Article 12 (Part 1)

Section C: Management: Provide further details, including the number of staff on site, the hours the facility is to be manned, i.e. other than security, and details of any contingency arrangements

The operations management of the Waterford Waste water Treatment works at Gorteens will be structured to provide all the necessary technical, analytical, supervisory and administrative management necessary to enable the proper operation and maintenance of the works, safely and efficiently on a continuous basis throughout the contracts Operation and Maintenance Period.

The Plant will be manned Monday to Friday from 8am to 5:00pm during the week, by the following qualified personal:

1 Operations and Maintenance Manager, and reporting to him:

- 1 x Electrical Technician
- 1 x Mechanical Technician
- 2 x Plant Operatives

Outside of the normal day time operations of the works there will be a callout Rota system in place consisting of the Electrical Technician, Mechanical Technician and two Operatives. The on-call Rota period for each member of staff will be for one week (Friday to Friday) in four. The call-out rota for the facility is shown below.

The Waste water Treatment works will be fully automated and controlled by a SCADA system which monitors & logs all plant equipment and process flows & levels. All critical plant will have standby systems in the event of plant failure. The SCADA system will also be equipped to send priority alarm messages to the on-call personnel, via the mobile phone text messaging service, alerting them to a potential problem at the works. The on-call member of staff will be equipped with a Laptop capable of logging into the plant SCADA system remotely for interrogation purposes.

In order to provide adequate duty cover during the whole of the Operations and Maintenance Period, a personnel rosta will be arranged so that no more than one member of staff shall be absent from the Works at any one time on holidays, training or otherwise. Where Operation and Maintenance personal leave the employment during the Operation and Maintenance period, they will be replaced with staff of equivalent experience and qualifications.

Waterford WwTW Call out Rota

Week = Friday to Friday

CAW Staff	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9
Operator 1									
Operator 2									
Electrical									
Mechanical									

	Week	Week	Week	Week	Week	Week	Week	Week	Week
CAW Staff	10	11	12	13	14	15	16	17	18
Operator 1									
Operator 2									
Electrical					as i	^{bo} r			
Mechanical					st. ay othe				
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	Week	Week	Week	Week	Week	Week	Week	Week	Week
CAW Staff	19	20	21	2220 real	23	24	25	26	27
			. Del	The WILC.					
Operator 1			COT INS	l.					
Operator 2			r copy						
Electrical			entor						
Mechanical		්ර	P.C.						

	Week								
CAW Staff	28	29	30	31	32	33	34	35	36
Operator 1									
Operator 2									
Electrical									
Mechanical									

CAW Staff	Week 37	Week 38	Week 39	Week 40	Week 41	Week 42	Week 43	Week 44	Week 45
Operator 1									
Operator 2									
Electrical									

Waterford WwTW Call out Rota

Week = Friday to Frida	y			
Mechanical				

	Week						
CAW Staff	46	47	48	49	50	51	52
Operator 1							
Operator 2							
Electrical							
Mechanical							

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Article 12 (Part 2) Section D.1: Infrastructure

Provide further details on site infrastructure including appropriately scaled labelled drawings for:

(a) Overall site layout showing all process areas

The overall site area showing all process areas is shown in Drawing No. C1197-3014.

It should be noted that the sequence is not always in numerical order, e.g. there is no Item 4 on the drawing. However, all items of the WWTP are included.

(b) Primary and secondary treatment: plant and infrastructure

The inlet works, where the main primary treatment is carried out is shown in Drawing C1197-2000. The storm tanks, to which excess flow passes during storm conditions, is shown in Drawing No. C1197-1013. The overall flow diagram detailing the preliminary treatment is shown in Drawing C1197-1012.

The secondary works, excluding the sludge treatment area, which is shown in 2(d) are shown in Drawing No. C1197-1017 and C1197-2005, (Final Settlement Tanks), Drawing C1197-1027 (Wash water, i.e. settled effluent that passes to the Final Effluent sampling and wash water pumping station), Drawing C1197-1016 (Aeration Tanks) and Drawing C1197-2006 (Selector and Aeration Tanks).

(c) Works Inlet building internal layout details

The works inlet building internal ayout details are provided as Drawing No. C1197-2000, which shows the plan view of the sludge building and Drawing No. C1197-2001 shows the section detail of the building. Here the incoming flow is screened by the automatic screens, prior to passing to grit traps. From the inlet works, the sewage passes on to a distribution chamber to the primary settlement tanks. The preliminary treatment for grease and grit details are shown in Attachment C1197-8402.

(d) Sludge building internal layout details

The sludge thickening and dewatering building internal layout details are shown in Drawing No. C1197-2011. Activated sludge is thickened here by the gravity belt thickeners. It is transferred to the sludge treatment building (See section (e)). Note - Also detailed on this drawing is the boiler room, where the two boilers are located. These plant items can also be seen in Drawing No. C1197-3006, where the buildings location in relation to the overall treatment area can be seen. The boiler specification is shown in Attachment C1197-8417.

(e) Sludge Treatment Area

Drawing No. C1197-3006 shows the layout details of the overall sludge treatment area, which includes the sludge thickening and dewatering area, and the sludge treatment area, where the following processes take place: Primary sludge is thickened by means of the picket fence thickener and added to the thickened

secondary sludge by means of a blending tank. The blended sludge is pasteurised and then fed to the anaerobic digesters.

From the digesters, the digested sludge flows to a digested sludge tank, and from there to one of the two dewatering sludge belt presses, to produce the final sludge cake.

(f) Wastewater drainage infrastructure

The pipework showing all the drainage from the plant, including the wastewater infrastructure, is shown in Drawing C1197-3002. The drainage for the sludge area is shown in Drawing No. J300-SK-009-250808.

Surface water site drainage including location of SW-01, sampling location, (g) interceptors, trunk pipe

The surface water drainage is shown in Drawing No. J300-SK-007-220808 and also in Drawing No. C1197-3002. The surface water sampling chamber is shown in the overall drawing for the site, i.e. Drawing No. C1197-3014, as mentioned in Section 2(a). The surface water sampling location is Item 29 on the drawing.

(h) Odour Control Units, process and areas served, pipework and open tanks

There are two odour control units (OCUs), one to serve the inlet works (OCU-1) and one to serve the sludge building (OCU-2). The P&ID diagram for the odour units is included as Drawing No. C1197-1026. This shows the 2 no. odour units, and which items or areas of the plant that may produce odours that are directed to the odour units. These include:

OCU 1 (Odour Control Unit 1) – Infet Works

- Inlet Works
- Grit Classifier •
- Screenings Wash &
 Inlot West =
- Inlet Works Building
- Screen/Grit Skips •
- **Primary Settlement Tank** •

The odours from the primary settlement tanks are directed through an odour unit biofilter before entering a droplet eliminator. Final effluent washwater is also added to the process at this point. All of the remaining areas/items listed above are directed straight to the droplet eliminator, then through two exhaust fans, through a carbon filter and the cleaned air is released to atmosphere via a stack.

OCU 2 (Odour Control Unit 2) – Sludge Works

- Picket Fence Thickener
- Gravity Belt Thickeners •
- Sludge Blending Tanks •
- Emergency Sludge Holding Tanks (Primary and Secondary) •
- Sludge Building •
- Sludge Dewaterers and Dewaterers Skip •
- Liquor Returns

All items are directed into the odour unit biofilter, including final effluent washwater, then directed to the droplet eliminator, through two no, exhaust fans and a carbon filter before being the cleaned air is released to atmosphere via a stack.

OCU-1 and OCU-2 are shown in the overall drawing for the site, i.e. Drawing C1197-3014, and are labelled as items 20/1 and 20/2.

OCU-2 is shown in more detail within the sludge treatment building in Drawing No. C1197-3006. Both OCUs are the same make and model and so OCU-1 is the same as OCU-2 shown in this drawing.

The process design details for the odour control design for the WWTP is included as Attachment C1197-8419. This data sheet provides information for each of the sources identified above. The average and maximum odour concentrations for each source is given, with the average and peak H_2S (hydrogen sulphide) concentrations. The flow rate for the air from each source is also provided along with the dimensions and details of the vessels or tanks for each odour source are given.

The attached sheet also provides the calculations that were used to determine the ventilation rates and the resulting ventilation rates. Calculations for the Odour concentrations are also included, along with H_2S_2 and airflow rates. This data was then used for the air dispersion model, to predict odours at sensitive receptors and boundaries.

There will be open tanks within the plant, these are the activated sludge areas, i.e. the final settlement tanks, the aeration tanks and selector tank. These tanks contain activated sludge, which would not be considered a common source of odour and are not typically covered. The OGUS do not treat air from these tanks, i.e. there is no odour control treatment, as it is not considered necessary given the nature of the material and the location of the plant.

(i) Biogas Storage, collection system and pipework; and waste burner

Biogas is produced as a product of digestion of the sludge in the digester tanks. This is utilised to provide the prime fuel source for the boilers, providing hot water for the pasteuriser system. Excess gas (or unused gas) is diverted to the waste gas flare for burning. Should there be insufficient gas available then the boiler system is designed to operate with gas oil. There is no provision for scrubbing.

The biogas collection system is located in the sludge treatment area, as shown in Drawing No. C1197-3006 (see attached). The pipework is shown, and the direction of flow of the biogas, from the 2 no. digesters to the biogas condensate holder, shown in Drawing No. C1197-2023 and Drawing No. C1197-1024.

Biogas from the Sludge Digesters flows to the flexible membrane gasholder. Water from the gas condenses in the gas pipework and gravitates forward to the condensate trap/chamber. See Attachment C1197-8418.

Gas is prevented from escaping from the condensate trap by means of a water trap, condensate discharges into a small pumping chamber for subsequent return to the liquors treatment plant. A system of valves in the condensate trap allows isolation of

the gasholder if necessary. Low-pressure fans pressurising the space between the outer membrane of the gasholder and the internal membrane bag maintain gas pressure. Vacuum and pressure relief valves on the gasholder allow discharge under abnormal circumstances. The set pressures of the relief valves will be lower on top of the digesters than at the gas holder so that if there is a high gas pressure the relief will be at high level to make the best use of dispersion for safety and odour reasons.

The gas holder (Drawing No. C1197-1024) is a flexible membrane gas holder of 100m³ capacity, which buffers the flow of biogas from the digesters and provides a reservoir of gas for semi-continuous operation of the boilers. The gas holder is constructed from two reinforced fabric membranes. The inner membrane is a hemispheric – cylindrical gas- holder, which is attached at its equator to the external, truncated spherical membrane, which is inflated by air pressure thus providing support to the inner membrane. The exterior membrane is inflated by two blowers, which maintain a constant air pressure in the outer membrane. The gas pressure is maintained by the exterior air pressure acting on the inner membrane.

The system operates at a working pressure of 200 mm wg. As the gas is utilised the inner membrane of the holder deflates under the constant pressure from the low-pressure fans. As the inner bag deflates an ultrasonic detector mounted in the top of the gasholder monitors the degree of deflation and computes a gas volume. Various set points will trigger various operations. As the inner membrane expands and fills with gas, the enclosed air volume between the inner and the outer membrane reduces, and to protect against this causing any excess air pressure, the air is automatically released through an air release valve mounted on the outer membrane. When gas consumption exceeds gas production the air blower provides air to replace the reducing gas volume whilst maintaining constant gas pressure.

Two air blowers configured as duty standby provide inflation air for the membrane Gasholder. These run continually in automatic and are rated for the maximum gas utilisation rate by the waste gas burner.

From the gas holder, the biogas is directed to the boilers, which are shown on Drawing No. C1197-3006. Gas is drawn from the gasholder via the condensate trap to the Boiler room for usage by the boilers (as the prime fuel source). The details of the gas use and flow rate for the boilers are shown in the P&ID for the boilers, included as Attachment C1197-8417.

A waste gas burner, located away from the gas holder, burns any excess Biogas, though as the hot water demand is high within the plant, use of this equipment will be limited and should be viewed as a standby route for the gas. This is shown in Drawing No. C1197-1024.

This low level waste gas burner operates under control of the SCADA (the operation control system). If the biogas level in the gasholder exceeds a set point the burner starts and biogas is drawn from the gasholder through a series of actuated valves and flame arrestors. In order that sufficient temperature is reached within the burner fresh air is added to the biogas at the burners to increase the oxygen/biogas mixture.

(j) Location of boiler emission points

The location of the boiler emission points A-01 (a&b) are shown in Drawing 07_4084E.1.2Rev.1 (Figure E.1.2 Emissions to Atmosphere).

The 2 no. boilers can be seen in detail on Drawing No. C1197-3006. A P&ID diagram of the boilers is shown in Drawing No. C1197-1028. This shows the loop system from the pasteurisers to the boilers and also where water is added from the service water pipe to the boilers.

The underground pipework for the boilers is also provided as Drawing No. C1197-2031. This shows the pipe work for the hot water/service water, the electrical ducts serving the boiler, the sump and drainage points and the gas/fuel oil pipework (as already mentioned, diesel will only be used to power the boilers in the rare event that sufficient biogas is not available.

(k) Provide further details of bunded areas and tanks

The sludge treatment area will be bunded, as shown in Drawing No. C1197-3006. The hatched area is the bund that will surround the sludge treatment area.

The bund is an earth structure and is designed to contain sludge spillages should any of the structures within the bunded area rupture or if a pipe bursts. Its area is approximately 90m x 40 m x 1.5m deep giving a volume of approximately 5500 m³. In particular the largest individual item within the sludge area is a digester tank, which has a design volume of 1,721m³.

There is no installed provision for pumping out this sludge should there be a spill or leak. It will be done on an individual incident basis by external licensed contractors. An "Incident Response Plan" to dealing with this will be written as part of the O&M (Operations and Maintenance manual) manual for the operational phase of the Plant.

Also shown in Drawing No. C1197-3006 is the fuel tanks for the boilers and the generator, which will be diesel fuelled. These tanks are outlined in blue on the drawing. The tanks are double skinned and so no additional containment is provided.



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Channel cross section - see also sketch			MIR 1	Q12		
D1 : Depth of channel	Select	4.00	m. ny rev	Ref: Metca	lf and Eddy 4th Edition	page 389
W1 : Width of Grit channel		3.40	meth where			•
W2 : Width of grease channel	1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -	1.70	Sm On			
W1 approx 0.85*D		AND	(18)		and a second	
W2 approx W1/2 and between 1 - 2m	n Corre	T's	3 . 19			
W4 Width : Wall to grit sump	Select	0.75	m	· .		
W3 Width of grit sump	Select	0.75	m			the second s
D2 Depth of grit sump	Select	0.85	m		1. A.	
Angle A of benching	Select	C¥ 60		· · · · ·		
Angle B of channel floor	Select	45	200 200	· · · · · · · · ·		and a second
	men como como de la secono de la				- -	
Area a		20.4	m2		· · · ·	
Area b		0.5	m2	•		and the second sec
Area c		4.8	m2			
Cross sectional area of channel	··· · · · · · ·	15.1	m2		in an a start.	n ang ang ang ang ang ang ang ang ang an
		· · · · ·	1			
Length of channel		10.01	m			
		4.2.2. 1 1 1 1 1 1	1. A.	•	1. A.	
Actual Length	Rounded	10.00	() m			
Actual W1	Rounded	3.40	m	-		
Actual W2	Rounded	1.70	m			
1 otal channel width		5.10	m			
Charle budgess lis mett	,	50 F	m/h	Note: da-"	consider surface	
CHECK BYORAUNC FATE AT MAXIMUM flow	¥	0 017	ш/Ц m/e	of greace	emoval normally	
Check hydraulic rate in non-second as	ction	178 30	m/h	- Broase I	we assume that y.	
- acta ay examine rate in non-actated se			· · · · · · · ·			
1. A start of the start of t		1999 - 1999 1999 - 1999 - 1999		•		
Purac AB design notes:	1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -			· · ·	· · · · · · · · · · · · · · · · · · ·	
Take cross section area around	10 and 15	m2			1	
Take typical airflow as	40	m3/hr			1997 - 1997 -	
The airflow will be set on site.		,	•			
Use one Saunders valves per down con	ner and perfor	ated stainless s	teel pipes DN40)-50 as aerat	ors.	
Fat removal zone width between	1 and 2	• m •				
Retention time at maximum flow	3 to 5	min			54 A	
Hydraulic load in non aerated zone	25	m/hr	e de la contra			

DESIGN ISSUE	-	P31												P32												40						13
Lange Customer Customer Customer Date 21/06 Drg. No.	COMP DATE:		- Z																											G	See	
Tritle Bulker Stranger Strange	D APPR LETED 31/07/2		OTE:-	P50	P49	P46 (2 No.)	P45	P43	P42	P41	P40	P37	P34	P32 P33	23		P29	P28	P26	Р24	P23	P22	P21	P19	P18	P16 P17	8	PIPELINE		Date	Pre	4
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Contract Name : Waterford

Contract No: C1197

Document Reference: 8417

Title : Bolier

Revision	No. of Pages	Date of	Purpose of Issue	Originator	Checked	Approved
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1	1	04/06/2007	Contract Issue	DGH	Broshell)	16
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8420 Waterford pasteurisation plant Rev 1 (incl.8415,8416,8417,8420,8124)

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BOILER SIZING							A	
		Cacol	Case 2	Case 3	Case 4			
· · · · · · · · · · · · · · · · · · ·		UdSE 1	0000 4	04000	0400		•	
Tatal Heat Required by all Digesters	kW	253	314	744	921	Ref: 8416 H	eat Exchan	ger Design
Total meat Required by all Digesters	, NTT				····			
Number of Duty Boilers Selected		1	1	2	2			
Output Required by Each Boiler	kŴ	253	314	372	461			
Boiler output required to be specified to suppliers.	Suppliers to	select actua	I boiler mod	el to meet th	e			
required output and advise actual output, efficienc	y and fuel inp	out requireme	ents. Calcul	lation given b	volex			
is for preliminary assessment purposes only.						· · · · · ·		
					500			
Boiler Output Selected (Each)	kW	500	500	500	500			
Boiler Efficiency (Assumed)	%	80	80	80	80	í		· · · · ·
	1.10/	605	625	625	625			
Estimated Fuel Input Required (Each)	KVV	025	025	020		·		
Ohudure One Hasse					• •			
Sludge Gas Usage								
Que Net Oplasta Valua	M.I/Nm ³	22.5	22.5	22.5	22.5			
Gas Net Calonic Value	Nim ³ /h	100	100	100	100	1		· .
Approximate Gas Flowrate (Each)	Nm ³ /b	100	100	200	200			
Approximate Gas Flowrate (10tal)	NIII /11	100	100	200	200			
http://www.come.v/ield/Tetal)	m ³ /d	2291	2291	3776	3776	8413 Gas F	Production	
Minimum Gas Yield (Total)		220.1						1. 1. 1.
Proportion of Minimum Gas Yield Consumed	%	105	105	. 127	127			
by all Boilers	+							
	1							
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Standby Fuels			•	. Ser				
				et V				
Fuel Oil Net Calorific Value	MJ/m ³	36900.00	36900.00	36900.00	36900.00	ļ		
Fuel Oil Flowrate (approx)	m ³ /h	0.06	0.06	0.06	0.06			
X I I	: l/h	61	0161 2	61	61			<u> </u>
			5 24	· ·				
LPG Net Calorific Value	MJ/m ³	93.900	\$93.90	93.90	93.90	· · · · · ·		
LPG Flowrate (approx)	Nm ³ /h	23,96,0	23.96	23.96	23.96			-
		ion of t						
Natural Gas Net Calorific Value	MJ/Nm ³	38.62	38.62	38.62	38.62			
Natural Gas Flowrate (approx)	Nm ³ /	58.26	58.26	58.26	58.26	1		
Natural Gas Flowrate (approx)		\$*						

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Contract Name : Waterford

Contract No: C1197

ocument Reference: 8419

Title : Odour Control Design

Revision	No. of Pages (Excluding Cover)	Date of Issue	Purpose of Issue	Originator	Checked	Approved
1	4	23/01/2007	Draft Issue	DGH	PB .	
2	<u> </u>	09/02/2007	Contract Issue	DGH	READO	an a
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PURAC Contract No.	C1197			-		-					•
Contract Title	Waterford	WMW									
PURAC Document No.	8419					-	•				
Date	09/02/07			•	-						
Revision	2			•	· · · ·			-			•
			Ave Odour	Max Odour							•
List Odour Control Unit Names	P&ID no.	Tag No.	concentration (OU _E /m ³)	concentration (OU _E /m ³)	Ave H ₂ S conc (ppm)	Peak H ₂ S conc (ppm)	Air flowrate (m ³ /hr)				
Combined Treatment OCU	C1197-1026	TBC		0 0	0.0	0.0	00	•			× .
			00	0	0.0	0.0	00	-			
Inlet Treatment OCU Studge Treatment OCU	C1197-1026 C1197-1026	TBC TBC	63533 97976	63533 97976	19.2	19.2	13815 5042				
			0	- 0	0.0	0.0	0	·			
Other discharges			0	0	0.0	0.0	0	•			
Check calc integrity		• •	72743 OK :	72743 OK	27.1 OK	27.1 OK	0K		•		
Areas to be odour controlled	Orange cells re	aquire input		CO					•••		
					ent of		Ave Odour concentration	Max Odour concentration	Converted average H ₂ S	Converted peak H ₅ S conc.	Air flowrate
Process Area	Process Fluid		P&ID no. & GA no.	No.	Tag No(S)	Air extracted to:	(OU _E /m ³)	(OU _E /m ³)	conc. (ppm)	(mqq)	(m ³ /hr)
Pre-screen and post-grit channels	Raw Sewage		C1197-1012 & 2000/1	1	T-1201	Inlet Treatment OCU	131243	131243	. 39	39	388 '
Fine Screens including bypass	Raw Sewage		C1197-1012 & 2000/1	4	A-1201A/B/C & A-1202	Inlet Treatment OCU	81000	81000	24	24	704
Screenings Compactors	Raw Sewage		C1197-1014 & 2000/1		A-1401	6 10 Treatment OCU	8000	80000	40	40	32
Grit Classifier	Grit	and a state of a state of the s	C1197-1014 & 2000/1	se en la factor de la construction de la construction de la construction de la construction de la construction La construction de la construction de	A-1402	Intel Treatment OCU	160000	160000	80	80	32 32
Grit Channel	Raw Sewage		C1197-1012 & 2000/1	. 2	T-1202A/B	Inlet Treatment OCU	65833	65833	20	20	1004
Preliminary Treatment Building	N/A		C1197-1012 & 2000/1	1		Inlet Treatment OCU	150	150	0	0	7247
Primary Sedimentation Tank	Screened Sewa	96	C1197-1015 & 2004	2	T-1501A/B	Inlet Treatment OCO	157664	157664	47 47	47	4407
Pasteuriser	Sludge.	and and the state of the state	C1197-1020	3	T-2001A/B/C	Sludge Treatment OCU	63000	630000	315	315	246
Picket Fence Thickener	Primary Sludge	artendar filde Arabenda Distriction and Arabendar Distriction and Arabendar	C1197-1018		T-1801	Sludge Treatment OCU	420000	420000	210	210	178
Secondary Sludge Thickener	Secondary Slude	e	C1197-1018 & 2011	2	A-1802A/B	Sludge Treatment OCU	280000	280000	140	140	60.
Sludge Building	N/A.		C1197-1018 & 2011	1		Sludge Treatment OCU	800	. 800	0	0	3580
Emergency Primary Sludge Tank	Primary Sludge		C1197-1019	.	T-1903	Sludge Treatment OCU	315000	315000	158	158	276
Emergency Secondary Sludge Tank	Secondary Slude	ge	C1197-1019	1	T-1902	Sludge Treatment OCU	315000	315000	. 158	158	329
Sludge Blending Tank	Sludge		C1197-1019		Т-1901	Sludge Treatment OCU	63000	630000	315	315	41
Sludge Dewaterer	Sludge		C1197-1023 & 2011	2	A-2301A/B	Sludge Treatment OCU	. 96000	96000	48	48	. 06
							0	0	0	0	0
Liquor Retum PS	Sludge Liquors		C1197-1030	1	C-3001	Sludge Treatment OCU	78750	78750	39	66	240

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Odour calculation - Rev 1 (Under revision)

Actual

Cover

C1197 - Waterford WwTW Ventilation. Odour Control and Declassification of Zoned Areas Calculations PURAC Document No. 8419 Date 09/02/2007 Date 2

Orange cells require input

														Process volume	Headspace / Gross	Perimeter	Perimeter	Perimeter	Max fill rate or
•							:				•			(per unit	volume				specified
Process Area	Process fluid N	Vo. Vess	el Shape Wo	orking Dime	ensions /	Details			Headspac	e / Gross	Vessel D	mension	s / Details	۳ ع	۳E	E	٤		m ³ /hr
														a substantial second					
Pre-screen and post-grit channe	Raw Sewage	1 Rect	angular 52	.4 m leng	۳ <u>0</u> ۲	m deep	רי יט	m width	52,4 m l	ength	0.5 m de	ep 1.1	5 m width	141.5	39.3	107.8		Perimeter	
Fine Screens including bypass	Raw Sewage	4 Rect	angular 1	0 m leng	е 22 22	m deep	2.2	m width	2 2	angth	ع ۲	ep 2.	2 m width	48.4	22.0	24.4		Perimeter	
Screenings Compactors	Raw Sewage	1 Othe		t m3 vol	- eu	5 5 5	<u>f</u> e							4.0	4.0	N/A		NA	
Grit Classifier	Grit	1 Othe	7	t m3 vol	- eme		67.12 16 - 12	Ś						4.0	4.0	N/A		NA	
Grit Channel	Raw Sewage	2 Rect	angular 1	0 m leng	<u>23</u>	m deep	2:3	- Marken	2 2	angth ·	0.5 m de	ep 2.	m width	112.2	25.5	30.2		Perimeter	400
Preliminary Treatment Building	N/A	1 Rect	angular 29	.3 m leng	р. С. Э	8 m deep	19.4	m widey	29.3 H	angth	i.38 m de	ep 19.	4 m width	3623.7	3623.7	97.4		ŇÅ	
Primary Sedimentation Tank	Screened Sewage	2 Circl	llar 3	2 m diarr	<u>е</u>	m deep			Ser all	iam 0	.37 m de	e		2412.7	1101.8	100.5		Perimeter	
Pasteuriser	Sludge	3 Othe	r 4	1 m3 vol	- em				8 ⁵⁰	at i				41.0	41.0	N/A		NA	
Picket Fence Thickener	Primary Sludge	1 Circl	llar 8.	7 m diam	4.5	m deep			8.7 m d	ame	0.5 m de	Ġ		267.5	29.7	27.3		Perimeter	æ
Secondary Sludge Thickener	Secondary Sludge	2 Rect	angular 5.	6 m leng	и 10 12	5 m deep	1.2	m width	5.6 m le	angth	Ø5 m de	ep	E m width	5.0 .	5.0	13.6		Cover	
Sludge Building		1 Rect	angular 19	5 m leng	р Р	3 m deep	14.4	m width	19.5 m le	angth -	38 38 9 9 8 5 8 5	ep 14.	4 m width	1790.1	1790.1	67.8		NA	9
Emergency Primary Sludge Tan	Primary Sludge	1 Circu	lar 9.0	88 m diam	5.6	m deep			9.38 m d	iam .	2 m de	6		387.0	138.2	29.5		Cover	
Emergency Secondary Sludge 1	Secondary Sludge	1 Circu	lar 10	.2 m diam	5.6	m deep			10.2 m d	am	a a de	ep		461.2	164.7	32.2		Cover	
Sludge Blending Tank	Sludge	1 Circu	lar 5.	12 m diam	2.9	m deep			5.12 m d	am	- <u>n</u> de	<u>в</u>		59.7	20.6	16.1		Cover	
Sludge Dewaterer	Sludge	2 Rect	angular 5	m lengt	й. 	5 m deep	2	mwidth	ي علام م	angth	.75 m de	ep · 2	m width	7.5	7.5	14.0		Cover	
		0 Rect	angular	m leng	4	m deep		m width	E	ngth	ਉ E	6	m width	0.0	0.0	0.0		NA	
Liquor Return PS	Sludge Liquors	1 Rect	angular 3	m lengl	4 4	m deep	0	m width	φ E O	ingth .	4 T de	ი გ	m width	60.0	60.0	16.0		Perimeter	240

Prepared by DGHemmings 09/02/2007

Odour calculation - Rev 1 (Under revision)

C1197 - Waterford WwTW Ventilation. Odour Control and Declassification of Zoned Areas Calculations PURAC Document No. 8419 Date 09/02/2007 Revision 2

	·			- defined a															
			Call	curations	TOL ZONIN	ig declassific	ation vent	lation rate											
rocess Area	CH4 rate of	Air		LEL % D	hensity		IS safety factor				Ventil	ation rate	s per unit I	n³/hr	Safety Factor	Final rate per unit	Choose /	Actual flowrate per unit	Actual air changes
	emission	changes per hour	Temp	•		Grade of release		Gas	Temperature corrected	Actual gas production					<u> </u>	Max X SF)	nnit		per hour (based on
	m.m.sec x 10		ပ္	×	°m / D		¥	rate kg/s	rate kg/s	rate kg/s	Rate 1	Rate 2	Rate 3	Rate 4		m ³ /hr	<u>-</u>	m ³ /hr	lieauspace)
re-screen and post-grit channel	6.9	0.0	· 8	5.3	0.72 S	econdary	0.5	7.03E-06	5.35E-06	Corrected	388.1	1.1	NA	314.4	%0	388.1	Max xSF	388.1	9.9
ine Screens including bypass	6.9	8.0	ຊ	5.3	0.72 S	econdary	Sec.	2.40E-06	1.83Ė-06	Corrected	87.8	0.4	N/A	176.0	%0	176.0	Max xSF	176.0	8.0
screenings Compactors	0.0	8.0	20	5.3	0.72 S	econdary	0.5	001000	0.00E+00	Corrected	N/A	0.0	N/A	32.0	%0	32.0	Max xSF	32.0	8.0
örit Classifier	0.0	8.0	20	5.3	0.72 S	econdary	0.5	0.008+000.0	0.00E+00	Corrected	N/A	0:0	N/A	32.0	%0	. 32.0	Max xSF	32.0 ·	8.0
brit Channel	6.9	4.0	20	5.3	0.72 S	econdary	0.5	5.57E-06	425E-06	Corrected	108.7	0.9	400.0	102.0	26%	502.0	Max xSF	502.0	19.7
reliminary Treatment Building	0.0	2.0	3	5.3	0.72 S	econdary	0.5	0.00E+00	0.00E400	Corrected	NA	0.0	NA	7247.4	%0	7247.4	Max xSF	7247.4	2.0
himary Sedimentation Tank	6.9	2.0	20	5.3	0.72 S	econdary	0.5	1.20E-04	9.13E-06	Corrected	361.9	18.6 1	NA	2203.6	%0	2203.6	Max xSF	2203.6	2.0
'asteuriser	163.0	2.0	22	2.3	0.72 S	econdary	0.5	4.81E-05	6.07E-05	Corrected	N/A	13.9	NA	82.0	0%	82.0	Max xSF	82.0	2.0
licket Fence Thickener	289.0	6.0	20	5.3	0.72 S	econdary	0.5	5.57E-04	4.24E-04	Corrected	98.4	86.5	8.0	178.3	%0	178.3	Max xSF	178.3	6.0
econdary Sludge Thickener	163.0	6.0	8	5.3	0.72 S.	econdary	0.5	5.91E-06	4.50E-06	Corrected	0.0	0:0	NA	30.2	0%	30.2	Max xSF	30.2	6.0
iudge Building	0.0	2.0	8	5.3	0.72 S	econdary	0.5	0.00E+00	0.00E+00	Corrected	see a	0.0	2.0	3580.2	. %0	3580.2	Max xSF	3580.2	2.0
mergency Primary Sludge Tank	289.0	2.0	8	5.3 (0.72 S	econdary	0.5	8.05E-04	6.13E-04	Corrected	0.0	125.2	N/A	276.4	%0	276.4	Max xSF	276.4	2.0
mergency Secondary Sludge T	163.0	2.0	20	5.3 (3.72 Si	econdary	0.5	5.41E-04	4.12E-04	Corrected	0.0	84.1	N/A	329.4	%0	329.4	Max xSF	329.4	2.0
ludge Blending Tank	289.0	2.0	2	5.3 ().72 Si	econdary	0.5	1.24E-04	9.46E-05	Corrected	0.0	19.3	AN	41.2	%0	41.2	Max xSF	41.2	2.0
ludge Dewaterer	110.0	6.0	20	5.3).72 St	econdary	0.5	5.94E-06	4.52E-06	Corrected	0.0	0.9	N/A	45.0	%0	45.0	Max xSF	45.0	6.0
	0.0	2.0	20	5.3 ().72 St	econdary	0.5	0.00E+00	0.00E+00	Corrected	N/A	0.0	NA	0.0	%0	0.0	Max xSF	0.0	i0//i0#
quor Return PS	110.0	2.0	8	5.3 ().72 St	econdary	0.5	4.75E-05	3.62E-05	Corrected	57.6	7.4	240.0	120.0	. %0	240.0	Max xSF	240.0	4.0
													「「「「「「」」」		の時に読みたまで				110000000000000000000000000000000000000

Odour calculation - Rev 1 (Under revision)

C1197 - Waterford WwTW	Paralase P	ification of 7	Zorod Arono	Calculations		•		· · · · · · · · · · · · · · · · · · ·				·		
PURAC Document No.	8419				Ci					• • •	. *			
Date Revision	09/02/2007 2					•	-					•		•
			OU concentrati	ion calculation					Ē.	nal Calculated Oc	dour, H ₂ S and	airflow rates		
Process Area				Surface area	Superficial air		Specified Odour	Odour	Chosen H ₂ S correlation	Direct H ₂ S	Factor of safety (peaking	Odour concentration	Estimated H ₂ S conc.	
•	Frechen data E _f (OU / s /m ²)	North data E _n (OU / s /m²)	UKWIR value OU _E .s ⁻¹ .m ⁻²	per tank A (m²)	velocity V (m / s)	Emission rate E _{out} (OU / s)	concentration (OU_E / m^3)	concentration (OU_E / m^3)	factor ppb H ₂ S/OU _E	correlation (ppm)	factor)	using SF (OU _E / m ³)	using SF (ppm)	Total flow m³/hr
Pre-screen and post-grit channel	S		180	78.6	60.0	14148		131243	Q.3	39.4	0.1	131243	39.4	388
Fine Screens including bypass			180 -	22.0	0.002	3960		81000	0.3 ·	24.3	0; -	81000	- 24.3	704
Screenings Compactors			180	NA	NA	2 Store	80000	80000	0.5 ·	40.0	1.	80000	40.0	32 ·
Grit Classifier			360	NA	N/A	of and	160000	160000	0.5	80.0	1. 0	160000	80.0	32
Grit Channel			180	51.0	0.003	9180	ونتائ	65833	0.3	19.7	1.0	.65833	19.7	1004
Preliminary Treatment Building				568.4	0.004	0	BUR	150	0.3	0.05	0.1	150	0.05	7247
Primary Sedimentation Tank			120	804.2	0.001	96510	Sector Oline	. 157664	0.3	47.3	0.1	157664	47.3	4407
Pasteuriser			480	N/A	N/A	NA	630000	630000	. 0.5	315.0	1 .0	63000	315.0	246
Picket Fence Thickener			350	59.4	0.001	20806		00007	0.5	210.0	1.0	420000	210.0	178
Secondary Sludge Thickener			350	6.7	0.001	2352		280000	0.5	140.0	1.0	280000	140.0	60
Sludge Building				280.8	0.004	0	800	800	0.5	0.4	1.0	800	0.4	3580
Emergency Primary Sludge Tank			350	69.1	0.001	24186		315000	0.5	157.5	1.0	315000	157.5 ·	276
Emergency Secondary Sludge T	ank 1		350	.82.4	0.001	28824		315000	0.5	157.5	1.0	315000	157.5	329
Sludge Blending Tank			350	20.6	0.001	7206		630000	0.5	. 315.0	0,1	630000	315.0	41
Sludge Dewaterer			120	10.0	0.001	1200		96000	0.5	48.0	0.1	96000	48.0	66
				0.0	0.000	0		0	02	0.0	1.0	0	0.0	0
Liquor Return PS			350	15.0	0.004	5250		78750	0.5	39.4	1.0	78750	39.4 ·	240

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Contract Name : Waterford

Contract No: C1197

ocument Reference: 8418

Title : Gas System Equipment

Revision	No. of Pages	Date of	Purpose of Issue	Originator	Checked	Approved
	(Excluding Cover)	Issue				
1	1	20/11/2006	Contract Issue	DGH	DG	DG
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GAS HOLDER, EXCESS GAS BURNER AND DIGESTER PRESSURE/VACUUM RELIEF VALVES SIZING

		Case 1	Case 2	Case 3	Case 4	
Gas Holder						
Number of Gas Holders		1	1	1	1	-
Average Gas Production Rate	m³/h	193	164	157	95	
Retention Time in each Gas Holder	min	20	20	20	20]
Capacity of each Gas Holder	m ³	64	55	52	32	-
Selected Capacity of each Gas Holder	m³	65	65	65	65	J
Retention Time at Minimum Production Rate	min	23	27	28	46	and the second
Retention Time at Average Production Rate	min	20	24	25	41	
Retention Time at Maximum Production Rate	min	18	21	. 22	37	
		•				
Excess Gas Burner			•			
Maximum Gas Production Rate	m³/h	215	182	175	106	
	0/	05	05	25	25	7
Gas Burner Oversizing Margin	% 3/L	20	20	210	133	. .
Gas Burner Capacity Required	m/n	200	220	219	100	
	1.1.4					
Digester Pressure/Vacuum Relief Valve - Pr	essure Re	lief Conditi	on		:	
Maximum Gas Production Rate	m³/h	· 107	91	87	53	
Mixing Compressor Flowrate	m ³ /h	0	0	. 0	0	Mechanical Mixing
Digester Feed Volume	m³/h	15	15	15	e ¹⁵	Ref: Pasteurisation design sheets 8420
Pressure Relief Rate Required	m³/h	122	106	102	5 ⁵ 68	
		•	N N	9. mg	• • •	
Digester Pressure/Vacuum Relief Valve - Va	icuum Rel	ief Conditi	on es of	tor o	e e e	
Digester Height (Centre of Cone to TWL)	m	13.173	11 13 173	13.173	13.173	na senten en e

		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	, ev		
Drain Pipe Diameter (ID)	m	0:20	0.20	0.20	0.20
Drain Pipe Length	 m	00.00	15.0	18.0	20.0
Boughness	 mm	\$ 0.5	0.5	0.5	0.5
Fittings K _T	(at)	202	2	2*	2
•	- X° 4				

Maximum vacuum relief rate will occur when the friction loss in the outlet line is equal to the static head above the outlet. To evaluate this, the flowrate at which the static head is equal to the friction loss must be determined. Note that the friction factor and hence the friction loss is dependent on the flowrate so the equations must be solved by iteration.

To solve, use the following procedure :

From "Tools" menu choose "Goal Seek" In "Set cell" box enter "C64", "D64", "E64", "F64" In "To value" box enter number contained in cell C39, D39, E39, F39 In "By changing cell" box enter "C56", "D56", "E56", "F56"

	 	 	• .	
	•			

Maximum Flowrate	, m³/h	882	824	794	776
Water Temperature for Design	°C	35.0	35.0	35.0	35.0
Water Density	kg/m ³	994	994	994	994
Water Viscosity	mNs/m ²	0.7204	0,7204	0.7204	0.7204
Velocity	m/s	7.80	7.28	7.02	6.86
Revnolds Number		2152745	2010124	1937033	1892508
Friction Factor	fus	0.02495	0.02495	0.02496	0.02496
Dynamic Head Loss	m H₂O	13.17	13.17	13.17	13.17
Vacuum Relief Flowrate Required	m³/h	882	824	794	776

![](_page_37_Figure_0.jpeg)

![](_page_38_Figure_0.jpeg)

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	14 15 1 16	Dawn DDFudger         Crisolat RJMeakin         Approvet JMNorton         Original Size         A1           Dae 31/08/2007         Dae 04/09/2007         Dae 04/09/2007         Original 04/09/2007         A1           Dig No.         C1197-2031         Rer.         A	Alt Coopying and Charge Right subleting is this accounted in the property of Ensure kinetic of Ensure subleting is the constraint in the property of Ensure kinetic of Ensure within the ensuremann of the ensure	Enpure Limited Enpure House. Birningham Road. Kiddeminister. DY10 2SH. Fax: +44 (0)1562 820 000 Fax: +44 (0)1562 820 000 Internet : www.enpure.co.uk	N. WY.II. CONTINUE INC. INC. 1002	ρ		0	NOTE:- THIS DRAWING TO BE READ IN CONJUNCTION WITH DRAWING C1197-2013 FOR ALL DIMENSIONS ETC. B	See Previous Issues For Past Revision Details           Rev.         Date         Description         Drawn	14 15 16

GAS/FUEL OIL-LAYER PIPE-4