ONSITE WASTEWATER MANAGEMENT PLAN

Addendum 1

Lot 1 DP 109606

Princes Highway, Frogs Hollow

26 April 2018

Prepared for:

Sport Aviation Australia

P.O. Box 752

NSW 2548

Prepared by:

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APPENDICIES

1.0 GENERAL

The intent of this addendum is to address comments by Bega Valley Shire Council (BVSC) in their letter dated 12 January 2018 regarding the proposed On Site Sewage Management system.

This addendum to the On Site Wastewater Management Plan will show that a number of disposal options are available in addition to using the just the runway area and by implementing one or a combination of disposal options that the peak occupancy treated effluent flows can be accommodated on site.

As an alternative to the initial proposal the effluent flows have been divided in to three separate unit flows (i.e. squadron compounds, common building and hangar and maintenance buildings). Effluent from each of these areas would be treated and disinfected to an advanced secondary standard.

BVSC has indicted that they are concerned with using the touch down areas of the runway for effluent disposal. Consequently the reliance on the touch down areas has been reduced by the addition of landscaped and trench irrigation disposal options. However irrigation of the runway using treated effluent remains a valid effluent disposal.

As requested by BVSC separate nutrient and water balances have been prepared for each of the proposed disposal categories. In addition the application of grease traps as an integrated part of the Ossi Kleen treatment plant has also been addressed.

Recycle of treated water for toilet flushing has also been proposed which reduces the total flow requiring disposal.

2.0 DESIGN FLOW

Design waste water flows have been determined based on building use and population. Three categories of use have been identified.

- Squadron units (10 total) are each composed of 36 accommodation units, three classrooms and a laundry.
- The Main Building includes administrative offices, dining area, kitchen and toilets.
- Hangar and maintenance buildings are located on the eastern side of the air field and include 12 buildings which have toilets and hand basins.

The waste water quantities for the above categories have been estimated as summarised in **Table 1**.

Table 1 also shows a recycle component of the total treated waste water flow which represents the WC component which would be recycled for toilet flushing rather than disposed of using the onsite disposal systems.

Table 1 Waste Water Quantities			
Squadron Compound per Compound			
	Q (l/p/d)	**Persons**	**Qt (l/d)**
Hb	10	36	360
shwr	50	36	1800
wc	13.5	36	486
Laundry	30	36	1080
Total			3726
Recycle	50	36	1800
Disposal			1926
Main Building			
HB	10	560	5600
WC	13.5	560	7560
Kitchen	10	560	5600
Total			18760
Recycle	13.5	560	7560
Disposal			11200
Hangar & Maintenance Buildings per building			
HB	10	52	520
WC	9	52	468
Total			988
Recycle	9	52	468
Disposal			520

l/p/d= litre per person per day, l/d= litre per day.

3.0 LAND AREA REQUIREMENTS

Category 4b soils with a design irrigation rate of 3.5 mm/day for irrigation and 6 mm/day for trench loading are listed in AS 1547 Table 5.2 and have been used to estimate required land areas. Recent assessment of site soils suggests that soils in the area of the proposed disposal trenches may be more accurately characterised as a Category 3 loam or sandy loam however Category 4b permeability's have been used as a conservative maximum.

Based on the above quantities the area required for disposal for trench adsorption, sub surface drip irrigation and surface spray irrigation have been determined using the nominated area method. Sample calculations for each option are provided as an attachment. **Table 2** summarises the water balance results.

Three methods of effluent disposal are possible including:

- surface spray irrigation of the grass covered air strip;
- subsurface irrigation of landscaped areas;
- and infiltration disposal in absorption trenches.

Each of the above methods of disposal may be implemented individually or in combination to provide for disposal of all treated effluent on site.

Table 2- Water Balance Results

		Disposal Area Required		
Flow (l/d)	**Use**	**Trench**	**Subsurface Drip**	**Surface Spray**
1926 per squadron compound	Squadron Compound	515	1550	1550
11200	Main Building	3000	9000	9000
520/hangar	Hangars	138	420	420

Based on the information summarised in **Table 2** a minimum of 1550 square meters of landscaping area would be required per squadron compound to dispose of treated waste water using a combination of subsurface drip irrigation in the landscaped areas around each squadron block and the runway surface.

9000 square meters of landscaped area would be required for disposal of treated waste water from the main building using a combination of subsurface drip irrigation in the landscaped borders adjacent to road ways as well as the runway surface.

3000 square meters of adsorption trench would be required for disposal of treated wastewater from the common building. The proposed absorption area is shown in **Figure 1**.

The area of the runway available for surface spray irrigation has been revised to include a total of 6.8 Ha in order to reduce the impact of irrigation on the touch down areas of the runway. The 6.8 Ha area excludes 200 m at each end of the north south runway and 100 m at the western end of the east west runway. The revised area for surface spray irrigation is shown in **Figure 1**.

Disposal of treated waste water from the hangar and maintenance buildings would require a total of 5040 square meters for surface spray irrigation or subsurface drip irrigation. Surface spray irrigation would utilise available area of the air strip. Subsurface drip irrigation would utilise the landscaped areas adjacent to the roads on the eastern side of the air strip and around the hangars and maintenance building as shown in **Figure 1**.

A trench absorption area comprising 1608 square meters has also been nominated for as an alternative for the 12 hangar buildings. The proposed trench absorption area is shown in **Figure 1**.

4.0 NUTRIENT BALANCE

A nutrient balance has been prepared which indicates the required area for the uptake of nitrogen and phosphorous for each of the above use categories. AS 1547 and the Sydney Catchment Authority publication do not specifically address the land area required for nutrient absorption for trench disposal, however a nutrient balance is required for irrigation areas.

Table 3 Summarises the required area for nutrient uptake.

Table 3- Nutrient Balance Results			
		Disposal area required	
Flow (l/p/d)	**Use**	**Nitrogen (m^2)**	**Phosphorous (m^2)**
1926/squadron compound	Squadron	770	1005
11200 total	Common	4480	5848
520/hangar	Hangar	208	272

From the nutrient balance results summarised in **Table 3** the area required for nutrient absorption is not limiting in comparison to the area required for irrigation therefore, the disposal areas determined based on the water balance would be appropriate for disposal.

5.0 SETBACK ANALYSIS

Setbacks used to offset disposal areas from surface waters were addressed in the Onsite Waste Water Management Plan, Dated 27 December 2017. A conservative off set of 100m was specified to surface waters and the surface spray irrigation areas proposed for the runway corridor were well within the 100 m setback.

Modifications to the plan for land disposal addressed above include the addition of subsurface irrigation in landscaped areas as well as subsurface trench absorption areas as alternatives to relying on the runway area as the only option for surface spray irrigation disposal.

Setbacks to ephemeral water ways from landscaping that incorporates sub surface drip irrigation, and trench absorption areas as shown in **Figure 1** are in some cases less than 100 m but in all cases greater than 60 m.

AS 1547 allows for setbacks to be determined based on risk, in relation to the quality of effluent. The quality of effluent is determined by the level of treatment where advanced secondary treatment with disinfection is the highest level of treatment achievable using the proposed Ozzi Kleen packaged waste water treatment system. Advanced secondary treatment with disinfection provides additional treatment beyond normal secondary treatment and produces a high quality effluent with a reduced risk of environmental or human health impact.

Because the effluent will be treated to an advanced secondary standard and disinfected and the majority of the proposed disposal areas are well set back from ephemeral surface waters it would be reasonable to adopt 60 m as the minimum setback to ephemeral surface waters.

6.0 GREASE TRAPS

Grease traps are incorporated in the proposed treatment unit (Ozzi Kleen SK25A-G). The proposed unit has a treatment capacity of 6000 l/day, therefore two (2) treatment units or a single treatment unit with a larger capacity than 6000 l/d would be required at peak occupancy to treat waste water from the main building. Two (2) treatment units are shown adjacent to the Main Building in **Figure 1**.

7.0 CONCLUSION

The revisions to the proposed design incorporate options for onsite disposal of treated effluent including surface spray irrigation, subsurface irrigation of landscaped areas and absorption trench disposal.

The proposed Ozzi Kleen SK25A-G packaged waste water treatment plant is capable of treating raw waste water to an advanced secondary standard with disinfection, therefore; the treated effluent is suitable for all of the proposed disposal options with a low risk of both environmental and human health impacts.

Based on the above design revisions it possible utilising a combination of disposal options to effectively dispose of treated effluent on site. The emphasis is on reducing the impact to the runway, however it should be noted that irrigation is necessary for maintaining the grass cover on the runway and that provision would be made for irrigation of the entire runway which would be managed on an as needed basis.

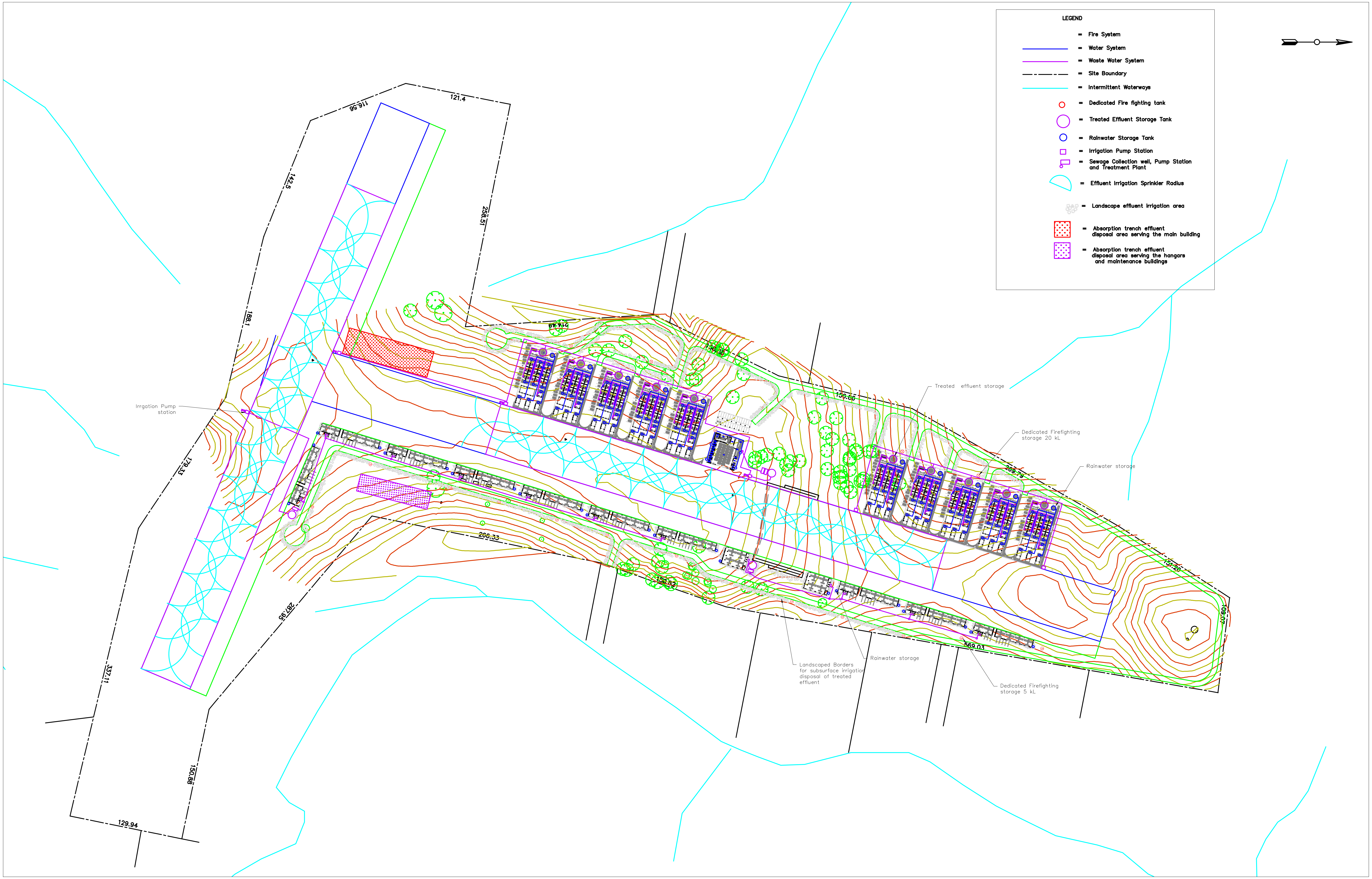
8.0 REPORT LIMITATIONS

This report is based on field observations and information provided in the development plan. The site has been evaluated using commonly accepted environmental engineering practices and standards. To the best of our knowledge these findings represent conditions at the times and places stated. The report should be read in its entirety. Figures and other attachments should not be separated from the report. The findings of this report should not be used to infer conditions for any other time or location except as specifically addressed in the report. Questions regarding this report, its findings or applicability to conditions not specifically addressed in the report should be directed to TEC. This report is intended to be used by the Client and their assigns. No part of this report may be used by any other party for any purpose without the express written permission of the Client and TEC.

Tasman Engineering Consultants

Austin F. Legler, CP. Eng.

Appendix A- Figures



No.	Revision	Drawn	Approved	Date

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Title
Frogs Hollow Flight School
Figure 1- Waste Water Disposal Concept

Client Recreational Aviation Australia

Size A1 | Drg. No. S518 | Sheet of | Rev

Appendix B- Water Balance and Nutrient Absorption Sample Calculations

WATER BALANCE CALCULATIONS - Nominated Area Method

Design Wastewater Flow	Q		L/day	1926
Design Percolation Rate	R		mm/day	3.5
Land Area	L		m^2	1550

Bega AWS Station 069139 Decile 7 Rainfall
Irrigation disposal per squadron compound

Parameter	Symbol	Formula	Units	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Days per Month	D	-	days	31	28	31	30	31	30	31	31	30	31	30	31
Precipitation	P	-	mm/month	61.05	108.4	121.6	49.9	61.45	88.7	57.5	55.3	46	66.25	85.35	107.85
Evaporation	E	-	mm/month	187.5	162.5	125.0	80.0	55.0	35.0	45.0	55.0	75.0	112.5	187.5	175.0
Crop Factor	C	-		0.8	0.8	0.8	0.8	0.7	0.6	0.6	0.6	0.7	0.8	0.8	0.8
Inputs															
Precipitation	P	-	mm/month	61.1	108.4	121.6	49.9	61.5	88.7	57.5	55.3	46.0	66.3	85.4	107.9
appied effluent	W	(QxD)/L	mm/month	38.5	34.8	38.5	37.3	38.5	37.3	38.5	38.5	37.3	38.5	37.3	38.5
Inputs		P+W	mm/month	99.6	143.2	160.1	87.2	100.0	126.0	96.0	93.8	83.3	104.8	122.6	146.4
Outputs															
Evapotranspiration	ET	E x C	mm/month	150.0	130.0	100.0	64.0	38.5	21.0	27.0	33.0	52.5	90.0	150.0	140.0
Percolation	B	RxD	mm/month	108.5	98.0	108.5	105.0	108.5	105.0	108.5	108.5	105.0	108.5	105.0	108.5
Outputs		ET+B	mm/month	258.5	228.0	208.5	169.0	147.0	126.0	135.5	141.5	157.5	198.5	255.0	248.5
Storage	S	(P+W)-(ET+B)	mm/month	-158.9	-84.8	-48	-82	-47	0	-39	-48	-74	-94	-132	-102
Cumulative Storage	M	-	mm	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Storage	V	largest M	mm	0											
		VxL/1000	m^3	0.0											

Notes : No allowance for runoff coefficient in P
No allowance for voids in S

WATER BALANCE CALCULATIONS - Nominated Area Method

Design Wastewater Flow	Q		L/day	11200	Bega AWS Station 069139 Decile 7 Rainfall
Design Percolation Rate	R		mm/day	3.5	Irrigation disposal area required for main building total
Land Area	L		m^2	9000	

Parameter	Symbol	Formula	Units	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Days per Month	D	-	days	31	28	31	30	31	30	31	31	30	31	30	31
Precipitation	P	-	mm/month	61.05	108.4	121.6	49.9	61.45	88.7	57.5	55.3	46	66.25	85.35	107.85
Evaporation	E	-	mm/month	187.5	162.5	125.0	80.0	55.0	35.0	45.0	55.0	75.0	112.5	187.5	175.0
Crop Factor	C	-		0.8	0.8	0.8	0.8	0.7	0.6	0.6	0.6	0.7	0.8	0.8	0.8
Inputs															
Precipitation	P	-	mm/month	61.1	108.4	121.6	49.9	61.5	88.7	57.5	55.3	46.0	66.3	85.4	107.9
appied effluent	W	(QxD)/L	mm/month	38.6	34.8	38.6	37.3	38.6	37.3	38.6	38.6	37.3	38.6	37.3	38.6
Inputs		P+W	mm/month	99.6	143.2	160.2	87.2	100.0	126.0	96.1	93.9	83.3	104.8	122.7	146.4
Outputs															
Evapotranspiration	ET	E x C	mm/month	150.0	130.0	100.0	64.0	38.5	21.0	27.0	33.0	52.5	90.0	150.0	140.0
Percolation	B	RxD	mm/month	108.5	98.0	108.5	105.0	108.5	105.0	108.5	108.5	105.0	108.5	105.0	108.5
Outputs		ET+B	mm/month	258.5	228.0	208.5	169.0	147.0	126.0	135.5	141.5	157.5	198.5	255.0	248.5
Storage	S	(P+W)-(ET+B)	mm/month	-158.9	-84.8	-48	-82	-47	0	-39	-48	-74	-94	-132	-102
Cumulative Storage	M	-	mm	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Storage	V	largest M	mm	0											
		VxL/1000	m^3	0.3											

Notes : No allowance for runoff coefficient in P
No allowance for voids in S

WATER BALANCE CALCULATIONS - Nominated Area Method

Design Wastewater Flow	Q		L/day	11200	Bega AWS Station 069139 Decile 7 Rainfall
Design Percolation Rate	R		mm/day	6	Frogshollow Airstrip
Land Area	L		m^2	3000	Main Building Area Required for Absorption Trench Disposal

Parameter	**Symbol**	**Formula**	**Units**	**Jan.**	**Feb.**	**Mar.**	**Apr.**	**May**	**Jun.**	**Jul.**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**
Days per Month	D	-	days	31	28	31	30	31	30	31	31	30	31	30	31
Precipitation	P	-	mm/month	61.05	108.4	121.6	49.9	61.45	88.7	57.5	55.3	46	66.25	85.35	107.85
Evaporation	E	-	mm/month	187.5	162.5	125.0	80.0	55.0	35.0	45.0	55.0	75.0	112.5	187.5	175.0
Crop Factor	C	-		0.8	0.8	0.8	0.8	0.7	0.6	0.6	0.6	0.7	0.8	0.8	0.8
Inputs															
Precipitation	P	-	mm/month	61.1	108.4	121.6	49.9	61.5	88.7	57.5	55.3	46.0	66.3	85.4	107.9
appied effluent	W	(QxD)/L	mm/month	115.7	104.5	115.7	112.0	115.7	112.0	115.7	115.7	112.0	115.7	112.0	115.7
Inputs		P+W	mm/month	176.8	212.9	237.3	161.9	177.2	200.7	173.2	171.0	158.0	182.0	197.4	223.6
Outputs															
Evapotranspiration	ET	E x C	mm/month	150.0	130.0	100.0	64.0	38.5	21.0	27.0	33.0	52.5	90.0	150.0	140.0
Percolation	B	RxD	mm/month	186.0	168.0	186.0	180.0	186.0	180.0	186.0	186.0	180.0	186.0	180.0	186.0
Outputs		ET+B	mm/month	336.0	298.0	286.0	244.0	224.5	201.0	213.0	219.0	232.5	276.0	330.0	326.0
Storage	S	(P+W)-(ET+B)	mm/month	-159.2	-85.1	-49	-82	-47	0	-40	-48	-75	-94	-133	-102
Cumulative Storage	M	-	mm	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Storage	V	largest M	mm	0											
		VxL/1000	m^3	0.0											

Notes : No allowance for runoff coefficient in P
No allowance for voids in S

WATER BALANCE CALCULATIONS - Nominated Area Method

Design Wastewater Flow	Q		L/day	520	Bega AWS Station 069139 Decile 7 Rainfall
Design Percolation Rate	R		mm/day	3.5	Irrigation disposal area per building
Land Area	L		m^2	420	Hangars and maintenance buildings

Parameter	**Symbol**	**Formula**	**Units**	**Jan.**	**Feb.**	**Mar.**	**Apr.**	**May**	**Jun.**	**Jul.**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**
Days per Month	D	-	days	31	28	31	30	31	30	31	31	30	31	30	31
Precipitation	P	-	mm/month	61.05	108.4	121.6	49.9	61.45	88.7	57.5	55.3	46	66.25	85.35	107.85
Evaporation	E	-	mm/month	187.5	162.5	125.0	80.0	55.0	35.0	45.0	55.0	75.0	112.5	187.5	175.0
Crop Factor	C	-		0.8	0.8	0.8	0.8	0.7	0.6	0.6	0.6	0.7	0.8	0.8	0.8
Inputs															
Precipitation	P	-	mm/month	61.1	108.4	121.6	49.9	61.5	88.7	57.5	55.3	46.0	66.3	85.4	107.9
appied effluent	W	(QxD)/L	mm/month	38.4	34.7	38.4	37.1	38.4	37.1	38.4	38.4	37.1	38.4	37.1	38.4
Inputs		P+W	mm/month	99.4	143.1	160.0	87.0	99.8	125.8	95.9	93.7	83.1	104.6	122.5	146.2
Outputs															
Evapotranspiration	ET	E x C	mm/month	150.0	130.0	100.0	64.0	38.5	21.0	27.0	33.0	52.5	90.0	150.0	140.0
Percolation	B	RxD	mm/month	108.5	98.0	108.5	105.0	108.5	105.0	108.5	108.5	105.0	108.5	105.0	108.5
Outputs		ET+B	mm/month	258.5	228.0	208.5	169.0	147.0	126.0	135.5	141.5	157.5	198.5	255.0	248.5
Storage	S	(P+W)-(ET+B)	mm/month	-159.1	-84.9	-49	-82	-47	0	-40	-48	-74	-94	-133	-102
Cumulative Storage	M	-	mm	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Storage	V	largest M	mm	0											
		VxL/1000	m^3	0.0											

Notes : No allowance for runoff coefficient in P
No allowance for voids in S

WATER BALANCE CALCULATIONS - Nominated Area Method

Design Wastewater Flow	Q		L/day	500	Bega AWS Station 069139 Decile 7 Rainfall
Design Percolation Rate	R		mm/day	6	Trench disposal area per building
Land Area	L		m^2	134	Hangars and maintenance buildings

Parameter	Symbol	Formula	Units	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Days per Month	D	-	days	31	28	31	30	31	30	31	31	30	31	30	31
Precipitation	P	-	mm/month	61.05	108.4	121.6	49.9	61.45	88.7	57.5	55.3	46	66.25	85.35	107.85
Evaporation	E	-	mm/month	187.5	162.5	125.0	80.0	55.0	35.0	45.0	55.0	75.0	112.5	187.5	175.0
Crop Factor	C	-		0.8	0.8	0.8	0.8	0.7	0.6	0.6	0.6	0.7	0.8	0.8	0.8
Inputs															
Precipitation	P	-	mm/month	61.1	108.4	121.6	49.9	61.5	88.7	57.5	55.3	46.0	66.3	85.4	107.9
appied effluent	W	(QxD)/L	mm/month	115.7	104.5	115.7	111.9	115.7	111.9	115.7	115.7	111.9	115.7	111.9	115.7
Inputs		P+W	mm/month	176.7	212.9	237.3	161.8	177.1	200.6	173.2	171.0	157.9	181.9	197.3	223.5
Outputs															
Evapotranspiration	ET	E x C	mm/month	150.0	130.0	100.0	64.0	38.5	21.0	27.0	33.0	52.5	90.0	150.0	140.0
Percolation	B	RxD	mm/month	186.0	168.0	186.0	180.0	186.0	180.0	186.0	186.0	180.0	186.0	180.0	186.0
Outputs		ET+B	mm/month	336.0	298.0	286.0	244.0	224.5	201.0	213.0	219.0	232.5	276.0	330.0	326.0
Storage	S	(P+W)-(ET+B)	mm/month	-159.3	-85.1	-49	-82	-47	0	-40	-48	-75	-94	-133	-102
Cumulative Storage	M	-	mm	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Storage	V	largest M	mm	0											
		VxL/1000	m^3	0.0											

Notes : No allowance for runoff coefficient in P
No allowance for voids in S

WATER BALANCE CALCULATIONS - Nominated Area Method

Design Wastewater Flow	Q		L/day	520	Bega AWS Station 069139 Decile 7 Rainfall										
Design Percolation Rate	R		mm/day	3.5	Irrigation disposal area per building										
Land Area	L		m^2	420	Hangars and maintenance buildings										
Parameter	**Symbol**	**Formula**	**Units**	**Jan.**	**Feb.**	**Mar.**	**Apr.**	**May**	**Jun.**	**Jul.**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**
Days per Month	D	-	days	31	28	31	30	31	30	31	31	30	31	30	31
Precipitation	P	-	mm/month	61.05	108.4	121.6	49.9	61.45	88.7	57.5	55.3	46	66.25	85.35	107.85
Evaporation	E	-	mm/month	187.5	162.5	125.0	80.0	55.0	35.0	45.0	55.0	75.0	112.5	187.5	175.0
Crop Factor	C	-		0.8	0.8	0.8	0.8	0.7	0.6	0.6	0.6	0.7	0.8	0.8	0.8
Inputs															
Precipitation	P	-	mm/month	61.1	108.4	121.6	49.9	61.5	88.7	57.5	55.3	46.0	66.3	85.4	107.9
appied effluent	W	(QxD)/L	mm/month	38.4	34.7	38.4	37.1	38.4	37.1	38.4	38.4	37.1	38.4	37.1	38.4
Inputs		P+W	mm/month	99.4	143.1	160.0	87.0	99.8	125.8	95.9	93.7	83.1	104.6	122.5	146.2
Outputs															
Evapotranspiration	ET	E x C	mm/month	150.0	130.0	100.0	64.0	38.5	21.0	27.0	33.0	52.5	90.0	150.0	140.0
Percolation	B	RxD	mm/month	108.5	98.0	108.5	105.0	108.5	105.0	108.5	108.5	105.0	108.5	105.0	108.5
Outputs		ET+B	mm/month	258.5	228.0	208.5	169.0	147.0	126.0	135.5	141.5	157.5	198.5	255.0	248.5
Storage	S	(P+W)-(ET+B)	mm/month	-159.1	-84.9	-49	-82	-47	0	-40	-48	-74	-94	-133	-102
Cumulative Storage	M	-	mm	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Storage	V	largest M	mm	0											
		VxL/1000	m^3	0.0											

Notes : No allowance for runoff coefficient in P
No allowance for voids in S

Nutrient Balance Calculations

Based on DLG 1998 p 153 Revised April 2018

Frogs Hollow Airstrip Main Building

$Q := 11200 \cdot \frac{L}{day}$ Wastewater flow rate (litre/day)

$Pcap := 3600 \cdot \frac{kg}{hectare}$ Phosphorus absorption capacity

Nitrogen

$Cn := 10 \cdot \frac{mg}{L}$ Average nitrogen concentration of treated sewage (mg/l), (OzziKleen 2014)

$Lx := 25 \cdot \frac{mg}{m^2 \cdot day}$ Critical nitrogen loading rate (mg/m^2/day) (DLG 1998 p 153)

$An := Cn \cdot \frac{Q}{Lx}$

$An = 4480\,m^2$ Land area required for nitrogen absorption.

Phosphorus

Phosphorous absorbed

$Lp := 3.0 \cdot \frac{mg}{m^2 \cdot day}$ Critical phosphorus loading rate (mg/m^2/day) (DLG1998 p 154)

$Pab := \frac{Pcap}{3}$ DLG 1998 p 153 Phosphorus sorption by soil up to 1/4 to 1/2 of Pcap. Use 1/3 as an average.(DLG 1998 p 153)

$Pab = 0.12 \cdot \frac{kg}{m^2}$

$Tp := 5 \cdot \frac{mg}{l}$ Total phosphorus concentration of in treated wastewater (OzziKleen 2014)

Phosphorus absorbed in 50 years

$Puptake := Lp \cdot (365 \cdot 50) \cdot day$

$Puptake = 0.055 \cdot \frac{kg}{m^2}$

Phosphorus generated over 50 years

$Pgen := Tp \cdot Q \cdot (365 \cdot 50) \cdot day$

$Pgen = 1022 \cdot kg$

$Ap := \frac{Pgen}{(Pab + Puptake)}$ Land area for phosphorus absorption (m^2)

$Ap = 5.848 \times 10^3\ m^2$

Reference

1) Environment & Health Protection Guidelines," Onsite Sewage Management for Single Households" Department of Local Government, February 1998.

2) OzziKleen Waste water Systems SK25 Series Specification 21-1-14

Report

$Ap = 5848.35\ m^2$	Land Irrigation area for phosphorus absorption (m^2)
$An = 4480 \cdot m^2$	Land irrigation area required for nitrogen absorption (m^2).

Nutrient Balance Calculations

Based on DLG 1998 p 153 Revised April 2018

Frogs Hollow Airstrip Squadron Compounds

$Q := 1926 \cdot \frac{L}{day}$ Wastewater flow rate (litre/day)

$Pcap := 3600 \cdot \frac{kg}{hectare}$ Phosphorus absorption capacity

---

Nitrogen

$Cn := 10 \cdot \frac{mg}{L}$ Average nitrogen concentration of treated sewage (mg/l), (OzziKleen 2014)

$Lx := 25 \cdot \frac{mg}{m^2 \cdot day}$ Critical nitrogen loading rate (mg/m^2/day) (DLG 1998 p 153)

$An := Cn \cdot \frac{Q}{Lx}$

$An = 770.4\,m^2$ Land area required for nitrogen absorption.

Phosphorus

Phosphorous absorbed

$Lp := 3.0 \cdot \frac{mg}{m^2 \cdot day}$ Critical phosphorus loading rate (mg/m^2/day) (DLG1998 p 154)

$Pab := \frac{Pcap}{3}$ DLG 1998 p 153 Phosphorus sorption by soil up to 1/4 to 1/2 of Pcap. Use 1/3 as an average.(DLG 1998 p 153)

$Pab = 0.12 \cdot \frac{kg}{m^2}$

$Tp := 5 \cdot \frac{mg}{l}$ Total phosphorus concentration of in treated wastewater (OzziKleen 2014)

Phosphorus absorbed in 50 years

$Puptake := Lp \cdot (365 \cdot 50) \cdot day$

$Puptake = 0.055 \cdot \frac{kg}{m^2}$

Phosphorus generated over 50 years

$Pgen := Tp \cdot Q \cdot (365 \cdot 50) \cdot day$

$Pgen = 175.75 \cdot kg$

$Ap := \frac{Pgen}{(Pab + Puptake)}$ Land area for phosphorus absorption (m^2)

$Ap = 1.006 \times 10^3 \ m^2$

Reference

1) Environment & Health Protection Guidelines," Onsite Sewage Management for Single Households" Department of Local Government, February 1998.

2) OzziKleen Waste water Systems SK25 Series Specification 21-1-14

Report

$Ap = 1005.71 \ m^2$	Land Irrigation area for phosphorus absorption (m^2)
$An = 770.4 \cdot m^2$	Land irrigation area required for nitrogen absorption (m^2).

Nutrient Balance Calculations

Based on DLG 1998 p 153 Revised April 2018

Frogs Hollow Airstrip Hangars and Maintenance Buildings

$Q := 520 \cdot \frac{L}{day}$ Wastewater flow rate (litre/day)

$Pcap := 3600 \cdot \frac{kg}{hectare}$ Phosphorus absorption capacity

---

Nitrogen

$Cn := 10 \cdot \frac{mg}{L}$ Average nitrogen concentration of treated sewage (mg/l), (OzziKleen 2014)

$Lx := 25 \cdot \frac{mg}{m^2 \cdot day}$ Critical nitrogen loading rate (mg/m^2/day) (DLG 1998 p 153)

$An := Cn \cdot \frac{Q}{Lx}$

$An = 208\ m^2$ Land area required for nitrogen absorption.

Phosphorus

Phosphorous absorbed

$Lp := 3.0 \cdot \frac{mg}{m^2 \cdot day}$ Critical phosphorus loading rate (mg/m^2/day) (DLG1998 p 154)

$Pab := \frac{Pcap}{3}$ DLG 1998 p 153 Phosphorus sorption by soil up to 1/4 to 1/2 of Pcap. Use 1/3 as an average.(DLG 1998 p 153)

$Pab = 0.12 \cdot \frac{kg}{m^2}$

$Tp := 5 \cdot \frac{mg}{l}$ Total phosphorus concentration of in treated wastewater (OzziKleen 2014)

Phosphorus absorbed in 50 years

$Puptake := Lp \cdot (365 \cdot 50) \cdot day$

$Puptake = 0.055 \cdot \frac{kg}{m^2}$

Phosphorus generated over 50 years

$Pgen := Tp \cdot Q \cdot (365 \cdot 50) \cdot day$

$Pgen = 47.45 \cdot kg$

$Ap := \frac{Pgen}{(Pab + Puptake)}$ Land area for phosphorus absorption (m^2)

$Ap = 271.531\ m^2$

Reference

1) Environment & Health Protection Guidelines," Onsite Sewage Management for Single Households" Department of Local Government, February 1998.

2) OzziKleen Waste water Systems SK25 Series Specification 21-1-14

Report

$Ap = 271.53\ m^2$	Land Irrigation area for phosphorus absorption (m^2)
$An = 208 \cdot m^2$	Land irrigation area required for nitrogen absorption (m^2).

Appendix C- Treatment Equipment Specifications

SPECIFICATION

for

OZZI KLEEN SEWAGE TREATMENT PLANT

Models: SK25A & SK25A-G

OZZI KLEEN
Waste Water Systems

Head Office: 59 Industrial Ave, Kunda Park, QLD 4556

Neatport Pty Ltd trading as Suncoast Waste Water Management

Phone: +61 7 5459 4900

Fax: +61 7 5456 4677

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GENERAL

Suncoast Waste Water Management has developed Ozzi Kleen a unique sewage treatment system. In this compact system, flow equalisation, biological oxidation, secondary sedimentation and biological nutrient removal occur in an aerobic treatment process.

RAW SEWAGE CHARACTERISTICS

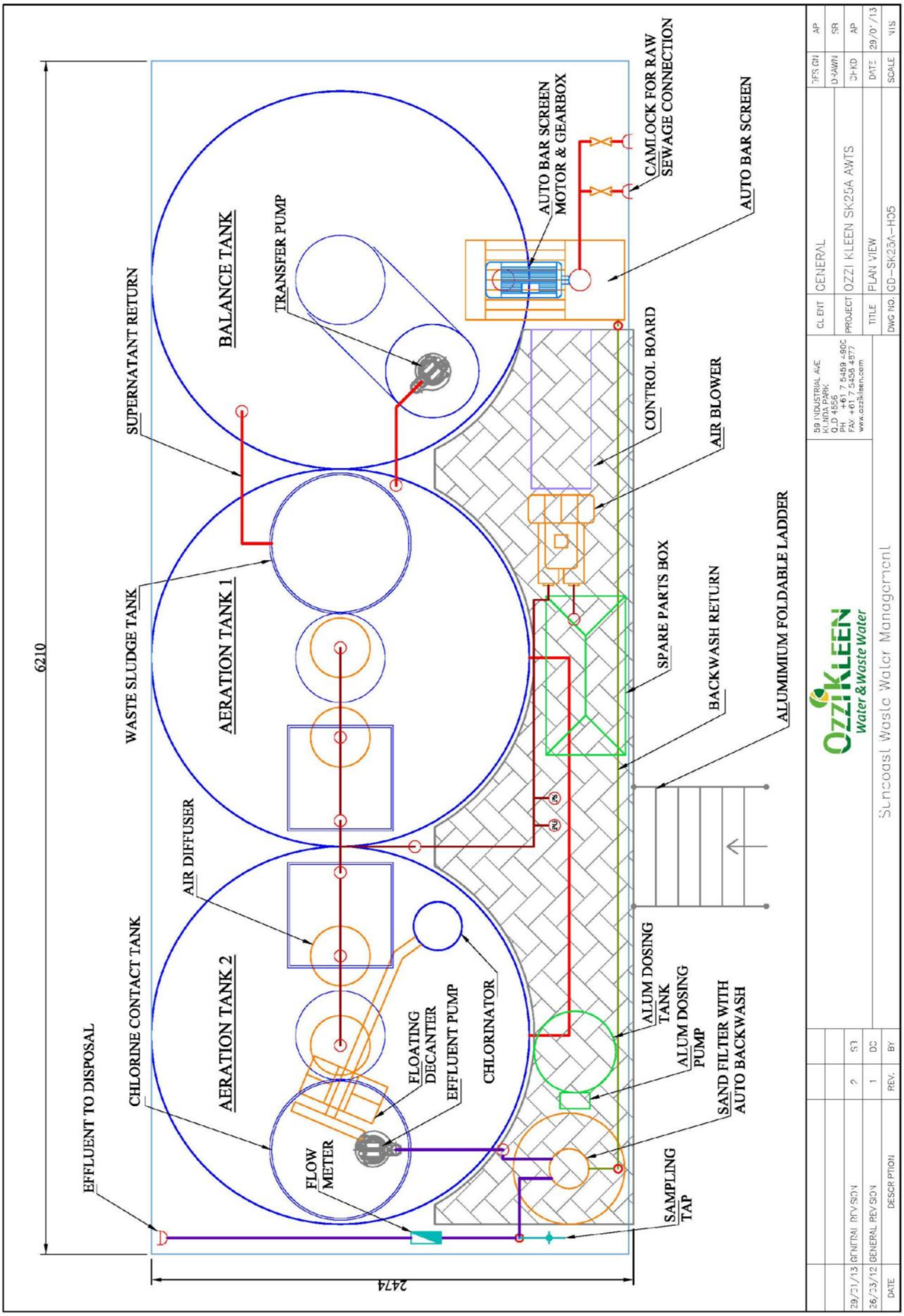
The plant performance is based on the following incoming raw sewage characteristics:

PARAMETER	RAW WASTEWATER CHARACTERISTICS
Wastewater treatment capacity	30 Equivalent Persons at 200 l/person/day
Maximum hydraulic load	6,000 l/day
Biological Oxygen Demand (BOD_5)	350 mg/litre or 70 g/day/person
Total Suspended Solids (TSS)	350 mg/litre or 70 g/day/person
Total Nitrogen	75 mg/litre or 15 g/day/person
Total Phosphorus	12.5 mg/litre or 2.5 g/day/person
Fats, Oils & Grease (FOG)*	75 mg/litre
pH	6 < pH < 10
Wastewater temperature range	10°C to 38°C

* *For restaurant applications, a grease trap must be fitted upstream of the treatment plant to remove grease and oils (SK25A model only).*

SYSTEM OVERVIEW

The SK25 series of sewage treatment plants consist of a 5,000 L balance tank, an automatic bar screen, nutrient removal equipment and two Ozzi Kleen bioreactors mounted on a steel skid (refer to diagram on Page 4). This also includes a grease trap on the SK25A-G model.


6210
2474
BALANCE TANK
TRANSFER PUMP
SUPERNATANT RETURN
AUTO BAR SCREEN MOTOR & GEARBOX
CAMLOCK FOR RAW SEWAGE CONNECTION
AUTO BAR SCREEN
CONTROL BOARD
AIR BLOWER
SPARE PARTS BOX
BACKWASH RETURN
ALUMINIUM FOLDABLE LADDER
WASTE SLUDGE TANK
AERATION TANK 1
AIR DIFFUSER
AERATION TANK 2
CHLORINE CONTACT TANK
EFFLUENT TO DISPOSAL
FLOATING DECANTER
EFFLUENT PUMP
CHLORINATOR
ALUM DOSING TANK
ALUM DOSING PUMP
SAND FILTER WITH AUTO BACKWASH
SAMPLING TAP
FLOW METER
OzziKleen Water & Waste Water
Suncoast Waste Water Management
59 INDUSTRIAL AVE
KUNDA PARK
QLD 4556
PH +61 7 5459 4900
FAX +61 7 5456 4577
www.ozzikleen.com
CLIENT GENERAL
PROJECT OZZI KLEEN SK25A AWTS
TITLE PLAN VIEW
DWG NO. GD-SK25A-H05
DESIGN AP
DRAWN SR
CHKD AP
DATE 29/01/13
SCALE NTS
29/01/13 GENERAL REVISION 2 ST
26/03/12 GENERAL REVISION 1 DC
DATE DESCRIPTION REV. BY

Treated Effluent Quality

The treated effluent produced by SK25 sewage treatment plants is designed to be within the required guidelines for advanced secondary effluent quality. The standard advanced secondary effluent quality guidelines are as follows:

Parameter	Unit	Advanced Secondary Effluent Quality
Ozzi Kleen Model		SK25A & SK25A-G
Biological Oxygen Demand (BOD_5)	mg/L	≤ 10
Total Suspended Solids (TSS)	mg/L	≤ 10
Total Nitrogen (TN)	mg/L	≤ 10
Total Phosphorus (TP)	mg/L	≤ 5
Turbidity	NTU	≤ 2
pH		6.5 - 8.5
Faecal Coliforms, FC	cfu per 100 mL	≤ 10
Chlorine Residual	mg/L	0.5 – 2.0

* The treatment plant is to be serviced at the regular interval of every three months, which will require a full service as set out in the Owner's Manual.

SK25 SEWAGE TREATMENT PLANT SPECIFICATIONS

SK25 System Specifications Table

Description	Make & Model	Service	No.	Rated Power or Size	Full Load Current
Bar Screen					
Automatic Bar Screen	Ozzi Kleen	Duty	1	---	---
Balance Tank					
Tank	Ozzi Kleen PT4000 Poly	Duty	1	∅1900 x 2800 H	---
Transfer Pump	Showfou STA-112NS	Duty	1	0.75 kW 240 VAC	1.5 A
Bioreactor					
Tank	Ozzi Kleen PT4000 Poly	Duty	2	∅1900 x 2800 H	---
Air Blower	Ozzi Kleen 4RB410	Duty	1	1.1 kW 240 VAC	1.0 A
Air Diffuser	GVA Elastox-T Type B	Duty	4	300 mm	---
Floating Decanter	Ozzi Kleen FD50	Duty	1	Poly Ø 50 mm	---
Float Switch (SBR)	Multitrode	Duty	3	---	---
Effluent Tank & Chlorinator					
Effluent Tank	Ozzi Kleen PT850 Poly	Duty	1	800 L	---
Chlorinator	Ozzi Kleen 120	Duty	1	1 Canister	---
Basket Strainer	Ozzi Kleen OK150	Duty	1	2000 μm mesh size	---
Effluent Pump	Reefe RHV180	Duty	1	400 W 240 VAC	4.0 A
Backwash Pump	Reefe RHV220	Duty	1	700 W 240 VAC	6.0 A
Waste Sludge Tank					
Sludge Tank	Ozzi Kleen PT850 Poly	Duty	2	800 L	---
Sand Filter					
Sand Filter with Automatic Backwash	Ozzi Kleen	Duty	1	∅600 x 900 H	---
Backwash Valves	Ozzi Kleen OM-A	Duty	2	10W	0.4 A

Description	Make & Model	Service	No.	Rated Power or Size	Full Load Current
Controls and Miscellaneous					
Control Panel	OK Control Panel with Mitsubishi PLC	Duty	1	---	---
Solenoid & Dump Valve Assembly	Ozzi Kleen	Duty	4	240 VAC	---
Aluminum Access Ladder	Ozzi Kleen 1500	Duty	1	750 x 600 x 1800	---
Aluminum Platform & Handrails	Ozzi Kleen 1900	Duty	1	4800 x 600 x 1800	---
Chlorine Tablets	Trichloroisocyanuric Acid Tablets	---	---	By client	---
Flow meter	HR Products MT-EX32	Duty	1	32mm	---
Phosphate Removal Equipment					
Chemical Dosing Pump	Iwaki B16 Pump	Duty	1	240 VAC	0.5 A
Chemical Dosing Tank	Ozzi Kleen 150	Duty	1	∅500 x 900 H	---
Chemical Dosing Agent	Alum (Aluminium Sulphate)	---	---	By client	---
Grease Trap *(SK25A-G only)*					
Grease Trap Tank	Ozzi Kleen GT500R Poly	Duty	1	500L	---
Lifting Pump	Reefe RVS300	Duty	1	400 W 240 VAC	4.0 A

METHOD OF CONSTRUCTION AND MATERIALS

The tanks are a one-piece vessel made of polyethylene, using the roto-moulding process. As the tanks are roto-moulded in one operation, there are no seams or joins.

The minor components of the plant are also made of roto-moulded polyethylene. These components are screwed in place to achieve a robust and corrosion proof system.

POLYETHYLENE SPECIFICATIONS TABLE

The polyethylene used to roto-mould Ozzi Kleen tanks and components is as follows:

DESCRIPTION	SPECIFICATION
Conforms to food grade requirement	FDA Regulations CFR21 Part 117.1520
Density to ASTM D1505	939 kg/m³
Tensile Strength at Yield @ 500 mm/min to ASTM D638M	18 MPa
Flexural (Young's) Modulus to ASTM D790M	760 MPa
Vicat Softening Temperature to ASTM D1525	117°C