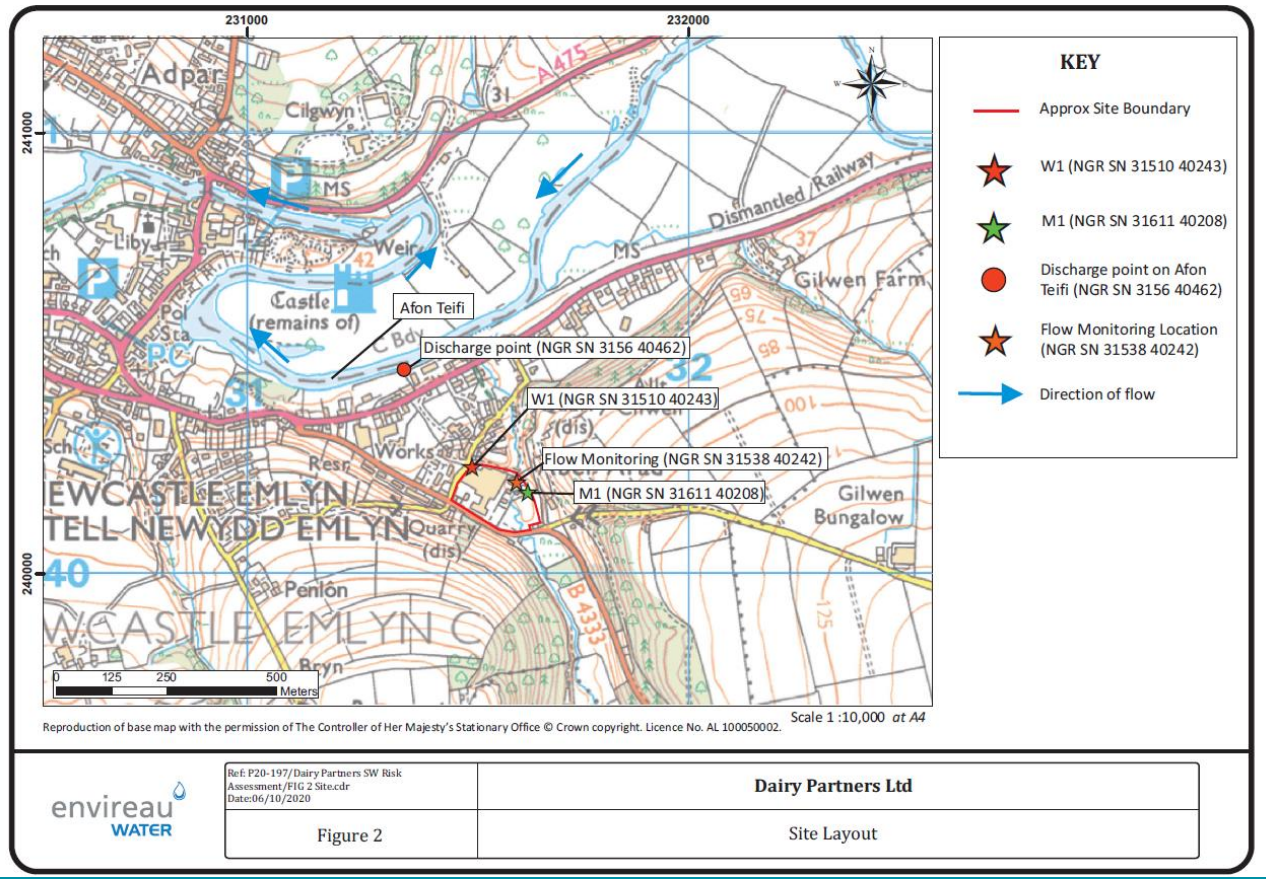
WFD Compliance Assessment of trade discharge at Dairy Partners (The Creamery Aberarad)

Table 1: project details.

a): Project details where an external party has applied to NRW for any form of authorisation	
Application reference number (if applicable)	PAN-010733
Date application received	16 June 2020
Applicant details	Dairy Partners (Cymru Wales) Limited
Activity proposed	The proposal is for the existing installation (permit number EPR/WP3231NB) to upgrade their existing effluent treatment plant (ETP). The existing ETP uses a Dissolved Air Flotation (DAF) plant and then series of trickling filters, the new ETP uses two DAF units and an activated sludge process, with additional flocculants, coagulants, neutraliser, pH control and phosphoric acid and urea used in the process. The treated effluent is then discharged to the Afon Teifi, there is no change to the discharge point and the permitted discharge volume will be reduced from 1050 m^3/day to 900 m^3/day as part of this variation. The proposed change is relevant to the Water Framework Directive as the composition of the discharge will change as the effluent treatment process changes. As part of this a number of new limits will be placed on the permit including a number of then reduced. The current limits on the permit are as follows: **Maximum daily discharge volume: 1050 m^3/day (Max)** **Temperature: 21 degrees celcius (Max)** **Chemical Oxygen Demand (COD): 120 mg/L (Max)** **Total suspended solids (TSS): 50 mg/L (Max)** **Ammonia as N: 22 mg/L (Max)** **Nitrite as N: 3 mg/L (Max)** **Mercury: 0.5 µg/L (Max)**

	Cadmium: 0.01 mg/L (Max) The proposed limits are as follows: **Maximum daily discharge volume: 900 m^3/day (Max)** **pH: 6 - 9** **Temperature: 21 degrees celcius (Max)** **Chemical Oxygen Demand (COD): 110 mg/L (Max)** **Biological Oxygen Demand (BOD): 20 mg/L (Max)** **Total suspended solids (TSS): 30 mg/L (Max)** **Ammonia as N: 10 mg/L (Max)** **Nitrite as N: 1.0 mg/L (Max)** **Total nitrogen: 20 mg/L (Max)** **Total phosphate as P: 1.0 mg/L (Max)** **Aluminium: 1.0 mg/L (Max)** **Mercury: 0.5 µg/L (Max)** **Cadmium: 0.525 µg/L (Max)** An assessment in accordance with WFD targets has been undertaken to determine whether the proposed limits are acceptable.
Relevant legislation	Environmental Permitting Regulations 2016
List other permissions that may be required where known	N/A
Location	The Creamery, Aberarad, Newcastle Emlyn, Carmarthenshire, SA38 9DQ Discharge NGR: The discharge is to the Afon Teifi at SN 31356 40462



Application documents *Include: Project purpose and background, site map, scaled plan, site photographs and*	Please find all documents associated with the application on the relevant DMS folder DMS

working method statement.	
Timing of works	ASAP, with no end date
List ongoing maintenance requirements. All structures will require maintenance	EPR permit will require a management system to be in place to control the process and discharge quality. The Management system will also ensure risk is managed and will include ongoing maintenance works.
Environmental Statement	Water Quality Assessment provided by the applicant alongside all other application documentation. All of which can be found on the DMS folder linked above. However, NRW audit of the WQ assessment can be found appended to this document (appendix 1).
Pre-application correspondence	None
NRW team responsible for drafting this WFD Compliance Assessment **report, and name of lead officer**	Team: Regulated Industry & RSR Permitting Team Officer: Rebecca Williams (Senior Permitting Officer, Installations & RSR Permitting Team)

Stage 1: Complete screening for each water body, add or delete cells as appropriate

Water body name	WB ID	Morphology status*	Overall water body status
Teifi - Afon Clettwr to Afon Ceri	GB110062043564	N/A (assumed good)	Moderate

Q1.1	Is the activity listed in Appendix 2 or Table 5 of OGN 72?	No	Yes – go to Q1.2 No – complete scoping assessment for each water body
Q1.2	Is the proposal in a water body at high status or high status for morphology? Water bodies at high status or high-status morphology have little or no human intervention and are more at risk of deterioration	No	No

Stage 2: Scoping Assessment

Q2.1 Is there a risk that a component of the activity or project may cause deterioration of any element that makes up water body status classification?	**Yes:** **3.3.4 in OGN72 (Water Quality: Physio-chemical and specific pollutants)** The discharge contains concentrations of sanitary determinands (Ammonia, Orthophosphate and BOD). Aluminium, phosphoric acid, sulphuric acid, sodium hydroxide, urea and two emulsion polymers are also dosed at the ETP. The ETP process is changing as part of this variation causing the composition of the discharge to change, therefore there could be deterioration in the water body and therefore the new discharge requires a full WFD assessment.
For Natura 2000 sites (SAC/SPA/Ramsar) Has a Habitats Regulations Assessment been completed?	A relevant screening report (IR EPR discharges to water) has been completed and saved to the DMS folder. LINK The Afon Teifi / River Teifi SAC is within the relevant screening distance. A HRA will be completed and consulted on.
Scoping decision of the project cumulatively or 'in combination'	No other projects that impact in combination. This has been concluded by looking at live permitting applications 10 km up/downstream of the proposed discharge point. None were found, therefore impacts on WQ will not be compounded by other proposals that can act 'in combination'. See the HRA for full details on the in combination.
Overall scoping decision *(choose one of the following)*	There is a risk the activity/project may cause deterioration or prevent the water body from meeting its objectives and therefore a detailed compliance assessment is required.

Stage 3: Detailed Assessment

A detailed assessment of the proposed impact the discharge would have on the watercourse at the proposed limits can be found in appendix 1 below. In summary:

- The proposed ammonia limit will ensure the JNCC SAC and WFD targets are met
- The proposed BOD limit will ensure the JNCC and WFD targets are met
- The proposed orthophosphate limit will greatly improve orthophosphate concentrations within the receiving watercourse, whilst the WFD target as set out in the SAC management plan will still potentially not be met, the proposed limit will equate to a 40 % improvement in terms of downstream mean orthophosphate concentrations and a limit in the permit will ensure improved monitoring and reporting

A detailed assessment regarding aluminium, mercury and cadmium and the dosing chemicals has also been completed (appendix 2 below) in summary:

- A limit of 1000 µg/L will be set for Total Aluminium as Al as per TGN7.01
- A limit of 0.525 µg/L will be set for Cadmium (reduced from 0.01 mg/L as per current permit)
- A limit of 0.5 µg/L will be set for Mercury (remains the same as per current permit)
- No numeric limits will be set for Anionic and cationic emulsion polymers as this will be controlled through the EMS
- No numeric limits will be set for other dosing materials as they ‘screen out’ as per the H1 methodology

As per the conclusions above, the applicants proposals are deemed acceptable.

Authorisation

Conclusion of WFD Compliance Assessment

Name of authorising officer	Rebecca Williams
Job title and date	Senior Permitting Officer, Installations & RSR
Technical specialist comments	Agree with the conclusions of the assessment
Name, job title and date	Elliot Burge – Senior Officer, Water Quality Permitting

Consultation with technical advisors/specialists

Relevant section of the WFD compliance assessment	Date(s) of correspondence* and any meeting(s) with technical advisor(s)	Description of how the comments from technical advisors have been considered
3 – Detailed Assessment	20/01/2021 (correspondence with Terry Gulliford – Lead Specialist Advisor in WQ Permitting)	pH limit for sulphuric acid considered appropriate as detailed in assessment. Please find email in Appendix 3

*Attach a copy of any written correspondence with the WFD assessment for the audit trail

Appendix 1 – Assessment of Sanitary Determinands:

PAN-010733
Water Quality Assessment Audit (sanitary determinands)

Background

The variation is to upgrade the effluent treatment plant at The Creamery, Aberarad operated by Dairy Partners (Cymru Wales) Limited. The effluent treatment process is changing therefore the composition of the effluent will change as new dosing chemicals have been introduced (these have been assessed in the H1 assessment).

There is a decrease of permitted discharge volume from 1050 m^3/day to 900 m^3/day. The current permit limit for ammonia (22 mg/L) is being reduced to 10 mg/L. There are limits being added to the permit for:

Total phosphate as P - 1.0 mg/L

Biological oxygen demand (BOD) – 20 mg/L

In order to review the effect on the water quality of the proposed changes, water quality modelling was undertaken in RQP to establish the impact of the current activity vs the proposed activity just downstream of the discharge point. Inputs into the models have been summarised in the below table:

Upstream (U/S) River Quality Data			
U/S River Quality	**Mean**	**Std.Dev**	**Comments on U/S Quality Data**
orthophosphate Ammonia BOD	24 (ug/l) 30.4 (ug/l) 1.29 (mg/l)	21 (ug/l) 27 (ug/l) 0.81 (mg/l)	These values are from samples taken over the years 2012-2014 from 'Teifi – Henllan Bridge'. This sample point is 6km upstream and represents the most applicable background concentration data for use within the risk assessments. It should be noted that whilst the data is 6-8 years old, there have been no significant changes upstream in the catchment that would render these results invalid. Ammonia and orthophosphate were converted to ug/l from mg/l as RQP can only model to 2 decimal places.
U/S River Flow	**Mean (m3/day)**	**Q95 (m3/day)**	**Comments**
Flow Estimate	1,892,160	214,790	Data supplied by NRW Internal Hydrology Team as per email saved on the DMS folder. Slight variance between this flow data and the flow data used by the applicant in their assessments.
Effluent Quality	**Mean**	**Std.Dev**	**Comments**
Orthophosphate (current impact model) Orthophosphate (proposed impact model)	12150 ug/l 1000 (ug/l)	12150 ug/l 1000 ug/l	I have modelled to review the estimated impacts at the discharge point of the existing permitted effluent quality: Ammonia 22000ug/l and BOD 30mg/l as per the historic consents BN6293IK and FP3434UB and the values for phosphate are as per the sampling results that

BOD (current impact model)	30 (mg/l)	30 (mg/l)	accompanied the original permit application. I have then compared these results to the proposed effluent quality limits (10000ug/l ammonia, 20mg/l BOD and 1000ug/l orthophosphate). In the absence of more complete reporting data, current impact models assume the concentration within the effluent currently is at the fully permitted load.
BOD (proposed impact model)	20 (mg/l)	20 (mg/l)	
Ammonia (current impact model)	22000 (ug/l)	22000 (ug/l)	
Ammonia (proposed impact model)	10000 (ug/l)	10000 (ug/l)	
Effluent Volume	**Mean (m3/day)**	**Std.Dev (m3/day)**	**Comments**
Effluent volume (current impact model	1050	0	Again, in the absence of abundant historical reporting data, the models have been undertaken to establish impact should the fully permitting existing volume and proposed maximum discharge volume be utilised.
Effluent volume (proposed impact model)	900	0	

Predicted current impact downstream of discharge point – BOD

MASS BALANCE CALCULATION: MONTE CARLO METHOD				
Version 2.5				
Calculations done on 19/01/2021 at 14.37				
Name of discharge	Dairy Partners (Current impact - 1050m3/day at 30mg/l)			
Name of river	Teifi			
Name of determinand	BOD (mg/l)			
INPUT DATA			**RESULTS**	
UPSTREAM RIVER DATA			**RIVER DOWNSTREAM OF DISCHARGE**	
Mean flow	1892160.0		Mean quality	1.35
95% exceedence flow	214790.0		Standard deviation of quality	0.83
Mean quality	1.29		90-percentile quality	2.31
Standard deviation of quality	0.81		95-percentile quality	2.82
90-percentile	2.29		99-percentile quality	4.17
DISCHARGE DATA			**DISCHARGE QUALITY**	
Mean flow	1050.0		Mean quality	30.85
Standard deviation of flow	0.00		Standard deviation of quality	28.41
Mean quality	30.00		95-percentile quality	84.90
Standard deviation of quality	30.00		99-percentile quality	142.79
... or 95-percentile	83.44		99.5-percentile quality	164.40

The model above demonstrates the current mean BOD concentration immediately downstream of the discharge point is **1.34 mg/l** and the 90%ile quality immediately downstream is **2.31 mg/l**

Predicted impact downstream of discharge point as a result of the proposal – BOD

MASS BALANCE CALCULATION: MONTE CARLO METHOD				
Version 2.5				
Calculations done on 19/01/2021 at 14.38				
Name of discharge	Dairy Partners (Proposed impact - 900m3/day at 20mg/l)			
Name of river	Teifi			
Name of determinand	BOD (mg/l)			
INPUT DATA			**RESULTS**	
UPSTREAM RIVER DATA			**RIVER DOWNSTREAM OF DISCHARGE**	
Mean flow	1892160.0		Mean quality	1.33
95% exceedence flow	214790.0		Standard deviation of quality	0.83
Mean quality	1.29		90-percentile quality	2.29
Standard deviation of quality	0.81		95-percentile quality	2.81
90-percentile	2.29		99-percentile quality	4.16
DISCHARGE DATA			**DISCHARGE QUALITY**	
Mean flow	900.00		Mean quality	20.57
Standard deviation of flow	0.00		Standard deviation of quality	18.94
Mean quality	20.00		95-percentile quality	56.60
Standard deviation of quality	20.00		99-percentile quality	95.20
... or 95-percentile	55.62		99.5-percentile quality	109.60

The model above demonstrates that should the total daily discharge volume reduce to 900 cubic metres and BOD concentration be limited to 20mg/l in the effluent, BOD concentrations immediately downstream of the discharge point would be **1.32 mg/l** and the 90%ile quality immediately downstream would be **2.29 mg/l**

Predicted current impact downstream of discharge point – Ammonia

MASS BALANCE CALCULATION: MONTE CARLO METHOD				
Version 2.5				
Calculations done on 19/01/2021 at 14.42				
Name of discharge	Dairy Partners (Current impact - 1050m3/day at 10mg/l)			
Name of river	Teifi			
Name of determinand	Ammonia (ug/l)			
INPUT DATA			**RESULTS**	
UPSTREAM RIVER DATA			**RIVER DOWNSTREAM OF DISCHARGE**	
Mean flow	1892160.0		Mean quality	65.78
95% exceedence flow	214790.0		Standard deviation of quality	66.99
Mean quality	30.40		90-percentile quality	130.20
Standard deviation of quality	27.00		95-percentile quality	174.59
90-percentile	60.39		99-percentile quality	368.02
DISCHARGE DATA			**DISCHARGE QUALITY**	
Mean flow	1050.0		Mean quality	22625.2
Standard deviation of flow	0.00		Standard deviation of quality	20836.6
Mean quality	22000.0		95-percentile quality	62260.6
Standard deviation of quality	22000.0		99-percentile quality	104715.0
... or 95-percentile	61187.3		99.5-percentile quality	120557.0

The model above demonstrates the current 90%ile ammonia concentration immediately downstream is **0.130 mg/l**

Predicted impact downstream of discharge point as a result of the proposal – Ammonia

MASS BALANCE CALCULATION: MONTE CARLO METHOD				
Version 2.5				
Calculations done on 19/01/2021 at 14.41				
Name of discharge	Dairy Partners (Proposed impact - 900m3/day at 10mg/l)			
Name of river	Teifi			
Name of determinand	Ammonia (ug/l)			
INPUT DATA			**RESULTS**	
UPSTREAM RIVER DATA			**RIVER DOWNSTREAM OF DISCHARGE**	
Mean flow	392160.0		Mean quality	44.37
95% exceedence flow	214790.0		Standard deviation of quality	36.71
Mean quality	30.40		90-percentile quality	85.35
Standard deviation of quality	27.00		95-percentile quality	109.14
90-percentile	60.39		99-percentile quality	190.02
DISCHARGE DATA			**DISCHARGE QUALITY**	
Mean flow	900.00		Mean quality	10284.2
Standard deviation of flow	0.00		Standard deviation of quality	9471.2
Mean quality	10000.0		95-percentile quality	28300.3
Standard deviation of quality	10000.0		99-percentile quality	47597.7
... or 95-percentile	27812.4		99.5-percentile quality	54798.6

The model above demonstrates that should the total daily discharge volume reduce to 900 cubic metres and ammonia concentration be limited to 10mg/l in the effluent, 90%ile ammonia concentration immediately downstream would be **0.0854 mg/l**

Predicted current impact downstream of discharge point – Orthophosphate

MASS BALANCE CALCULATION: MONTE CARLO METHOD				
Version 2.5				
Calculations done on 19/01/2021 at 14.43				
Name of discharge	Dairy Partners (Current impact - 1050m3/day at 12.15mg/l)			
Name of river	Teifi			
Name of determinand	Orthophosphate (ug/l)			
INPUT DATA			**RESULTS**	
UPSTREAM RIVER DATA			**RIVER DOWNSTREAM OF DISCHARGE**	
Mean flow	1892160.0		Mean quality	43.60
95% exceedence flow	214790.0		Standard deviation of quality	39.99
Mean quality	24.00		90-percentile quality	87.24
Standard deviation of quality	21.00		95-percentile quality	111.40
90-percentile	47.46		99-percentile quality	231.63
DISCHARGE DATA			**DISCHARGE QUALITY**	
Mean flow	1050.0		Mean quality	12495.3
Standard deviation of flow	0.00		Standard deviation of quality	11507.5
Mean quality	12150.0		95-percentile quality	34384.8
Standard deviation of quality	12150.0		99-percentile quality	57831.2
... or 95-percentile	33792.1		99.5-percentile quality	66580.3

The model above demonstrates the current mean orthophosphate concentration immediately downstream is **0.044 mg/l**

Predicted impact downstream of discharge point as a result of the proposal – Orthophosphate

MASS BALANCE CALCULATION: MONTE CARLO METHOD				
Version 2.5				
Calculations done on 19/01/2021 at 14.44				
Name of discharge	Dairy Partners (Proposed impact - 900m3/day at 1mg/l)			
Name of river	Teifi			
Name of determinand	Orthophosphate (ug/l)			
INPUT DATA			**RESULTS**	
UPSTREAM RIVER DATA			**RIVER DOWNSTREAM OF DISCHARGE**	
Mean flow	392160.0		Mean quality	25.68
95% exceedence flow	214790.0		Standard deviation of quality	29.23
Mean quality	24.00		90-percentile quality	51.60
Standard deviation of quality	27.00		95-percentile quality	70.36
90-percentile	50.80		99-percentile quality	130.31
DISCHARGE DATA			**DISCHARGE QUALITY**	
Mean flow	900.00		Mean quality	1028.4
Standard deviation of flow	0.00		Standard deviation of quality	947.12
Mean quality	1000.0		95-percentile quality	2830.0
Standard deviation of quality	1000.0		99-percentile quality	4759.8
... or 95-percentile	2781.2		99.5-percentile quality	5479.9

The model above demonstrates that should the total daily discharge volume reduce to 900 cubic metres and orthophosphate concentration be limited to 1 mg/l in the effluent, mean orthophosphate concentration immediately downstream would be **0.0257 mg/l**

Ammonia in Relation to Habitats and WFD Targets

Ammonia in relation to the Habitats Directive (JNCC CSM targets) - The table below demonstrates the organic pollutant standards relevant to all riverine SACs as published in 'Common Standards Monitoring Guidance for Rivers: (Version September 2016)':

Attribute	Target
10%ile DO (% saturation)	85
Mean BOD (mg L^{-1})	1.5
90%ile total ammonia (NH_3-N, mg L^{-1})	0.25
95%ile un-ionised ammonia (NH_3-N, mg L^{-1})	0.025

As the discharge is directly into the Afon Teifi SAC, the 90%ile total ammonia must be below the 0.25 stated target in the table above. The predicted current impact from the modelling above is a downstream 90%ile of 0.130 mg/l, the predicted impact is 0.0854 mg/l, the reduction in discharged load will result in more compliance headroom in relation to the Habitats Directive ammonia target.

Furthermore, the reduction in daily discharge volume and tightening of the ammonia concentration will reduce the daily load discharged from 0.0231 kg/day to 0.009 kg/day, a reduction in discharged load of 0.0141 kg/day.

Ammonia in relation to the WFD target – Due to the altitude and alkalinity of the receiving watercourse, Typology 1 standards for ammonia/BOD have been utilised for the assessment:

Table 7

Ammonia standards for rivers (rivers categorised by type in accordance with paragraph 1(1) of Schedule 2)				
Total Ammonia as nitrogen (mg/l)				
(90 percentile)				
Type	High	Good	Moderate	Poor
1, 2, 4 and 6	0.2	0.3	0.75	1.1
3, 5 and 7	0.3	0.6	1.1	2.5

This means to ensure the receiving watercourse remains in ‘high’ classification, the 90%ile ammonia concentration must remain below 0.2 mg/l.

The modelling demonstrates the watercourse at the discharge point is currently within ‘high’ classification and the reduction in discharged load will ensure this classification is maintained with more compliance headroom available.

Orthophosphate in Relation to Habitats and WFD Targets

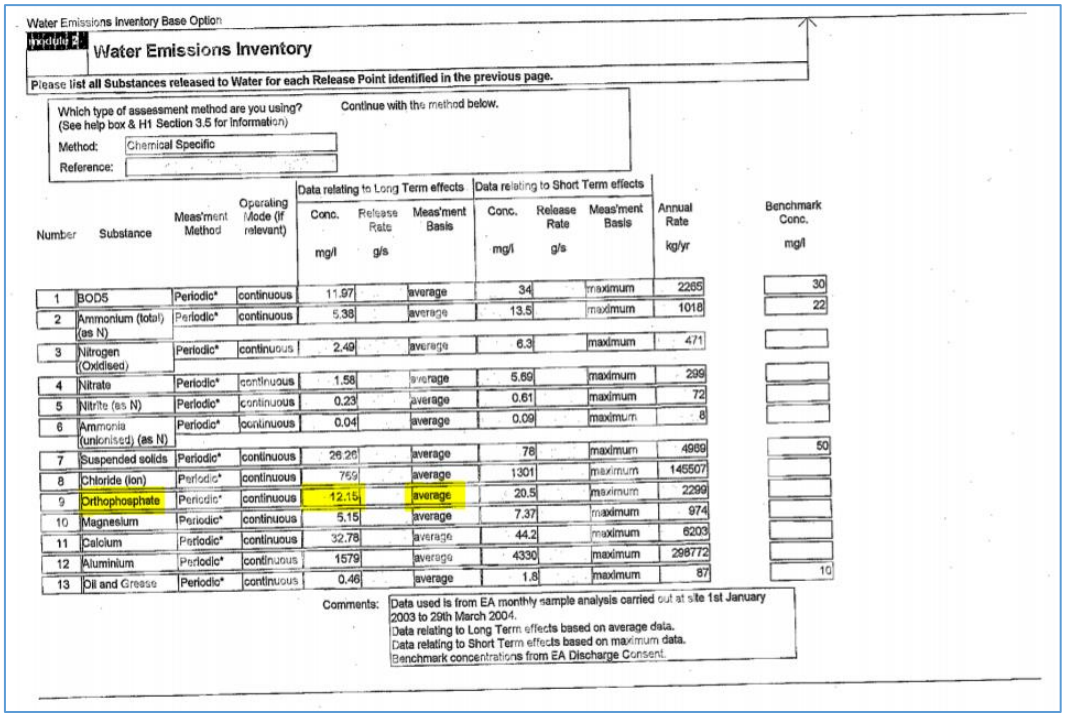
Orthophosphate in relation to the relevant targets - The table below is taken from the Afon Teifi SAC Core Management Plan and it outlines the relevant orthophosphate target for the receiving watercourse (highlighted):

Table A4. Phosphate target and typology for all waterbodies in or draining into the Afon Teifi SAC.

Water Body Name	Water Body ID	Type	Phosphate target (mg/L)	Reason
Brefi - headwaters to confluence with Teifi	GB110062039250	HL	0.010	CSM (max allowable)
Cerdin - headwaters to confluence with Teifi	GB110062039140	LL	0.030	CSM (max allowable)
Ceri - Dulas to conf Teifi	GB110062039110	LL	0.040	CSM (max allowable)
Ceri - headwaters to conf Dulas	GB110062039190	LL	0.030	CSM (max allowable)
Cledlyn - headwaters to confluence with Teifi	GB110062039150	HL	0.005	CSM (near natural)
Clettwr - headwaters to confluence with Teifi	GB110062039220	LL	0.030	WFD (good)
Cych - headwaters to confluence with Teifi	GB110062039041	LL	0.020	WFD (high)
Dulas - headwaters to confluence with Cych	GB110062039010	LL	0.020	WFD (high)
Dulas - headwaters to conf Teifi	GB110062039240	HL	0.020	CSM (max allowable)
Grannell - headwaters to confluence with Teifi	GB110062039230	HL	0.020	CSM (max allowable)
Groes - headwaters to confluence with Teifi	GB110062043490	HL	0.010	CSM (near natural)
Talog - headwaters to confluence with Tyweli	GB110062038980	HL	0.010	CSM (max allowable)
Teifi - conf Fflur to conf Brennig	GB110062043501	HL	0.010	CSM (near natural)
Teifi - Afon Brennig to Afon Dulas	GB110062043566	HL	0.010	CSM (near natural)
Teifi - Afon Ceri to estuary	GB110062043563	LL	0.020	WFD (high)
Teifi - Afon Clettwr to Afon Ceri	GB110062043564	LL	0.020	WFD (high)
Teifi - Afon Dulas to Afon Clettwr	GB110062043565	HL	0.010	CSM (near natural)
Teifi - headwaters to confluence with Meurig	GB110062043540	HL	0.010	CSM (max allowable)
Tyweli - confluence with Talog to confluence with Teifi	GB110062039020	LL	0.034	WFD (good)

The 0.020 mg/l target is set as a mean. As this WFD target in the table is tighter than the applicable CSM/JNCC target for the receiving watercourse, this is the target that should be adhered to.

From reviewing historical documents, a H1 risk assessment supporting a previous application (2005) demonstrates that the in situ effluent treatment plant is capable of treating to a mean of 12.15 mg/l orthophosphate:



Water Emissions Inventory Base Option

Water Emissions Inventory

Please list all Substances released to Water for each Release Point identified in the previous page.

Which type of assessment method are you using? (See help box & H1 Section 3.5 for information) Continue with the method below.

Method: Chemical Specific

Reference:

Number	Substance	Meas'ment Method	Operating Mode (if relevant)	Data relating to Long Term effects: Conc. mg/l	Release Rate g/s	Meas'ment Basis	Data relating to Short Term effects: Conc. mg/l	Release Rate g/s	Meas'ment Basis	Annual Rate kg/yr	Benchmark Conc. mg/l
1	BOD5	Periodic*	continuous	11.97		average	34		maximum	2285	30
2	Ammonium (total) (as N)	Periodic*	continuous	5.38		average	13.5		maximum	1018	22
3	Nitrogen (Oxidised)	Periodic*	continuous	2.49		average	6.3		maximum	471	
4	Nitrate	Periodic*	continuous	1.58		average	5.69		maximum	299	
5	Nitrite (as N)	Periodic*	continuous	0.23		average	0.61		maximum	72	
6	Ammonia (unionised) (as N)	Periodic*	continuous	0.04		average	0.09		maximum	8	
7	Suspended solids	Periodic*	continuous	26.26		average	78		maximum	4969	50
8	Chloride (ion)	Periodic*	continuous	769		average	1301		maximum	145507	
9	Orthophosphate	Periodic*	continuous	12.15		average	20.5		maximum	2299	
10	Magnesium	Periodic*	continuous	5.15		average	7.37		maximum	974	
11	Calcium	Periodic*	continuous	32.78		average	44.2		maximum	6203	
12	Aluminium	Periodic*	continuous	1579		average	4330		maximum	298772	
13	Oil and Grease	Periodic*	continuous	0.46		average	1.8		maximum	87	10

Comments: Data used is from EA monthly sample analysis carried out at site 1st January 2003 to 29th March 2004.
Data relating to Long Term effects based on average data.
Data relating to Short Term effects based on maximum data.
Benchmark concentrations from EA Discharge Consent.

More recent data is not available. It should also be noted there is no limit on the current permit.

Modelling the impact of the discharge assuming it still contains 12.15 mg/l orthophosphate shows that concentrations just downstream of the discharge point are currently estimated to be around 0.044 mg/l, which is in excess of the target within the SAC Core Management Plan.

Should the volume and load be reduced in line with the applicants proposals then the mean concentration of orthophosphate downstream of the discharge point would reduce to 0.026 mg/l. Whilst this value is still in excess of the proposed target of 0.02 mg/l, taking into account the reduction in permitted daily discharge volume, the variation will reduce the orthophosphate load discharged per day from 12.7575 kg/day to 0.9 kg/day, a reduction of 11.8575 kg/day or 92.9453 %. Furthermore, placing a 1 mg/l orthophosphate limit on the permit will ensure the concentrations are closely regulated through regular monitoring and reporting, therefore, the proposal will not cause deterioration in the watercourse with respect to orthophosphate.

BOD In Relation to Habitats and WFD Targets

BOD in relation to the Habitats Directive (JNCC CSM targets) - The table below demonstrates the organic pollutant standards relevant to all riverine SACs as published in 'Common Standards Monitoring Guidance for Rivers: (Version September 2016)':

Attribute	Target
10%ile DO (% saturation)	85
Mean BOD (mg L^{-1})	1.5
90%ile total ammonia (NH_3-N, mg L^{-1})	0.25
95%ile un-ionised ammonia (NH_3-N, mg L^{-1})	0.025

As the discharge is directly into the Afon Teifi SAC, the mean BOD must be below the 1.5 mg/L stated target in the table above.

The current mean concentration downstream of the discharge point is estimated to be 1.34mg/l, should the applicant implement the improvements proposed, the mean concentration would reduce to 1.32mg/l. Both concentrations are compliant with the JNCC target with ample compliance headroom remaining.

BOD in relation to the Water Framework Directive

The below table demonstrates the class boundaries associated with Type 1 rivers for BOD standards:

Table 2

Biochemical oxygen demand (BOD) standards for rivers[i] (rivers categorised by type in accordance with paragraphs 1(1) and 1(2) of Schedule 2)				
Biochemical Oxygen Demand (mg/l)				
(90 percentile)				
Type	High	Good	Moderate	Poor
1, 2, 4, 6 and salmonid	3	4	6	7.5
3, 5 and 7	4	5	6.5	9

[i] Biochemical Oxygen Demand must not be used in classifying the status of water bodies.

Based on the table above, the 90%ile BOD concentration downstream of the discharge point needs to remain below 3 mg/l. Based on the current permitted concentration, the downstream 90%ile is estimated to be 2.31 mg/l, should the operator implement the proposed improvements this would decrease to 2.29 mg/l. Both concentrations ensure the watercourse remains within ‘High’ classification with ample compliance headroom remaining.

pH In Relation to Habitats and WFD Targets

The proposal for a limit of a pH of 6 (minimum) and 9 (maximum) is in line with the WFD targets for a ‘High’ and ‘Good’ watercourse (see below), therefore the limit is deemed appropriate

Table 3

Acid conditions standards in rivers			
pH – all river types in England and Wales			
High	Good	Moderate	Poor
5 and 95 percentile		10 percentile	10 percentile
>=6 to <=9		4.7	4.2

Temperature in Relation to Habitats and WFD Targets

The proposal is to keep the currently permitted 21 degree celcius limit on the permit, there are no concerns with the proposed limit. The receiving watercourse GB110062043564 'Teifi (Afon Clettwr to Afon Ceri)' is designated 'High' for temperature, with the annual 95th percentile being 17.7 degrees celcius, which is in line with the standards as published within the WFD (see below). Whilst there is no data available to show the impact the discharge is having immediately downstream, considering the temperature of the effluent itself lies within 'Good' status, it is anticipated there will be negligible effect on the temperature of the receiving watercourse. There have also never been any recorded incidents or issues associated with the temperature of the discharge, from reviewing recent monitoring submission data, the temperature is often comfortably below the permitting 21 degrees celcius.

Table 6

Temperature standards for rivers (rivers categorised by type in accordance with paragraph 1(2) of Schedule 2)								
	High		*Good*		*Moderate*		*Poor*	
River temp type	*Salmonid*	*Cyprinid*	*Salmonid*	*Cyprinid*	*Salmonid*	*Cyprinid*	*Salmonid*	*Cyprinid*
River temp (°C) as an annual 98-percen-tile standard	20	25	23	28	28	30	30	32
Increase or decrease in temp (°C) in relation to the ambient river temp, as an annual 98 percentile standard[(i)]	2	2	3	3	-	-	-	-

Final Comment on Sanitary Determinands

The proposed reduction in daily discharge volume and reduction in concentration of sanitary determinands discharged ensures both BOD and Ammonia comply with the relevant targets. Whilst orthophosphate concentrations are still in excess of the target, the proposal implements a large reduction in discharged orthophosphate load and can be seen as a large improvement. Furthermore, proposed pH and temperature standards are deemed appropriate when reviewing the relevant WFD classification boundaries.

Appendix 2 – Assessment of dosing materials and priority hazardous substances:

Dairy Partners – The Creamery Aberarad - H1 Surface Water Risk Assessment Audit Notes

Background

A normal variation has been received from Dairy Partners (Cymru Wales) Limited for their site: The Creamery Aberarad in Newcastle Emlyn. The variation is to upgrade the existing effluent treatment plant (ETP), the new ETP will replace their existing ETP. The upgrade will see a change of technology used in the effluent treatment process. The existing process uses 1x Dissolved Air Flotation (DAF) unit and 2x trickling filter systems, the new process will use 2x DAF units, an activated sludge process and pH control in a balancing tank. There will also be an 'out of specification' tank that will be used to store re-routed trade effluent that does not meet specification for discharge to surface water (Afon Teifi). The new process incorporates a number of new treatment chemicals, therefore a complete H1 surface water risk assessment has been completed to determine the impact of the new process, a complete review of any existing parameters/limits on the existing permit has also been carried to ensure these limits remain appropriate. There are no changes to the permitted activities and they will remain on the permit as:

S6.8 A(1)(e) – Treatment and processing milk, the quantity of milk received being more than 200 tonnes per day (average value on an annual basis) – *Cheese making activities*

S5.4 A(1)(a)(i) – Disposal of non-hazardous waste with a capacity exceeding 50 tonnes per day involving one or more of the following activities (i) biological treatment) - *effluent treatment plant*

Emissions to surface water – discharge of treated trade effluent from ETP

All process waters from the milk processing activity are directed through the ETP for treatment prior to discharge to the Afon Teifi. The existing emission point (where the discharge leaves the installation) is NGR: SN 31510 40243 (labelled as W1 on the existing permit), the effluent then travels via a shared pipe to the discharge point at NGR: SN 31356 40462 into the Afon Teifi. The parameters monitoring point is NGR: SN 31611 40208 (labelled as M1 on the existing permit) and flow rate is monitored at NGR: SN 31538 40242. None of these monitoring, discharge or emission points are changing as part of this variation. The current maximum permitted discharge volume is 1050 m^3/day, this will be reduced to 900 m^3/day as part of this variation.

The operator has employed a consultant (Envireau Water) to complete the H1 surface water risk assessment on their behalf. The site uses the following additives in the ETP process:

(i) ClearFlo C36 – polyaluminium chloride (PAC)
(ii) Flocculant – anionic emulsion polymer
(iii) Flocculant – cationic emulsion polymer
(iv) Urea (CH_4N_2O)
(v) Phosphoric acid (H_3PO_4)
(vi) ClearFlo-pH-SA-D50% - Sulphuric acid (H_2SO_4)
(vii) ClearFlo-pH-SH-U-32% - Sodium Hydroxide (NaOH)

MSDS have been provided for these additives and are available on the DMS.

The following two priority hazardous substances have also been assessed, they are currently listed in the permit, therefore have been assessed to ensure the limits remain appropriate:

(i) Mercury
(ii) Cadmium

Anionic and cationic emulsion polymers

Non-ionic polyacrylamides are considered to be low toxicity and have no hazard ratings, are therefore are not considered any further in this surface water risk assessment. Anionic and non-ionic polyacrylamide polyelectrolytes are significantly less toxic (in the range of 50 – 100 mg/L) but have the same detection limit as their cationic forms. Anionic and non-ionic polyelectrolytes are therefore environmentally preferable in areas where water hardness and pH are low because polyelectrolyte activity will persist longer under such conditions and we need to be able to measure permitted concentrations in the effluent to demonstrate safe environmental concentrations. For anionic and non-ionic polyacrylamide polyelectrolytes, we set an EQS of 3.5 mg/l as a 95 percentile in soft acid waters (pH 6 or less, total hardness 20 mg/l or less). For hardness greater than 20 mg/l as calcium carbonate, a 95 percentile EQS of 7.5 mg/l is appropriate. Alternatively, 0.05 or 0.1 times an actual 24h LC50 for the polyelectrolyte in question could be used as a 95 percentile EQS (see Table 3). Tables 2 and 3 give default values for polyelectrolytes. More relaxed EQS can be considered on a case by case basis if the operator provides toxicity data and information on analytical methods. We will normally limit these substances at concentrations well below EQS by operational control through the Management System. We will only very exceptionally need to set a numeric permit limit.

Polyaluminium chloride (PAC) (ClearFlo C36) assessment

The primary pollutant associated with Polyaluminium chloride is aluminium. Aluminium is not a specified pollutant in the H1 assessment tool, however an EQS can be taken from EPR 7.01 guidance page 122 'Use of Chemicals in Treatment':

Aluminium	The standard is 1mg/l (total) MAC EQS but subject to a maximum concentration in the discharge of 10 mg/l (dissolved) EMISSION STD if • 1:10 dilution.

There are different EQS to be used for aluminium depending on the pH of the watercourse. The latest Water Framework Directive Phys/Chem data for GB110062043564 'Teifi (Afon Clettwr to Afon Ceri)' demonstrates the pH of the receiving watercourse is 7.6 therefore the EQS 1000 µg/L MAC is applicable in this H1 risk assessment.

The H1 risk assessment uses screening tests:

Screening test 1:

Substance (AA or MAC)	Release Concentration (RC) - µg/L (Mean for AA, 95%ile for MAC)	EQS (or PNEC) - µg/L (AA or MAC)	% of EQS (or PNEC)
Aluminium (effluent treatment plant specification)	**1000**	**1000**	**100 %**

The specification of the Effluent Treatment Plant is 1.0 mg/L of aluminium; therefore this value has been used as the maximum release concentration. The specification of the ETP is listed within the H1 assessment submitted by the applicant, this can be found here.

As the % of the EQS exceeds 10 % the first screening test has failed and therefore the second screening test is applied.

Screening test 2:

Effluent Flow Rate (EFR) - m^3/s	Release Concentration (RC) - µg/L	River Flow Rate (RFR) - m^3/s	Process Contribution (PC) - µg/L	EQS (or PNEC) - µg/L	PC as % of EQS (or PNEC)
0.010416	**1000**	2.486	4.172381526	1000	**0.42 %**

The effluent flow rate (EFR) is taken as the existing (maximum) discharge volume of 900 m^3/day = 0.010416 m^3/second. The River Flow Rate (RFR) is based on the Q95 exceedance data provided by NRW hydrology, confirmation e-mail can be found here.

The process contribution (PC) is calculated using the following equation:

Process contributions for discharges to rivers

The process contribution of substances released to inland rivers is given by:

$$PC = \frac{(EFR \times RC)}{(EFR + RFR)}$$

where

- PC = process contribution (µg/l)
- EFR = effluent flow rate (m^3/s)
- RC = release concentration of the pollutant in the effluent (µg/l)
- RFR = river flow rate (m^3/s).

As the % of the EQS is less than 4 % the second screening test has passed and therefore no further assessment is required.

Conclusion

The screening tests have been based on the specification of the ETP. The proposed discharge has screened out in screening test 2 and no further modelling of aluminium is requested, a limit of 1000 µg/L will be set in the permit.

Urea (CH_4N_2O) assessment

Dairy Partners use approximately 45 L/day of Urea (taken from here) which is approximately 40 % concentration. This is equivalent to 18 kg/day urea being added to the effluent. Using the average (693.09 m^3/day) and maximum (900 m^3/day) flow rates and the conservative assumption that 100 % of the urea dosed is present in the treated effluent, this represents release concentrations of 25970.65316 µg/L and 20000 µg/L respectively.

The hazard assessment conclusion gives a PNEC value of 0.47 mg/L (470 µg/L), this has been used as a surrogate EQS for the screening tests below:

Screening test 1:

Substance (AA or MAC)	Release Concentration (RC) - µg/L (Mean for AA, 95%ile for MAC)	EQS (or PNEC) - µg/L (AA or MAC)	% of EQS (or PNEC)
Urea (PNEC)	25970.65	470	**5525.67%**

Screening test 2:

Effluent Flow Rate (EFR) - m^3/s	Release Concentration (RC) - µg/L	River Flow Rate (RFR) - m^3/s	Process Contribution (PC) - µg/L	EQS (or PNEC) - µg/L	PC as % of EQS (or PNEC)
0.010416	25970.65	2.486	**108.36**	470	**23.06%**

Screening test 3:

Process Contribution (PC)	Avg. Background Concentration (BC) - µg/l	Predicted Environmental Concentration (PEC) - µg/l	EQS (or PNEC) - µg/l	Difference as % of EQS

108.36	**47.00**	**155.36**	**470.00**	**23.06%**

Screening test 4:

The PEC is <EQS, therefore urea screens out and modelling isn't required.

Phosphoric acid (H_3PO_4) assessment

Dairy Partners use approximately 15 L/day of phosphoric acid (taken from *H1 risk assessment link)* which is approximately 70 % concentration. This is equivalent to 10.5 kg/day phosphoric acid being added to the effluent. Using the average (693.09 m^3/day) and maximum (900 m^3/day) flow rates and the conservative assumption that 100 % of the phosphoric acid dosed is present in the treated effluent, this represents release concentrations of 15149.54768 µg/L and 11666.6 µg/L respectively.

The hazard assessment conclusion gives a PNEC value of 0.49 mg/L (490 µg/L), this has been used as a surrogate EQS for the screening tests below:

Screening test 1:

Substance (AA or MAC)	**Release Concentration (RC) - µg/l (Mean for AA, 95%ile for MAC)**	**EQS (or PNEC) - µg/l (AA or MAC)**	**% of EQS (or PNEC)**
Phosphoric Acid (PNEC)	15149.55	490	**3091.74%**

Screening test 2:

Effluent Flow Rate (EFR) - l/s	Release Concentration (RC) - µg/l	River Flow Rate (RFR) - l/s	Process Contribution (PC) - µg/l	EQS (or PNEC) - µg/l	PC as % of EQS (or PNEC)
0.010416	15149.55	2.486	63.20970255	490	**12.90%**

Screening test 3:

Process Contribution (PC)	**Avg. Background Concentration (BC) - µg/l**	**Predicted Environmental Concentration (PEC) - µg/l**	**EQS (or PNEC) - µg/l**	**Difference as % of EQS**

63.21	49.00	112.21	490.00	**12.90%**

Screening test 4:

The PEC is <EQS, therefore phosphoric acid screens out and modelling isn't required.

ClearFlo-pH-SA-D50% - Sulphuric acid (H_2SO_4) assessment

Dairy Partners use approximately 600 L/day of sulphuric acid (taken from *H1 risk assessment link)* which is approximately 37 % concentration. This is equivalent to 222 kg/day sulphuric acid being added to the effluent. Using the average (693.09 m^3/day) and maximum (900 m^3/day) flow rates and the conservative assumption that 100 % of the sulphuric acid dosed is present in the treated effluent, this represents release concentrations of 320304.7223 µg/L and 246666.6 µg/L respectively. From reviewing literature, the hazard to freshwaters associated with sulphuric acid is a drastic change in pH. Considering there will be a limit on the permit for pH (between 6-9), this is seen as appropriate control for sulphuric acid.

There could be a potential concern with regards to sulphuric acid forming sulphate, which is an 'other pollutant' with a statutory EQS (400,000 µg/L), however even if we were to assume that 100% of sulphuric acid dosed is discharged in the form of sulphate in the final effluent, this screens out at test 2:

Effluent Flow Rate (EFR) - l/s	Release Concentration (RC) - µg/l	River Flow Rate (RFR) - l/s	Process Contribution (PC) - µg/l	EQS (or PNEC) - µg/l	PC as % of EQS (or PNEC)
0.010416	320304.72	2.486	1336.433496	400000	**0.33%**

ClearFlo-pH-SH-U-32% - Sodium Hydroxide (NaOH) assessment

Dairy Partners use approximately 600 L/day of sodium hydroxide (taken from *H1 risk assessment link)* which is approximately 32 % concentration. This is equivalent to 192 kg/day sodium hydroxide being added to the effluent. Using the average (693.09 m^3/day) and maximum (900 m^3/day) flow rates and the conservative assumption that 100 % of the sodium hydroxide dosed is present in the treated effluent, this represents release concentrations of 277020.3004 µg/L and 213333.3 µg/L respectively.

NaOH does not fill the criteria for persistency, bioaccumulation and toxicity, therefore, in the absence of a generic PNEC available, no further assessment has been undertaken on this substance.

Mercury

Mercury is found to be present in trace amounts in the milk and in dosing chemicals at the plant, therefore has the potential to be present in the treated effluent. There is already an emission limit value on the permit for mercury (0.5 µg/L), therefore the purpose of this assessment is to ensure this limit remains appropriate.

The H1 risk assessment uses screening tests:

Screening test 1:

Substance (AA or MAC)	Release Concentration (RC) - µg/L (Mean for AA, 95%ile for MAC) - µg/L	EQS (or PNEC) - µg/L (AA or MAC)	% of EQS (or PNEC)
Mercury (emission limit value)	**0.5**	**0.07 (MAC)**	**714.29 %**

As the % of the EQS exceeds 10 % the first screening test has failed and therefore the second screening test is applied.

Screening test 2:

Effluent Flow Rate (EFR) - m^3/s	Release Concentration (RC) - µg/L	River Flow Rate (RFR) - m^3/s	Process Contribution (PC) - µg/L	EQS (or PNEC) - µg/L	PC as % of EQS (or PNEC)
0.010416	**0.5**	2.486	0.002086191	0.07	**2.98 %**

The effluent flow rate (EFR) is taken as the existing (maximum) discharge volume of 900 m^3/day = 0.010416 m^3/second. The River Flow Rate (RFR) is based on the Q95 exceedance data provided by NRW hydrology, confirmation e-mail can be found here. The process contribution (PC) is calculated using the following equation:

Process contributions for discharges to rivers

The process contribution of substances released to inland rivers is given by:

$$PC = \frac{(EFR \times RC)}{(EFR + RFR)}$$

where

- PC = process contribution (µg/l)
- EFR = effluent flow rate (m^3/s)
- RC = release concentration of the pollutant in the effluent (µg/l)
- RFR = river flow rate (m^3/s).

As the % of the EQS is less than 4 % the second screening test has passed and therefore no further assessment is required.

Conclusion

The proposed discharge has screened out in screening test 2 and no further modelling of mercury is required. The current limit of 0.5 µg/L remains appropriate. The specification of the ETP ensures this limit can be met.

Cadmium

Cadmium is found to be present in trace amounts in the milk and in dosing chemicals used at the plant, therefore has the potential to be present in the treated effluent. There is already an emission limit value on the permit for cadmium (0.01 mg/L or 10 µg/L), although the applicant has stated the removal efficiency of the new ETP would achieve 0.525 µg/L in the treated effluent, therefore the release concentration has been based on the removal efficiency of the new ETP.

The H1 risk assessment uses screening tests:

Screening test 1:

Substance (AA or MAC)	Release Concentration (RC) - µg/L (Mean for AA, 95%ile for MAC) - µg/L	EQS (or PNEC) - µg/L (AA or MAC)	% of EQS (or PNEC)
Cadmium (AA)	**0.525 (no mean data available)**	**0.08**	**656.25**
Cadmium (MAC)	**0.525**	**0.45**	**116.67**

As the % of the EQS exceeds 10 % the first screening test has failed and therefore the second screening test is applied.

Screening test 2:

Effluent Flow Rate (EFR) - m^3/s	Release Concentration (RC) - µg/L	River Flow Rate (RFR) - m^3/s	Process Contribution (PC) - µg/L	EQS (or PNEC) - µg/L	PC as % of EQS (or PNEC)
0.010416	**0.525**	2.486	0.0021905	0.08	**2.74 %**
0.010416	**0.525**	2.486	0.0021905	0.45	**0.49 %**

The effluent flow rate (EFR) is taken as the existing (maximum) discharge volume of 900 m^3/day = 0.010416 m^3/second. The River Flow Rate (RFR) is based on the Q95 exceedance data provided by NRW hydrology, confirmation e-mail can be found here. The process contribution (PC) is calculated using the following equation:

Process contributions for discharges to rivers

The process contribution of substances released to inland rivers is given by:

$$PC = \frac{(EFR \times RC)}{(EFR + RFR)}$$

where

- PC = process contribution (µg/l)
- EFR = effluent flow rate (m^3/s)
- RC = release concentration of the pollutant in the effluent (µg/l)
- RFR = river flow rate (m^3/s).

As the % of the EQS is less than 4 % the second screening test has passed and therefore no further assessment is required

Conclusion

The proposed discharge has screened out in screening test 2 and no further modelling of cadmium is required. The current limit of 0.01 mg/L will be reduced to 0.525 µg/L and set in the permit.

Appendix 3 – Consultation with Technical Specialist

RE_ Sulphuric Acid.msg