Annual Environmental Report

2023

Castledermot

D0236-01

CONTENTS

1 EXECUTIVE SUMMARY AND INTRODUCTION TO THE 2023 AER

This Annual Environmental Report has been prepared for D0236-01, Castledermot, 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.

There were no capital works, significant changes or operational changes undertaken in 2023.

1.2 TREATMENT SUMMARY

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

- Castledermot WWTP with a Plant Capacity PE of 2400, 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
TPEFF1400D0236SW001	Castledermot WWTP	Treated	Compliant	N/A

1.4 LICENCE SPECIFIC REPORTING

Assessment / Report
Small Stream Risk Score Assessment

2 TREATMENT PLANT PERFORMANCE AND IMPACT SUMMARY

2.1 CASTLEDERMOT WWTP - TREATED DISCHARGE

2.1.1 INFLUENT MONITORING SUMMARY - CASTLEDERMOT 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
COD-Cr mg/l	12	2211	670
ortho-Phosphate (as P) - unspecified mg/l	12	5.60	3.15
BOD, 5 days with Inhibition (Carbonaceous) mg/l	12	349	187
pH pH units	12	8.12	7.74
Suspended Solids mg/l	12	869	224
Total Phosphorus (as P) mg/l	12	14	6.56
Ammonia-Total (as N) mg/l	12	68	39
Total Nitrogen mg/l	12	186	60
Hydraulic Capacity	N/A	1620	565

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 greater than the peak Treatment Plant Capacity. Further details on the plant capacity and efficiency can be found under the sectional 'Operational Performance Summary'. The design of the wastewater treatment plant allows for peak values and therefore the peak loads have not impacted on compliance with Emission Limit Values.

2.1.2 EFFLUENT MONITORING SUMMARY - TPEFF1400D0236SW001

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	12	N/A	N/A	16	Pass
Suspended Solids mg/l	30	75	N/A	12	N/A	N/A	3.58	Pass
BOD, 5 days with Inhibition (Carbonaceous) mg/l	10	20	N/A	12	N/A	N/A	2.57	Pass
pH pH units	6	9	N/A	12	N/A	N/A	7.55	Pass
Total Phosphorus (as P) mg/l	0.7	0.84	N/A	12	N/A	N/A	0.211	Pass
Ammonia-Total (as N) mg/l	0.6	1.2	N/A	12	N/A	N/A	0.325	Pass
ortho-Phosphate (as P) - unspecified mg/l	0.3	0.6	N/A	12	N/A	N/A	0.077	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)
Total Nitrogen mg/l	N/A	N/A	N/A	12	N/A	N/A	13	

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):

Not applicable

Significance of Results:

The WWTP is compliant with the ELV's set in the Wastewater Discharge Licence.

2.1.3 AMBIENT MONITORING SUMMARY FOR THE TREATMENT PLANT DISCHARGE TPEFF1400D0236SW001

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	277669, 184624	RS14L010120	No	No	No	No	Poor
Downstream	277507, 184609	RS14L010140	No	No	No	No	Poor

The results for ambient results and / or additional monitoring data sets are included in the **Appendix 7.1 - Ambient monitoring summary.**

Significance of Results:

The WWTP discharge was compliant with the ELV's set in the wastewater discharge licence.

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 deterioration in Ammonia & BOD concentrations 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 Barrow Report (HA 14), Agriculture, Urban Runoff and Hydromorphology are significant pressures on Lerr_020 waterbody. The Castledermot WWTP is not cited as a significant pressure in the Cycle 3 Report.

The discharge from the wastewater treatment plant does not have an observable negative impact on the Water Framework Directive status.

2.1.4 OPERATIONAL PERFORMANCE SUMMARY - CASTLEDERMOT WWTP

2.1.4.1 Treatment Efficiency Report - Castledermot 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)
COD	112386	4108	96
cBOD	31339	662	98
TN	10015	3456	65
TP	1100	54	95
SS	37502	924	98

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

2.1.4.2 Treatment Capacity Report Summary - Castledermot 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.

Castledermot WWTP	
Peak Hydraulic Capacity (m^3/day) - As Constructed	1350
DWF to the Treatment Plant (m^3/day)	540
Current Hydraulic Loading - annual max (m^3/day)	1620
Average Hydraulic loading to the Treatment Plant (m^3/day)	565
Organic Capacity (PE) - As Constructed	2400
Organic Capacity (PE) - Collected Load (peak week)[Note1]	1840
Organic Capacity (PE) - Remaining	560
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 - CASTLEDERMOT 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 2023.			

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 Uisce Éireann 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	Recurring (Y/N)	Closed (Y/N)
Uncontrolled release	SWO exceptional rainfall and overflow expected	No	Yes
Uncontrolled release	SWO exceptional rainfall and overflow expected	No	Yes

3.2.2 SUMMARY OF OVERALL INCIDENTS

Question	Answer
Number of Incidents in 2023	2
Number of Incidents reported to the EPA via EDEN in 2023	2
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	No. of times activated in 2023 (No. of events)	Total volume discharged in 2023 (m^3)	Monitoring Status
SW-3	277646,184620	Yes	Low Significance	Meeting Criteria	Unknown	854	Monitored

Any TBC SWO(s) were identified as part of the on-going National SWO programme and will be updated in subsequent AER(s) once the information is confirmed.

SWO Summary	
How much wastewater discharge by metered SWOs during the year (m^3)?	854
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
D0236-SIP:01	Upgrade of SWO to comply with the criteria outlined in the DoEHLG "Procedures and criteria in relation to storm water overflows, 1995". SW2	C	31/12/2012	Yes	Works Completed		
D0236-SIP:02	Upgrade of SWO to comply with the criteria outlined in the DoEHLG "Procedures and criteria in relation to storm water overflows, 1995". SW3	C	31/12/2012	Yes	Works Completed		

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	Included in this AER
D0236-01-Priority Substances Assessment	Yes	No
D0236-01-Small Stream Risk Score Assessment	Yes	Yes

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
Is there a need to advise the EPA for Consideration of a Technical Amendment/Review of the Licence?	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	N/A

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

Date: 11/11/2024

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

Eleanor Roche

Head of Environmental Regulation.

7 APPENDIX

Appendix
Appendix 7.1 - Ambient Monitoring Summary
Appendix 7.2 - Small Stream Risk Score Assessment

Castledermot Ambient Monitoring Summary 2023

			Receiving Waters Designation (Yes/No)					Mean (mg/l)		
Ambient Monitoring Point from WWDL (or as agreed with EPA)	**Irish National Grid Reference (Easting, Northing)**	**EPA Feature Coding Tool code**	**Bathing Water**	**Drinking Water**	**FWPM**	**Shellfish**	**Current WFD Status**	**cBOD**	**o-Phosphate (as P)**	**Ammonia (as N)**
Upstream Monitoring Point	277669, 184624	RS14L010120	No	No	No	No	Poor	0.951	0.078	0.1125
Downstream Monitoring Point	277507, 184609	RS14L010140	No	No	No	No	Poor	1.092	0.073	0.1133
Difference								*0.141*	*-0.004*	*0.0008*
EQS								1.500	0.035	0.065
% of EQS								9.405%	-11.905%	1.282%

Castledermot Ambient Monitoring Summary 2023

Upstream Results										
Date		pH pH units	BOD mg/ l	COD mg/l	Suspended solids mg/l	Total Nitrogen mg/l	Total Phosphorus mg/l	Ammonia mg/l	Ortho-Phosphate mg/l	DO mg/l
24/01/2023	U/S	7.89	0.8	6.9	22.4	8.22	0.064	0.07	0.06	10.33
14/02/2023	U/S	7.89	1	9.7	9.2	7.96	0.091	0.15	0.08	10.49
10/03/2023	U/S	7.86	1.4	10.1	1.2	7.39	0.081	0.07	0.07	10.92
25/04/2023	U/S	7.84	1	< 15	2.4	7.24	0.071	0.02	0.06	10.31
16/05/2023	U/S	7.99	1	< 15	2.4	6.55	0.081	0.07	0.06	10.51
16/06/2023	U/S	7.59	1.4	20.7	47.2	7.81	0.107	0.1	0.1	9.12
05/07/2023	U/S	7.46	0.5	< 15	4	7.38	0.084	0.08	0.07	9.26
01/08/2023	U/S	8.33	0.2	< 15	1.6	6.32	0.078	0.06	0.04	8.82
07/09/2023	U/S	8.27	0.2	< 15	2.4	6.56	0.2	0.05	0.13	8.75
13/10/2023	U/S	8.1	0.8	16.2	12.8	6.03	0.145	0.2	0.12	8.85
24/11/2023	U/S	7.94	< 1	< 15	2.4	7.78	0.073	0.08	0.06	9.89
07/12/2023	U/S	8.31	2.4	< 15	53.6	11.4	0.131	0.4	0.08	9.73
Mean		**7.956**	**0.951**	**11.487**	**13.467**	**7.553**	**0.101**	**0.113**	**0.078**	**9.748**
95%ile		**8.319**	**1.850**	**18.225**	**50.080**	**9.651**	**0.170**	**0.290**	**0.125**	**10.695**

Downstream Results										
Date		pH pH units	BOD mg/ l	COD mg/l	Suspended solids mg/l	Total Nitrogen mg/l	Total Phosphorus mg/l	Ammonia mg/l	Ortho-Phosphate mg/l	DO mg/l
24/01/2023	D/S	7.88	1	2.7	1.2	8.01	0.062	0.07	0.06	10.6
14/02/2023	D/S	7.93	1.3	13.6	16	8.51	0.075	0.16	0.07	10.9
10/03/2023	D/S	7.89	1.8	13.2	16.4	7.52	0.085	0.09	0.07	11.37
25/04/2023	D/S	7.9	1	< 15	0.8	7.93	0.074	0.02	0.06	10.71
16/05/2023	D/S	7.97	1.2	< 15	12.8	6.81	0.072	0.1	0.06	10.77
16/06/2023	D/S	7.71	1.1	< 15	3.2	7.61	0.098	0.1	0.09	9.29
05/07/2023	D/S	7.51	0.6	< 15	2	7.51	0.062	0.06	0.06	9.5
01/08/2023	D/S	8.41	0.4	< 15	1.2	6.27	0.086	0.07	0.08	9.03
07/09/2023	D/S	8.38	0.5	< 15	2.4	6.43	0.098	0.05	0.09	8.96
13/10/2023	D/S	8.25	0.8	10.3	7.2	5.85	0.128	0.2	0.11	8.94
24/11/2023	D/S	8.08	1.2	< 15	2	7.36	0.091	0.11	0.07	10.01
07/12/2023	D/S	8.3	2.2	15	22	7.38	0.101	0.33	0.06	9.6
Mean		**8.018**	**1.092**	**10.754**	**7.267**	**7.266**	**0.086**	**0.113**	**0.073**	**9.973**
95%ile		**8.394**	**1.980**	**14.230**	**18.920**	**8.235**	**0.113**	**0.259**	**0.099**	**11.112**

Note: Where the concentration in the result is less than the limit of detection (LOD), a value of 50% of the LOD was used in calculating the mean and 95%ile concentrations.

Castledermot Small Stream Risk Score 2023

Produced by

AQUAFACT International Services Ltd

For

Kildare County Council

November 2023

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Report Approval Sheet

Client	Kildare County Council
Report Title	Castledermot Small Stream Risk Score 2023
Job Number	P13876
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Rev	Status	Issue Date	Document File Name	Author (s)	Approved by:
1	Draft	3/11/2023	Castledermot SSRS 2023 Draftv1	Aaron Skehan	E. McCormack
2	Final	15/11/2023	Castledermot SSRS 2023 Final	Aaron Skehan	E. McCormack

AQUAFACT
APEM Group

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Appendices

1. Introduction

AQUAFACT was contracted by Kildare County Council to carry out an SSRS assessment of the discharge belonging to Castledermot wastewater treatment plants. A sample was taken upstream and downstream of the discharge point. The sampling was carried out on the 12th of October 2023.

2. Methodology

2.1. Sampling

Two 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: Castledermot SSRS sampling sites.

Table 2.1: Castledermot SSRS station coordinates.

Station	Latitude	Longitude
Castledermot Upstream	52.9071780	-6.8459593
Castledermot Downstream	52.9071713	-6.8478906

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

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. Both stations had riffle and glide habitats. Significant levels of calcification were present on the substrate at both upstream and downstream stations. This is likely due to eutrophication.

Table 3.1: Taxa list

Taxa	Upstream	Downstream
Ephemeroptera		
Rhithrogena	2	1
Trichoptera		
Hydropsychidae	2	1
Glossomatidae	1	1
Rhyacophila	1	
Other Trichoptera	1	
Gastropods, Oligochaetes and Diptera (G.Ol.D)		
Potamopyrgus	1	1
Lumbriculus	1	1
Tubificidae	2	2
Chironomidae		
Simuliidae	2	
Dicranota	1	2
Other GOLD		1
Asellus	Few/Low	Few/Low

Table 3.2: Biological sampling results.

Station	SSRS score	SSRS category
Castledermot Upstream	4.0	Stream at risk
Castledermot Downstream	5.6	Stream at risk

4. Castledermot WWTP comparison 2016 to 2023

Table 4.1 compares the SSRS results from 2016 to 2023 and **Error! Reference source not found.** displays the trend over time. Both upstream and downstream stations have been 'at risk' since 2016 with the exception of 2017 and 2020 when upstream was 'Indeterminate stream may be at risk'.

Table 4.1: Castledermot WWTP- SSRS Comparison 2015 -2023 (AR: At Risk; PNAR: Probably not at Risk; Indet: Indeterminate)

Site	SSRS							
	2016	2017	2018	2019	2020	2021	2022	2023
Upstream	3.2	7.2	5.6	6.4	7.2	4.8	4.8	4.0
Downstream	4	4.8	6.4	5.6	4.0	6.4	4.0	5.6
Site	**SSRS Risk Category**							
Upstream	AR	Indet.	AR	AR	Indet.	AR	AR	AR
Downstream	AR	AR	AR	AR	AR	AR	AR	AR

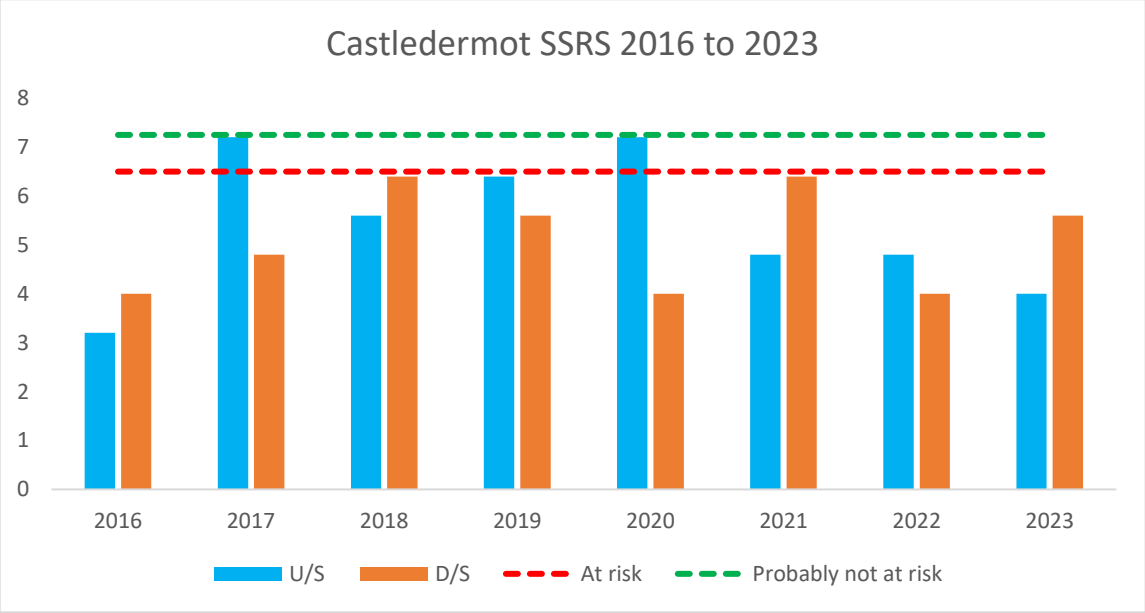

Figure 4.1: Castledermot WWTP SSRS scores 2016 to 2023

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

Castledermot upstream 1

Castledermot upstream 2

Castledermot downstream 1

Castledermot downstream 2