Design Documentation

Targoora Park Integrated Water Management Treatment Plant
Clarkes Lane Project

July 22, 2024

DRAFT V1

Submitted to North East Water Authority.

Clarkes Lane Process Description

Please review with the file Clarkes Lane Bioreactor Calculations and the P&ID.

Assumptions

ADWF including sewer mining from Wenham's Lane	300,000 L/d
PWWF	525,000 L/d
Peak diural flow (dry)	9.4 L/s
Peak diural flow (wet)	12 L/s
Plant design basis on all systems, peak flow of	12 L/s
Aerobic tank volume	352 kL
Volume between high/high and low levels	37 kL
Volume between high and low levels	10 kL

Pump Station Operation

During the night the plant will have treated waste water with little or no flow entering the plant. This will have lowered the aerobic tank level to between low level and high level (LT302).

Waste water will be collected in the Clarkes Lane and Wehnam Lane pump stations. All of the flow to the Clarkes Lane pump station will be pumped to the plant at 8 L/s, which is the capacity of the pump.

If the level in the aerobic tank level is below high/high level and the Clarkes Lane pump is not running, the Wenham Lane pump station will pump to the plant at 11 L/s. If the pump station is full (indicated by LT102) and the conditions for acceptance of waste at the plant at not met, the waste water will be pumped to sewer (AV101 closed). It is expected that 80% of the flow to the Wenham Rd pump station will be delivered to the treatment plant and 20% will be pumped to sewer. This can be increased to 100% by installing an additional level switch in the pump station to create high and high/high status in the Wenham Lane pump station.

Screening and pumping

Waste water is pumped directly through the inlet screens. Under normal operation both screens will be functioning. The capacity can be handled by one screen in case of failure of the other. The screens are fitted with inlet tanks and level switches (LSH201/202). When the level rises to high level the screen auger rotation and washing is activated. The washed screening are delivered to 240L bins fitted with plastic hoods to enclose the washed screenings.

The screened water will flow to a subsurface tank wet well with an operational volume of approximately 1000L. This wet well has low (0%), high (50%) and high/high (90%) level transmission (LT203). There is also a 100% high/high/high to shut the process.

When the level in the wet well increases to high the sump pump (P201/202) will start at a flow rate matching the expected incoming flow, being 8L/s or 11L/s, depending in the pump station in operation. These pumps are on VSD controllers. This will continue until the level reaches low, when the pumps will stop. There will be small difference in the incoming flow and the sump pump flow. If the level in the subsurface tank increases to high/high the sump pump flow will increase to 12L/s. These flows are measured with a magnetic flow meter (FT101) on the sump pump discharge.

Should LT203 reach 100% (H/H/H) it is assumed that overflow is imminent. Flow from Clarkes Lane will be diverted to the Wenhams Lane manhole pit and any flow from Wenhams Lane will be diverted to sewer.

MBR Operation

Flow from the wet well and the RAS both enter the bioselector at the top. This flow goes directly to the from the bioselector into the bottom of the anoxic tank. The anoxic tank is agitated with a submersible mixer (MIX301).

The anoxic tank overflows to the aerobic tank.

The mixer is a submersible rail mounted devise which can be accessed from the walkway. A dry spare is provided.

Sodium hydroxide solution is dosed in the Anoxic tank based on the pH in the aerobic tank. Dosing only operates when the sump pumps (P201/2) are operating.

Alum is dosed into the overflow between the anoxic and aerobic tanks at a rate determined by operator to control Total Phosphorus. This is flow paced to the flow indicated by FIT202 and only while pumps P201/2 are operating. This is likely to be different for periods when the water is being used for irrigation or when it is being discharged to One Mile Creek.

Aeration is through 2 sets of ceramic aeration disks. These operate in parallel. Each can operate independently during periods of service on one of them. These can be removed for service. Each is capable of providing sufficient aeration with the other out of service.

Aeration is provided by AB301/2 operating on VSD control and duty/standby. The aeration is controlled to give period of aeration and anoxic conditions in the aerobic tank to improve denitrification. This may change during period of irrigation and creek discharge.

Temperature (TT301) and MLSS (AT301) are measured in the aerobic tank for operator information.

The membrane feed pumps or Return Activated Sludge Pumps (P301/2) operate continuously. When the aerobic tank is low and the membranes are at F_0, these operate at minimum speed of 30% from the VSD. This is prevent sludge settling in the membrane tanks an to ensure there is a flow of RAS entering the bioselector.

Membrane Operation

The operation of the membranes is determined by the level in the aerobic tank (LT302). At low level the membranes will be at F_0, effectively not flowing. The permeate pumps will be stopped and there will be no aeration. Every 20 minutes each membrane will have its blower turned on for 1 minute to prevent solids settling within the membrane bundle.

When the level in the aerobic tank increases to high, one membrane train operate at F_{opt}, being 6L/s flow and a flux of 30 LMH. Each membrane train will operate for 20 minutes before swapping to the next train in sequence. When the level increases to high/high, which is expected only during high diurnal flow periods, all 3 membrane trains will operator to produce a flow of 12L/s at a flux of 20 LMH. That is 4L/s for each train.

While the membrane permeate pumps are running the blowers for that membrane train will operate. The blowers product 0.1Nm^3/hr of air for a total flow of 70Nm^3/hr for each train.

The membrane feed pumps will operate at 30% while one membrane train is in operation and this will increase to 100% when all trains are operating.

While in operation the membranes will backwash by reversing the flow through pumps P303/4/5. These are rotary lobe pumps on VSD controllers and can operate in forward flow and reverse flow direction. Each train will backwash at a flux of 30 LMH, giving a backwash flow of 6L/s. The membranes backwash for 30 seconds each backwash cycle. The backwash frequency is every 5 minutes. This results in an overall forward flow, allowing for ramping times, of more than 80%.

Water is collected in a permeate tank to facilitate volumes need for backwash, CIP and to ensure a constant flow through the UV and chlorine contact tank.

CIP

Daily maintenance cleaning is carried out on the membranes. This is done daily with sodium hypochlorite. At 2am, if the aerobic tank is at low level, the maintenance clean will be carried out one train at a time. The pump associated with the membrane train will start in the reverse flow direction at a reverse flux of 6 LMH (flow of 1.2L/s). Into this stream sodium hypochlorite is dosed to give 120ppm of free chlorine. Sodium hypochlorite (12.5%) is dosed at 4L/hr into this stream and this continues for 20 minutes. The membrane aeration is turned off at this stage. After 20 minutes the next membrane is cleaned until all have been completed.

Once a week (determine by results on site) a citric acid clean can be undertaken. This process is the same as hypochlorite clean with 50% citric acid dosed at 4L/hr to give a concentration of 500ppm.

The spent solution is returned to the biomass.

Once every 6 months the membranes will require a recovery clean. This is carried out by draining the membrane tank in question and fill it with permeate in the reverse flow direction at 1.2L/s dosing 8 L/hr of hypo solution. Once filled, another 15 L of hypo is added. This is allowed to soak with the aeration cycle running in CIP mode for 12 hours.

WAS

Waste Activated Sludge (WAS) is drawn from the overflow launder on the membrane tank. This is to give the highest concentration of WAS. To maintain 20 days sludge age, 7500L of WAS at 12g/L needs to be wasted. This will be done in 3 lots of 2500L at 7am, 12 noon and 5 pm. The time is selected to ensure that there is a high flow in the sewer and the retention time is minimised. The WAS is directed to the gravity sewer manhole. After each discharge a volume of recycled water is discharged to ensure that the flow is not held in the sewer. This will be in the order of 5000L.

UV

The UV is an in-pipe pressure system designed to give 1.5 log virus removal at a flow rate of 12L/s. The UV feed pumps (P401/2) will operate between 20% and 100% level in the permeate tank (LT401). They will come on at 50% and operate at 6L/min. They will stop at 20% leaving enough volume for the membranes to continue operating. At 75% tank level they will increase to 12L/s. The UV system incorporates UV transmittance and UV dose transmitters and alarms.

Chlorine Contact Tank

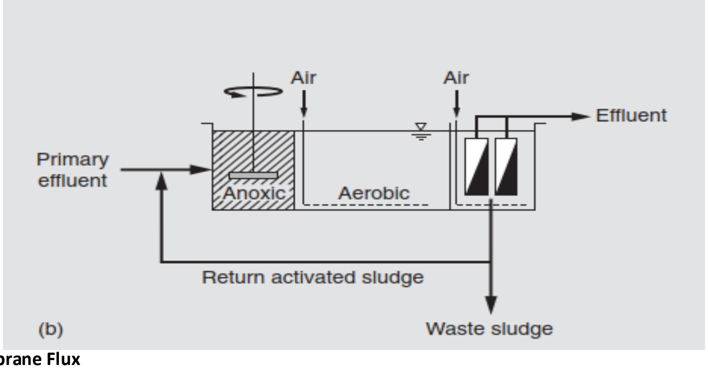
The chlorine contact tank is design to give 60 mins residence time. The tank is baffled to give a factor of 0.3. The chlorine is dosed to give a residual of 0.1 ppm to 1 ppm. This will give a log removal of more than the required 4 log for this process. Sodium Hypochlorite will be dosed at a rate to give 5ppm of chlorine before the contact tank. This will be between 900mL and 1800mL/hr depending on the flow rate. This will be trimmed to give 0.5 to 1 ppm at the tank outlet. At startup this function will be disabled for a period of time to give the tank time stabilise.

Recycle Water

Recycled water, for use around the site and screening washing, will be supplied from this line via a pressure pump system at 500 kPa.

Project Name:	Clarkes Lane MBR	Revision		Created:	HY	Checked:	
Calculation:	BIOREACTOR COMPUTATION CHECK			Date:	DRAFT	Date:	

LINE	Quantity	Symbol	Unit	Value	Typ./Rec. Range	Source/formula/Comment
1	**Influent characterisation**					
2	Instantaneous peak flow	Qmax	m3/hr	43.2		12 L/s design
3	peak capacity	Q	m3/d	400		[1]1.2.2 PWWF
4	design BOD	BOD	mg/L	350		[1]Table 2. 90%ile
5	design TKN	TKN	mg/L	65		[1]Table 2. 90%ile, assumed all N as TKN
6	BOD load		kg/d	140		=Q*BOD
7	TKN Load		kg/d	26		=Q*TKN
8	Influent TSS	TSS	mg/L	300		[1]Table 2. 90%ile
9	Influent VSS	VSS	mg/L	225		Assumed 90%ile. Based on typical ratio TSS/VSS domestic wastewater
10	Design winter water temp	Tmin	°C	10		[1]1.5.2



LINE	Quantity	Symbol	Unit	Value	Typ./Rec. Range	Source/formula/Comment
11	**Membrane Flux**					
12	Sustainable design flux		L/(m2*h)	20		
13	Membrane standby factor		-	1.5		D/D/S => 1.5
14	Required membrane area	$A_{m,req}$	m2	2160		
15	Installed membrane area	$A_{m,des}$	m2	2100		3*Pulsion LE16=700m2*3
16						
17						
18	**Aeration tank sizing, nitrification rate limiting**					
19	effluent NH4 concentration	S_{NH}	mg/L	1		[1]Table 3 max
20	aeration tank DO	So	mg/L	2	2-4	2 recommended min. [1]1.6.6 states 0.5-2.0
21	nitrification max specific growth rate @ Tmin	$\mu_{max,AOB,Tmin}$	g/(g*d)	0.449049954		= (0.90 g/(g*d))$(1.072)^{(Tmin-20)}$, [2]Table 8-14
22	specific decay rate coefficient	b_{AOB}	g/(g*d)	0.127730665		= (0.17 g/(g*d))$(1.029)^{(Tmin-20)}$, [2]Table 8-14
23	nitrification specific growth rate, adjusted	μ_{AOB}	g/(g*d)	0.111762643		[2] Eq. (7–94)
24	theoretical min Solids Retention Time	SRT_{min}	d	8.947533533		[2] Eq. 7-98, SRT=1/μ_{AOB}
25	design aerobic SRT	SRT_a	d	16		Note: [1]Table 7 total SRT 20 days
26	nitrification safety factor	SF	-	1.788	1.3-2.0	[2]Range
27						
28	Heterotrophic biomass yield	Y_H	g_{VSS}/g_{bCOD}	0.45		[2] Table 8-14
29	Nitrification biomass yield	Yn	g_{VSS}/g_{TKN}	0.15		[2] Table 8-14
30						
31	biodegradable COD	bCOD	mg/L	560		[2] Eq. 8-13, ≈1.6(BOD)
32						
33	heterotrophic decay coefficient @ Tmin	$b_{H,Tmin}$	g/(g*d)	0.0810677		= (0.12 g/(g*d))$(1.04)^{(Tmin-20)}$, [2]Table 8-14
34	heterotrophic specific growth rate @Tmin	μ_m	g/(g*d)	3.050095753		= (6.0 g/(g*d))$(1.07)^{(Tmin-20)}$, [2]Table 8-14
35	Half velocity constant	Ks	mg/L	8		[2] Table 8-14, temperature invariant
36	effluent biodegradable soluble COD	S	mg/L	0.395159304		[2] Eq. 7-46
37						
38	Biomass production, heterotrophs + AOB	$P_{X,bio}$	kg_{VSS}/d	52.79251523		[2] Eq. 8-20, with nitrification included assume NOx=0.8*TKN
39	nitrogen oxidised	NOx	mg/L	48.16224543		[2] Eq. 8-24
40						
41	**ITERATE AND CHECK**					
42	Biomass production, heterotrophs + AOB	$P_{X,bio}$,VSS	kg_{VSS}/d	53.33190472		[2] Eq. 8-20
43	nitrogen oxidised	NOx	mg/L	48.00042858		[2] Eq. 8-24
44						
45	nonbiodegradable Volatile Suspended Solids	nbVSS	mg/L	80	60-100	municipal waste no primary treatment
46						
47	volatile sludge prouction	$P_{X,VSS}$	kg_{VSS}/d	85.33190472		[2] Eq. 8-20
48	Chemical sludge production	$P_{X,TSS,CHEM}$	kg/d	25.78584259		See Phosphorus precipitation sheet
49	sludge production inc. nbTSS + chem. sludge	$P_{X,TSS}$	kg_{TSS}/d	150.5292599		[2] Eq. 8-21
50						
51	Reactor Mass (volatile)	$P_{X,VSS}$*V	kg	1365.310476		[2] Eq. 7-56
52	Reactor Mass (total solids)	$P_{X,TSS}$*V	kg	2408.468159		[2] Eq. 7-57
53						
54	Bioreactor Mixed Liquor SS conc.	MLSS	mg/L	8000	6,000-12,000	**note [1]1.5.3 was 6000mg/L**
55	Bioreactor MLVSS	MLVSS	mg/L	4535.033509		=MLSS*$P_{x,VSS}/P_{x,TSS}$
56	Aeration basin volume	V_O	m3	301.0585198		=($P_{X,TSS}$*V)/MLSS
57	Hydraulic retention time	τ	h	18.06351119		=Vo/Q
58	Preaeration tank active biomass	Px_b	kg/d	43.85077177		

Table 2 : STP MBR Design Wastewater Characteristics

Parameter	Design 50%ile Concentration	Design 90%ile Concentration
Alkalinity (mg/L)	250	300
BOD (mg/L)	300	350
TSS (mg/L)	260	300
NH_3-N (mg/L)	38	50
TN (mg/L)	52	65
TP (mg/L)	9.5	12.1

Table 7: MBR Design Summary

Parameter	Design
Bioselector No. chambers	1
Bioselector width	0.5 m
Bioselector length	2.5 m
Total bioselector vol	0.5 m3
Bioselector overflow baffles	2.5 m
Bioreactor basins	1 anoxic 1 aerobic
Maximum Top Water Level	3.8 m
Minimum Bottom Water Level	2.8 m
Basin Width	5 m anoxic 9 m aerobic
Bioreactor Basin volume (both)	60m3 anoxic 110 m3 aerobic
Membrane tank recycle rate	30 L/sec
MBR chambers	3
No. Membrane cassettes	3
SRT	

$$\mu_{AOB} = \mu_{maxAOB}\left[\frac{S_{NH_4}}{S_{NH_4}+K_{NH_4}}\right]\left[\frac{S_o}{S_o+K_{o,AOB}}\right]-b_{AOB}$$

Table 3 : Treated Effluent Quality Requirements

Parameter	90%ile
Turbidity (NTU)	<2 *(100%ile)*
pH	6.5 – 8.0
Colour (Hazen units)	<15
BOD_5 (mg/L)	<10
TSS (mg/L)	<5
Total Nitrogen (mg/L)	10
Ammonia (mg/L)	<1.0
Total Phosphorus (mg/L)	<1.0
Oil and Grease (mg/L)	<1
Faecal coliforms	<10 per 100 mL
Free Chlorine	0.2 ppm summer 0.0 ppm winter

$$S = \frac{K_s[1 + b_H(SRT)]}{[SRT(\mu_m - b_H) - 1]}$$

$$P_{X,bio,VSS} = \frac{QY_H(S_o - S)}{1 + b_H(SRT)} + \frac{(f_d)(b_H)QY_H(S_o - S)SRT}{1 + b_H(SRT)} + \frac{QY_n(NO_X)}{1 + b_{AOB}(SRT)}$$

59	Fraction active mass to TSS		-	0.291310618		=Px,b/Px,TSS
60	Active mass in anoxic	X_b	mg/L	2330.484946		
61						
62	Required effluent Nitrate concentration	Ne	mg/L	10		[3]TN 10mg/L effluent limit, assume NO3-N 6mg/L
63	Required recycle rate for denitrification	RQ+IRQ	m3/hr	63.33404764		=Q*[N/Ne-1]
64	amount of NO3-N fed to anoxic tank	NOx feed	kg/d	15.20017143		
65	Anoxic zone volume	V_{anoxic}	m3	140		start with 1/3 aerobic volume, check
66	Food mass ratio	F/M_b	g/(g*d)	0.429095241	0.15-0.50	
67						
68						
69						
70	**Determine SDNR**					
71	if % rbCOD =10%					
72		SDNRb		0.120006043		[2]Eq. 8-56, Table 8-22
73	if % rbCOD =50%					
74		SDNRb		0.132935627		[2]Eq. 8-56, Table 8-22
75	Assume rbCOD 10%					
76						
77	Temperature adjusted SDNRb			0.092838797		= SDNRb*$(1.026)^{(Tmin-20)}$, [2]
78	Recycle rate adjusted SDNRb			0.105375012		[2] EQ 8-60
79						
80	overall SDNR based on MLVSS		g NO3-N/g I	0.054150621		=SDNRb(MLVSSb/MLVSS),[2]
81						
82	nitrate reduction capactiy	NOr	kg/d	17.66760895		$=V_{anoxic}$*SDNR*Xb
83						
84	**Compare with NOx feed**					
85	amount of NO3-N fed to anoxic tank	NOx feed	kg/d	15.20017143		(copy from above)
86						
87						
88						
89						
90	**Check alkalinity**					
91	influent alkalinity		mg/L as Ca(	250		[1]Table 2 median, **need minimum**
92	alkalinity used		mg/L as Ca(	342.7230601		=(7.14 g CaCO3/g NH4-N)*Nox [2]
93	alkalinity produced		mg/L as Ca(	135.66153		=(3.57 g CaCO3/g NOx)*(Nox-Ne) [2]
94						
95	**Alkalinity to be added**		mg/L as Ca(	27.06153005		**~70mg/L alkalinity required for pH stability**
96	**Mass of alkalinity needed**		kg/d	10.82461202		=Q*alkalinity to be added
97						
98						
99	**Aeration**					
100	Biomass production, heterotrophs only	$P_{X,bio}$,VSS	kg_{VSS}/d	52.3824867		[2] Eq. 8-20
101	Oxygen without denitrification		kg/h	9.883482859		
102	Oxygen credit for denitrification		kg/h	1.811353763		
103	Net oxygen required	Ro	kg/h	8.072129096		
104						
105	Average diffuser submergence depth	Df	m	3.5		4m deep tank assumed 0.5m freeboard
106	diffuser fouling factor	F	-	0.9		[1] Table 8
107	alpha	α	-	0.45		[1]1.6.3
108	beta	β	-	0.95		[1]1.6.3
109	saturated DO @sea level & 20°C diffused aeration	$C^*_{\infty,20}$	mg/L	10.49793804		[2]US EPA, see image:
110	altitude		m AHD	160		maps, note. [1] assumed 100m
111	Altitude pressure correction	Pb/Pa	-	0.99820983		[2]Appendix B
112	Standard Oxygen Transfer Rate	SOTR	kg/h	33.34158304		[2] see image:
113	Peaking factor		-	2		[1]1.6.3
114	SOTE per depth		%/m	6.2		**Assumed, need data from EDI**
115	Standard Oxygen Transfer Efficiency	SOTE	%	21.7		
116	Required oxygen supply rate		kg/h	307.2956963		=SOTR*F/SOTE
117	Biological Blower capacity required	Q_N	Nm3/h	1027.669189		
118	Summer air temperature		°C	50		based on sydney water spec M31.1
119						
120	Diffuser pressure loss		kPa	6		**Assumed, need data from EDI**
121	Pipework pressure loss		kPa	2		2 kPa max per sydney water spec M30.2.1
122	Hydrostatic pressure		kPa	36.05175		
123	Blower outlet pressure required		kPa	48.456925		minimum
124	biology blower approximate power required		kW	20.5		based on isentropic efficiency 70%, $= C_p\left[\left(\frac{P_2}{P_a}\right)^{\frac{\gamma-1}{\gamma}} * T_1 - T_1\right] * 1/\eta_{IS} * \rho_N * \frac{Q_N}{3600}$
125						
126	Membrane aeration peak		m3/h/row	4.3		[3] Low flux mode
127	number of rows		-	48		3* LE-16 (16 rows)
128	Membrane Air scour required	Q_N	Nm3/h	206.4		
129	Blower outlet pressure required		kPa	36		[3] 33kPa +2kPa distribution
130	air scour blower approximate power required		kW	3.170257688		

$$\text{IR} = 2 \qquad \text{SDNR}_{adj} = \text{SDNR}_{IR1} - 0.0166\ln(\text{F/M}_b) - 0.078 \qquad (8\text{–}59)$$

$$\text{IR} = 3\text{–}4 \qquad \text{SDNR}_{adj} = \text{SDNR}_{IR1} - 0.029\ln(\text{F/M}_b) - 0.012 \qquad (8\text{–}60)$$

where SDNR_{adj} = SDNR adjusted for the effect of internal recycle
SDNR_{IR1} = SDNR value at internal recycle ratio = 1
F/M_b = BOD F/M ratio based on anoxic zone volume and active biomass concentration, g/g·d

$$C^*_{\infty,20} = C^*_{S20}\left[1 + d_e\left(\frac{D_f}{P_a}\right)\right]$$

P_a = standard pressure at sea level, (760 mm) (10.33 m)
P_b = pressure at the plant site based on elevation, m
D_f = depth of diffusers in basin, m or ft
C = operating DO in basin, mg/L
T = aeration basin temperature, °C
d_e = mid-depth correction factor; may vary from 0.25–0.45 (0.40)

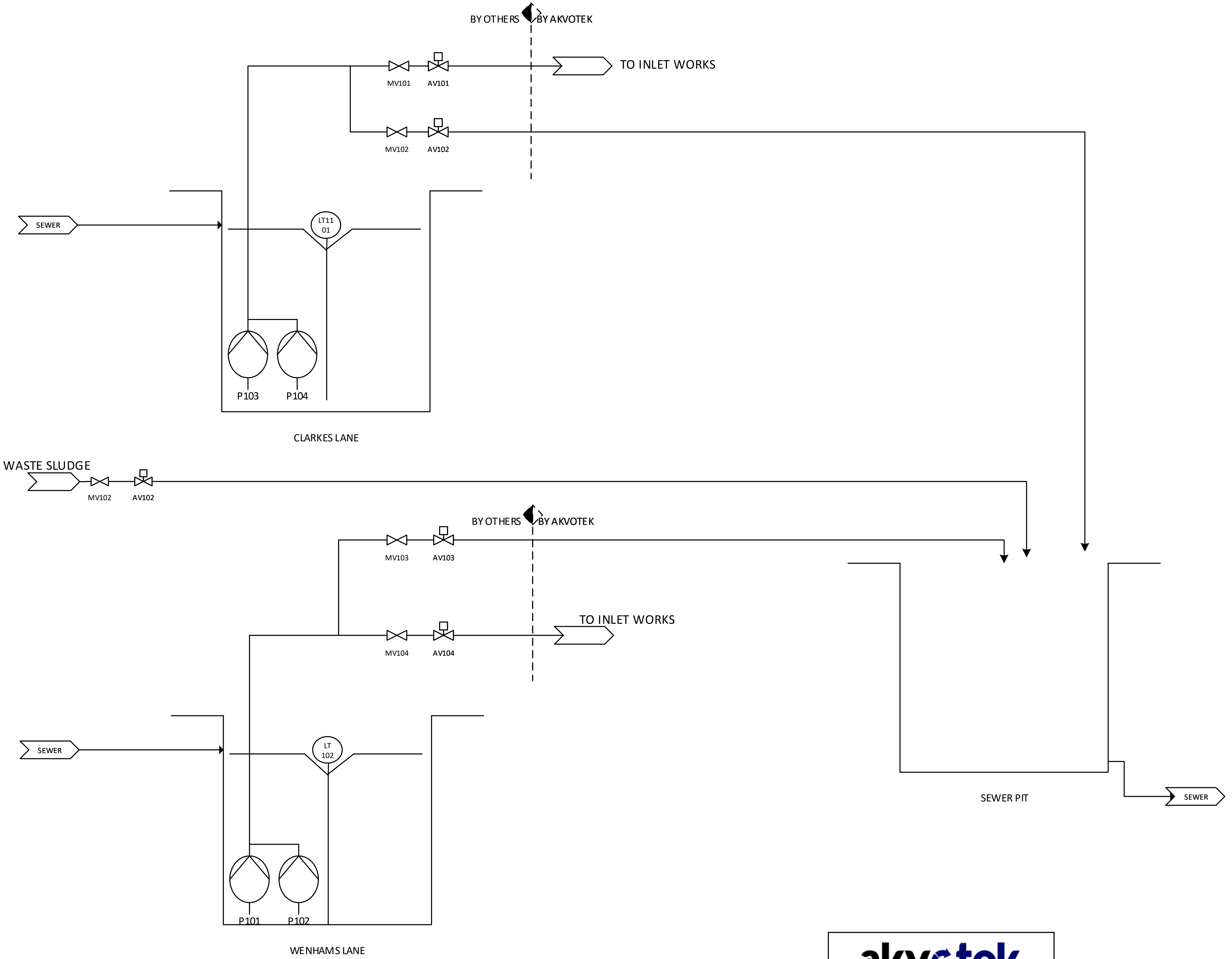
Table 8: Summary of Aeration Design Verification

Parameter	Value
No. bioreactor aeration blowers	1 duty, 1 standby
Peak diurnal airflow estimated	312 Nm^3/hr
Each bioreactor blower maximum capacity required	300 Nm^3/hr (intake) @ 60 kPa relief pressure
Blower turn-down	To at least 40% of maximum via VSD
No. EDI Minipanel diffusers per basin	10 duplexes
No. drop-legs	2 (removable laterals)

$$\text{SOTR} = \left(\frac{\text{OTR}_f}{\alpha F}\right)\left\{\frac{C^*_{\infty 20}}{\left[\beta\frac{C^*_{st}}{C^*_{s20}}\left(\frac{P_b}{P_a}\right)(C^*_{\infty 20}) - C_L\right]}\right\}(1.024^{20-T})$$

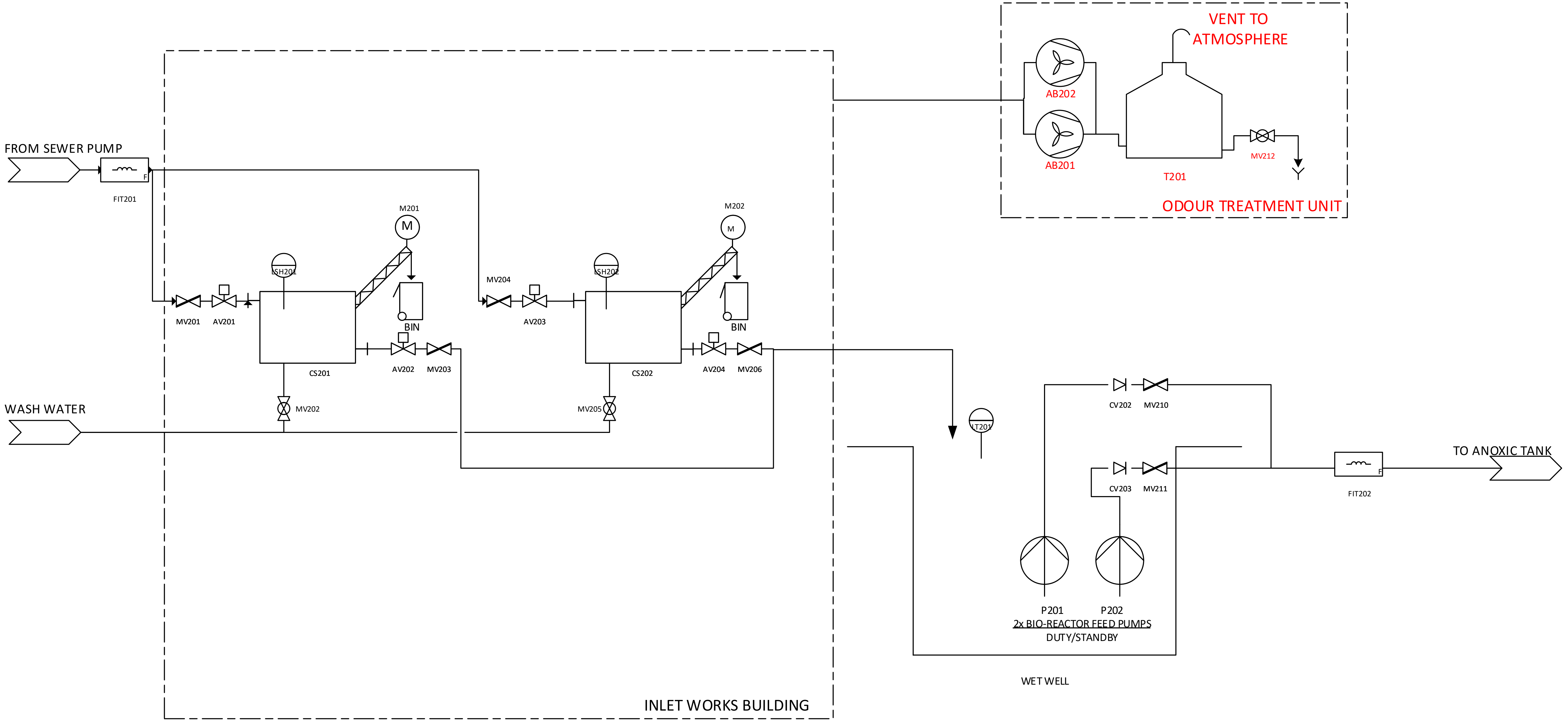
REFERENCES

1. CLARKES LANE MBR SEWAGE TREATMENT PLANT ASSESSMENT. Rev. B 15/12/22 AKVOTEK
2. Wastewater Engineering 5th ed. Metcalf & Eddy



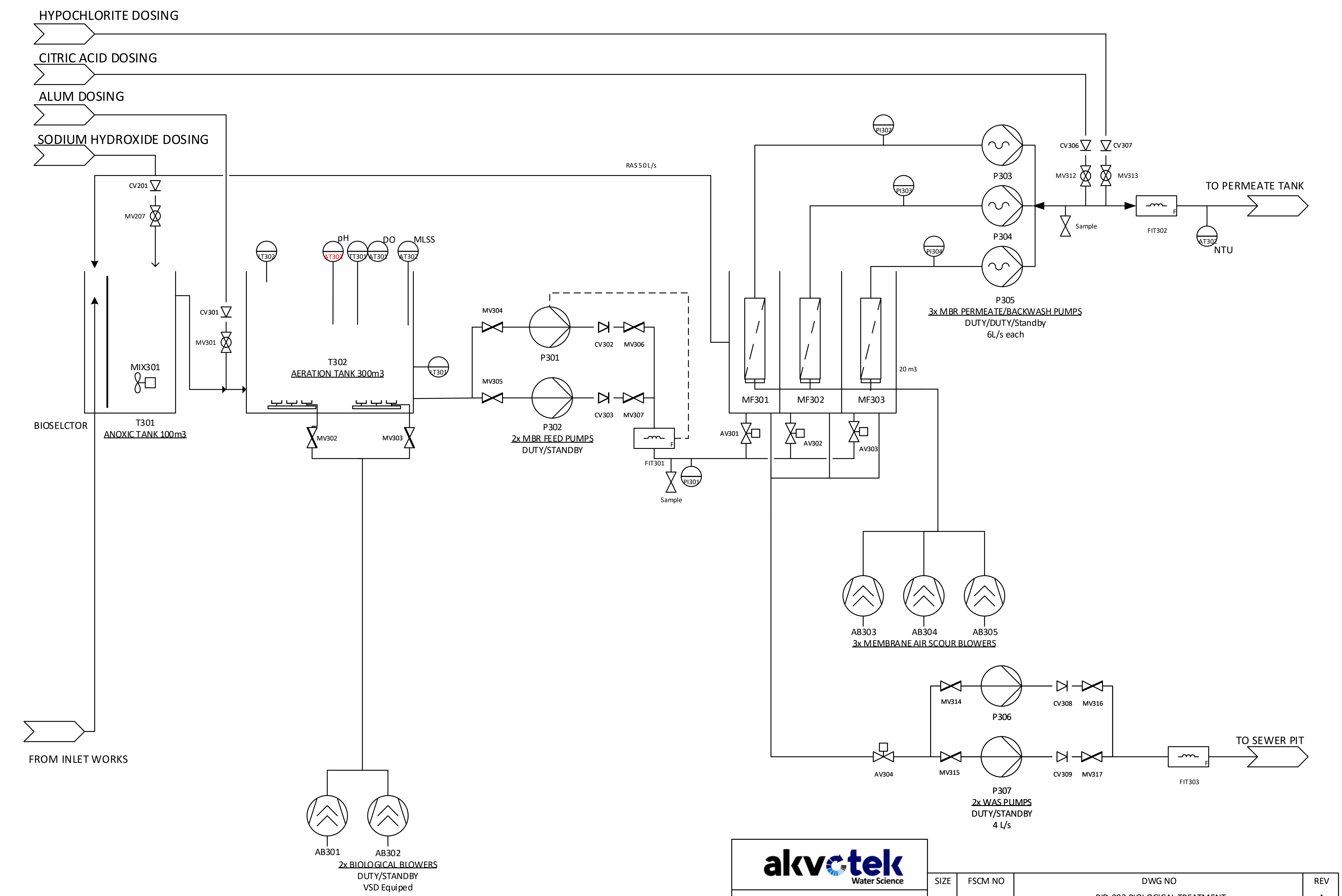
akvotek Water Science

DRAWN	HAMISH YOUNG	SIZE	FSCM NO	DWG NO	-PID-001 SEWER PIT	REV A
ISSUED	25/06/2024	SCALE	NTS		SHEET	1 OF 5



akvotek Water Science

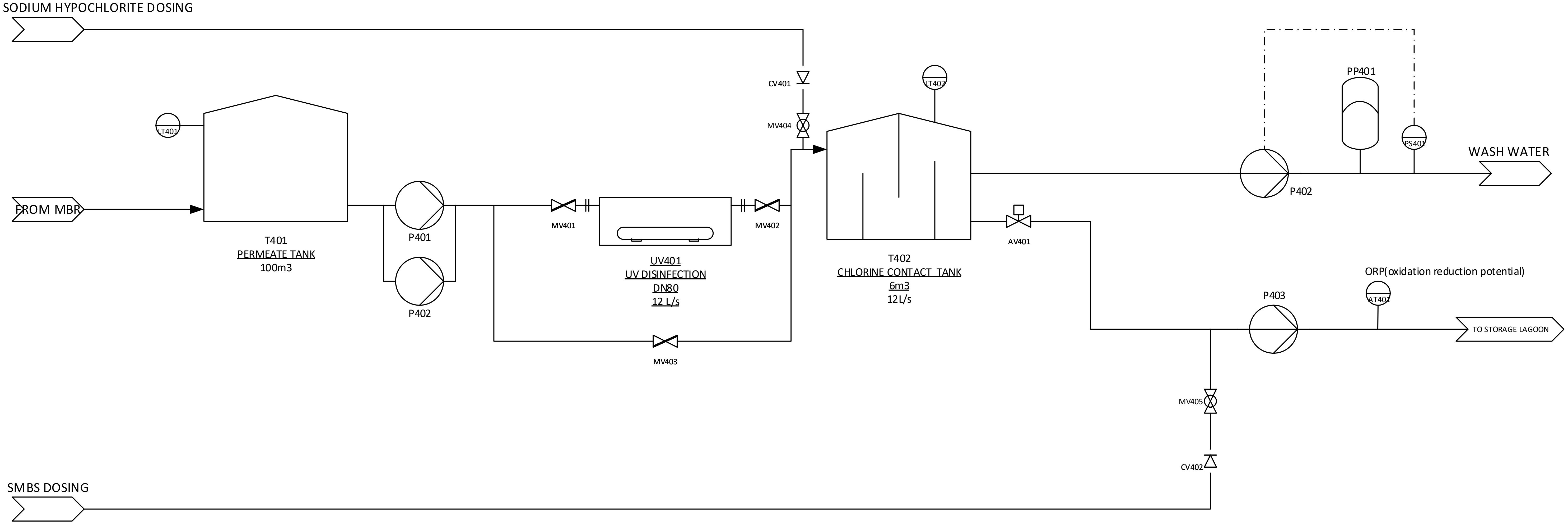
DRAWN	HAMISH YOUNG	SIZE	FSCM NO	DWG NO -PID-002 INLET WORKS	REV A
ISSUED	25/06/2024	SCALE	NTS	SHEET	2 OF 5



akvotek Water Science

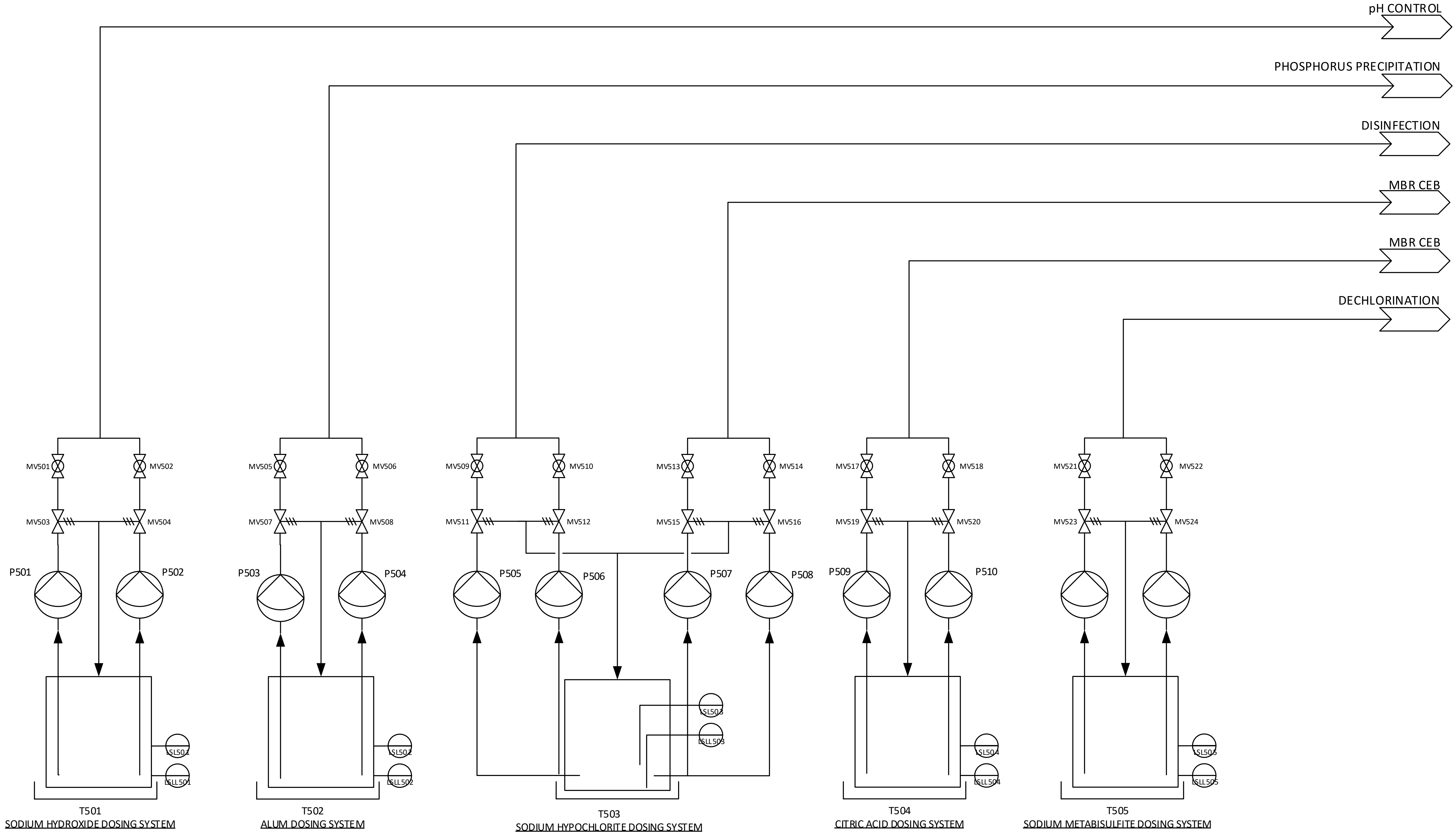
SIZE	FSCM NO	DWG NO	REV
		-PID-003 BIOLOGICAL TREATMENT	A

DRAWN	HAMISH YOUNG				
ISSUED	25/06/2024	SCALE	NTS	SHEET	3 OF 5



akvotek Water Science

DRAWN	HAMISH YOUNG	SIZE	FSCM NO	DWG NO -PID-004 TERTIARY TREATMENT	REV A
ISSUED	25/06/2024	SCALE	NTS	SHEET	4 OF 5



akvotek Water Science

		SIZE	FSCM NO	DWG NO		REV
				-PID-005 CHEMICAL DOSING		A
DRAWN	HAMISH YOUNG					
ISSUED	25/06/2024	SCALE	NTS		SHEET	5 OF 5

akvotek Water Science

Equipment list

Project Name:	Clarks Lane MBR	**Revision**		**Created:**	RN	**Checked:**	
Location:	Wangaratta, VIC	**Reference P&ID:**		**Date:**	12/9/2023	**Date:**	

NOTE: GREY = CONTRACTOR SCOPE

MAJOR EQUIPMENT

Item	Tag No.	Description	Quantity	Manufacturer	Model	Material (Wetted)	Power (kW)	Physical Size (m)
1	CS201	Capacity screen	2	CSL Wastewater solution	SFC/T	316 SS		
2	CS202							
3	MF301	Microfiltration membrane unit	3	Kovalus	Pulsion LE16 membrane modules			
4	MF302							
5	MF303							
6	UV401	UV light disinfection		UV Guard	S440			

PUMPS

Item	Tag No.	Description	Manufacturer	Model	Duty	Material (Wetted)	Power (kW)	Voltage	VSD/DOL	
1	P101	Feed pump from sewer tank								
2	P201	Bioreactor feed pump standby	EBARA	80 DF 51.5	12L/s @ 5m	316SS	1.2	415	VSD	
3	P202	Bioreactor feed pump	EBARA	80 DF 51.5	12L/s @ 5m	316SS	1.2	415	VSD	
4	P301	MBR feed pump standby	EBARA	GSO	48 L/s @ 1m	316SS	5.5	415	VSD	
5	P302	MBR feed pump	EBARA	GSO	48 L/s @ 1m	316SS	5.5			
6	P303	MBR permeate pump for MF301	Volesang		6.148 l/s / 5.25 m	316SS	0.55			**Double direction** pump
7	P304	MBR permeate pump for MF302	Volesang		6.148 l/s / 5.25 m	316SS	0.55			
8	P305	MBR permeate pump for MF303	Volesang		6.148 l/s / 5.25 m	316SS	0.55			**Progessing cavity** pump
9	P306	Waste discharge pump standby	Mono		4 l/s / 7 m	316SS	0.55			
10	P307	Waste discharge pump	Mono		4 l/s / 7 m	316SS	0.55			
13	P401	Permeate feed to UV401	EBARA	3M4 65-160/2.2	10.04 l/s / 10.08 m	316SS	2.2			
14	P402	Washwater feed pump	Davey							
15	P403	Recycled water feed pump to storage lagoon								
16	PP401	Pressure pump								
17	P501	Dosing pump for T501	Trility	Granfos DDA						
18	P502	Stantby dosing pump for T501	Trility	Granfos DDA						
19	P503	Dosing pump for T502	Trility	Granfos DDA						
20	P504	Stantby dosing pump for T502	Trility	Granfos DDA						
21	P505	Dosing pump for T503 (To UV Disinfection)	Trility	Granfos DDA						
22	P506	Stantby dosing pump for T503 (To UV Disinfection)	Trility	Granfos DDA						
23	P507	Dosing pump for T503 (To MBR CEB)	Trility	Granfos DDA						
24	P508	Stantby dosing pump for T503 (To MBR CEB)	Trility	Granfos DDA						
25	P509	Dosing pump for T504	Trility	Granfos DDA						
26	P510	Stantby dosing pump for T504	Trility	Granfos DDA						
27	P511	Dosing pump for T505	Trility	Granfos DDA						
28	P512	Stantby dosing pump for T505	Trility	Granfos DDA						

TANKS

Item	Tag No.	Description	Manufacturer	Model	Capacity (kL)	Material (Wetted)	Physical Size (m)			
1	T201	Odour control tank	**Aquatec**							
2	T301	Anoxic tank (MBR)	**Kingspan**		100	Glass fused steel				
3	T302	Aeration tank (MBR)	**Kingspan**		200	Glass fused steel				
4	T401	Permeate tank			30	PE				170
5	T402	Chlorine contact tank			150	PE				
6	T501	Sodium hydroxide tank	Trility		1	bunded PE				
7	T502	Alum tank	Trility		1	bunded PE				
8	T503	Sodium hypochlorite tank	Trility		1	bunded PE				
9	T504	Critic acid tank	Trility		1	bunded PE				

INSTRUMENTS

Item	Tag No.	Description	Manufacturer	Model	Power Supply	Output	Material (Wetted)	Range	Process Connection
1	LSH201	Level switch high for CS201	Endress & Hauser	Ultrasonic					
2	LSH202	Level switch high for CS202	Endress & Hauser	Ultrasonic					
3	PI201	Pressure indicator for wastewater feed to MBR	Endress & Hauser						
4	TT301	Temperature transmitter for T302	Endress & Hauser						
5	AT301	Analysis transmitter for dissolve oxygen for T302	Hach						
6	AT302	Analysis transmitter for Mixed liquor suspended solid for T302	Endress & Hauser						
7	LT301	Level transmitter for T302	Endress & Hauser						
8	PI301	Pressue indicator for MBR feed to MF unit	Endress & Hauser						
9	PI302	Peessure indicator for waste outlet to sewer pit	Endress & Hauser						
10	FIT301	Flow indicator transmitter for permeate	Endress & Hauser	Magflow					
11	FIT302	Flow indicator transmitter for waste outlet	Endress & Hauser	Magflow					
12	LT401	Level transmitter for T401	Endress & Hauser						
13	LT402	Level transmitter for T402	Endress & Hauser						

14	LT403	Level transmitter for T403	Endress & Hauser						
15	PS401	Pressure switch for P402	Endress & Hauser						
16	AT401	Analysis transmitter for oxidation reducion potential for recycle water	Hach						
17	LSL501	Level switch low for T 501	Endress & Hauser						
18	LSL502	Level switch low for T 502	Endress & Hauser						
19	LSL503	Level switch low for T 503	Endress & Hauser						
20	LSL504	Level switch low for T 504	Endress & Hauser						
21	LSL505	Level switch low for T 505	Endress & Hauser						
22	LSLL501	Level switch low-low for T 501	Endress & Hauser						
23	LSLL502	Level switch low-low for T 502	Endress & Hauser						
24	LSLL503	Level switch low-low for T 503	Endress & Hauser						
25	LSLL504	Level switch low-low for T 504	Endress & Hauser						
26	LSLL505	Level switch low-low for T 505	Endress & Hauser						

VALVES

Item	Tag No.	Description	Manufacturer	Type	Actuation	Material (Wetted)	Pressure rating (bar)	Process Connection
1	MV101	Sewer outlet valve (for isolation)			Manual	UPVC	16	
2	AV101	Sewer outlet valve			Pneumatic	UPVC	16	
3	MV102	Waste sludge inlet valve (for isolation)			Manual	UPVC	16	
4	AV102	Waste sludge inlet valve			Pneumatic	UPVC	16	
5	MV201	Sewer inlet to CS201 (for isolation)		Ball	Manual	UPVC	16	
6	AV201	Sewer inlet to CS 201		Ball	Pneumatic	UPVC	16	
7	MV202	Wash water inlet to CS201		Ball	Manual	UPVC	16	
8	MV203	CS201 outlet (for isolation)		Ball	Manual	UPVC	16	
9	AV202	CS201 outlet		Ball	Pneumatic	UPVC	16	
10	MV204	Sewer inlet to CS202 (for isolation)		Ball	Manual	UPVC	16	
11	AV203	Sewer inlet to CS 202		Ball	Pneumatic	UPVC	16	
12	MV205	Wash water inlet to CS202		Ball	Manual	UPVC	16	
13	MV206	CS202 outlet		Ball	Manual	UPVC	16	
14	AV204	CS202 outlet (for isolation)		Ball	Pneumatic	UPVC	16	
15	CV201	Check valve for Sodium hydroxide dosing		Check	Manual	UPVC	16	
16	MV207	Sodium hydroxide dosing valve		Ball	Pneumatic	UPVC	16	
17	MV208	Standby feed valve for P201		Ball	Manual	UPVC	16	
18	CV202	Standby check valve for P201		Check	Manual	UPVC	16	
19	MV210	Standby outlet valve for P201		Butterfly	Manual	UPVC	16	
20	MV209	Feed valve for P202		Ball	Manual	UPVC	16	
21	CV203	Check valve for P202		Check	Manual	UPVC	16	
22	MV211	Outlet valve for P201		Butterfly	Manual	UPVC	16	
23	MV212	Odour treatment outlet valve		Ball	Pneumatic	UPVC	16	
24	CV301	Check valve for Alum dosing		Check	Manual	UPVC	16	
25	MV301	Alum dosing valve		Ball	Pneumatic	UPVC	16	
26	MV302	Air aeration inlet valve 1		Manual	Manual	UPVC	16	
27	MV303	Air aeration inlet valve 2		Manual	Manual	UPVC	16	
28	MV304	Standby MBR feed inlet to P301		Manual	Manual	UPVC	16	
29	MV305	MRB feed inlet to P302		Manual	Manual	UPVC	16	
30	CV302	Standby check valve for P301		Check	Manual	UPVC	16	
31	CV303	Check valve for P302		Check	Manual	UPVC	16	
32	MV306	Standby outlet valve for P301		Manual	Manual	UPVC	16	
33	MV307	Outlet valve for P302		Manual	Manual	UPVC	16	
34	AV301	Feed valve for MF301		Pneumatic	Pneumatic	UPVC	16	
35	AV302	Feed valve for MF302		Pneumatic	Pneumatic	UPVC	16	
36	AV303	Feed valve for MF303		Pneumatic	Pneumatic	UPVC	16	
37	CV304	Check valve for Citric acid dosing		Check	Manual	UPVC	16	
38	CV305	Check valve for hypochlorite dosing		Check	Manual	UPVC	16	
39	MV308	Citric dosing valve		Ball	Pneumatic	UPVC	16	
40	MV309	Hychloride dosing valve		Ball	Pneumatic	UPVC	16	
41	AV304	Waste valve from MF301, MF302 and MF303		Pneumatic	Pneumatic	UPVC	16	
42	MV310	Standby waste inlet valve for P306		Manual	Manual	UPVC	16	
43	MV311	Waste inlet valve for P307		Manual	Manual	UPVC	16	
44	CV306	Standby check valve for P306		Check	Manual	UPVC	16	
45	CV307	Check valve for P 307		Check	Manual	UPVC	16	
46	MV312	Standby waste outlet valve for P306		Manual	Manual	UPVC	16	
47	MV313	Waste outlet valve for P307		Manual	Manual	UPVC	16	
48	MV401	Feed valve for UV401		Manual	Manual	UPVC	16	
49	MV402	Outlet valve for UV401		Manual	Manual	UPVC	16	
50	MV403	Standby valve for UV401		Manual	Manual	UPVC	16	
51	MV404	Sodium hydroxide dosing valve		Manual	Manual	UPVC	16	
52	MV405	SMBS dosing valve		Manual	Manual	UPVC	16	
53	CV401	Check valve for Sodium hydroxide dosing		Check	Manual	UPVC	16	
54	CV402	Check valve for SMBS dosing		Check	Manual	UPVC	16	

55	AV401	Discharge valve from T402 to T403		Pneumatic	Pneumatic	UPVC	16	
56	MV501	Dosing valve for T501	Trility					
57	MV502	Standby dosing valve for T501	Trility					
58	MV503	Isolation valve for T501	Trility					
59	MV504	Standby Isolation valve for T501	Trility					
60	MV505	Dosing valve for T502	Trility					
61	MV506	Standby dosing valve for T502	Trility					
62	MV507	Isolation valve for T502	Trility					
63	MV508	Standby Isolation valve for T502	Trility					
64	MV509	Dosing valve for T503 (For UV disinfection)	Trility					
65	MV510	Standby dosing valve for T503 (For UV disinfection)	Trility					
66	MV511	Isolation valve for T503 (For UV disinfection)	Trility					
67	MV512	Standby Isolation valve for T503 (For UV disinfection)	Trility					
68	MV513	Dosing valve for T503 (For MBR CEB)	Trility					
69	MV514	Standby dosing valve for T503 (For MBR CEB)	Trility					
70	MV515	Isolation valve for T503 (For MBR CEB)	Trility					
71	MV516	Standby Isolation valve for T503 (For MBR CEB)	Trility					
72	MV517	Dosing valve for T504	Trility					
73	MV518	Standby dosing valve for T504	Trility					
74	MV519	Isolation valve for T504	Trility					
75	MV520	Standby Isolation valve for T504	Trility					
76	MV521	Dosing valve for T505	Trility					
77	MV522	Standby dosing valve for T505	Trility					
78	MV523	Isolation valve for T505	Trility					
79	MV524	Standby Isolation valve for T505	Trility					

OTHERS

Item	Tag No.	Description	Quantity	Manufacturer	Type	Material (Wetted)		
1	AB201	Air blower for odour control	2	Aquatec	Fan			
2	AB202							
3	AB301	Biological blowers for MBR	2	Atlas Copco	PD, Root-type blower			
4	AB302							
5	AB303	Air scour blowers	3	Esam	Side Channe			
6	AB304							

Beyond Scope