows are captured at the point where waste enters and exists the treatment system. A mechanical water meter have been installed on the system outlets to monitor effluent flows to the land treatment application area. The water meter will also have a pulse emitter fitted which will be monitored and collated by the control panel and interpreted as flows. Records of daily flows are automatically collated & saved to the internal memory of the TCOM control panel at the same time of every consecutive day & then can be easily accessed & downloaded. A copy of the flow logs can be requested from Innoflow.

6.24. TCOM CONTROL PANEL

An Orenco Systems Inc TCOM control panel will is installed. The control panel is purpose built to attend to the functions and requirements of the specific waste water treatment plant. As well as general operations of the plant such as pump run times, fan run, water meter readings and monitoring of sensors, the panel allows for automatic call-out to Cell phone and/or emails during alarm conditions or when the panel detects trends that could lead to system failure. It has the ability to maintain logs for system conditions and events, such as Pump Run Time, Pump Cycles, and Alarm Conditions and Downloadable logs into a *.dif or ASCII format for simple conversion to common spreadsheet or word processor programs. The Control panel can be set to run in three options- Manual, Off or Automatic. In Automatic, the programmed settings control the on/off time of the nominated pump. Set to off, it will turn off the nominated pump, or set in manual, it will allow the nominated pump to run whilst the manual switch is engaged.

6.25. TELEMETRY

Telemetry is a technology that allows the remote measurement and reporting of information.. Innoflow Technologies NZ Limited provides its telemetry through Digital Telemetry, who are a company specialising in the provision of wireless telemetry services for your remote equipment. They connect to our remote, unattended equipment wirelessly using proven Siemens wireless controllers and modems connected to their network of management servers, through which customers can securely access their equipment using RS232/serial, digital I/O, analogue input or current loop (4-20mA) from any Internet connection in the world.

6.26. CONTROL PANEL ALARMS

Alarms are generated at the panel and are communicated to the receiver (at this stage, Innoflow). The following table identifies the paged codes which will send an alarm:

Alarm Code	Alarm Meaning
9001	Recirc Tank HLA
9002	Recirc Tank LLA
9003	TET HLA
9004	TET LLA
9008	Power Failure
9009	Recirc Tank Pump fail (current sensor)
9010	TET Pump Fail (current sensor)
9011	Fan Fail
9020	General Alarm*

*General Alarm: General alarms should be investigated in further detail while accessing the system remotely. There can be a number of subsidiary alarms which the panel can be programmed for which are represented by a general alarm.

7. OPERATION & MAINTENANCE SCHEDULE

7.1. SCHEDULED SERVICING VISIT CHECKS

The wastewater treatment plant at this site requires routine servicing by a professional outfit that is familiar with the components and operation of the wastewater treatment plant. Preventative maintenance is recommended to be carried out on a three monthly basis. The following detail describes the routine maintenance checks which are to be carried out by the servicing agency, as a minimum.

Task	Frequency
All Primary Tanks	
Inspect tank levels and integrity	3 monthly
Inspect And Clean Tank Biotube Vault & clean if required	3 monthly
Recommend Removal Accumulated Biomass/Grease	As Site Testing Indicates
AdvanTex® Treatment Units/Recirculation Tank	
Inspect Flow Pattern of POD orifice caps	3 monthly
Flush Distribution Laterals	3 monthly
Check Operation & Clean ALL pumps	3 monthly
Clean & Check operation of ALL control floats	3 monthly
Check operation of fan & ventilation systems (vents etc)	3 monthly
Check integrity of AX tanks/Access Lids	3 monthly
Check splitter valve operation	3 monthly
Check & Adjust Timer operation settings (advise from Innoflow Engineer)	3 monthly
Check Outlet pipe work to TET tank	3 monthly
Chemical Dosing	
Ensure carbon dosing tank is at least half full	3 monthly
Ensure there is stock of alkalinity	3 monthly
Test dosing pump operation	3 monthly

Test dry chemical feeder operation	3 monthly
Treated Effluent Chamber	
Inspect tank levels and integrity including Access Risers etc	3 monthly
Inspect And Clean Treated Effluent Tank Floats And Alarms	3 monthly
Inspect And Clean Treated Effluent Tank Pump	3 monthly
Measure And Log Biomass Level In Treated Effluent Tank	3 monthly
UV Unit	
Clean Lamps	3 monthly
Replace Lamps	Annually
Reporting	
Forward Maintenance Inspection Summary to Client	3 monthly
Collate all maintenance reports and flow logs and assess the plants performance	Annually

7.1. MAINTENANCE, RECORD KEEPING & INTERVALS OF REPORTING

The outcomes of the maintenance schedules should be recorded, stored in Innoflow's files & sent to the consent holder on a 3-monthly basis. These records are to be kept safe and accessible for assessment of performance.

8. ALARMS AND TOURBLESHOOTING

8.1. POWER FAILURE

In the event of total power outage the treatment plant provides over 24 hours storage above the high-level alarm.

In the extremely unlikely situation that power outages exceed this duration. The generation of wastewater is likely to be considerably reduced during periods of power outage also, further increasing the storage duration within the system. Normal operation of the system automatically occurs when power is restored.

8.2. ALARM ACTIVATION

All pumps in the treatment plant are linked to an audio/visual alarm indication at the control panel. Provision has been made for the following events to trigger alarms:

- Liquid high level in any tank
- Liquid low level in any tank
- Fan Fails
- Recirculation Pump Fail
- Treated Effluent Pump Fail

Should an alarm activate, the onsite manger should investigate immediately to determine the cause and if he is unable to rectify the problem he will notify the service company on their 24 hr emergency number. The service company will respond within 24 hours to prevent any potential detrimental environmental effect that may result from the fault. The effluent will be either pumped out to the land disposal system or pumped out and disposed to off-site discharge.

8.3. PUMP FAILURE

Mechanical failure of pumps within the treatment plant will result in high-level alarms being triggered. Please refer to Alarm Activation procedures below. All tanks within the treatment plant have at least 24-hours emergency storage above the high level, which is sufficient time for the pump to be replaced.

8.4. GENERAL TROUBLESHOOTING PROCEDURE

The following troubleshooting chart describes most of the common problems found in treatment systems. This simple table should be used to diagnose any alarm from the wastewater treatment plant.There are a number of situations which could cause an alarm situation. The first thing is to determine whether it is a high level or a low level situation:

PROBLEM	CAUSE	SOLUTION
Infrequent short duration alarms	Unexpectedly high inflow (toilet running constantly, tap left on, flooding over gully traps in very high rainfall)	Occasional excessive water usage will not affect the system; the alarm simply alerts the user of an unusual event. The alarm can be silenced by pushing the Red indicator light on the front of the panel
Frequent short duration alarms	Water usage beyond what the system is designed to handle.	Reduce water usage - check for leaking plumbing fittings such as faucets and toilets. Check for infiltration into tanks.
	Programmable Timer not set properly to handle acceptable daily flow.	Contact Service Provider to have timer re-calibrated.
	Float Switches set incorrectly.	Contact Service Provider to reset float levels.
	Pump Vault Screen Clogged	Clean screen

Short duration alarms only during storms or wet weather	Infiltration from leaking tanks, plumbing or broken sewer connection	Call Installer to remedy leaks. Call drainlayer to fix broken pipe
Continuous high water alarms	Pump Failure Float Failure Splitter valve stuck down Bottom float failure Tank leak Broken inlet pipe allowing groundwater infiltration Top float stuck on Gate valve closed	Repair or replace pump Replace failed float Plunge splitter valve ball float This should only cause intermittent alarms as the pump will begin to run constantly when the top float is raised Infiltration into tank - repair leak - also check risers Check seal around inlet tee also and around electrical conduit Broken seal on Pod (infiltration) Broken pipework on Pod (infiltration) Check for water in splice box, check for faulty float Check handle is in line with discharge assembly, open if closed
Continuous low level alarms	Pump siphoning Hole in tank Screen clogged Tank leak	Install anti-siphon valve Repair hole Clean screen Exfiltration out of tank - repair leak Broken underdrain pipe (this is the return pipe to the tank from the AdvanTex® Pod)

	Bottom float stuck up	Check for water in splice box, check for faulty float

8.5. HIGH LEVEL ALARMS DUE TO PUMP FAILURE

Mechanical failure of pumps within the treatment plant will result in high-level alarms being triggered, particularly within the tank that the pump operates, for example if the recirculation tank is in constant high level, and the tank downstream is not, then this may be an indication of a pump failure. All tanks within the treatment plant have at least 24-hours emergency storage above the high level. Contact your service provider or Innoflow in the meantime to arrange an inspection. Alternatively, it is possible to change the timer settings on the discharge pump to limit the flow to the land application system once the trigger level has been exceeded. This can be done with direct access to the control panel or contact an Innoflow Engineer to do this remotely.

8.6. NON COMPLIANT EFFLUENT QUALITY DUE TO PROCESS TANKS

Primary treatment happens in the tank, and several conditions inside the tank affect the ultimate effluent quality. The first is the **incoming wastewater**: its strength (concentration), mass loading (amount of each wastewater component), hydraulic loading (volume), and chemical characteristics. Effluent quality samples that are high in contaminants may indicate that the incoming wastewater strength exceeds the treatment capacity of the WWTP. Samples of influent over a week period should be assessed to ensure that the wastewater strength do no exceed the design. If the wastewater strength exceeds the design parameters, addition of process tanks and/or chemical dosing stages may be required.

Finally, the tank and all pipe joints must be **watertight** to prevent both infiltration and exfiltration of liquid. Infiltration of rainwater or groundwater will overload the system, preventing proper stratification in the processing tank and overloading the AdvanTex textile filter. Exfiltration of liquid effluent from the tank can make liquid levels too low for stratification, leading to clogging of the Biotube® effluent filter. Of course, exfiltration also pollutes the soil, and potentially the groundwater. Assessment of effluent flows are required and dye testing to ascertain sources of stormwater infiltration.

8.7. NON-COMPLIANT EFFLUENT QUALITY DUE TO OVER LOADED TEXTILE FILTER

The AdvanTex textile filter provides secondary wastewater treatment. The filter is a sturdy, watertight fibreglass basin filled with a non-woven textile material. This lightweight, highly absorbent media treats a large amount of wastewater in a small space because it has a very large surface area — about five times greater than that of an equivalent volume of sand, for example. Textile also has a greater void volume (for free flow of oxygen) and greater water-holding capacity.

These properties make it an excellent environment for aerobic micro-organisms to live and digest the nutrients in effluent. As effluent from the processing tank percolates through and between the sheets of textile, the micro-organisms remove what they need from it, reducing BOD and TSS. Also, the aerobic conditions within the AdvanTex filter are ideal for microbes that convert ammonia to nitrates (nitrification). Where maximum de-nitrification is necessary, AdvanTex filters can be configured, so that the filtrate re-circulates back to the high-carbon, low oxygen environment at the inlet end of the processing tank, which is ideal for microbes that reduce nitrates to nitrogen gas (de-nitrification). Harmless nitrogen gas is then released back into the atmosphere.

In addition to being affected by **oxygen**, the AdvanTex filter's performance is affected by **mass loading, hydraulic loading, strength,** and **chemical characteristics** of the influent. If the effluent coming from the processing tank is contaminated with harsh chemicals or excessive grease, the bio-mat of micro-organisms will suffer and so will the effluent quality.

Influent samples to assess levels of fats, oils & grease should be taken as well as assessment of chemicals used for cleaning should be undertaken to ensure performance is not hindered by the textile filters.

8.8. NON-COMPLIANT EFFLUENT QUALITY DUE TO INCORRECT RECIRCULATION RATIOS

Maintaining an **appropriate recirculation ratio** is important for proper functioning of the system. Adjusting the frequency and length of the doses of effluent delivered from the tank to the AdvanTex filter optimises the conditions for the micro-organisms. A recirc ratio that's too high can generate a highly aerobic bio-mat growth on the pump filter. It also increases alkalinity consumption and dissolved oxygen concentration in the processing tank, which can inhibit de-nitrification. Conversely, a recirc ratio that's too low can tend to liberate periodic odours during dosing events. The optimum ratio is typically between 2:1 and 6:1.

8.9. WHAT TO LOOK FOR WHEN EFFLUENT QUALITY IS POOR

If effluent is cloudy and colour/turbidity is significantly higher than expected, do the following:

- Check the Biotube® filter for clogging.
- Check to see if the textile filter smells of chemicals (medication, chlorine, etc.) or has a granular or crusty appearance. (For example, a white crystalline crust could signal that water softener discharge or industrial strength detergents have been flushed into the system.)

- Check to see if the recirculation ratio is too high or the pump dose time is too long (this can be confirmed by an Innoflow Engineer).
- Check that ventilation is occurring at the pod.

If none of these troubleshooting steps makes a difference, lab tests may be necessary to determine the cause of the problem. Call Innoflow for recommended lab tests or design remedies.

8.10. WHAT TO LOOK FOR WHEN BAD ODOURS ARE GENERATED

If the tank or textile filter smells like rotten eggs or cabbage:

- Check dissolved oxygen levels using a DO meter or DO wet test kit.
- Check filter surface for evidence of clogging.
- Check that the pump is working.
- Check that ventilation is occurring at the pod
- Check that the recirculation ratio isn't too low; increase if too low.
- Check that influent strength isn't too high (check AdvanTex Design Criteria).
- Check to ensure hydraulic retention time isn't too high.
- Check to ensure recirculation ratio isn't too high.
- Check to see if influent flows are below normal.

8.11. CAUSE OF FREQUENT BIOTUBE FILTER CLOGGING

If a visual inspection of the Biotube® filter for biomass build-up shows the need for cleaning more often than quarterly, try the following:

- Verify the pump isn't running too long
- Ensure the recirc ratio isn't too high.
- Verify normal DO levels; if high, reduce recirc ratio.
- Check for below normal influent flows.
- Check influent Grease & Oil and TSS; if excessive, a review of component sizes may be required.

Any signs of oil or grease anywhere in the system (in the tank, in the vault, on the effluent filter or textile filter) must be investigated. Ask the system user to identify the probable source:

- Over full grease traps
- Excessive use of detergents

If the system user can’t identify the probable source, try the following:

Sample and test at all process steps, including influent (if possible).

Label, date, and photograph all samples.

- When photographing, use standard glass beakers and set samples in front of a common, uniform background
- Check bio-mat accumulation at AdvanTex Filter.
- Note if bio-mat is yellowish and wax-like or lard-like. If so, scrape bio-mat sample for analysis:

  -Photograph/document bio-mat sample.
  -Send to lab with effluent samples.

9. CONTINGENCY PLAN

9.1. SYSTEM IS EXCEEDING PERMITTED VOLUMES

The following checks and recommended actions are to be completed in the event recorded flows exceed the permitted volume;

1. Metered flows exceed the maximum permitted discharge volume
   a. Confirm water meter calibration and check that both water meter data generally align (note the incoming water meter may differ slightly that then outlet water meter given the lead time of treatment process expected through the plant. This lead time however should not be any greater than 48 hours).

   b. Investigate infiltration at wastewater treatment plant
      i. Broken pipes
      ii. Lid Seals
      iii. Stormwater discharge onto treatment plant area
      iv. Pipework connections/riser connections and electrical connections at treatment plant tanks

2. Wastewater Flow Exceeds the Design Flow
   i. Determine if excess flows are intermittent or consistent.
   ii. Where excess flow is intermittent, investigate buffering the excess and discharging on days where flows are less than the consented peak flow.
   iii. If excess flow is constant subdivision wide excess wastewater production design extension of land disposal system into the Reserve Land Disposal Area.

iv. Investigate if additional wastewater treatment is required to comply with the treated effluent requirement.
v. Apply to Council for consent to utilise part or all of the reserve land disposal area.

3. Effluent breakout/surface runoff from the treatment and land disposal system.

In the event of breakout within the land application system the treatment plant discharge pump can be turned off for up to 24 hours while the cause of the breakout is identified. Service personnel will visually inspect the land application area and remedy any identifiable fault. In the extremely unlikely situation that remedial action exceeds this duration individual septic tanks can be pumped out as required, providing over 4 days storage.

Where no fault can be found, an investigation should be undertaken by an experienced wastewater consultant to identify the cause of breakout. The investigation should look specifically at the following:

i. Investigate land disposal system integrity for the following maintenance issues.
ii. Disconnected laterals
iii. Broken pipes
iv. Flush tap failure.
v. Sequencing valve operation.
vi. Confirm actual irrigation rate is within design.

9.2. BOD, TSS NOT COMPLYING WITH EFFLUENT QUALITY TARGETS

Should samples show that either BOD or TSS are in breach of the target treatment levels, the service team should report any breach to council and arrange for a follow up sample to be taken within 7 days. During this time the treatment plant should be investigated – primarily focusing on treatment plant process recommendations detailed in this document.

9.3. TOTAL NITROGEN NOT COMPLYING WITH TARGETS

A contingency plan of action to be taken in the event discharge quality monitoring indicates a total nitrogen level in excess of the design parameters. Firstly resample and analyse for Total Nitrogen. If the results again exceed the target limit of 25mg/L review the nitrogen reduction cycle within the treatment plant including;

a. Anoxic stage operation.
b. Carbon dosing operation.
c. Alkalinity dosing operation.

d. Review alkalinity and carbon dose with treated effluent sample dosing required and if necessary adjust.
e. Allow 2 weeks at revised dosing quantity and analyse treated effluent, including a grab sample of influent from the effluent sewer inlet to Pre-anoxic tank # 1 (test for TN)
f. If TN concentration is less than 25mgN/L in treated effluent no further action is required.
g. If TN concentration exceeds 25mgN/L investigate influent sample for TN and if sample exceeds 100mg/L the system may be overloaded with influent TN. Further removal processes may be required alternatives to improve Nitrogen reduction.

10. RECOMMENDED HEALTH & SAFETY GUIDELINES

Upon servicing the wastewater treatment plant there are a number of health & safety aspects which must be addressed & it's recommended that the service personnel are educated & aware of all possible risks associated with the wastewater treatment plant. Without carrying out a formal Health & Safety Evaluation of the plant, the table below highlights some of the main health & safety risks, risk management & mitigation measures which need to be in place. It's recommended that prior to any servicing, the service agency carry out a full independent Health & Safety Risk analysis of the plant.

ASPECT OF PLANT	RISK	MITIGATION MEASURE
Electrical Controls/Electrical Equipment replacement	Electrical Shock	• Allow only registered Electricians/Appropriately qualified staff to deal with Electrical aspects • Isolate all power prior to working on electrical connections • Visually inspect all electrical equipment prior to handling • Keep all liquids away from electrical connections
Working with Effluent/Wastewater	Hazardous Waste Handling/Exposure	• Ensure All appropriate PPE is worn • No Eating or Drinking or Smoking around Treatment plant • Ensure employees employ good hygiene practices • Ensure any wounds are appropriately dealt with & not exposed to
Potential of working in Confined Spaces	Confined Space	• Ensure all personnel entering, or overseeing are appropriately qualified in Confined Space entries
All Visitors To Site, be it service personnel or others	Exposure to effluent/Sewage	• Wash hands & body after entering work zone • Ensure all hazardous areas are identified with sign posts • Ensure all appropriate Personal Protective Equipment (PPE) is worn • Ensure all parties are aware of potential risks

	Access to hazardous areas	
General Safety Onsite	General Risks	• Risks of working around open access hatches, Tripping/falling hazards – ensure general precautions are taken • Risks of working around pressurised pipe work lines • Ensure Control room & Treatment plant area are kept in tidy condition • Ensure adequate First Aid kits are made available onsite or carried by service personnel • Best practices adopted when lifting heavy weights – apparatus including pumps/filters can be heavy • Safe utilisation of hand & powered tools onsite used for servicing requirements\ • Ensure all as-builts are followed to ensure that all underground services are identified prior to any digging/future excavation • Ensure new employees unfamiliar to the system are trained appropriately • Ensure all vehicular movements are kept to designated areas & driven responsibly