Dairy Crest Limited

DAVIDSTOW ENVIRONMENTAL PERMIT VARIATION APPLICATION

Supporting Report

MAY 2022

Dairy Crest Limited

DAVIDSTOW ENVIRONMENTAL PERMIT VARIATION APPLICATION

Supporting Report

TYPE OF DOCUMENT (VERSION) PUBLIC

PROJECT NO. 70053935

DATE: MAY 2022

Dairy Crest Limited

DAVIDSTOW ENVIRONMENTAL PERMIT VARIATION APPLICATION

Supporting Report

WSP.com

QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	First Draft	Second Draft	Final Report	Final Report V2
Date	17/03/2022	31/03/2022	28/04/2022	11/05/2022
Prepared by	[redacted]	[redacted]	[redacted]	[redacted]
Signature	[redacted]	[redacted]	[redacted]	[redacted]
Checked by	[redacted]	[redacted]	[redacted]	[redacted]
Signature	[redacted]	[redacted]	[redacted]	[redacted]
Authorised by	[redacted]	[redacted]	[redacted]	[redacted]
Signature	[redacted]	[redacted]	[redacted]	[redacted]
Project number	70083590	70083590	70083590	70083590
Report number	70083590/EPR/001	70083590/EPR/001	70083590/EPR/001	70083590/EPR/001
File reference	[redacted]	[redacted]	[redacted]	[redacted]

CONTENTS

TABLES

FIGURES

APPENDICES

EPR APPLICATION FORMS

APPENDIX B

SITE CONDITION REPORT (SCR)

APPENDIX C

ENVIRONMENTAL RISK ASSESSMENT

APPENDIX D

HABITATS RISK ASSESSMENT

APPENDIX E

WASTEWATER BAT OPTIONS APPRAISAL

APPENDIX F

ODOUR IMPACT ASSESSMENT

APPENDIX G

NOISE IMPACT ASSESSMENT

1. NON-TECHNICAL SUMMARY

Dairy Crest Limited ("Dairy Crest") is responsible for the operation of Davidstow Creamery in Camelford, Cornwall. The facility produces the following products: cheese, whey cream, demineralised whey powder (Demin) and galacto-oligosaccharide (GOS), which is a prebiotic syrup. The installation comprises two main sites; the Creamery facility itself incorporating reception, manufacturing / processing and exporting operations, and a separate Water Processing Facility (WPF) which treats process water generated from the Creamery. The WPF is located approximately 1 km to the east of the Creamery and is connected by pipeline. The original environmental permit (EPR/BN6137IK) was issued in June 2006. This has been varied on multiple occasions to reflect changes and improvements made during the operational lifetime of the Creamery and associated WPF.

Dairy Crest is currently seeking to vary its permit to reflect a number of operational updates and improvements that have taken place and / or are due to take place at the installation since the last operator initiated permit variation in 2014. These changes will therefore need to be reflected in the site's environmental permit, which is issued by the regulatory body, the Environment Agency.

In summary, the changes requiring the permit variation comprise the following six Creamery projects, plus several changes as part of the redevelopment of the WPF:

1. 4-hour clean-in-place (CIP);
2. Milk protein standardisation;
3. Milk fat standardisation;
4. Whey protein concentration;
5. GOS bulk loading; and
6. Cheese capacity growth phase 3.

Redevelopment of the WPF comprises a number of changes and improvements, including:

- New contingency lagoon with extraction to an odour control unit (OCU) (note this is physically located at the Creamery but has been developed as part of the redevelopment of the WPF);
- Two new dissolved air flotation (DAF) units;
- Covering and extraction of existing Balance Tank (BT1) and Divert Tank to a new OCU;
- New raw material store;
- New aeration pumps for BT1 and Divert Tank;
- Installation of acoustic fencing;
- Installation of noise monitoring equipment;
- Provision of floating discs on Balance Tank 2 (BT2);
- Upgrade to activated filter media (AFM) filtration tanks;
- Installation of a perimeter containment wall to the downgradient portion of the WPF;
- Upgraded outfall pipework from the WPF to the River Inny;
- Installation of a third reverse osmosis (RO) plant;
- Installation of a fourth membrane bioreactor (MBR) loop;

- Installation of an ultrafiltration (UF) / RO flow attenuation tank;
- Replacement of W2 v notch sampling point with a MCERTs flume;
- Implementation of tertiary filters downstream of tank ST2 and prior to W2;
- Enclosure of sludge centrifuges and trailer; and
- Installation of an automated forward / divert solution for both cheese / whey and Demin / GOS.

The effect of Creamery Projects No. 1-6 above is to maximise process efficiencies and the utilisation of milk at the site which, once all projects are fully operational, will increase cheese production from the current rate of 9.6 t/hr to 11.4 t/hr. In addition to the individual projects, many of the improvements implemented, especially those at the WPF, have enhanced the approach to general management and monitoring and, therefore, increased the efficiency and resilience of the overall dairy production and wastewater treatment processes.

As part of this permit variation application, the following requirements have been considered:

- **Management Systems:** Dairy Crest operates the site in accordance with an Environmental Management System (EMS) which is certified to ISO 14001. There will be no overarching changes to the structure and implementation of the EMS as a result of this permit variation; however, where relevant, new operational processes and procedures will be established in relation to the changes. Existing processes, procedures and management plans will be reviewed and updated as necessary to ensure that all operations are undertaken in accordance with the EMS. A summary of Dairy Crests EMS and how it meets the Environment Agency's guidance on the GOV.UK website is provided in the application.
- **Energy Efficiency:** The changes implemented as part of the permit variation will alter the use of energy at the installation. Whilst the projects implemented at the Creamery will result in an increased hourly production capacity, the primary energy consumption is expected to decrease, due to energy efficiency improvements that have been introduced and the installation of a solar farm to reduce dependency on electricity from the national grid. The energy demand at the WPF, required to treat wastewater from the Creamery, is expected to remain similar. The future anticipated energy efficiency level (once all changes are implemented and fully operational) is lower than all levels in the 2021 Dairy UK Environmental Benchmarking Report; demonstrating that the Davidstow site is performing in line with similar sites in the UK dairy industry in terms of energy efficiency.
- **Raw Materials and Water:** No new raw materials will be required as a result of the changes on site, but there will be a marginal increase in the use of existing raw materials and water consumption at the facility. Raw materials such as cleaning products, packaging and wastewater treatment chemicals, are expected to increase by approximately 10 %. The amount of water consumed by the installation is expected to remain similar or increase marginally because of the increased hourly production capacity for cheese and associated activities. However, the amount of water imported to the facility will not increase. Instead, the additional water required to support the changes is recovered from on-site processes, thereby enhancing self-sufficiency in terms of water use.
- **Waste Management:** No new operational waste streams will be generated as a result of this permit variation application and the existing wastes generated will continue to be managed via the same contractors and existing recovery / disposal routes, with some improvements in

the way particular waste streams are managed and re-used. However, following implementation of the proposed changes on site, the generation of waste will increase slightly (by approximately 10 %) as a result of the increased hourly production capacity. Processes on site have been designed to minimise waste generation and, where unavoidable, wastes for removal offsite are managed in line with the recommendations of the Waste Hierarchy; recovery for reuse is the preferred option selected by Dairy Crest, followed by recycling. No waste is sent to landfill from the facility and any waste which cannot be reused or recycled is sent for recovery through energy from waste

- **Emissions to Air:** Two new point source emissions to air will be introduced as a result of this permit variation application; comprising two new OCUs serving the contingency lagoon at the Creamery and the Balance and Divert Tank at the WPF. An Odour Impact Assessment has been undertaken to model and evaluate the potential impact of odour from the installation, which includes emissions from these two OCUs.
- **Emissions to Water:** There will be no new point source emissions to water as a result of this permit variation application. The facility will continue to re-circulate treated process water where possible and will discharge the remaining treated process effluent into the River Inny, as per the existing environmental permit. A range of measures have been introduced to improve the management, monitoring, operation, efficiency and resilience of the existing WPF processes. The Environment Agency has conveyed its intention to review the emission limit values for emission point W2 (treated effluent from the WPF) during the permit variation determination process. Indicative emission limit values were provided during pre-application discussions; a commentary on these and consideration of BAT is provided in the Wastewater BAT Options Appraisal report which has been submitted as part of this permit variation application.
- **Emissions to Sewer:** There are no discharges made to sewer from the installation.
- **Emissions of Substances not Controlled by Emission Limits:** Fugitive emissions to water have been considered in relation to sub-surface structures and sumps, site surfacing, bunds / secondary containment and storage areas for IBCs and drums. New sub-surface structures include a contingency lagoon located at the Creamery and a new (replacement) section of pipeline from the WPF to River Inny. With regards to site surfacing, most of the changes at the Creamery and WPF have been implemented within areas of the site that are already developed and therefore, do not require new or upgraded surfacing. The exception to this is the new raw material store which is being developed on an area of land located next to the existing WPF. For all new tanks which are required, these are impermeable and resistant to the stored materials and are subject to regular inspection and integrity testing. Appropriate containment is provided to ensure that any liquids stored do not present an unacceptable risk to the environment.
- **Odour:** The main raw material (milk) is not inherently odorous and as the projects subject to this permit variation are primarily located within the main Creamery building, they are not expected to result in an increase of odour from the facility. Activities undertaken at the WPF have the greatest potential to generate odours; however a number of the changes that have been implemented as part of this permit variation at the WPF have the objective of minimising odour emissions. An Odour Impact Assessment has been undertaken to support this environmental permit variation application (Appendix F). The results of the assessment

demonstrate that the benchmark criterion (1.5 OU_E/m^3) is not predicted to be exceeded at any of the identified sensitive receptors.

- **Noise and Vibration:** Many of the changes on site comprise internal project updates, i.e. those inside the main Creamery building. These projects, therefore, are not considered to have the potential to cause a significant change in noise levels at the closest noise sensitive receptors. However, some of the other changes, particularly those at the WPF, could have the potential to give rise to a change in operational noise levels. Accordingly, a Noise Impact Assessment has been undertaken to support the environmental permit variation application (Appendix G). The aim of the assessment was to establish the potential impacts of the changes implemented on site on noise emissions and the associated noise levels experienced at sensitive locations in the local area. The Noise Impact Assessment identified that operational noise levels from the proposed permit variation will be substantially below the prevailing sound levels at the closest receptors to the Creamery and the WPF.
- **Environmental Risk Assessment:** The original permit application for the installation included an environmental risk assessment which identified the risks from the permitted activities relevant to the facility. A new risk assessment has been produced considering the changes to the installation covered by this environmental permit variation application. The updated environmental risk assessment is provided in Appendix C; it covers the potential risks associated with land and groundwater contamination, odour, noise, fugitive emissions and accidents. The risk assessment concludes that all risks associated with the proposed changes on site are deemed to be acceptable when considered in line with the intended risk management techniques.
- **Best Available Techniques (BAT):** Throughout the application document, technical descriptions have been provided for all of the changes on site, including details of any changes to plant, equipment and infrastructure. A full review of these changes against the relevant BAT Conclusions from the most recent BREFs for the Food, Drink and Milk and Waste Treatment sectors has been undertaken. A BAT Options Appraisal has also been undertaken for wastewater management and treatment (Appendix E). This assessment considers alternative options to the continued discharge of treated process wastewater into the River Inny.
- **Site Condition Report (SCR):** As part of this environmental permit variation application, a SCR has been produced for a new area of land which is to be incorporated into the installation's permit boundary (Appendix B). The land is used for the purposes of storing wastewater treatment chemicals and is located adjacent to the existing WPF.
- **Habitats Risk Assessment:** A Habitats risk assessment for emissions to water has been undertaken (Appendix D). This report qualitatively assesses the risk to designated habitats sites and protected species that are located within the relevant screening distances from the site. The assessment concludes that the overall risk to these receptors is not significant, so long as the detailed management practices are adhered to.

2. BACKGROUND AND INTRODUCTION

2.1. ABOUT THE INSTALLATION

This application is for a variation to the environmental permit for Davidstow Creamery in Cornwall which is operated by Dairy Crest Limited ("Dairy Crest"). Saputo Dairy UK ("SDUK") is a trading name used for Dairy Crest following the acquisition by Saputo Inc. in 2019. However, Dairy Crest remains the legal trading entity for the company and, therefore, it remains the named operator on the environmental permit.

The site's address is:

Davidstow Creamery
Camelford
Cornwall
PL32 9XW

The site location is shown in Figure 2-1 below; it is situated approximately 88 km to the west of Exeter and 56 km to the north of Plymouth. The National Grid Reference (NGR) of the approximate centre of the Creamery facility is SX13825 86588. The installation boundary, shown in red in Figure 2-2 below, includes the main Creamery facility and the onsite water processing facility (WPF), which is located approximately 1 km to the east of the Creamery and is connected by pipeline.

Figure 2-1 - Site Location

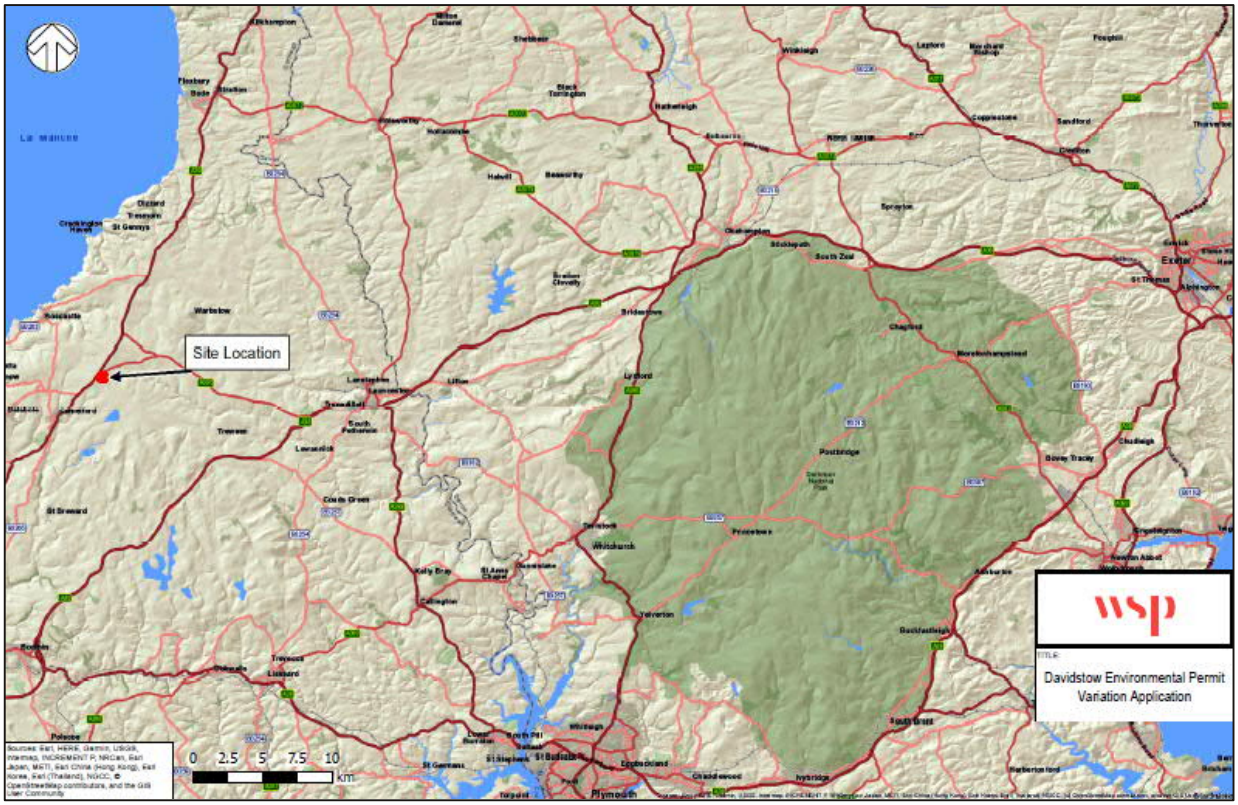
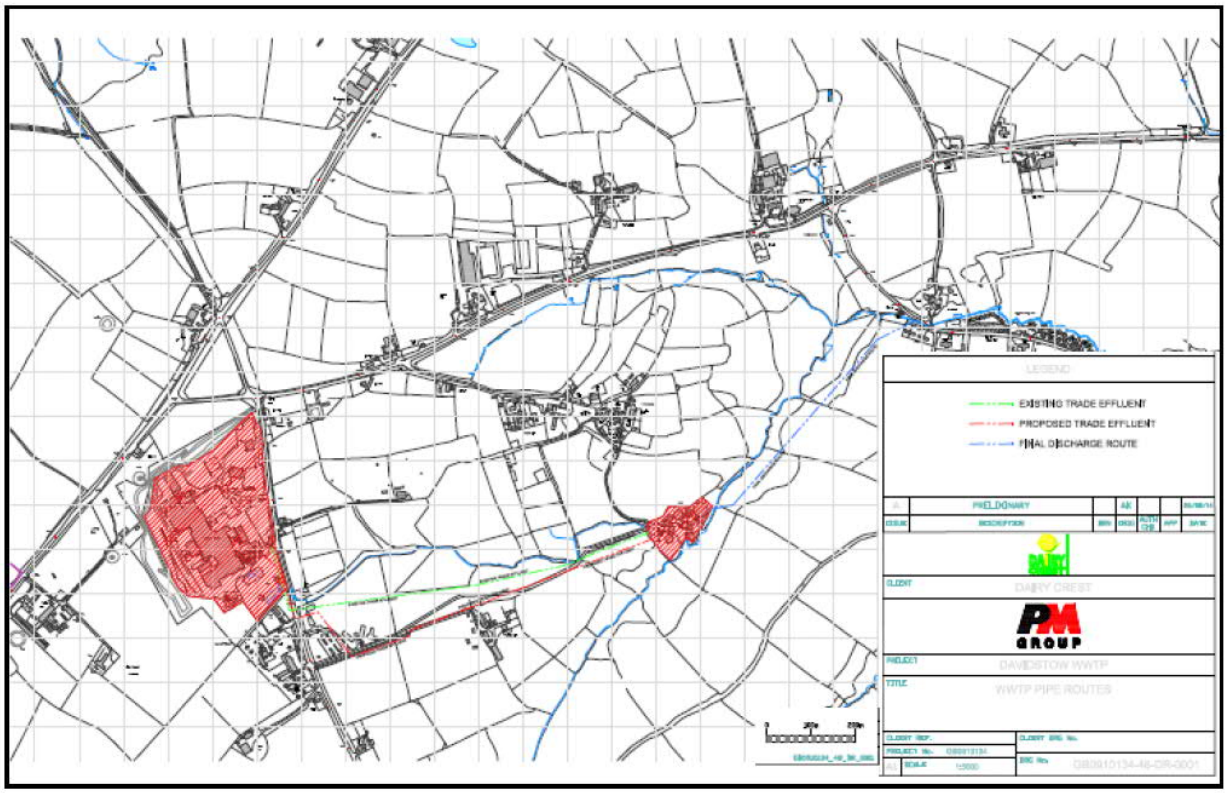


Figure 2-2 - Existing Installation Boundary

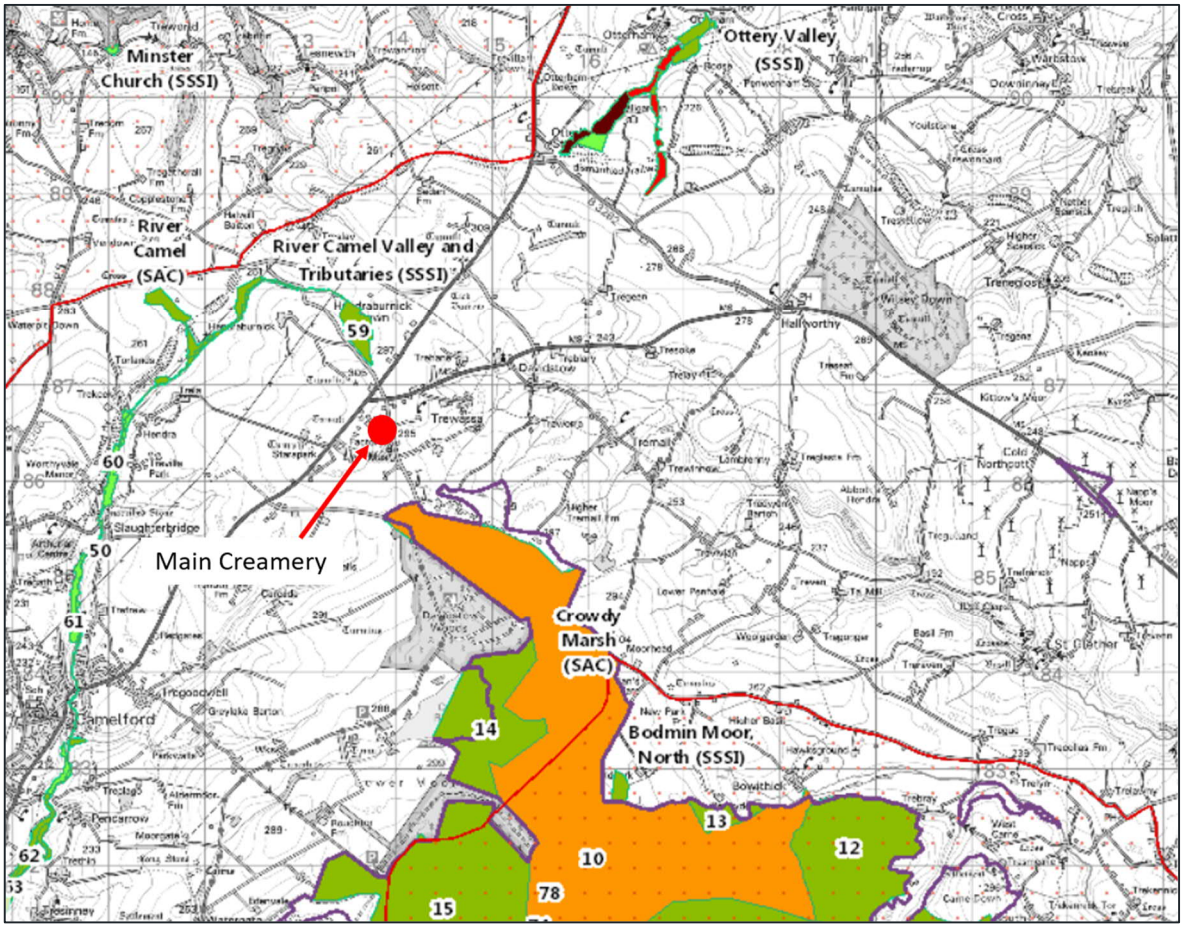


The facility is located in a predominantly rural location; the nearest villages to the site are Trewassa, Davidstow and Tremail. The nearest watercourse, which forms the final discharge point for treated effluent from the WPF, is the River Inny, which is a tributary of the River Tamar. The River Inny joins the River Tamar approximately 32 km downstream from the facility.

There are two Sites of Special Scientific Interest (SSSI) within 1 km of the installation; the River Camel Valley and Tributaries approximately 600 m to the north, and Bodmin Moor North approximately 800 m to the south. The River Camel is also classed as a Special Area of Conservation (SAC). Within 5 km is the Cornwall Area of Outstanding Natural Beauty (AONB) (to the north of the installation), Bodmin Moor AONB to the south, and the following additional statutory designated sites: Ottery Valley SSSI approximately 3.3 km to the north-east, Minster Church SSSI 4.6 km to the north-west and Crowdy Marsh Special Area of Conservation (SAC) 2.5 km to the south-east.

These ecologically designated sites can be seen in Figure 2-3. In the introductory note to the site's environmental permit, the Environment Agency confirms that none of these designated sites are in hydraulic continuity.

Figure 2-3 - Ecologically Designated Sites in the Vicinity of Davidstow Creamery



The site receives milk which it pasteurises and processes into cheese. Whey from the cheese making process is then used to manufacture whey cream and demineralised whey powder. The site also imports lactose powder which is processed to produce galacto-oligosaccharide (GOS), a prebiotic syrup. An overview of the existing dairy production processes and products manufactured on site is provided in Section 4 of this report. Process effluent which is generated during the manufacturing process is transported by pipeline and treated at the onsite WPF which incorporates primary, secondary and tertiary treatment. A proportion of the treated effluent is recycled back to the Creamery for re-use via the Water Recovery Plant (WRP) and the remainder is discharged to the River Inny. A more detailed description of the WPF and WRP is provided in report Section 4.

Dairy Crest is applying for an environmental permit variation in order to reflect a number of changes at the site, many of which have already been implemented in order to drive operational improvements since the last operator initiated permit variation was granted in 2014. The changes include six Creamery projects, with the key aim of maximising the utilisation of the main raw material (milk), thus increasing the hourly (t/hr) production capacity for cheese, as well as several changes as part of the redevelopment of the WPF. One of the Creamery projects will also make improvements to handling and dispatch of the finished GOS product by implementing bulk tanker loading. Many of the changes have already taken place over recent years; these have previously been communicated to the Environment Agency, but specific permit variation applications were not requested by the Environment Agency at the time they were implemented. Therefore, this current

application seeks to address all changes implemented at the site in order to bring the environmental permit up to date.

2.2. ENVIRONMENTAL PERMIT INSTALLATION CHANGES

In summary, the changes that are the subject of this environmental permit variation application comprise:

- Creamery Project No. 1: 4-hour clean-in-place (CIP);
- Creamery Project No. 2: Milk protein standardisation;
- Creamery Project No. 3: Milk fat standardisation;
- Creamery Project No. 4: Whey protein concentration;
- Creamery Project No. 5: GOS bulk loading;
- Creamery Project No. 6: Cheese capacity growth phase 3; and
- Redevelopment of the WPF: this comprises a number of changes and improvements at the WPF, including:
    - New contingency lagoon with extraction to an odour control unit (OCU) (note this is physically located at the Creamery but has been developed as part of the redevelopment of the WPF);
    - Two new dissolved air flotation (DAF) units;
    - Covering and extraction of existing Balance Tank (BT1) and Divert Tank to a new OCU;
    - New raw material store;
    - New aeration pumps for BT1 and Divert Tank;
    - Installation of acoustic fencing;
    - Installation of noise monitoring equipment;
    - Provision of floating discs on Balance Tank 2 (BT2);
    - Upgrade to activated filter media (AFM) filtration tanks;
    - Installation of a perimeter containment wall to the downgradient portion of the WPF;
    - Upgraded outfall pipework from the WPF to the River Inny;
    - Installation of a third reverse osmosis (RO) plant;
    - Installation of a fourth membrane bioreactor (MBR) loop;
    - Installation of an ultrafiltration (UF) / RO flow attenuation tank;
    - Replacement of W2 v notch sampling point with a MCERTs flume;
    - Implementation of tertiary filters downstream of tank ST2 and prior to W2;
    - Enclosure of sludge centrifuges and trailer; and
    - Installation of an automated forward / divert solution for both cheese / whey and Demin / GOS.

The effect of Creamery Projects No. 1-6 above is to maximise process efficiencies and the utilisation of milk at the site which, once all projects are fully operational, will increase cheese production from the current rate of 9.6 t/hr to 11.4 t/hr.

Whilst not all of the above changes would warrant a permit variation in their own right, reference is made to them all in this application in order to give a full picture of the significant improvements made at the site since 2014. In addition to the individual projects, many of the improvements implemented, especially those at the WPF, have enhanced the approach to general management

and monitoring and, therefore, increased the efficiency and resilience of the overall dairy production and wastewater treatment processes.

An overview of the projects and changes detailed above and how they fit within the relevant regulations and, therefore how they are expected be regulated within the site's permit, is provided in Section 2.3 below. Further detailed information on each of the projects and associated changes is provided in Section 4 of this report.

2.3. REGULATORY CONTEXT

The site is regulated by environmental permit reference EPR/BN6137IK. The original permit was issued in June 2006 and the permit has since been varied on eight occasions. The last operator initiated permit variation, in August 2014, accounted for several changes at the site including:

- Upgrading the whey powder plant, in the form of two new cyclones fitted to the spray dryer, to produce demineralised whey powder for use in infant formula. A new CIP system was also installed as part of this process;
- Introduction of a new prebiotic production plant to process lactose powder into GOS, which is used to enhance the nutritional value of foods. This process required the addition of a new listed activity under Section 6.8 Part A(1)(d)(i) to the environmental permit;
- Installation of a new RO plant enabling treated water from the WPF to be reused in the factory;
- Expansion of the WPF and drainage network on site to manage increased volumes of effluent generated by the new demineralised whey and GOS processes described above. This included a new discharge pipeline connecting the demineralisation and prebiotic processes at the Creamery to the WPF; and
- The site plan / installation boundary was updated to include the effluent discharge pipeline from the Creamery to the WPF and the treated effluent pipeline from the WPF to the final discharge point at the River Inny within the permit boundary.

The last Environment Agency initiated variation was determined in November 2020 which was undertaken to include additional monitoring requirements for the treated effluent at emission point W2 into the River Inny. The current permit version is EPR/BN6137IK/V009.

The permit authorises the following prescribed activities as listed under Schedule 1 of the Environmental Permitting (England and Wales) Regulations 2016, as amended (EPR):

- Section 6.8 Part A(1)(e): Treating and processing milk, the quantity of milk received being more than 200 tonnes per day (average value on an annual basis);
- Section 6.8 Part A(1)(d)(i): Treating and processing materials intended for the production of food products from animal raw materials (other than milk) at a plant with a finished product production capacity of more than 75 tonnes per day;
- Section 5.4 Part A(1)(a)(i): Disposal of non-hazardous waste in a facility with a capacity exceeding 50 tonnes per day by biological treatment; and
- Section 5.1 Part (A)(1)(b): The incineration of non-hazardous waste in a waste incineration plant or waste co-incineration plant with a capacity exceeding 3 tonnes per hour.

During pre-application discussions with the Environment Agency it was also agreed that the permit should reference:

- Section 5.4 Part A(1)(a)(ii): Disposal of non-hazardous waste in a facility with a capacity exceeding 50 tonnes per day by physico-chemical treatment.

This activity has never been included in the permit despite such activities taking place at the WPF since the site was first permitted in 2006, e.g. primary treatment in the form of screening, balancing and DAF. It was, therefore, agreed that the Environment Agency would add this activity into the varied permit for completeness, noting that this is not a new activity introduced by this permit variation application.

In addition to the prescribed activities identified above, the permit also authorises the following Directly Associated Activities (DAAs) which form part of the installation:

- Oil fired boilers: Three oil fired boilers of thermal input 11.5 MW, 10.5 MW and 10.5 MW (aggregated thermal input of 32.5 MW); and
- Waste storage and disposal.

This document has been developed to provide the information required for an environmental permit variation application to address the changes detailed in Section 2.2 above.

An initial pre-application meeting was held between Dairy Crest, the Environment Agency and WSP on 15th January 2019. Dairy Crest applied for enhanced pre-application advice and a number of subsequent meetings have been held by conference call since then, with a further face to face meeting held on 16th March 2020. The last formal meeting prior to the submission of this application was held on 25th February 2021, however, there has been ongoing communication with the Environment Agency since this date. The Environment Agency has provided upfront advice and guidance on a number of matters during these meetings and in subsequent follow-on correspondence, including confirmation of the required scope and content of the application. This advice has been taken on board during development of the application and, where information / approaches / methodologies have been discussed and agreed upfront with the Environment Agency during pre-application discussions, such information is referenced throughout this report.

Table 2-1 below provides an overview of the projects included in this variation application along with where each of the project elements falls within the EPR, if applicable. To help put the projects and associated changes on site into context, Figure 2-4 below shows the location of each project within the Davidstow Creamery installation.

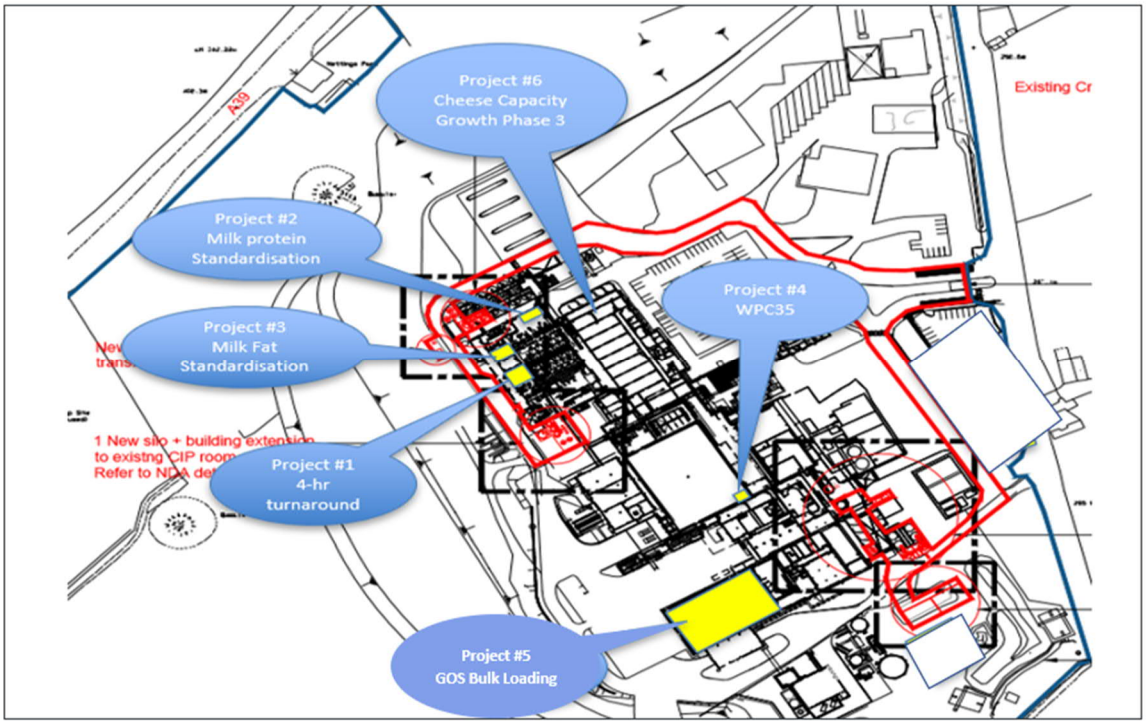
Table 2-1 – Davidstow Creamery - Changes on Site and their Regulation Under EPR

Project	Summary Description	Regulation Under EPR
Solar Panel Farm	Implementation of a 5 MW DC photovoltaic solar power plant project run by Lightsource BP. The plant is located on a plot of agricultural land adjacent to the Creamery.	This is not a prescribed activity under the EPR and it is not considered to be a DAA for the following reasons: ▪ The solar farm has no effect on emissions as there are no releases; ▪ It is not necessary for the solar farm to serve the site. Whilst the site is the principal user, the solar farm could be there if the site

		wasn't and could generate electricity in the event the plant was on an extended down time; and ▪ The site could also operate on grid electricity alone if, for whatever reason, the connection with the solar farm was disrupted. Therefore, it is not considered further in this application document, other than in relation to the site's energy supply in report Section 3.2.
Project No. 1 CIP 4-hour Turnaround	A new CIP set will provide additional cleaning channels to shorten the length of time taken to clean the cheese department. This will shorten CIP cleans by 2 hours each time (from 6 to 4 hours), thereby increasing the available production time and capacity (20-hr processing).	The new CIP set is considered to be integral to the main listed activity of Section 6.8 Part A(1)(e) (milk processing) in ensuring the cleanliness and hygiene of the equipment for food manufacture.
Project No. 2 Milk Protein Standardisation	A small portion (approximately 20 %) of the raw milk will be concentrated via a new ultra-filtration membrane to increase fat, protein and milk solids. This protein standardised milk will be dosed back into the main raw milk stream thus increasing the cheese milk protein by approximately 9 %. This increases the curd yield from each vat and ultimately the hourly cheese production capacity (t/hr) by ~9 %. Following the implementation of Project No. 6 below, this process change will increase the curd production from 10.5 t/hr to 11.4 t/hr. It is intended to either UV treat the permeate from this process and reintroduce it back into the whey stream for conversion into demineralised whey powder or concentrate it via RO for export off site as a functional ingredient.	This is considered to be a process optimisation measure to enhance the utilisation of raw milk and therefore the cheese production capacity as part of the existing Section 6.8 Part A(1)(e) activity (milk processing).
Project No. 3 Milk Fat Standardisation	Reduced fat cheese is manufactured in a batch process and is currently limited by the volume of skimmed milk that can be separated and stored. The new processing solution allows skimmed milk to be separated and blended in-line in a continuous process. This saves time and therefore allows for an increase in available production time and capacity.	This is considered to be a process optimisation measure to enhance the utilisation of raw milk and therefore the cheese production capacity as part of the existing Section 6.8 Part A(1)(e) activity (milk processing).
Project No. 4 Whey Protein Concentrate (WPC35)	Up to 10 % of the separated sweet whey stream is treated via an UF plant to concentrate the protein content. The concentrated whey is dosed back into the main whey stream to standardise the protein content of the demineralised feed stream. The	This is considered to be a process optimisation measure to enhance the utilisation of whey generated by the cheese making process and therefore improve the production of demineralised whey powder as part

	permeate from the UF plant is then passed through a RO plant to concentrate the solids (from 13 % to 20 %) prior to export from site. The permeate from the RO plant is currently discharged to the WPF but it is proposed to recycle this water stream to use for cleaning purposes.	of the existing Section 6.8 Part A(1)(d)(i) activity (treating and processing animal raw material other than milk).
Project No. 5 GOS Bulk Loading	An alternative method of transporting GOS product to customers has been implemented on site. The solution enables the export of bulk tanker volumes of up to 29,000 kg instead of individual 1,000 kg IBCs. This project incorporates an additional export storage tank, process pipework, new tanker loading bay and a tanker CIP set.	This is considered to be a process optimisation measure to enhance the management and efficiency of dispatch of finished product as part of the existing Section 6.8 Part A(1)(d)(i) activity (treating and processing animal raw material other than milk).
Project No. 6 Cheese Capacity Growth Phase 3	It is proposed to implement a number of process changes that will increase the curd production capacity from 9.6 t/hr to 10.5 t/hr. Only one additional cheese vat (no. 12) will be installed, however, the ancillary plant and equipment will enable the vats to be filled and emptied quicker, increasing the processing capacity from 87,000 l/hr to 95,000 l/hr. The ancillary plant and equipment will include a larger milk pasteuriser with more plates, an additional curd pump and whey separator and a new Rapid Chill Store (RCS). Overall, this project will increase the curd production from 9.6 t/hr to 10.5 t/hr.	This is considered to be a process optimisation measure to enhance the utilisation of raw milk and therefore the cheese production capacity as part of the existing Section 6.8 Part A(1)(e) activity (milk processing).

Figure 2-4 – Location of Creamery Projects



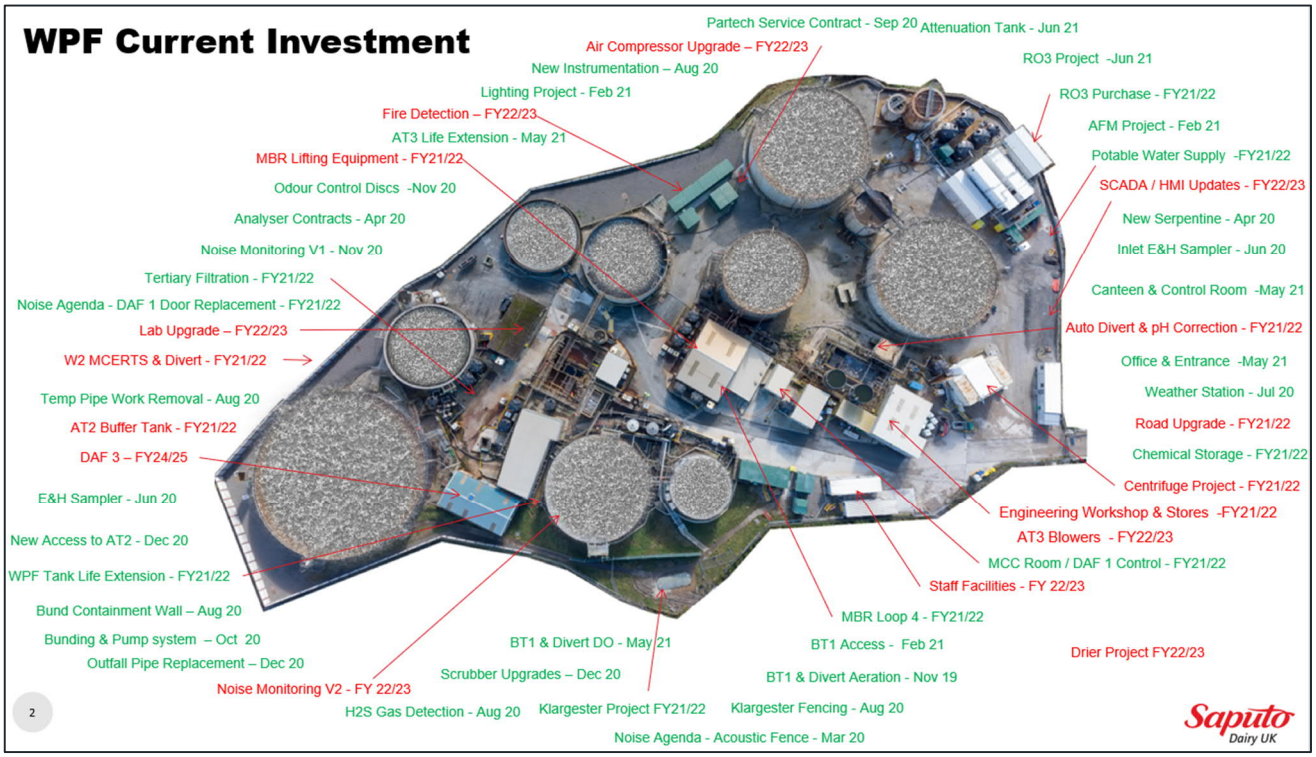
With regards to the redevelopment of the WPF, Table 2-2 below summarises where each of the changes / improvements is considered to fall within the EPR and Figure 2-5 shows the approximate location within the WPF.

Table 2-2 – Davidstow WPF Redevelopment - Proposed Changes on Site and their Regulation Under EPR

Change / Improvement	Summary Description	Regulation Under EPR
Contingency lagoon & OCU	The changes comprise a range of measures to improve the management, monitoring, operation, efficiency and resilience of the existing WPF processes. Further details are provided in Section 4. Figure 2-5 shows the location of the changes at the WPF.	These activities will be regulated under Section 5.4 Part A(1)(a)(ii): Disposal of non-hazardous waste in a facility with a capacity exceeding 50 tonnes per day by physico-chemical treatment, which is required to be added to the permit. Note this is not a new prescribed activity to be undertaken at the installation, however, it has previously been missed off the permitted activities in error. Two new point source emissions to air will also be introduced (OCUs) associated with these activities.
2 new DAF units		
Covering / extraction from BT1 and Divert Tanks & OCU		
Upgraded AFM tanks		
3rd RO plant		
UF / RO flow attenuation tank		
Downstream tertiary filters		
4th MBR loop		This activity will be regulated under the existing Section 5.4 Part A(1)(a)(i) activity: Disposal of non-hazardous waste in a facility with a capacity exceeding 50 tonnes per day by biological treatment.
New raw material store		This activity will be regulated as a DAA to the above prescribed activities under Section 5.4 (physico-chemical and biological treatment). It requires additional land to be included in the installation boundary.
Upgraded outfall pipework from WPF		This is not a new activity and does not strictly require a permit variation. The Introductory Note in the current environmental permit (V009) confirms that the site plan was updated (in 2014) to include the effluent discharge pipeline from the WPF to the final discharge point at the River Inny. However, it has been included within this application at the Environment Agency's request.
New aeration pumps for BT1 and Divert Tank		These are not deemed to be permitted activities (i.e. prescribed

Installation of acoustic fencing		activities or DAA under the EPR) and the changes are not considered to warrant a permit variation in their own right. However, reference is made to them in this application in order to give a full picture of the improvements made at the WPF since 2014. Furthermore, many of the changes and improvements are relevant to and will be considered in the appropriate sections of this application as they have implications on process management and control, environmental monitoring and impacts, including noise and odour.
Noise monitoring equipment		
Floating discs on BT2		
Perimeter containment wall		
Replacement of W2 v notch sampling point with a MCERTs flume		
Enclosure of sludge centrifuges and trailer		
Installation of an automated forward / divert solution for both cheese/whey and Demin/GOS		

Figure 2-5 – Location of WPF Changes



Note:- Green text = complete, Red text = work in progress

As detailed in Table 2-2 above, the new raw material store requires additional land to be included within the installation boundary (it will be located to the west of the existing WPF) and the Environment Agency has also requested that the application incorporates the discharge pipeline from the WPF to the River Inny. Therefore, a Site Condition Report (SCR) has been developed in relation to these two areas of land and a copy is included in Appendix B.

Whilst the purpose of this application is to permit the changes at the installation described above, Dairy Crest is also aware of the Environment Agency's ongoing review of all food, drink and milk sector permits. This is being undertaken in order for the Regulator to incorporate the latest Best Available Techniques (BAT) as outlined in the revised Food, Drink and Milk BREF and ahead of the implementation deadline on 03 December 2023. This application is not intended to provide a full BAT compliance review / gap analysis of Dairy Crest's operations against the revised BREF / BAT conclusions, however, where relevant, the changes that form part of this permit variation application have been compared to the latest BAT standards. Where aspects of the site's operations are not impacted as a result of this application, such as point source emissions to air from combustion activities, the application states this and does not go into further detail regarding BAT for these elements.

2.4. APPLICATION STRUCTURE

The application to vary an environmental permit consists of Forms A, C2, C3 and F1 as required under the EPR. The completed application forms, provided in Appendix A, are supported by this report which comprises the main application document detailing the proposed changes on site and their environmental impact, including consideration of management techniques to avoid and control emissions and design of the process to meet BAT. The report is supported by the following appendices to provide further supporting information and detailed environmental assessments:

- Appendix A – EPR Application Forms;
- Appendix B – Site Condition Report;
- Appendix C – Environmental Risk Assessment;
- Appendix D – Habitats Risk Assessment;
- Appendix E – Wastewater BAT Options Appraisal;
- Appendix F – Odour Impact Assessment; and
- Appendix G – Noise Impact Assessment.

This report has been structured and developed in accordance with and with reference to the relevant technical guidance for the site activities, namely:

- Environmental permit guidance obtained from GOV.UK webpages (replacing previous EPR 1.00 'How to Comply' guidance);
- Food, Drink and Milk Industries BREF and BAT Conclusions (December 2019); and
- Waste Treatment BREF and BAT Conclusions (August 2018).

It should be noted that the information provided in this report is that in relation to the recent changes on site only. Where there have been no changes to processes, procedures, emissions or monitoring as a result of the permit variation being applied for, the relevant information in the original permit application or previous variation applications should be referred to and such information or environmental assessments are not repeated in this document.

3. MANAGING YOUR ACTIVITIES

3.1. ACCIDENT MANAGEMENT

The effective management of environmental performance is a key requirement for ensuring that all pollution prevention and control techniques are delivered reliably, monitored and measured appropriately, and on an integrated basis. The Environmental Management System (EMS) helps to maintain compliance with regulatory requirements and to understand and manage all other significant environmental impacts.

The EMS employed by Dairy Crest has been certified to ISO14001:2015 and it covers a number of its sites, including Davidstow. As part of the EMS, Dairy Crest has developed a spreadsheet based system using a shared filing structure which provides managers and site leads with a systematic way to create, retrieve, update and manage applicable environmental data. The existing EMS will continue to be implemented at the site and it will be reviewed and updated as necessary in order to reflect any changes introduced by the permit variation. Table 3-1 below provides a summary of the EMS and how its meets Environment Agency requirements (from GOV.UK guidance). The fundamental approach to maintaining an EMS has not changed as a result of the environmental permit variation being applied for.

Table 3-2 and Table 3-3 below show sector specific BAT standards from the Food, Drink and Milk and Waste Treatment BREFs, respectively, in relation to accident management and environmental performance. It should be noted that, whilst there is some overlap, the BAT requirements in Table 3-2 apply to the changes to the main Creamery processes (i.e. Projects 1-6), and those in Table 3-3 apply to the changes at the WPF.

Table 3-1 – Indicative BAT Requirements for Environmental Management Systems from GOV.UK Guidance

GOV.UK Requirements	Current / Proposed Arrangements	BAT?
As part of the Environmental Management System guidance available on the GOV.UK website the following should be incorporated: You must include a **Site Infrastructure Plan** which highlights where the activities covered by an Environmental Permit are undertaken. Your plan must also include: ▪ Buildings and other main constructions such as treatment plants, incinerators, storage silos and security fencing; ▪ Storage facilities for hazardous materials like oil and fuel tanks, chemical stores, waste materials; ▪ Locations of items for use in accidents and emergencies; ▪ Entrances and exits to be used by emergency services;	As part of its EMS, Dairy Crest maintains all necessary documents for operational planning and control on a site-specific basis. This includes appropriate site infrastructure plans containing the information detailed in the relevant guidance. However, whilst the individual documents are site specific, each site uses a shared filing structure directly aligned to the clauses of ISO14001:2015. As a result of the permit variation being applied for, updated site infrastructure plans will be developed and incorporated into the EMS, as necessary.	YES

▪ Pollution control points, such as inspection and monitoring points; ▪ Trade effluent or sewage effluent treatment plants; ▪ Effluent discharge points; and ▪ Contaminated land, or land you believe is contaminated. The plan must also demonstrate areas which are vulnerable to pollution from the site. Such as rivers and streams; groundwater sources; residential, commercial or industrial premises; protected wildlife. Your plan must show foul and combined drainage facilities marked in red and surface water drainage facilities in blue. It must also show: ▪ The direction of flow of water in the drain; ▪ The location of discharge points to sewer, watercourse or soakaway; ▪ The location of manhole covers and drains; and ▪ The location of stop and diverter valves and interceptors. Your plan must show the location of mains water, gas and electricity supplies on your site including: ▪ The mains water stop tap; ▪ Gas and electric isolating valves and switches; and ▪ The routes for gas, electricity and water supplies around the site. If your permit covers a standalone water discharge activity or point source standalone groundwater activity, your site plan must show: ▪ Your wastewater treatment plant; ▪ Monitoring points; ▪ Locations of emergency equipment; ▪ Location of any mitigation measures referred to in your management system; ▪ The outlet to surface water; and ▪ The infiltration system (standalone groundwater activities only).	As a result of the permit variation being applied for, existing drainage plans will be reviewed and updated, as necessary. These will be incorporated into the EMS. As a result of the permit variation being applied for, existing utilities plans will be reviewed and updated, as necessary. These will be incorporated into the EMS. N/A as the permit is not for a standalone water discharge activity or point source standalone groundwater activity.	
Site Operations List the operations that will be carried out on your site during start up, normal operation and shut down.	All significant environmental impacts stemming from site operations are detailed in the existing EMS. These will be reviewed and updated as necessary as part of the permit variation process.	YES

For waste, mining waste, and installations, list the wastes that will be produced by each activity or process. List the steps you will take to prevent or minimise risks to the environment from each activity or process and type of waste. If you are a waste operator you must include a waste storage plan that states: ▪ The longest amount of time you will store each type of waste; ▪ How you will make sure you will not exceed these time limits; ▪ The maximum amount of each type of waste you will store in terms of volume; ▪ The maximum height of each storage pile on site; ▪ How you will identify the specific types of waste you are storing; ▪ How you will separate different types of waste if required; and ▪ How you will make sure your site only takes waste that your permit allows you to store. **Fire Prevention Plans (FPP)** If you need a permit for waste activities and you plan to store combustible waste you will need to write a fire prevention plan and submit it with your application. This must explain how you would prevent fire at your site or manage risks from fire if one occurs.	All details relating to waste generation and waste minimisation and management are filed under Section 9.1 (Performance Evaluation) of the EMS. This will be reviewed and updated, as necessary, as part of the permit variation application. For further information on the types and quantities of waste generated at the site and how this will change as a result of the permit variation being applied for, refer to Section 3.4 of this report. N/A as Dairy Crest is not a 'waste operator'. Relevant information on wastes, as a result of the permit variation being applied for, are provided in Section 3.4 of this report. Dairy Crest incorporates a FPP into its site Business Continuity Plan. The FPP includes measures to minimise the likelihood of a fire happening and reduce the risks if one does occur. No changes are required to the site's FPP as a result of the permit variation being applied for.	
You will need to produce a **Site and Equipment Maintenance Plan** detailing how you will maintain the site infrastructure and any machinery.	As a result of the permit variation being applied for, existing preventative maintenance plans will be reviewed and updated as necessary. All new plant and equipment installed as a result of the permit variation will be included and maintenance regimes will be implemented in accordance with manufacturers' recommendations. These documents will be incorporated into the EMS.	YES
You will need **Contingency Plans** to demonstrate how you minimise the impact on the environment of any: ▪ Breakdowns;	As a result of the permit variation being applied for, the existing Business Continuity Threat Plans (which cover pollution incidents, breach of permit conditions and WPF failure) and Emergency and Disaster	YES

▪ Enforced shutdowns; and ▪ Any other changes in normal operations. A changing climate and how this could affect your operations should also be considered as part of contingency planning.	Plan will be reviewed and updated as necessary. Existing Emergency Procedures (which detail actions required in the event of operational equipment failure) and Risk Assessments will also be reviewed and updated where necessary to reflect the changes implemented at the Creamery and WPF. These documents will be incorporated into the EMS.	
You will need an **Accident Prevention and Management Plan** which details how you would deal with any incidents or events that could result in pollution. This plan must: ▪ Identify any potential accidents or other unexpected incidents which could cause an unexpected change to normal operations. For each potential incident the following must be stated: ▪ Likelihood of the accident happening; ▪ Consequences of the accident happening; ▪ Measures taken to avoid the accident from happening; and ▪ Measures to minimise any impacts if the accident happens. The plan must say how you will record, investigate and respond to accidents or breaches of your permit. It must also include: ▪ Date last reviewed; ▪ Date of next review; ▪ A list of emergency contacts and how to reach them; ▪ A list of substances stored on site and storage facilities; and ▪ Forms to record accidents on.	As a result of the permit variation being applied for, the existing Accident Management Plan will be reviewed and updated as necessary. This plan details incidents which could occur including spillages of various substances and fire / explosion. The plan includes: ▪ Description of the accidents which could occur; ▪ Likelihood of occurrence; ▪ Consequence of occurrence; ▪ Actions to minimise the likelihood of occurrence; and ▪ Actions to be undertaken if the event occurs. The Emergency and Disaster Plan details how incidents and accidents will be recorded and investigated and by whom. These documents will be reviewed and updated as necessary and incorporated into the EMS. An Accident Management Plan relevant to the changes being applied for is also provided as part of the Environmental Risk Assessment in Appendix C.	YES
▪ Contact Information for the Public ▪ A noticeboard is to be displayed at the site entrance including the following information: ▪ Permit holder's name; ▪ Emergency contact name and telephone number; ▪ Statement to show the site is permitted by the Environment Agency; ▪ The permit number; and	Dairy Crest already displays a noticeboard at the site entrance detailing the required information. The contact details will not change as a result of the permit variation being applied for and, therefore, no update / action is required. Contact information for the general public is also held on Dairy Crest's corporate website.	YES

▪ EA contact number and incident hotline number.		
You need a **Complaints Procedure** to record: ▪ Any complaints received in relation to the activities covered in your permit; ▪ How complaints are investigated; and ▪ Any actions taken as a result of complaints.	Dairy Crest has a complaints procedure which is implemented as part of its EMS. The Environment Manager for the site is responsible for instigating the procedure, completing complaint logs and providing feedback to the Environment Agency and / or complainant. The complaints procedure will not change as a result of the permit variation being applied for.	YES
Include details in the management system on **Staff and Resources** including: ▪ An explanation of who is responsible for what procedures; ▪ Technical competency records; ▪ A list of roles carried out in relation to activities covered in the permit and by whom; and ▪ Competency check procedure and training records.	Details on employees, competency records and other resources are recorded as per the procedures established in the EMS Manual, and other site management systems including Quality, Safety and Laboratory Management Systems. These procedures will not change as a result of the permit variation being applied for, however, the roles and technical competencies required for any new activities will be reviewed and identified by Dairy Crest.	YES
Record Keeping Any records required by your permit must be kept. You must keep records to show how your management system is being implemented. Records to be kept include: ▪ Permits issued to the site; ▪ Legal requirements; ▪ Risk assessment; ▪ Management system plans; ▪ Any other plans required by your permit (such as noise); ▪ All operating procedures; ▪ Staff competence and training; ▪ Emissions and any other monitoring undertaken; ▪ Compliance checks, investigation findings and actions taken; ▪ Management reviews and changes made to the management system; and ▪ Certification audit reports and any actions taken.	Dairy Crest's EMS Manual outlines environmental record keeping procedures. Environmental records and documents are held in a common filing system shared by all certified sites, to which access is controlled by the Group Sustainability Manager. This includes information and records in relation to: ▪ Contacts; ▪ Risks and Opportunities; ▪ Compliance Obligations; ▪ Objectives and Targets; ▪ Interested Parties; ▪ Aspects and Impacts; ▪ Process Flows; and ▪ Waste Management. Other records are held on an individual site basis including: ▪ Site permits; ▪ Risk assessments; ▪ Operational plans; ▪ Compliance checks; ▪ Audit reports and actions taken; and	YES

	▪ Emissions monitoring and reporting records. The Record Keeping Procedures will not change as a result of the permit variation being applied for.	
Waste Operators must also record the following for each waste delivery to the site: ▪ Quantity (weight or volume); ▪ LoW code; ▪ Origin of the waste; ▪ Producer identity of the waste; ▪ Date of arrival of waste to site; ▪ Date when the waste was produced; ▪ Quarantined materials as part of the delivery; ▪ Duty of Care records; and ▪ Compliance with the site record and return requirements for hazardous waste.	N/A as Dairy Crest is not a 'waste operator' and does not accept waste from offsite.	
If you hold a permit for waste, mining waste or installations, a **Site Condition Report** is required. This must detail the condition of land or groundwater on the site and be kept updated regularly. The following information is to be included: ▪ Details of historic spills or contamination and responses to these incidents; and ▪ Evidence of the effectiveness of any measures taken to protect land and groundwater.	An Application Site Report (ASR) and Site Protection and Monitoring Programme (SPMP) for the site was developed by Dairy Crest to support the original permit application in 2005. Additional land is being included in the installation boundary as part of this permit variation; for the new raw material store to be located adjacent to the existing WPF. As such, a SCR has been produced for this area of land to accompany the permit variation application (Appendix B). Dairy Crest will continue to keep and update records of incidents and measures taken to protect land and groundwater throughout the operational phase of the site.	
A procedure needs to be in place for checking you are complying with permit conditions and management system requirements. The management system is to be reviewed and updated when: ▪ Changes are made to the site, operations, or equipment that affect activities covered by your permit; ▪ If you apply to change / vary your permit; ▪ After an accident, complaint or breach of your permit; and	Dairy Crest maintains an EMS Manual which details the approach taken to environmental auditing and Management Reviews. As a result of this permit variation, the EMS will be reviewed and updated as necessary. The review will consider the new activities being applied for and the environmental risks from the associated changes to plant and equipment.	YES

▪ If a new environmental issue is encountered and new control measures are implemented. Changes made to the management system will be recorded.	Any changes to the EMS will be recorded in the relevant documentation (that is required to be updated).	

Table 3-2 – BAT Requirements for Accident Management from Food, Drink and Milk BREF (December 2019)

BREF Requirements	Current / Proposed Arrangements	BAT?
BAT 1: In order to improve the overall environmental performance, BAT is to implement and adhere to an environmental management system (EMS) that incorporates all required features. Note: The level of detail and the degree of formalisation of the EMS will generally be related to the nature, scale and complexity of the installation, and the range of environmental impacts it may have.	Dairy Crest has an EMS which is certified to ISO 14001: 2015. The EMS includes an Environmental Sustainability Policy and an Environmental Management System Manual which details requirements and procedures which are implemented as part of the EMS including: ▪ Top management leadership requirements; ▪ Description of the scope of the EMS and context of the organisation; ▪ Identification of relevant interested parties; ▪ Identification of compliance obligations; ▪ Establishment of environmental objectives and targets; ▪ Identification of significant environmental aspects and required control measures; ▪ Identification of other required management plans; ▪ Resources and training requirements; ▪ Communications procedures and record keeping; ▪ Operational procedures (including emergency response processes); ▪ Approach to management reviews and auditing; and ▪ Approach to ensuring continual improvement. As a result of this permit variation application and the changes implemented on site, the EMS will be reviewed and updated as necessary (as detailed in Table 3-1).	YES
BAT 2: In order to increase resource efficiency and to reduce emissions, BAT is to establish, maintain and regularly review (including when a significant change occurs) an inventory of water, energy, and raw	Dairy Crest has established an inventory of all water, energy and raw materials consumption as well as waste water and waste gas streams.	YES

materials consumption as well as of waste water and waste gas streams, as part of the EMS. Note: The level of detail of the inventory will generally be related to the nature, scale and complexity of the installation, and the range of environmental impacts it may have.	This inventory incorporates the following features: ▪ Information about the cheese, GOS and demineralised whey production processes, including process flow sheets showing the origin of emissions and descriptions of process-integrated techniques and waste water treatment techniques; ▪ Information about water consumption and usage including identification of actions to reduce water consumption and waste water volume; ▪ Information about the quantity and characteristics of the waste water streams, such as flow, pH and temperature, and average concentration and load values of relevant pollutants/parameters; ▪ Information about the characteristics of waste gas streams, such as: average values and variability of flow and temperature, average concentration and load values of relevant pollutants/parameters; ▪ Information about energy consumption and usage, the quantity of raw materials used and residues generated, alongside identification of actions to enable continuous improvement of resource efficiency; and ▪ Identification and implementation of an appropriate monitoring strategy with the aim of increasing resource efficiency. The information is maintained in Dairy Crest's common filing system shared by all certified sites and the data will be reviewed and updated as necessary as a result of the permit variation being applied for. For further information on the expected changes to resource efficiency as a result of the permit variation being applied for, refer to Sections 3.2, 3.3 and 3.4 of this report.	

Table 3-3 – BAT Requirements for Accident Management from Waste Treatment BREF (August 2018)

BREF Requirements	Current / Proposed Arrangements	BAT?
BAT 1: In order to improve the overall environmental performance, BAT is to implement and adhere to an environmental management system (EMS) that incorporates all required features.	As detailed in Table 3-2 above.	YES
BAT 2: In order to improve the overall environmental performance of the plant, BAT is to use all of the techniques given below: a. Set up and implement waste characterisation and pre-acceptance procedures; b. Set up and implement waste acceptance procedures; c. Set up and implement a waste tracking system and inventory; d. Set up and implement an output quality management system; e. Ensure waste segregation; f. Ensure waste compatibility prior to mixing or blending of waste; and g. Sort incoming solid waste.	Waste characterisation and pre-acceptance procedures are not required as the WPF does not accept waste from offsite and only treats waste effluent arising from the onsite Creamery processes. The changes that are being applied for at the WPF are specifically designed to improve the overall environmental performance by reducing the inorganic load of the delivered effluent. In particular, such changes have included provision of a Divert Tank and automation of monitoring processes, in addition to the provision of a contingency lagoon at the Creamery. These measures allow the segregation, separate management and diversion of problematic / out of specification effluent streams, if required, in order to prevent shock loading of the WPF. This helps to maintain compliance with the permit conditions and, therefore, ultimately protect the River Inny. Likewise, specific waste acceptance procedures are not required. However, procedures are in place (and will be updated as necessary) to cover the sampling and monitoring of waste / effluent at the inlet to the WPF. This includes monitoring for pH, turbidity, temperature and COD. A new MCERTS flow meter has been installed to monitor and record the quantity of effluent leaving the WPF site, i.e. discharged into the River Inny. For other wastes generated on site, that are not discharged to the onsite WPF, Dairy Crest maintains a waste inventory and tracking system. Further details are provided in Section 3.4.	YES
BAT 3: In order to facilitate the reduction of emissions to water and air, BAT is to establish and to maintain an inventory of waste water and waste gas streams, as part of the EMS.	As detailed in Table 3-2 above.	YES

BAT 4: To reduce the environmental risk associated with the storage of waste, BAT is to use all of the techniques given below: a. Optimised storage location; b. Adequate storage capacity; c. Safe storage operation; and d. Separate area for storage and handling of packaged hazardous waste.	The WPF has been designed to provide adequate capacity to safely store and treat the maximum amount of process effluent generated at the Creamery. The new contingency lagoon, located at the Creamery, has been designed to optimise storage and, in addition to the Divert Tank located at the WPF, allows separate segregation and management of out of specification effluent streams. This helps to reduce the environmental risk because, if a problem is detected, the lagoon can be used to capture the process effluent at source without sending it to the WPF. Safe storage operations are provided at the WPF. All storage tanks are designed to relevant British Standards, safe equipment access is provided and tanks contain level probes to prevent over-filling with a full SCADA system incorporating feedback on tank levels as required. The site does not store or handle packaged hazardous waste and, therefore, a designated area for such wastes is not required.	YES
BAT 5: In order to reduce the environmental risk associated with the handling and transfer of waste, BAT is to set up and implement handling and transfer procedures.	Existing procedures related to the handling and transfer of waste at the installation will be reviewed and updated as necessary in line with the proposed changes.	YES
BAT 21: In order to prevent or limit environmental consequences of accidents and incidents, BAT is to use all of the techniques given below, as part of the accident management plan: a. Protection measures; b. Management of incidental/accidental emissions; and c. Incident/accident registration and assessment system.	As a result of the permit variation being applied for, the existing Accident Management Plan will be reviewed and updated as necessary. An Accident Management Plan relevant to the proposed changes being applied for is also provided as part of the Environmental Risk Assessment in Appendix C. Dairy Crest's existing procedures for managing incidents / accidents, including their registration and assessment will be applied to any new processes.	YES

3.2. ENERGY EFFICIENCY

The changes introduced on site will alter the use of energy at the installation. However, whilst the projects implemented at the Creamery result in an increased hourly production capacity, the amount of energy consumed is expected to remain similar or marginally decrease due to the energy efficiency improvements that have been introduced. The same trend is anticipated for the energy demand required to treat the wastewater generated from the Creamery processes at the redeveloped WPF. Where possible, the most energy efficient options have been chosen for any new processes, plant and equipment; this has ultimately meant that the energy efficiency measures

incorporated have helped to avoid energy increases resulting from the changes at both the Creamery and WPF.

There is a corporate level Saputo 'Promise' which specifies longer term targets or 'Pledges' including a 10 % reduction in energy intensity and a 20 % reduction in CO2 intensity (per tonne of finished product) by 2025 against a 2020 baseline. Dairy Crest sets annual targets for each of its manufacturing sites to align to the overall longer-term Saputo 'Promise' targets. At Davidstow Creamery, Dairy Crest uses Carbon Desktop energy and resource management software to monitor and manage the day to day energy use on site. The system records the energy use for the site as a whole and at sub-levels, including at the Creamery and WPF, at a departmental level, unit operation and main plant items (for large items only) or at the local board. Dairy Crest reviews the site's energy use regularly and a monthly report is produced and provided to the management team.

Each year a balanced score card is agreed for the site, which includes:

- Annual energy targets for the site;
- Energy efficiency opportunities for the site; and
- Progress towards the company's strategic energy targets, e.g. five-year carbon reduction target for the business as a whole.

The site is subject to a Climate Change Agreement (Agreement Identifier DIAL/T000332 v9, dated 18th March 2022) with targets for energy reduction set compared to the baseline year (2018). The current target period (Target Period 5) has a target of 6.67 % reduction compared to the baseline year. This is measured based on the combined energy use for 2021 + 2022 / combined milk intake for 2021 + 2022 against the 2018 baseline. Davidstow is also required to comply with the UK Emissions Trading Scheme (ETS) due to an installed boiler capacity of >50 MW^{th}. The site has a Greenhouse Gas (GHG) Emissions Permit (reference UK-E-IN-13300, last updated 21st March 2022) and each year Dairy Crest is required to report third party verified CO_2 emissions for fuels used in the boilers (electricity is not included in the UK ETS). A sufficient amount of carbon allowances are then surrendered to cover verified emissions. Dairy Crest receives a free annual allocation each year; if emissions exceed this free allowance, it is required to purchase more allowances to cover the emissions. Conversely, if less emissions are emitted, the surplus allowances can be sold or banked.

Dairy Crest also meets the requirements to qualify for the Energy Savings Opportunity Scheme (ESOS) which implements the EU Energy Efficiency Directive. ESOS is a mandatory energy assessment scheme which requires qualifying organisations to carry out ESOS assessments every four years. These assessments are audits of the energy used by buildings, industrial processes and transport to identify cost-effective energy saving measures. The Davidstow site was audited in February 2019 as part of Dairy Crest's organisational level ESOS obligation. The resultant report stated that Dairy Crest, as an organisation, has the potential to reduce its energy use by approximately 26 % for a £4.4M investment. An overview of the results is provided in Figure 3-1 below. Specifically, in relation to the Davidstow site, the report recommended that a 26 % reduction in energy usage could be achieved, equivalent to saving £1.9M (at 2019 energy prices), subject to an investment of £3.6M. The energy efficiency opportunities identified from the audit are divided into those which have a payback period of <1 year, 1-3 years and >3 years.

Figure 3-1 – Potential Energy Efficiency Savings

Site	< 1 year payback			1 – 3 year payback			> 3 year payback			All Opportunities		
	Saving		Capex	Saving		Capex	Saving		Capex	Saving		Capex
	% kWh	£k	£k	% kWh	£k	£k	% kWh	£k	£k	% kWh	£k	£k
Davidstow	5.6%	499	179	15.3%	1,084	1,995	5.1%	340	1,452	26.0%	1,923	3,626
Kirkby	*30.6%*	567	241	2.6%	48	91	1.9%	25	134	35.0%	641	465
Nuneaton	-	-	-	2.3%	30	81	3.3%	32	204	5.6%	63	285
Total	**8.6%**	**938**	**476**	**6.0%**	**600**	**1,500**	**4.3%**	**398**	**1,871**	**26.1%**	**2,625**	**4,376**
									'19/20 Capital Plans	**3.9%**	**462**	**713**

The most cost effective and practical to implement opportunities have been included in Dairy Crest's Utility Reduction Plans which are produced on an annual basis. Recent and / or current projects at the Davidstow site, which focus on reducing water as well as energy consumption, include:

- Installation of a biomass steam accumulator;
- Improvements in Demin water reuse;
- Tertiary filtration system as part of improvements to the WPF;
- Boiler efficiency improvements, e.g. ID fans, boiler blow down efficiency, economiser to recover waste heat from boiler flue gases (feasibility study in progress);
- Abstraction sand filter hydro cyclones;
- GOS CIP recovery;
- Lighting upgrades;
- Remediating compressed air leaks;
- Implementing lagging works around the site;
- Mechanical Vapour Recompression (MVR) condensate heat recovery; and
- Heat recover projects to reuse waste heat from air and refrigeration compressors through pre-heating of boiler feed water (planned for 2022).

Figure 3-2 below provides a Sankey diagram of energy use at the site, based on energy data from 2018. Whilst there was an improvement in relative energy performance (by ~7 %) between 2017/18 and 2019/20, the overall Sankey, in terms of energy sources and the proportion of energy used by the different processes on site, is still relevant.

Figure 3-2 – Davidstow Energy Sankey Diagram (2018 Data)

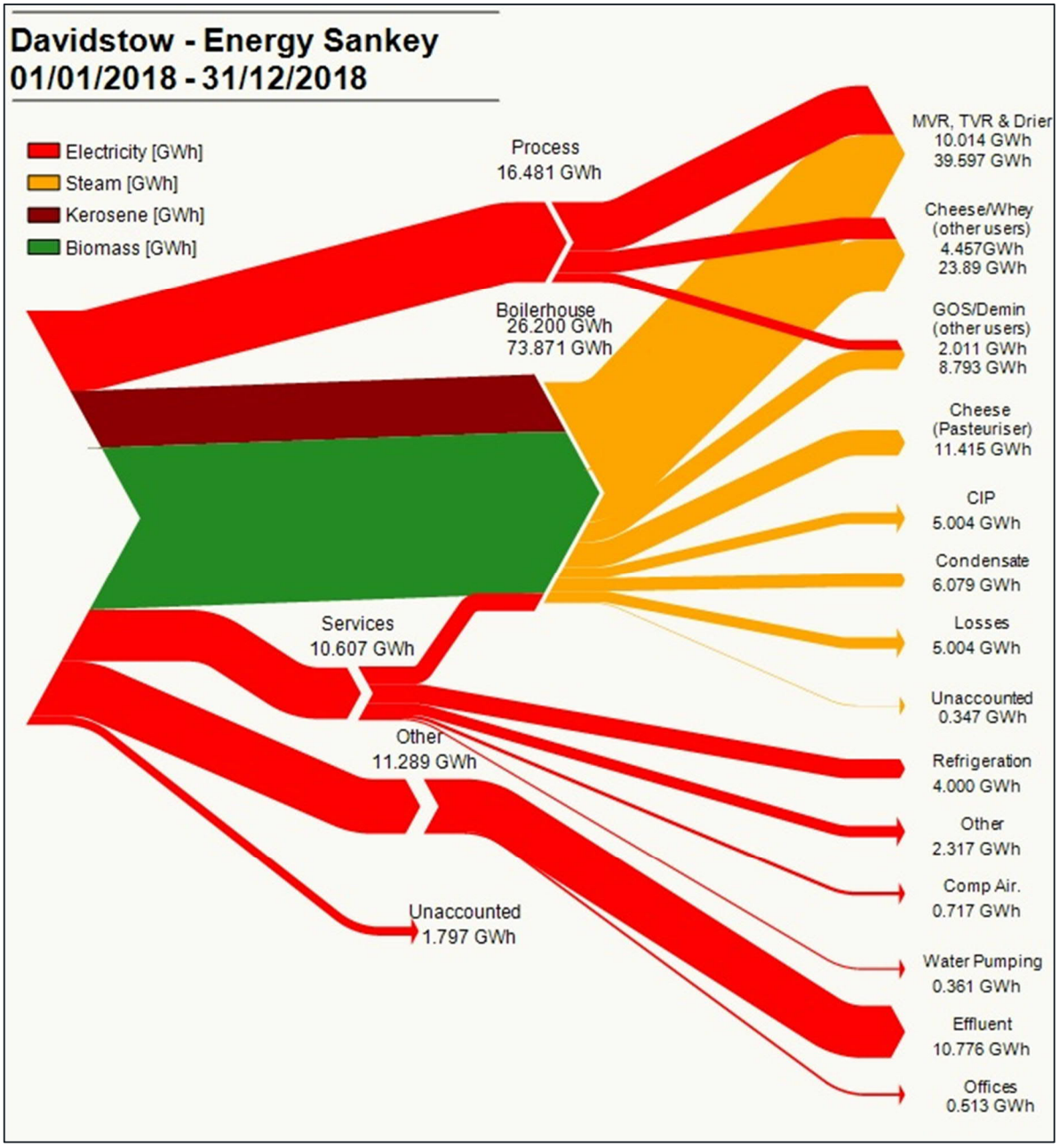


Table 3-4 and Table 3-5 below show the changes in energy use anticipated at the site as a result of the environmental permit variation being applied for. The estimated future energy consumption at the Creamery is shown in Table 3-4; this is once all of the projects (1-6) to maximise the utilisation of the main raw material (milk) have been fully implemented and are operational. The estimated future energy consumption at the WPF, shown in Table 3-5, incorporates the energy demand for the redeveloped WPF and enhanced WRP once all of the changes have been implemented.

Table 3-4 – Current and Estimated Future Annual Energy Consumption – Main Creamery

Energy Source	Current Delivered Energy Consumption (MWh)[1]	Current Primary Energy (MWh)[1]	Future Delivered Energy Consumption (MWh)[2]	Future Primary Energy (MWh)[2]
Electricity from public supply	29,136	69,926[3]	24,220	58,128[3]
Electricity from solar farm	0	0	4,280	4,280
Gas (biomass boiler ignition)	5	5	5	5
Oil (kerosene)	23,988	23,988	7,900	7,900
Biomass	69,803	69,803	69,525	69,525

Notes: 1. Current energy consumption based on 2019/20 data for the Creamery which is used as a baseline.
2. Future energy consumption is a best estimate at this stage following full implementation of all changes at the Creamery.
3. Electricity imported from the grid is multiplied by a factor of 2.4 to account for heat losses from thermal generation.

Table 3-5 – Current and Estimated Future Annual Energy Consumption – WPF

Energy Source	Current Delivered Energy Consumption (MWh)[1]	Current Primary Energy (MWh)[1]	Future Delivered Energy Consumption (MWh)[2]	Future Primary Energy (MWh)[2]
Electricity from public supply	11,023	26,455[3]	11,000	26,400[3]
Oil (gas oil)[4]	33	33	33	33

Notes: 1. Current energy consumption based on 2019/20 data for the WPF which is used as a baseline.
2. Future energy consumption is a best estimate at this stage following full implementation of all changes at the WPF.
3. Electricity imported from the grid is multiplied by a factor of 2.4 to account for heat losses from thermal generation.
4. Gas oil is used for various stationary and mobile devices at the WPF.

The changes on site will increase the hourly production capacity and enable a ~19 % increase in cheese production (largely delivered by operational improvements), however, there will be a corresponding decrease in primary energy consumption. The data in Table 3-4 shows that the primary energy consumption at the Creamery is estimated to decrease by approximately 23,884 MWh per year, which represents around a 15 % reduction. In addition to the energy efficiency measures which have been introduced, the electricity generated by the solar farm will reduce the requirement for electricity from public supply.

Whilst more of the main raw material, milk, will be processed, the new plant and equipment installed at the Creamery will drive operational improvements and allow additional process flexibility and optimisation, thus increasing the process efficiency. In particular, the additional / upgraded CIP

systems, which are one of the site's major energy users, will minimise unproductive time and optimise CIP effectiveness (thereby improving energy efficiency) by:

- Simultaneously operating CIP on all block formers (the current system can only CIP four at once);
- Performing CIP of the alfomatics from two CIP circuits (the current system works from one circuit);
- Allowing the ability to simultaneously CIP two vats (the current system can CIP one vat at a time);
- Using hot water for rinsing of vats (the current system uses cold water); and
- Introducing a greater factor of safety in terms of volume, pressure, flowrates and heating capacity (the current system is close to its limit in terms of heat capacity which means that it only needs a small perturbation in the system to cause a delay).

In relation to the WPF, the data in Table 3-5 shows that there will be no change or a marginal decrease in primary energy consumption per year. This is despite the changes implemented in order to achieve BAT and treat the process effluent from the Creamery to meet more stringent emission limit values prior to discharge to the River Inny. The changes to the WPF are summarised in report Section 2 and described in more detail in report Section 4. Overall the changes have been designed and implemented to improve the management, monitoring, operation, efficiency and resilience of the existing WPF processes.

As detailed in Table 2-1 (in report Section 2.3), Dairy Crest has installed a 5 MW DC photovoltaic solar power plant on a plot of land adjacent to the Creamery. The solar facility has been operational since September 2021 and is contacted to provide up to 5,318 MWh per year to the site, thus reducing the site's demand on electricity from public supply. To put this into context, the solar facility is able to provide approximately 4 % of the future electricity demand for the Creamery or 39 % for the WPF.

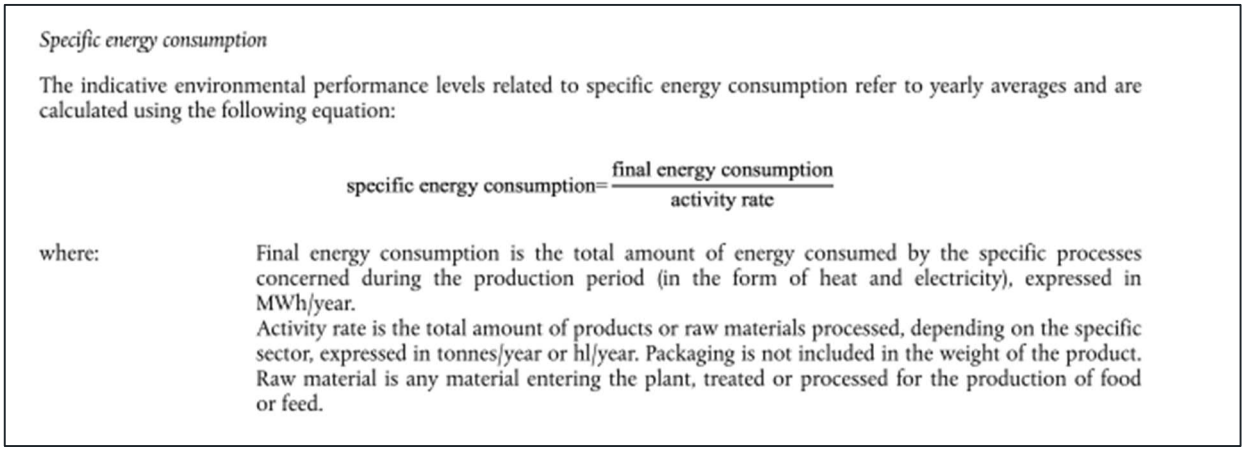
Table 3-6 below provides indicative environmental performance levels for Specific Energy Consumption (SEC) at dairies, taken from the Food, Drink and Milk BREF. Figure 3-3 below shows how the BREF identifies SEC should be calculated.

Table 3-6 – Indicative Environmental Performance Levels for SEC from BREF

Main Product (at least 80% of the production)	Unit	Specific Energy Consumption (yearly average)
Market milk	MWh/tonne of raw materials	0.1-0.6
Cheese		0.10-0.22(1)
Powder		0.2-0.5
Fermented milk		0.2-1.6

Notes: (1) The specific energy consumption level may not apply when raw materials other than milk are used.

Figure 3-3 – Specific Energy Consumption Methodology



Specific energy consumption

The indicative environmental performance levels related to specific energy consumption refer to yearly averages and are calculated using the following equation:

$$\text{specific energy consumption} = \frac{\text{final energy consumption}}{\text{activity rate}}$$

where:

Final energy consumption is the total amount of energy consumed by the specific processes concerned during the production period (in the form of heat and electricity), expressed in MWh/year.
Activity rate is the total amount of products or raw materials processed, depending on the specific sector, expressed in tonnes/year or hl/year. Packaging is not included in the weight of the product. Raw material is any material entering the plant, treated or processed for the production of food or feed.

Using the current and estimated future energy consumption figures for the Creamery (Table 3-4), Table 3-7 below presents the current and future estimated SEC levels. Table 3-7 also presents the current and future estimated SEC levels calculated for the WPF processes, although the Waste Treatment BREF does not contain indicative environmental performance levels for SEC for comparison of the data. The future SEC calculations are a best estimate at this stage; the data in the tables will be monitored and maintained up to date with further development of the SEC levels once the permit variation comes into effect and all of the changes are fully implemented and operational.

Table 3-7 – Current and Estimated Future Environmental Performance Levels for SEC

Source of Energy Consumption	Current SEC (MWh/tonne of milk) (yearly average)	Future SEC (MWh/tonne of milk) (yearly average)
Creamery processes	0.227	0.161
WPF processes	0.020	0.017

Notes: (1) SEC levels have been calculated using the delivered energy consumption figures from Tables 3-4 and 3-5 above and current / baseline (2019/20) and future milk utilisation figures.

The site's current SEC level for the Creamery, shown in Table 3-7, is marginally higher than the indicative SEC level for cheese from the BREF, shown in Table 3-6. However, this reflects the fact that the amount of energy used at the Creamery goes into the manufacture of a number of other products alongside cheese. In particular, the Davidstow site also produces demineralised whey powder and GOS. The Food, Drink and Milk BREF notes that the indicative environmental performance level for SEC (cheese production) may not be appropriate when raw materials other than milk are used and, furthermore, the SEC levels quoted are relevant for sites where the main product, e.g. cheese or powder, comprises at least 80 % of the site's production. This does not apply at Davidstow, where neither cheese nor milk comprise 80 % of the site's production. In addition, the BREF makes reference to the fact that the most energy-consuming operations are the evaporation, demineralisation and drying of milk and, therefore, the SEC calculated for the Creamery processes at Davidstow is considered to reflect the efficiency of the processes in place.

Notwithstanding this, the data shows that, overall, the estimated SEC for future energy use at both the Creamery and WPF is lower than the current level, reflecting the efficiencies which will be introduced with the changes on site.

In addition to the SEC levels reported in the Food, Drink and Milk BREF, Table 3-8 below contains figures taken from the 2021 Dairy UK Environmental Benchmarking Report. The data shows typical environmental performance levels in relation to energy efficiency for the dairy sector for the years 2008, 2019 and 2020. The figures presented are for the sub-sector 'mixed and dairy other' which best represents Dairy Crest's operations. The table also presents the current and estimated future energy efficiency figures for Davidstow for comparison.

Table 3-8 – Dairy UK Energy Efficiency Levels Per Tonne of Raw Material (Milk) Processed

2008 Energy Efficiency (kWh/tonne)	2019 Energy Efficiency (kWh/tonne)	2020 Energy Efficiency (kWh/tonne)	Davidstow Current Energy Efficiency (kWh/tonne)	Davidstow Estimated Future Energy Efficiency (kWh/tonne)
287.9	251.3	218.8	227.7	160.5

The Dairy UK Environmental Benchmarking Survey was launched in 2008 and since then the UK dairy sector has demonstrated continuous environmental improvement including a 21 % increase in energy efficiency (kWh/tonne) and a corresponding 21 % decrease in energy-related carbon per kg milk (CO_2/kg). The current energy efficiency level calculated per tonne of raw material processed at Davidstow is in between the 2019 and 2020 levels published in the Dairy UK Environmental Benchmarking Report. This, therefore, demonstrates that the Davidstow site is performing in line with similar sites in the UK dairy industry.

The future anticipated energy efficiency level is lower than all levels in the Benchmarking Report. This estimate suggests that, following once the permit variation comes into effect and all of the changes are fully implemented and operational, Dairy Crest is likely to not only meet but potentially exceed the typical energy efficiency levels for similar dairies in the UK.

Table 3-9 and Table 3-10 below show sector specific BAT standards for energy efficiency and detail how the changes implemented on site will comply with the requirements from the Food, Drink and Milk (December 2019) and Waste Treatment (August 2018) BREFs, respectively.

Table 3-9 – BAT Requirements for Energy Efficiency from Food, Drink and Milk BREF (December 2019)

BREF Requirements	Current / Proposed Arrangements	BAT?
BAT 6 (General): In order to increase energy efficiency, BAT is to (a) incorporate an Energy Efficiency Plan as part of the EMS and is to (b) use an appropriate combination of the common techniques listed below: ▪ Burner regulation and control; ▪ Cogeneration;	Dairy Crest uses Carbon Desktop energy and resource management software to monitor and manage the day to day energy use on site. A Utility Reduction Plan is in place for the Davidstow site which incorporates energy efficiency opportunities identified from the last ESOS audit. There are five existing boilers on site, predominantly used to generate steam for the production process,	YES

▪ Energy efficient motors; ▪ Heat recovery with heat exchangers and/or heat pumps; ▪ Minimising blowdown from the boiler; ▪ Optimising steam distribution systems; ▪ Preheating feed-water (inc. use of economisers); ▪ Process control systems; ▪ Reducing compressed air system leaks; ▪ Reducing heat losses by insulation; ▪ Variable speed drives; ▪ Multiple-effect evaporation; and ▪ Use of solar energy.	and already regulated by the current environmental permit. These will not change as a result of the permit variation being applied for, however, boiler efficiency improvements have been made as a result of the ESOS audit findings (e.g. the biomass steam accumulator as described above). Energy efficient plant and equipment have been selected for the changes implemented on site; where relevant this includes the use of energy efficient motors and variable speed drives. The existing process control systems will remain in place and any new plant and equipment installed will be interconnected into this system allowing automation of the process. Whilst not forming part of this permit variation application, solar energy is now also used at the facility as a 5 MW DC photovoltaic solar power plant is located on a plot of land adjacent to the Creamery. It is contracted to provide up to 5,318 MWh per year to the site, thus reducing the site's demand on electricity from public supply. This is the maximum possible use of solar energy at the site given the land available. All of the techniques for energy efficiency listed under BAT 6 are implemented at Davidstow, with the exception of: cogeneration (which is considered uneconomic as costs to integrate low grade heat into the existing Creamery heat distribution infrastructure are technically prohibitive); and the use of heat pumps.	
BAT 21 (Dairy): In order to increase energy efficiency, BAT is to use an appropriate combination of the techniques specified in BAT 6 (above) and those below: a. Partial milk homogenisation; b. Energy-efficiency homogeniser; c. Use of continuous pasteurisers; d. Regenerative heat exchange in pasteurisation; e. Ultra-high temperature (UHT) processing of milk without immediate pasteurisation; f. Multi-stage drying in powder production; and g. Precooling of ice-water.	No milk homogenisation takes place on site as this technique is not relevant to cheese manufacturing. The site uses continuous pasteurisers and the current hot bowl separators have been upgraded to hermetically sealed cold bowl separators which are more energy efficient. Regenerative heat exchange is already used in pasteurisation; full heat regeneration is designed into the existing milk pasteurisers and is incorporated into the new cream pasteurisers. No UHT processing takes place on site as this technique is not relevant to cheese manufacturing. The site produces demineralised whey powder; however, this process will not change as a result of the permit variation being applied for. Whilst no new powder drying solutions are planned and, therefore, no new plant and equipment is proposed for this process, the current whey powder process incorporates multi-stage concentrations followed by crystallisation of drying. Pre-cooling of ice water is not relevant to the Creamery processes undertaken on site nor the environmental permit variation being applied for. Chilled water is provided by the ammonia cooling system.	YES

Table 3-10 – BAT Requirements for Energy Efficiency from Waste Treatment BREF (August 2018)

BREF Requirements	Current / Proposed Arrangements	BAT?
BAT 23: In order to use energy efficiently, BAT is to use both of the techniques given below: a. Energy efficiency plan; and b. Energy balance record providing a breakdown of energy consumption and generation by the type of source.	Dairy Crest uses Carbon Desktop energy and resource management software to monitor and manage the day to day energy use on site. A Utility Reduction Plan is in place for the Davidstow site which incorporates energy efficiency opportunities identified from the last ESOS audit. Tables 3-4 and 3-5 above provide the current and estimated future breakdown of energy consumption for the site by the type of source.	YES

3.3. EFFICIENT USE OF RAW MATERIALS AND WATER

The principal raw material used at the installation is milk, which comprises the main ingredient used in the dairy production processes. Other ingredients used to make the dairy products include rennet, granular salt and lactose powder. The changes introduced at the site will maximise the use of these raw material ingredients by introducing operational improvements and this will increase the hourly production capacity at the Creamery (for further details refer to report Section 4).

Other raw materials which are used in significant quantities at the installation include cleaning products, packaging and wastewater treatment chemicals. No new raw materials will be required as a result of the changes on site, but there will be a marginal increase in the use of existing raw materials and water consumption at the facility. Table 3-11 below shows the estimated changes in raw material and water use at the site for the main Creamery and WPF processes.

Whilst the changes introduced will result in a ~19 % increase in the hourly production capacity for cheese at the Creamery, other raw materials, such as cleaning chemical usage, is estimated to increase by only ~10 %. This is because the new / upgraded CIP system will introduce increased efficiencies, e.g. longer run times, and therefore there will not be a proportionate increase in associated chemicals.

Table 3-11 – Current and Estimated Future Raw Material Use – Creamery and WPF

Material and Composition	Use of Material	Risks	Approximate Annual Usage (tonnes)		Environmental Impact (where known) e.g. degradability, toxicity	Suitable Alternative for those with Significant Impact Potential / Justification
			Current[1]	Future[2]		
Creamery - Packaging Materials						
Glue pellets	Packaging final product	None	16	20	Not applicable – solid material and non-soluble. However, proper disposal required (refer to Section 3.4 for further details on waste management).	No better alternative – most appropriate material for activity.
Cardboard	Packaging final product	None	2,750	3,350	Not applicable – solid material and non-soluble. However, proper disposal required (refer to Section 3.4 for further details on waste management).	No better alternative – most appropriate material for activity.
Wooden pallets	Packaging final product	None	590	710	Not applicable – solid material and non-soluble. However, proper disposal required (refer to Section 3.4 for further details on waste management).	No better alternative – most appropriate material for activity.
Plastic shrink wrap	Packaging final product	None	290	370	Not applicable – solid material and non-soluble. However, proper disposal required (refer to Section 3.4 for further details on waste management).	No better alternative – most appropriate material for activity.

Cleaning Chemicals						
Ansep CIP - Alkaline	Tanker CIP cleaning	R34 Causes burns R35 Causes severe burns R31 Contact with acids liberates toxic gas R50 Very toxic to aquatic organisms	21	23	Very toxic to aquatic organisms.	No better alternative – most appropriate material for activity.
Caustic Soda 47 %	CIP cleaning	R35 Causes severe burns	4,650	5,115	Substantial amounts may lead to changes in pH / acidity in small water systems which could impact aquatic organisms.	No better alternative – most appropriate material for activity.
Horolith Sd - acid	Tanker CIP cleaning	R36/38 Irritating to eyes and skin R52/53 Harmful to aquatic organisms, may cause long-term effects in the aquatic environment	5	6	Harmful to aquatic life.	No better alternative – most appropriate material for activity.
Nitric Acid 60 %	CIP cleaning	R8 Contact with combustible material may cause fire R35 Causes severe burns	376	414	May cause adverse effects in the aquatic environment due to changes in pH. Substance is not considered to be persistent and is readily biodegradable.	No better alternative – most appropriate material for activity.

Ultrasil 110	Specialist CIP cleaning	R20/22 Harmful by inhalation and if swallowed R35 Causes severe burns R36 Irritating to eyes R37/38 Irritating to respiratory system and skin R41 Risk of serious damage to eyes	18	20	Harmful to aquatic life with long lasting effects.	No better alternative – most appropriate material for activity.
Ultrasil 62A	Specialist CIP cleaning	R20/22 Harmful by inhalation and if swallowed R35 Causes severe burns R36 Irritating to eyes R37/38 Irritating to respiratory system and skin R41 Risk of serious damage to eyes	2	3	Harmful to aquatic life with long lasting effects.	No better alternative – most appropriate material for activity.
Ultrasil 67 Ultrasil 69 Ultrasil 78	Specialist CIP cleaning	R22 Harmful if swallowed R34 Causes chemical burns	4 10 13	5 11 14	Harmful to aquatic life with long lasting effects.	No better alternative – most appropriate material for activity.

		R36 Irritating to eyes R38 Irritating to respiratory system and skin R41 Risk of serious damage to eyes R42 May cause sensitisation by inhalation R50 Very toxic to aquatic life				
Hydrochloric Acid 36 %	Demin process – regenerate ion exchange bed	R23 Toxic by inhalation R34 Causes burns R35 Causes severe burns R37 Irritating to respiratory system R41 Risk of serious eye damage	3,967	4,364	Forms corrosive mixtures with water even when diluted. Harmful effects resulting from changes in pH.	No better alternative – most appropriate material for activity.
Sodium Hypochlorite Solution 14/15 %	Disinfectant	R31 Contact with acids liberates toxic gas R34 Causes burns	41	45	Very toxic to aquatic life. Should not come into contact with soil, surface or groundwater.	No better alternative – most appropriate material for activity.

		R50 Very toxic to aquatic organisms				
OXYSAN ZS	Sanitiser	R8 Combustible R34 Causes burns	5	6	No ecotoxicity data available.	No better alternative – most appropriate material for activity.
POLIX	CIP cleaning	R31 Contact with acids liberates toxic gases R34 Causes burns R35 Causes severe burns R50 Very toxic to aquatic organisms	3	3	Very toxic to aquatic life. Should not come into contact with soil, surface or groundwater.	No better alternative – most appropriate material for activity.
PRIPAN	Surface cleaning product	H319 Causes serious eye irritation	2	2	No known ecotoxicological effects. Should not come into contact with soil, surface or groundwater.	No better alternative – most appropriate material for activity.
TOPAZ MD1	Foam cleaning product	H314 Skin Corrosion H318 Serious eye damage	1	1	No known ecotoxicological effects.	No better alternative – most appropriate material for activity.
TRIQUART AM	Disinfectant	R38 Irritating to skin	2	2	Very toxic to aquatic life with long lasting effects.	No better alternative – most appropriate material for activity.

		R41 Risk of serious eye damage R50 Very toxic to aquatic organisms				
WPF Chemicals						
2081 polymer (Aqua treat)	DAF chemical used for flocculation (bio-plant)	Not classified as hazardous	95	105	May be harmful to aquatic life.	No alternative – most appropriate material for activity.
N223 polymer (Aquatreat)	Coagulant used for sludge thickening from phosphate removal plant	Not classified as hazardous	64	70	May be harmful to aquatic life.	No alternative – most appropriate material for activity.
Antifoam 5449	Used to control or eliminate foam (de-foaming agent)	R52 Harmful to aquatic organisms R53 May cause long-term adverse effects in the aquatic environment	4	4	Harmful to aquatic organisms and aquatic environment.	No alternative – most appropriate material for activity.
Bionutrient	Removal of organic matter as part of biological	Not classified as hazardous	3	3	Low toxicity to aquatic organisms and aquatic environment.	No alternative – most appropriate material for activity.

	treatment stage					
Caustic Soda 32 %	pH correction	R35 Causes severe burns	2,834	3,117	Substantial amounts may lead to changes in pH / acidity in small water systems which could impact aquatic organisms.	No alternative – most appropriate material for activity.
Caustic Soda 47 %	pH correction (ex Demin and GOS)	R35 Causes severe burns	26	29	Substantial amounts may lead to changes in pH / acidity in small water systems which could impact aquatic organisms.	No alternative – most appropriate material for activity.
Citric Acid 50 %	Membrane cleaning	R36 Irritating to eyes	60	65	Soluble in water. Reacts with strong alkalis. Not considered toxic to fish.	No alternative – most appropriate material for activity.
DIOX Max sludge and effluent additive	Odour treatment	R8 Contact with combustible materials may cause fire R22 Harmful if swallowed R32 Contact with acids liberates toxic gas	19	21	Toxic to aquatic organisms.	No alternative – most appropriate material for activity. Only used to address peak odour at infrequent times.
DIOX 5000 used in OCU wet scrubber	Odour treatment	R8 Contact with combustible materials may cause fire R22 Harmful if swallowed	0	26	Toxic to aquatic organisms.	No alternative – most appropriate material for activity. Only used to address peak odour at infrequent times.

		R32 Contact with acids liberates toxic gas				
Ferric Chloride	DAF coagulant and coagulant for phosphate removal plant	R22 Harmful if swallowed R38 Irritating to skin R41 Risk of serious damage to eyes	1,582	1,967	Toxic to aquatic life.	No alternative – most appropriate material for activity.
Genesol 701	Membrane cleaner / cleaning agent	R35 Causes severe burns	1	1	Somewhat harmful to aquatic life.	No alternative – most appropriate material for activity.
Genesol 704	Membrane cleaner / cleaning agent	R35 Causes severe burns	3	4	Somewhat harmful to aquatic life.	No alternative – most appropriate material for activity.
Microbial Concentrate	Bio-Augmentation	Not classified as hazardous	18	20	Low toxicity to aquatic organisms and aquatic environment.	No alternative – most appropriate material for activity.
Sodium Bisulphate (CP Plant only)	Dosed upstream of WRP to remove chlorine	R41 Risk of serious damage to eyes	39	43	Acidic product which will lead to changes in pH of watercourses. May be toxic to fish and other aquatic species.	No alternative – most appropriate material for activity.
Ultralime Hydrate	Dosing of lime for pH correction as part of phosphate removal	R37/38 Irritating to respiratory system and skin	1,079	1,187	Aquatic toxicity due to alkalinity. Does not bioaccumulate.	No alternative – most appropriate material for activity.

		R41 Risk of serious damage to eyes				
Urea 23%	For nitrogen balancing in AT3	Not considered hazardous.	18	20	Persistence in environment unlikely. Likely to be mobile in environment due to water solubility.	No alternative – most appropriate material for activity.
Sulphuric Acid 77 %	pH correction	R14 Reacts violently with water R26 Very toxic by inhalation R35 Causes severe burns R41 Risk of severe eye damage	1,270	1,397	Harmful to aquatic life. Large quantities will result in changes to pH of water environments.	No alternative – most appropriate material for activity.

Notes: 1. Current raw material quantities based on 2019/20 data for the Creamery and WPF which is used as a baseline.
2. Future raw material quantities comprise a best estimate at this stage following full implementation of all changes at the installation.

The estimated data in the table above will be reviewed and updated once all changes have been fully implemented and a full year's worth of operational data is available.

As is the case for most dairies, Dairy Crest's water consumption is primarily used for cleaning operations. Dairy Crest currently obtains its process water from three sources:

- Mains water from South West Water (SWW);
- River / spring water from an authorised abstraction; and
- Recovered water from the Creamery processes – evaporation plant at the main Creamery and RO plant at the WPF / WRP.

Once all projects outlined in this environmental permit variation come into effect and the full benefits are realised, overall water consumption at the installation is expected to increase marginally as a result of the increased hourly production capacity for cheese and the associated activities (refer to Table 3-12 below). However, the amount of water imported will not increase; instead the additional water required to support the changes is recovered from certain processes (including the RO of milk and re-use of permeate from the WPC plant) within the installation, thereby enhancing self-sufficiency in terms of water use.

Figure 3-4 below shows the new water mass balance for the installation as of November 2021. Using this data in combination with a number of estimates and assumptions, the current (2019 baseline) and future (post project implementation) water use data for the installation is summarised in Table 3-12 below.

Figure 3-4 – Water Mass Balance for the Installation

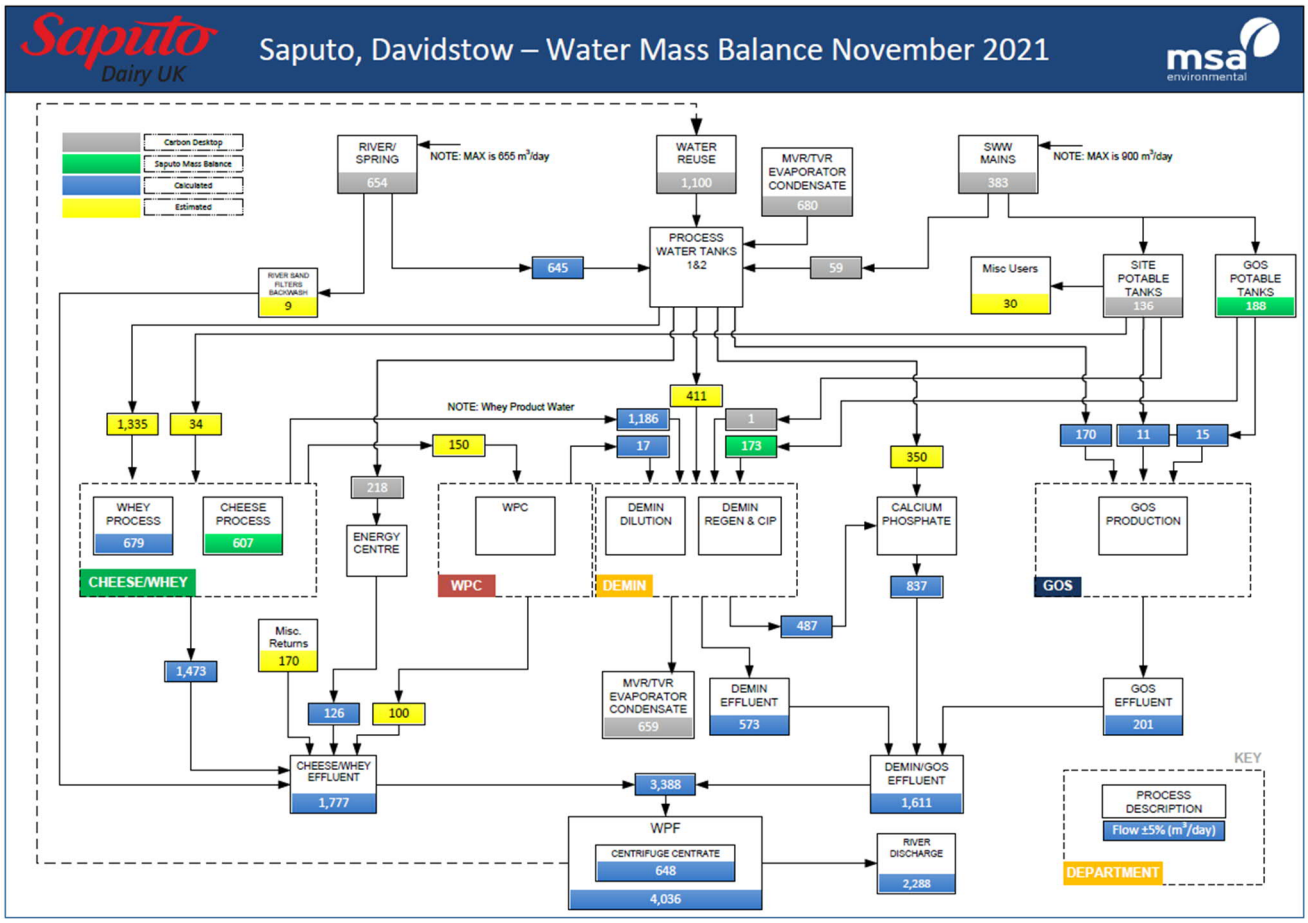


Table 3-12 – Current and Future Water Use at the Installation

Source	Current Use (m^3/day)[1]	Future Use (m^3/day)[2]
Mains supply (SWW)	492	383
Abstraction (river / spring)	582	654
Total water imported to site	***1,074***	***1,037***
Recycled water (from evaporation and WRP)	1,725	1,780 (2,259)[3]
Whey (water from WPC plant)	100	100
Total water from recovered sources	***1,825***	***1,880 (2,359)***
Total water use from imported and recovered sources	***2,899***	***2,917***

Notes: 1. Current water consumption figures are based on 2019 Q4 data which is used as a baseline.
2. Future (post-project implementation) water consumption figures are based on the water mass balance shown in Figure 3-4.
3. 2,259 m^3/day recycled water is what the design specification for the plant and equipment should achieve, however, the future data in the above table is from November 2021 when not all projects were complete.

The data shows that the total water consumption for the installation is estimated to increase marginally from 2,899 m^3/day to 2,917 m^3/day, which is less than a 1 % increase from current (2019 baseline) consumption rates. The total amount of water imported to site (from the mains supply and through abstraction) will not increase however; rather the amount of water from recovered (non-imported) sources at the installation itself will increase due to improvements and changes to water recycling processes. The data in Table 3-12 above suggests that the amount of water recovered at the installation has already increased by 3 % to 1,880 m^3/day based on the November 2021 data. However, once all of the projects are complete and the full benefits are realised, this figure is expected to increase to 2,359 m^3/day which represents a 29 % increase compared to the 2019 baseline data. The total amount of water re-used on site will come from a number of sources, which in addition to the enhanced WRP, will include evaporators and whey water.

The figures in the above table demonstrate how, following full implementation of the changes on site, Dairy Crest is improving its water efficiency. Furthermore, despite the increase in hourly cheese production capacity and overall water use at the installation, the current maximum effluent discharge rate of 2,600 m^3 per day will not be required to be increased. More water will instead be recovered and reused on site rather than being discharged into the River Inny.

Table 3-13 below presents the figures from the 2021 Dairy UK Environmental Benchmarking Report which shows typical environmental performance levels in relation to water efficiency for the dairy sector for the years 2008, 2019 and 2020. The figures shown are for the sub-sector category 'Mixed Dairy and Other', which best represents Dairy Crest's operations. The table also presents the current and estimated future water efficiency figures for Davidstow for comparison.

Table 3-13 – Dairy UK Water Efficiency Levels Per Tonne of Raw Material (Milk) Processed

2008 Water Efficiency (m^3/tonne)	2019 Water Efficiency (m^3/tonne)	2020 Water Efficiency (m^3/tonne)	Davidstow Current Water Efficiency (m^3/tonne)[1]	Davidstow Future Water Efficiency (m^3/tonne)[2]
2.55	1.66	1.14	0.73	0.57

Notes: 1. Current water efficiency level calculated using the site's imported water consumption data (i.e. excluding recovered sources) and tonnage of raw milk processed in 2019/20.
2. Future water efficiency level is a best estimate at this stage following full implementation of all changes at the Creamery and WPF/WRP.

Both the current (based on 2019 Q4 data) and future (post-project implementation based on November 2021 data) water efficiency levels, calculated per tonne of raw material (milk) processed, are considerably lower than all three environmental performance levels taken from the Dairy UK Environmental Benchmarking Report. This is due to the fact that Dairy Crest recovers a significant proportion of water from various aspects of the production processes at the Creamery and at the WPF / WRP on site. As described above, this is set to increase following the full implementation of all changes on site that are the subject of this permit variation application. The figures suggest that Dairy Crest exceeds the typical water efficiency levels for similar dairies in the UK and will continue to do so in the future.

In addition to the above water efficiency levels for water used on site, both the Dairy UK Environmental Benchmarking Report and the Food, Drink and Milk BREF present indicative environmental performance levels / waste water efficiency levels for waste water discharged per tonne of raw material used. The figures in Table 3-14 below are taken from the BREF. For dairies where the main product (at least 80 % of production) is cheese, the target specific waste water discharge (yearly average) is between 0.75 and 2.5 m^3/tonne. This does not strictly apply to the Davidstow site where neither cheese nor milk comprise 80 % of the site's production, however, the figures still provide an indication of typical waste water discharge levels for the dairy sector.

Table 3-14 – Indicative Environmental Performance Levels for Specific Waste Water Discharge from Food, Drink and Milk BREF (December 2019)

Main Product (at least 80 % of the production)	Unit	Specific Waste Water Discharge (yearly average)
Market milk	m^3/tonne of raw materials	0.3 - 3.0
Cheese		0.75 - 2 .5
Powder		1.2 - 2.7

Table 3-15 below shows the equivalent figures for waste water efficiency taken from the Dairy UK Environmental Benchmarking Report 2021 for the years 2008, 2019 and 2020 in the 'Mixed and Dairy Other' sub-sector category. These figures align with the range established in the BREF as detailed above. Table 3-15 also contains the current and estimated future waste water efficiency levels for Davidstow for comparison.

Table 3-15 – Dairy UK Waste Water Efficiency Levels Per Tonne of Raw Material (Milk)

2008 Waste Water Efficiency (m^3/tonne)	2019 Waste Water Efficiency (m^3/tonne)	2020 Waste Water Efficiency (m^3/tonne)	Davidstow Current Waste Water Efficiency Level (m^3/tonne)[1]	Davidstow Future Waste Water Efficiency Level (m^3/tonne)[2]
1.95	1.46	1.19	1.76	1.44

Notes: 1. Current waste water efficiency level calculated using the maximum permitted discharge from the WPF (2,600 m^3/day) and the tonnage of raw milk processed in 2019/20.
2. Future waste water efficiency level calculated using the maximum permitted discharge from the WPF (2,600 m^3/day) and the tonnage of raw milk proposed to be processed following full implementation of all changes at the Creamery.

The current waste water efficiency level is calculated to be 1.76 m^3/tonne of raw milk processed, with the future level improving to 1.44 m^3/tonne of milk processed. Both of these figures are well within the indicative range for cheese or powder production as detailed in the BREF and are generally in line with the figures reported in the Dairy UK Environmental Benchmarking Report. The estimated future waste water efficiency level for Davidstow represents an ~18 % improvement in the amount of waste water discharged per tonne of raw milk processed. This is due to the fact that a greater volume of process effluent will be recycled and reused at the Creamery following the implementation of all of the changes on site.

Table 3-16 and Table 3-17 below show sector specific BAT standards for raw materials and water use and detail how the changes on site comply with the requirements from the Food, Drink and Milk (December 2019) and Waste Treatment (August 2018) BREFs, respectively.

Table 3-16 – BAT Requirements for Efficient Use of Raw Materials and Water from Food, Drink and Milk BREF (December 2019)

BREF Requirements	Current / Proposed Arrangements	BAT?
BAT 7: In order to reduce water consumption and the volume of waste water discharged, BAT is to use BAT 7a and one or a combination of the techniques b to k below: a. Water recycling and/or reuse; b. Optimisation of water flow; c. Optimisation of water nozzles and hoses; d. Segregation of water streams; e. Dry cleaning; f. Pigging system for pipes; g. High-pressure cleaning; h. Optimisation of chemical dosing and water use in cleaning-in-place (CIP); i. Low-pressure foam and/or gel cleaning;	There is an existing WRP which treats a portion of the final effluent at the WPF for reuse back at the factory. As part of the redevelopment works at the WPF, the WRP has been enhanced which enables the amount of water recovered and recycled on site to be maximised and increased considerably (by ~30%). This will help to ensure that, despite an increase in the hourly production capacity at the Creamery, Dairy Crest is not increasing demand on imported water supplies and will become more self-sufficient in terms of its water consumption. The control of water flow and the use of water nozzles and hoses will not change as a result of the permit variation being applied for. However, such processes and activities are already optimised on site, e.g. by the use of devices to automatically adjust water flow, using the correct number and position of nozzles and adjusting water pressure. Water streams that do not need treatment, such as uncontaminated surface water runoff at the main Creamery, are and will continue to be segregated and	YES

j. Optimised design and construction of equipment and process areas; and k. Cleaning of equipment as soon as possible.	managed separately from process waste water that has to undergo treatment at the WPF. The general cleaning techniques used at the main Creamery will not change as a result of the permit variation being applied for. However, as part of the process upgrades and project implementation, a new CIP system has been installed and modifications have been made to the existing raw milk and whey CIP systems. This is to enable optimisation of water reuse; final rinse water is re-used for the next pre-rinsing stage. This helps to reduce mains water consumption and the amount of waste water generated from the CIP processes. The CIP system measures conductivity and temperature to dose hot water and chemicals in optimised quantities. All new equipment and process areas have been designed and constructed in a way that facilities cleaning, taking into consideration hygiene requirements. All equipment is cleaned as soon as possible after use, to prevent wastes hardening and thereby reducing water consumption and waste water generation.	
BAT 8: In order to prevent or reduce the use of harmful substances, e.g. in cleaning and disinfection, BAT is to use one or a combination of the techniques below: a. Proper selection of cleaning chemicals and/or disinfectants; b. Reuse of cleaning chemicals in cleaning-in-place (CIP); c. Dry cleaning; and d. Optimised design and construction of equipment and process areas.	There are existing processes in place which help to ensure the proper selection of, and prevent and reduce where possible the use of, harmful substances. These processes will not change as a result of the permit variation being applied for. The cleaning chemicals and other substances used at both the main Creamery and the WPF are detailed above in Table 3-11. These substances have been selected as the most suitable materials for the operations which are required and the activities taking place. The CIP systems have in-built chemical recovery systems which reduce the quantity of raw materials (cleaning agent chemicals) required in each stage of the systems. All new equipment and process areas are designed and constructed in a way that facilities cleaning, taking into consideration hygiene requirements. This is a specific requirement included in any Request For Proposal (RFP) for new plant and equipment issued by Dairy Crest, e.g. the new RCS RFP.	YES
BAT 9: In order to prevent emissions of ozone-depleting substances and of substances with a high global warming potential from cooling and freezing, BAT is to use refrigerants without ozone depletion potential and with a low global warming potential.	Dairy Crest maintains an F-Gas Register which lists all plant containing refrigerant gases. The Register is regularly updated and whenever a change in plant containing refrigerants takes place. The Register also details: type of plant, location, cooling loads served, refrigerant gas type, refrigerant quantity, plant manufacturer, serial number, model and the leak test frequency (which are carried out in line with F-Gas Regulations).	YES

	The majority of F-Gas containing equipment comprises refrigeration units used for canteen food and air conditioning units. The most significant user of ozone depleting / global warming potential substances (refrigeration gas) is the RCS on site, which is used to chill 20 kg blocks of cheese. The existing RCS utilises refrigerant type R404A (now prohibited in new equipment), however, it is being replaced with a new system as part of Project No. 6 (Cheese capacity growth Phase 3) at the Creamery. The new RCS will make use of the facility's internal ammonia system as the primary refrigerant which will then be transferred to glycol as the secondary refrigerant, thereby eliminating the use of refrigerant gases for the RCS. Ammonia is considered to be the most environmentally friendly and "natural" refrigerant; it has both a global warming potential and ozone depleting potential equal to zero.	
BAT 10: In order to increase resource efficiency, BAT is to use one or a combination of the techniques below: a. Anaerobic digestion; b. Use of residues; c. Separation of residues; d. Recovery and reuse of residues from the pasteuriser; e. Phosphorus recovery as struvite; and f. Use of waste water for land spreading.	The specific technologies employed at the current WPF, used to treat the process effluent from the Creamery, are not changing as a result of the permit variation being applied for. However, the WPF is being redeveloped with the ultimate aim of increasing resilience and driving operational improvements and it is deemed to meet BAT by applying an appropriate combination of relevant techniques. Anaerobic digestion is not employed and is not considered to be an appropriate technique for Davidstow due to the quantity and nature of the effluent / residues produced from the processes at the Creamery (as noted in the BREF). The main Creamery facility is designed and operated to maintain the separation of residues from different parts of the process, where appropriate, e.g. cheese, whey, Demin and GOS. One of the changes implemented comprises the installation of a WPC plant. Permeate from this process is tankered offsite to be re-used as animal feed or alternatively sent for anaerobic digestion, thus maximising resource efficiency. Other opportunities to increase resource efficiency are being investigated by Dairy Crest, including the identification of potential options for the reuse / recovery of salt whey and the use of GOS carbon filter waste for soil conditioner (refer to report Section 3.4 below for further details). Whilst phosphorus is not recovered as struvite, a similar technique is used at the phosphate removal plant. Chemical precipitation takes place using hydrated lime and ferric chloride to produce a calcium phosphate cake. This technique is specifically listed	YES

	as BAT in the BREF. Dairy Crest is currently investigating incorporating the CaPh cake into organo-mineral fertiliser production. A proportion of cake currently goes to co-composting and is used as a fuel moderator in a local incinerator whilst the remaining residue sludge is land spread. In addition to the above specific techniques, Dairy Crest will continue to monitor its waste and resource efficiency measures and investigate whether changes to the measures implemented should be made in accordance with permit Condition 1.4 (Avoidance, recovery and disposal of waste produced by the activities).	
BAT 7 (Dairy): In relation to the general techniques to reduce water consumption and the volume of waste water discharged (included above in BAT 7), see Table 3-14 above for indicative environmental performance levels for dairies.	The current maximum daily discharge limit for waste water from the WPF to the River Inny is 2,600 m^3/day. This will not increase in the future as a result of the changes implemented on site to maximise the use of the main raw material ingredient and increase the hourly production capacity. Therefore, the site's waste water efficiency level is expected to decrease in the future from 1.76 to 1.44 m^3/tonne following the full implementation of the changes on site, as shown in Table 3-15 above. Similarly, the site's water consumption efficiency levels are also expected to increase following the implementation of all changes on site, as show in in Table 3-13.	YES

Table 3-17 – BAT Requirements for Efficient Use of Raw Materials and Water from Waste Treatment BREF (August 2018)

BREF Requirements	Current / Proposed Arrangements	BAT?
BAT 19: To optimise water consumption, to reduce the volume of waste water generated and to prevent, or, where that is not practicable, to reduce emissions to soil and water, BAT is to use an appropriate combination of the following techniques: a. Water management; b. Water recirculation; c. Impermeable surface; d. Techniques to reduce the likelihood and impact of overflows and failures from tanks and vessels;	As described in Section 3.2, water reduction targets are set as part of the facility's Utility Reduction Plans which are used to ensure that the Davidstow site contributes toward meeting higher-level corporate targets set out as part of the Saputo 'Promise'. Water use is monitored at the facility as part of the EMS. With regards to water recirculation, the redeveloped WPF incorporates an enhanced WRP, which recovers water and allows it to be recirculated for use back at the Creamery, as shown in Figure 3-4 above. Once all of the projects are complete and the full benefits are realised, the amount of water recirculated is expected to increase by approximately 30 % (compared to the 2019 baseline figure). Local hardstanding and kerbing is provided in key areas of the WPF and the recently installed (August 2020) perimeter containment wall to the downgradient portion of the WPF provides an additional bund. As detailed in the Environmental Risk Assessment (Appendix C), all impermeable surfaces are and will continue to be regularly inspected and monitored for any signs of damage, such as	YES

e. Roofing of waste storage and treatment areas; f. Segregation of water streams; g. Adequate drainage infrastructure; h. Design and maintenance provisions to allow detection and repair of leaks; and i. Appropriate buffer storage capacity.	cracks or holes, which could potentially present a pathway to soil / water. Any tanks and vessels at the WPF containing potentially polluting liquids are fitted with overflow detectors and located within suitable secondary containment. They are also regularly checked as part of routine maintenance procedures. These measures will reduce the likelihood and impact of potential overflows and failures. Waste storage and treatment areas at the WPF are generally covered, as appropriate, e.g. the sludge centrifuge equipment is located inside a building and balance / divert tanks are covered. The main exception to this is the Aeration Tanks and BT2 which will remain open / uncovered in order to optimise the aeration process. There are separate drainage arrangements for clean uncontaminated surface water, process water (trade effluent) from the Creamery and foul (domestic) water. General (uncontaminated) surface water passes through oil interceptors and then into an attenuation pond prior to discharge to the River Inny. This discharge is also regulated by the environmental permit for the Creamery and WPF installation. Process effluent from the Creamery is treated at the WPF before being discharged into the River Inny. Domestic foul effluent is segregated and flows via a dedicated pipeline to the WPF area where it is treated through a package sewage treatment plant, prior to discharge to the River Inny. This discharge is regulated by a separate environmental permit (reference: 303542) and does not form part of the Davidstow Creamery regulated facility. Dairy Crest has recently undertaken a facility-wide drainage survey which identified where improvements were required to ensure adequate drainage infrastructure and these have since been implemented. A number of repairs were made and all trade effluent and surface water drains were re-lined. The drainage systems will continue to be subject to routine planned preventative inspection and maintenance regimes. All plant and equipment associated with the treatment of waste water are and will continue to be regularly inspected, on a risk-based schedule, for potential leaks. Any defects or leaks identified will be repaired. New tanks and equipment will be designed and installed as above ground components in order to facilitate inspection and maintenance regimes. The redeveloped WPF has been designed with improved buffer storage capacity and, in particular, this is provided by the enhanced functionality of the Divert Tank / BT1 and the provision of an UF / RO flow attenuation tank. Furthermore, the 600 m^3 partitioned contingency lagoon provides additional buffer storage capacity at the main Creamery for process effluent generated during other than normal operating conditions. The discharge of effluent / waste water from the contingency lagoon will only take place after monitoring has been undertaken to confirm an appropriate treatment route, e.g. delivery to the on-site WPF or tankering off site.	

	Enhanced automation and controls to manage waste water streams have been implemented on site with the introduction of continuous automatic monitoring, for example, the provision of pH control and external aeration on the Divert Tank (to keep the contents fresh). This will improve the WPF process control and efficiency, which therefore also minimises the need for additional buffer storage capacity (compared to that which is currently provided).	
BAT 22: In order to use materials efficiently, BAT is to substitute materials with waste.	The main raw materials used at the WPF are water treatment chemicals. The chemicals required are selected based on the required outputs and cannot be substituted with waste-derived materials. However, the provision of increased buffer storage capacity (within Balance Tanks, Divert Tank and contingency lagoon), as described above, in combination with enhanced monitoring, automation and controls, will contribute to reductions in the amount of dosing chemicals required, as it will enable waste streams to be balanced / mixed / optimised prior to discharging to each stage of the WPF process. Furthermore, as described previously, a significant proportion of the waste water generated will be treated at the WPF / WRP and recirculated for re-use back at the main factory, which will reduce the consumption of imported water.	YES

3.4. AVOIDANCE, RECOVERY AND DISPOSAL OF WASTES

The changes introduced on site will have a minor impact on the generation and management of waste at the installation. The principal waste stream generated at the installation is, and will continue to be, effluent produced from the various production processes at the Creamery. The process effluent will continue to be treated at the onsite WPF, which has been redeveloped and enhanced by a number of changes introduced as described in other sections of this report.

Other (operational) wastes which are generated at the installation and are required to be removed from site, include sludge and filter cake from effluent treatment, packaging and various hazardous wastes. No new operational waste streams will be generated as a result of the changes implemented on site.

In general, the processes on site have been designed to minimise waste generation and, where unavoidable, wastes for removal offsite are managed in line with the recommendations of the Waste Hierarchy; recovery for reuse is the preferred option selected by Dairy Crest, followed by recycling. No waste is sent to landfill from the facility and any waste which cannot be reused or recycled is sent for recovery through energy from waste.

Dairy Crest is always looking for ways to improve the management of waste at the site and move it up the waste hierarchy where possible. Two examples of ongoing projects looking at potential options for the re-use of specific waste streams, to enhance resource efficiency at the installation, are summarised below. Both of these projects are in the early stages with research and feasibility assessments ongoing.

The first project relates to GOS carbon. The production of GOS includes a filtration stage to remove colour from the finished product. Powdered activated carbon is used as a filter media and requires periodic replenishment. The spent powdered carbon is unsuitable for regeneration to enable reuse and consequently the spent carbon is currently recovered off-site via energy from waste. This project is exploring the suitability of using the spent carbon by composting it to be used as a soil conditioner.

The second project relates to the generation of calcium phosphate 'cake' which results from the demineralisation of whey. The waste water stream from this process is rich in phosphorus (which originates from the raw milk), the majority of which is removed from the waste water at the onsite phosphate removal plant. This takes place through a precipitation reaction with solubilised hydrated lime to form the calcium phosphate precipitate or cake. Flocculant is added during the process to encourage gravity settlement and the resultant cake is dewatered to around 20 % dry solids on a belt press. The calcium phosphate cake is classed as a waste stream and is exported from site for recovery via a combination of land application and incineration. However, multiple potential end users of the cake have shown interest in receiving samples of the cake such to assess its use in soil conditioners and high quality compost products to increase the phosphorus content for plant growth. The cake also has potential for use in animal feedstuffs. However, such opportunities to commercialise use of the cake have not progressed as the current moisture content of around 80 % makes transport and further processing uneconomic. Dairy Crest is therefore investigating the feasibility of implementing a project to install a drier to dry the cake and make it suitable for transport and offsite use as a feedstock by others.

If proven successful and taken forwards, both of the above projects would allow these waste streams to be fully recovered and, therefore, classified as non-waste, thus maximising resource efficiency and contributing to a circular economy.

Table 3-18 below shows the key operational waste streams generated at the installation which are removed offsite and the estimated waste quantities following the changes introduced on site. As is the case currently, all wastes that are removed from site will continue to be stored in appropriate containers and locations prior to collection by authorised waste carriers.

Table 3-19 and Table 3-20 below show the sector specific BAT standards for avoidance, recovery and disposal of wastes and detail how the changes on site comply with the requirements from the Food, Drink and Milk (December 2019) and Waste Treatment (August 2018) BREFs, respectively.

Table 3-18 – Current and Estimated Future Operational Waste Streams and Quantities

Waste Type	Origin	Storage Details	Method of Transfer and Disposal	Current Generation (tonnes per year)[1]	Estimated Future Generation (tonnes per year)[2]	Justification for Disposal
Hazardous wastes (including mixed liquids, gases, aerosols, printing inks, oil drums, absorbents, hydraulic oil, mixed electrical equipment, fluorescent tubes)	Main Creamery and WPF e.g. from maintenance activities and lighting	Various – hazardous wastes are segregated from non-hazardous waste types and other types of hazardous wastes Stored within covered containers in designated waste storage areas located on concrete hardstanding at Creamery and WPF	Removed from site as hazardous waste by licensed contractor for re-use and / or recycling (or energy from waste)	54.5	60	N/A Waste stream recovered and recycled
General waste	Main Creamery and WPF	Segregated and stored within covered containers in designated	Exported from site for re-use and / or recycling (or	238	262	N/A Waste stream recovered and recycled

[1] Figures based on those obtained during 2020.

		waste storage areas located on concrete hardstanding at Creamery and WPF	energy from waste)			
Contaminated petri dishes	Main Creamery and WPF	Segregated and stored within covered containers in designated waste storage areas located on concrete hardstanding at Creamery and WPF	Exported from site to energy from waste facility	0.5	The quantity of this waste stream is not expected to change significantly as a result of the proposed permit variation	Until recently this waste stream was disposed of via landfill but it is now exported to an energy from waste facility
Mixed Recyclables	Main Creamery and WPF	Segregated and stored within covered containers in designated waste storage areas located on concrete hardstanding at Creamery and WPF	Exported from site for recycling	51	56	N/A Waste stream recovered and recycled
Cardboard / Paper	Generated at Creamery and WPF e.g. from delivery of raw materials and spare parts	Segregated and stored within covered containers in designated waste storage areas located on concrete hardstanding at	Exported from site for recycling	46	51	N/A Waste stream recovered and recycled

		Creamery and WPF				
Food	Main Creamery	Secure 240 litre lidded wheelie bins kept remote from main production processes to manage risks of contamination	Exported from site for anaerobic digestion	3	3.3	N/A Waste stream recovered and recycled
Metal	Generated at Creamery and WPF e.g. from maintenance activities	Segregated and stored within covered containers in designated waste storage areas located on concrete hardstanding at Creamery and WPF	Exported from site for recycling	15	The quantity of this waste stream is not expected to change significantly as a result of the proposed permit variation	N/A Waste stream recovered and recycled
Plastic	Generated at Creamery and WPF	Segregated and stored within covered containers in designated waste storage areas located on concrete hardstanding at Creamery and WPF	Exported from site for recycling	3	The quantity of this waste stream is not expected to change significantly as a result of the proposed permit variation	N/A Waste stream recovered and recycled
Wood	Various originating from palletised materials delivered to site.	Segregated and stored within covered containers in designated waste storage	Exported from site for recycling	4	5	N/A Waste stream recovered and recycled

		areas located on concrete hardstanding at Creamery and WPF				
Carbon filter waste	GOS process	Stored in waste bags within skips on site	Exported from site to energy from waste facility	50	The quantity of this waste stream is not expected to change significantly as a result of the proposed permit variation	Waste stream currently incinerated. Dairy Crest is currently exploring its potential use in organo-mineral fertiliser production or use as bio-char soil conditioner as described above.
Ash	Biomass boilers	Stored in waste bags within skips on site	Recovered in land application	49	54	N/A Waste stream recovered and recycled
Calcium phosphate cake	Phosphate removal plant	Covered skip	Exported from site and co-composted / incinerated / spread on land	3,650	4,234	N/A Waste stream recovered and recycled
Sludge	WPF processes – DAF and biological treatment	Existing sludge storage tanks at WPF	Exported from site for land spreading	12,185	The quantity of this waste stream is not expected to change significantly as a result of the proposed permit variation	N/A Waste stream recovered and recycled

Notes: 1. Current waste quantities based on 2019/20 data for the Creamery and WPF which is used as a baseline.
2. Future waste quantities comprise a best estimate at this stage following full implementation of all changes at the installation.

Table 3-19 – BAT Requirements for Avoidance, Recovery and Disposal of Wastes from Food, Drink and Milk BREF (December 2019)

BREF Requirements	Current / Proposed Arrangements	BAT?
BAT 22: In order to reduce the quantity of waste sent for disposal, BAT is to use one or a combination of the techniques below: a. Optimised operation of centrifuges; b. Rinsing of the cream heater with skimmed milk or water; c. Continuous freezing of ice-cream; d. Minimisation of the generation of acid whey; e. Recovery and use of whey.	With regard to the changes implemented on site: a. No new centrifuges have been installed or are proposed, however, operation of existing centrifuges will continue to be optimised. Centrifuges are operated in accordance with manufacturers' specifications, thus minimising the rejection of product (and wastage of raw material) whilst maintaining quality and hygiene standards. b. Is not applicable as there are no cream heaters proposed as part of the permit variation being applied for. Whey butter is no longer produced on site. c. Is not applicable as ice cream is not produced on site. d. Is not applicable as the site does not produce acid-type cheeses such as mozzarella or cottage cheese. With regards to point e., Dairy Crest already recovers and reuses whey on site (using techniques such as evaporation and membrane filtrations) to make whey powder, demineralised whey power and whey protein concentrates. One of the changes at the main Creamery has been the introduction of a WPC process which increases the amount of whey recovered at the Creamery. Approximately 78,000 litres per hour of whey is processed via the WPC plant, treating 8,000 litres per hour and reusing up to 1,500 litres per hour retentate (within the Creamery to increase / stabilise protein levels within the demineralised feed stream) with the permeate concentrated for export. Further details of the WPC plant process are provided in Section 4 below.	YES

Table 3-20 – BAT Requirements for Avoidance, Recovery and Disposal of Wastes from Waste Treatment BREF (August 2018)

BREF Requirements	Current / Proposed Arrangements	BAT?
BAT 24: In order to reduce the quantity of waste sent for disposal, BAT is to maximise the reuse of packaging, as part of the residues management plan.	In accordance with the Waste Hierarchy and existing waste management measures already implemented on site, Dairy Crest will ensure that any packaging waste generated by the changes on site is re-used wherever possible. Drums, containers, IBCs and pallets, e.g. from the delivery of raw materials, will be returned to suppliers for re-use, wherever possible. The re-use of such packaging will be dependent on the risk of contamination of the waste and health and safety considerations associated with re-using containers. Other packaging waste streams, such as plastic film and cardboard, will be compacted, baled and removed from site by a third-party contractor for recycling.	YES

4. INSTALLATION OPERATIONS

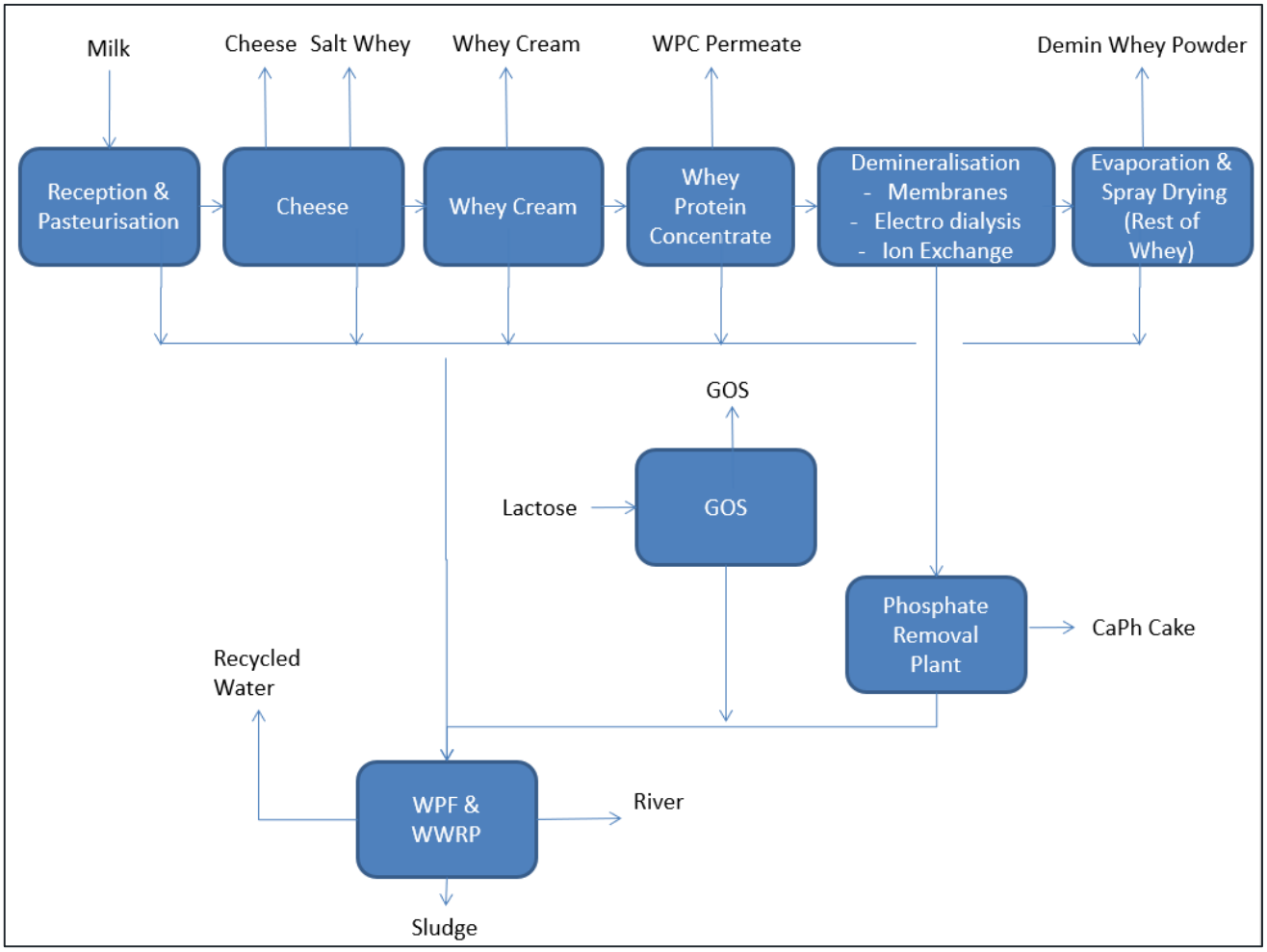
4.1. INSTALLATION OPERATIONS AND CHANGES TO ONSITE PROCESSES

Sections 4.2 and 4.3 below provide an overview of the operations and processes which take place at the installation as part of the main Creamery processes and at the WPF. For a more detailed description of the existing operations (and consideration of BAT), the original environmental permit application (2005) and subsequent variation applications, in particular the 2014 substantial variation application, should be referred to. Sections 4.4 and 4.5 of this report then describe, in more detail, the changes which have resulted in the need for this environmental permit variation application.

4.2. OVERVIEW OF CREAMERY OPERATIONS

Figure 4-1 below provides an overview of the current dairy production processes undertaken at Davidstow Creamery.

Figure 4-1 - Current Production Processes



The site receives milk which it pasteurises and processes into cheese. Whey from the cheese making process is then used to manufacture demineralised whey powder (D90 infant formula powder). Until recently, whey butter was also produced, however, this activity ceased in March 2020 and whey cream is now exported from the site. The site also imports lactose powder, which is processed to produce GOS, a prebiotic syrup. The production of demineralised whey powder and GOS commenced in 2016 following the 2014 permit variation and as part of a major production expansion project. In summary, the following dairy products (at the current production rates specified) are manufactured at Davidstow Creamery:

- Cheese – 9.6 t/hr;
- Whey cream – 7.8 t/hr;
- Demineralised whey powder – 4.2 t/hr; and
- GOS (prebiotic syrup derived from lactose) – 1.2 t/hr.

Milk is received daily in bulk tankers and is pumped into storage silos. It is then transferred to the processing area where it is pasteurised before being pumped into vats for the manufacture of cheddar cheese. The cheese manufacturing process involves the addition of bacterial starter organisms and rennet to the pasteurised milk, which develops acidity, coagulates and separates into curds and whey. The curds are physically separated from the whey and processed into cheese. The whey is stored in silos for further processing into whey cream and whey powder. The remaining fat from the whey is separated to produce whey cream which is then pasteurised and exported from site. Separated whey is concentrated by removal of water in multi effect evaporators. The whey concentrate is crystallised and dried in a hot air spray drier. The resulting whey powder is stored in silos before packing into bulk bags for export from site.

To produce GOS, the prebiotic process involves the dissolving of lactose powder to make a solution that is then treated by enzymes. Lactose powder is delivered to the site in one tonne bags. It is dissolved in hot water and pumped into reactor vessels where the enzymes are added. Following the reaction stage, carbon powder is added and the pH adjusted before undergoing filtration and evaporation. The final product comprises a syrup which, up until recently, was packaged in IBCs for despatch from site. However, there is now a new GOS bulk loading process which forms part of this permit variation application; further details of the changes are provided in Section 4.4 below.

4.3. OVERVIEW OF WPF OPERATIONS

The WPF is located approximately 1 km to the east of the main Creamery site on a plot of land also owned by Dairy Crest. The WPF handles the process-derived wastewater from the Creamery. The wastewater is treated through a series of pre-treatment, primary, secondary and tertiary treatment processes before being discharged via pipeline into the River Inny. The original WPF was installed in 1990 and was upgraded substantially in 2003 and 2014 to make improvements to the treatment process and to accommodate product expansion. Further changes have been made recently in order to drive operational improvements and enhance the recovery and recycling of water back to the Creamery; these changes, which form part of this permit variation application, are detailed in Section 4.5 below.

Under the last substantial permit variation in 2014, a new discharge pipeline between the Creamery and the WPF was installed to enable process wastewater from the Demin and GOS processes to be collected and treated at the WPF. This gravity pipeline runs adjacent to the original discharge

pipeline which connects the Creamery to the WPF and transports wastewater from the cheese / whey and salt whey processes.

Other changes to the WPF, as a result of the 2014 permit variation, included:

- A new phosphate removal plant to remove between 70 and 90 % of the phosphate from the effluent arising from the whey demineralisation process prior to it entering the WPF. Note: the phosphate removal plant is physically located at the Creamery site but it forms part of the WPF operations, i.e. treatment of process effluent;
- A new WRP to enable the amount of process water recycled and re-used back at the factory to increase to approximately 1,000m^3/day;
- A new Balance Tank, Anoxic Tank, two Aeration Tanks and a Settlement Tank;
- Blowers replaced with 'triton' aerators; and
- Increases in the volumes of dosing chemicals used (namely ferric chloride, nitric acid and hypochlorite) to enable suitable treatment of process waters.

Figure 4-2 and Figure 4-3 below provide an overview of the current wastewater treatment processes undertaken at Davidstow Creamery WPF and WRP.

Figure 4-2 - Current WPF Process

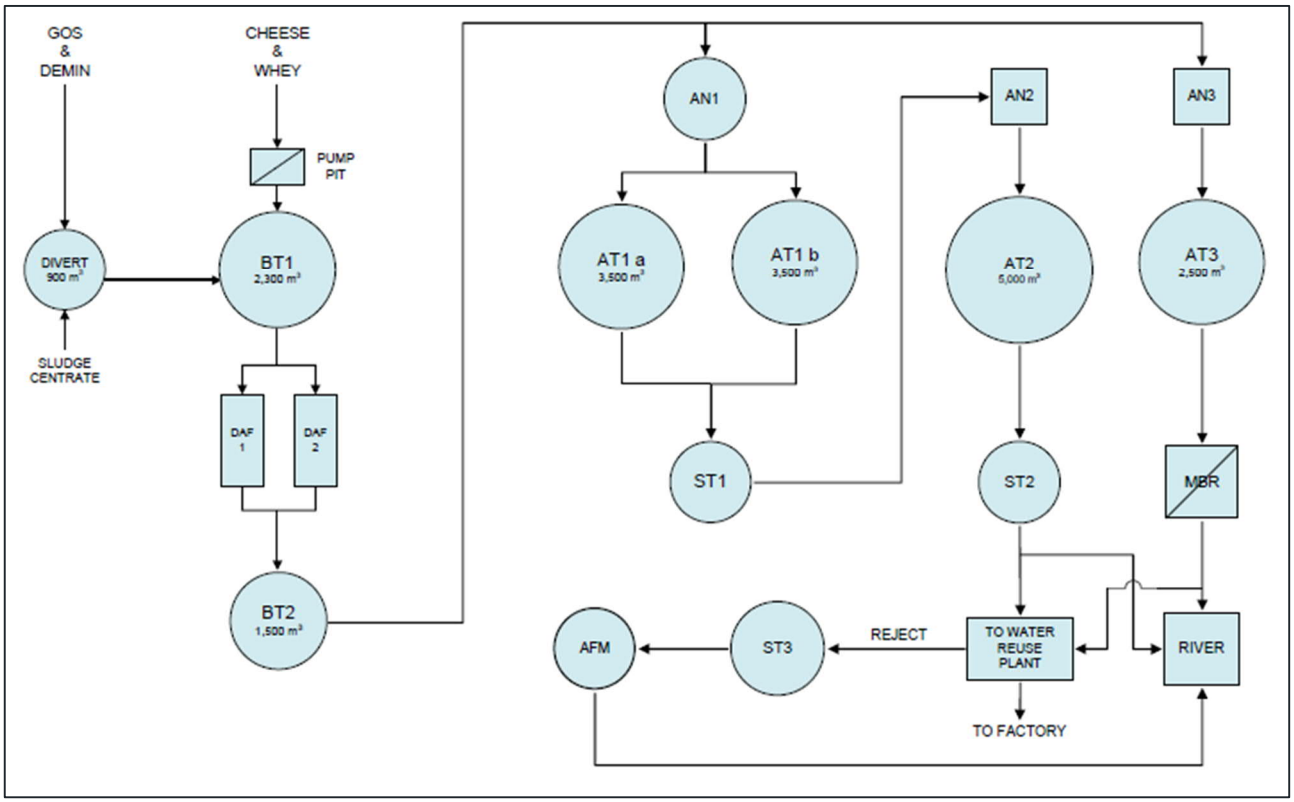
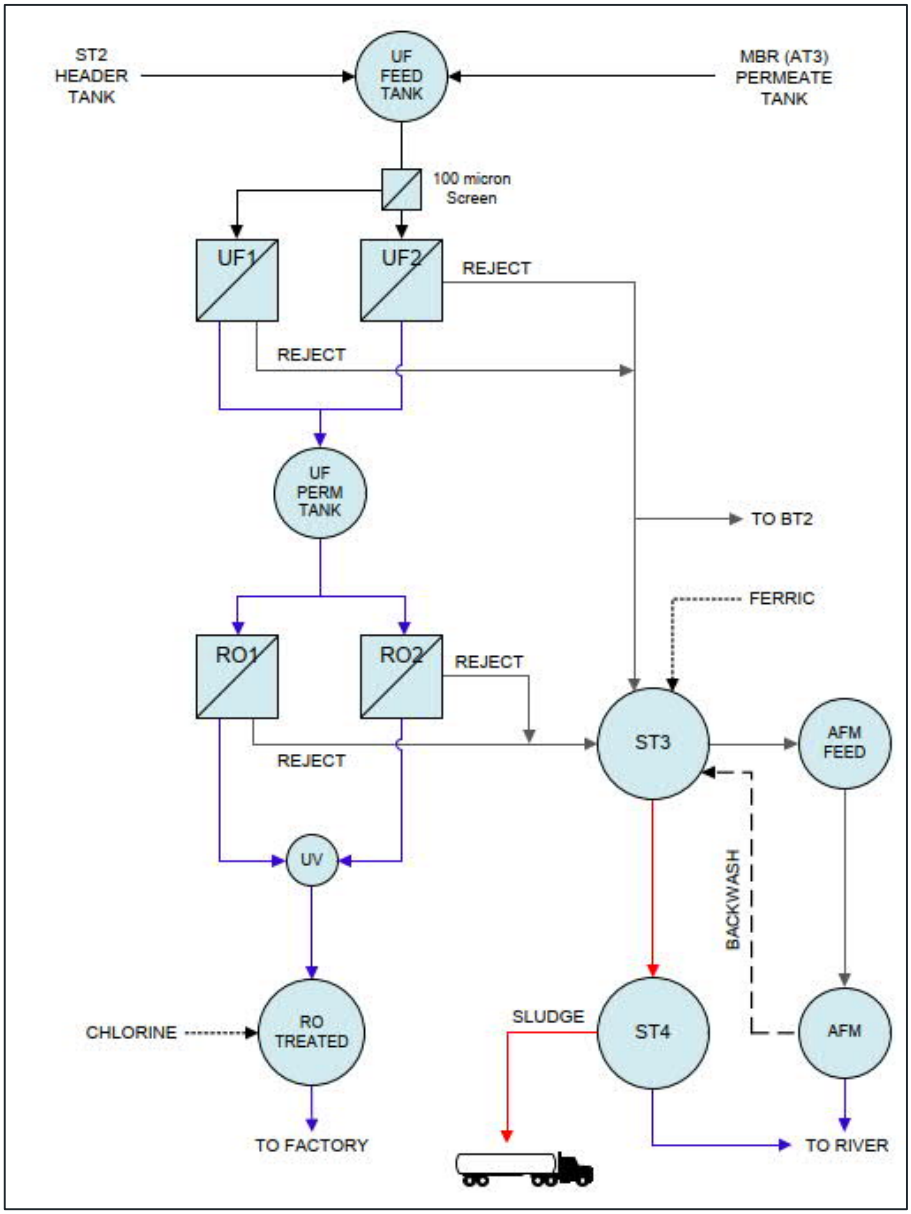


Figure 4-3 - Current WRP Process



It should be noted that the original design intent was for the combined flow from the Demin and GOS processes to be routed to BT2 (after initial treatment at the phosphate removal plant), followed by treatment in AT1a and AT1b. With this process configuration, the cheese and whey effluent would be received by BT1, followed by treatment through the DAF plant, AT3 and the MBR. This left the Divert Tank to operate as a periodic storage tank for the receipt of higher strength / flows of effluent prior to treatment through the WPF stages. However, due to elevated levels of total P in the final treated effluent discharged to river, an investigation was undertaken and a number of process changes were made at the WPF, resulting in the configuration shown in Figure 4-2 above. The process reconfiguration at the WPF, plus the more recent changes implemented during the redevelopment works which form part of this permit variation application, are explained further in report Section 4.5 below.

The treated process effluent consent limits, i.e. point source emission to the River Inny, were not changed in the 2014 permit variation.

In terms of other water generated on site (i.e. non-process effluent), there are separate drainage arrangements for clean uncontaminated surface water and foul water. General (uncontaminated) surface water generated at the Creamery passes through oil interceptors and then into an attenuation pond prior to discharge to the River Inny. This discharge is also regulated by the environmental permit for the Creamery and WPF installation. Domestic foul effluent from the factory (plus a number of neighbouring properties) is segregated and flows via a dedicated pipeline to the WPF area where it is treated through a package sewage treatment plant, prior to discharge to the River Inny. This discharge is regulated by a separate environmental permit (reference: 303542) and does not form part of the Davidstow Creamery regulated facility.

4.4. CHANGES TO CREAMERY OPERATIONS

The changes at the Creamery (Project Numbers 1-6 as summarised in Sections 2.2 and 2.3 above) will increase the cheese production capacity from the current rate of 9.6 t/hr to 11.4 t/hr once all of the projects have been fully implemented on site. The changes predominantly achieve this by increasing process efficiencies and maximising the utilisation of raw milk. As a result of the changes, the raw milk intake will increase from approximately 1.6 ML of milk to 1.9 ML of milk per day.

The additional whey which is separated during the cheese manufacturing process will be used to increase the production of demineralised whey powder from ~25,000 to ~29,000 tonnes per year using the existing plant and equipment used on site. It should be noted that Demin production will reach maximum capacity once cheese production reaches 10.5 t/hr following implementation of Creamery Project No. 6.

The following information below, in Tables 4-1 to 4-8, provides further details on the Creamery projects. For each one, a process description is provided, along with details of any additional equipment and / or infrastructure installed and the key benefits introduced. Where a particular change has a direct impact on environmental emissions, e.g. odour, noise, water etc., the relevant sections of the application where this is considered further is cross-referred to.

Table 4-1 – Creamery Project No. 1: CIP 4-Hour Turnaround

Change / Improvement	Description	Additional Equipment / Infrastructure
CIP 4-hour turnaround	The new Creamery CIP set (Set 7) was installed and became operational in January 2021. It provides three additional cleaning channels to shorten the length of time taken to clean the cheese department. This has shortened CIP cleans by 2 hours each time (from 6 to 4 hours), thereby increasing the available production time; the number of production hours per day can increase from 18 to 20. However, this change has not increased the hourly cheese production rate of 9.6 t/hr. A review of the new CIP process design against best practice requirements for cleaning and sanitation is provided in Table 4-2 below. In addition to the standards in	The additional tanks include 1 x 20,000 litre caustic, 1 x 20,000 litre acid, 1 x 40,000 litre hot water, 1 x 40,000 lite fresh water, and 1 x 110,000 litre drain attenuation tank. All new tanks are constructed of stainless steel and provided with secondary containment, as deemed necessary.

	the table, the cleaning applications of existing CIP Set 3 and new CIP Set 7 have been designed to allow CIP Set 7 to 'hibernate' during normal cheese production hours, thus reducing the quantity of steam and power consumed to keep the CIP set constantly at operating conditions. The new CIP set is only used during the 4-hour turnaround. An additional tank will also be installed to attenuate peak flows during CIP to prevent peaks / fluctuations in flow conditions to the WPF. CIP Set 7 is located in a new CIP room (comprising an existing building at the Creamery) adjacent to the cheese vats (refer to Figure 2-4 in report Section 2.3 above for project location within the overall Creamery site). The caustic and acid tanks are located inside the new CIP room, as shown in blue in Figure 4-4 below, with the remaining tanks (fresh water, hot water, drain attenuation) located outside. Figure 4-5 below provides an extract from the P&ID for CIP Set 7. Full P&IDs for all CIP sets on site can be provided to the Environment Agency on request, if required.	There have also been minor modifications to existing CIP sets 3 and 4 to facilitate changes to the existing cleaning circuits. Further information on the tanks for the new Creamery CIP process, including their construction and secondary containment, is provided in Section 5.4.

Figure 4-4 – New CIP Room Equipment Layout (CIP Set 7)

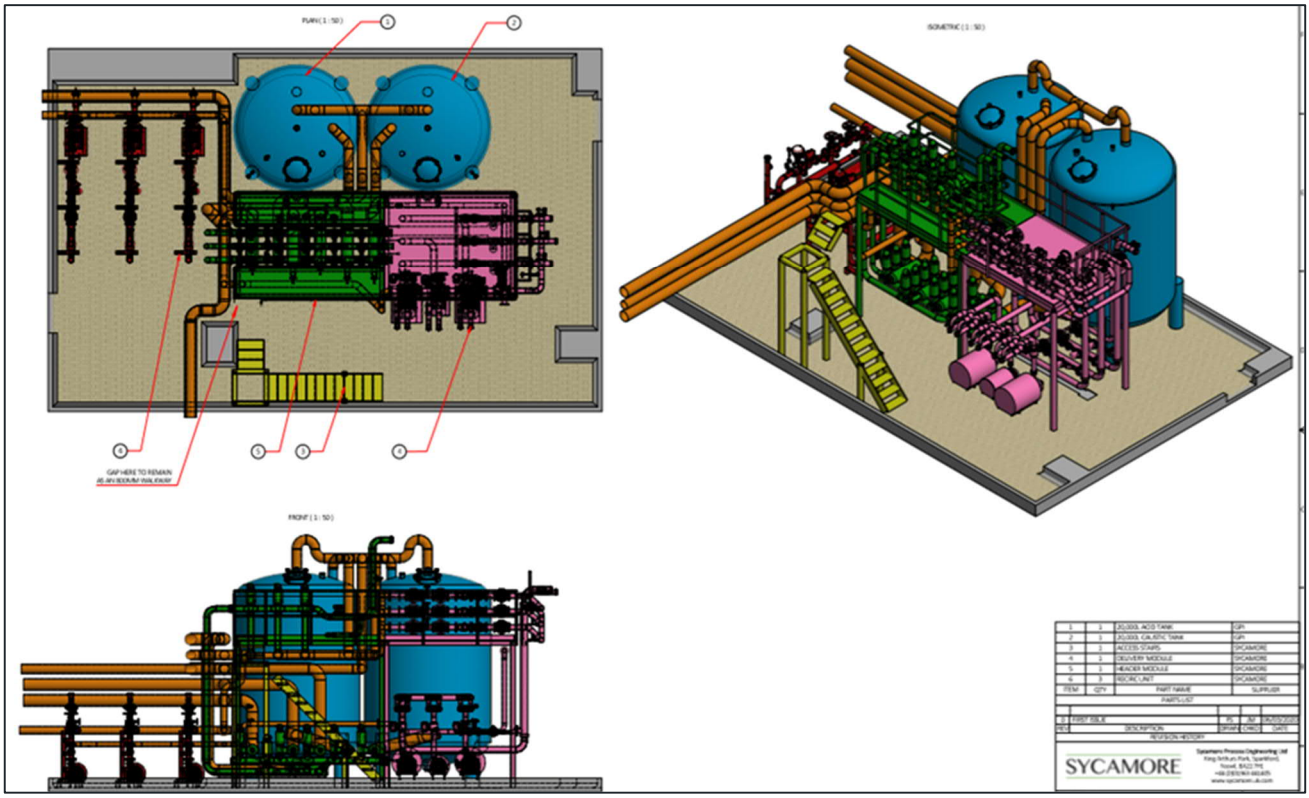


Figure 4-5 - Extract from P&ID

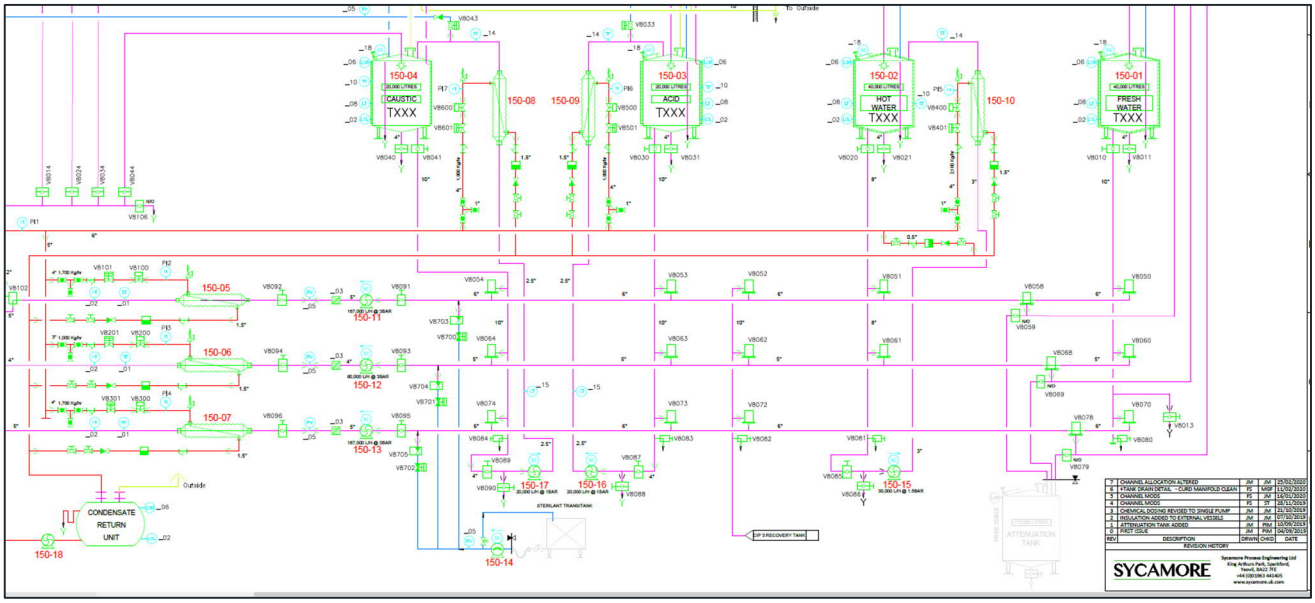


Table 4-2 – BAT Requirements for Cleaning and Sanitation from EPR 6.13 (Dairy and Milk)

EPR Requirements	Current / Proposed Arrangements	BAT?
5. Cleaning-in-Place (CIP) ▪ Removing product before the start of the wash cycle by gravity draining, pigging or air blowdown ▪ Pre-rinsing to enable remaining product to be recovered for re-use or disposal ▪ Using in-line turbidity or conductivity detectors to isolate product/water interface and maximise product recovery - For example, conductivity sensors can be used to monitor levels of dissolved salts. This enables the automatic detection of milk: water interfaces so that product may be recovered for re-processing - Turbidity sensors to monitor the quality of process water and CIP systems which will minimise effluent from out-of-specification products/process water and optimise re-use of cleaning water ▪ Optimising the CIP programme for the size of plant and type of soiling ▪ Optimising frequency and duration of rinses to reduce water use	An additional 3 circuit CIP system has been installed alongside the original 3 channel CIP system. There are 6 CIP channels in total. The reason for this upgrade is to enable items to be cleaned concurrently and to reduce the overall CIP time for the cheese process. As per the original CIP systems, product will be removed prior to the onset of the wash cycle by gravity draining. Warm water is used on all pre-rinses to recover more product for re-use or disposal. As per the original CIP systems, both turbidity and conductivity sensors are used to isolate product / water interface and maximise product recovery. Post commissioning and demonstrating acceptable cleaning performance, CIP optimisation is part of the project scope for implementation of the new system. As per the original systems: - All CIP chemicals are automatically dosed on flowmeters. - Caustic and acid chemicals are recovered and final rinse water recovered for pre-rinse.	YES

▪ Automatic dosing of chemicals at correct concentrations ▪ Internal recycling of water and chemicals ▪ Setting the recycle control on conductivity rather than time ▪ Continuous cleaning of re-circulated solutions ▪ Using water-efficient spray devices ▪ Optimisation of chemical dosing and water use in cleaning-in-place ▪ Reuse of cleaning chemicals in cleaning-in-place	- Where appropriate, recycle control is set on conductivity with guard timers, rather than time. - Continuous cleaning of re-circulated solutions takes place. - In terms of water-efficient spray devices, more rotary spray balls are used as opposed to fixed. - Chemical dosing is optimised and water is re-circulated and re-used for pre-rinse stages.	

Notes: Guidance document EPR 6.13 was withdrawn in May 2020 following publication of the new Food, Drink and Milk BREF and BAT Conclusions in 2019. However, the BAT standards in the above table are still considered to be useful in order to help identify best practice and appropriate considerations for the justification of BAT, since the new BREF / BAT Conclusions do not provide any specific requirements or standards for CIP processes.

Table 4-3 – Creamery Project No. 2: Milk Protein Standardisation

Change / Improvement	Description	Additional Equipment / Infrastructure
Milk protein standardisation	This is the second of three cheese related projects at the Creamery. The process allows the production of more cheese (t/hr) from the same existing number of cheese vats. A small portion (approximately 20 %) of the raw milk imported is concentrated via a new ultrafiltration membrane to increase fat, protein and milk solids. The ultrafiltration unit operates at a rate of ~6,000 litres per hour of retentate from a milk feed rate of ~20,000 kg per hour. The protein standardised milk is then dosed back into the main raw milk stream, thus increasing the cheese milk protein by approximately 9 %. This increases the curd yield from each vat and ultimately cheese production capacity (t/hr) by ~9 %. This project, in conjunction with Project No. 6 (refer to Table 4-8 below) enables curd production to be increased from 10.5 t/hr to 11.4 t/hr. It is intended to either UV treat the permeate from this process and reintroduce it back into the whey stream for conversion into demineralised whey powder or concentrate it via RO for export off site as a functional ingredient. The equipment associated with this project is located inside the existing pasteurising room adjacent to the cheese milk pasteurisers. The layout of the new equipment and infrastructure is shown in Figure 4-6 and Figure 4-7 below. Figure 4-8 provides a process flow diagram for the ultrafiltration process.	1 x 11,000 litres/hr ultrafiltration plant, 1 x 10,000 litre storage/dosing tank, 2 x 60,000 litre permeate holding tanks and UV treatment equipment. All new tanks are constructed of stainless steel and provided with secondary containment, as deemed necessary. Further information on the tanks required for the milk protein standardisation process, including their construction and secondary containment, is provided in Section 5.4.

Figure 4-6 – Milk Protein Standardisation Equipment Layout (1)

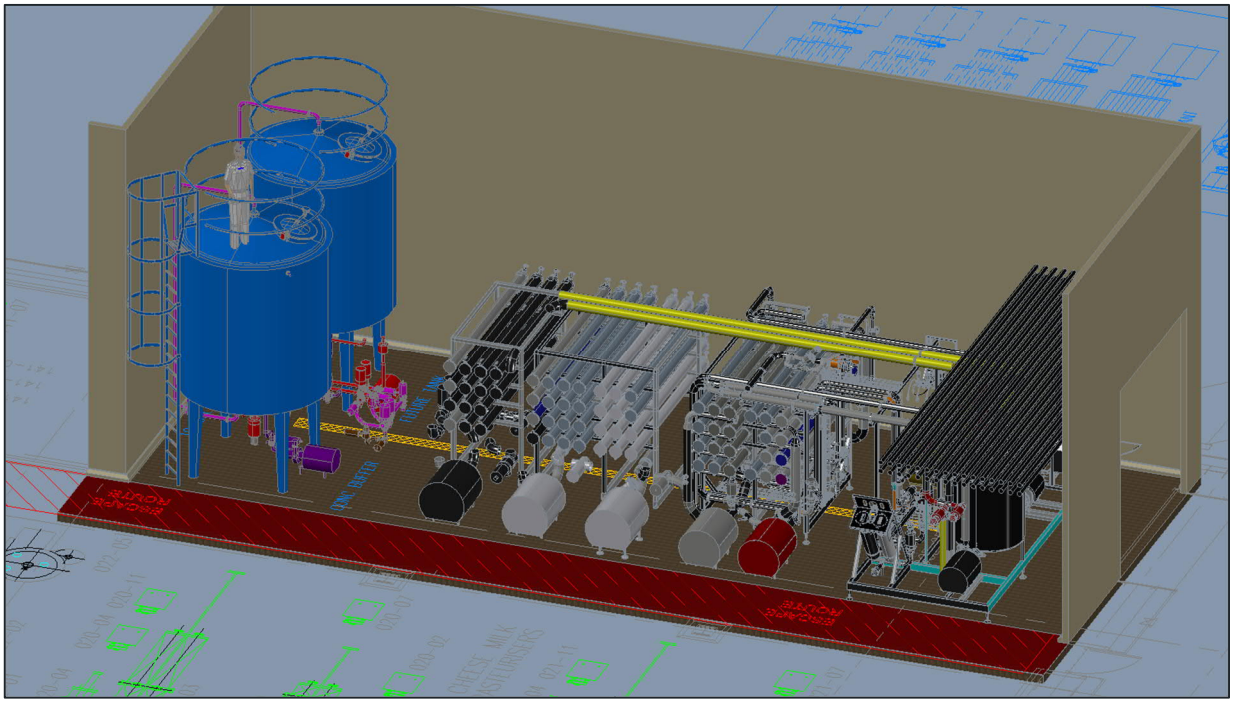


Figure 4-7 – Milk Protein Standardisation Equipment Layout (2)

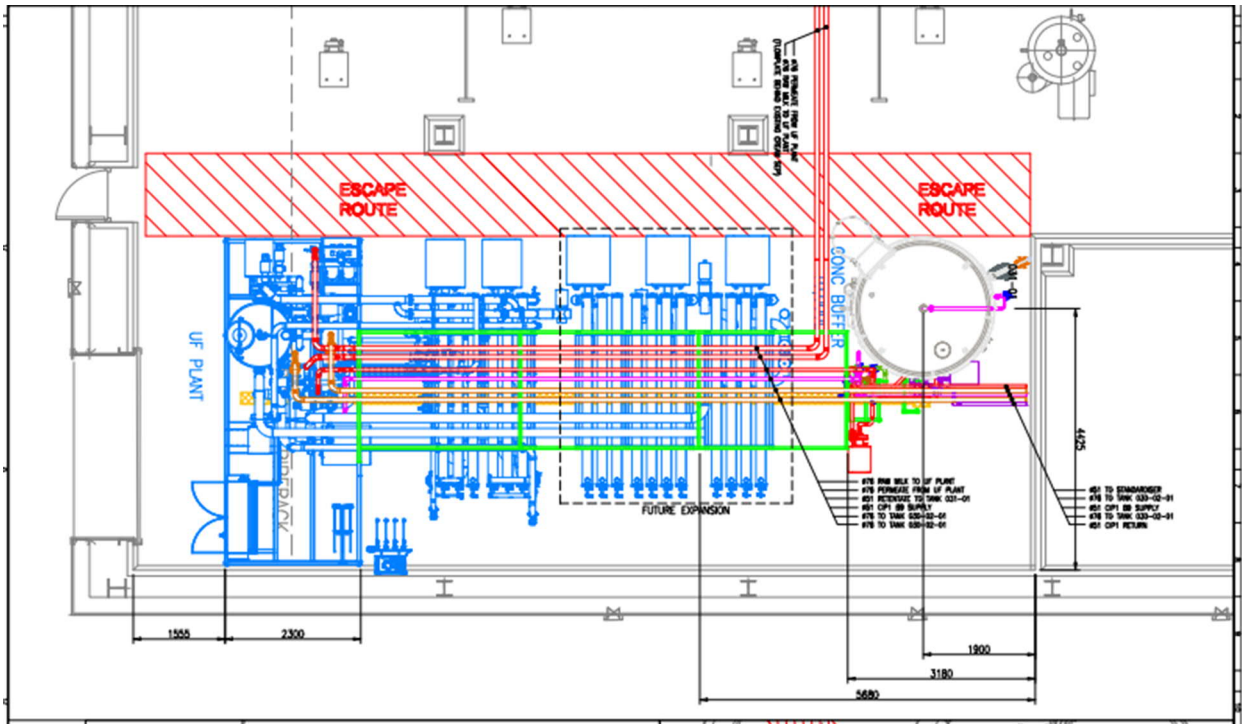


Figure 4-8 - Process Flow Diagram Showing Ultrafiltration and Milk Protein Standardisation

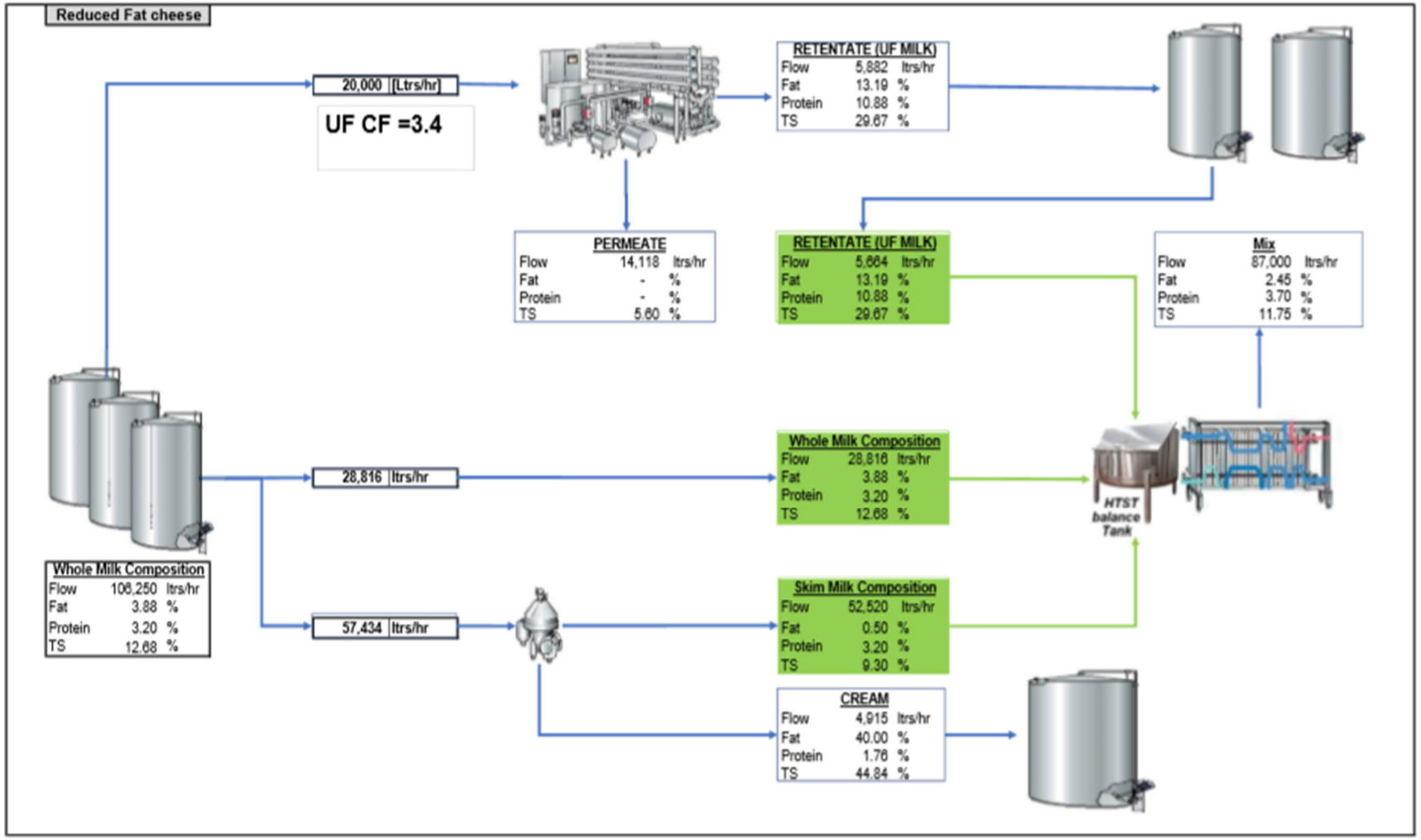


Table 4-4 – Project No. 3: Milk Fat Standardisation

Change / Improvement	Description	Additional Equipment / Infrastructure
Milk fat standardisation	Reduced fat cheese (fat standardisation) was previously manufactured in a batch process and was limited by the volume of skimmed milk that could be separated and stored. Raw milk was separated into skimmed milk and pasteurised cream. Raw skim was then added to raw milk and fed into the cheese milk pasteurisers. The new processing solution allows skimmed milk to be separated in-line and blended in-line in a continuous process. This saves time and therefore allows for an increase in available production time; the new process increases production time by about 4 hours per week. However, this change does not increase the hourly cheese production rate from the current 9.6 t/hr. Excess cream is pasteurised and aged prior to export from site. A review of the new cream pasteuriser against best practice requirements for pasteurisation is provided in Table 4-5 below. The layout of the new equipment and infrastructure for milk fat standardisation is shown in Figure 4-9 below and Figure 4-10 provides a process flow diagram which shows the combined in-line standardisation process for both milk protein and fat.	2 x 30,000 litre/hr cold bowl raw milk separators, 1 x 15,000 litre cream buffer tank, 1 x 8,000 litre/hr cream pasteuriser and 2 x 60,000 litre cream ageing tanks. The new processing equipment is located within the existing culture freezer room. Two externally mounted existing cream silos have been replaced by two new larger silos. All new tanks are constructed of stainless steel and provided with secondary containment, as deemed necessary. Further information on the tanks for the milk fat standardisation process, including their construction and secondary containment, is provided in Section 5.4.

Figure 4-9 – Milk Fat Standardisation Equipment Layout

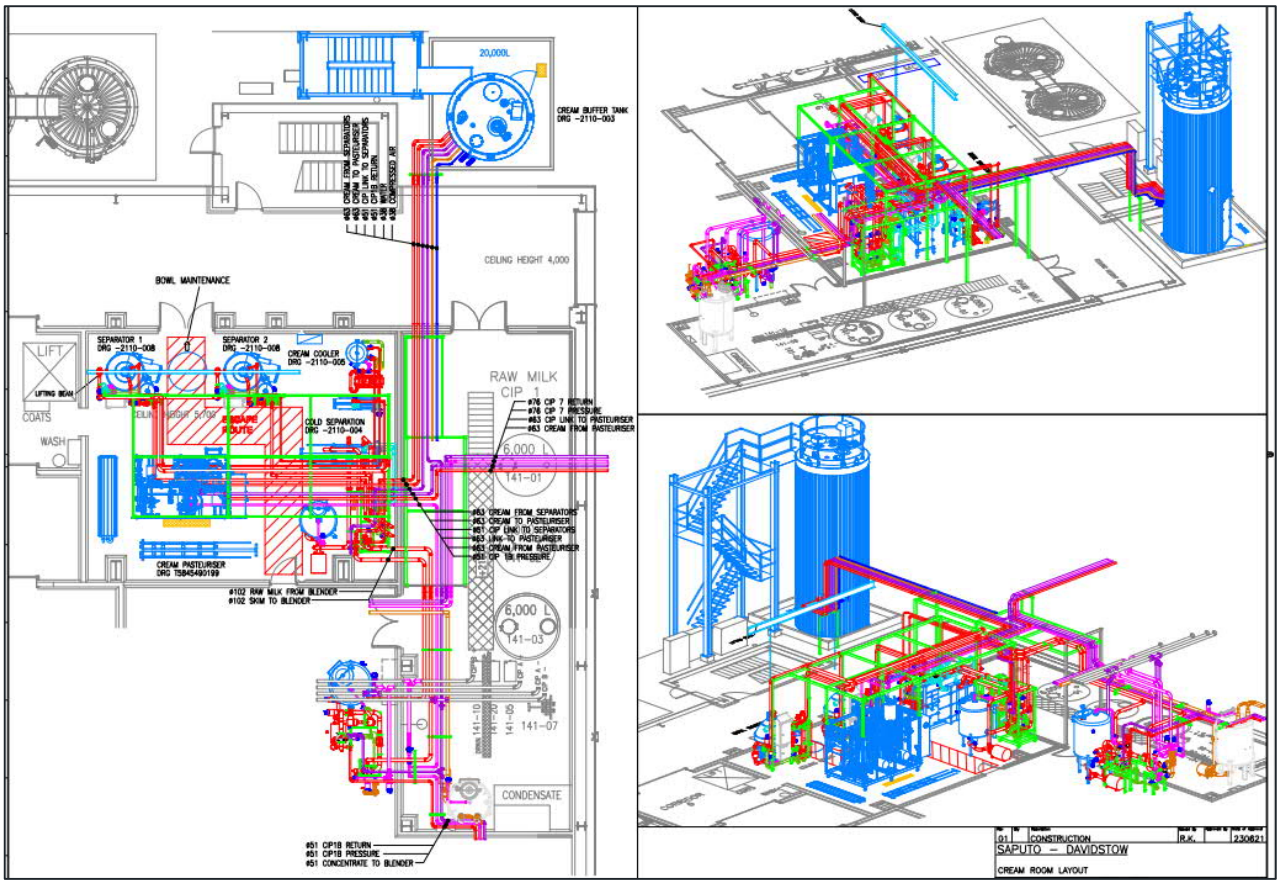


Figure 4-10 – Process Flow Diagram Showing Proten and Fat Standardisation

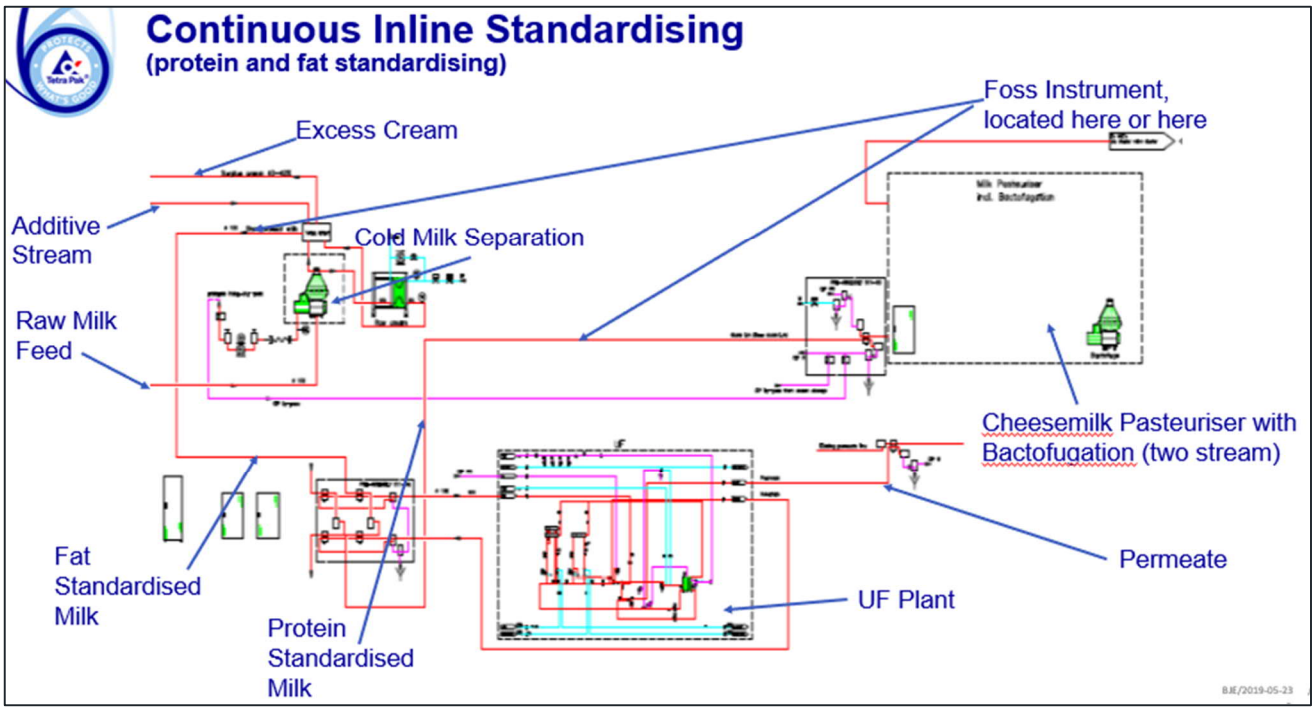


Table 4-5 – Indicative BAT Requirements for Pasteurisation from EPR 6.13 (Dairy and Milk)

EPR Requirements	Current / Proposed Arrangements	BAT?
You should where appropriate: Use recirculating systems to recycle water.	Refer to report Section 3.3 on efficient use of raw materials and water. The new cream pasteuriser uses the existing site hot and cold water recovery tanks.	YES
Use energy efficiency techniques, including regenerative heat exchangers.	Refer to report Section 3.2 on energy efficiency. The new cream pasteuriser is designed with energy regeneration; warm and cold water tanks are used for pre-heating and pre-cooling.	YES

Notes: Guidance document EPR 6.13 was withdrawn in May 2020 following publication of the new Food, Drink and Milk BREF and BAT Conclusions in 2019. However, the BAT standards in the above table are still considered to be useful in order to help identify best practice and appropriate considerations for the justification of BAT, since the new BREF / BAT Conclusions do not provide any specific requirements or standards for pasteurisation.

Table 4-6 – Project No. 4: Whey Protein Concentration (WPC35)

Change / Improvement	Description	Additional Equipment / Infrastructure
WPC35 Whey protein standardisation	Due to the natural variation in milk protein levels, especially between seasons, there is also variation in the protein content of whey. The WPC35 plant was installed and commissioned in October 2019. In this project, up to 10 % of the separated sweet whey stream is drawn off and passed through the WPC35 plant. Here it is treated via an ultrafiltration plant to concentrate the protein content. The concentrated whey is dosed back into the main whey stream to standardise the protein content of the Demin feed stream to meet customer requirements. The permeate from the ultrafiltration plant is passed through a RO plant to concentrate the solids from 13 % to 20 % and it is then exported from site as a saleable ingredient. The process design, therefore, diverts this concentrated waste stream away from the WPF. The permeate from the RO plant currently passes to drain and ends up as wastewater going to the onsite WPF. However, during Phase 2 of the project (which does not form part of this permit variation application), it is proposed to pipe a proportion of the permeate to the onsite process water tanks so that it can be recycled and used use for cleaning purposes (CIP, WPC and RO). The new equipment associated with this project is located inside the demineralised whey process area building adjacent to the existing processing equipment. The layout of the new equipment and infrastructure is shown in Figure 4-11 below and Figure 4-12 provides a process flow diagram which shows the whey protein standardisation process.	1 x 8,000 litre/hr ultrafiltration plant, 2 x new 2,000 litre retentate tanks, 1 x 8,000 litre/hr permeate RO plant and a retentate dosing system. All tanks are constructed of stainless steel and provided with secondary containment, as deemed necessary. Further information on the tanks required for the WPC35 process, including their construction and secondary containment, is provided in Section 5.4.

Figure 4-11 – WPC35 Equipment Layout (Within Existing Demineralsed Whey Process Area)

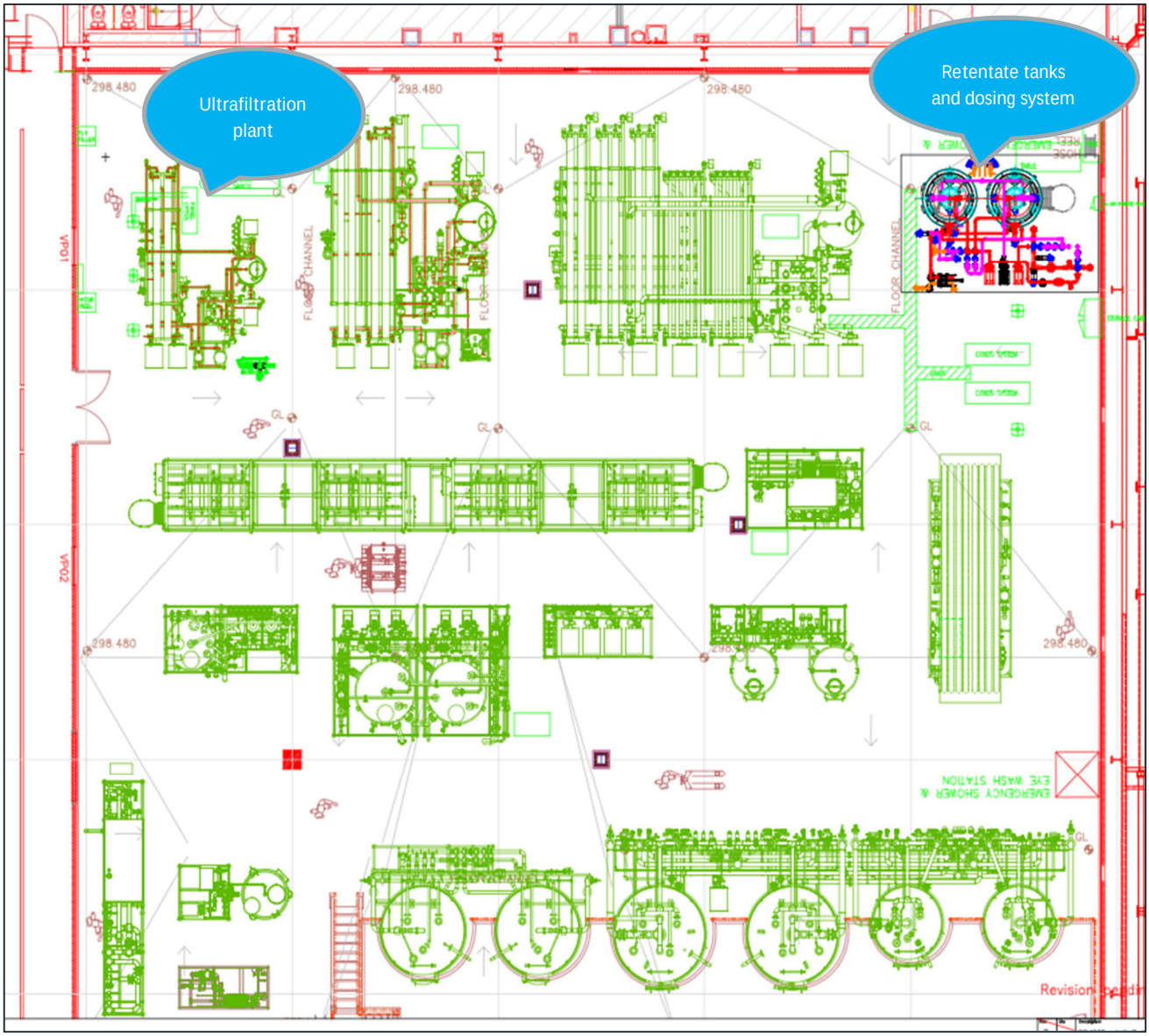


Figure 4-12 – Process Flow Diagram Showing WPC35 Process

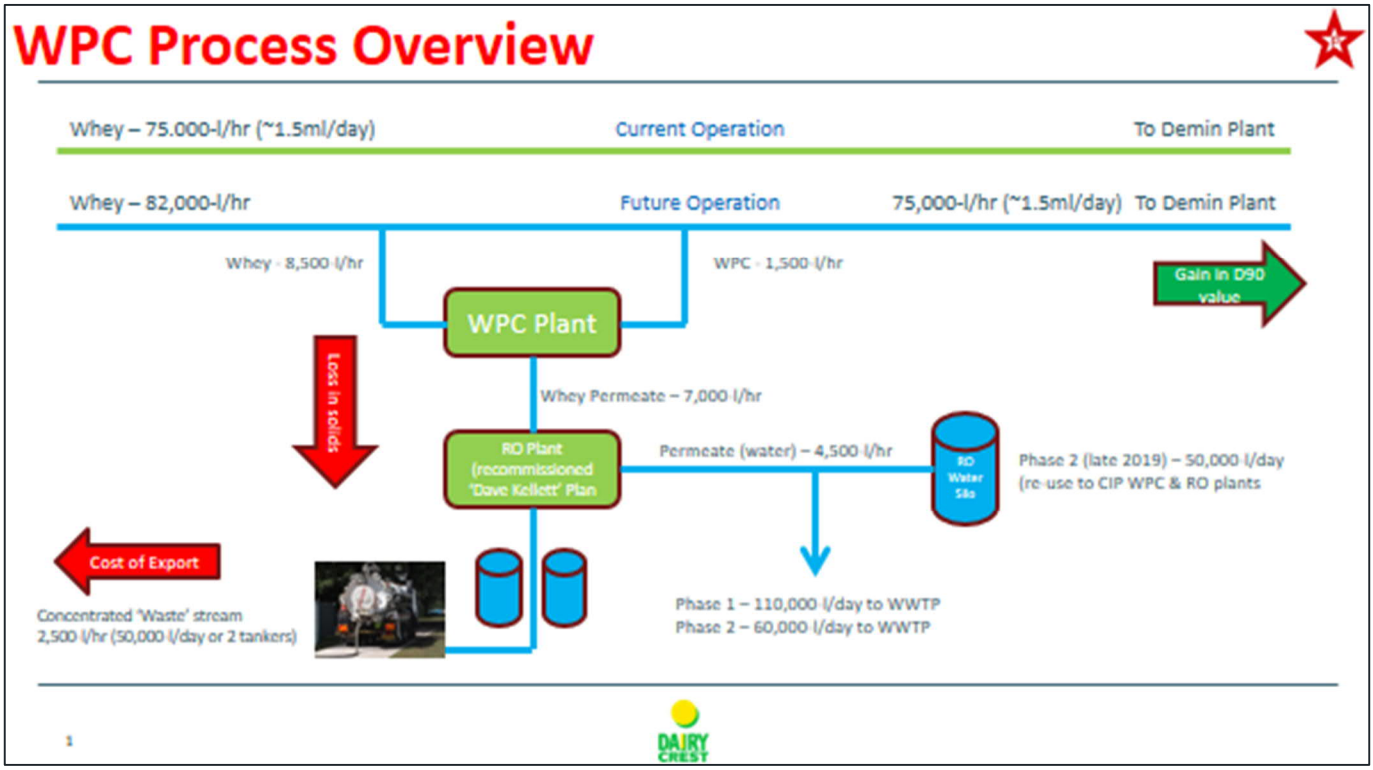


Table 4-7 – Project No. 5: GOS Bulk Loading

Change / Improvement	Description	Additional Equipment / Infrastructure
GOS bulk loading	An alternative method of transporting GOS product to customers has been implemented on site. The solution enables the export of bulk tanker volumes of up to 29,000 kg instead of individual 1,000 kg IBCs. This project incorporates an additional export storage tank, process pipework and a tanker CIP set, which was installed in October 2020. Transfer of bulk product in heated or ambient bulk tankers is more efficient, minimises the potential for accidents / spillages and also helps to reduce packaging waste. The new enclosed GOS bulk tanker loading bay is located adjacent to the current powder dispatch area next to the demineralised whey process building. A portable CIP container (tanker CIP) is located external to the building and the export storage tank is located inside the GOS process area building adjacent to the existing GOS processing equipment. The location and layout of the bulk tanker loading bay is shown in Figure 4-13 below and Figure 4-14 provides a summary process flow diagram. Photographs of the newly installed system are shown in Figure 4-15.	Addition of a 25,000 litre export storage tank, process pipework and tanker CIP set. All tanks are constructed of stainless steel and provided with secondary containment, as deemed necessary. Further information on the tanks required for the GOS bulk tanker loading, including their construction and secondary containment, is provided in Section 5.4.

Figure 4-13 – GOS Bulk Tanker Loading Layout

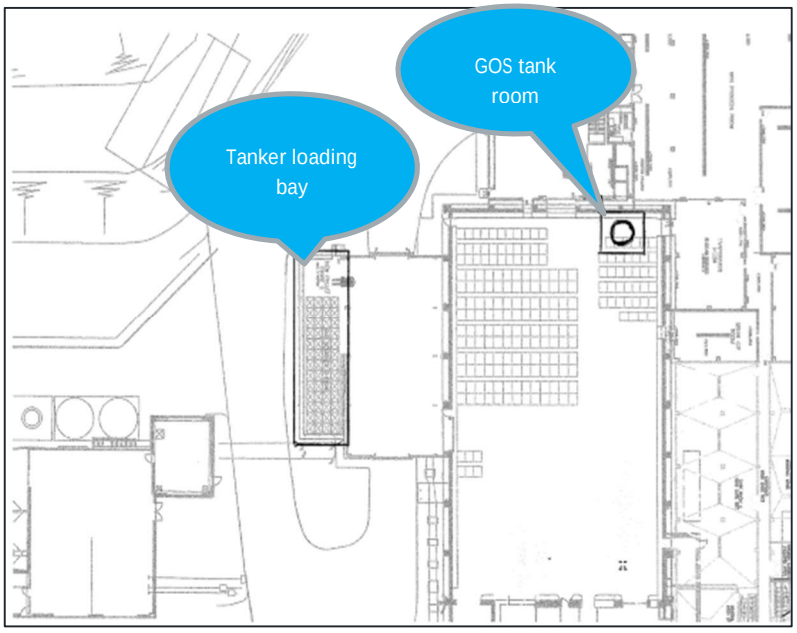


Figure 4-14 – GOS Bulk Tanker Loading Process

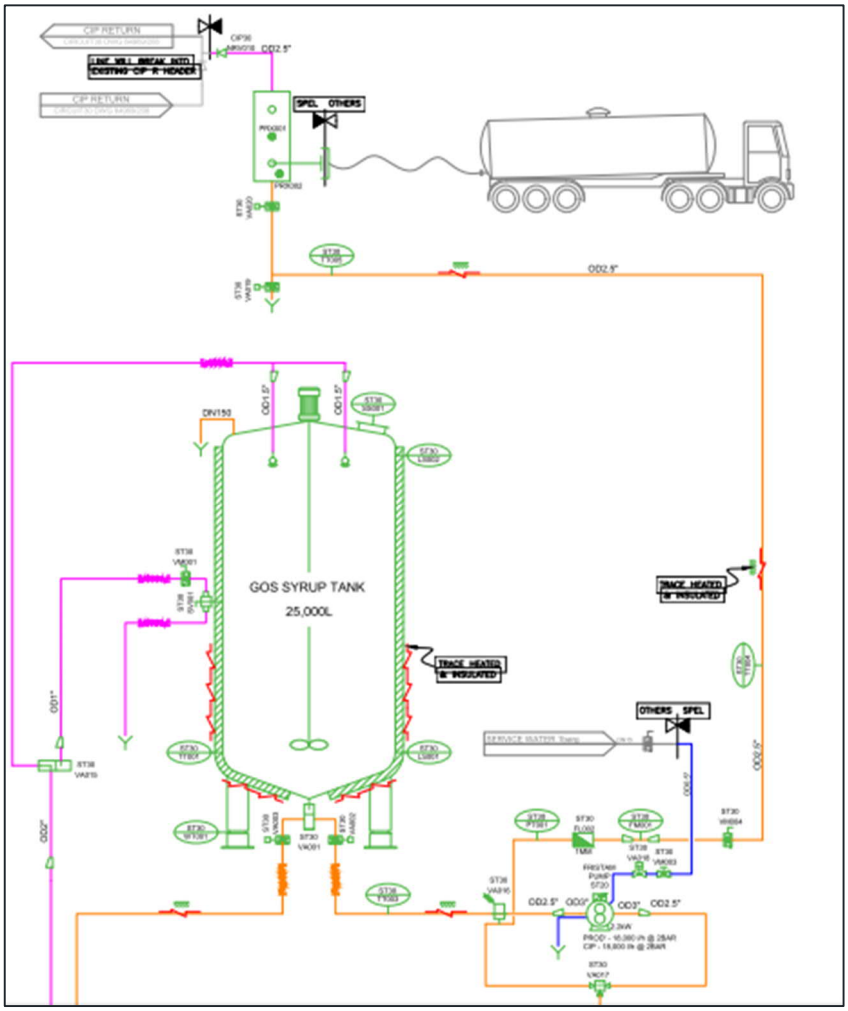
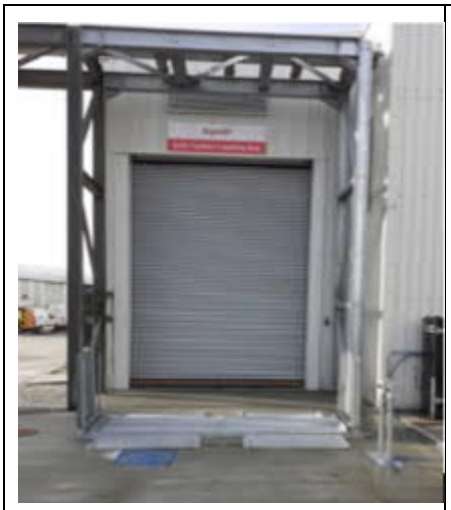
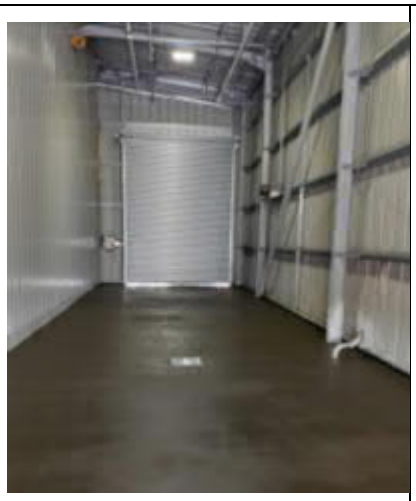


Figure 4-15 – Photographs of Installed GOS Bulk Tanker Loading Facility



Loading Bay Entrance



Inside Enclosed Loading Bay

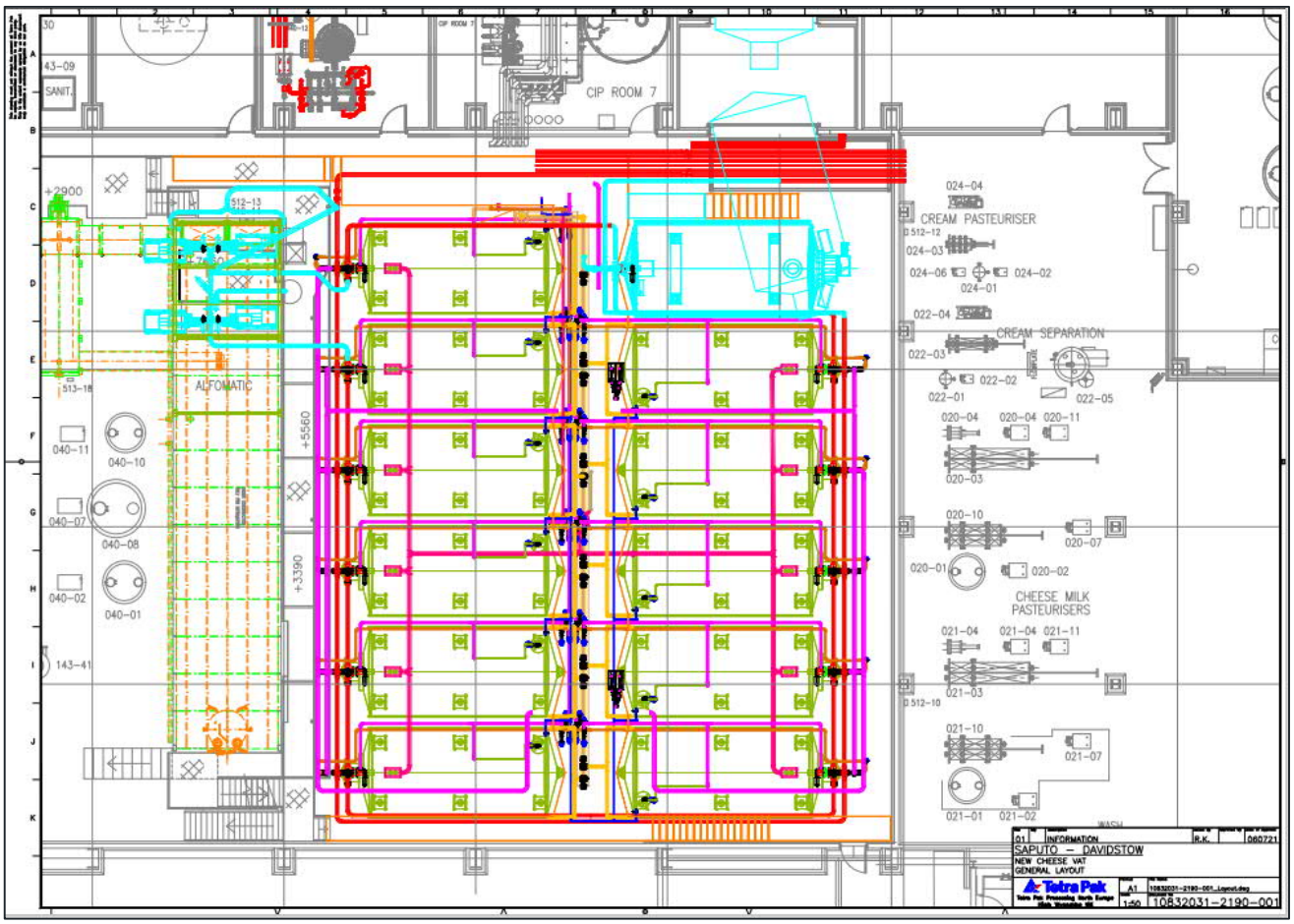
Container CIP Unit

Bulk Tanker Commissioning

Table 4-8 – Project No. 6: Cheese Capacity Growth Phase 3

Change / Improvement	Description	Additional Equipment / Infrastructure
Cheese capacity growth phase 3	A number of process changes have been implemented that will enable curd production capacity to be increased from 9.6 t/hr to 10.5 t/hr. Only one additional cheese vat (no. 12) has been installed, however, the ancillary plant and equipment enables the vats to be filled and emptied quicker, increasing the processing capacity from 87,000 l/hr to 95,000 l/hr. The ancillary plant and equipment includes a larger milk pasteuriser with more plates and an additional curd pump, a whey separator and a new rapid chill store (RCS). Overall, this project increases the curd production from 9.6 t/hr to 10.5 t/hr. The new plant and equipment are located in the existing cheese production facility. The proposed layout is shown in Figure 4-16 below.	1 x cheese vat, milk pasteuriser, curd pump, whey separator and RCS. (Further information on the rapid chill store is provided in report Section 3.3 in relation to BAT 9).

Figure 4-16 – Cheese Capacity Growth Phase 3 – Proposed Layout



4.5. CHANGES TO WPF OPERATIONS

OVERVIEW

As descried in report Sections 2.2 and 2.3 above, redevelopment of the WPF and enhancement of the WRP incorporates a number of changes and improvements which can be broadly categorised as:

- Those improving the main treatment process at the WPF (i.e. physico-chemical and / or biological treatment activities);
- DAAs to the main treatment processes; or
- Non permitted activities and changes at the site (i.e. not prescribed activities or DAAs) to improve management, monitoring, process control etc.

Further information on the changes covered by the first two bullet points above is presented in Table 4-9 to Table 4-17 below, i.e. those changes that comprise part of the prescribed activities undertaken at the WPF or those to be regulated as DAAs. For each one, a process description is provided (where relevant), along with details of any additional equipment and / or infrastructure installed and the key benefits introduced.

As detailed in Table 2-2 in report Section 2.3 above, a number of changes at the WPF are not considered to warrant a permit variation in their own right, as they do not comprise permitted

activities. These changes, examples of which include replacement aeration pumps, installation of acoustic fencing and noise monitoring equipment etc., are not detailed individually in the tables below, but referred to in the relevant sections of this report, e.g. as improved process control, monitoring or mitigation measures.

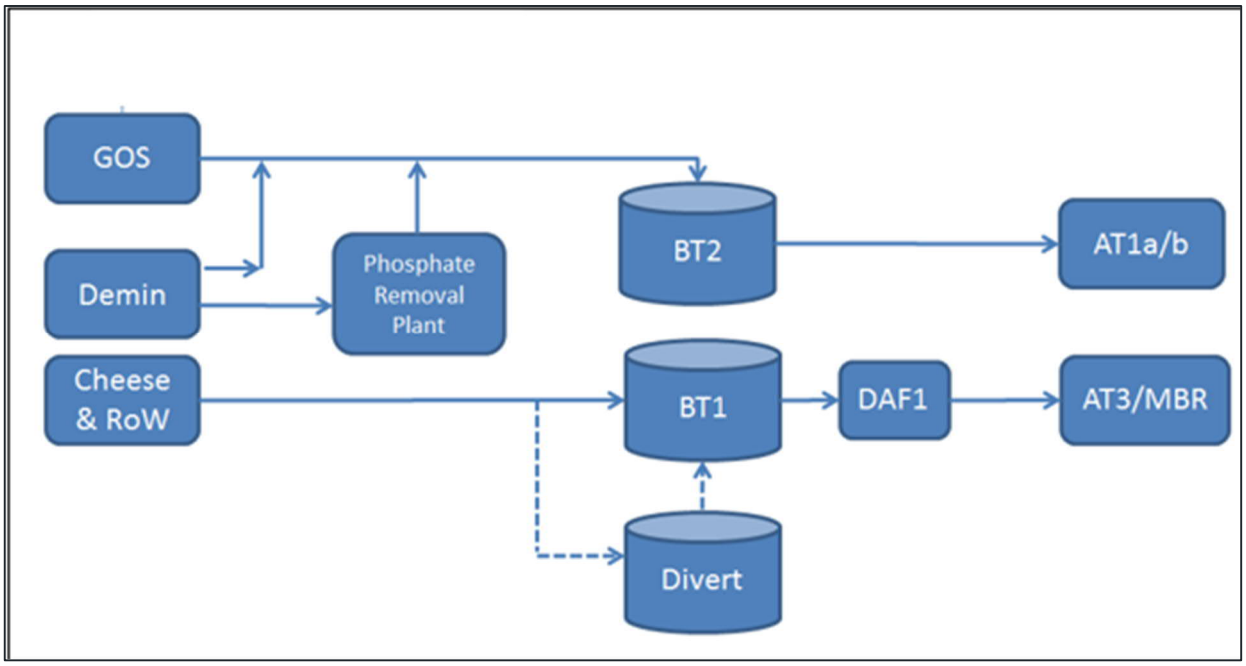
In addition to the above, there have also been a number of changes to the configuration of the WPF operations over the last few years, with the most recent changes supporting the redevelopment works; these are explained below.

CHANGES TO WPF CONFIGUARTION

Wastewater from the Creamery will continue to enter the WPF via two separate gravity fed pipelines; one for cheese and whey effluent and the other for Demin and GOS effluent. As detailed in report Section 4.3 above, the original design intent was for the combined flow from the Demin and GOS processes to be routed to BT2, following removal of a significant proportion of the total P load in the phosphate removal plant. The organic and inorganic (phosphate) load would then be treated in the biological processes of Aeration Tanks AT1a and AT1b. With this WPF process configuration, the cheese and whey effluent would be received by BT1 prior to treatment through the original DAF plant (DAF1), and in turn the biological processes of Aeration Tank 3 (AT3) and the MBR, as had been the case prior to the introduction of the Demin and GOS manufacturing processes. The Divert Tank would continue to operate as it had prior to the introduction of the Demin and GOS processes; for periodic storage of higher strength / flow effluents prior to treatment.

This configuration of the WPF from December 2015, the time of commissioning of the Demin and GOS production processes at the Creamery, until March 2017, is shown in Figure 4-17 below.

Figure 4-17 – Summary Flow Diagram of WPF Configuration December 2015 to March 2017

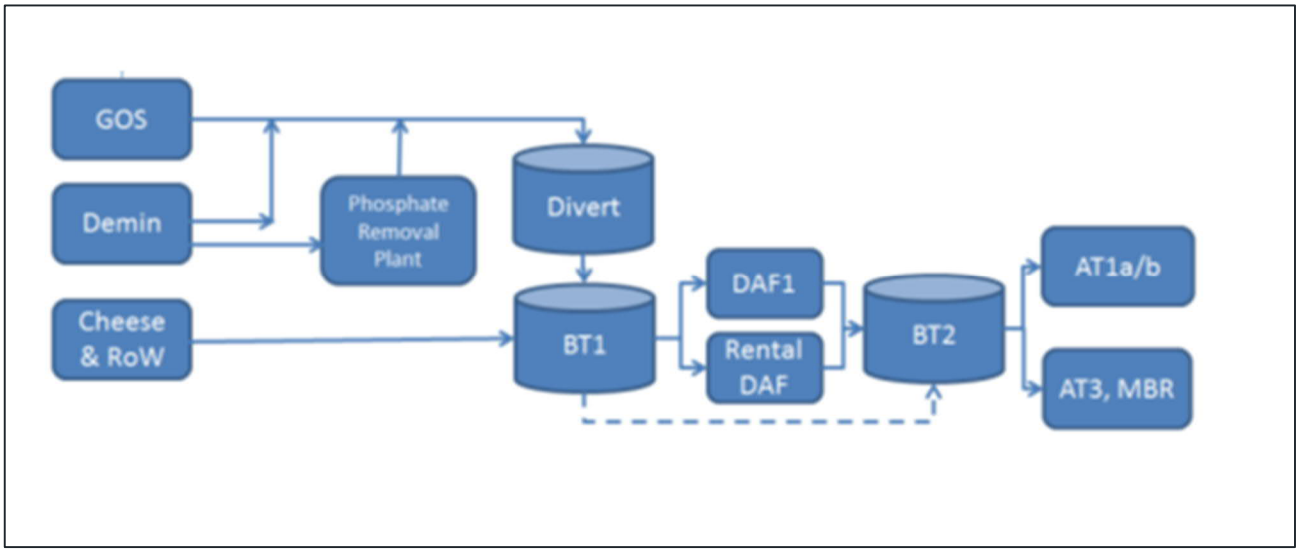


Under this configuration, the full commissioning of Demin and GOS in 2016 resulted in elevated levels of total P in the final treated effluent discharged to river. That is, the original design intent of

the removal of the phosphate load (measured as total P) in the Demin and GOS effluent by the biological processes of AT1 a/b was found to be insufficient.

In January 2017, during investigation of an effective means of reducing total P in the final treated effluent, an additional DAF plant was installed on a temporary trial basis in the line from Settlement Tank 2 (ST2) to the WRP, in order to reduce both total P and solids loading. Although this achieved some reduction in the total P concentration of the final treated effluent at the outfall, it was of limited efficacy due to the DAF treating only one of the phosphate containing effluent streams. Consequently, in March 2017, the rental DAF was repurposed to provide enhanced removal of total P for all influents to the WPF. This was achieved by operating the rental DAF (DAF2 in Table 4-10 below) in parallel with the existing DAF1 as DAF1 did not have sufficient hydraulic capacity to treat the combined volumetric flow of effluents from cheese / whey and Demin / GOS. This WPF configuration is shown in Figure 4-18 below.

Figure 4-18 – Summary Flow Diagram of Effluent Configuration entering the WPF March 2017 to December 2017



Use of the rental DAF (DAF2) to supplement DAF1 in providing treatment of all flows to the WPF necessitated the use of the Divert Tank as the reception tank for effluent from the Demin and GOS processes. The principal reasons for routing Demin and GOS effluent to the Divert Tank were threefold:

1. The efficacy of the DAF process in reducing total P load of Demin and GOS effluent was found to be greater when the flow was mixed with effluent from cheese and whey;
2. The pipework configuration around BT1 and the Divert Tank did not enable routing of the Demin and GOS flow direct to BT1; and
3. The need to utilise BT2 to balance and split the DAF treated effluents between the downstream parallel biological processes of AT1 a/b and AT3/MBR.

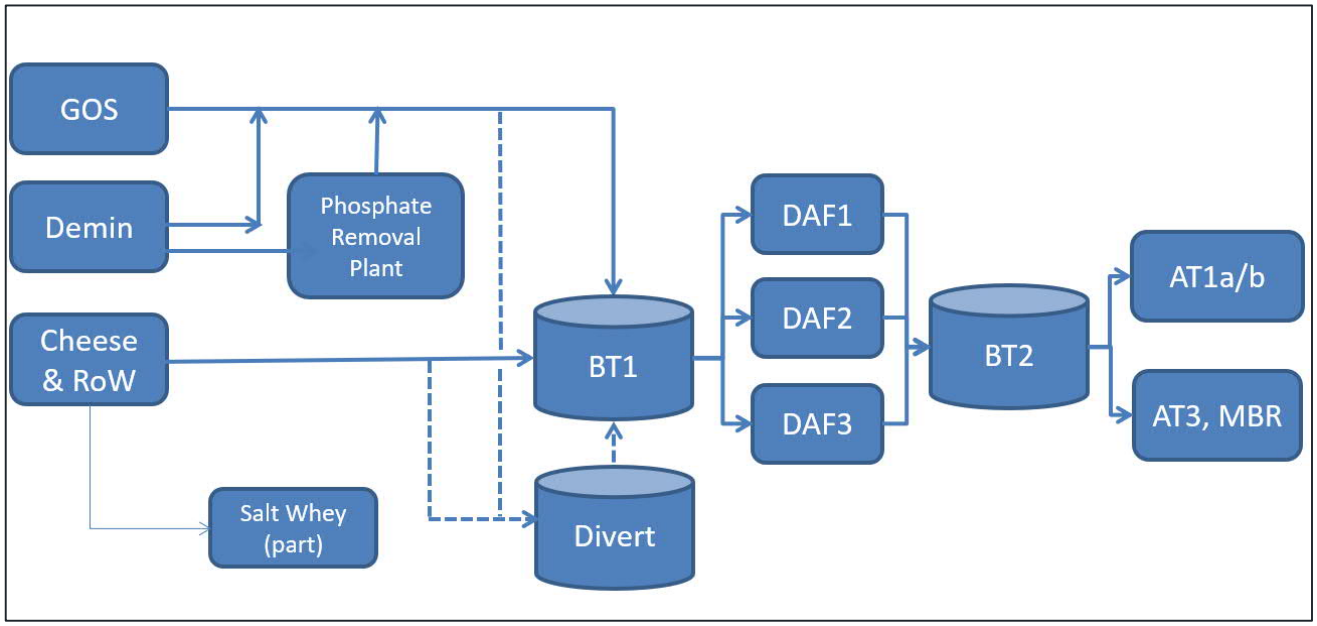
During this time, trials were undertaken to route a proportion of the combined effluent in BT1 directly to BT2, i.e. bypassing both DAF1 and the rental DAF, with the aim of increasing the hydraulic treatment capacity of the WPF as a whole and reducing DAF operating costs. However, this was

shown to have an adverse effect on the concentration of Total P in the final treated effluent. Consequently, this configuration was not adopted as a normal mode of operation.

The use of two DAF plants in parallel to treat all effluent flows to the WPF has been shown to provide greater control of total P in the final treated effluent. Consequently, in January 2018, the rental DAF was replaced with a permanent DAF which is now referred to as DAF2. This comprises one of the new DAF units referred to in Table 4-10 below which is one of the changes forming part of the permit variation application.

Further changes to the configuration of the WPF have recently been implemented to facilitate the reinstatement of the Divert Tank as a true means of diverting higher strength / volume effluents to temporary storage to enable them to be gradually reintroduced to the combined effluent treated by the DAFs. This has been achieved by pipework modifications enabling effluent from Demin and GOS to be routed directly to BT1, or automatically fed to the Divert Tank if required, as shown in Figure 4-19 below.

Figure 4-19 – Summary Flow Diagram of Current Effluent Configuration entering the WPF



CHANGES TO PRESCRIBED PROCESSES AND DAAS

Table 4-9 – WPF Redevelopment: Contingency Lagoon and OCU

Change / Improvement	Description and Benefits
Contingency lagoon and OCU	In 2019, a new 600 m^3 partitioned contingency lagoon was installed; the lagoon comprises two 300 m^3 below ground chambers constructed from cast concrete and treated with a 2 mm chemical resistant epoxy resin coating on the walls and floor. The left hand side of the lagoon supports the phosphate removal plant Balance Tank and the right hand side is for Creamery production contingency. The contingency lagoon is located at the Creamery, on an area of land adjacent to the phosphate removal plant. However, it is considered to form part of the WPF

operations, as the primary purpose is to help manage and control the flow of effluent from the Creamery to the WPF. The location and design of the contingency lagoon is shown in Figure 4-20 and Figure 4-21 below.

The contingency lagoon provides storage capacity for the discharge of process materials (ingredients and intermediates) from the Creamery during abnormal operations. Such abnormal operations are associated with failure modes which can broadly be categorised as follows:

- Plant breakdown / outage resulting from mechanical, electrical or control failure;
- Failure of essential utilities and services, e.g. steam, compressed air etc.;
- Detection of a quality issue that could affect food safety, e.g. in relation to the manufacture of ingredients for infant formula markets; or
- Inadvertent losses of materials to drain, e.g. automatic valves failing to re-set, seal failures etc.

Each of the above abnormal operations results in the discharge of process materials to drain in a relatively short space of time, which could overload the WPF and decrease its resilience. Such scenarios are also known to have an impact on odour emissions at the WPF. Therefore, the contingency lagoon provides essential storage provision for these effluent streams, preventing them from being discharged directly to the WPF. This in turn allows the Creamery to maintain continuous operation, thereby continuing to receive raw milk without wasting / disposing of this valuable raw material.

In order to inform the design requirements for the contingency lagoon, Dairy Crest undertook an assessment of the above failure modes vs frequency, considering the typical volume of process effluent associated with each foreseeable type of failure. This assessment (which has been submitted to the Environment Agency previously, in 2017) concluded that a contingency provision of 500 m^3 was required. A 600 m^3 lagoon was installed in practice which, therefore, affords more than the necessary provision to contain all foreseeable failure modes.

Diverting process materials to the contingency lagoon enables:

- Subsequent export from site for re-use as animal feed, for recovery via off-site anaerobic digestion or land application by licensed contractors; and / or
- Subsequent gradual reintroduction to the WPF where process conditions indicate that the WPF is capable of treating such influents without resulting in increased odour emissions or exceedance of the conditions for discharge of treated effluent to river.

The design of the contingency lagoon has the following additional benefits:

- The lagoon is covered / enclosed; this prevents rainwater ingress which would reduce the effective capacity and have the potential to increase odour emissions as a result of exposure of the lagoon surface to the prevailing wind;
- Air displaced from the covered headspace is collected and treated via an OCU, in order to minimise odours, before discharge to atmosphere. The OCU comprises an AWT Peacemaker Dry-Filter Scrubber, as shown in Figure 4-22 below. The OCU release point represents a new point source emission to air (A10) which should be reflected in the environmental permit; and
- It comprises two separate chambers which facilitates routine cleaning without removing the full capacity of contingency storage from operational use. The ability to clean the lagoon also minimises the rate of deterioration of process materials held in contingency storage.

As a result of the above design features, if and when the process materials held in contingency storage are reintroduced to the WPF, the potential for the formation of

	odorous conditions in tanks receiving influents (BT1 and Divert Tank) is further reduced. Flow is currently diverted manually from the cheese / whey drains at the Creamery into the contingency lagoon and the contents can either be emptied into export tankers by suction or pumped to the phosphate removal plant buffer tanks. The discharge of effluent from the contingency lagoon will only take place after monitoring has been undertaken to confirm an appropriate treatment route, e.g. delivery to the phosphate removal plant buffer tanks, on-site WPF (BT1 / Divert Tank) or tankering off site to a third party. Further details on monitoring are provided in report Section 5.8.

Figure 4-20 – Contingency Lagoon Location and Construction

Note: For a site layout plan showing the location of the lagoon in the full Creamery context refer to Figure 2-4 in report Section 2.3.

Figure 4-21 – Contingency Lagoon Location and Design

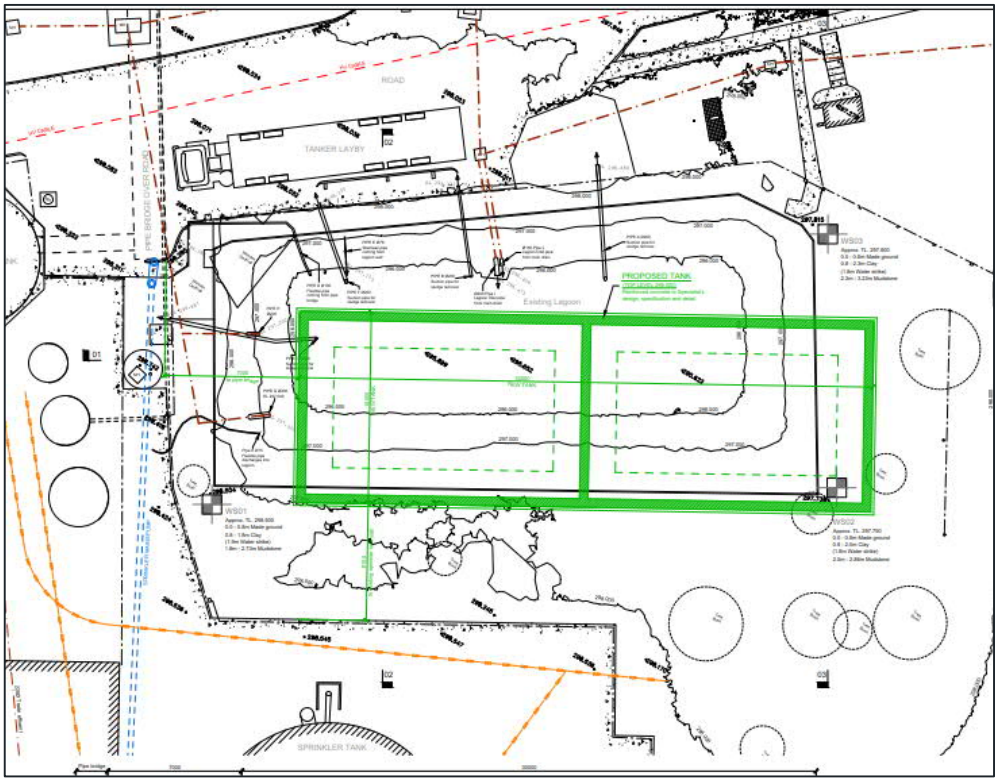


Figure 4-22 – Photograph of OCU at Contingency Lagoon

Table 4-10 – WPF Redevelopment: New DAF Units

Change / Improvement	Description and Benefits
2 new DAF units: DAF2 and DAF3	Along with screening and balancing, DAF forms an integral part of the primary treatment process provided at the WPF. DAF is widely used in the food and drink sector for the removal of solids, e.g. free fats, oil and greases (FOG) and suspended solids from waste water. The basic mechanism of DAF is the introduction of small air bubbles into the waste water; the fine air bubbles attach themselves to the chemically conditioned particles and, as they raise to the surface, the solids float to the surface with them. The addition of chemicals, such as polymers and / or ferric chloride, is used to enhance flocculation and, therefore, the adhesion of bubbles. In addition to suspended solids, DAF reduces levels of BOD/COD, nitrogen and phosphorus in the waste water. Following commissioning of the Demin and GOS processes at the Creamery, an additional DAF plant was installed in 2017, with the aim of reducing total P and solids. This was initially a temporary rental DAF plant located after ST2 and before the WRP, however, it was subsequently repurposed to provide enhanced removal of total P for all influents to the WPF. This was achieved by operating the rental DAF in parallel with the original DAF1. The use of two DAF plants in parallel to treat all effluent flows to the WPF has been shown to provide greater control of total P in the final treated effluent. Consequently, in January 2018, the rental DAF was replaced with a permanent DAF which is now referred to as DAF2. Together the DAFs treat the combined volumetric flow for all process effluent received at the WPF, after BT1. Following the success and environmental benefits afforded by DAF2, a third temporary / rented DAF was installed on a trial basis in 2019 (DAF3). This is operated in parallel with DAF1 and DAF2, in duty/duty/assist mode, thus providing a greater residence time and better process control. It is proposed to replace this with a permanent DAF3 which will be located within a process building at the WPF. The location of DAF1 / DAF2 / DAF3 (current temporary and future permanent) within the WPF is shown in Figure 4-23 below. A review of monitoring data from 2021 shows that the DAF plant at the WPF achieves an approximate 30 % reduction in COD compared to the inlet concentration in BT1. It also removes approximately 70 % of the total P compared to BT1 (noting that >95 % of the total P from the Demin effluent stream has already been removed in the phosphate removal plant). DAF is listed as an appropriate treatment technique in the Food, Drink and Milk BREF. Further information on the justification of BAT for the redeveloped WPF is provided in the Wastewater BAT Options Appraisal report (Appendix E).

Figure 4-23 – Location of DAF1 / DAF2 / DAF3 at the WPF (and other plant & equipment)

Table 4-11 – WPF Redevelopment: Covering and Extraction of BT1 and Divert Tank

Change / Improvement	Description and Benefits
Covering / extraction from BT1 and Divert Tanks (and OCU)	BT1 and the Divert Tank have been covered with a Glass Reinforced Plastic (GRP) lid and the air displaced from the covered headspace of the tanks is treated via an OCU, in order to minimise odours, before discharge to atmosphere. This provides additional contingency (on top of that provided by operation of the contingency lagoon) to minimise odour emissions at the WPF associated with failure modes at the Creamery (refer to Table 4-9 for details of potential failure modes). The provision of tank covers also reduces the base level of odorous emissions during steady state operation of the Creamery and WPF. This helps to improve the overall resilience of the WPF and enables it to be operated effectively under a wider range of process conditions. The original OCU, installed in 2018, comprised a single stage dry chemical scrubber. Following ongoing monitoring and process improvements, the scrubber has gone through a number of iterations and it now comprises a three-stage scrubber incorporating the following: - **Stage 1 Wet Scrubber:** A wet scrubber removes gaseous pollutants from the gas stream via mass transfer to a liquid solvent. In this case, the chamber is packed with pall rings and it incorporates a scrubber liquor distribution system. An automated dosing system

	adds odour suppressant (Diox-Max) to the recirculating scrubber liquor. - **Stage 2 Dry Scrubber #1:** A dry scrubber removes pollutants from the waste gas stream by retention on a solid surface. In this case, the dry scrubber comprises a chamber filled with 8 m^3 of AWT's proprietary 'Tri-Ox' adsorbent which selectively removes hydrogen sulphide. - **Stage 3 Dry scrubber #2:** The chamber contains three layers of different adsorbent materials; 5.5 m^3 'Di-Ox' (bottom layer) targeting hydrogen sulphide, mercaptans and organic amines, 1.0 m^3 'ADS-C' (middle layer) for neutralisation of acid gases such as hydrogen sulphide, mercaptans and organic sulphides, including reduced sulphur compounds e.g. DMS / DMDS and 1.5 m^3 'Ecosorb' (top layer) which is a high activity, extruded activated carbon. The OCU release point represents a new point source emission to air (A11). An extract fan pulls air through the wet scrubber and head space of the two dry scrubber tanks. The treated air is released to atmosphere via a vent stack which discharges at a height of approximately 1 m above the height of BT1 (10 m agl). The design specification for the system is to discharge treated air containing <1,000 OUe/s. The tank head spaces and vent stack are fitted with Crowcon continuous hydrogen sulphide measurement. The OCU is located adjacent to / south of BT1, as shown in Figure 4-23 above. The three-stage OCU system is shown in Figure 4-24 below. Emissions from this release point have been included in the Odour Impact Assessment (Appendix F).

Figure 4-24 – Photograph of OCU Serving BT1 and Divert Tank

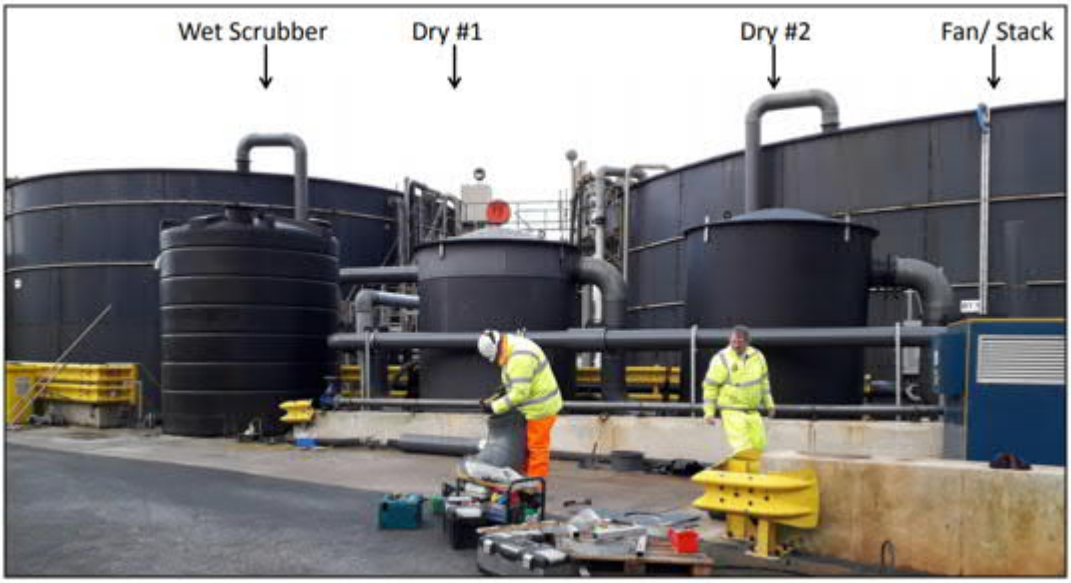


Table 4-12 – WPF Redevelopment: Upgraded AFM Tanks

Change / Improvement	Description and Benefits
Upgraded AFM tanks	The AFM tanks form part of the WRP process which treats a portion of the final effluent from the WPF to enable reuse back at the factory, thus minimising raw water consumption. The primary treatment processes at the WRP comprise UF followed by RO; the full process flow is show in Figure 4-3 above. The AFM tanks specifically treat the RO concentrate (reject) and UF backwash water, after it has passed via ST3. The AFM tanks contain glass beads which act as a filtration media and further remove solids from the effluent. The glass beads have been processed to obtain the optimum particle size and shape and then activated to increase the surface area compared to crushed glass or sand. The treated output from the AFM tanks is discharged to the W2 outfall where it combines with treated effluent before it is discharged to the River Inny and the backwash from the AFM process is discharged back to ST3. Four new skid mounted AFM vessels were installed adjacent to the containerised WRP in 2020. The four AFM vessels, which are fully automated, run in a series of two, parallel to one another. The location and design of the new AFM tanks is shown in Figure 4-25 below.

Figure 4-25 – New AFM Tanks Location and Photo During Installation

Table 4-13 – WPF Redevelopment: Third RO Plant

Change / Improvement	Description and Benefits
3rd RO plant	The WRP previously housed two RO plants located in containers, where a portion of the waste water from the WPF is passed across a membrane, after first undergoing UF. Water is separated from dissolved salts by filtering through a semi permeable membrane at a pressure greater than the osmotic pressure caused by the salts. The advantage of RO is that dissolved organics are less selectively separated than in other processes. The purified solution permeates through the membrane and suspended, colloidal and dissolved solid emission levels are reduced (including phosphorus). As part of the changes to enhance the WRP, a third RO plant has also been installed which is located in a shed next to the existing RO containers. The three RO plants now operate in duty/duty/regeneration mode, thus allowing two ROs to operate continuously whilst the third is being regenerated. This improves the resilience of the WRP, as there are now always two plants operational whilst one set of membranes is being cleaned. This also increases the amount of process water that is recycled and reused at the Creamery, from ~1,100 m^3 per day to ~1,600 m^3. Trial results following commissioning of the third RO plant shows that it reduces conductivity from approximately 10,000 (inlet) to 500 (outlet) and therefore efficiently recovers water for reuse at the Creamery. The location of the third RO plant is shown in Figure 4-26 below.

Figure 4-26 – Location of Third RO Plant

Table 4-14 – WPF Redevelopment: UF / RO Flow Attenuation Tank

Change / Improvement	Description and Benefits
UF / RO flow attenuation tank	A 100 m^3 carbon steel flow attenuation tank has been installed at the WRP. The tank helps to modulate the flow of final treated water discharged down the pipeline to the outfall W2 and into the River Inny. Previously, when one UF or RO unit was out of service for cleaning or other maintenance, the flow was redirected to the river, causing a surge in flow down the pipeline. However, following installation of the new flow attenuation tank, the treated water can now be diverted to this tank for storage in such circumstances. The treated water consists of permeate from the MBR process and effluent from ST2. The presence of a third RO plant, as detailed in Table 4-13 above, also helps to reduce surges in flow. These changes help to ensure more consistent compliance with the emission limit values at the final discharge monitoring point (W2). Automatic monitoring is installed for pH, turbidity and temperature and there is a further contingency option to divert the treated water to BT2 if it does not meet the parameters specified for discharge via W2. The tank also provides additional contingency / resilience as it could be used for other purposes, if required. The design and location of the UF / RO flow attenuation tank is shown in Figure 4-27 and Figure 4-28 below.

Figure 4-27 – Photos During Installation of UF / RO Flow Attenuation Tank

Figure 4-28 - Approximate Location of UF / RO Flow Attenuation Tank

Table 4-15 – WPF Redevelopment: Downstream Tertiary Filters

Change / Improvement	Description and Benefits
Downstream tertiary filters	As previously described in above sections, following treatment of the effluent from the Creamery at the WPF, a portion of the treated water (approximately 1 million litres per day) is diverted to the WRP after ST2, with the remainder (approximately 2 million litres per day) being discharged to the River Inny via W2. In order to reduce the concentration of suspended solids in the final treated water (both to river and the WRP), a tertiary filtration system has been installed, which acts as a final polishing stage prior to discharge. The previous gravity Settlement Tanks (particularly ST2) proved unreliable in consistently controlling suspended solids on their own as they were vulnerable to variations in aerobic sludge quality / density in the upstream biological processes, resulting in carry over of fine solids of poor settling characteristics. This resulted in: - Compromised sustained compliance with the final effluent TSS emission limit value specified in the environmental permit; and - Reduced throughput of the membrane plant used to recycle treated water for use in the Creamery, due to increased backwashing of the UF membranes (therefore reducing running time), and an increase in the quantity of feedwater required for backwashing; hence necessitating increased imports of water. The effluent entering ST2 is treated in coarse basket canister filters. However, the filters provided inadequate tertiary treatment (evident through periodic breaches of the TSS limit for final treated effluent) and are prone to becoming blocked. They also require high levels of operational labour to routinely monitor and clean. Furthermore, the canister filters provide little reduction in TSS loading on the membrane WRP.

	A proprietary, tertiary filtration system to reduce suspended solids concentration has therefore been installed downstream of the current gravity Settlement Tank ST2. This reduces the solids concentration in both the effluent discharged to river and that received by the membrane WRP. The system comprises a continuously rotating mesh filtration belt. Filtration within the system occurs from the centre outwards; whereby sludge / effluent flows out of the drum from the centre. The flow from ST2 to the filters and from the filters to W2 can be controlled. There are three units that form the tertiary filtration system and they operate in a duty / duty / clean mode, thus providing continuous treatment of both effluent streams, even during cleaning and maintenance of one of the units. The benefits associated with the tertiary filtration stage at the WPF are: - Improved effluent quality compliance measured as percentage of days when all parameters are compliant with conditions of the environmental permit, and - Improved performance of the WRP through reduction of frequency of backwashes, hence overall availability of the recycling plant as well as reducing the volume of feedwater required for backwash, which is not converted to recycled water. Increasing the quantity of recycled water reduces reliance of imports from the potable main. An automated composite sample can be taken from the filtrate tank and continuous turbidity monitoring is performed in order to demonstrate compliance with the W2 emission limits. Therefore, if there is a problem with compliance at W2 this part of the process can be checked, although in reality it is very unlikely to be the source of any non-compliance with emission limit values. The tertiary filters are located adjacent to ST2, as shown in Figure 4-29 below. Figure 4-30 and Figure 4-31 provide a schematic, photograph as installed and a process flow diagram for the filters indicating how they operate.

Figure 4-29 – Downstream Tertiary Filters Location

Figure 4-30 – Downstream Tertiary Filters – Schematic and Photograph as Installed

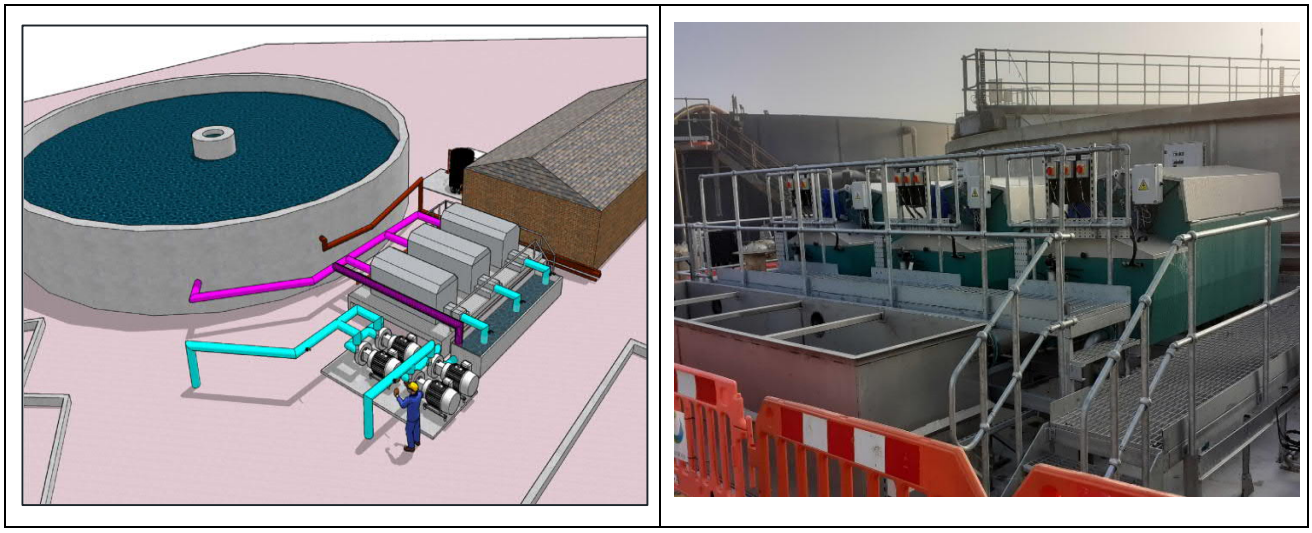


Figure 4-31 – Downstream Tertiary Filters – Process Flow Diagram

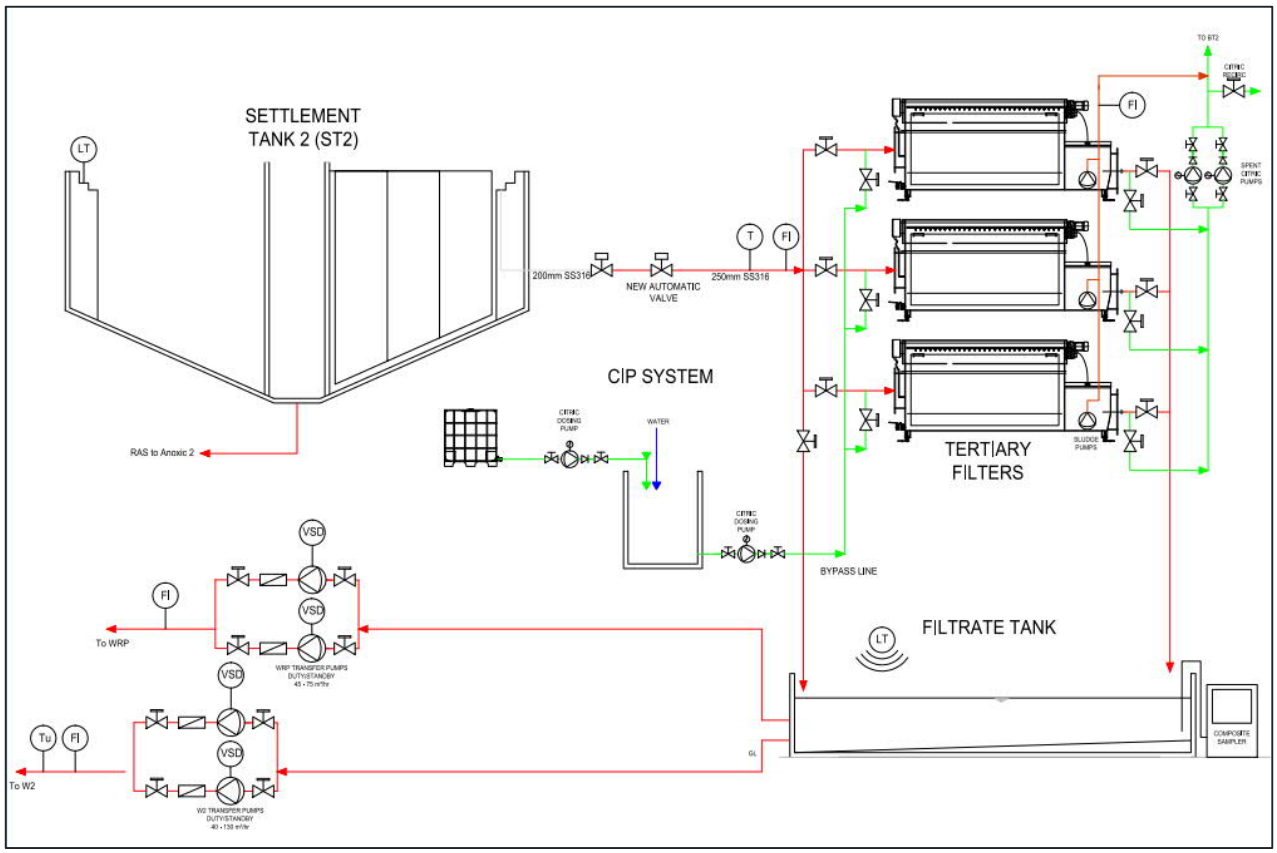


Table 4-16 – WPF Redevelopment: Fourth MBR Loop

Change / Improvement	Description and Benefits
4th MBR loop	After primary treatment consisting of screening, balancing and DAF, the effluent at the WPF is subject to biological treatment which consists of activated sludge with a combination of gravity clarification and MBR for biomass separation. The WPF previously incorporated three MBR plants located inside a building adjacent to the DAF1 plant. MBR is a variation on a conventional activated sludge treatment whereby a number of membrane modules, or cartridges, replace the secondary clarifier and the tertiary filtration step (see Figure 4-32 below which provides a photograph of one of the MBR loop systems). Following biological treatment the mixed liquor is pumped under static head pressure to the membrane unit where the solids and liquids are separated, the clean waste water is discharged and the concentrated mixed liquor is pumped back to the bioreactor. The MBR process reduces the load of suspended solids, COD/TOC and BOD and it also reduces the volume of sludge produced compared to conventional aerated sludge treatment. A fourth treatment MBR plant was installed during November 2021, located in the same building as the existing MBRs (see Figure 4-33 below). The four MBRs provide increased capacity and continue to deliver clean water to the WRP process. They also introduce increased resilience and maintainability over the previous system. Automatic turbidity monitoring is in place for each MBR loop, in addition to turbidity monitoring for the combined MBR system. A review of monitoring data from 2021 shows that the MBR system at the WPF achieves >95 % reduction in COD compared to the inlet concentration measured in BT2. Membrane filtration is listed as an appropriate treatment technique in the Food, Drink and Milk BREF. Further information on the justification of BAT for the redeveloped WPF is provided in the Wastewater BAT Options Appraisal report (Appendix E).

Figure 4-32 - MBR Loop

Figure 4-33 – Fourth MBR Loop Location

Table 4-17 – WPF Redevelopment: New Raw Material Store

Change / Improvement	Description and Benefits
New raw material store (DAA)	An area of land located adjacent to the existing WPF is being incorporated into the environmental permit installation boundary for use as chemical storage. Dairy Crest already owns this area of land and a separate Site Condition Report (SCR) for the land has been produced as part of this permit variation application (Appendix B). The location of the new chemical storage area is shown in Figure 4-34 below. The chemicals which will be stored in this area are for use at the WPF and will comprise sulphuric acid, caustic (for pH correction of influent and DAF feed), Diox (for odour abatement), ferric (used as coagulant on DAFs and polishing of Total P), DAF polymer and cleaning chemicals (e.g. membrane cleaners). These will be contained within approximately 48 IBCs, which will in turn be housed within three steel containers (IBC stores inclusive of air vents, epoxy resin coated sump / bund and a HIAB offload). The IBC container units have a 20-year structural guarantee and each unit can hold up to 64 x 205 litre or 16 x 1,000 litre IBCs. Any overflow stock will be stored Outside the container units but on bunded pallets providing appropriate secondary containment (up to a maximum of approximately 40 IBCs). Further detail on the substances to be stored, including proposed quantities and storage arrangements, are detailed in full within the SCR submitted as part of this environmental permit variation application.

Figure 4-34 - Location of Chemical Storage Area

Figure 4-35 - Photograph of Steel Containers and Sumps

5. EMISSIONS AND MONITORING

5.1. OVERVIEW OF SECTION AND MONITORING ARRANGEMENTS

This section identifies the emissions from the site and describes the measures for managing and monitoring relevant emissions where changes are introduced by the permit variation being applied for. Table 5-1 below shows the current arrangements for monitoring emissions (in accordance with the environmental permit) from the Creamery and WPF processes. It establishes which monitoring arrangements will change directly as a result of the permit variation being applied for, and those that will remain the same.

Table 5-1 – Monitoring Arrangements

Emissions	Current Monitoring Arrangements	Future Monitoring Arrangements
Emissions to air (point source)	As per Table S3.1 in Schedule 3 of the current environmental permit (EPR/BN6137IK/V009). There are seven emission points for emissions to air. The following parameters are monitored: ▪ Oxides of nitrogen ▪ Particulate matter ▪ Sulphur dioxide Depending on the individual emission point reference the parameters are measured on either a 6-monthly or annual basis, with the exception of emission points A3 (spray drier for drying of concentrated whey), which is provided with continuous monitoring. Emission point A5 (filtermat spray drier for whey based products) does not require monitoring. As detailed in Section 5.2 below this emission point is no longer used.	There will be no changes to the existing point source emissions to air specified in the permit as a result of the variation being applied for and, therefore, no changes to air emissions monitoring are required. However, there will be two new point source emissions to air introduced as a result of the permit variation. These comprise the two OCUs; one associated with the contingency lagoon at the Creamery and the other associated with BT1 / Divert Tank at the WPF. It is not anticipated that monitoring will be included in the permit for the OCUs but that they will be listed as discrete emission points (A10 and A11) in Table S3.1 of the permit. However, Dairy Crest does undertake periodic olfactometry monitoring surveys at the site to identify and monitor odorous emission sources and help inform management techniques. The OCUs are also monitored (OU/s at the inlet / outlet) to check the abatement efficiency. As emission point A5 is no longer used it is requested that this emission point reference is removed from the permit during the variation process.
Emissions to surface water (point source)	As per Table S3.2 in Schedule 3 of the current environmental permit. (EPR/BN6137IK/V009). Emissions to surface water are monitored at two emission point references; W1 and W2. Both emission points discharge into the River Inny. The source for W1 is uncontaminated surface water drainage from the	There will be no new point source emissions to water as a result of the permit variation being applied for. Whilst the changes on site do not introduce the manufacture of any new products at the Creamery, generate any new effluent streams requiring treatment at the WPF, limit or increase the volume of effluent discharged at emission point W2, the

	interceptor and attenuation pond at the Creamery; W2 comprises treated effluent from the WPF. Flow, pH and temperature are monitored on a continuous basis from emission point W2. pH is monitored monthly from emission point W1. Daily monitoring is undertaken for the following parameters at W2: ▪ Ammoniacal nitrogen (expressed as N) ▪ Biological Oxygen Demand (BOD) ▪ Suspended solids (TSS) ▪ Total phosphorus (P) ▪ Total iron (Fe) ▪ Total sodium (Na) ▪ Total potassium (K) ▪ Chloride (Cl); and ▪ Sulphate (SO_4). Annual monitoring is undertaken for mercury and its compounds and cadmium and its compounds (using a mass balance approach based on the volume of caustic used).	Environment Agency has conveyed its intention to review the Emission Limit Values (ELVs) for this point source emission during the permit variation determination process. It is understood that additional monitoring will be required for Chemical Oxygen Demand (COD) and total nitrogen, ELVs will be introduced for those parameters which don't currently have them and revised ELVs will be provided for parameters with existing ELVs. Further information on the ELV review process, including commentary on the Environment Agency's indicative ELVs provided during pre-application discussions and consideration of BAT, is provided in the Wastewater BAT Options Appraisal report in Appendix E. It is understood that the Environment Agency will remove the monitoring requirement for mercury and cadmium. Dairy Crest will implement suitable monitoring arrangements as required by the varied permit. Dairy Crest is also replacing the v notch sampling point at W2 with a MCERTs flume and will introduce Total Organic Carbon (TOC) monitoring as a proxy for BOD and continuous monitoring of P, N and turbidity (as a proxy for TSS). It should be noted that these arrangements are for the purpose of process monitoring and not compliance.
Emissions to sewer	N/A as Dairy Crest does not discharge to sewer.	
Waste emissions	There are no monitoring arrangements set out in the current environmental permit in relation to waste. There is a limit set on the amount of waste which is permitted to be burnt in the biomass boilers on site; 18,000 tonnes per annum. All waste data is recorded on a spreadsheet based system that forms part of Dairy Crest's EMS.	There will be no change to waste emissions monitoring as a result of this permit variation.
Noise emissions	No specific emission limits or monitoring requirements for noise are specified in the current environmental permit; the standard qualitative noise boundary condition is included. However, periodic	Noise emissions from the Creamery and WPF are not anticipated to change significantly as a result of the changes on site covered by the permit variation application.

	noise monitoring is undertaken by a third party contractor to inform management and operational practices and ensure that emissions from the site are not causing noise pollution. Any complaints regarding noise emissions are recorded and suitably addressed.	As such, there will be no change to current noise monitoring arrangements specified in the permit. However, acoustic fencing and new noise monitoring equipment has been installed, as described in Section 2.2 and Section 2.3 above and shown in Figure 2-5. The Environmental Risk Assessment in Appendix C considers noise emissions and appropriate noise mitigation techniques and a separate Noise Impact Assessment has been undertaken (provided in Appendix G).
Odour emissions	No specific emission limits or monitoring requirements for odour are specified in the current environmental permit; the standard qualitative odour boundary condition is included. However, periodic odour monitoring is undertaken by a third party contractor to inform management and operational practices and ensure that emissions from the site are not causing odour pollution. Any complaints regarding odour emissions are recorded and suitably addressed. The site has an approved Odour Management Plan (OMP) which forms part of the EMS.	Odour emissions from the Creamery and WPF are expected to be reduced as a result of the changes on site covered by the permit variation application. Dairy Crest undertakes periodic olfactometry monitoring surveys at the site to identify and monitor odorous emission sources and help inform management techniques. The OCUs are also monitored (OU/s at the inlet / outlet) to check the abatement efficiency. The Environmental Risk Assessment in Appendix C considers odour emissions and appropriate odour mitigation techniques and a separate Odour Impact Assessment has been undertaken (provided in Appendix F).

The Tables below outline the BAT requirements for monitoring and describe how Dairy Crest's operational arrangements meet these requirements.

Table 5-2 – BAT Requirements for Monitoring from Food, Drink and Milk BREF (December 2019)

BREF Requirements	Current / Proposed Arrangements	BAT?
BAT 3: For relevant emissions to water as identified by the inventory of waste water streams (see BAT 2), BAT is to monitor key process parameters (e.g. continuous monitoring of waste water flow, pH and temperature) at key locations (e.g. at the inlet and/or outlet of the pre-treatment, at the inlet to the final treatment, at the point where the emission leaves the installation).	Point source emissions to water are described in Section 5.3 below. No new point source emissions to water are introduced as a result of the permit variation application. However, a number of improvements to monitoring arrangements have been implemented as part of the redevelopment of the WPF. This includes monitoring at the WPF influent, improved monitoring at W2 (including TOC) and additional in-house laboratory monitoring (comprising both composite and spot samples) at key stages of the WPF treatment process. Dairy Crest maintains a	Yes

	process monitoring spreadsheet which records the results of the monitoring undertaken by the WPF in-house laboratory and these are regularly reviewed in order to aid management of the treatment process.	
BAT 4: BAT is to monitor emissions to water with at least the frequency given below (Table 5-3) and in accordance with EN standards.	The current permit (V009) already includes daily monitoring for total phosphorus, suspended solids, BOD and chloride. It is understood that the Environment Agency will include additional monitoring obligations for total nitrogen and TOC during determination of the variation application, in order to address the BREF requirements in Table 5-3 below.	Yes

Table 5-3 – Frequency of Monitoring Emissions to Water from Food, Drink and Milk BREF (December 2019) and Waste Treatment BREF (August 2018)

Substance / Parameter	Standard(s)	Minimum Monitoring Frequency ([1])	Monitoring Associated With
Chemical oxygen demand (COD) ([2]) ([3])	No EN standard available	Once every day ([4])	BAT 12
Total nitrogen (TN) ([2])	Various EN standards available (EN 12260, EN ISO 11905-1)		
Total organic carbon (TOC) ([2]) ([3])	EN 1484		
Total phosphorus (TP) ([2])	Various EN standards available (EN ISO 6878, EN ISO 15681-1 and -2, EN ISO 11885)		
Total suspended solids (TSS) ([2])	EN 872		
Biological oxygen demand (BOD) ([2])	EN 1899-1	Once every month	
Chloride (Cl^-)	Various EN standards available (EN ISO 10304-1, EN ISO 15682)	Once every month	

(1) The monitoring only applies when the substance concerned is identified as relevant in the waste water stream based on the inventory mentioned in BAT 2.

(2) The monitoring only applies in the case of a direct discharge to a receiving water body.

(3) TOC monitoring and COD monitoring are alternatives. TOC monitoring is the preferred option because it does not rely on the use of very toxic compounds.

(4) If the emission levels are proven to be sufficiently stable, a lower monitoring frequency can be adopted but in any case at least once every month.

Table 5-4 – BAT Requirements for Monitoring from Waste Treatment BREF (August 2018)

BREF Requirements	Current / Proposed Arrangements	BAT?
BAT 6: For relevant emissions to water as identified by the inventory of waste water streams (see BAT 3), BAT is to monitor key process parameters identified in the inventory of waste water streams at key locations (e.g. at the inlet and/or outlet of the pre-treatment, at the inlet to the final treatment, at the point where the emission leaves the installation).	Key process parameters are routinely monitored (comprising both composite and spot samples) at key stages of the WPF treatment process. Dairy Crest maintains a process monitoring spreadsheet which records the results of the monitoring undertaken by the WPF in-house laboratory and these are regularly reviewed in order to aid management of the treatment process.	Yes
BAT 7: BAT is to monitor emissions to water with at least the frequency given in the table below.	Refer to BAT 4 in Table 5-2 above, which is considered to be more appropriate for the emissions from W2 at the WPF.	Yes
BAT 10: BAT is to periodically monitor odour emissions.	Dairy Crest undertakes periodic olfactometry monitoring surveys at the site to identify and monitor odorous emission sources and help inform management techniques. The OCUs are also monitored (OU/s at the inlet / outlet) to check the abatement efficiency.	Yes
BAT 11: BAT is to monitor the annual consumption of water, energy and raw materials as well as the annual generation of residues and waste water with a frequency of at least once per year.	Water, energy and raw material consumption and residue and waste generation are already monitored and recorded by Dairy Crest as part of its EMS. The data is typically recorded on a monthly basis and reported annually. No changes are considered necessary to these monitoring and reporting procedures as a result of the permit variation being applied for. Water / raw material consumption and waste generation are expected to increase slightly as a result of the changes on site covered by the permit variation being applied for. Primary energy consumption is expected to decrease as a result of the energy efficiency measures which have been introduced. More information on these topics is provided in Section 3, which also compares the data on current and future consumption / generation to relevant industry figures and benchmarks.	Yes

5.2. POINT SOURCE EMISSIONS TO AIR

Existing point source emissions to air are detailed in Schedule 3, Table S3.1 of the current environmental permit for Davidstow Creamery and comprise:

- A1, A2, A7, A8 and A9 – boilers for steam generation;
- A3 – spray drier for drying of concentrated whey; and
- A5 – filtermat spray drier for drying of whey based products.

It should be noted that emission point A5 is no longer in use and it is requested that this emission point reference is removed from the permit during the variation process.

Two new point source emissions to air are introduced as a result of the permit variation application; comprising two new OCUs serving the contingency lagoon at the Creamery and BT1 / Divert Tank at the WPF. Table 5-5 below provides details of these new point source emissions to air from the installation and Figure 5-1 and Figure 5-2 show their location (small blue dots).

Table 5-5 – New Point Source Emissions to Air

New Release Point Reference	Release Point	Process Source	Nature of Emissions	Further Consideration?
A10	4 m (agl) stack	Contingency lagoon	Odour	✓
A11	10 m (agl) stack	BT1 and Divert Tank	Odour	✓

Figure 5-1 – Location of New Point Source Emission to Air – OCU at Creamery

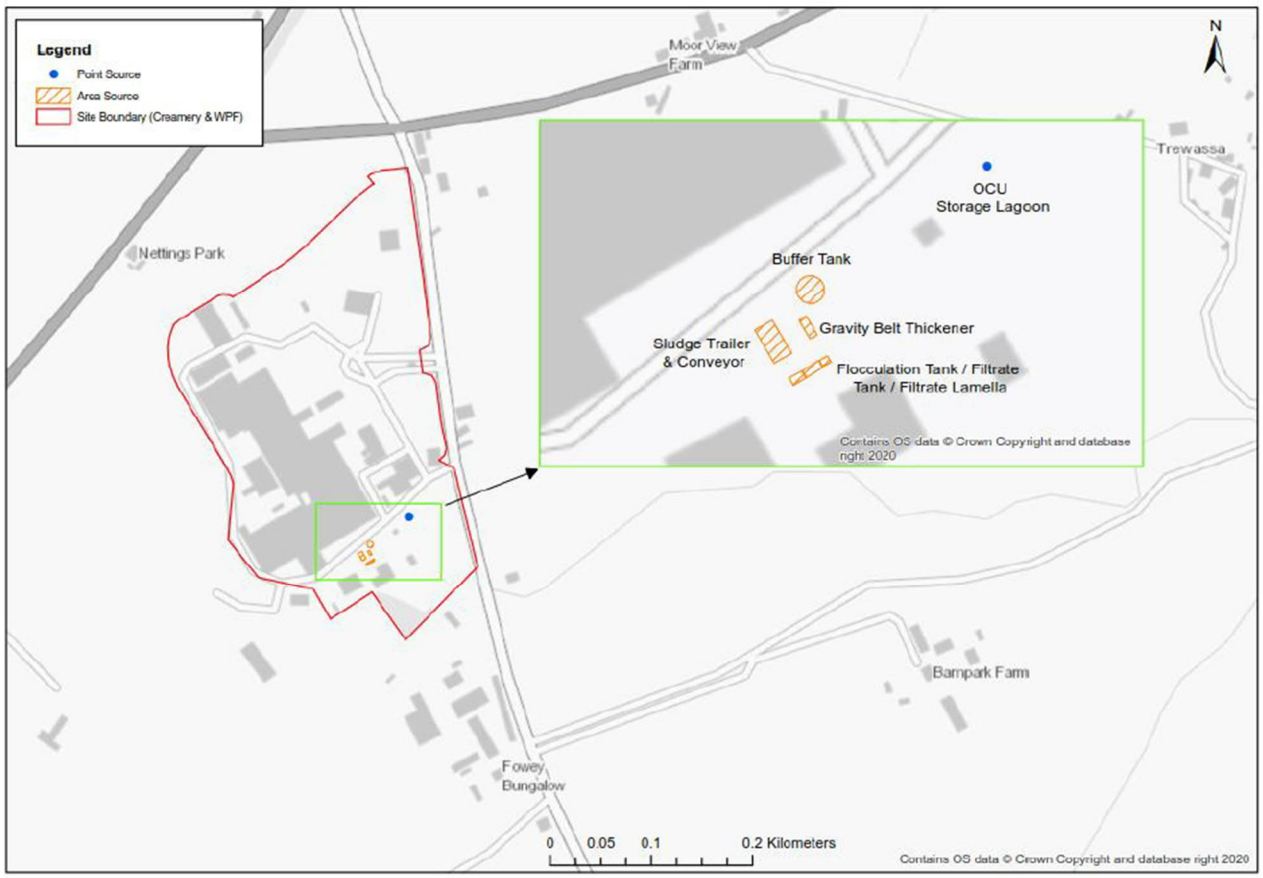


Figure 5-2 - Location of New Point Source Emission to Air – OCU at WPF

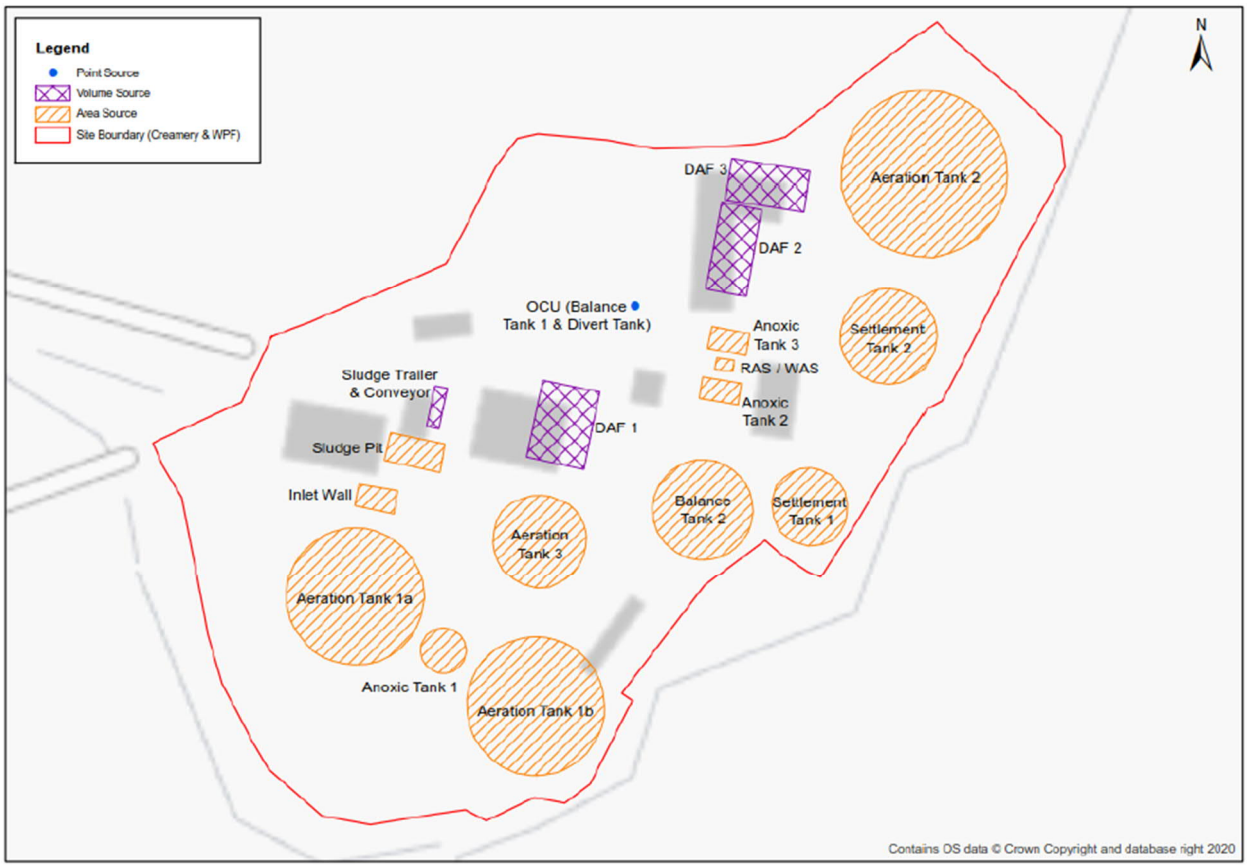


Table 5-6 below shows the emissions data for the two new point source emissions to air; data from this table has been used in the Odour Impact Assessment (Appendix F) to model and evaluate the potential impact of odour from the installation.

Table 5-6 – Inventory of Emission Point Sources to Air (Considered in Odour Impact Assessment)

Release Point Reference	Release Point	Height (m agl)	Efflux Velocity (m/s)	Exhaust Temperature (°C)	Odour Emission Rate (OU_E/s)	Basis for Data
A10	OCU – Contingency lagoon	4	1.4	14.3	2,017	Based on results from 2021 odour survey data
A11	OCU – BT1 and Divert Tank	10	22.4	17.8	1,970	Based on results from 2021 odour survey data

The only BAT Conclusions for point source emissions to air in the Food, Drink and Milk BREF (BAT 23 and associated monitoring in BAT 5) are for emissions to air from drying and, therefore, these are not relevant to the OCUs as they are not associated with drying activities. BAT Conclusions specifically related to odour are addressed in Section 5.5.

5.3. POINT SOURCE EMISSIONS TO WATER

Existing point source emissions to water are detailed in Schedule 3, Table S3.2 of the current environmental permit for Davidstow Creamery and comprise:

- W1 – Uncontaminated surface water drainage from interceptor and attenuation pond; and
- W2 – Treated effluent from the WPF.

No new point source emissions to water are introduced as a result of the permit variation application. However, the Environment Agency has conveyed its intention to review the ELVs for emission point W2 during the permit variation determination process. Further information on the ELV review process, including commentary on the Environment Agency's indicative ELVs provided during pre-application discussions and consideration of BAT, is provided in the Wastewater BAT Options Appraisal report in Appendix E.

The Tables below outline the BAT requirements for point source emissions to water and describe how Dairy Crest's operational arrangements meet these requirements.

Table 5-7 - BAT Requirements for Emissions to Water from Food, Drink and Milk BREF (December 2019)

BREF Requirements	Current / Proposed Arrangements	BAT?
BAT 11: In order to prevent uncontrolled emissions to water, BAT is to provide an appropriate buffer storage capacity for waste water.	The redeveloped WPF has been designed with improved buffer storage capacity and, in particular, this is provided by the enhanced functionality of the Divert Tank (900 m^3) / BT1 (2,300 m^3) and the provision of a UF / RO flow attenuation tank (100 m^3). Furthermore, the 600 m^3 partitioned contingency lagoon provides additional buffer storage capacity at the main Creamery for process effluent generated during other than normal operating conditions. The contingency lagoon, Divert Tank and BT1 can hold process effluent, if required, to prevent overloading of the WPF and therefore avoid uncontrolled emissions to water. The discharge of effluent / waste water from these tanks will only take place after monitoring has been undertaken to confirm an appropriate treatment route, e.g. controlled discharge to and treatment at the on-site WPF or tankering off site. The UF / RO flow attenuation tank helps to modulate the flow of final treated water discharged down the pipeline to the outfall W2 and into the River Inny. It provides buffer storage capacity in the event that the UF or RO unit(s) are out of service, however, the tank can also provide additional contingency / resilience as it can be used for other (buffer storage) purposes, if required. Enhanced automation and controls to manage waste water streams have been implemented on site with the introduction of continuous automatic monitoring, for example, the provision of pH control and external aeration on the Divert Tank (to keep the contents fresh). This will improve the WPF process control and efficiency, which therefore also minimises the need for additional buffer storage capacity (compared to that which is currently provided).	Yes
BAT 12: In order to reduce emissions to water, BAT is	An overview of the treatment process delivered at the WPF is provided in Section 4.3 above with a more detailed description of	Yes

to use an appropriate combination of the techniques given below: ▪ Preliminary and primary treatment: e.g., equalisation, neutralisation, physical separation, e.g., screens, sieves, grit separators, oil/fat separators, or primary settlement tanks ▪ Aerobic and/or anaerobic treatment (secondary treatment): e.g., activated sludge process, aerobic lagoon, upflow anaerobic sludge blanket, anaerobic contact process, membrane bioreactor ▪ Nitrogen Removal e.g., nitrification and/or denitrification, partial nitritation – anaerobic ammonium oxidation ▪ Phosphorus recovery and/or removal: e.g., phosphorus recovery as struvite, precipitation, enhanced biological phosphorus removal ▪ Final solids removal: e.g., coagulation and flocculation, sedimentation, filtration, flotation BAT associated emission levels (AELs) for emissions to water are shown below in Table 5-8 below and apply to direct emissions to a receiving water body. The BAT-AELs apply at the point where the emission leaves the installation.	the specific changes implemented as part of the redevelopment works and comprising the subject of this environmental permit variation application provided in Section 4.5. The WPF employs a number of techniques in an integrated treatment process, which incorporates preliminary, primary, secondary and tertiary treatment as required by BAT. For a detailed review of how the design and operation of the WPF is considered to meet BAT, the Wastewater BAT Options Appraisal in Appendix E should be referred to, however, a summary of relevant key points is provided below. There are two discharge pipes which transfer crude effluent to the WPF via gravity lines. The cheese and whey line discharges into an open channel whereby there is a 10 mm aperture channel screen for gross solids removal. From here the effluent is discharged into an inlet sump before being pumped to BT1 (or transferred to the Divert Tank if required). The Demin and GOS line does not require screening and is discharged directly into BT1 (or can also be transferred to the Divert Tank if required). The phosphorus rich waste stream from the Demin process is also pre-treated at the phosphate removal plant located at the Creamery before it arrives at the WPF. The Balance Tanks aid in the equalisation of the wastewater by combining wastewater of different loadings and pH adjustment also takes place here. Redevelopment of the WPF in terms of new plant and equipment and its configuration means that there is now more control over the quantity and quality of effluent delivered to the WPF for treatment. After balancing the effluent is treated via three DAF plants for solids, COD and phosphorus removal before passing to the biological treatment stage. Secondary treatment takes place in the form of a biological treatment plant which is comprised of two separate treatment systems; activated sludge with gravity settlement and the membrane bioreactor system (which has been upgraded with the introduction of a 4th MBR loop). A portion of the treated wastewater from this stage is then sent to the WRP; this incorporates ultrafiltration membranes followed by reverse osmosis to provide water that can be reused at the Creamery as part of processing operations. The reject stream from this stage is treated through AFM filters after which it is discharged to the River Inny. In relation to nitrogen removal, nitrification and denitrification is employed as part of the integrated treatment process at the WPF. Nitrification takes place in the Aeration Tanks where ammonia is oxidised to nitrate and the nitrate is then converted to nitrogen gas in the Anoxic Tanks. Phosphorus recovery takes place via chemical precipitation at the phosphate removal plant and is further enhanced by coagulation and flocculation at the DAF plant and Settlement Tank. In order to reduce the concentration of suspended solids in the final treated water (both to river and the WRP), a tertiary filtration system has been installed, which acts as a final polishing stage prior to discharge.	

	Monitoring data from W2 (monitoring point for treated effluent prior to discharge into the River Inny) demonstrates that the WPF can comply with the BAT-AELs from the Food, Drink and Milk BREF, when taking the average values, as detailed in Table 5-8 below. The Environment Agency has conveyed its intention to review the ELVs for point source emissions to water during the permit variation determination process. This will include additional parameters being specified in the monitoring regime in the permit and lower ELVs for some parameters already listed in the permit. In some cases, the ELVs are likely to be set lower than the BAT-AELs and other ELVs will be set for parameters which do not have BAT-AELs or Environmental Quality Standards (EQSs) and are not priority substances under the Water Framework Directive (WFD). The Environment Agency is intending to undertake an installation specific assessment to justify that BAT is being implemented when setting the ELVs for emissions to water. Further information is provided in the Wastewater BAT Options Appraisal in Appendix E.	

Table 5-8 - BAT AELs for Direct Emissions to a Receiving Water Body from Food, Drink and Milk BREF (December 2019)

Parameter	BAT-AEL (daily average)	Current Permit ELV	Davidstow Actual 2020 - 2021 Average (min – max)
Chemical Oxygen Demand (COD) (1)(2)	25-100 (3)	-	53 mg/l (11 – 380) **
Biological Oxygen Demand (BOD) (1)	<20	13	2.9 mg/l (1 – 47)
Total Suspended Solids (TSS)	4-50 (4)	20	17.16 mg/l (1 – 125)
Total Nitrogen (TN)	2-20 (5)(6)	-	9.2 mg/l (0.8 – 137) **
Total Phosphorus (TP)	0.2-2 (7)	1	0.33 mg/l (0.04 – 3.27)

(1) No BAT-AEL applies for biochemical oxygen demand (BOD). As an indication, the yearly average BOD_5 level in the effluent from a biological waste water treatment plant will generally be ≤ 20 mg/l.

(2) The BAT-AEL for COD may be replaced by a BAT-AEL for TOC. The correlation between COD and TOC is determined on a case-by-case basis. The BAT-AEL for TOC is the preferred option because TOC monitoring does not rely on the use of very toxic compounds.

(3) The upper end of the range is: — 125 mg/l for dairies.

(4) The lower end of the range is typically achieved when using filtration (e.g. sand filtration, microfiltration, membrane bioreactor), while the upper end of the range is typically achieved when using sedimentation only.

(5) The upper end of the range is 30 mg/l as a daily average only if the abatement efficiency is ≥ 80 % as a yearly average or as an average over the production period.

(6) The BAT-AEL may not apply when the temperature of the waste water is low (e.g. below 12 °C) for prolonged periods.

(7) The upper end of the range is: — 4 mg/l for dairies and starch installations producing modified and/or hydrolysed starch.

** For COD and TN the results are based internal lab data

Table 5-9 – BAT Requirements for Point Source Emissions to Water from Waste Treatment BREF (August 2018)

BREF Requirement	Current / Proposed Arrangements	BAT?
BAT 19: To optimise water consumption, to reduce the volume of waste water generated and to prevent, or, where that is not practicable, to reduce emissions to soil and water, BAT is to use an appropriate combination of techniques.	Refer to information provided in relation to BAT 19 from the Waste Treatment BREF in Table 3-17 above.	Yes
BAT 20: BAT is to treat waste water using an appropriate combination of the following techniques: ▪ Preliminary and primary treatment: e.g., equalisation, neutralisation, physical separation e.g., screens, sieves, grit separators ▪ Physico-chemical treatment: e.g., adsorption, distillation/rectification precipitation, chemical oxidation; chemical reduction, evaporation, ion exchange, stripping ▪ Biological treatment: e.g., activated sludge process, membrane bioreactor ▪ Nitrogen Removal through nitrification / denitrification ▪ Solids Removal: e.g., coagulation and flocculation, sedimentation, filtration, flotation BAT-AELs for emissions given to water are shown below in Table 5-10 and apply to direct emissions to a receiving water body.	Refer to information provided in relation to BAT 12 from the Food, Drink and Milk BREF in Table 5-7 above. The BAT-AELs from the Waste Treatment BREF, detailed in Table 5-10 below, are comparable to those from the Food, Drink and Milk BREF as detailed in Table 5-8 above.	Yes

Table 5-10 - Relevant BAT-AEL's for direct discharges to a receiving water body from Waste Treatment BREF

Substance / Parameter	BAT-AEL
Total organic carbon (TOC)	10 - 60 mg/l
Chemical oxygen demand (COD)	30 - 180 mg/l
Total suspended solids (TSS)	5 – 60 mg/l
Total nitrogen (Total N)	1 – 25 mg/l
Total phosphorus (Total P)	0.3 – 2 mg/l

5.4. EMISSIONS OF SUBSTANCES NOT CONTROLLED BY EMISSION LIMITS

FUGITIVE EMISSIONS TO WATER

Fugitive emissions to water are reviewed under four headings, as follows:

- Sub-surface structures and sumps;
- Surfacing;
- Bunds / secondary containment; and
- Storage areas for IBCs, drums and bags etc.

Sub-Surface Structures and Sumps

Table 5-11 below provides a list of all new sub-surface structures associated with the environmental permit variation application, i.e. the Creamery projects and redeveloped WPF as described in Section 4 above. The table details what materials the sub-surface structures contain alongside estimated releases, control and monitoring measures and any improvements to be implemented.

Table 5-11 – Sub-Surface Fugitive Emissions for New Underground Structures

Source	Specification	Substance Released	Estimated Release	Control and Monitoring Measures	Improvements Proposed
Contingency lagoon	Cast concrete partitioned lagoon treated with a 2 mm chemical resistant epoxy resin coating on the walls and floor	Process materials (ingredients and intermediates) from the Creamery during abnormal operations and / or effluent from the phosphate removal plant Balance Tank	Potential for fugitive releases from construction joints	The epoxy coating has a 20-yr material guarantee. The product warranty includes a 5-year inspection plan whereby the spark test (originally undertaken during commissioning) will be repeated and any damage repaired.	None required
New section of pipeline from WPF to River Inny [1]	1.8 km of 225 mm twin wall unperforated drainage pipe	Final treated effluent from the WPF	Potential for fugitive releases from joints in the pipework	Rodding eyes are present approximately every 100 m along the pipeline to allow for inspection and maintenance. An inspection cameral will be used by the Dairy Crest maintenance team in accordance with the site's Planned Preventative Maintenance Programme (PPMP).	None required

Notes: 1. Further details on the replacement section of pipeline are provided in the SCR in Appendix B. This is not listed as a specific change comprising part of the permit variation application as it is a like for like replacement due to the original pipeline reaching the end of its design life. It is, however, included in the SCR as the Environment Agency has requested that it be included in the installation boundary.

Surfacing

Table 5-12 below provides a list of all new surface finishes proposed on site associated with the environmental permit variation application, i.e. the Creamery projects and redeveloped WPF as described in Section 4 above. The table details the potential substances the surfaces may have to hold and an estimate of the annual releases.

Most of the changes at the Creamery and WPF are being implemented within areas of the site that are already developed and, therefore, do not require new or upgraded surfacing. The exception to this is the new raw material store which is being developed on an area of land located next to the existing WPF.

Table 5-12 – Surface Fugitive Emissions for New Surfacing

Area	Design	Impervious Surface with Sealed Drainage System	Substance Contained	Actual Emissions	Control and Monitoring Measures	Improvements Proposed
Raw material store	Hardstanding (gravel chippings)	No	Chemicals used at the WPF (for a full list refer to Table 3-11 in Section 3.3 above)	No	Chemicals will not be stored directly on the hardstanding but within IBCs which will be housed inside self-bunded steel storage containers. A written procedure for chemical delivery will be in place and the surface integrity will be regularly inspected.	None required

Bunds / Secondary Containment

Table 5-13 below lists all new fixed tanks on site associated with the environmental permit variation application, i.e. the Creamery projects and redeveloped WPF as described in Section 4 above. The table also summarises the primary, secondary and tertiary containment measures which are in place for the tanks / vessels. Appropriate containment is provided to ensure that any liquids stored in containers do not present an unacceptable risk to the environment or human health.

All tanks are impermeable and resistant to the stored materials and regularly inspected for their integrity.

Table 5-13 – Containment Measures for New Fixed Tanks

Vessel / Tank	Is the structure bunded? (Y/N)	Description	Tank Capacity (litres)	Primary Containment	Secondary Containment	Tertiary Containment
CIP - caustic tank	Yes, within the factory	Raw material for CIP process	20,000	Stainless steel tank	Creamery building	Trade effluent drains and WPF
CIP - acid tank	Yes, within the factory	Raw material for CIP process	20,000	Stainless steel tank	Creamery building	Trade effluent drains and WPF
CIP - hot water tank	No	Raw material for CIP process	40,000	Stainless steel tank	Surface water drains	Attenuation pond
CIP - fresh water tank	No	Raw material for CIP process	40,000	Stainless steel tank	Surface water drains	Attenuation pond
CIP - drain attenuation tank	No	Attenuating rinse water to drain	110,000	Stainless steel tank	Surface water drains	Attenuation pond
Milk protein standardisation - storage/dosing tank	Yes, within the factory	Intermediate product storage	10,000	Stainless steel tank	Creamery building	Trade effluent drains and WPF
Milk protein standardisation - permeate tanks x 2	Yes, within the factory	Export storage tank	60,000 (each)	Stainless steel tank	Creamery building	Trade effluent drains and WPF
Milk fat standardisation - cream buffer tank	Yes, within the factory	Intermediate product storage	15,000	Stainless steel tank	Creamery building	Trade effluent drains and WPF
Milk fat standardisation - cream ageing tanks x 2	No	Export storage tank	60,000 (each)	Stainless steel tank	Hardstanding and trade effluent drains	WPF
WPC35 - Retentate tanks x 2	Yes, within the factory	Intermediate product storage	2,000 (each)	Stainless steel tank	Creamery building	Trade effluent drains and WPF
GOS export storage tank	Yes, within the factory	Process vessel	25,000	Stainless steel tank	Creamery building	Trade effluent

						drains and WPF
Redeveloped WPF - upgraded AFM tanks x 4	Yes, within the WPF	WPF process tank	5,000 (each)	GRP	WPF building	Down gradient perimeter containment wall
Redeveloped WPF – UF / RO flow attenuation tank	Yes, within the WPF	WPF process tank	100,00	Mild steel	Down gradient perimeter containment wall	WPF
Redeveloped WPF – tertiary filters filtrate tank	Yes, within the WPF	WPF process tank	4,000	Stainless steel	WPF building	Down gradient perimeter containment wall

Storage Areas for IBCs, Drums, Bags etc.

As described in Section 4 above, a new area of land adjacent to the WPF is to be used for chemical storage. The chemicals to be stored are described in Table 4-17 above. These will be held in 1,000 litre IBCs which in turn will be housed within three self-bunded steel containers (with the addition of surplus IBCs being stored on pallet sumps). The containers / IBCs will be stored on gravel hardstanding and the area will be fenced for security / access control. A separate SCR has been produced for this new area of land to be incorporated into the installation boundary (Appendix B).

The table below details indicative BAT requirements for fugitive emissions from GOV.UK guidance.

Table 5-14 – Indicative BAT Requirements for emissions of substances not controlled by emissions limits from GOV.UK Guidance

GOV.UK Requirements	Current / Proposed Arrangements	BAT?
Emissions to water: ▪ You need to ensure that site surfaces, including roofs, hardstanding, working areas, and any containment structures required by your permit, such as bunds and other secondary containment measures, and your site drainage infrastructure will prevent pollution to surface and ground water. ▪ Rainfall collection systems must be kept separate from contaminated, or potentially contaminated, areas of the site. ▪ Surfaces and containment and drainage facilities must be resistant to spilled chemicals.	As per Table 5-12 above, there have been / will be no changes to the site surfacing at the main Creamery or WPF as a result of the environmental permit variation being applied for. Some internal building work is required in order for refurbishments and equipment installation / replacements to take place and minor local drainage modifications have been required to integrate the new plant and equipment. However, no significant changes have taken place to surfacing or site drainage. There are three separate drainage systems on site; for uncontaminated surface water, process (trade) effluent and foul domestic wastewater. Surface water passes via interceptors before entering an attenuation pond and is then	Yes

▪ A plan should be included in your management system about how surfaces and containment facilities will be inspected and maintained. **The following measures should be incorporated to prevent contaminated run-off polluting groundwater or surface waters:** ▪ A waterproof surface ▪ Spill containment kerbs ▪ Sealed construction joints **If you have a sealed drainage system, you must:** ▪ Collect any liquid that passes through the system in a sealed sump unless you have a permit to discharge. ▪ Dispose of collected liquid through a treatment facility or have it collected by a waste disposal company. **If your operation causes pollution you must:** ▪ Clean up the pollution as soon as possible. ▪ Stop the activity until you have changed your operation to prevent future pollution. ▪ Inform the Environment Agency.	discharged into the River Inny. Monitoring instrumentation is provided for pH, oil and turbidity with an automatic slam shut valve which operates in the event of a failure. Process effluent drains lead directly, via two pipelines, to the WPF where the effluent it is treated prior to discharge into the River Inny. Further details on the monitoring performed on this effluent stream (at W2) are provided in Table 5-1 above. Domestic foul effluent is segregated and flows via a dedicated pipeline to the WPF area where it is treated through a package sewage treatment plant prior to discharge to the River Inny. Waterproof surfaces with spill containment kerbs and sealed construction joints are provided at various locations across the site, however, these have not changed as a result of the environmental permit variation application being applied for. The sealed drainage system (for process / trade effluent) at the Creamery collects effluent and delivers it to an inlet sump or BT1 (or it can be directed to the Divert Tank if required) at the WPF where is undergoes treatment before being discharged to the River Inny in accordance with the environmental permit. Effluent can be tankered off site from various locations / tanks for disposal if required, i.e. in the event that it does not meet the specification for treatment at the WPF. At the WPF, all tanks and structures are sited on concrete hardstanding with additional local impermeable hardstanding and kerbing provided in key areas. Any areas of impermeable ground drain to a sump within the perimeter containment wall which acts as an additional bund; any liquid that collects in the sump is returned to the WPF for treatment. Emergency spill procedures, alongside Accident Management Plans and Risk Assessments, are in place. As part of this permit variation process, these have been reviewed and updated in line with the proposed changes. In the event that any operations cause pollution, or have the potential to cause pollution, action will be taken promptly to stop any loss of containment and the Environment Agency informed where required.	
Leaks from Containers: ▪ Leaks or accidental releases of liquids that could cause pollution from tanks, sumps, containers and bunds must be prevented.	As per the above section, any leaks or accidental releases will be contained by the site drainage systems.	Yes

▪ You must design your site so that leaks from underground structures are prevented and detected quickly. ▪ A record of the route of any underground drains or pipework on site must be retained. ▪ If oil is used, oil separators must be installed to surface water drainage systems. ▪ Containment for underground pipework, sumps and storage vessels must be provided. A leak detection system will need to be installed if site is located within a groundwater Source Protection Zone. ▪ A list must be kept of any underground sumps or storage vessels. These must be waterproof and resistant to any materials that will be stored in them. **The following must be undertaken:** ▪ Checks to ensure sumps and bunds are working correctly ▪ Hydraulic testing for any sumps or bunds you suspect are not working properly ▪ Fit a high-level probe to any sumps or bunds that you cannot check with an alarm **Bunds must have a capacity larger than both:** ▪ 110% of the largest tank the bund is protecting ▪ 25% of the combined volume of all the tanks the bund is protecting **Bunds must also:** ▪ Have no outlets ▪ Drain to a blind collection point ▪ Have self-contained pipework that is separate from the container pipework ▪ Any area where environmentally harmful substances are stored must be bunded ▪ Substances must be stored separately if there is a hazard of storing them close to each other **Storage areas must:** ▪ Be located away from watercourses, sensitive groundwater areas, unprotected drainage systems and sensitive boundaries	In order to reduce the risk of leaks or accidental releases, containers are stored in secure, designated areas provided with appropriate secondary containment. Specifically in relation to the environmental permit variation being applied for, any new underground structure and fixed tanks are detailed in Table 5-11 and Table 5-13 above, along with information on bunding and other control measures. A site drainage plan is maintained which records all drainage routes. Other than local minor drainage modifications to connect new plant and equipment, there are no changes to the existing drainage infrastructure. However, following a recent drainage survey, all trade effluent and surface water drains at the Creamery have been relined / repaired. Interceptors / oil separators are currently installed within the surface water drainage system at the Creamery. The site is not located in a Source Protection Zone. All drainage infrastructure, tanks, bunds and sumps are subject to regular checks and inspection in accordance with the site's PPMP. No new tank bunds have been constructed that form part of the environmental permit variation application, however, there are a number of existing bunds across the site that meet the necessary specification and requirements. A downgradient perimeter containment wall has been constructed at the WPF which acts as an additional bund; the design has been calculated so that the WPF can contain at least 110 % of the largest tank size. Any effluent that drains this way is collected in a sealed sump and returned to the WPF. Additional secondary containment has also been constructed around BT1 / Divert Tank in the form of a local cast concrete wall to provide extra mitigation against spills or leaks. A new raw material store has been developed on an area of land adjacent to the WPF. It is used to store chemicals that are used in the wastewater treatment process. Whilst this area itself is not bunded, the chemicals are stored in IBCs inside self-bunded steel storage containers that can contain 25 % of the total volume of containers (16 x IBCs). Further details on the raw material store are provided in Section 4 above and in the Site Condition Report in Appendix B.	

▪ Be clearly marked and ensure any containers within them are clearly marked ▪ Define the maximum storage capacities for each storage area and container ▪ Have containers stored securely with lids, caps and valves in place ▪ Be inspected at least once a week to check not damaged	Operatives are trained to ensure that all containers, including empty containers, are stored with lids, caps and valves secured and in place. All storage containers are inspected and dealt with appropriately if found to be damaged. The raw material sore will be added to the site's inspection and maintenance programme.	

DUST, MUD, LITTER AND PESTS

Installations are required to use appropriate measures to prevent emissions of dust and particulates, including mud, litter and pests. Whilst there are no specific BAT Conclusions in the BREFs relevant to the Davidstow site, the tables below outline the indicative BAT requirements (or appropriate measures) from the GOV.UK website and describe how Dairy Crest's operational arrangements meet these requirements.

Table 5-15 – Indicative BAT Requirements for Dust, Mud and Litter from GOV.UK Guidance

GOV.UK Requirements	Current / Proposed Arrangements	BAT?
Site layout, housekeeping and operations: ▪ Designing the layout of your site to prevent emissions and limit the emissions sensitive receptors are exposed to ▪ Using good housekeeping practices to make sure your site is clear of dust, mud, litter and other debris ▪ Using road sweepers to remove dust, mud, litter and other debris ▪ Erecting litter fences or micro-netting around the site ▪ Avoiding activities that could spread dust and particulates, mud or litter during high winds ▪ Making sure treatment process parameters, such as temperature or moisture, are set at the right level ▪ Making sure abatement systems are designed to treat and minimise releases – these systems must be monitored and maintained following the designer's or manufacturer's recommendations ▪ Enclosure of relevant activities in buildings ▪ Managing vehicle movements ▪ Dust suppression and monitoring	The primary feedstocks (milk at the Creamery and effluent at the WPF) are liquid and, therefore, do not have the potential to generate dust, mud or litter. The dairy processes are carried out within a building and the WPF activities are carried out in buildings and / or enclosed tanks and vessels; no dry or dusty raw materials are used in the process. No raw materials or wastes are stockpiled at the installation. The main potential litter source is cardboard and plastic packaging materials; these are stored within a dedicated area of the Creamery building. Waste packaging materials are storage in designated enclosed containers to prevent the escape of litter. Roadways are constructed of hardstanding and maintained in good condition so that they can be cleaned effectively, as necessary. Vehicles within the installation will remain on designated roadways and delivery areas. Rigorous maintenance procedures and regular housekeeping ensure that the site is kept clean and emissions of dust, mud and litter are minimised. It is not considered that the changes that form part of the permit variation application	Yes

▪ Managing stockpiled wastes	have the potential to increase emissions of dust, mud or litter.	

Table 5-16 – Indicative BAT Requirements for Pest Management from GOV.UK Guidance

GOV.UK Requirements	Current / Proposed Arrangements	BAT?
If your activity causes pests (such as birds or flies) you must control them by: ▪ Undertaking regular inspections ▪ Securing and removing waste that attracts scavenging birds or flies ▪ Employing professional pest controllers ▪ Using deterrent methods, such as scaring ▪ Netting A pest management plan is to be produced explaining how pests will be prevented or minimised if your risk assessment shows that your operation is likely to cause pests.	The activities undertaken at the Creamery and WPF do not particularly attract pests. The Creamery operations are undertaken inside enclosed buildings. The site is a food producer and as such has to maintain a high standard of hygiene. The WPF only treats process effluent from the Creamery and does not accept solid or biodegradable wastes which are associated more with pests. All process and equipment changes that form part of this permit variation application will either take place in enclosed buildings with the doors kept shut or within enclosed pipework or tanks that are not generally accessible. These measures would prevent any pest infestation issues. Nonetheless the site has a third party pest control contractor visits regularly to ensure that all pest control at site is managed effectively.	Yes

5.5. ODOUR

The main raw material (milk) is not inherently odorous and as the six Creamery projects are primarily located within the Creamery building, they are not expected to give rise to additional odour risk. The activities undertaken at the WPF are considered to have the greatest potential to generate odours. This is because dairy wastewater is high in COD and, therefore, there is the potential for organic compounds to be broken down into smaller, more odorous constituents. However, a number of the changes implemented at the WPF, that form the subject of this environmental permit variation application, have the objective of minimising odour emissions, as detailed below:

- New contingency lagoon with extraction to an OCU (note this is physically located at the Creamery but has been implemented as part of the redevelopment of the WPF) – the contingency lagoon has been installed to help manage abnormal operations at the Creamery which would otherwise discharge process material directly to the WPF in a short space of time. This would have the potential to overload the WPF and have an impact on odours.]Further information on the contingency lagoon and OCU is provided in Table 4-9 in Section 4 above.

- Covering and extraction of BT1 and Divert Tank to a new OCU – these tanks have been covered with a GRP lid and the air displaced from the covered headspace of the tanks is

treated via an OCU, in order to minimise odours, before discharge to atmosphere. This provides additional contingency (on top of that provided by operation of the contingency lagoon) to minimise odour emissions at the WPF associated with failure modes at the Creamery. The provision of tank covers also reduces the base level of odorous emissions during steady state operation of the Creamery and WPF. Further information on the OCU at BT1 / Divert Tank is provided in Table 4-11 in Section 4 above.

- New aeration pumps for BT1 and Divert Tank – the new pumps maximise aeration of the process at this stage, prevent degradation of the tanks' contents and, therefore, minimise odorous emissions.

- Implementation of additional process monitoring to control odour – monitoring of Dissolved Oxygen (DO) in BT1 / Divert Tank and hydrogen sulphide (H2S) (as a proxy for total odour) in the headspace of both tanks is undertaken. Periodic monitoring at the inlet / outlet the OCUs is performed to help assess and check the abatement efficiency. Enhanced automation and controls to manage wastewater streams have also been implemented on site with the introduction of continuous automatic monitoring, for example, the provision of pH control on the Divert Tank which further prevents odorous emissions.

- Provision of floating discs on BT2 – BT2 is required to remain open / uncovered in order to optimise the aeration process, however, floating discs have been employed as a management technique to reduce the potential for odorous emissions from this source;

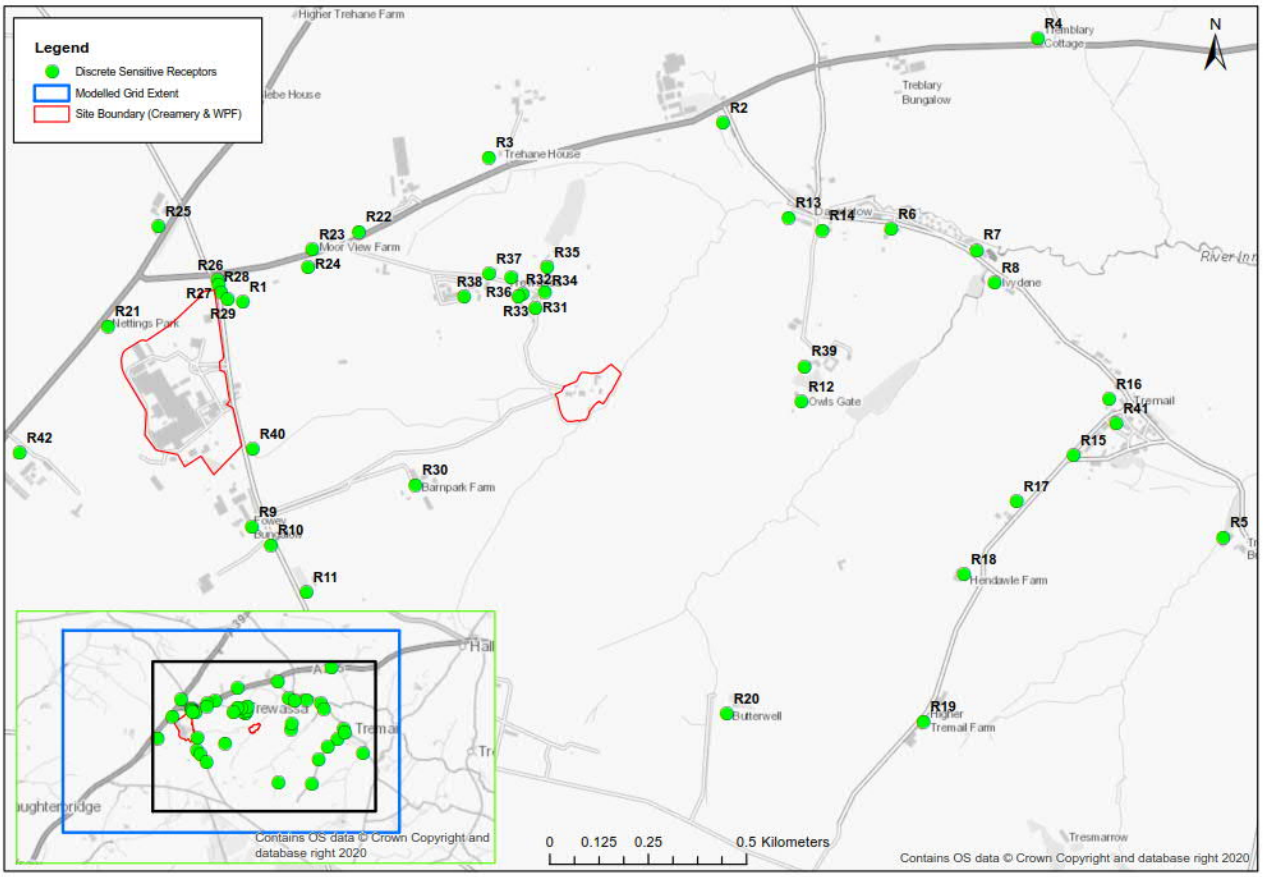
- Enclosure of sludge centrifuges and trailer – this plant and equipment, which forms part of the sludge handling process at the WPF, has been partially enclosed by a rigid structure constructed between the two centrifuge skids to minimise the potential for odours to be carried on prevailing wind. It is further proposed to construct a new encloser later this year; this will enclose the centrifuge containers and the trailers with roller shutter door access into the new building.

The operations at the WPF that have the greatest potential to give rise to odour are:

- Contingency lagoon extracted to OCU;
- BT1 and Divert Tank extracted to OCU;
- Sludge pit at WPF;
- Sludge trailer and conveyor at WPF;
- Flocculation tank (part of phosphate removal plant);
- BT2 at WPF; and
- Inlet well at WPF.

The site is located in a predominantly rural location, however, there are a number of local sensitive receptors; these are predominantly located in the nearby villages of Trewassa, Treworra, Davidstow and Tremail, but there are also a number of isolated individual dwellings. **Figure** 5-3 below shows the location of potential odour sensitive receptors in the vicinity of the facility.

Figure 5-3 – Location of Potential Odour Sensitive Receptors



The tables below outline the BAT requirements for odour and describe how Dairy Crest's operational arrangements meet these requirements.

Table 5-17 – Indicative BAT Requirements for Odour from GOV.UK Guidance

GOV.UK Requirements	Current / Proposed Arrangements	BAT?
You must prevent, or minimise where prevention is not possible, odour. Appropriate measures must be incorporated including: ▪ Restricting raw materials likely to cause odour ▪ Minimising quantities and storage times for odorous or potentially odorous materials ▪ Management materials and processes in ways which minimise the production of odorous chemicals ▪ Working within the effective operational capacity of the site	The main raw material (milk) used in the manufacturing process at the Creamery is not inherently odorous. Other raw materials used in both the Creamery processes and at the WPF are detailed in Table 3-11 above; none of these are considered to be particularly odorous. Wastewater treatment and cleaning chemicals, which could give rise to fugitive releases, are stored in appropriate containers with lids, caps and valves in place. The activities undertaken at the WPF have the greatest potential to generate odour. Rather than minimising quantities and storage times for odorous materials, it is more important to implement a number of key operational controls in order to reduce the potential for odorous emissions. These can generally be attributed to:	Yes

▪ Providing effective containment and abatement for odorous materials and activities	▪ Measures at the Creamery to manage a consistent flow and load of untreated effluent to the WPF; and ▪ Proactive controls at the WPF that contribute to minimisation of odour, including monitoring, mixing and aeration, sludge management and equipment inspection and maintenance. During previous odour monitoring exercises, BT1 and the Divert Tank were identified to contribute to >90 % of the odours generated at the WPF. These tanks have subsequently been provided with containment and abatement i.e. covered and extracted to an OCU.	
You must produce an odour management plan that details how odour will be prevented and/or minimised if your site causes odour pollution or if any of the following activities are undertaken: ▪ Food production involving any form of cooking or heating and brewing	Dairy Crest operates in the food production sector (which involves heating) and, as such, is required to have an OMP in accordance with the GOV.UK guidance. However, as detailed previously, the WPF is considered to represent the greater risk in terms of odour potential (although wastewater treatment is not listed as an activity requiring an OMP in the GOV.UK guidance). As detailed in permit condition 3.4.2 (qualitative odour boundary condition), the Environment Agency can request an OMP to be produced by an operator and submitted to the Regulator for approval. Dairy Crest has an existing OMP in place which is implemented as part of its EMS; further details are provided in Table 5-18 below.	Yes

Table 5-18 - BAT Requirements for Odour from Food, Drink and Milk BREF (December 2019)

BREF Requirements	Current / Proposed Arrangements	BAT?
BAT 15: In order to prevent or, where that is not practicable, to reduce odour emissions, BAT is to set up, implement and regularly review an odour management plan, as part of the environmental management system (see BAT 1), that includes all of the following elements: ▪ A protocol containing actions and timelines. ▪ A protocol for conducting odour monitoring. It may be complemented by measurement/estimation of odour exposure or estimation of odour impact. ▪ A protocol for response to identified odour incidents, e.g. complaints.	Dairy Crest has an existing OMP which is implemented as part of its EMS. The OMP has been developed with reference to the Environment Agency's H4 Odour Management Guidance and includes the following: 1. Introduction and purpose 2. Overview 3. Operational controls – Creamery and WPF (including normal and abnormal operations) 4. On-site odour monitoring 5. Off-site odour monitoring 6. External complaints 7. Responsibilities Appendix 1: On-site monitoring log Appendix 2: Off-site monitoring log	Yes

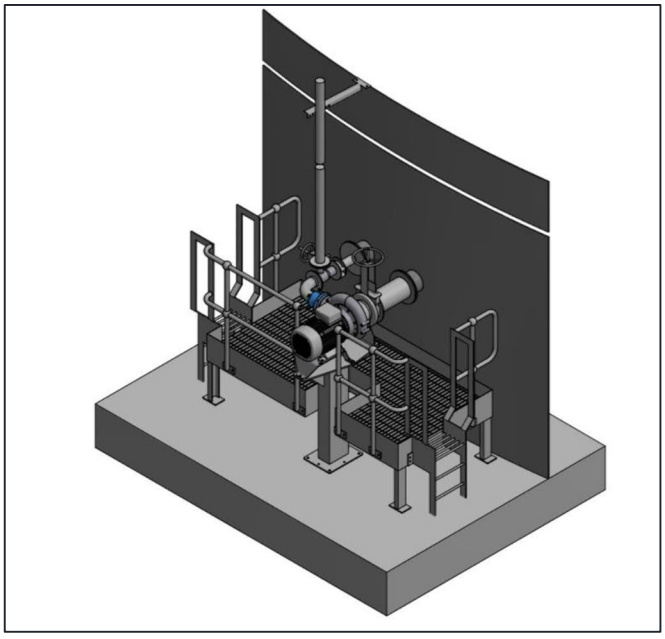
▪ An odour prevention and reduction programme designed to identify the source(s); to measure/estimate odour exposure; to characterise the contributions of the sources; and to implement prevention and/or reduction measures.	Relevant EMS documents and procedures will be reviewed and updated, as necessary, as a result of the changes on site which are the subject of this environmental permit variation application.	

Table 5-19 - BAT Requirements for Odour from Waste Treatment BREF (August 2018)

BREF Requirements	Current / Proposed Arrangements	BAT?
BAT 12: In order to prevent, or reduce, odour emissions, BAT is to set up, implement and regularly review an odour management plan as part of the EMS.	See Table 5-18 above.	Yes
BAT 13: In order to prevent, or reduce, odour emissions, BAT is to use one or a combination of the following techniques: a. Minimising residence times b. Using chemical treatment c. Optimising aerobic treatment	As detailed above, rather than minimising residence times at the WPF, it is more important to implement a number of key operational controls in order to reduce the potential for odorous emissions. Chemical treatment is used as one of the techniques at the WPF; caustic is dosed in the reception tanks to increase the pH of the predominantly acidic effluent received from Demin in order to minimise emissions of odour. Aerobic treatment is optimised using a number of techniques, including aeration, removal of sludge in tanks and frequent maintenance of the aeration system. As detailed previously, BT1 was identified to be the predominant source of odour at the WPF. Maintaining good operating conditions in BT1 are known to be a critical management control to minimise emissions of odour from the WPF as a whole; most notably maintaining adequate levels of DO in BT1 of circa 2 mg/litre is key to prevention of the formation of reduced sulphur compounds. Similarly, good mixing is required to prevent quiescent zones within the tank which become oxygen depleted. The previous submerged 'helixor' systems in BT1 and the Divert Tank were replaced with externally mounted Landia type mixer / aerator pumps in January 2020, as shown in Figure 5-4 below. The pumps are installed with Variable Speed Drives (VSDs) to enable operation to be optimised over time for various operating conditions of flow / load. Effectiveness of operation is measured by new instrumentation to provide more reliable and representative measurement of DO in BT1.	Yes
BAT 14: In order to prevent, or reduce, diffuse emissions to air (including dust, organic compounds and odour), BAT	The techniques listed are not all applicable to the treatment of wastewater at the WPF, however, a number are implemented as detailed below.	Yes

is to use an appropriate combination of the techniques below: a. Minimising the number of potential diffuse emission sources b. Selection and use of high-integrity equipment c. Corrosion prevention d. Containment, collection and treatment of diffuse emissions e. Dampening f. Maintenance g. Cleaning of waste treatment and storage areas h. Leak detection and repair (LDAR) programme	The number of potential diffuse emission sources is minimised by the appropriate design of piping layout, including reducing the number of flanges and valves and using welded fittings and pipes wherever possible. Other examples include the provision of floating discs on BT2 and enclosure of the sludge centrifuges and trailer. High integrity plant and equipment is selected when purchasing new equipment for the WPF, including tanks, valves, pumps, compressors and agitators. Corrosion prevention is also considered by ensuring that appropriate construction materials are selected for tanks and other equipment so that they are resistant to the contents that they store and come into contact with. Emissions from the most odorous parts of the process are contained, collected and treated by an OCU. This includes combined emissions from BT1 and the Divert Tank and emissions from the contingency lagoon.	

Figure 5-4 – Externally Mounted Aeration Pump on BT1



As agreed with the Environment Agency during pre-application discussions, an Odour Impact Assessment has been undertaken to support the environmental permit variation application (Appendix F). The aim of the assessment was to establish the potential impacts of the changes implemented on site on odour emissions and the associated odour concentrations experienced at sensitive locations in the local area (refer to Figure 5-3 above).

The modelled odour emissions from both the Creamery and WPF odour sources were based on an average of the emission rates obtained from annual odour monitoring surveys completed between 2019 and 2021. This approach was employed to account for daily and seasonal influences on odour releases from the site and also to account for the incremental improvements applied to the WPF in recent years, which are the subject of this environmental permit variation application.

The results of the assessment have demonstrated that the benchmark criterion (1.5 OU_E/m^3) is not predicted to be exceeded at any of the identified sensitive receptors. However, the predicted odour concentration is predicted to be equal to the benchmark (but not exceed it) at the closest receptor to the WPF when using the worst case dispersion conditions.

The outputs of the assessment were compared to equivalent odour baseline modelling results presented in the 2017 assessment for the site, thereby enabling a comparison of potential odour impacts before and after the implementation of the improvement works covered by the permit variation application. This comparison has demonstrated that the improvement works already implemented and proposed for the WPF site are expected to significantly reduce odour emissions and associated impacts at identified sensitive receptors relative to the 2017 baseline.

5.6. NOISE

A number of the activities undertaken at the Creamery and WPF have the potential to generate noise emissions; these are regulated by the Environment Agency in accordance with the standard qualitative noise boundary condition in the environmental permit (Condition 3.5.1). To date, Dairy Crest has not been notified by the Environment Agency to submit a formal Noise Management Plan (NMP) for approval (in accordance with Condition 3.5.2).

Previous and extensive baseline noise survey work has been undertaken for both the Creamery and the WPF, including source noise measurements of existing operational plant items and monitoring the prevailing noise environment at a sample of the closest noise sensitive receptors. With respect to the changes on site that are the subject of this environmental permit variation application, many of the changes comprise internal project updates, i.e. those inside the main Creamery building such as the new CIP set, milk protein standardisation and cheese capacity growth phase 3 etc. These projects, therefore, are not considered to have the potential to cause a significant change in noise levels at the closest noise sensitive receptors. However, some of the other changes, particularly those at the WPF, could have the potential to give rise to a change in operational noise levels, e.g. new aeration pumps, downstream tertiary filters, OCUs etc.

It should also be noted that the following changes implemented at the WPF, that are included in this environmental permit variation application, have the objective of minimising noise emissions, as detailed below:

- New acoustic fencing has been installed along the boundary to the north of BT1 and the Divert Tank (to provide additional mitigation to the noise sensitive receptors located at Trewassa). The fencing (shown in
-
- Figure 5-5 below) comprises panels manufactured from glass reinforced polymers which are durable, have low maintenance requirements and conform to EN 14388.
- New noise monitoring equipment has been installed on tank ST2 (shown in Figure 5-6 below). The output in monitored on the SCADA system and the data is trended on data history and traceable at short notice in order to identify any foreseeable problems with noise emissions from the site.

Figure 5-5 – Photo of Acoustic Fencing Installed

Figure 5-6 – Photo of Noise Monitoring Equipment

In terms of local noise sensitive receptors in the vicinity of the facility, these are considered to be the same receptors identified in Section 5.5 (and shown Figure 5-3) above for odour. They are predominantly located in the nearby villages of Trewassa, Treworra, Davidstow and Tremail, but there are also a number of isolated individual dwellings.

The tables below outline the BAT requirements for odour and describe how Dairy Crest's operational arrangements meet these requirements.

Table 5-20 - BAT Requirements for Noise from Food, Drink and Milk BREF (December 2019)

BREF Requirements	Current / Proposed Arrangements	BAT?
BAT 13: In order to prevent or, where that is not practicable, to reduce noise emissions, BAT is to set up, implement and regularly review a noise management plan, as part of the environmental management system (see BAT 1), that includes all of the following elements: ▪ A protocol containing actions and timelines. ▪ A protocol for conducting noise emissions monitoring. ▪ A protocol for response to identified odour incidents, e.g. complaints. ▪ A noise reduction programme designed to identify the source(s); to measure/estimate noise and vibration exposure; to characterise the contributions of the sources; and to implement prevention and/or reduction measures. BAT 13 is only applicable to cases where a noise nuisance at sensitive receptors is expected and/or has been substantiated.	Whilst Dairy Crest has a number of the measures in place, as identified in BAT 13, it does not have a formal NMP. To date, Dairy Crest has not been notified by the Environment Agency to submit a NMP for approval in accordance with permit Condition 3.5.2. It is noted that the pre-application advice letter from the Environment Agency makes reference to a NMP. However, during subsequent discussions with the National Permitting Team, it confirmed that a NMP would not be required to be submitted as part of the permit variation application as long as the results of the Noise Impact Assessment did not predict a problem with noise beyond the site boundary. This is because the permit variation application only focuses on the changes on site (i.e. Creamery Projects 1-6 and the redeveloped WPF). Therefore, it would not make sense to develop a NMP for these aspects in isolation and it was agreed that, if a NMP was considered to be necessary, one should be produced for the installation as a whole and requested in accordance with permit Condition 3.5.2 rather than forming part of the permit variation determination. The Noise Impact Assessment determined that a noise nuisance a sensitive receptors is considered unlikely as a result of the changes covered by the permit variation application.	Yes
BAT 14: In order to prevent or, where that is not practicable, to reduce noise emissions, BAT is to use one or a combination of the techniques given below: a. Appropriate location of equipment and buildings; b. Operational measures; c. Low-noise equipment;	Whilst noise levels can be reduced by increasing the distance between the emitter and the receiver, by using buildings as noise screens and by relocating buildings' exits or entrances, the BREF notes that this may not be possible for existing plants. Nonetheless, the changes at the Creamery are all located within the building (i.e. Projects 1-6) and, where possible, noise generative plant at equipment at the WPF is also located within buildings (e.g. DAFs). Dairy Crest implements a number of operational measures to reduce noise emissions, including inspection and maintenance regimes, closing doors and windows where	Yes

d. Noise control equipment; e. Noise abatement.	possible and equipment operation by experienced staff. Low-noise plant and equipment is selected where possible. Noise control measures include the insulation and / or enclosure of noisy equipment. Noise abatement has also been installed in the form of acoustic fencing along the boundary to the north of BT1 and the Divert Tank to provide additional mitigation to the noise sensitive receptors in Trewassa.	

Table 5-21 - BAT Requirements for Noise from Waste Treatment BREF (August 2018)

BREF Requirements	Current / Proposed Arrangements	BAT?
BAT 17: In order to prevent or, where that is not practicable, reduce noise and vibration emissions, BAT is to set up, implement and regularly review a noise and vibration management plan as part of the EMS (see BAT 1).	See Table 5-20 above. Note: as for BAT 13 in the Food, Drink and Milk BREF, BAT 17 is restricted to cases where a noise nuisance at sensitive receptors is expected and/or has been substantiated. As explained in Table 5-20, the Noise Impact Assessment determined that a noise nuisance a sensitive receptors is considered unlikely as a result of the changes covered by the permit variation application. It was agreed with the Environment Agency that, in this case, a NMP would not be required to support determination of the permit variation application which is only focusing on the changes on site and not the site as a whole.	Yes
BAT 18: In order to prevent or, where that is not practicable, reduce noise and vibration emissions, BAT is to use one or a combination of the following techniques: a. Appropriate location of equipment and buildings; b. Operational measures; c. Low-noise equipment; d. Noise and vibration control equipment; e. Noise abatement.	See Table 5-20 above.	Yes

As agreed with the Environment Agency during pre-application discussions, a Noise Impact Assessment has been undertaken to support the environmental permit variation application (Appendix G). The aim of the assessment was to establish the potential impacts of the changes implemented on site on noise emissions and the associated noise levels experienced at sensitive locations in the local area (refer to Figure 5-3 above).

The Noise Impact Assessment identified that operational noise levels from the proposed permit variation will be substantially below the prevailing sound levels at the closest receptors to the Creamery and the WPF. Identified differences have been identified to range form -6dB to -16dB. This confirms that levels generated by the proposed permit variation are not sufficient to give rise to any observable change in the currently prevailing noise levels.

No noise mitigation measures focussed on the elements falling under the permit variation are therefore warranted, but Dairy Crest will continue with its annual noise monitoring and assessment programme that is designed to monitor and reduce noise levels from the existing facility and ensure that compliance with the principles of BAT is retained.

In summary, the Noise Impact Assessment has identified that noise is not a factor that requires further consideration in the determination of the permit variation application.

6. ENVIRONMENTAL RISK ASSESSMENT (IMPACTS)

6.1. ENVIRONMENTAL RISK ASSESSMENT

An assessment of the environmental risks posed by the proposed changes on site has been undertaken. In accordance with the Environment Agency's requirements for risk assessments (from GOV.UK guidance), the proposed changes have been assessed with regards to their potential to generate significant environmental consequences. A copy of the environmental risk assessment is provided in Appendix C which:

1. Identifies and considers the risks for the site (as a result of the proposed changes) and the sources of the risks;
2. Identifies the receptors at risk from the site;
3. Identifies the possible pathways from the sources of the risks to the receptors;
4. Identifies appropriate risk management techniques to control the risks, as necessary; and
5. Assesses the overall risks to determine if they can be screened out as insignificant.

Based on the risk assessment provided in Appendix C, it can be seen that all risks associated with the proposed changes on site are deemed to be acceptable when considered in line with the intended risk management techniques.

The guidance also specifies that there are additional risk assessment requirements depending on:

- The activity the bespoke permit relates to; and
- Where substances are released or discharged into the environment.

6.2. EMISSIONS TO WATER

Initially it was agreed with the Environment Agency that the H1 tool would be completed for emissions to water (i.e. emission point W2) for mercury and cadmium only (as documented in meeting minutes dated 04/06/19). This was because the Environment Agency would be undertaking detailed water quality modelling for all other parameters as part of the enhanced pre-application advice process, in order to calculate indicative emission limit values. However, the Environment Agency subsequently confirmed (in email and attachment from Mike Alexander dated 27/07/20) that its intention was to remove mercury and cadmium emission limits / mass balance calculation requirements from the permit altogether as part of its EPR Food, Drink and Milk sector review, as this is covered by alternative legislation. Therefore, it was determined that an H1 assessment would not be required to support this environmental permit variation application.

Appendix A

EPR APPLICATION FORMS

Appendix B

SITE CONDITION REPORT (SCR)

Appendix C

ENVIRONMENTAL RISK ASSESSMENT

Appendix D

HABITATS RISK ASSESSMENT

Appendix E

WASTEWATER BAT OPTIONS APPRAISAL

Appendix F

ODOUR IMPACT ASSESSMENT

Appendix G

NOISE IMPACT ASSESSMENT

8 First Street
Manchester
M15 4RP

wsp.com

PUBLIC