Appendix E.2.3
WWTP Manual

Glanbia Ingredients
Ballyragget
Co. Kilkenny
Ireland

Telephone +353 56 36000
Facsimile + 353 56 36001
www.glanbia.com

GLANBIA INGREDIENTS

WASTEWATER TREATMENT PLANT OPERATING MANUAL

Volume No: 1

Approved By: _____
Environmental Services Manager

Issue Date: _____

Title: INDEX	EF 01

Approved By:	Revision No.: 0	Issue Date:
Environmental Services Mgr.	Issue No. 1	2/11/00

Title: INDEX	EF 02

Approved By:	Revision No.: 0	Issue Date:
Environmental Services Mgr.	Issue No. 1	2/11/00

This manual is a controlled document as indicated by the headed paper used. Only such manual pages are official. The master copy is signed and held by the Environmental Manager. Each page is given a revision number and issue number.

Once an amendment is deemed necessary:

(a) The change is written by the relevant personnel and reviewed by the Environmental Manager.

(b) It is given a revision number, i.e. the original revision number is "0", the first amendment number is "1" and so on.

(c) When a major change or a large number of amendments are made a new issue number is given.

(d) The amendment status page is updated.

(e) The Environmental Manager ensures that the new pages are included in the manual and obsolete material is removed.

(f) The signed copies of the obsolete documents are stamped "obsolete" and filed in the Environmental Manager's office for record purposes and the other copies are destroyed.

The Environmental Manager will ensure that the Environmental Services Manual is kept up-to-date at all times and that any amendments are made as quickly as practical. In his absence, the Asst. Environmental Manager may amend the manual pending approval of the Environmental Manager.

Title: AMENDMENT STATUS	EF 03

Approved By:	Revision No.: 0	Issue Date:
Environmental Services Mgr.	Issue No. 1	2/11/00

Title: CIRCULATION LIST	EF 04

Approved By:	Revision No.: 0	Issue Date:
Environmental Services Mgr.	Issue No. 1	2/11/00

Manual Holder	Location
Plant Operator	Control Room

Title: INTRODUCTION	EF 05

Approved By:	Revision No.: 0	Issue Date:
Environmental Services Mgr.	Issue No. 1	2/11/00

The function of the wastewater treatment plant at Ballyragget is to treat process wastewater into clean water, which is discharged to the River Nore and sludge land spread in accordance with license limits from the E.P.A. License Register No. 359.

Title: SOURCES	EF 06

Approved By:	Revision No.: 0	Issue Date:
Environmental Services Mgr.	Issue No. 1	2/11/00

Effluent is delivered to the plant via an underground drain system from the following four sources:

1. Sewage waste from the administration building.

2. Fatty waste from the following process plants:
   (i) Butter Room
   (ii) Milk Intake, Dairy and Caseinate
   (iii) Cream Separation and Skim Milk Powder Plant I
   (iv) Casein
   (v) Cheese Process

3. Whey Factory

4. Contaminated Surface Water

Title: MONITORING OF WASTE STREAMS	EF 07

Approved By:	Revision No.: 0	Issue Date:
Environmental Services Mgr.	Issue No. 1	2/11/00

The following table shows the monitoring equipment installed in each effluent source.

	Source	Equipment
1.	Sewage Waste -	No equipment. Visual monitor daily.
2. (i)	Butter Room -	Continuous flow meter and proportional sampler.
(ii)	Milk Intake, Dairy & Caseinate -	Continuous flow and total organic carbon monitor (TOC).
(iii)	Cream Separation & Skim Power Plant I -	Continuous flow and TOC.
(iv)	Casein -	Continuous flow and TOC.
(v)	Cheese	Continuous flow and TOC.
3.	Whey -	Continuous flow and TOC.
4.	Contaminated Surface Water -	No equipment. Visual monitor daily.

The data from all the continuous monitors is recorded continuously by the site scada (Orbis) system on a Vax database located in the Assistant Environmental & Services Manager's office. The data is also display in all the control room on the Satt plc screen in the effluent plant. A daily report is generated by the database, which is printed off daily and reviewed with the production staff.

The operation maintenance and calibration of the monitoring equipment is managed by E. Ryan in accordance with the procedures outlined in the laboratory manual.

Title: REFERENCE LIST	EF 08

Approved By:	Revision No.: 0	Issue Date:
Environmental Services Mgr.	Issue No. 1	2/11/00

Reference Drawings

1. Plant Location
2. Plant Layout
3. P & ID
   - 63-101 Balance tank and inlet works
   - 63-102 Biological treatment
   - 63-103 Sludge handling
   - 63-104 Membrane Plant

Reference Manuals

Operating Instruction Mahon & McPhilips Volume 1
Operating Instruction Mahon & McPhilips Volume 2
Operating & Maintenance Manual Waste Water Treatment Plant Upgrade by Treatment Systems Volume 1, 2 and 3
Operating & Maintenance Manual Waste Water Treatment Plant by Treatment Systems Volume 1, 2 and 3 Parts 1 and 2
Installation Operating and Maintenance Document by MBR Technology
Longwood Screen Operating and Maintenance Manual
Installation Operating and Maintenance Manual for Sludge Press Model SF/2000 – Solids Technology Volume 1 and 2
The above manuals and drawings are kept in the Assistant Environmental & Services Manager's office.
Working copies are located in the plant Control Room.

Title: PLANT DESCRIPTION & OPERATIONS	EF 09

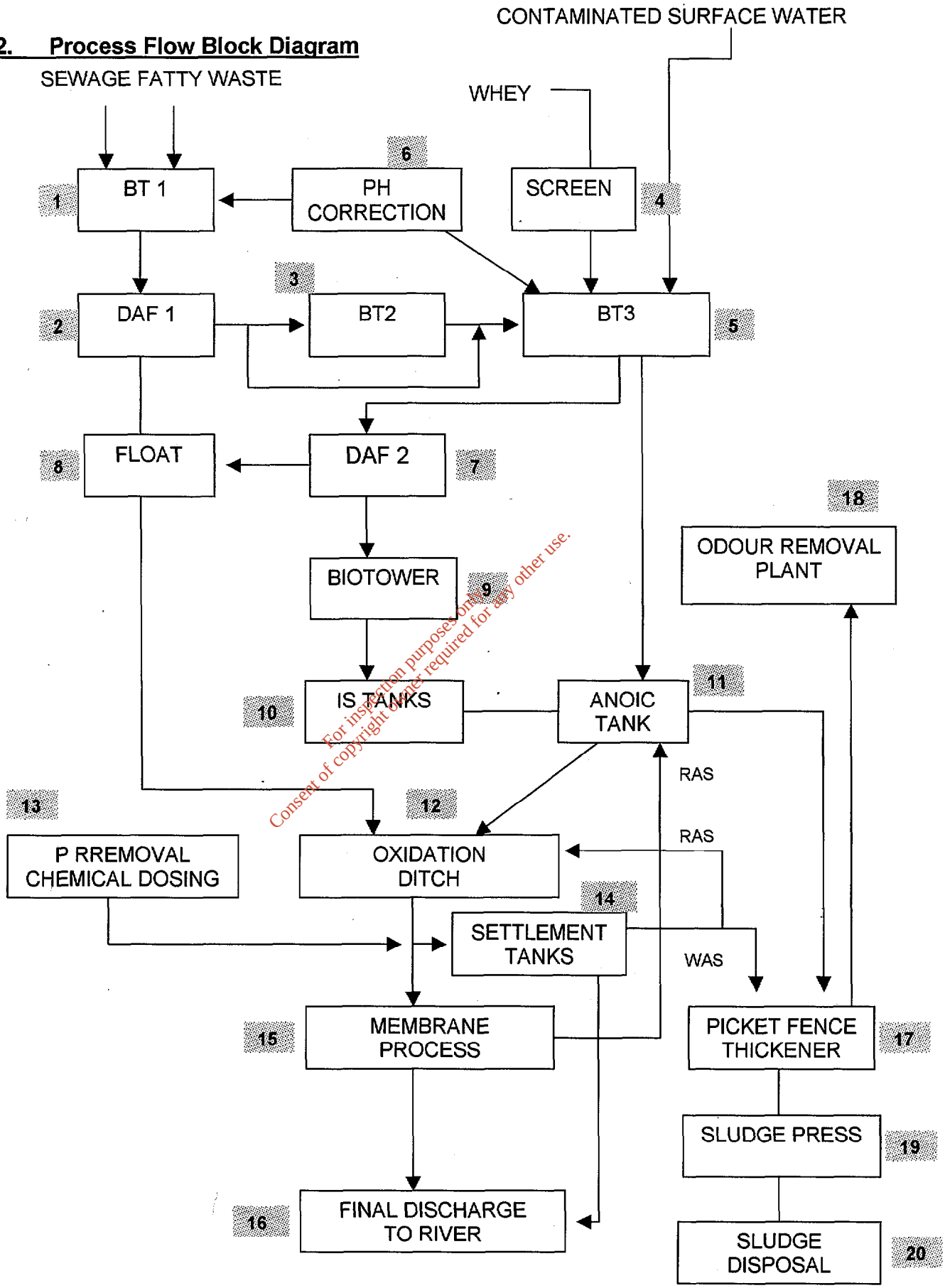
Approved By:	Revision No.: 0	Issue Date:
Environmental Services Mgr.	Issue No. 1	2/11/00

01. Operations

The wastewater treatment plant comprises of the following unit operations. See Process Flow Block Diagram.

1. Balance Tank 1
2. Dissolved Air Flotation Unit 1
3. Balance Tank 2
4. Inlet Screen
5. Balance Tank 3
6. PH Correction
7. Dissolved Air Flotation 2
8. DAF Float Holding Tank
9. Biotower
10. Inter Stage Settling Tank
11. Anoxic Bioreactor Tank
12. Oxidation Ditch
13. Chemical Dosage for P removal
14. Settlement Tank
15. Membrane Process
16. Final Discharge
17. Picket Fence Thickener
18. Odour Removal Plant
19. Sludge Press
20. Sludge Disposal

02. Process Flow Block Diagram



03. Balance Tank No. 1

Dimensions: 24.13 x 10 x 2.9
Capacity: 700m³

Ancillary Equipment

(a) 2 x ABS submersible mixers 1.5 kW
(b) 1 x 5.5 kW blower including ring main and submerged bubble mixers.
(c) Level indication
(d) Duty /standby submersible forward feed pump
(e) PH Correction
(f) Control Satt plc

Process effluent from the Butter, Milk Intake & Dairy/Caseinate, Cream Separation/SMP Plant I, Casein, Cheese and sewage waste from the administration building is drained to balance tank no. 1 via a series of underground drains.

The effluent is mixed in the tank using the mixers mentioned above. PH correction also takes place in the balance tank to control the pH between 7 and 9. This is to enhance fat removal at the next treatment stage. The pH correction system is described in Section 6 of unit operations. Effluent is pumped forward by a duct standby submersible pump to the next stage of treatment, DAF1, which is described in the next section.

The purpose of balance tank 1 is to:

(i) Balance low/high inlet flows
(ii) Balance low/high inlet BOD loads
(iii) Balance pH variation
(iv) Provide uniform feed forward flow

04. Dissolved Air Flotation Unit 1 (DAF 1)

Make:	KROFTA Supacell 50
Capacity:	220m³/hr
Solids Removal:	@ 600mg/l 60% less than 600mg/l = 40%
COD Removal:	15% @ 2680 mg/l

Ancillary Equipment

(i) Inlet flow meter
(ii) Float holding tank level controls and float pumps
(iii) Air dissolving tube recycle pump and air compressor
(iv) Valves and pipe work

Purpose

The purpose of DAF 1 is to remove high fat material (float) from the effluent before it is discharged to balance tank 2 and 3 in order to minimise odours from the tank.

Operation

Effluent is delivered from balance tank 1 via a submersible. A mixture of compressed air and effluent from the recycle pump is added to the effluent at the inlet point of the DAF. A bridge assembly distribute the mixture over the radius of the circular steel tank. The compressed air causes the fatty and solid particles to rise to the top of the tank. A scoop collects this float and discharges it into a balance tank underneath the DAF. The float is pumped from here to the float holding tank at DAF2 via a positive displacement pump, which is controlled by a level sensor in the balance tank.

The fat free effluent is discharged from the unit via a weir at the centre of the DAF unit to either balance tank no. 2 or balance tank no. 3 depending on effluent volumes.

05. Balance Tank no. 2

Capacity: 2,000m³
Equipment: 18.5kw floating aerator

Purpose

The purpose of this balance tank is to provide additional effluent storage during periods of high effluent volumes.

Operation

The tank is filled from the discharge of the fat free effluent from DAF1. The floating aerator provides mixing and keeps conditions aerobic. Effluent is discharged from the tank by gravity to balance tank 3 via pipe work and an automatic valve, which is controlled by the level transmitter in balance tank no. 3. The tank is also equipped with an overflow pipe, which also discharges to balance tank 3.

06. D. Screen

Dimensions: 2m diameter x 2m long
3kw drive motor and bushes

The D screen is located on the effluent drain line from the whey factory. Its purpose is to remove debris such as nuts, bolts, bags, cable ties, etc. from the waste stream. The rotating bushes provide a constant cleaning action and remove the debris into the adjacent collection tray.

Operation
A control switch adjacent to the screen operates the drive motor. The tray is cleaned as necessary and the debris is disposed of with the existing factory waste to landfill.

07. Balance Tank No. 3

Dimensions: 48.27 x 10 x 2.9m

Capacity: 1400m³

Ancillary Equipment:
(a) 2 x 2.8 kW submersible mixers
(b) 1 x 15kw blower and air sparce mixing system
(c) PH correction system
(d) Level indication
(e) 5 x forward feed pumps

Process waste from the whey plant is routed directly to balance tank 3. Effluent from balance tank 2 is also emptied to tank 3 depending on the level in tank 2. The effluent is mixed in the tank by 2 submersible mixers, which becomes active when the level is above 40% and an air sparge mixing system, which runs constantly. Ph correction also takes place in the balance tank to control the pH between 7 and 9. This is the optimum pH to facilitate the biological process. There are 5 forward feed pumps at balance tank 3, which pump effluent from tank 3 to the anoxic tank and the dissolved air flotation unit no. 2 (DAF2).

Three pumps supply the biotower, two and one standby. Two of the pumps are fixed speed and one variable speed. The pump speed is controlled by calculating the kgs of COD from the TOC meter at the biotower and the flow meter to DAF2. This controls the COD load being pumped to DAF 2. The max flow to DAF 2 is 300m³/hr and the COD load set point is 700 kg/hr.

The low level probe in balance tank 3 also controls the pumps.

Two pumps supply the anoxic tank, 1 duty and 1 standby. Both pumps are equipped with variable speed drives and are controlled by calculating the kgs of COD from the TOC meter at biotower and the flow meter to the anoxic tank. The max flow is 200m³/hr and the COD load set point is 500kgs/hr. The level transmitter in tank 3 also controls the pumps. Pump is off when level is <30% and on when level is > 40%.

The operation of all pumps, mixers and pH control system is controlled by the plant plc and MMI located in the plant control room.

The purpose of balance tank 3 is similar to balance tank 1 and 2.

08. PH Correction System

Equipment

Caustic tank insulated and bunded capacity 8600g
Acid tank capacity 4,300g bunded
Acid tank fume scrubber
PH probe and Controller balance tank no. 1
Acid/caustic dosing pump balance tank no. 1
PH probe and controller balance tank no. 3
Duty/standby acid/caustic dosing pumps balance tank 3
PH probe and controller Ox ditch and caustic dosing pump

Ph Control Balance Tank 1

The pH in balance tank 1 is controlled between 7 and 9 by a controller located in the control house. When the measured pH is below 7 the caustic pump comes on and the controller controls its speed. When the pH is above 9 the acid pump becomes active.

Ph Control Balance Tank 3

The pH probe and controller for B/T3 are located at DAF2. The measure pH valve is input to the plc, which in turn activates the caustic pump if the pH is below 7 or the acid pump if the pH is above 9. The set points for the acid and caustic dosing are located on the computer screen in the control room.

Ph Control Oxidation Ditch

The pH in the oxidation ditch is also kept above 7.5 to prevent calcite formation on the membranes. A probe and controller at the ditch give a measured valve input to the plc which is turn activates the caustic pump of the valve is below 7.5. There is no acid dosing to the ditch.

09. Dissolved Air Flotation (DAF2)

Flow rate:	300 m³/hr
Max BOD loading:	18000 kg/day
BOD Removal:	15%

Purpose

This DAF was installed as part of the original plant to remove fat from the effluent prior to the biotower to prevent odours from the tower. The DAF is still used even though the majority of the fat is removed at DAF 1.

Operation

Effluent is delivered to DAF2 from balance tank 3 by forward feed pumps 1, 2 and 3. A recycle pump takes a portion of this effluent from the DAF cell and it pumps it through on air dissolving tube where compressed air is added. The saturated air mixture is mixed with the incoming effluent where the fine air bubbles attaché to the suspended solids and rise to the top of the mixture. The floating material is scraped off by a rotating scraper over a weir and discharged by gravity to a float holding tank underneath. The fat free effluent flows by gravity to the splitter chamber at the biotower.

10. Float Holding Tank

Dimensions: 10 x 3 x 2.5
Capacity: 75m³

The float holding tank stores float it receives by gravity from DAF2 and by pump from DAF1.

Operation

The DAF fat (float) is emptied daily from the float holding tank to the oxidation ditch via a positive displacement pump, which is manually controlled by the operator. The float is only discharged if the D.O. levels in the ditch are above 20% and it is stopped when the D.O. levels drop to 10%.

11. Biotower

Section 1	20 x 9 x 6m	1080 m³
Section 2	20 x 9 x 6m	1080m³
Section 3	20 x 5 x 6m	600m³
Total media volume		2760m³
Recycle pump 1		22kw
Recycle pump 2		22kw
Recycle pump 3		6.6 kW
Media Type		Flocor E
Packed Height		6m
Recycle Ratio		680m³/hr
Approx. BOD Removal		60%
Max BOD loading		5.24% kg/m³/day

The biotower is a three-stage biotower, which operates in parallel. Its purpose is to break down the organic matter to remove BOD.

Operation

Effluent from DAF2 is split in a splitter box between the three sections of biotower from where it goes to a sump at the base of each section. A submersible pump in each sump pumps the effluent over a distribution system at the top of the tower where it percolates down through the media. The bromass, which is attached to the media, breaks down the effluent as it makes its way down to the media. Each section of tower is equipped with duty/standby pump. The pumps are controlled from the Satt plc and by level probes to prevent them running dry. The treated effluent from each section is collected in a sump at each section and routed to the interstage clarifiers, which is the next stage of treatment.

12. Interstage Clarifiers

No.:	2 of
Diameter	8.5 m
Area	56.72m³ each
Flow rate (max)	150m³/hr each
Upward flow rate	2.64 m/hr
Max excess sludge draw off:	5500 kgs/day
Airlift blower	

Effluent from the biotower enters each clarifier from underground at the centre. As the liquid moves up through the clarifier the heavier sludge, which is the material left after the bacteria have broken it down, settles to the bottom of the clarifier. An airlift blower removes the sludge, which is located at the sludge sump no. 1 adjacent to the clarifiers. There is one blower for the two clarifiers and it operates on a time basis. The time is set by visually checking the surface of the clarifier liquid for rising sludge and increasing or reducing the length the blower is on. The blower operates every 15 minutes so sludge is removed from each clarifier every 30 minutes. The sludge flows by gravity from the sump to the picket fence thickener. The clarified effluent flows by gravity to the forward feed pump sump where it is pumped to the anoxic tank for further treatment. These pumps are controlled on level switches by the Satt plc located in the control room.

13. Anoxic Tank

Capacity:	2000m³
Liquid Depth:	4m
Equipment:	Submersible mixer 6 kW
	2 x dry mounted submersible pumps

The anoxic tank is part of the extended activated sludge treatment system. Its function is to remove nitrogen from the wastewater.

Operation

Wastewater from the biotower and from balance tank 3 is pumped to the anoxic tank where it is mixed with mixed liquor, which is pumped from the oxidation ditch and return activated sludge, which is pumped either from the membrane tanks or the two final stage settlement tanks. The high BOD load that is added to the tank causes low oxygen conditions (anoxic) in the tank. Because of this the nitrifying bacteria in the tank break down nitrates and nitrites in search of oxygen into nitrogen. Nitrogen is given off to the atmosphere. The ratio of BOD to nitrogen removed is approximately 3:1.

The mixture exits the tank via an overflow weir into the third lane of the oxidation ditch. The pumps and mixer run constantly and are controlled by switches located in the control panel beside the anoxic tank.

14. Oxidation Ditch

Capacity	12750m³
Liquid depth	4m
MLSS Range (Mixed Liquor Suspended Solids)	1000-10000mg/l *
BOD Removal min/max	1475-14750 kg/day *
F/M (Food/Micro organism)	0.1
Sludge age	10-20 days
Kgs O_2 Req'd/kg BOD	2
Mixers	4 x 4 kW submersible mixers

Aeration System

D.O. Meters	3
Air addition	16 Suprafilt fine bubble diffusers
Blowers	5 (4 duty, 1 standby) - 3 variable speed, 2 fixed, Type Aerzen 132kw
Oxygen transfer efficiency:	2.5-3.0kg O_2/kwh

* Figure quoted here include the anoxic tank.

The oxidation ditch is a 4-lane racecourse design. Microbial action in the oxidation ditch break down the incoming organic load (Food (F)) from the biotower and balance tank 3 into sludge and water. Oxygen is added via the blowers and fine bubble diffuser to aid respiration of the microorganisms. Mixing is provided by 4 submersible mixers, which keep the liquid moving in one direction.

Operation

1. Oxygen Control

The dissolved oxygen D.O. levels are measured at 3 points in the ditch, lane 1, 2 and 4. The levels in lane 1 and 2 are controlled at 20-30% 2-3mg/l. There are 2 fixed speed blowers which run continuously except during periods of low demand and 2 variable speed blowers, which modulate to maintain a D.O. level in lane 1 and 2 at 20%. The D.O. level in lane 4 is normally kept at less than 5% to assist the denitrification process of the anoxic tank. This is controlled by manually shutting off the fine bubble diffusers in lane 4. The blowers are manually selected to run from the Satt plc screen in the control room. The speed of the blowers is automatically controlled from the Satt.

2. MLSS Control

The MLSS is controlled by continually wasting a certain amount of sludge. The term for this is waste activated sludge (WAS). It is important to keep the MLSS at the correct level to ensure that there are sufficient microorganisms available to treat the BOD load. The ratio of BOD (F) to microorganisms (m) should be about 0.1. The MLSS levels vary seasonably because of changes in quantity of BOD from peak production during the summer to winter.

The F/M ratio is calculated as follows:

$$FM = \frac{\text{(Daily Anoxic Flow m}^3 \text{ x BOD of raw effluent mg/l) + Daily flow to Biotower x BOD ex Biotower)}}{\text{MLSS mg/l x 14750m}^3}$$

From the above formula the MLSS levels can be calculated based on the expected BOD volumes subject to a max BOD load of 14750 kgs/day.

Return activated sludge (RAS) is continually added back to the anoxic tank to continually "seed" from the membrane plant from the settlement tanks, if they are being used. Waste activated sludge is bled off continually to keep the MLSS at the desired levels. The laboratory measures the MLSS levels daily. The WAS rate is adjusted based on this value by daily adjusting the control valve adjacent to the oxidation ditch. The RAS and WAS rates are recorded continuously by mag flow meters and are fed back to the Satt control screen. In general, each kg of BOD processed produces about 0.3 to 0.4 kg's of dry sludge solids.

PH Control

The ph in the ditch is naturally between 7.8 and 8.5. A falling pH is indicative of overloading or unstable conditions. Usually, the D.O. will have dropped to zero before the pH starts to drop. Caustic is added automatically to the ditch if the pH drops below 7.7 to prevent calcium deposition on the surface of the membrane plant.

The mixed liquor leaves the oxidation by overflowing an outlet weir. Aluminium sulphate is added here to remove phosphate. The mixed liquor normally goes to the membrane plant for further treatment. The final settlement tanks, which are now redundant, can also be used if necessary in the event of a problem with the membrane tanks.

15. Phosphate Removal System

Aluminium Sulphate Storage Tank	30m³
Variable Stroke Dosing Pumps	2 off

Aluminium sulphate is delivered in bulk to the treatment plant and stored in a bunded storage tank. It is dosed to the mixed liquor leaving the oxidation ditch at the weir via to variable speed dosing pumps. The pumps are manually set each day depending on the final effluent phosphate results from the lab. The process of p removal is very complex. From historical analysis the ratio of alum dosed to P removal vary between 10-40 litres/kg P removed.

16. Final Settlement Tanks

Final Settlement Tanks	3 off
Main Settlement Tanks (1)	1 x 17mø
2nd Settlement Tank (2)	2 x 12mø
Settling Area (1)	226m³
Settling Area (2)	226m³ Total
Flow Rate Net (1)	152 m³/hr
Flow Rate Net (2)	152m³/hr
Upward Velocity	0.67m/hr

Since the installation of the membrane system the settlement tanks are on standby if a problem arises with the membrane tanks.

Mixed liquor leaving the ditch at the weir can be routed to the three settlement tanks by opening two hand control valves in manholes adjacent to the weir. The flow to the 17mø tank is normally set between 150-300m³/hr by controlling the hand valve and reading the flow meter adjacent. Mixed liquor is delivered to the centre of the settlement tank. Because the upward velocity of the final wastewater is so low it allows the heavier sludge solids to settle to the bottom where a rotating scraper diverts the solids to the lowest centre point. The solids level in the tank is controlled by the belmouth, adjacent to the oxidation. This is manually set to keep the solids level as low as possible. A screw pump lifts the sludge from the belmouth to the surface level of the ditch were some of it is returned to the ditch (RAS) and some of it is diverted to the picket fence thickener (WAS).

The two 12m diameter settlement tanks operate in the same manner. Again the flow is set with the control valve and flow meter at the weir. A hand set flow splitter splits the flow equally between the two tanks. Sludge is removed continuously from the bottom of the two tanks by two airlift blowers and is pumped by level controlled submersible pumps to the anoxic tank. The controls for the pumps and blowers are located in the adjacent electrical panel.

The clear final effluent overflows the weirs of each tank and is discharged to the river via the final monitoring point. .

Two parameters are used to check the settleability of the final effluent.

1. 30 min Imhoff cone settlement tank. A 1 l sample of mixed liquor is taken from the oxidation ditch and allowed to settle for 30 minutes in the Imhoff cone. A reading is taken of where the settled sludge level is in the cone. For good settling the reading should be between 350-550mg.
2. Sludge Volume indix SVI

$$SVI = \frac{\text{Cone Test} \times 1000}{\text{MLSS}}$$

For good settlement this should have a result between 80-140.

17. Membrane Tanks

Membrane Tanks		8
Membrane Packs/Tank		6 x 9 and 2 x 10
Total Packs		74
Membrane Panels/Pack		150
Guaranteed Throughput		7200 m³/day
Expected Throughput		9000m³/day

Ancillary Equipment

1 Longwood 3 mm Inlet Screen		756m³/hr @ 760mm
Duty/Standby RAS Pumps	2 off	
Splitter Chambers		3 off
Permeate Recycle Pump		
Air Blower		3 off x 3600nm³/hr each

Mixed liquor is routed from the oxidation ditch outlet weir through a 3 mm automatic screen to the main splitter box where the flow is split in two to feed the two membrane streams.

Stream 1

The flow to stream 1 goes through another splitter box when the flow is split to feed four membrane tanks. The four tanks are connected via the RAS pipes to a RAS chamber where the level is monitored. The level is controlled between 75 & 80%. At 80% the inlet valve to stream 1 closes, at 75% it opens. Air agitation is provided by means of a diffuser pipe work underneath each membrane pack to provide agitation and to provide a scouring action on the surface of the membrane pack to keep them clean. Clear water permeates through the membrane surface and joins permeate from other panels where it is routed to two permeate chambers for each stream. From there it flows by gravity to a chamber where the recycle pump is located and from there to the final outlet monitoring chamber.

The concentrated solids remaining in each tank are routed to a RAS chamber where they are pumped back continuously to the anoxic tank RAS or the picket fence thickener (WAS). The mlss level in each tank is controlled at 10000-15000 mg/l. Because of variation in permeate flux rate in each tank the mlss levels vary. An airlift mechanism in the RAS pipe from each of the four tanks controls the rate of sludge bled off. These are handset for each tanks depending on the mlss measured valves and visual inspection of the tanks. A hand valve, located after the RAS pumps, controls the rate of sludge being returned from stream 1 and is set based on the stream throughput and the MLSS levels.

Stream 2

Stream 2 is identical in operation to stream 1. The entire start-up, shutdown and running sequence are controlled automatically from the Satt plc. The flows to each stream. The RAS and WAS flows are recorded on mag flow meters. The flows are read daily and input into the spreadsheet in the computer in the plant room.

MLSS tests are carried out every second day on each tank.

The membrane system maintenance procedures are outlined in the Guidance Note for Membrane Maintenance issued by MRB Technology, which is kept in the plant room and the Asst. Environmental Manager's office.

Cleaning of Screen

The screen at the inlet to the membrane plant is cleaned automatically. The screening, which consists mainly of fat globules, is collected in a mesh box where the wash water is allowed to drain back to the oxidation ditch. The screenings are emptied on alternate days and disposed of with the sludge.

Recycle Pumps

The permeate recycle pump is located at the permeate outlet manifold. It supplies permeate to the belt press for belt washing and to the membrane plant to clean the air diffusers. The pump is controlled on pressure via a frequency inverter. The pump runs continuously.

18. Final Outlet Chamber

Dimensions 4m x 1.5 x 1.8

The final outlet chamber contains the following monitoring equipment, which monitors the wastewater before it is discharged to the River Nore.

1. Ultrasonic flow meter and 1m Weir
2. TOC analyser
3. PH meter
4. Temperature
5. Auto Sampler

The data from the flow meter, TOC analyser, pH meter and temperature probe is fed back to the plc and computer screen in the control room. The auto sampler samples the final effluent in proportion to the flow as measured by the ultrasonic flow meter. This generates a 24-hour composite sample for analysis by the lab.

The reference in the IPC License for this discharge point is SW1 and the analysis carried out on the sample is in accordance with Schedule 2 (i) Emissions to Water.

19. Picket Fence Thickener

Diameter	15m
Volume	620m³

The picket fence thickener receives sludge (WAS) from the membrane plant from the Biotower interstage clarifiers and/or from the 17m final settling tank. Its purpose is to act as a storage tank and to thicken the waste activated sludge and biotower sludge to 2% solids.

Sludge from the three sources enters the picket fence thickener at the centre where it settles to the bottom. The supernatant from the sludge overflows the weir at the top edge of the thickener and is diverted by gravity to the forward feed pump sump from where it is pumped to the anoxic tank. A scraper diverts the settled sludge to the centre of the thickener where it is drawn off by a duty/standby sludge pump. These are located at sludge sump no. 2. These pumps supply the belt press with sludge. The thickener is covered with a GRP cover which captures odours for treatment by the odour removal plant.

20. Odour Removal Plant

Bord na Mona Odour Removal System

Size	$2m^3$
Flow Rate	$130\text{-}200m^3/hr$
H_2S Level	10-30 ppm

The odour removal plant captures odorous air via pipe work and GRP cover from sludge sump no. 1, sludge sump no. 2 and the picket fence thickener. The unit consists of a bed of peat on which microorganisms grow and remove the odorous compound hydrogen sulphide. Water is added automatically to the unit to keep the peat moist. An extract fan pulls air through the peat bed from the 3 sumps.

The unit is controlled from a local panel. The only operational requirement is to check the fan is running and water is being added.

21.Sludge Dewatering

Belt press

Solids Technology	Model S5/2000-10-31
Capacity	500 kgs dry solids/hr
Poly mixing system	

The purpose of the sludge dewatering plant is to remove water from the sludge so that it can be transported to farms for landspreading.

The sludge mixture is pumped from sump no. 2 at the picket fence by speed controlled sludge pumps. Polyelectrolyte is automatically dosed into the sludge pumps. Polyelectrolyte is automatically dosed into the sludge line prior to the belt press. The poly and sludge are mixed in the mixing tank from where it overflows into the belt press. The mixture at this stage should consist of flocculated sludge and clear water. The dose rate of pay is set manually to the minimum rate to achieve this. Water is drained and squeezed from the sludge as it passes through the belt press. An auger at the end transfers the dewatered sludge to a pump, which pumps it to the loading bay. The water from the sludge is drained by gravity to the oxidation ditch. The entire operation of the press is controlled from its own plc. The press is shutdown automatically in the event of any malfunction.

The poly mixing system is also automatically controlled. Dry poly is added daily to the hopper over the machine from 25kg bags. The dose rate is set manually by setting the speed of the poly-dosing pump from visually checking the condition of the flocculated sludge. The % dry solids in the influent and dewatered sludge are measured weekly by the lab. The usage rate of poly is 3kg/ton of dry solids.

Operations

Check that poly hopper is full.
- Add poly if necessary.

Switch "poly control system" to "ON".
- Poly will be mixed automatically.

On press control panel switch "press control" to "ON".
- Press will go through a start up sequence in which it washes the belts.
- Sludge pumps start.
- Poly dosing start.
- Mixing start.
- After a few minutes the cake pump starts.

Set the timer to the duration required to run.
- 0-4 hours.

When the timer has timed down the press will shutdown automatically.

22. Sludge Disposal

Refer to Environmental procedures EP015 – land spreading of organic waste.

Title: ANALYSIS – QUALITY ASSURANCE	EF 10

Approved By:	Revision No.: 0	Issue Date:
Environmental Services Mgr.	Issue No. 1	2/11/00

Please see Waste Water Treatment Plant Lab Manual

Title: COMPUTER SYSTEM	EF 11

Approved By:	Revision No.: 0	Issue Date:
Environmental Services Mgr.	Issue No. 1	2/11/00

The wastewater treatment plant is controlled by a Satt plc. The information from this is displayed on a computer in the control room, which contains a satt line graphics package.

There are 5 screens on this computer which are displayed as follows:

F1 - Balance Tanks and DAF Units
F2 - Plant Losses
F3 - Old Balance Tank Screen
F4 - Biotower and Oxidation Ditch
F5 - Membrane Plant and Final Outlet

The plc is networked to the following control rooms:

Dairy Control Room	220
Whey Intake	312
Main Whey Control	303
Water Treatment Plant	

The plant losses screen can be viewed in these areas. In addition to the above there is a site scada system, which collects information from all plant monitoring stations and the effluent plant. This information is stored in a server. It is used to generate daily effluent loss reports. Critical plant information can be viewed from any networked pc.

Title: LOSS ANALYSIS & CONTROL	EF 012

Approved By:	Revision No.: 0	Issue Date:
Environmental Services Mgr.	Issue No. 1	2/11/00

Targets for volume of effluent and kgs COD are set each year between the production and services management team.

The current daily targets are:

	Volume	Kgs COD
Whey	4000	9000
Cheese	900	1800
Casein	1000	2900
Butter	80	500
Cream Separation	570	3000
Milk Intake Dairy	820	2400
Miscellaneous	1000	1500

The targets are based on the production plans and on the effluent plant capacity.

The losses from all plants with the exception of the butter are monitored continuously by TOC and flow meters. The butte flow is monitored continuously and kgs COD are calculated based on a daily composite sample. The data is recorded on the site scada system database from which a daily report is generated showing hourly losses for the previous 24 hours. This data is reviewed daily with the production managers by service management. If there are exceedances of targets they are noted and corrective action taken by the production managers. The weekly plant loss results and the discharge results for SW1 and SW2 are recorded on spreadsheets by Services administrator and e-mailed to all managers weekly. The weekly results are reviewed at the weekly operations meeting by the general manager and production heads. Recurring effluent losses that require capital investment are also noted and are submitted annually for capital approval.

Title: PREVENTIVE MAINTENANCE	EF 013

Approved By:	Revision No.: 0	Issue Date:
Environmental Services Mgr.	Issue No. 1	2/11/00

The maintenance of all items in the effluent plant is controlled by the maintenance manager and the computerised maintenance system. The preventative maintenance schedule is based on manufacturers information and plant experience.

Investment maintenance and calibration is also controlled by the maintenance dept. reference engineering procedure CPM 200.

PM for Effluent Instrumentation

Below is a list of control instrumentation for the Effluent Plant and Cooling Line with suggested schedule for peventative maintenance checks.

		Frequency
1.	PH meter & dosing – small balance tank.	3 months
2.	PH meter & dosing at biotower	
3.	PH meter oxidation ditch	
4.	PH meter effluent outlet	
5.	Flow meter to new DAF	As Required
6.	Flow meter to Biotower.	
7.	Flow meter to anoxic tank	
8.	Flow meter inlet membrane stream 1	
9.	Flow meter inlet membrane stream 2	
10.	RAS flow meter membrane plant	
11.	WAS flow meter membrane plant	
12.	Flow meter to sludge press	
13.	Final outfall flow meter new outlet	As Required
14.	Final outfall flow meter old outlet	
15.	D.O. meter 1 oxidation ditch	As Required
16.	D.O. meter 2 oxidation ditch	
17.	D.O. meter 3 oxidation ditch	Annually
18.	Level transmitter balance tank no. 1	
19.	Level transmitter balance tank no. 2	
20.	Level transmitter balance tank no. 3	
21.	Level transmitter membrane stream 1	
22.	Level transmitter membrane stream 2	
23.	Temperature transmitter oxidation ditch	6 months
24.	Temperature transmitter final outlet	
25.	TOC meter biotower	E. Ryan
26.	TOC meter final outlet	
27.	Effluent flow meter whey	As Required
28.	Effluent flow meter cheese	
29.	Effluent flow meter dairy	
30.	Effluent flow meter cream separation	
31.	Effluent flow meter casein	
32.	Effluent flow meter butter	
33.	TOC Meter whey	E. Ryan
34.	TOC Meter cheese	
35.	TOC Meter	
36.	TOC Meter cream separation	
37.	TOC Meter casein	
	Cooling Line	
38.	Flow meter cooling water	As Required
39.	PH meter cooling water	3 months
40.	Temperature cooling water	6 months
41.	TOC meter cooling water	E. Ryan

Title: TROUBLE SHOOTING	EF 14

Approved By:	Revision No.: 0	Issue Date:
Environmental Services Mgr.	Issue No. 1	2/11/00

The detailed trouble shooting measures please refer to the following manuals:

Operators Pocket Guide to Activated Sludge I Part I
Operators Pocket Guide to Activated Sludge I Part II

Activated Sludge System – Forbairt

These are located in the Asst. Environmental Services Manager's office.

Below are listed some fundamental items which directly effect outlet quality.

Effect	Cause
High outlet B.O.D.	- Plant overloaded - Low D.O. in ditch - Biotower pumps not operational - Check F/M ratio
High outlet S.S.	- Check permeate from each membrane tank, membrane may be damaged - Check clarifiers if operational for rising solids - Check MLSS/solids loading on clarifiers - Check RAS operational
High outlet Nitrates	- Check anoxic tank mixing - Check ratio COD to N. in anoxic - Check MLSS pumps at anoxic not blocked
High Outlet Ammonia	- Check D.O. levels in Ditch
High Outlet Phosphate	- Check chemical dosing pumps - Check for excessive incoming phosphate loads

Attachment E.3

EMISSIONS TO SEWER

Glanbia Food Ingredients (Ballyragget) Ltd.
Revised IPPCL Application

Project Ref: OES1044_01

Attachment E.3 is not applicable as there are no emissions to sewer.

Attachment E.4

EMISSIONS TO GROUND

Glanbia Food Ingredients (Ballyragget) Ltd.
Revised IPPCL Application

Project Ref: OES1005_01

Attachment E4 Emissions to Ground

E4.1 Introduction

Glanbia Ballyragget generate approximately 18,000 tonnes of sludge from the on site waste water treatment plant annually.

This material is landspread on an Agency approved landbank in accordance with Condition 7 of the IPC Licence and a Nutrient Management Plan (NMP), which is approved in advance of spreading by the EPA.

E4.2 Landspread Areas

Organic waste is landspread and soil injected by Nore Farm Relief Services:

Nore Farm Relief Services Ltd.

Landspreading takes place in counties Kilkenny, Laois, Offaly, North and South Tipperary, Carlow, Waterford and Cork.

E4.3 Characteristics of Organic Waste

The sludge generated through the treatment of process waste waters is dewatered to approximately 10-11% solids at the treatment plant and has the following characteristics.

Parameter	Concentration (kg/ t)
Nitrogen	7.5
Phosphorus	3.9
Potassium	1.6
Dry Matter %	-

The total area of land available for spreading of organic material is approximately 30,000 acres.

E4.4 Nutrient Management Plan

The Nutrient Management Plan (NMP) detailed below sets out a series of criteria which will be used to regulate and manage the landspreading of organic waste arisings from the plant in a way which will minimise the potential for environmental impact.

The proposed NMP sets out a maximum soil P level of 15 mg/kg for landspread areas on the basis of EPA recommendations.

In setting this soil P level as a criteria for landspread areas, Glanbia Ballyragget intend to maintain a sustainable landbank, wherein application rates are maintained at levels which on a year to year basis, will not result in an increase in the concentration of Phosphorous in soil.

The NMP is intended to facilitate management control over the landspreading activities of the waste management contractors involved in landspreading.

Accordingly, landbanks will be identified for use on a monthly basis, with the contractor being provided information on the landarea to be used, the rate of application and the records, which must be maintained.

The activities of the landspreading contractors will be the subject of periodic unannounced inspection and site visits by Glanbia personnel.

The Nutrient Management Plan comprises the following elements:

Vulnerability Assessment

This ***Draft Nutrient Management Plan*** assumes that all land is suitable for spreading on when taking into account vulnerability criteria. These criteria are set out below:

- presence of waterlogged ground
- presence of exposed bedrock or within 15 m of exposed karst limestone features such as shallow holes or collapse features
- presence of steep gradients (i.e. in excess of 10 degrees)
- presence of residential dwellings within 100 m of landspread area
- presence of lakes or marsh river channels within 20 m of landspread area
- presence of small watercourses and field drains within 10 m of landspread area
- presence of public roads within 10 m of landspread area
- presence of domestic wells within 60 m of landspread area
- presence of public water supplies within 300 m of landspread area
- presence of sensitive buildings such as schools or hospitals within 200 m of landspread area

The above criteria will form the primary element in the assessment of new landspread areas as they are required and for the establishment of buffer zones within the landspread areas.

Nitrate concentrations are also calculated based on farm nitrate levels as a result of fertiliser application and also landspread sludge input.

Nutrient Management Plan

The ***Draft Nutrient Management Plan*** records the following information:

1. *Area Reference Number*
   The unique reference number assigned to each landspread area.

2/3. *Name and Address*
   The name and address of the landowner is recorded.

4. *Map Reference*
   Each landspread area is referenced to a specific map area indicating its location.

5. *Soil Sample No.*
   Each soil sample is given a unique reference number to enable its location on a map.

6. *Area of Soil Sample*
The area in hectares from which each soil sample was collected is recorded.

7. *Soil P Level*
The soil phosphorous level (expressed in mg/kg) is taken to be representative of the area within which the sample was collected.

8. *1998 Land Use*
This column describes the land use for the sample area for the current year

C1 - Cut once
C2 - Cut twice
G - Grazing

9. *Phosphorous Requirement*
The phosphorous requirement is derived on the basis of the soil P level (7) and the current years land use (8) utilising recommended factors as follows
On Farm P Estimate
An estimate should be made where possible of the quality and sources of on farm available phosphorous through manure, slurry or other external sources.
Net P Input
On the basis of the overall input requirements and the on farm available phosphorous, the net input requirements is calculated.

10 *Sludge Application*
On the basis of the P concentration of the sludge, the total quality of sludge required is calculated

11. Nitrogen Requirement
The total nitrogen application rate arising from sludge input requirements based on P is determined in order to ensure the application rate does not exceed 250kgs/ha (Phosphorous is the predominant limiting factor)

Records

The following records are required to be maintained as part of the NMP.

- Date and quantity of sludge transported off-site
- Weather conditions on the day
- Location of landspread area
- Rate of application of sludge

The information recorded as part of the NMP will be collated on a monthly basis. A running total of sludge quantity spread on each of the landspread areas will be maintained.

Responsibility

The Environmental & Services Manager is responsible for implementing and updating the Nutrient Management Plan at the site and is assisted by the Environmental Coordinator in managing the day to day aspects of the NMP.

Sludge Storage

Glanbia have an existing sludge storage facility at Ballyconra, to provide for temporary winter storage of organic material. This facility was fitted with a cover to prevent rainwater ingress, which was damaged in heavy weather earlier this year. Planning permission has been received from Kilkenny Co. Council for the construction of 2,677m^2 storage shed and associated site works at Ballyconra to cover and upgrade the existing storage area.