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HYDROLOGICAL ASSESSMENT OF PROPOSED DISCHARGE TO WATERCOURSE

2022

DAWN MEATS IRELAND
GREENHILLS, BEAUPARC,
NAVAN, CO MEATH

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HYDROLOGICAL ASSESSMENT OF PROPOSED DISCHARGE TO WATERCOURSE
DAWN MEATS (SLANE), GREENHILLS, BEAUPARC, NAVAN, CO WESTMEATH

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HYDROLOGICAL ASSESSMENT OF PROPOSED DISCHARGE TO WATERCOURSE

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EXECUTIVE SUMMARY

An assimilative capacity assessment was conducted on the River Boyne, during 95%ile flow conditions, to predict the ability of the watercourse to accommodate treated effluent discharge of BOD₅, orthophosphate, nitrogen, ammonia and suspended solids from Dawn Meats.

Final effluent quality figures for the discharge from the Dawn Meats facility have been selected in accordance with the design of the effluent treatment plant and EPA guidance BREF for the Slaughtering and Food & Drink Industries.

It has been concluded that the River Boyne would have sufficient assimilative capacity to accommodate discharges of up to 400 M³ from the Dawn Meats facility.

The following table summarises the existing background quality of the watercourse, the legislated limits and surface-water objectives downstream of the proposed discharge location, the proposed final effluent quality from the facility and the resultant concentration within the River Boyne due to the discharge.

RIVER BOYNE

Parameter	Units	Background Quality	Legislated Quality	Proposed Discharge Quality	Predicted Levels Post Discharge (mg/l)	% Headroom Utilised
BOD ₅	mg/l O ₂	1.4415	2.6	20.0	1.4594	1.54%
COD	mg/l O ₂	21.08	40	100	21.16	0.40%
Orthophosphate	mg/l PO ₄ -P	0.0305	0.075	2.0	0.0324	4.26%
Nitrogen	mg/l N	2.8278	3.00	20.0	2.8443	9.61%
Total Ammonia	mg/l N	0.0438	0.14	5.0	0.0486	4.96%
Unionised Ammonia*	mg/l NH ₃ -N	0.0013	0.0165	0.153	0.0014	0.96%
Suspended Solids	mg/l SS	8.36	25.0	30.0	8.38	0.13%

**Calculated from total ammonia based upon field temperature and pH results.*

As can be seen from the above table, a discharge from the proposed biological treatment plant at 400 M³ per day would not result in a significant deterioration in the existing quality of the River Boyne.

This assessment has predicted that, under receiving water 95-percentile flow conditions, the River Boyne would have adequate assimilative capacity for the proposed discharge of 400M³/day.

Therefore, it is concluded that the River Boyne would have sufficient assimilative capacity to accommodate discharges from the Dawn Meats facility.

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1.0 INTRODUCTION

Dawn Meats Ireland Unlimited Company (also referred to as Dawn Meats (Slane)) is a producer and processor of beef products. This site takes in live cattle and produces sides and quarters for further processing at other Dawn Meats Group sites or direct sale.

Dawn Meats (Slane) is located in a rural location off the N2, approximately 4.5km south of the village of Slane, Co. Meath. The site of the abattoir was originally a farmyard where on-farm slaughter of cattle was undertaken. The facility at Slane, which was previously operating as Newgrange Meats, was acquired by the Dunbia Group in 2001. The facility was then incorporated into the Dawn Meats Group in September 2018.

Panther Environmental Solutions Ltd was requested by Dawn Meats to undertake an assimilative capacity assessment of the River Boyne, in relation to a proposed effluent treatment plant extension and discharge to the river from the site.

This report presents details of the works and calculations undertaken to determine the assimilative capacity of the receiving watercourse.

2.0 BACKGROUND INFORMATION FOR RECEIVING WATERCOURSES

2.1 CATCHMENT INFORMATION

The River Boyne is located within the River Boyne catchment (River Code 07B04). The catchment topography generally falls in a northerly direction from hills in Painestown (155m OD) and Kingstown and Carnuff Great (100m OD) to the River Boyne (30 OD).

The River Boyne rises at Trinity Well, Newberry Hall, near Carbury, County Kildare, and flows for approximately 112km before reaching the Irish Sea.

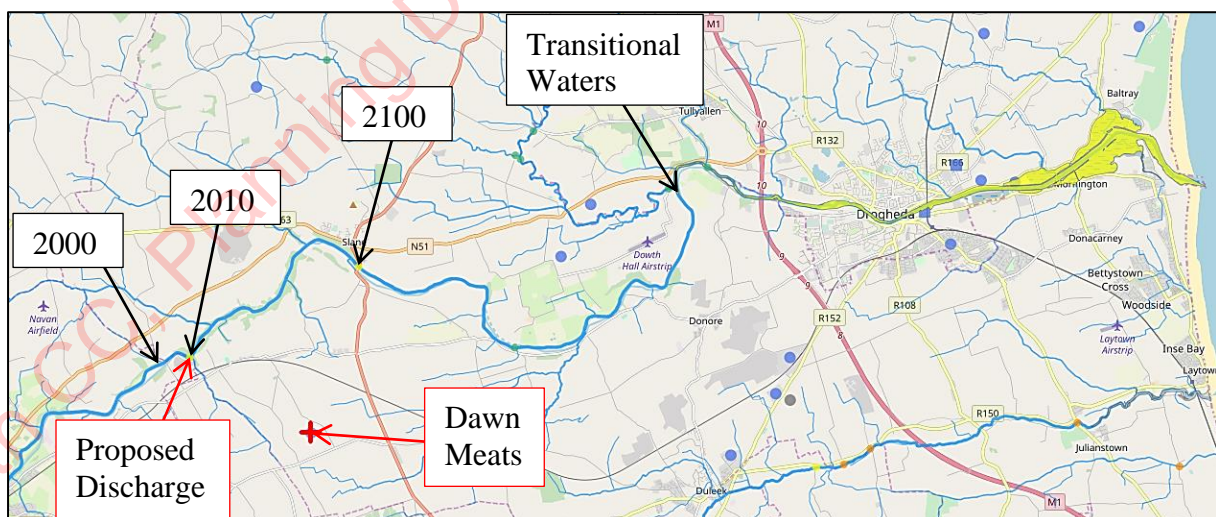


Figure 2.1: Site Location and Proposed Discharge Point

The proposed main route would follow the local road network to the River Boyne. The proposed discharge location [E292417, N271406] is approximately 10 meters upstream of the

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confluence of the Dollardstown River and the River Boyne, which is approximately 750m downstream of the Broadboyne Bridge, EPA station code 2000, [E291858, N271311].

The EPA monitoring station number 2010 “d/s Broadboyne Br (RHS)” [E292447, N271437], ecological monitoring only, is located in the vicinity of the proposed discharge and the outflow from the Dollardstown Stream.

The next EPA monitoring station downstream is number 2100 “Slane Bridge” [E296399, N273644], downstream of the Slane municipal WWTP, and is approximately 5.67km downstream of the proposed discharge.

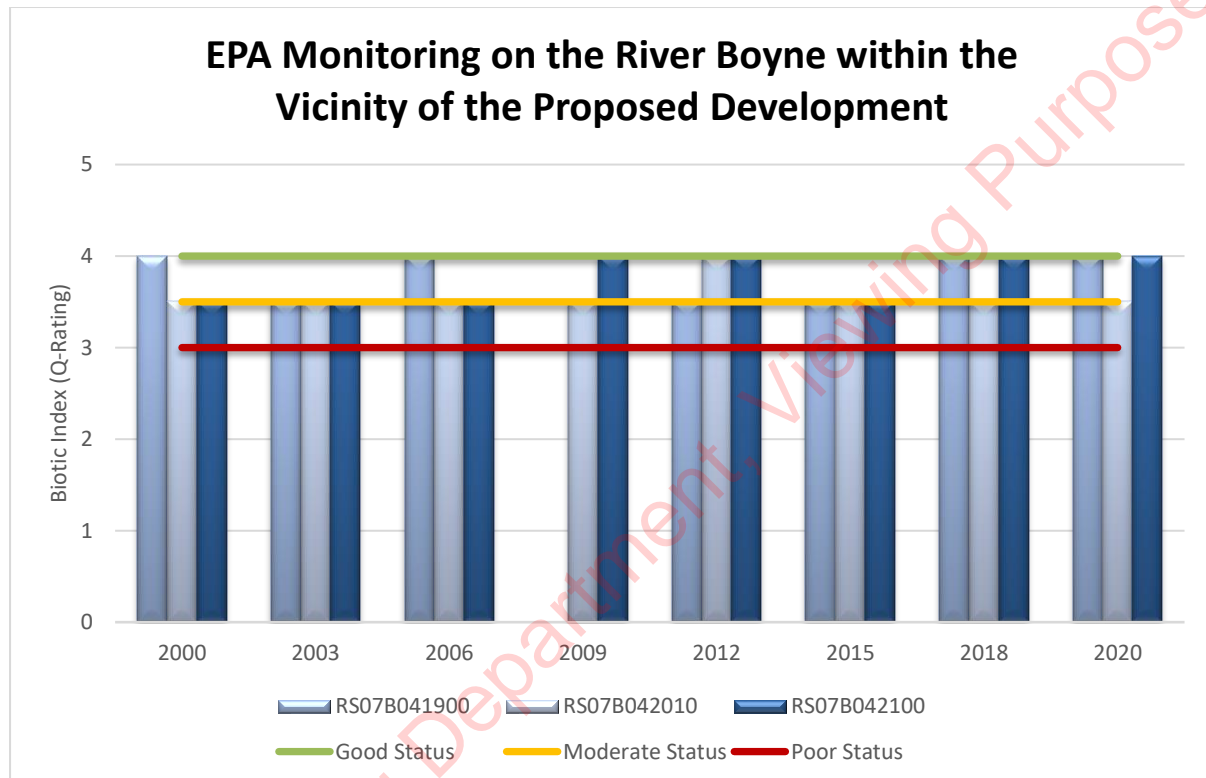


Figure 2.2: EPA Ecological Monitoring of the River Boyne

As can be seen in **Figure 2.2** above, the River Boyne is mainly achieving a water quality status of Q4 (Good) to Q3-4 (Moderate) in recent years at the monitoring stations located upstream and downstream of the proposed discharge point.

EPA comments on the most recent monitoring results for the River Boyne are as follows; “Five of the fourteen stations on the Boyne were in satisfactory condition when assessed in 2020 (0400, 0800, 0900, 2100 and 2200). One site declined in quality, Kinnafad Bridge (0300), which is now of poor ecological status. All other sites were of moderate ecological status.”

The River Boyne has been classified as being at risk of not achieving good status between Navan town and Slane Bridge.

The River Boyne, main channel, is designated as a salmonid water under the European Commission (Quality of Salmonid Waters) Regulations 1988.

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The River Boyne and River Blackwater are designated as a Special Area of Conservation (SAC code: 002299) for Alkaline fen and alluvial forest habitats and the species river lamprey *Lampetra fluviatilis*, salmon *Salmo salar*, and otter *Lutra lutra*. The site is also a Special Protection Area (SPA code: 004232) for the Kingfisher *Alcedo atthis*.

The Slane Agglomeration Wastewater Treatment Plant (Discharge Licence: D0257-01) [E295890, N274260] comprises of two separate treatment systems. The first system has a design capacity of 1500 p.e. and consists of preliminary treatment (screening,) secondary treatment (aeration and followed by settlement). The second system has a design capacity of 750 p.e. which consists of primary settlement, Rotating Biological Contactor followed by settlement. The outflows from both systems combine prior to discharge. At present, the plant is operating below its design capacity of 2,250 p.e.

Navan UWWTP (D0059) discharges to the River Boyne [E 288954, N 269554], approximately 4.6km upstream of the proposed discharge location. Slane UWWTP (D0257) discharges to the River Boyne [E296247, N273851], approximately 5.4 kilometres downstream of the proposed discharge location.

The Staleen Water Treatment Works is located downstream of the proposed discharge location [E303375, N273095], and provides coagulation, sedimentation, filtration and disinfection treatment. The water abstraction point is located at Staleen (Abstraction Code: 2100PUB1019) [E301795, N272201], approximately 12.7 kms downstream of the proposed discharge point.

2.2 FLOWS IN THE RECEIVING WATERCOURSES

The Water Services Training Group (WSTG) “*Technical Guidance Manual*” (Aug 2011) states that;

“The EPA, in conjunction with the Western River Basin District, has developed a ‘Flow Estimating Tool’/ ‘Hydrotool’: The tool can be used to provide estimated 95%ile flows for ungauged river catchments. This on-line facility allows the user to pick a site and estimate flows based on recorded flows from the nearest appropriate gauged site.

This method of calculating flows should be used in preference to on-site flow measurements where data is not readily available. However, the Flow Estimating Tool is not appropriate for use in some circumstances such as in karst limestone areas. In such cases, on-site measurement may be required.”

The WSTG Guidance (Aug 2011) also states that;

“Allowable discharge limits should be based on the 95%ile concentration [receiving water] quality standard at the 95%ile [receiving water] flow”

The EPA HydroTool is currently in the process of being updated. The EPA Office of Environmental Assessment were contacted to source an updated 95%ile flow rate from the closest hydrometric gauge c. 4 km downstream at Slane Castle. Consultation with the EPA is included in Appendix C of this report.

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Table 2.1: Flow Data for the River Boyne

Watercourse	95-Percentile Flow (M ³ /s)
River Boyne Slane Castle Hydrometric Gauge (07012)_	4.8

2.3 BACKGROUND WATER QUALITY OF RECEIVING WATERCOURSES

The figures derived from the assessment by McCloy Consulting (Report Ref: M02171-01_WQ01) of EPA monitoring of the River Boyne have been used to inform the baseline condition of the receiving watercourse.

As stated in the McCloy Report:

- All monitoring water quality values (except COD) have been obtained from station 'Broadboyne Bridge' (RS07B042000). The station is located c. 0.65km upstream of the proposed outfall location. The available chemistry data was recorded for the period 2007 – 2021 and the average value for each parameter was selected as the ambient concentration in the river.
- Monitoring COD values have been obtained from station 'Slane Bridge' (RS07B042100). The station is located c.5km downstream from the proposed outfall location, however it was the only chemical monitoring station along the reach that recorded COD levels. The available chemistry data was recorded for the period 2008 – 2010 and the average concentration was adopted for use in the assessment.
- The concentration of UiA in the river is derived based on the total ammonia concentration, and measured pH levels and water temperatures. pH and temperature were obtained from station 'Broadboyne Bridge' (RS07B042000).

The figures used to demonstrate the existing water quality of the watercourses is displayed below in Table 2.2.

Table 2.2: Background Water Quality Values for Receiving Watercourse

Parameter	Parameter	Background River Concentration
BOD ₅	mg/l O ₂	1.4415
COD	mg/l O ₂	21.08
Orthophosphate	mg/l PO ₄ -P	0.0305
Nitrogen	mg/l N	2.8278
Total Ammonia	mg/l N	0.0438
Unionised Ammonia*	mg/l NH ₃ -N	0.0013
Suspended Solids	mg/l SS	8.36

*Calculated from total ammonia based upon field temperature and pH results.

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2.4 DISCHARGE CONCENTRATIONS AND LEGISLATIVE LIMITS

2.4.1 Proposed Final Effluent Quality at Dawn Meats (Slane) Facility

The proposed final effluent quality from the Dawn Meats (Slane) facility is summarised in the following table.

Table 2.3: Proposed Effluent Discharge Limits

Parameter	Units	Proposed limits	2005 Slaughter Industry BREF	2017 Food & Drink BREF
BOD ₅	mg/l O ₂	20	10 - 40	<20
COD	mg/l O ₂	100	—	—
Orthophosphate	mg/l PO ₄ -P	2.0	—	—
Nitrogen	mg/l N	20	15 – 40	2 – 20
Total Ammonia	mg/l N	5.0	—	—
Unionised Ammonia*	mg/l NH ₃ -N	0.153	—	—
Suspended Solids	mg/l SS	30	5 – 60	4 – 65
Flow Rate	M ³ /day	400	—	—

*Calculated from total ammonia based upon field temperature and pH results.

2.4.2 Water Quality Standards of Receiving Watercourses as per Legislation

Legislated water quality standards for Irish surface waters are summarised in the following table.

Table 2.4: Maximum Permissible Concentrations Downstream from Discharge

Parameter	Units	Legislated River Conc ⁿ .	Legislation
BOD ₅	mg/l O ₂	2.6	Surface Waters Objectives Regs (SI 272 of 2009)
COD	mg/l O ₂	40	Surface Water Regs (SI 294 of 1989)
Orthophosphate	mg/l PO ₄ -P	0.075	Surface Waters Objectives Regs (SI 272 of 2009)
Nitrogen	mg/l N	3.0	Surface Water Regs (SI 294 of 1989)
Total Ammonia	mg/l N	0.14	Surface Waters Objectives Regs (SI 272 of 2009)
Unionised Ammonia	mg/l NH ₃ -N	0.0165	Salmonid Waters Regs (SI 293 of 1988)
Suspended Solids	mg/l SS	25	Salmonid Waters Regs (SI 293 of 1988)

3.0 ASSIMILATIVE CAPACITY ASSESSMENT RESULTS

Using the River Boyne flow rate, background water quality information, proposed final effluent quality figures and the legislated river water quality standards as presented in Sections 2.2, 2.3, and 2.4 respectively, an assimilative capacity of the River Boyne has been carried out for the 95-percentile flow. The results of this assessment are summarised below and detailed calculation examples are provided in Appendix B.

The calculations were carried out on the basis of an average daily effluent discharge volume of 400 M³/day.

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3.1 ASSIMILATIVE CAPACITY RESULTS FOR THE RIVER BOYNE

River Boyne		Characteristics of Watercourse			Proposed Effluent	400 M ³ Effluent Flow Scenario		
						Mass Balance		Headroom
Parameter	Unit	Existing Level in Stream	Downstream Legislated Limits	Available Assimilative Capacity (kg/day)	Discharge Concentration	Rise in Levels due to Discharge	Predicted Levels Post Discharge	% Headroom Utilised
BOD ₅	mg/l O ₂	1.4415	2.6	480	20	0.0179	1.4594	1.54%
COD	mg/l O ₂	21.08	40	7,847	100	0.08	21.16	0.40%
Orthophosphate	mg/l PO ₄ -P	0.0305	0.075	18.4550	2	0.0019	0.0324	4.26%
Nitrogen	mg/l N	2.8278	3.00	71.4148	20	0.0165	2.8443	9.61%
Total Ammonia	mg/l N	0.0438	0.14	39.8961	5	0.0048	0.0486	4.96%
<i>Unionised Ammonia*</i>	<i>mg/l NH₃-N</i>	<i>0.0013</i>	<i>0.0165</i>	<i>6.3037</i>	<i>0.153</i>	<i>0.0001</i>	<i>0.0014</i>	<i>0.96%</i>
Suspended Solids	mg/l SS	8.36	25.0	6,901	30	0.02	8.38	0.13%

**Calculated from total ammonia based upon field temperature and pH results.*

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DAWN MEATS IRELAND, GREENHILLS, BEAUPARC, NAVAN, CO WESTMEATH

4.0 DISCUSSION

An assessment of the River Boyne has been undertaken to predict the assimilative capacity of the watercourse to accommodate proposed treated effluent discharge flows from the Dawn Meats facility.

As can be seen from Table 2.3 above, proposed final effluent quality values have been selected in accordance with the EPA guidance BREF for the Slaughtering and Food & Drink Industries.

Background water quality for the River Boyne was determined from EPA historic sampling datasets, the average of which were used to represent the typical water quality in the watercourse.

As can be seen from table 2.2 above, the existing average background concentration of all parameters are within relevant water quality standard limits. Therefore, there is available assimilative capacity within the Boyne Rivers which may be sufficient to accommodate the proposed discharge.

Using flow data obtained from the EPA, the 95-percentile flow was estimated to be 4.8 M³/s for the River Boyne at the proposed discharge location.

An assimilative capacity assessment was carried out on the River Boyne based upon the proposed discharge parameters detailed in table 2.3 above.

Resultant parameter concentrations within the River Boyne were calculated based upon a discharge of 400 M³ per day of treated effluent.

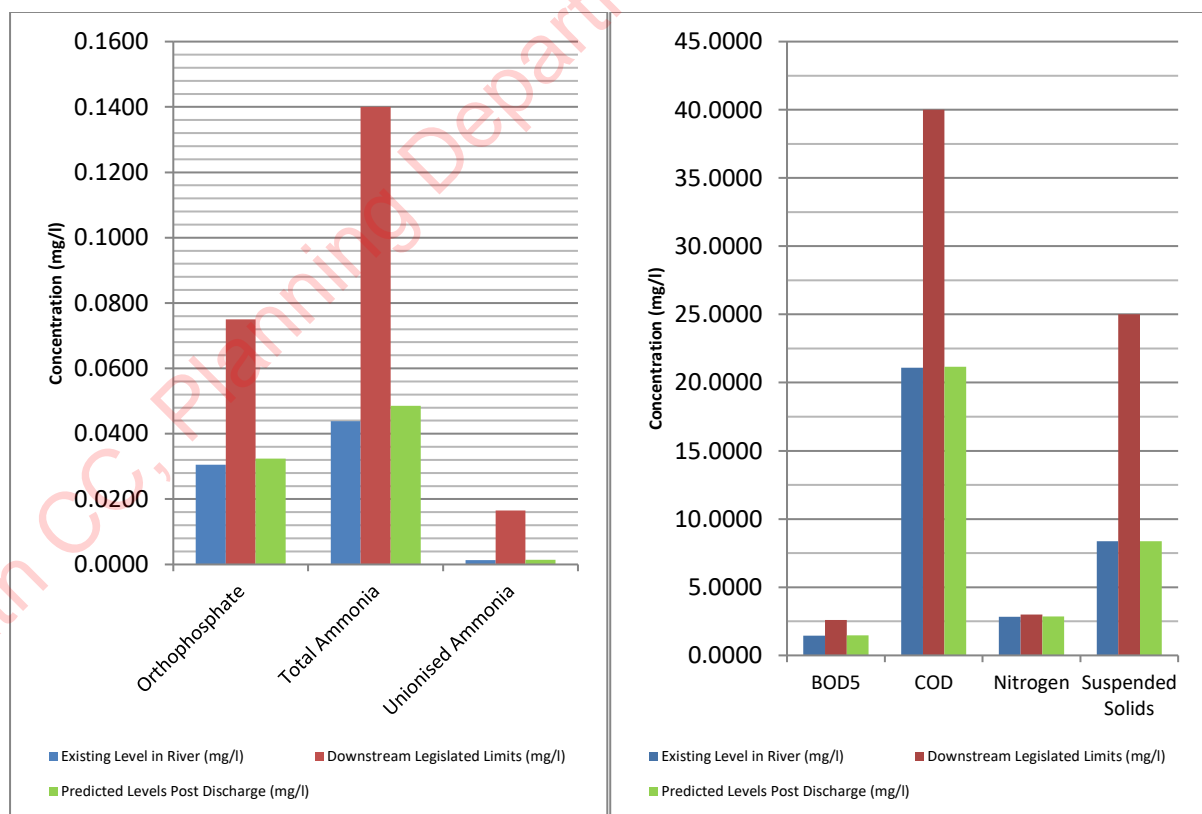


Figure 4.1: Assimilative Capacity Results for the River Boyne at 400 M³/day

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DAWN MEATS IRELAND, GREENHILLS, BEAUPARC, NAVAN, CO WESTMEATH

As can be seen in figure 4.1 above, the planned discharge would have no significant effect upon the existing quality of the River Boyne, with no significant increase in the concentration of any parameter considered in this assessment.

Percentage headroom utilisation would range from 0.13% for Suspended Solids to 9.61% for Total Nitrogen. This is significantly below the recommended rule of thumb of 25% headroom utilisation threshold for new discharges as outlined in WSTG guidance.

In 2020, the River Boyne in the vicinity of the proposed discharge location was classified as being of “moderate quality status” under the Surface Water Regulations (SI 272 of 2009). Under the Surface Water Regulations classification system, a waterbody is classified based upon the lowest score attained for any of the determining parameter. (River Waterbody: Q-rating, BOD, orthophosphate, ammonia, temperature, pH, heavy metals and priority substances)

This assimilative capacity assessment has determined that the planned discharge from the Dawn Meats (Slane) facility would not result in the River Boyne failing to achieve good status, based upon average EPA monitoring results.

Therefore, it is considered that the River Boyne would have sufficient assimilative capacity to accept a discharge of 400 M³ per day of effluent from the Dawn Meats (Slane) facility.

5.0 CONCLUSIONS

The existing average background concentrations of all parameters assessed for the River Boyne were found to be in compliance with relevant water quality standard limits.

The River Boyne is classified as being of moderate status in the vicinity of the proposed discharge point, however averaged EPA monitoring has shown that physico-chemical parameters are in compliance with a “good status” classification.

The planned future discharge would have no significant effect upon the existing quality of the River Boyne, with no significant increase in the concentration of any parameter considered in this assessment.

Percentage headroom utilisation would range from 0.13% for Suspended Solids to 9.61% for Total Nitrogen.

The planned future discharge from the Dawn Meats (Slane) facility would not result in the River Boyne failing to achieve good status, based upon average EPA monitoring results.

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6.0 REFERENCES

WSTG, (Aug 2011). "Guidance, Procedures and Training on the Licensing of Discharges to Surface Waters, Groundwater and to Sewer for Local Authorities: Volume 1 – Technical Guidance Manual." Water Services Training Group, Monastery Road, Roscrea, Co. Tipperary.

EPA Ireland (Environmental Protection Agency), 2001. "*Parameters of Water Quality: Interpretation and Standards.*" Environmental Protection Agency, Wexford.

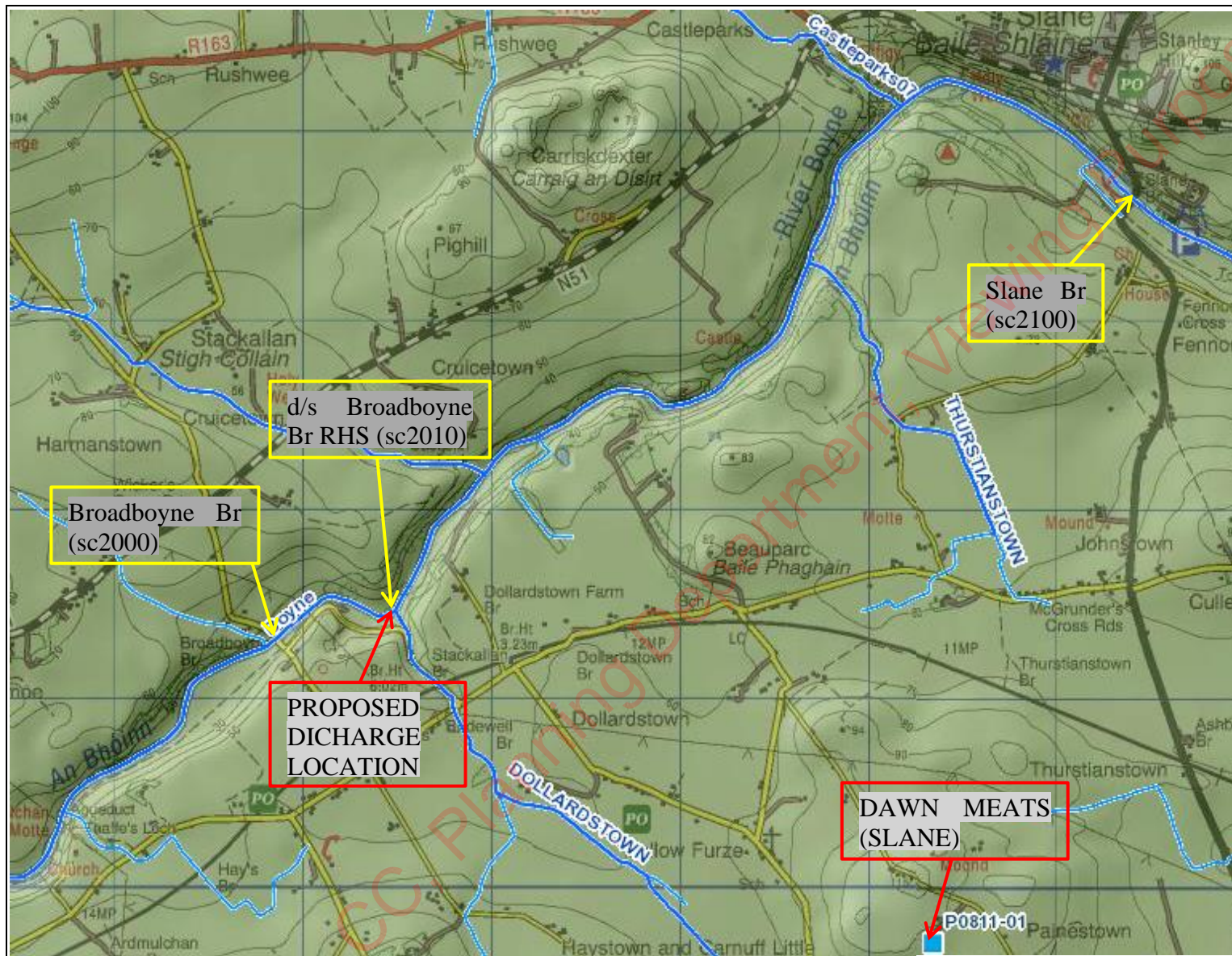
European Communities Environmental Objectives (Surface Waters) Regulations (S.I. No. 272 of 2009)

European Communities (Quality of Salmonid Waters) Regulations (S.I. No. 293 of 1988)

European Communities (Quality of Surface Water Intended For The Abstraction of Drinking Water) Regulations (S.I. No. 294 of 1989)

APPENDIX A
- MONITORING LOCATION MAP -

HYDROLOGICAL ASSESSMENT OF PROPOSED DISCHARGE TO WATERCOURSE **DAWN MEATS IRELAND, GREENHILLS, BEAUPARC, NAVAN, CO WESTMEATH**



Notes:



Dawn Meats (Slane)
Co. Meath

Monitoring Locations



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APPENDIX B
- ASSIMILATIVE CAPACITY CALCULATIONS -

HYDROLOGICAL ASSESSMENT OF PROPOSED DISCHARGE TO WATERCOURSE
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C1 Assimilative Capacity of Receiving Watercourses

Mass Balance Equation – Calculations based on Proposed Discharge Licence Limits

Using the mass balance approach (as detailed in WSTG document Volume 1 – Technical Guidance Manual, Aug 2011) the resultant concentration in a receiving watercourse due to a discharge is calculated as follows:-

$$\text{Mass Balance} = \quad T = \frac{(F \times C) + (f \times c)}{(F + f)}$$

Where,

T = resultant concentration due to the discharge (mg/l).

F = 95-percentile flow in receiving water (m³/s).

C = mean background concentration in receiving water (mg/l).

f = maximum discharge flow (m³/s).

c = maximum concentration in the discharge (mg/l).

This method is applied to the 95-percentile receiving water flow in this assessment.

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Table C1: Example of Mass Balance Calculation for the River Boyne [BOD₅]

GIVEN;		Units	400 M³ Discharge
Watercourse 95%ile Flow	(Table 2.1 of this Report)	m ³ /s	4.8
Background Watercourse Concentration	(Table 2.2 of this Report)	mg/l	1.4415
Rate of Effluent discharge	(Table 2.3 of this Report)	m ³ /day	400
Effluent Concentration	(Table 2.3 of this Report)	mg/l	20
Water Quality Limit in Watercourse	(Table 2.4 of this Report)	mg/l	2.6
CALCULATION			
Watercourse %ile Flow	= %ile Flow(m ³ /s)*86.4*1000 =	l/day	414,720,000
Watercourse Load	= %Flow (l/day)*BG Conc (mg/l) =	mg/day	597,818,880
Rate of Effluent Discharge	= Rate of Discharge (m ³ /day)*1000 =	l/day	400,000
Effluent Load	= Rate of Discharge (l/day)*Effluent Conc (mg/l) =	mg/day	8,000,000
Combined Flow	=%Flow Watercourse (l/day) + Rate of discharge (l/day) =	m ³ /day	415,120,000
Combined Load	= Watercourse Load (mg/day) + Effluent Load (mg/day) =	mg/day	605,818,880
Combined Concentration	= Combined Load (mg/day) / Combined Flow (l/day) =	mg/l	1.4594
Increase in Concentration	= Combined Concentration (mg/l) – Background Watercourse Concentration (mg/l) =	mg/l	0.0179
Available Assimilative Capacity	[(C _{max} – C _{back}) x F x 86.4]	kg/day	480.4531
% Headroom Utilised	= [(C _{comb} - C _{back}) * 100] / (C _{max} - C _{back}) =	%	1.54%