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Attachment D

INFRASTRUCTURE & OPERATION

Kerry Ingredients (Ireland) Ltd.
Revised IPPCL Application

Project Ref: OES1005_09

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Attachment No. D

D1 Operational Information Requirements

Kerry Ingredients (Ireland) Ltd. Is the Dairy and Food ingredients division of the Kerry Group plc, headquartered in Tralee, Co. Kerry.

Within the division, Kerry Ingredients (Ireland) Ltd. currently operate six processing plants, of which Kerry Ingredients-Listowel is the flagship plant and one of the original casein processing plants in Ireland.

The other plants are located in Charleville, UK and Continental Europe.

The Listowel plant processes over 546,000m^3 of milk per annum to produce a large range of Dairy Products, while a range of non milk based specialist food and food ingredients are also produced.

The plants major products include butter, cheese, spreads, casein, and whey derivatives. Allowing for the range of production steps the plant processes 1,000,000m^3 of dairy liquid every year with all the attendant energy and waste disposal requirements.

The main production departments are Casein, Powder, Yellowfats and Cheese.

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List of Processes

The following processes are carried out at the Listowel facility:

- Dairy Liquid Process
- Yellow Fats
- Casein and Whey
- Cheese Production
- Powder, Blending, Bottling and Block Milk Process
- Services / Effluent Treatment Plant

These processes are described in greater detail in the following sections.

D1.1 DAIRY LIQUID PROCESS

Secretion of milk in the cow's udder begins shortly before calving, so that the calf can begin to feed almost immediately after birth. The cow then continues to produce milk for about 300 days. This period is known as lactation. Because most cows will calf in spring, the greatest volume of milk is available at this time of year, between April and July. Production of milk will fall off in September and October to coincide with the decline in grass growth. This will vary with the breed of cow, diet, age and stage of lactation. Processing of milk at the plant coincides with lactation period. The plant operates an end of season period between December and February when little or no milk is processed. Most plant maintenance is carried out at this time. However cheese processing, spreads production, and powder drying continue throughout this period.

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Milk Intake:
Whole-milk arrives at the plant in bulk road tankers. The milk is tested for acceptability before being filtered, and pumped to one of eight bulk milk storage silos with a capacity of 273m^3. As previously indicated over 546,000m^3 of milk is processed at the Listowel plant on an annual basis.

Separation:
Fat in whole-milk exists as globules, which are lighter than the rest of the milk, and therefore fat tends to rise to the surface giving a fat rich layer. If milk is allowed to stand it separates into distinct layers. Passing the milk through centrifugal separators can do this very efficiently. The end products are cream (45% fat) and skim milk (0.7% fat).

Both cream and skim milk are pasteurised, cooled and pumped to storage. Cream is held in a jacketed tank where it is gently stirred and cooled to crystallize the fat. Cream can then be used to produce butter and butter oil.

A process flowchart is outlined below indicating waste and emission points.

D1.2 YELLOWFATS

Butter
Butter is produced by agitating cold cream so that the skin around the fat globules breaks and the fat sticks together to form grains of fat. The liquid portion of the cream (butter milk) is separated from the fat grains, which are then worked to form a homogenous product to which salt or lactic cultures can be added. The fat content of butter is around 80-82%.

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Spreads
Spreads are manufactured from oil, either butteroil and/or vegetable oil. The oil is mixed with an aqueous solution and then crystallised in a scraped surface cooler. The fat content may vary between 5 and 80% depending on whether a low or high fat product is required.

Butteroil
Butteroil can be manufactured from either cream or butter. It is produced by passing the butter or cream through a series of fat concentrating steps much the same as the original milk separation step. The fat is concentrated up to 99.8%.

Separate process flow diagrams are included in Appendix D.1 for butter and spreads production.

D1.3 CASEIN AND WHEY

Skim milk is pumped to storage in one of eight 273m^3 silos as indicated in the Dairy Liquid Process Flow Diagram.

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Average analysis of skim milk and wholemilk is outlined below.

Constituient	Whole Milk	Skim Milk
Fat	3.5%	0.7%
Lactose	4.7%	4.7%
Minerals	0.8%	0.8%
Protein	3.2%	3.2%
Water	87%	91.2%

Protein is the most valuable component of milk and the level increases in the months from April to November.

Protein in milk consists of:
a) Casein (80%)
b) Whey Proteins (20%)

Casein Production

Caseins precipitate from solution when the pH of milk is adjusted to pH 4.6, whereas whey proteins do not. This difference in properties of the two groups of proteins is used in Acid Casein Production.

The enzyme Rennet produces a very slight and specific change in the casein molecules, resulting in its precipitation from solution, in the absence of calcium ions. This property is used in Rennet Casein Production.

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The above differences between the two properties of Casein and Whey proteins allow casein to be separated from milk on an industrial scale.

At Kerry Ingredients the skim milk is processed in the Casein Plant where the Casein is separated from the whey proteins, which remain in to await further processing as indicated in the Dairy Liquid Process Flow Diagram.

After separation from the whey proteins the casein, i.e. curds, is further washed to remove lactose, free acids and minerals. It is then dried and milled to give a product, which meets with customer specification.

Wash water is recovered by further processing.

Two types of Casein are produced at Kerry Ingredients:

i) Acid Casein,
ii) Rennet Casein

Since there are different methods of manufacture the whey that results from each method is slightly different composition, which impacts on the subsequent whey processing.

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Whey Processing

The whey resulting from Acid Casein Production and Rennet Casein Production is known as Acid Whey or Rennet Whey respectively.

Acid and Rennet Whey have the following composition.

Parameter	Acid Whey	Rennet Whey
pH	4.6	6.5 to 6.7
Lactose	5.1%	5.4%
Salts / Ash	0.8%	0.5%
Protein	1.0 to 1.1%	1.0 to 1.1%
Fat	0.08%	0.5%
Water	93%	93%

Both types of Whey have different uses.

Rennet Whey may be concentrated by evaporation and spray dried as whey powder. When Rennet Whey is demineralised, it may be evaporated and dried. It can then be sold as an added value product principally to the baby food industry. Rennet Whey is used for demineralisation in preference to Acid Whey because of its lower ash content.

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Acid whey is more difficult to spray dry than Rennet Whey and more difficult to demineralise because of its high ash content. At Kerry Ingredients the Whey Proteins in the acid whey are recovered by Ultrafiltration (UF), which is a membrane separation process. A milk whey protein with protein levels up to and exceeding 75% protein is produced and is then spray dried. Rennet Whey may also be processed by UF.

In addition to the processing and drying of whey, both whole milk and skim milk are used as raw materials for a range of powdered products. These may be either dried separately or with a variety of vegetable fats, sugars and other ingredients.

The main processes and products produced are outlined in the Dairy Liquid Process Flow Diagram. This flow diagram also outlines the areas where losses may occur in washing, etc. and which goes by drain to the effluent plant for treatment.

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D1.4 CHEESE PRODUCTION

Manufacture of cheese takes place in the cheese plant. Both industrial cheese and mozzarella cheese are manufactured in the cheese plant within separate manufacturing areas.

Cheese is manufactured by reconstituting casein, fat, starch and emulsifying salts with water, cooking and hot filling into boxes, etc. which are then placed in cold storage.

The cheese plant operates as two production lines – Line 1 and Line 2.

Dry ingredients and incoming cheese are handled at the Cheese Preparation area. Within this area, cheese is passed through a grinder and onto Line 1 or Line 2.

Cheese and dry ingredients are then passed through the blender to the cookers on Line 1, whereas they are passed directly to Cookers on Line 2.

The unit operations for each line are described below.

Cooking Line 1:

Cheese paste is formed in the blender and is sent directly to the paste hopper. This is then filtered and sent to either the Kerry Cookers or to the Karl Schnell Cooker (Prodal Products), depending on the final product.

Kerry Cookers – once cheese is cooked it is sent to the hopper and then filtered and pumped into the Handtmann (volumetric filling hopper)(Prior to Packing).

Karl Schnell Cookers – once the cheese is cooked it is pumped and filtered and sent to Handtmann(Prior to Packing)

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Cooking Line 2:

The cheese paste is passed to the Kerry Cooker, where it is cooked and sent to the hopper, filtered and pumped to Handtmann (prior to packaging).

Packing Polyclip

Cooked Cheese is sent from the Handtmann Filler to the stuffing horn and filling horn where it is packed off as sausage and or square chubbs respectively.

There is a metal detector on the polyclip so cheese is passed through this immediately prior to packing.

Chubbs are packed, printed and sent to cooling tunnel.

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Packing Tiromata

Volumetric Line 1 and Line 2 – Cooked Cheeses are volumetrically filled into blocks formed on the tiromat line via Handtmann filler. The blocks are passed through a metal detector before being printed and sent to cooling tunnel.

Weighing Line 2 only – The Handtmann filler drops cooked cheese into a small hopper, which has load cells on it and weighs exactly 10kg of cheese for blocks. This packing system is used on formulated cheeses only. Again blocks are metal detected and sent to cooling tunnel.

Odenberg Cooling Tunnel:

This is a lift operating system. It takes in chubbs and blocks and stores them on levels. It also outfeeds blocks and chubbs. This is done alternatively. Blocks have a residence time of 650 mins average and chubbs have a residence time of 450 mins average.

A process flow diagram is included in Appendix D.1.

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D1.5 PROCESS SUMMARY /EMISSIONS AND WASTES

This section provides a brief summary of the main operations at Kerry Ingredients and also provides details of aqueous discharges, emissions to atmosphere and wastes generated.

Yellowfats Process Summary

A brief description of the operations carried out in this department is included in Section D1.2 of this attachment.

Cream is pumped from the cream silos to the Balance Tank feeding the churn. The cream is then fed into the churn and churned into butter. The buttermilk is separated from the butter in the separating section.

Buttermilk is pumped to the buttermilk holding silos and is sold as product in liquid form. Some of the buttermilk is added back through the churning section to ensure that all of the butter is removed.

After the working section, the salt/curd or lactic solution is injected into the butter. Following this the butter is pumped to a holding trolley from where it is fed to the packaging machine.

Bulk butter is packed into 25kg boxes, which are lined with plastic sheets. These boxes are taped, coded and palleted. Butter is stored in the cold store awaiting despatch.

Spreads are produced by blending butter oil with vegetable oil to form an emulsion.

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Wastes and Emissions (Yellowfats)

Wastewater generated in this department goes to the Effluent Treatment Plant. Treated effluent is discharged to the River Feale at SW1.

The main source of wastewater is from Clean In Place (C.I.P.) washes. For every C.I.P. wash, the pre-rinse goes to the drain (and from there to the Effluent Plant), caustic is recirculated and the final rinse channelled to the pre-rinse tank. The pre-rinse goes to the drain and contains fat/oil residues, which are retained in the Fat Trap in the effluent plant.

Solid waste generated in this department includes packaging material such as cardboard boxes, plastic tubs and aluminium foil. Aluminium foil is not for recycling according to the Waste Management (Packaging) Regulation, 2003.

There are no significant emissions to atmosphere from this department.

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Casein, Whey, Caseinate Process Summary

Casein is produced by destabilisation of the casein micelles in skim milk, either by the action of rennet at normal pH or by lowering the pH to the isoelectric point of milk as outlined in section D1.3 of this attachment.

The pH is lowered by the addition of dilute mineral acid.

The coagulum formed by destabilisation is heated and the curd, which then separates from the whey, is washed, dried, ground and bagged.

The whey, which is the liquid remaining after the recovery of the curds, comprises 80 - 90% of the total volume of milk entering the process and contains more than half the solids present in the original whole milk, including 20% of the protein and most of the lactose, minerals and water soluble vitamins.

Whey powders are produced by drying whey after demineralising by ion exchange.

Proteins are recovered from whey by ultrafiltration.

Lactose is recovered from concentrated whey by crystallisation and drying.

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Wastes and Emissions

Aqueous Discharges
The main source of aqueous discharges from this process are C.I.P. washes. All waste waters generated go to the effluent plant via the drainage system for treatment prior to discharge to the River Feale.

Some NaOH, HCl and C.I.P. wash are released to the effluent plant from the Demin Plant. Liquid waste from the evaporation and UF plants is also discharged to the effluent plant, once all spent heat is extracted.

Solid Waste
All solid waste in this area is disposed of through a compactor to the Kerry County Council Landfill site. This includes clean up debris from all plants. General packaging materials such as cardboard boxes, paper sacks and black bags, are recycled. Waste plastic drums are returned to supplier or are recycled.

Emissions to Atmosphere
The main emissions to atmosphere in this area are due to particulates from the drying process. This includes the following:
Casein Plant

- Casein Driers (x3), A2-7 to A2-9, Particulate (Dust).
- Casein burner (A1-9), Combustion Gases
- Casein Fluid Beds (x2), A2-10 and A2-11, Particulate emissions.
- Casein Mills (x2), A2-12 and A2-13, Particulate emissions.

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Powder, Blending, Bottling and Block Milk Process

Water is removed from liquid concentrate by evaporation followed by drying. Drying is carried out in a spray drier in which the liquid concentrate is atomised into a flow of hot air. The hot air removes the remaining water. The dried powder is sifted and packed into 25kg bags or 1 tonne bulk bags.

In the case of blending, several dry ingredients are batched together, mixed and bagged off as a single product in 25kg or bulk bags. In the bottling plant, plastic bottles are moulded out of polyethylene beads. The bottles are then printed, filled with milk powder, capped, shrink wrapped in trays and finally palleted.

Block milk is manufactured by reconstituting milk powder, sugar and cocoa with water into a liquid concentrate, which is dried, milled and bagged.

Wastes and Emissions

Aqueous Discharges
Contaminated condensate, which is a by-product of the evaporation process, is discharged to the drain. Evaporator process water and C.I.P. wash containing caustic and HCl, is also discharged to the drain after all recoverable heat is extracted.

Water, C.I.P. solution and losses from the wet area go to drain. All effluent is pumped through the Effluent Treatment Plant. Some C.I.P. is recovered. Wastewater from the Niro 2 Scrubber is discharged to the Effluent Treatment Plant.

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Solid Wastes
Product spillage from the driers is collected as sweepings. Bagged dust is collected from the dust extractors in the bag-off area and sold as tailings. All waste packaging from the blending process is placed in bulk plastic liners and compacted for recycling. Dust is collected by extractors and bagged as tailings. Sweepings/tailings are sold off for the most part as animal feed. Plastic waste from the bottling area is also sent for recycling. Some waste paper and boxes are also disposed of in this way. Empty drums/plastic containers are collected and returned to the supplier.

Emissions to Atmosphere
The main emissions to atmosphere are due to particulate emissions from the driers:

- Niro 1 Drier, A2-1, Particulate Emissions
- Niro 2 Drier, A2-3, Particulate Emissions

Other minor emission points are:

- Dust Extractor (Bag-off), A2-6, Particulate emissions.
- Blending Bins (x2), A2-14 and A2-15, Particulate Emissions.
- Crosana Fluid Bed, A2-16 and Crosana Mill, A2-17, Block Milk particulate emissions.
- Dust extraction blending, A3-9 (Particulates)
- Exhaust from Printer (Bottling Plant) A3-10, VOCs.

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- Niro Burners (x2), A1-7 and A1-8, Combustion gases.
- Odour is removed by the Niro 2 Scrubber (AP-1) during drying of certain cheese powders.

Services & Effluent Treatment Plant

Effluent Treatment Plant

All effluent waste streams and storm water drains are routed to the Effluent Treatment Plant.

The treatment process include:

Primary, Secondary and Tertiary treatment processes (copy of the Effluent Plant Manual has been enclosed).

Waste effluent streams at Kerry Ingredients are generally fed through fat traps and grit chambers, through raw waste sumps and then through two dissolved air flotation (DAF) units, with the exception of the Demin Plant Liquid Stream, which is introduced at a later stage in the process and immediately prior to phosphorus removal.

The waste stream gravitates to an aerated balancing tank (4,550 m^3 capacity) and is then metered to an Anaerobic Digester. It is then pumped to an aerated storage tank, where it then goes to a Biotower.

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The waste stream then settles in an interstage clarifier. The solids which settle at the bottom of the clarifier go through a dewatering process (belt presses and centrifuge). The sludge settles in a sludge holding tank. It is then disposed of as farm fertilizer by landspreading. The supernatant from the clarifier is pumped through an interstage pumping station, through a denitrification tank, and through activated sludge plant and clarifiers. The treated demin liquid stream is fed into the activated sludge plant.

The supernatant from the clarifiers is pumped through six sand filters and into a final discharge sump. The final effluent is discharged at SW1 to the River Feale in accordance with the IPC license requirements.

An Abatement Equipment -WWTP Schematic is included in Appendix D.1.

Services

A Multi Solid Fuel Boiler and/or five oil boilers provide steam for the plant. The solid fuel boiler is run on coal and peat.

Wastes and Emissions

Aqueous Discharges
All aqueous waste streams and also all storm water drains in the Kerry Ingredients Plant are routed through the Effluent Treatment Plant. The treated effluent is discharged to the River Feale. Final effluent is monitored on a daily basis, and in accordance with Schedule 2(ii) of the IPCC. Comprehensive and frequent intermediary sampling and analysis is also carried out on waste streams.

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Solid Waste
Two compactors process most of the solid waste on-site. This mainly consists of production and miscellaneous solid material. Approved and licensed waste disposal contractors remove solid waste to the Kerry County Council landfill site. Scrap metal is removed off site by licensed scrap metal merchants for recycling.

Sludge from the Effluent Treatment Plant is suitable for use as a fertiliser and is removed by licensed contractor for landspreading to farms in the North Kerry area. Sludge is regularly analysed. Records are maintained of the quantity and location where sludge is landspread.

All sludge is land spread in accordance with a Nutrient Management Plan, which is agreed with and submitted to the Agency. The activities of landspreading contractors are the subject of periodic unannounced inspections and site visits by Kerry Ingredients personnel.

Waste ash from the solid fuel boiler is disposed of via landfilling by a licensed contractor.

Hazardous Waste
Licensed hazardous waste disposal contractors dispose of all hazardous waste, which includes waste oil, fluorescent tubes and laboratory chemicals.

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Emissions to Atmosphere
The main emissions to atmosphere from services are as follows:-

a) Combustion gases from the solid fuel boiler and oil fired boilers.
- Oil Boilers No's 1 to 5, A1-1 to A1-5
- Solid fuel boiler A1-6 (combustion gases and particulates)

b) Combustion gases from office and canteen (KCC lab) boilers.
- Office boiler (diesel), A3-7
- KCC lab boiler, (canteen), (diesel), A3-8

c) Combustion gases from the Diesel Generators, Stacks A3-3, A3-4 and A3-5, used during winter months max demand period for a couple of hours each day.

d) (A3-6) Biogas Flare: Methane gas is flared off by burning with propane gas, when digester pressure is high. Otherwise biogas may be burned as a fuel.

e) Odours are removed by scrubbers on Balance Tank (AP-2).

f) Acid fumes: These are removed by acid scrubbers in the Acid Bund at AP-4, AP-5, and AP-6.

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D2 Development & Operational History of the Site

The Kerry Ingredients Listowel plant is located on the outskirts of Listowel on level ground between the N69, Tralee-Listowel national primary route and the River Feale (NGR 0989E, 1328N).

Construction on the Listowel site commenced in 1972 on a green field site and has developed over the years to a fully integrated dairy manufacturing plant incorporating services, wastewater treatment plant, storage and car parking. The installation covers an area of approximately 10.5Ha.

The original planning permission for the installation was granted in 1971 for the development of a milk-processing factory.

Over the intervening period, the facility has expanded to reflect changing production output and technology. It is noted that the core activity has remained consistent since the development of the installation and no areas of the site have been made redundant.

Developments at the site since construction of the original installation have included:

- Construction of office and administration block (1972) with extension in 1978 and 1989.
- Construction of new warehouse, storage tanks, generator room (1975).
- Installation of 38kV Transformer (1978).
- Installation of multi fuel steam boiler (MFSB) (1983).
- Construction of anaerobic digester at WWTP (1987).
- Construction of maintenance workshop (1991).
- Construction of cheese production facility (1994).
- Construction of pallet storage and washing area (1994).
- Construction of palletising facility (1998).
- Upgrade of Niro 2 abatement system through installation of a new baghouse (1998)
- Construction of firewater storage tank and associated pump house (2001).
- Construction of covered and lined sludge storage lagoons (Causeway) (2002).
- Upgrade of Niro 1 abatement system through installation of new baghouse (2002).

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There has been consistent development in environmental improvements since the plant was originally constructed, including the following:

- Incorporation of anaerobic digestion at wastewater treatment plant.
- Construction of new Niro 1 baghouse.
- Construction of new outfall on SW-1 to R. Feale.
- Increase in stack height of casein mills emission points.
- Upgrades to wastewater treatment plant to improve nitrogen and phosphorus removal.
- Installation of decanter for improved sludge separation (dewatering) at WWTP.
- Provision of dedicated off-site sludge storage facility at Causeway.
- Blow down recovery from MSFB.
- Upgrade of oil burners to HFO/LFO option.
- Installation of cooling tower on wastewater stream.
- New stack, bagfilter and monitoring system on MSFB.

In addition to the above capital projects aimed at improving environmental performance, a number of improvements and have been made to improve performance and provide environmental monitoring data as follows:

- Integrity testing of site drainage system.
- Relining and relaying of the site drainage system.
- Installation of monitoring boreholes at waste ash landfill.
- Overhaul and provision of monitoring access to solid fuel boiler.
- Improvements in reliability and efficiency of solid fuel boiler, reducing fuel consumption, per tonne of product produced.
- Installation of noise reduction technologies.

Expenditure on environmental improvements over the 2003/04 period has exceeded €3.5m.

D2.1 Future Developments

The focus on future developments at the Listowel site will be on the provision of improved research and development facilities to underpin the main processing activities and facilitate the development of new improved products.

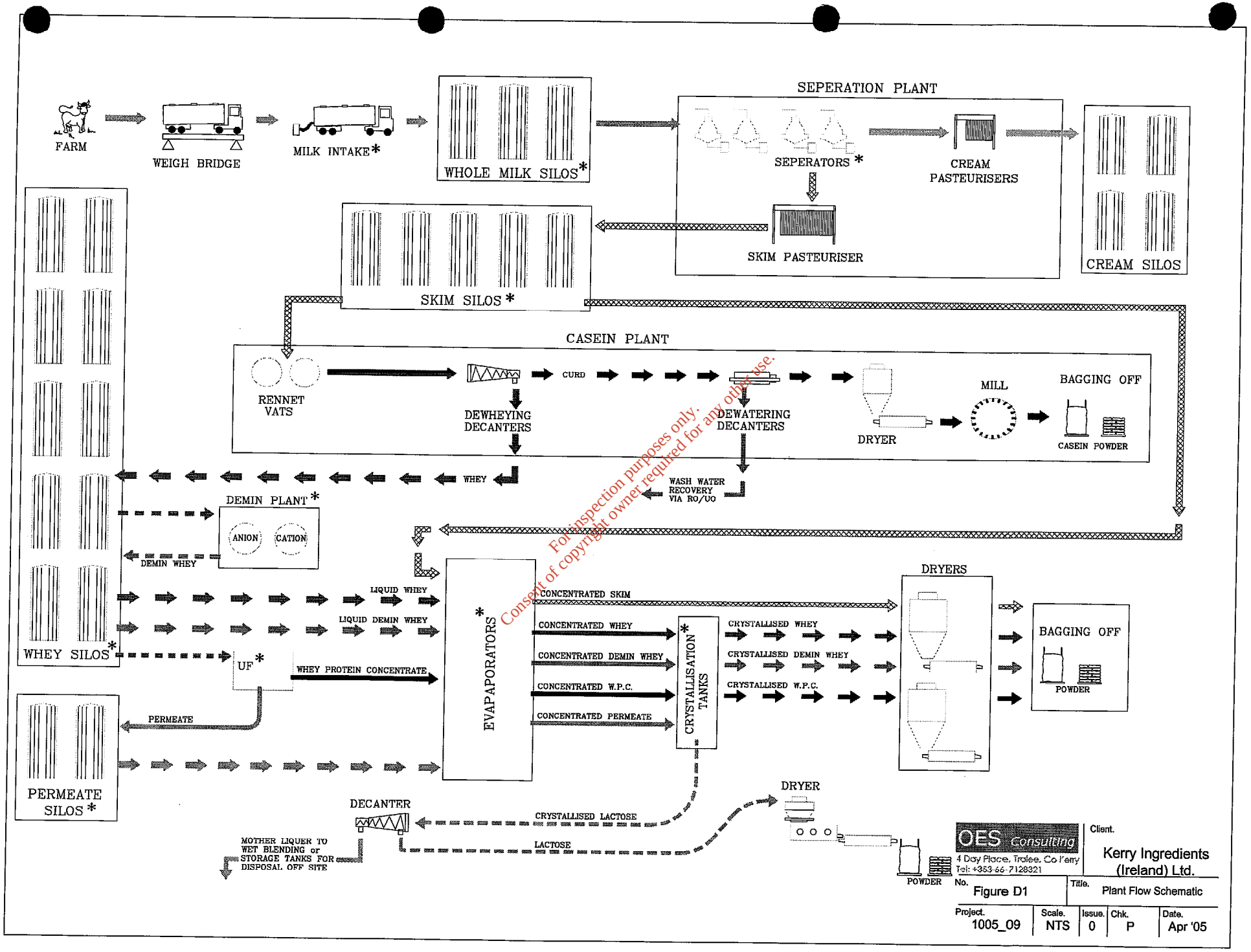
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Appendix D.1
Plant Flow Diagrams

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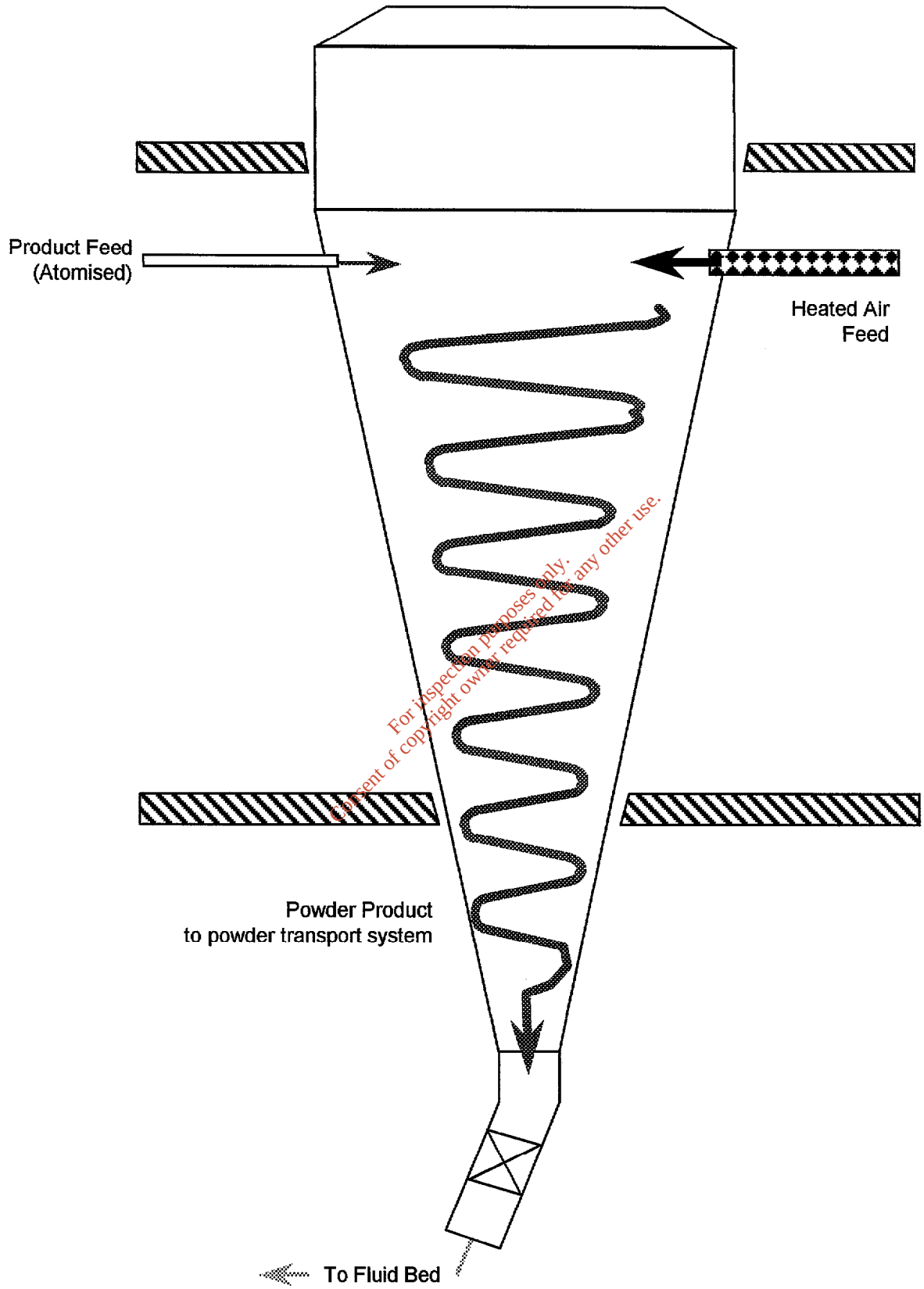
Client. Kerry Ingredients (Ireland) Ltd.

No. Figure D1

Title. Plant Flow Schematic

Project.	Scale.	Issue.	Chk.	Date.
1005_09	NTS	0	P	Apr '05

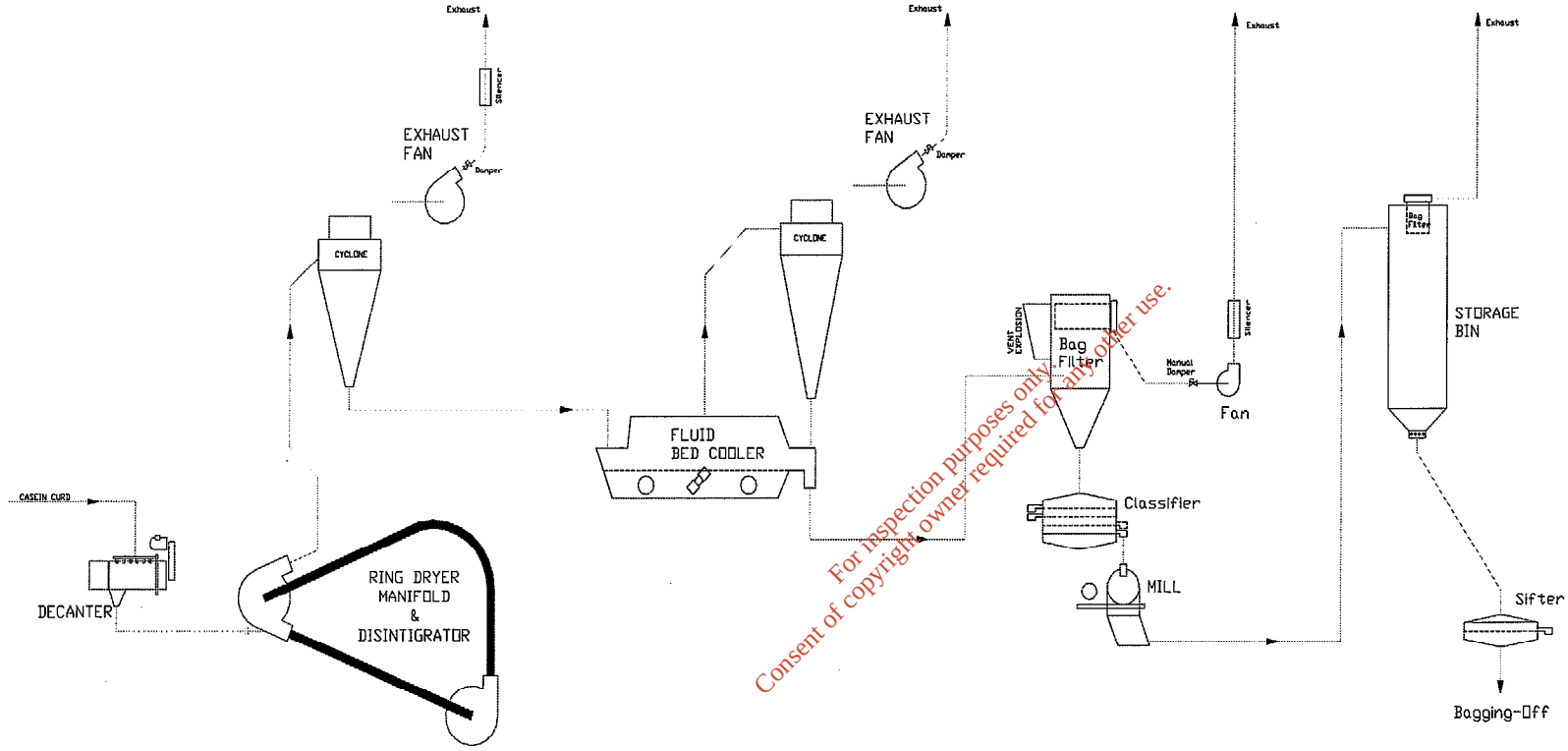
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No. Figure D.2				Title. Spray Drier Schematic	
Project. 1005_09	Scale. NTS	Issue. 0	Chk. P	Date. Apr '05	

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TYPICAL CASEIN DRYING PROCESS FLOW

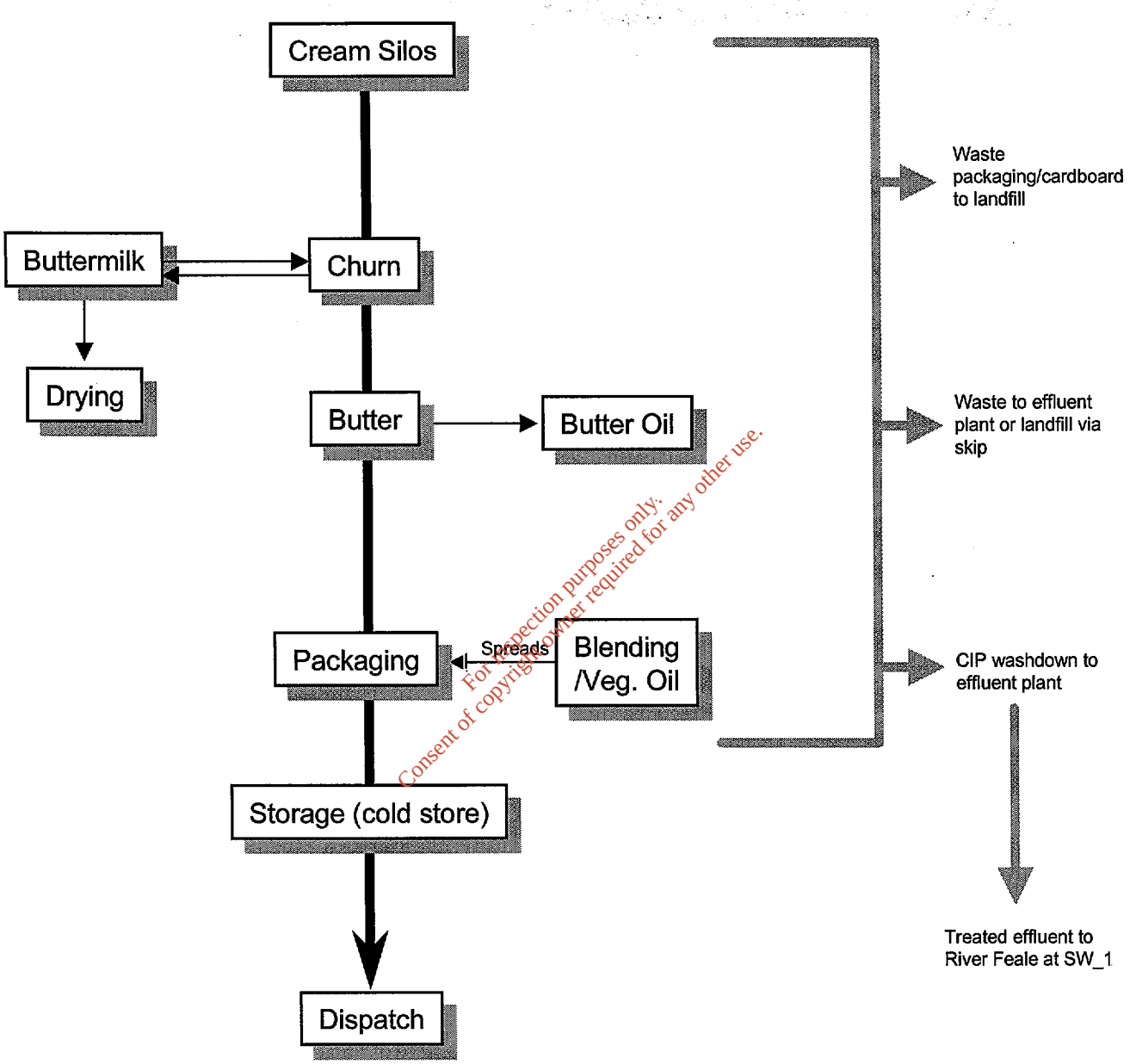
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Client.
Kerry Ingredients (Ireland) Ltd.

No.	Title.
Figure D.3	Typical Casein Drying Process Flow

Project.	Scale.	Issue.	Chk.	Date.
1005_09	NTS	0	P	Apr '05

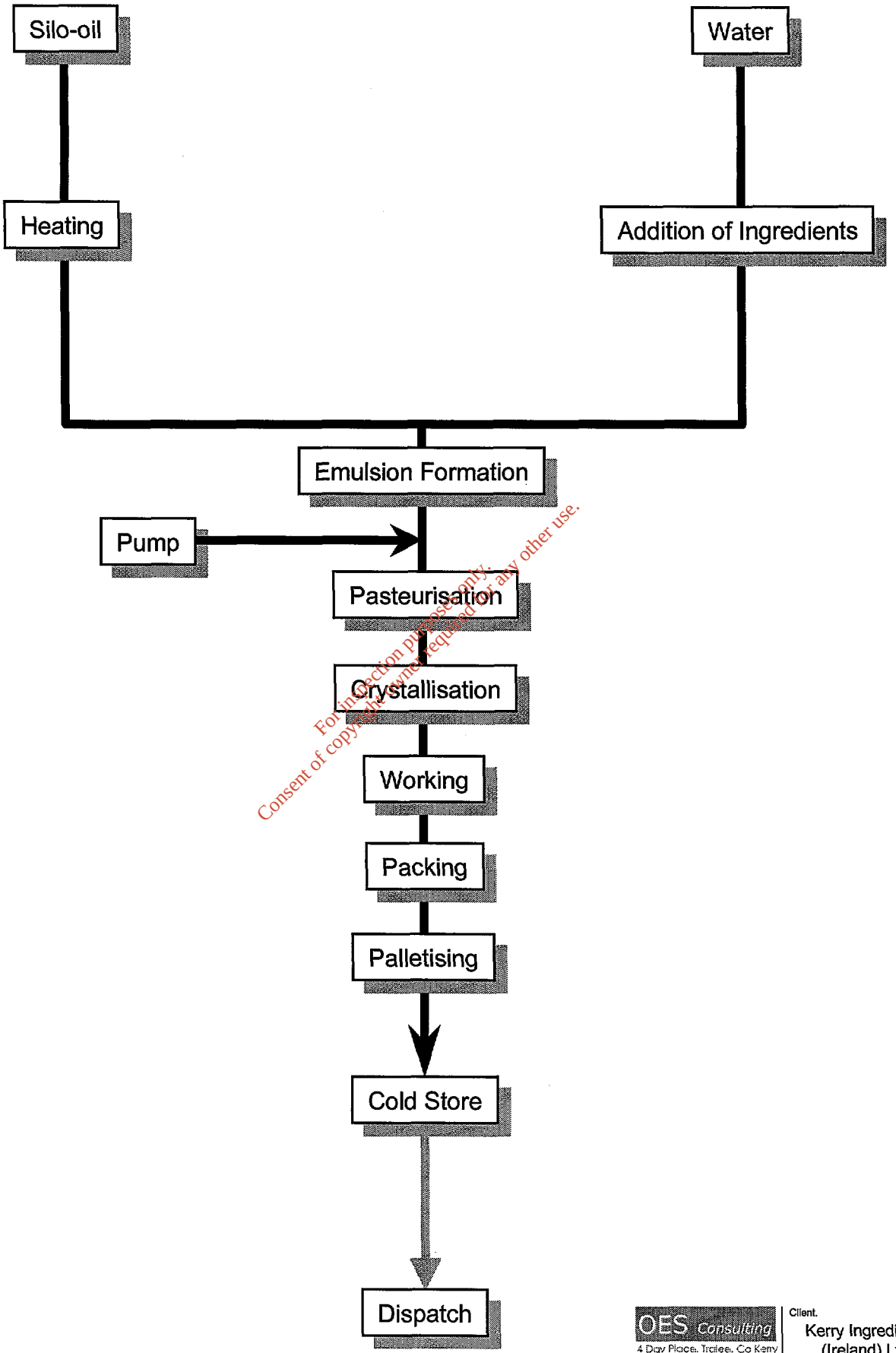
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No. Figure D.4					Title Process Flow Diagram - Yellowfats
Project. 1005_09	Scale. NTS	Issue. 0	Chk. P	Date. Apr '05	

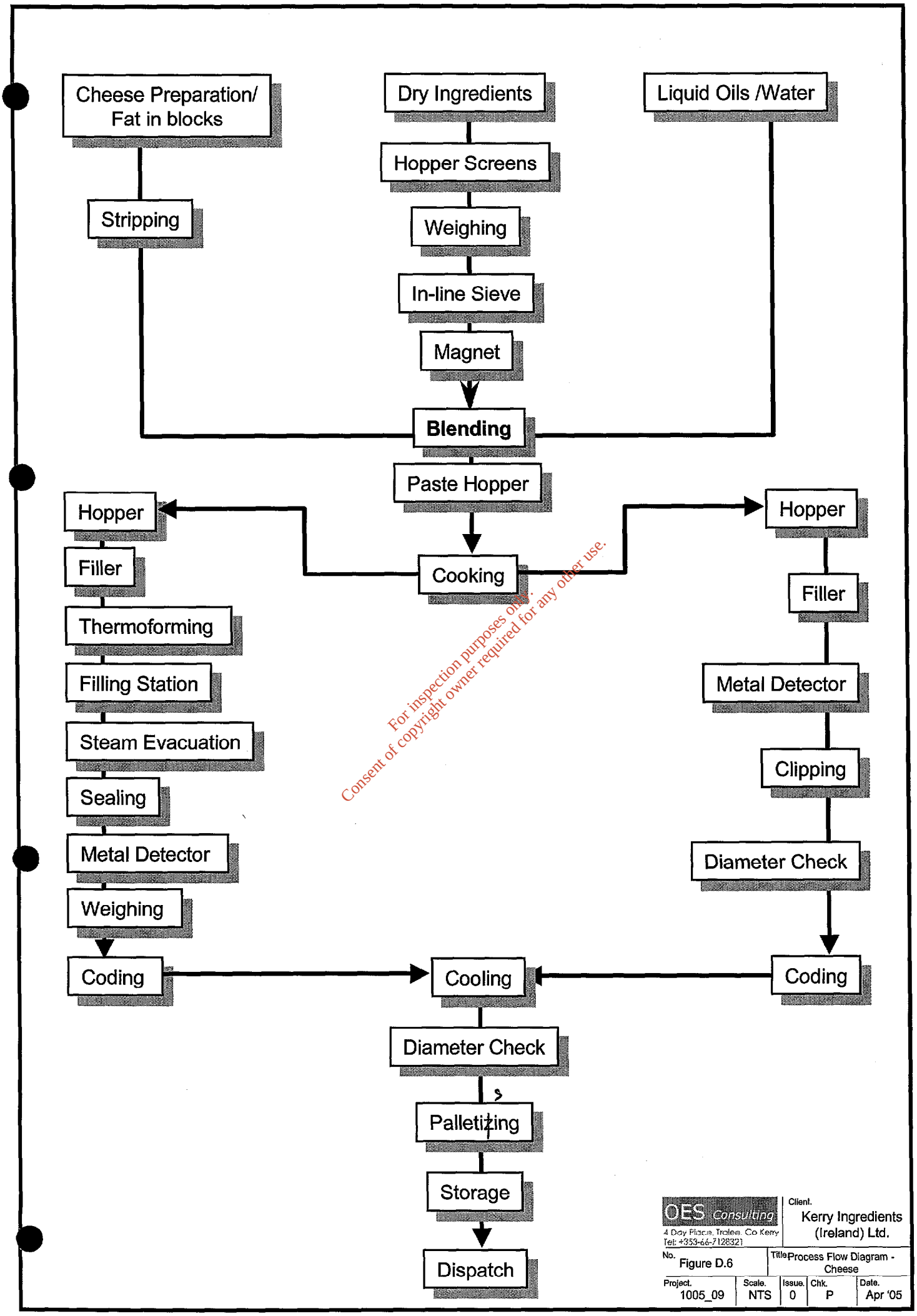
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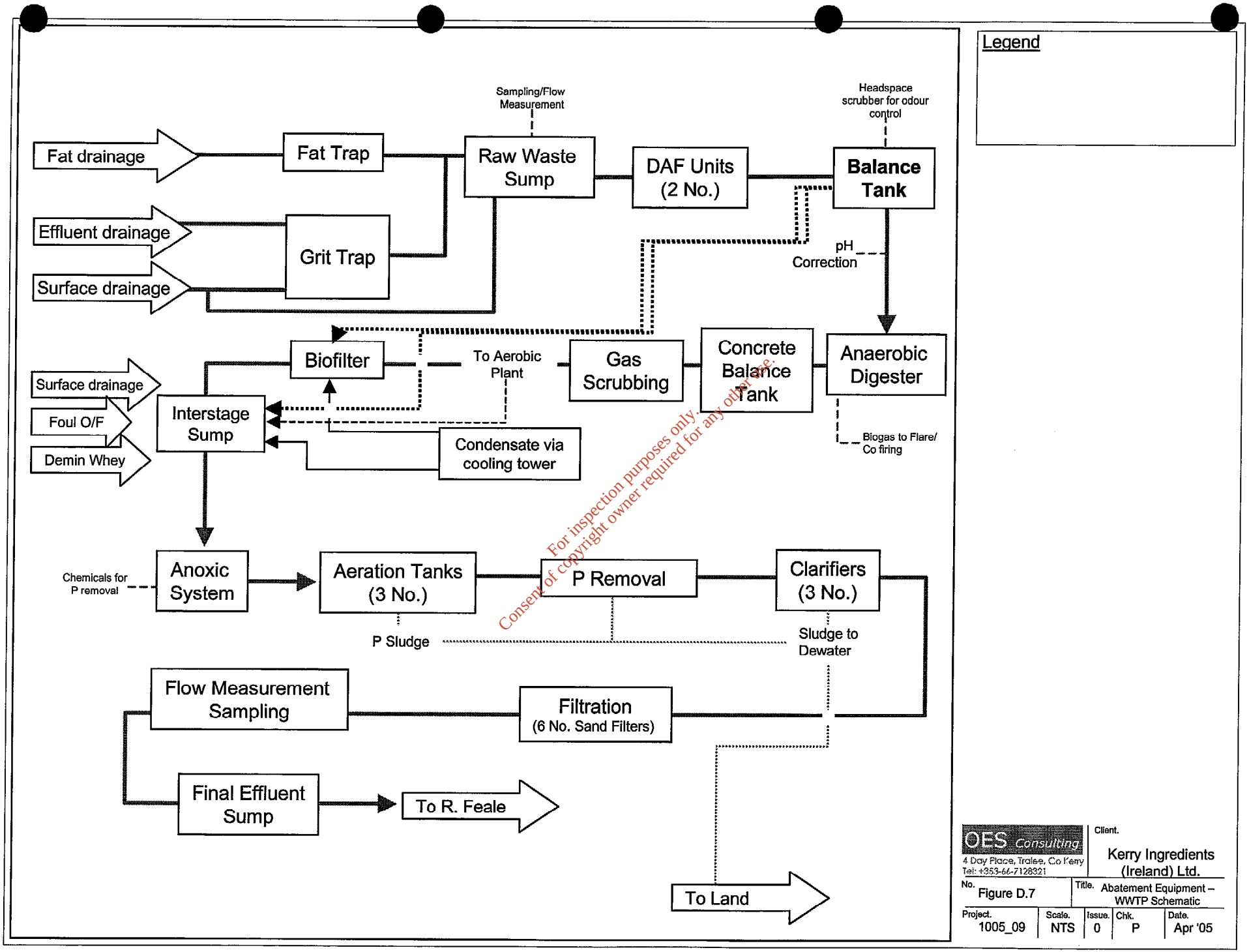
OES Consulting 4 Day Place, Tralee, Co Kerry Tel: +353-66-7128321					Client. Kerry Ingredients (Ireland) Ltd.
No. Figure D.5					Title. Process Flow Diagram - Spreads
Project. 1005_09	Scale. NTS	Issue. 0	Chk. P	Date. Apr '05	

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