

Annual Environmental Report

2021



Coill Dubh

D0242-01

CONTENTS

1 EXECUTIVE SUMMARY AND INTRODUCTION TO THE 2021 AER

- 1.1 ANNUAL STATEMENT OF MEASURES
- 1.2 TREATMENT SUMMARY
- 1.3 ELV OVERVIEW
- 1.4 LICENSE SPECIFIC REPORT INCLUDED IN AER

2 TREATMENT PLANT PERFORMANCE AND IMPACT SUMMARY

- 2.1 COILL DUBH WWTP - TREATED DISCHARGE
 - 2.1.1 INFLUENT SUMMARY - COILL DUBH WWTP
 - 2.1.2 EFFLUENT MONITORING SUMMARY - COILL DUBH WWTP -
 - 2.1.3 AMBIENT MONITORING SUMMARY FOR THE TREATMENT PLANT DISCHARGE -
 - 2.1.4 OPERATIONAL REPORTS SUMMARY FOR COILL DUBH WWTP
 - 2.1.5 SLUDGE/OTHER INPUTS TO COILL DUBH WWTP

3 COMPLAINTS AND INCIDENTS

- 3.1 COMPLAINTS SUMMARY
- 3.2 REPORTED INCIDENTS SUMMARY
 - 3.2.1 SUMMARY OF INCIDENTS
 - 3.2.2 SUMMARY OF OVERALL INCIDENTS

4 INFRASTRUCTURAL ASSESSMENT AND PROGRAMME OF IMPROVEMENTS

- 4.1 STORM WATER OVERFLOW IDENTIFICATION AND INSPECTION REPORT
 - 4.1.1 SWO IDENTIFICATION AND INSPECTION SUMMARY REPORT
- 4.2 REPORT ON PROGRESS MADE AND PROPOSALS BEING DEVELOPED TO MEET THE IMPROVEMENT PROGRAMME REQUIREMENTS
 - 4.2.1 SPECIFIED IMPROVEMENT PROGRAMME SUMMARY
 - 4.2.2 IMPROVEMENT PROGRAMME SUMMARY
 - 4.2.3 SEWER INTEGRITY RISK ASSESSMENT

5 LICENCE SPECIFIC REPORTS

- 5.1 PRIORITY SUBSTANCES ASSESSMENT
- 5.2 SMALL STREAM RISK SCORE ASSESSMENT

6 CERTIFICATION AND SIGN OFF

- 6.1 SUMMARY OF AER CONTENTS

7 APPENDIX

1 EXECUTIVE SUMMARY AND INTRODUCTION TO THE 2021 AER

This Annual Environmental Report has been prepared for D0242-01, Coill Dubh, in Kildare in accordance with the requirements of the wastewater discharge licence for the agglomeration. Specified reports where relevant are included as an appendix to the AER.

1.1 ANNUAL STATEMENT OF MEASURES

A summary of any improvements undertaken is provided where applicable.

Works carried out in 2021 to improve operational performance at the plant included the following:

- Replaced SBR1 diffuser membranes
- Cleaned and improved operation of both tertiary sand filters
- Developed cleaning schedule for removal of large-scale grit build up in Inlet Buffer Tank

1.2 TREATMENT SUMMARY

The agglomeration is served by a wastewater treatment plant(s)

- Coill Dubh WWTP with a Plant Capacity PE of 2000, the treatment type is 3P - Tertiary P removal.

1.3 ELV OVERVIEW

The overall compliance of the final effluent with the Emission Limit Values (ELVs) is shown below. More detailed information on the below ELV's can be found in Section 2.

Discharge Point Reference	Treatment Plant	Discharge Type	Compliance Status	Parameters failing if relevant
TPEFF1400D0242SW001	Coill Dubh WWTP	Treated	Non-Compliant	Ammonia-Total (as N) mg/l

1.4 LICENCE SPECIFIC REPORTING

Assessment / Report
Small Stream Risk Score Assessment

2 TREATMENT PLANT PERFORMANCE AND IMPACT SUMMARY

2.1 COILL DUBH WWTP - TREATED DISCHARGE

2.1.1 INFLUENT MONITORING SUMMARY - COILL DUBH WWTP

A summary of influent monitoring for the treatment plant is presented below. This monitoring is primarily undertaken in order to determine the overall efficiency of the plant in removing pollutants from the raw wastewater.

Parameters	Number of Samples	Annual Max	Annual Mean
Total Phosphorus (as P) mg/l	10	11	7.50
Total Nitrogen mg/l	10	74	36
BOD, 5 days with Inhibition (Carbonaceous BOD) mg/l	10	253	161
Ammonia-Total (as N) mg/l	10	61	27
COD-Cr mg/l	10	930	745.98
Suspended Solids mg/l	10	507	334.08
pH pH units	9	8.49	7.70
ortho-Phosphate (as P) - unspecified mg/l	10	5.55	3.68
Hydraulic Capacity	N/A	769	365

If other inputs in the form of sludge / leachate are added to the WWTP then these are included in Section 2.1.5 if applicable.

Significance of Results:

The annual mean hydraulic loading is less than the peak Treatment Plant Capacity. The annual maximum hydraulic loading is less than the peak Treatment Plant Capacity. Further details on the plant capacity and efficiency can be found under the sectional 'Operational Performance Summary'.

2.1.2 EFFLUENT MONITORING SUMMARY - TPEFF1400D0242SW001

Parameter	WWDL ELV (Schedule A)	ELV with Condition 2 Interpretation included ^{Note 1}	Interim % reduction from influent concentration	Number of sample results	Number of exceedances	Number of exceedances with Condition 2 Interpretation included	Annual Mean	Overall Compliance (Pass/Fail)
COD-Cr mg/l	125	250	N/A	11	N/A	N/A	27	Pass
Suspended Solids mg/l	10	25	N/A	11	N/A	N/A	3.32	Pass
pH pH units	6.00	9.00	N/A	11	N/A	N/A	7.48	Pass
BOD, 5 days with Inhibition (Carbonaceous BOD) mg/l	8.00	16	N/A	11	N/A	N/A	2.33	Pass
Total Phosphorus (as P) mg/l	0.500	0.600	N/A	10	1	N/A	0.224	Pass
Ammonia-Total (as N) mg/l	0.500	1.00	N/A	11	1	1	0.434	Fail
ortho-Phosphate (as P) - unspecified mg/l	0.250	0.500	N/A	11	1	N/A	0.097	Pass

Parameter	WWDL ELV (Schedule A)	ELV with Condition 2 Interpretation included ^{Note 1}	Interim % reduction from influent concentration	Number of sample results	Number of exceedances	Number of exceedances with Condition 2 Interpretation included	Annual Mean	Overall Compliance (Pass/Fail)
Conductivity @20°C µS/cm	N/A	N/A	N/A	8	N/A	N/A	780	
Total Nitrogen mg/l	N/A	N/A	N/A	9	N/A	N/A	14	

Notes:

1 – This represents the Emission Limit Values after the Interpretation provided for under Condition 2 of the licence is applied

2 – For pH the WWDA specifies a range of pH 6 - 9

Cause of Exceedance(s):

INCI0021445 Shock load to WWTP/ Plant or equipment breakdown at WWTP.

Significance of Results:

The WWTP is non compliant with the ELV's set in the Wastewater Discharge Licence. The impact on receiving waters is assessed further in Section 2.

2.1.3 AMBIENT MONITORING SUMMARY FOR THE TREATMENT PLANT DISCHARGE TPEFF1400D0242SW001

A summary of monitoring from ambient monitoring points associated with the wastewater discharge is provided in the sections below. For discharges to rivers upstream (U/S) and downstream (D/S) location data is provided. For other ambient points in lakes, coastal or transitional waters, monitoring data from the most appropriate monitoring station is selected.

The table below provides details of ambient monitoring locations and details of any designations as sensitive areas.

Ambient Monitoring Point from WWDL (or as agreed with EPA)	Irish Grid Reference	River Station Code	Bathing Water	Drinking Water	FWPM	Shellfish	WFD Ecological Status
Upstream	278857, 226765	RS14S010000	No	No	No	No	Poor
Downstream	278857, 226765	RS14S010020	No	No	No	No	Poor

The table below provides a summary of monitoring results for designated ambient monitoring points. The upstream and downstream annual mean values are shown (mg/l), and the difference between both monitoring stations is given as a percentage of the Environmental Quality Standard (EQS) where relevant.

Parameter Name	Upstream Monitoring Point Location	Upstream Monitoring Point Annual Mean	Downstream Monitoring Point Location	Downstream Monitoring Point Annual Mean	EQS	% of EQS
BOD - 5 days (Total) mg/l	RS14S010000	1.21	RS14S010020	1.26	1.50	3.4
Ammonia-Total (as N) mg/l	RS14S010000	0.486	RS14S010020	0.041	0.065	-684.8
ortho-Phosphate (as P) - unspecified mg/l	RS14S010000	0.074	RS14S010020	0.051	0.035	-65.6
Temperature °C	RS14S010000	17	RS14S010020	11	N/A	
pH pH units	RS14S010000	7.58	RS14S010020	8.14	N/A	
Total Nitrogen mg/l	RS14S010000	2.70	RS14S010020	N/A	N/A	
COD-Cr mg/l	RS14S010000	42	RS14S010020	N/A	N/A	
Total Phosphorus (as P) mg/l	RS14S010000	0.139	RS14S010020	N/A	N/A	
Dissolved Oxygen mg/l	RS14S010000	8.08	RS14S010020	9.66	N/A	
Suspended Solids mg/l	RS14S010000	2.25	RS14S010020	N/A	N/A	

Parameter Name	Upstream Monitoring Point Location	Upstream Monitoring Point Annual Mean	Downstream Monitoring Point Location	Downstream Monitoring Point Annual Mean	EQS	% of EQS
True Colour PtCo Units	RS14S010000	193	RS14S010020	N/A	N/A	

Significance of Results:

The WWTP discharge was not compliant with the ELV's set in the wastewater discharge licence for the following: Ammonia-Total (as N) mg/l.

The ambient monitoring results do not meet the required EQS at the upstream and the downstream monitoring locations. The EQS relates to the Oxygenation and Nutrient Conditions set out in the Surface Water Regulations 2009.

Based on ambient monitoring results a slight deterioration in BOD concentration downstream of the effluent discharge is noted.

A deterioration in water quality has been identified, however it is not known if it or is not caused by the WWTP.

As per the 3rd Cycle Draft Barrow Catchment Report (HA 14), the significant pressures on the At Risk Slate_020 waterbody are Agriculture and Urban Waste Water. The Coill Dubh WWTP is listed as a significant pressure in the Cycle 3 Catchment Report.

Based on the SSRS Assessment carried out in 2021, there was no evidence of impact on the downstream water quality due to the discharge at Coill Dubh.

The discharge from the wastewater treatment plant does not have an observable negative impact on the Water Framework Directive status. The WFD status is poor upstream and downstream of the primary discharge point.

2.1.4 OPERATIONAL PERFORMANCE SUMMARY - COILL DUBH WWTP

2.1.4.1 Treatment Efficiency Report - Coill Dubh WWTP

Treatment efficiency is based on the removal of key pollutants from the influent wastewater by the treatment plant. In essence the calculation is based on the balance of load coming into the plant versus the load leaving the plant. The efficiency is presented as a percentage removal rate.

A summary presentation of the efficiency of the treatment process including information for all the parameters specified in the licence is included below:

Parameter	Influent mass loading (kg/year)	Effluent mass emission (kg/year)	Efficiency (% reduction of influent load)
TP	900	27	97
COD	89554	3148	96
TN	4333	1651	62
cBOD	19353	270	99
SS	40106	385	99

Note: The above data is based on sample results for the number of dates reported

2.1.4.2 Treatment Capacity Report Summary - Coill Dubh WWTP

Treatment capacity is an assessment of the hydraulic (flow) and organic (the amount of pollutants) load a treatment plant is designed to treat versus the current loading of that plant.

Coill Dubh WWTP	
Peak Hydraulic Capacity (m ³ /day) - As Constructed	1229
DWF to the Treatment Plant (m ³ /day)	460
Current Hydraulic Loading - annual max (m ³ /day)	769

Coill Dubh WWTP	
Average Hydraulic loading to the Treatment Plant (m ³ /day)	365
Organic Capacity (PE) - As Constructed	2000
Organic Capacity (PE) - Collected Load (peak week) ^{Note1}	1395
Organic Capacity (PE) - Remaining	605
Will the capacity be exceeded in the next three years? (Yes/No)	No

Nominal design capacities can be based on conservative design principles. In some cases assessment of existing plants has shown organic capacities significantly higher than the nominal design capacity. Accordingly plants that appear to be overloaded when comparing a collected peak load with the nominal design capacity can be fully compliant due to the safety factors in the original design.

2.1.5 SLUDGE / OTHER INPUTS - COILL DUBH WWTP

'Other inputs' to the waste water treatment plant are summarised in table below

Input type	Quantity	Unit	P.E.	% of load to WWTP	Included in Influent Monitoring (Y/N)?	Is there a leachate/sludge acceptance procedure for the WWTP?	Is there a dedicated leachate/sludge acceptance facility for the WWTP? (Y/N)
There is no Sludge and Other Input data for the Treatment Plant included in the AER.							

3 COMPLAINTS AND INCIDENTS

3.1 COMPLAINTS SUMMARY

A summary of complaints of an environmental nature related to the discharge(s) to water from the WWTP and network is included below.

Number of Complaints	Nature of Complaint	Number Open Complaints	Number Closed Complaints
There were no relevant environmental complaints in 2021.			

3.2 REPORTED INCIDENTS SUMMARY

Environmental incidents that arise in an agglomeration are reported on an on-going basis in accordance with our waste water discharge licences. Where an incident occurs and it is reportable under the licence, it is reported to the Environmental Protection Agency through their Environmental Data Exchange Network, or in some instances by telephone. Some incidents which arise in the agglomeration are recorded by Irish Water but may not be reportable under our licence for example where the incident does not have an impact on environmental performance.

A summary of reported incidents is included below.

3.2.1 SUMMARY OF INCIDENTS

Incident Type	Cause	No. of incident occurrences	Recurring (Y/N)	Closed (Y/N)
Abatement Equipment offline	Plant or equipment breakdown at WWTP	1	No	Yes
Abatement Equipment offline	Plant or equipment breakdown at WWTP	1	No	Yes
Breach of ELV	Plant or equipment breakdown at WWTP	1	No	Yes

Incident Type	Cause	No. of incident occurrences	Recurring (Y/N)	Closed (Y/N)
Uncontrolled release	SWO Design not meeting DoEHLG Criteria	1	No	Yes
Uncontrolled release	SWO Design not meeting DoEHLG Criteria	1	No	Yes
Uncontrolled release	SWO Design not meeting DoEHLG Criteria	1	No	Yes

3.2.2 SUMMARY OF OVERALL INCIDENTS

Question	Answer
Number of Incidents in 2021	6
Number of Incidents reported to the EPA via EDEN in 2021	6
Explanation of any discrepancies between the two numbers above	N/A

4 INFRASTRUCTURAL ASSESSMENTS AND PROGRAMME OF IMPROVEMENTS

4.1 STORM WATER OVERFLOW IDENTIFICATION AND INSPECTION REPORT

A summary of the operation of the storm water overflows and their significance where known is included below:

4.1.1 SWO IDENTIFICATION

WWDL Name / Code for Storm Water Overflow (chamber) where applicable	Irish Grid Ref. (outfall)	Included in Schedule of the WWDL	Significance of the overflow(High / Medium / Low)	Assessed against DoEHLG Criteria	Total volume discharged in 2021 (m ³)	Monitoring Status
SW002	279437, 227002	Yes	Low	Meeting	1,243	Monitored

SWO Summary	
How much sewage was discharged via monitored SWOs in the agglomeration in the year (m ³)?	1,243
Is each SWO identified as not meeting DoEHLG Guidance included in the Programme of Improvements?	N/A
The SWO Assessment included the requirements of relevant of WWDL schedules?	Yes
Have the EPA been advised of any additional SWOs / changes to Schedule C3 and A4 under Condition 1.7?	N/A

4.2 REPORT ON PROGRESS MADE AND PROPOSALS BEING DEVELOPED TO MEET THE IMPROVEMENT PROGRAMME REQUIREMENTS

4.2.1 SPECIFIED IMPROVEMENT PROGRAMME SUMMARY

A wastewater discharge licence may require a number of reports on specific subject areas to be prepared for the agglomeration in question. These reports are submitted to the EPA as part of the Annual Environmental Report. This section provides a list of the various reports required for this agglomeration and a brief summary of their recommendations.

Specified Improvement Programmes (under Schedule A and C of WWDL)	Description	Licence Schedule	Licence Completion Date	Date Expired? (N/NA/Y)	Status of Works	Timeframe for Completing the Work	Comments
There are no Specified Improvement Programmes for this Agglomeration.							

A summary of the status of any other improvements identified by under Condition 5 assessments- is included below.

4.2.2 IMPROVEMENT PROGRAMME SUMMARY

Improvement Identifier	Improvement Description / or any Operational Improvements	Improvement Source	Expected Completion Date	Comments
No additional improvements planned at this time.				

4.2.3 SEWER INTEGRITY RISK ASSESSMENT

The utilisation of multiple capital maintenance programmes and the outputs of the workshops with the Local Authority Operations Staff held under the programme can be used to satisfy the requirements of Condition 5 regarding network integrity. Improvement works identified by way of these programmes and workshops will be included in the Improvements Summary Tables 4.2.1 and 4.2.2.

5 LICENCE SPECIFIC REPORTS

A wastewater discharge licence may require a number of reports on specific subject areas to be prepared for the agglomeration in question. These reports are submitted to the EPA as part of the Annual Environmental Report. This section provides a list of the various reports required for this agglomeration and a brief summary of their recommendations.

Licence Specific Report	Required by licence	Year included in AER	Included in this AER
Priority Substances Assessment	Yes	2011	No
Small Stream Risk Score Assessment	Yes	2017	Yes

5.1 PRIORITY SUBSTANCES ASSESSMENT

The Priority Substances Assessment Report has been included in the AER 2011.

5.2 SMALL STREAM RISK SCORE ASSESSMENT

The Small Stream Risk Score Assessment Report is included in Appendix 7.1 - Small Stream Risk Score Assessment. A summary of the findings of this report is included below.

Parameter	Value
Condition 5 Improvement Programme Reference	N/A
Does SSRS indicate discharges are posing a pollution risk?	No
Does improvement programme include any procedural and/or infrastructural works?	No

Parameter	Value
Downstream SSRS Water Quality Risk	At Risk
SSRS Required?	Yes
Upstream SSRS Water Quality Risk	At Risk
What is Downstream SSRS?	4.8
What is Upstream SSRS?	3.2

6 CERTIFICATION AND SIGN OFF

6.1 SUMMARY OF AER CONTENTS

Parameter	Answer
Does the AER include an Executive Summary?	Yes
Does the AER include an assessment of the performance of the Waste Water Works (i.e., have the results of assessments been interpreted against WWDL requirements and or Environmental Quality Standards)?	Yes
Has a Technical amendment/licence review application been submitted to the Agency by IW?	No
List reason e.g., additional SWO identified	N/A
Is there a need to request/advise the EPA of any modification to the existing WWDL with respect to condition 4 changes to monitoring location, frequency etc	No
List reason e.g., changes to monitoring requirements	N/A
Have these processes commenced?	N/A
Are all outstanding reports and assessments from previous AERs included as an appendix to this AER	Yes

I certify that the information given in this Annual Environmental Report is truthful, accurate and complete:

Date: 18/02/2022

This AER has been produced by Irish Water's Environmental Information System (EIMS) and has been electronically signed off in that system for and on behalf of,

Katherine Walshe

Acting Head of Environmental Regulation.

7 APPENDIX

Appendix

Appendix 7.1 - Small Stream Risk Score Assessment



Kildare Small Stream Risk Score 2021

Produced by

AQUAFACT International Services Ltd

For

Kildare County Council

November 2021

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Report Approval Sheet

Client	Kildare County Council
Report Title	Kildare Small Stream Risk Score 2021
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Rev	Status	Issue Date	Document File Name	Author (s)	Approved by:
1	Draft	25/11/2021	JN1675 Kildare WWTP SSRS	Kevin Mc Caffrey	E. McCormack



Table of Contents

1.	Introduction	1
2.	Methodology	1
2.1.	Sampling.....	1
2.2.	Small Stream Risk Score.....	3
3.	Results	4
3.1.	Coill Dubh.....	4
3.2.	Derrinturn.....	4
3.3.	Castledermot.....	4
3.4.	Ballymore Eustace.....	5
4.	Discussion	6
5.	References	6

List of Figures

Figure 2.1: Kildare SSRS sampling sites.....	2
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List of Tables

Table 2.1: Kildare SSRS station coordinates.	3
Table 2.2: SSRS Categories.	3
Table 3.1: Species list.....	5
Table 3.2: Biological sampling results.....	6

Appendices

Appendix 1: Photo log	
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1. Introduction

AQUAFACT was contracted by Kildare County Council to carry out an SSRS assessment of discharges belonging to four wastewater treatment plants at Castledermot, Ballymore Eustace, Coill Dubh and Derrinturn respectively. A sample was taken upstream and downstream of each discharge point. The sampling was carried on the 12th of November 2021.

2. Methodology

2.1. Sampling

Eight kick samples were taken (See Figure 2.1 and Table 2.1). The two-minute kick and one minute stone wash sampling method was employed to collect samples of macroinvertebrates for analysis. This involved placing a standard hand net of pore size 500µm in the river, facing upstream and disturbing the riverbed in front of the net mouth. The surveyor then moved in a diagonal direction upstream to ensure that different micro-habitats were included in the sample. The kick method dislodges macroinvertebrates from the substrates and submerged plant material. This was continued for approximately two minutes and followed by one minute of stone washing (Lucey *et al.*, 1999).

The macroinvertebrate assemblages of each sample were identified and counted on the riverbank. The details of the macroinvertebrate assemblages were recorded on data sheets. The resulting species list was then used to assign the SSRS score to the sampled streams.

The IFI's 2010 Biosecurity Protocol for Field Survey Work document was followed during sampling. Nets and all other equipment were thoroughly disinfected between stations.

Figure 2.1: Kildare SSRS sampling sites.

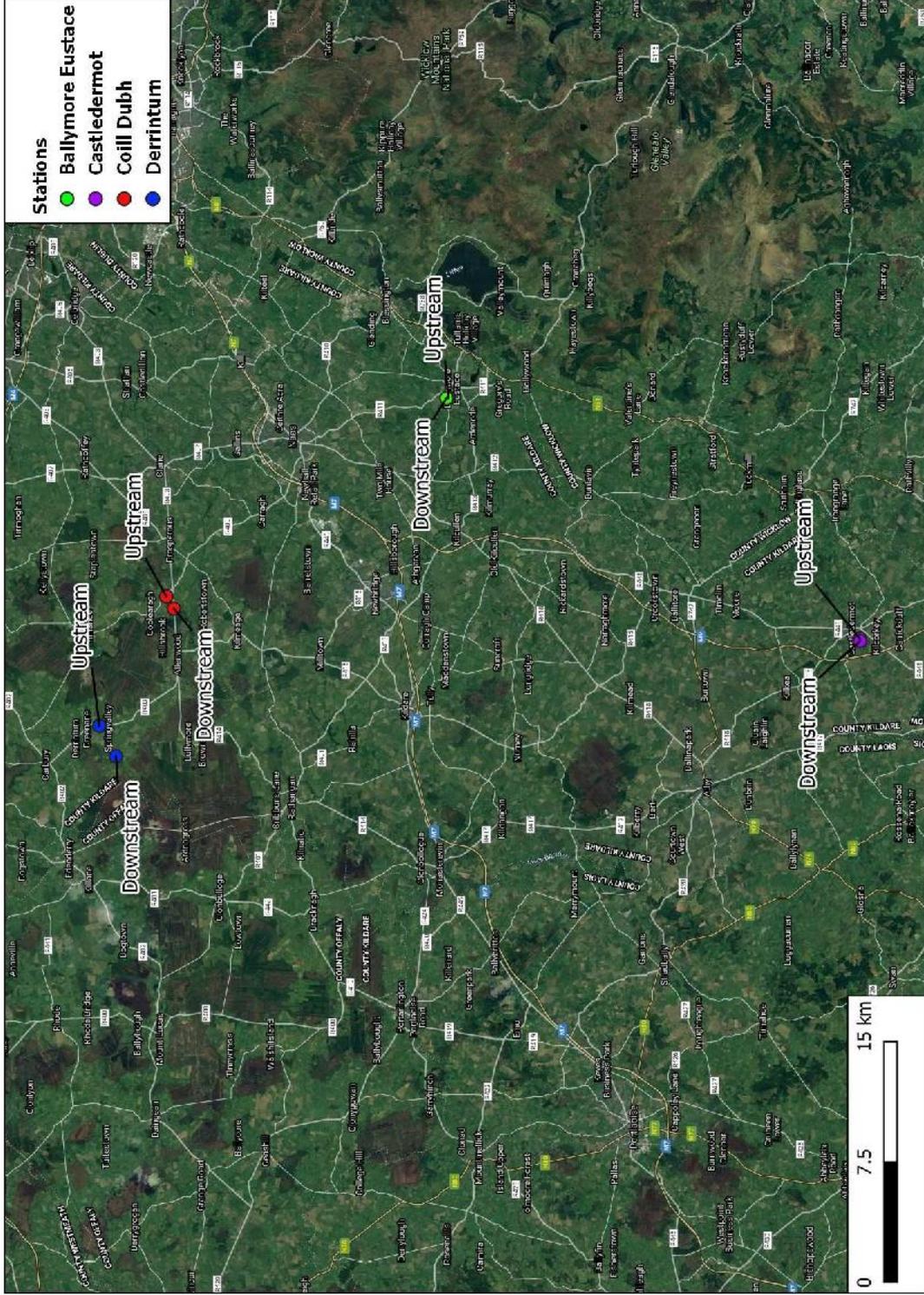


Table 2.1: Kildare SSRS station coordinates.

Station	Easting	Northing
Coill Dubh aSW1-PU	279586	227222
Coill Dubh aSW1-PD	278840	226750
Derrinturn aSW1-PU	271514	231178
Derrinturn aSW1-PD	269657	230144
Castledermot aSW1-PU	277669	184624
Castledermot aSW1-PD	277507	184609
Ballymore Eustace aSW1-PU	292154	210202
Ballymore Eustace aSW1-PD	292148	210304

2.2. Small Stream Risk Score

The Small Streams Risk Score (SSRS) is a biological risk assessment system for identifying rivers that are 'at risk' of failing to achieve the 'good' water quality status goals of the Water Framework Directive (WFD). It was developed by the Environmental Protection Agency (EPA) in association with the Western River Basin District (WRBD) in 2006 and revised in 2009.

The SSRS method is a rapid field methodology for risk assessment that is based solely on macroinvertebrate indicators of water quality and their well-understood response to pollution. Importantly, the SSRS score indicates whether or not the stream is at risk from pollution and not the ecological health of the stream. The SSRS score ranges from 0-11.2.

Table 2.2: SSRS Categories.

SSRS range	Category
<6.5	Stream at Risk
>6.5-7.25	Indeterminate stream may be at risk
>7.25	Probably not at risk

3. Results

3.1. *Coill Dubh*

Based on the SSRS score both the upstream and downstream stations were categorised as “Stream at risk” of not meeting Good status (See Table 3.2). Although the downstream station received a slightly higher score. The morphological characteristics of both stations were the same. The substrate was a mixture of cobbles and gravels with moderate levels of silt. The dominant land use in the area is pasture. The velocity was higher at the downstream station and there was less shading which may account for the slightly higher SSRS score.

3.2. *Derrinturn*

The downstream station recorded a slightly lower SSRS score. However, both the upstream and downstream stations were categorised as “Stream at risk” of not meeting Good status. The substrate at the upstream station was cobbles with a thick layer of silt (5-10cm) and leaf litter was abundant. The velocity of the stream was very slow with little perceivable flow. The downstream station substrate was a mix of cobbles and gravel with some sand. The velocity was moderate. There was cattle access both above and below the downstream station. The downstream station recorded the gastropod *Lymnaea*, while it was not recorded upstream. The oligochaete *Lumbriculus* was present in a higher abundance downstream.

3.3. *Castledermot*

Base on the SSRS score both the upstream and downstream stations were categorised as “Stream at risk” of not meeting Good status, although the downstream station received a higher score. The stream substrate was the same at both stations with a mix of cobbles and gravel. The velocity was fast at both stations. The downstream station was mostly riffle while the upstream station was mostly glide. Significant levels of calcification were present on the substrate at both upstream and downstream. This is likely due to eutrophication.

3.4. Ballymore Eustace

The downstream SSRS score was higher than the upstream station. As such the downstream station was characterised as “Probably not as risk” while the upstream station was “Stream at risk”. The river substrate was the same at both stations with a mix of boulders, cobbles and gravel. The flow in the river was torrential. There was no siltation present. One female white-clawed crayfish was recorded at the upstream station. It appeared to be health with no sign of infection.

Table 3.1: Species list

Relative abundance of macroinvertebrates 1 = 1-5, 2 = 6-20, 3 = 21-50, 4 = 51-100 and 5 = 101+								
Taxa	Coill Dubh		Derrintum		Castledermot		Ballymore Eustace	
	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream
Ephemeroptera								
<i>Heptagenia</i>					3	1		2
<i>Caenis</i>								1
<i>Ephemera danica</i>							1	
Trichoptera								
Limnephilidae	1	2	1	1	1			
Hydropsychidae	1				1	2	1	3
Sericostomatidae		2						
Glossosomatidae								1
<i>Rhyacophila</i>						1		
<i>Philopotamidae</i>						1		
Gastropoda								
<i>Lymnaea</i>				2			2	
<i>Potamopyrgus</i>	2							
<i>Ancylus</i>								1
Oligochaeta								
<i>Lumbriculus</i>			2	3				
Diptera								
Chironomidae		2	3	3	3	1		
Simuliidae					4	4	1	
Dicranota					1	1		

Table 3.2: Biological sampling results.

Station	SSRS score	SSRS category
Coill Dubh aSW1-PU	3.2	Stream at risk
Coill Dubh aSW1-PD	4.8	Stream at risk
Derrinturn aSW1-PU	2.4	Stream at risk
Derrinturn aSW1-PD	0.8	Stream at risk
Castledermot aSW1-PU	4.8	Stream at risk
Castledermot aSW1-PD	6.4	Stream at risk
Ballymore Eustace aSW1-PU	4	Stream at risk
Ballymore Eustace aSW1-PD	8	Probably not at risk

4. Discussion

There was no evidence of impact on the streams due to the discharges at Castledermot, Ballymore Eustace and Coill Dubh with all downstream stations receiving a higher SSRS score than upstream. Although both the upstream and downstream stations for Derrinturn were categorised as “At risk” the downstream station received a lower SSRS score. There was cattle access both above and below the downstream station. This may have impacted on the downstream SSRS score.

All stations except Ballymore Eustace downstream were categorised as “Stream at risk” of not meeting Good status. The Ballymore Eustace downstream station was categorised as “Probably not at risk”.

5. References

EPA. 2015. Guidance on Application and Use of the SSRS in Enforcement of Urban Waste Water Discharge Authorisations in Ireland.

<https://www.epa.ie/publications/compliance--enforcement/waste-water/SSRS-in-Enforcement-of-UWWDAs.pdf> Accessed September 2021.

Lucey, J., Bowman, J.J., Klabby, K.J., Cunningham, P., Lehane, M., MacCarthaigh, M., McGarrigle, M.L. and Toner, P.F. 1999. Water Quality in Ireland, 1995 – 1997. EPA.

Appendix 1

Photo log



Coill Dubh upstream



Coill Dubh Downstream



Derrinturn upstream



Derrinturn downstream



Ballymore Eustace upstream



Ballymore Eustace downstream



Castledermot upstream



Castledermot downstream