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Technical Note: Stormwater Impact Assessment; Cruiserath Road, Dublin 15

Technical Report Prepared For

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CONTENTS

1.0 INTRODUCTION

This report presents the assessment of the potential for water quality impacts as a result of the discharge of evaporative cooling water to stormwater sewer at the Amazon Data Services Ireland Ltd. (“ADSIL” or ‘the applicant’) data storage facility (the subject ‘installation’ under this IED licence application) located on Cruiserath Road, Dublin 15.

The Installation comprises 3 no. two-storey data storage installation buildings (Buildings A, B and C) and ancillary elements. The ancillary elements of the development include loading bays, maintenance and storage spaces, associated water tanks, sprinkler tanks, pump house and electrical rooms, security and utility spaces, underground foul and storm water drainage network, attenuation/detention basins, internal roading network, hardstanding and site landscaping. The site includes the Cruiserath 220 kV Substation. The site layout and main buildings is shown on Site Layout Plan Drawing Ref: 21_123H-CSE-00-XX-DR-C-0002-Overall Site Plan included with the IED application.

The Site stormwater discharges offsite at 1 no. Emission Points (SW1). The Site drainage is shown on Drawing 21_123H-CSE-00-XX-DR -C-1100 Surface Water Layout Plan included with this IE application. The emission to storm sewer consists of stormwater runoff from building roofs, and the site hardstanding areas. The evaporative cooling water, associated with the evaporative cooling process, is also discharged from the cooling systems to the stormwater sewer when elevated temperatures occur.

The onsite stormwater network conveys stormwater collected from buildings, roads and hardstanding via hydrocarbon interceptors to 2 no. offline stormwater detention basins and 1 no. online stormwater detention basin. The SW1 emission point discharges attenuated flows to the existing 900mm Fingal County Council (FCC) network within the R121 Regional Road (Cruiserath Road) to the south-east of the Site. The FCC network(s) eventually discharge to the Ballycoolen Stream and the River Tolka which flows to the Liffey Estuary transitional water body (11.6 km hydrologically downgradient).

Further details on the stormwater network and emissions are set out in Attachment 4-8-1 Operational Report of the IED licence application.

As described in the Operational Report submitted with the IED licence application (Attachment-4-8-1), the cooling units or Air Handling Units (AHUs) on the data centre roofs provide conditioned air to maintain temperature, relative humidity and pressurisation in the data halls. The cooling units operate under two modes; free cooling (normal temperatures) and evaporative cooling (when temperatures are elevated). Evaporative cooling is used when atmospheric temperatures are above a setpoint, to cool components within the facility, it has been assumed for the purpose of this assessment that the peak discharge occurs 5 days a month throughout the year. Evaporative cooling utilises mains water (at ambient temperature) from the mains supply as the cooling media. The majority of the evaporative cooling water is evaporated in this process. Prior to the cooling process, water is sanitised using ultraviolet disinfection. When water is used for cooling, it is recirculated in a closed loop system. When a conductivity of 1,500 µS/cm is reached, evaporative cooling water is automatically discharged to the onsite stormwater network at ambient temperature.

The main objective of this study is to assess the likely impact of the assumed evaporative cooling water discharge (recirculated evaporative cooling water from the AHUs) on the surface waterbody receptor (Ballycoolen Stream and River Tolka) using a numerical analysis, based on the assimilative capacity of this surface water body. As explained in Section 2.1.1, there is no water quality or water flow data available for the

Ballycoolen Stream, therefore the analysis has focused on the downstream effects on the River Tolka.

2.0 METHODOLOGY

This assessment of the stormwater emissions assesses the potential impact on the surface water environment i.e., the River Tolka at the Environmental Protection Agency (EPA) monitoring point downgradient of the site. It includes a desktop review of the emission (flow and quality) of evaporative cooling water from the installation to the River Tolka.

A highly conservative approach is taken in assuming all of the evaporative cooling water reaches the EPA monitoring point (undiluted by rainwater) when the river is at low and average flow. In reality, evaporative cooling water will likely accumulate in the stormwater attenuation system until there is adequate rainfall for discharge to occur from the system. This will result in dilution of the evaporative cooling water in the installation attenuation system, and once discharge occurs, there will be further dilution within the public FCC stormwater network prior to reaching the Ballycoolen Stream and River Tolka.

As described in the Operational Report (Attachment-4-8-1) submitted with the IED licence application the attenuation system at the Installation comprises of 3 no. attenuation systems (see Drawing: 21_123H-CSE-00-XX-DR -C-1100), this consists of: Detention Basin 1 (1,745 m^3 capacity), located to the south of Building A, Detention Basin 2 (1,379 m^3 capacity) is located to the north of Building C, Detention Basin 3 (380 m^3 capacity) is located to the west of Building C. As mentioned above, all stormwater from the Site stormwater network outfalls at 1 no. emission point (SW1) that discharges attenuated flows to the existing 900mm Fingal County Council (FCC) network within the R121 Regional Road (Cruiserath Road) to the south-east of the Site.

2.1.1 Sources of Information

This assessment has been prepared from a desktop review of existing information. The following is a list of sources of information consulted for use in this section:

- Environmental Protection Agency (EPA, 2023) monitoring data, *www.catchments.ie*. Which includes the following information: EPA monitoring stations; historical water quality data; and Water Framework Directive (WFD) Status, surface water bodies status and risk score.
- HydroNet (https://epawebapp.epa.ie/hydronet/#Flow) developed by the EPA that includes information on river flow, and the EPA Hydrotool for estimating flow.

The EPA has a water quality monitoring station in the River Tolka (Mulhuddart Br) from which information has been obtained by accessing the above EPA data sources.

The EPA does not have a water gauging station (flow monitoring) within the Ballycoolen Stream, or within the River Tolka near to the confluence. As there is no measured flow for the point of discharge, the EPA (2023) Hydrotool[1] has been used to estimate 95%ile (low flow) and 50%ile (average) flow (EPA Hydrotool ungauged ref. point 09-1459). The flow estimates represent flows that could be expected in rivers

[1] https://www.epa.ie/publications/monitoring--assessment/freshwater--marine/river-flow-estimates-hydrotool---read-me.php

under naturalised conditions and do not take account of artificial influences of any kind such as water supply abstractions or wastewater discharges.

It should be noted that the Hydrotool does not include flow estimates or water quality data for the Ballycoolen Stream, therefore the nearest data associated with the River Tolka has been used. This data is taken from an EPA station (Mulhuddart Bridge (RS09T010800)) located 500 m upgradient of the confluence of the Ballycoolen and Tolka.

2.2 CALCULATION METHODOLOGY

2.2.1 Assimilative Capacity

The definition of assimilative capacity, as used by the EPA, is *'the ability of a body of water to cleanse itself; its capacity to receive waste waters or toxic materials without deleterious effects and without damage to aquatic life or humans who consume the water'*. Guidance carried out by the EPA and Water Services Training Group on the assessment of assimilative capacity details the following methodology.

The Assimilative Capacity is estimated for any parameter of concern using the following calculation:

$$Assimilative\ Capacity = (C_{max} - C_{back}) \cdot Q_{95} \cdot 86.4\ [kg/day]$$

Where:

- Q_{95} = Dry Weather or 95%ile flow in river stream (m^3/s);
- C_{max} = Maximum permissible concentration (mg/l) ;
- C_{back} = Background upstream concentration (mg/l);
- 86.4 = Time conversion factor from seconds to day.

Q_{95} is the flow rate in the river associated with a dry weather condition (DWF).

C_{max} is the concentration associated with threshold values based on European regulations which are defined in Section 2.3 below for both the 95%ile hydrological conditions, and the also 50%ile flow in the river stream (Q_{50}).

C_{back} is the concentration associated with the quality data obtained by the EPA at its station located in the River Tolka (refer to Section 3.3 below) which is considered representative of the River Tolka and the Ballycoolen Stream where the stormwater sewer discharge point is located. Site discharges attenuated flows to the existing 900mm Fingal County Council (FCC) network within the R121 Regional Road (Cruiserath Road) to the south-east of the Site, then into Ballycoolen Stream. Based on this data, the 95%ile value of these records have been considered as the C_{back} concentration.

2.2.2 Downstream Concentration

In order to assess the effect of the evaporative cooling water discharge on the Ballycoolen Stream and River Tolka, the downstream concentration ($C_{D/S}$) has been estimated from the EPA quality data (C_{back}) and the expected ADSIL effluent water quality as follows.

Where:

$$C_{D/S} = \frac{C_{back} \cdot Q_{95} + C_{ADSIL} \cdot Q_{ADSIL}}{Q_{95} + Q_{ADSIL}}$$

- $C_{D/S}$ = Estimated concentrations at Ballycoolen Stream immediately downstream of the stormwater sewer discharge point (mg/l);
- C_{ADSIL} = ADSIL effluent concentrations (mg/l);
- Q_{ADSIL} = ADSIL effluence discharge rate (m^3/s).

However, as mentioned above, since water quality and flow data for the Ballycoolen Stream are not available, the effect of the evaporative cooling water discharge was estimated based on concentrations and flow representative from the River Tolka using the EPA (2023) Hydrotool.

2.3 EMISSION QUALITY AND FLOW

The criteria used to estimate water use and evaporative cooling water discharge volumes and quality has been provided by the Operator's Water Team and is presented below:

- A dry-bulb temperature of 30.4 degC and wet-bulb temperature of 21.2 degC is used for modelling water use for evaporative cooling. This is a conservative design criterion, and is greater than the ASHRAE n=50 year temperature for Dublin Airport, Ireland (WMO: 039690). Water use is evaluated based on a theoretical peak day with 6 hours of evaporative cooling working at these peak weather conditions.
- Evaporative cooling water discharge volume and quality is estimated based on the cooling systems operating at 3 cycles of concentration of the mains water supply, per mains water quality analyses carried out on-site.

Estimated evaporative cooling water concentrations and discharge flow from the site are presented in Table 2.1 below. To note 107 m^3/d is the maximum flow that could be expected within a 6-hour period at peak weather conditions, based on the conservative assumptions made. Generally, the discharge volume would be significantly less.

Parameter	Unit	Value [1]
Conductivity	μS/cm	1,500
TDS	mg/l	894
Alkalinity	mg/l	458
Ca (as CaCO3)	mg/l	594
Chloride	mg/l	55
Silicone (as SiO2)	mg/l	6.8
Sulphate (SO4)	mg/l	131
Barium	mg/l	0.085
Magnesium	mg/l	91
Potassium	mg/l	3.8
Sodium	mg/l	36
Discharge Flow	m^3/d	107

Note: 1. Data obtained from the Operator's water team

Table 2.1 *Estimation of evaporative cooling water discharge parameters*

2.4 THRESHOLD VALUES

The parameters of interest are based on the targets / thresholds for water quality established in current legislation.

The most recent Irish legislation set down as part of the Water Framework Directive to provide guidelines for river quality in Ireland is *EU Environmental Objectives (Surface Water) Regulations (S.I. 272/2009 and amendment S.I. 77/2019*) (known as the 'Surface Water Regulations').

The Surface Water Regulations has established ecological, biological and chemical conditions or 'Threshold Values' for the protection of surface water bodies whose status is determined to be high or good and measures requiring the restoration of surface water bodies of 'less than good status' (or good potential as the case may be) to 'not less than good status'.

The Surface Water Regulations does not provide Threshold Values for all parameters set out in Table 2.1 above. In order to establish the basis for discussion and assessment of the impact, this assessment has considered other water regulations beyond the Surface Water Regulations. The *EU (Drinking Water) Regulations (S.I. 122/2014 and amendment S.I. 464/2017* (known as the 'Drinking Water Regulations') establishes a number of monitoring parameters in respect of every water supplies for human consumption.

This assessment uses the parametric values listed in the Drinking Water Regulations to assess if the evaporative cooling water discharge from the site would alter the water quality of the receiving waterbody (i.e., Ballycoolen Stream and River Tolka); when compared with available drinking water quality parameters monitored by the EPA in the River Tolka downstream of the site.

The parameters considered are also related to the characteristics of the ADSIL evaporative cooling water which are also part of the EPA monitoring suite. Refer to Table 2.2 below.

Parameter	Unit	Surface Water [1]		Drinking Water [2]
		95%ile	Mean	
Ammonia as N	mg/l	0.14	0.065	*n.v.*
Biological Oxygen Demand (BOD)	mg/l	2.6	1.5	*n.v.*
Orthophosphate as P	mg/l	0.075	0.035	*n.v.*
Chloride	mg/l	250		250
Sulphate	mg/l	250		250
Alkalinity-total	mg/l	*n.v.*		*n.v.*
Conductivity	µS/cm	*n.v.*		2,500
TDS	mg/l	*n.v.*		*n.v.*
Calcium (as CaCO3)	mg/l	*n.v.*		*n.v.*
Silicone (as SiO2)	mg/l	*n.v.*		*n.v.*
Barium	mg/l	*n.v.*		*n.v.*
Magnesium	mg/l	*n.v.*		*n.v.*
Potassium	mg/l	*n.v.*		*n.v.*
Sodium	mg/l	*n.v.*		*200*

Notes: 1. EU Environmental Objectives (Surface Water) Regulations (S.I. 272/2009 and amendment S.I. 77/2019) (known as the 'Surface Water Regulations').
2. EU (Drinking Water) Regulations (S.I. 122/2014 and amendment S.I. 464/2017).
n.v.: No value

Table 2.2 Parameter and threshold values considered (mg/l)

3.0 EXISTING BASELINE CONDITIONS

The existing surface water environment in terms of water quality with reference to the Water Framework Directive environmental quality objectives and standards is described in Section 7.3 of the Baseline Report (Attachment 4-8-3) submitted with the IED licence application.

There are no streams on the site itself or along its boundaries. Stormwater run-off from the site will be collected and discharged at 1 no. emissions point to the existing FCC stormwater sewer (SW1) in the R121 Regional Road (Cruiserath Road) to the south-east of the Site. The FCC network(s) eventually discharges to the Ballycoolen Stream and the River Tolka which flows to the Liffey Estuary transitional water body (11.6 km hydrologically downgradient). The confluence between the Ballycoolen Stream and the River Tolka is located c. 1.54 km (straight line) southwest of the subject site.

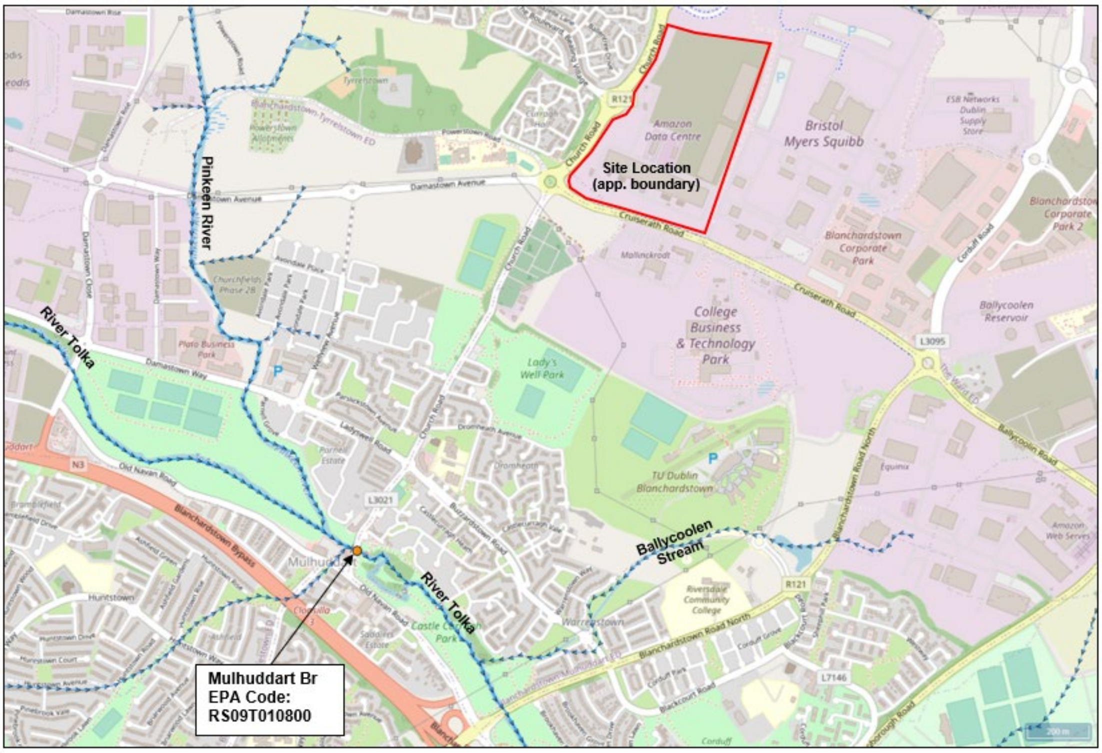

Figure 3.1 Hydrological Environment, illustrating the River Tolka flowing in a south-easterly direction.

3.1 SENSITIVE AREAS OR AREAS OF SPECIAL INTEREST

The nearest European site to the Installation is the Rye Water Valley/Carton SAC (Site Code 001398), located over 8.7 km to the southwest. In addition, there is an indirect hydrological link between the installation and the South Dublin Bay and River Tolka Estuary SPA (Site Code 004024), located c. 14 km to the east through the stormwater drainage from the site which discharges into the Ballycoolen Stream via the FCC stormwater drainage network. There is no connectivity to any other European sites.

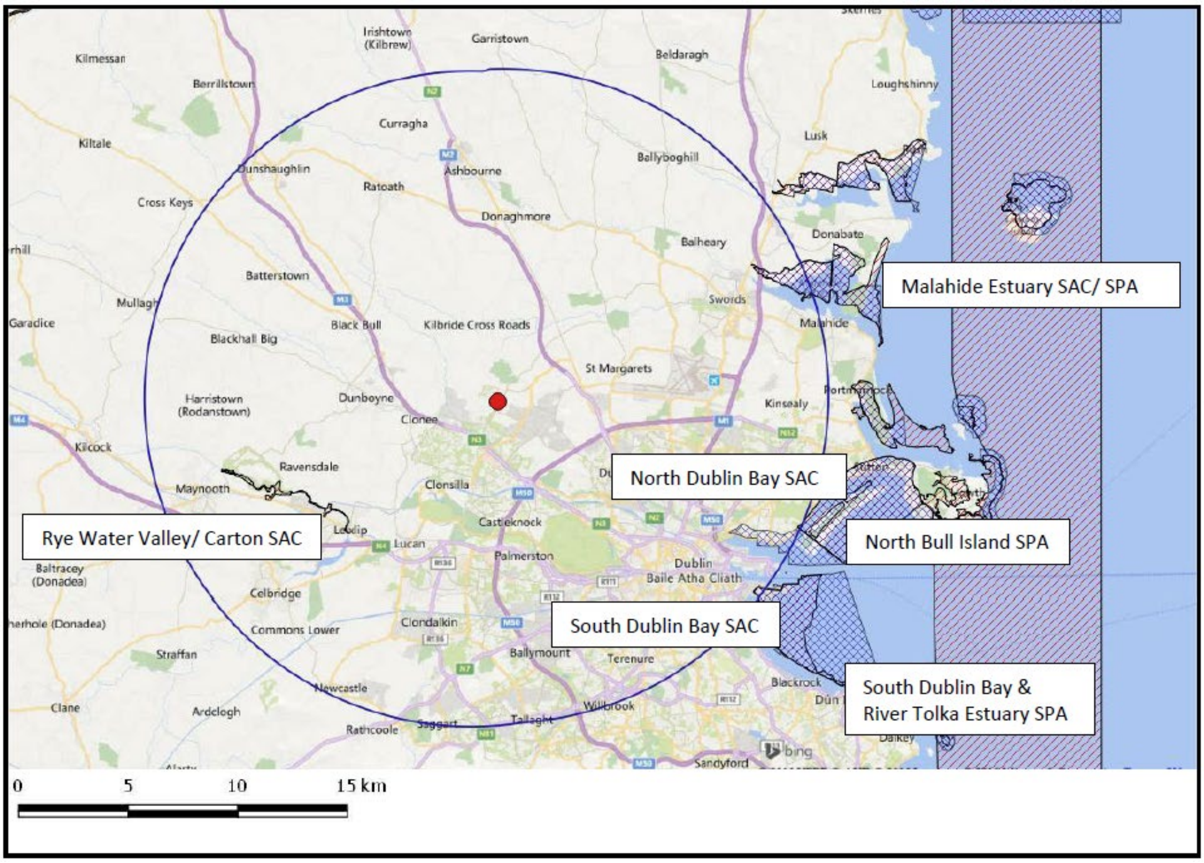

Figure 3.2 Site Location, Showing European sites and NHA's/pNHS'a in the vicinity of the Project

3.2 FLOW DATA

As noted in Section 2.1, in the absence of any available dataset at the actual confluence, it is assumed that the water flow at the confluence is the same as at the EPA Hydrotool ungauged ref. point 09-1459 located 500 m upstream.

Based on the available information from the EPA (EPA Hydrotool), the River Tolka has a 95%ile flow (Q_{95}) of approx. **0.111 m^3/s** or 9,590 m^3/d (EPA Hydrotool ungauged ref. point 09-1459), which is located immediately upstream of the confluence with Ballycoolen Stream (i.e., c. 1.2 km downstream of the stormwater sewer discharge point at this stream) (refer to Figure 3.3 below). The 50%ile flow (Q_{50}) of **0.85 m^3/s** (73,440 m^3/d) has been estimated by the EPA at this Hydrotool point.

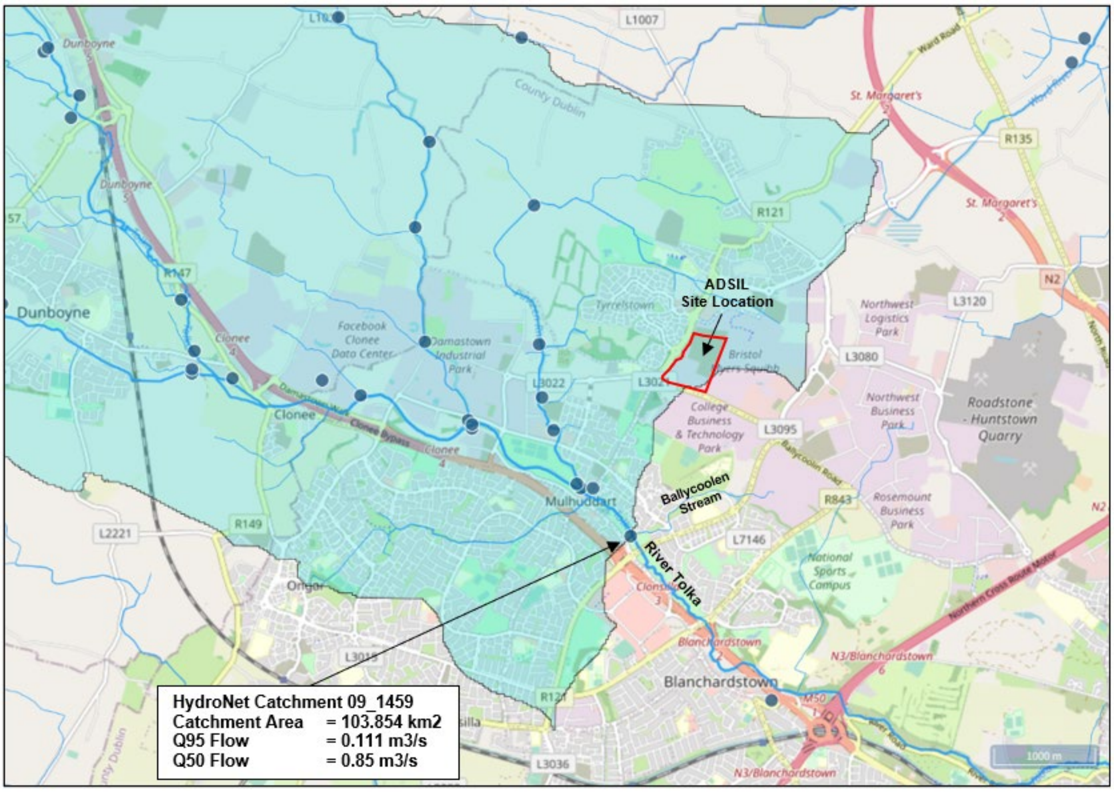

Figure 3.3 EPA Hydronet estimation point in the River Tolka

3.3 WATER QUALITY DATA

A review of available EPA surface water quality data has been undertaken. There is 1 active EPA monitoring station located in the River Tolka (Mulhuddart Bridge, (RS09T010800)) c. 500 m upstream of its confluence with Ballycoolen Stream (refer to Figure 3.1 above). As noted in Section 2.1, in the absence of any available dataset at the actual confluence, it is assumed that the water quality at the confluence is similar to that at the EPA Mulhuddart Bridge, (RS09T010800) station 500 m upstream.

The water quality data from Mulhuddart Bridge monitoring station is available for the period between 2007 to 2022 and this has been considered in this analysis. The monitoring data and concentration of the parameters of interest are presented below in Table 3.1. A comparison with the threshold values defined above in Section 2.4 is also shown. As can be seen in Table 3.1, the water quality for the 95%ile and mean conditions exceed the Surface Water Regulation's threshold values for Ammonia, and Orthophosphate as P for both the 50%ile condition and the 95%ile, BOD is exceeded for the 95%ile, however, BDO is not exceeded for the mean condition (50%ile condition). Overall, the quality data is representative of the 'poor' water quality status of this river.

The aforementioned EPA monitoring on the River Tolka (RS09T010800) obtained a Q rating of 2-3 Poor Status (EPA, 2023).

The EPA classifies the WFD Ecological Status for the Tolka water body as having '*Poor Status'* (Cycle Status 2016-2021) with a current WFD River Waterbody risk of '*At risk of not achieving good status'.*

EPA Station	Sampled Date	Ammonia	BOD	ortho-Phosphate	Alkalinity-total	Chloride	Sulphate
		mg/l as N	mg/l	mg/l as P	mg/l as CaCO3	mg/l	mg/l as N
	TV 95%ile	*0.14*	*2.6*	*0.075*	*n.v.*	*250*	*250*
	TV mean	*0.065*	*1.5*	*0.035*	*n.v.*		
Mulhuddart Br (RS09T010800)	28/06/2007	0.04	1.0	0.07	306	24	
	26/09/2007	**1.16**	**8.0**	**0.23**	302	31	
	28/11/2007	0.06	1.0	**0.09**	321	26	
	05/03/2008	0.05	1.0	0.06	306	30	48
	12/06/2008	0.1	2.0	0.03	230	36	79
	19/09/2008	0.03	1.0	0.06	344	19	17
	12/12/2008	0.09	1.0			31	32
	19/03/2009	0.04	1.0		286	25	42
	17/06/2009	0.03	2.0		155	15	30
	30/09/2009	0.015	1.0	0.03	296	19	39
	11/12/2009	0.06	1.0	0.05	339	19	30
	26/03/2010	**0.17**	**3.0**	0.07	280	35	34
	25/06/2010	0.09	1.0	0.05	256	28	59
	24/09/2010	0.015	1.0	**0.08**	294	19	39
	17/12/2010	0.06	1.0	0.05	312	37	43
	25/03/2011	0.06	1.0	0.015	269	35	47
	24/06/2011	0.1	1.0	0.06	235	41	77
	23/09/2011	**0.15**	1.0	**0.09**	240	42	89
	16/12/2011	0.05	1.0	**0.09**	300	35	52
	23/03/2012	0.05	1.0	0.04	294	44	58
	22/06/2012	0.06	1.0	0.07	279	22	43
	21/09/2012	0.03	2.0	0.015	237	39	42
	14/12/2012	0.06	**4.0**	0.03	329	35	35
	22/03/2013	0.13	2.0	0.06	230	47	36
	07/06/2013	0.07	2.0	**0.22**	256	85	70
	27/09/2013	0.04	1.0	**0.09**	254	68	84
	13/12/2013	**0.15**	1.0	0.07	333	31	51
	26/03/2014	0.06	2.0	**0.1**	317	31	38
	27/06/2014	**0.5**	**4.0**	0.07	212	26	57
	19/09/2014	0.04	0.5	**0.08**	271	47	75
	12/12/2014	0.11	2.0	**0.1**	247	33	30
	20/03/2015	0.07	0.5	0.06	317	40	51
	26/06/2015	**0.3**	2.0	**0.09**	257	12	24
	18/09/2015	0.08	0.5	**0.1**	265	43	79
	11/12/2015	0.03	0.5	**0.12**	276	21	29
	17/02/2016	0.08	**3.0**	**0.11**	183	22	14
	20/04/2016	0.03	0.5	**0.1**	286	25	42
	15/06/2016	**0.25**	2.0	**0.08**	256	30	63
	28/09/2016	0.04	0.5	**0.14**	290	25	54
	23/11/2016	0.03	0.5	**0.1**	333	28	46
	22/02/2017	0.02	1.0	0.07	317	33	43
	19/04/2017	**0.22**	**3.0**	0.06	294	28	52
	14/06/2017	0.05	0.5	**0.11**	317	24	69
	20/09/2017	**0.16**	1.0	**0.13**	298	34	72
	06/12/2017	0.04	0.5	0.07	329	29	47
	21/02/2018	0.05	0.5	**0.17**	348	40	37
	25/04/2018	0.01	1.0	0.04	293	54	55
	27/06/2018	**0.21**	**4.0**	**0.08**	237	59	67
	05/09/2018	**0.22**	2.0	**0.09**	224	54	75
	21/11/2018	0.05	**3.0**	0.07	139	45	88
	27/02/2019	0.11	0.5	**0.09**	289	42	65
	24/04/2019	0.03	1.0	0.06	291	37	66
	12/06/2019	0.11	**3.0**	**0.08**	284	37	66
	18/09/2019	0.06	0.5	**0.12**	263	39	75
	20/11/2019	0.05	0.5	0.07	301	43	56
	26/02/2020	0.072	1.4	0.055	275	35.7	
	10/06/2020	**1.6**	**4.1**	**0.14**	262	48.2	
	23/09/2020	0.037	1.2	0.069	309	34	
	18/11/2020	0.01	0.5	0.069	327	22.2	
	10/02/2021	0.06	0.5	0.052	310	58.5	
	28/04/2021	**0.19**	1.0	0.01	289	42	
	09/06/2021	0.13	1.5	0.063	310	36.9	
	29/09/2021	0.11	1.4	**0.13**	227	44.7	
	17/11/2021	**0.2**	1.1	**0.14**	334	40.5	
	27/04/2022	0.14	1.6	0.049	293	52	
	08/06/2022	**0.66**	**3.1**	**0.13**	253	51.5	
	28/09/2022	**0.49**	1.5	**0.12**	274	44.9	
	16/11/2022	0.042	1.1	**0.076**	299	30.6	
	Data 95%ile	**0.59**	**4.0**	**0.161**	337	59	85
	Data mean	**0.14**	1.5	**0.083**	280	36	52

XXX	*Over 95%ile threshold value (95%ile)*
XXX	*Over mean threshold value (95%ile)*
n.v.	*No value*

Table 3.1 *EPA Water Quality Data in the River Tolka (Data Source: https://catchments.ie/)*

4.0 ANTICIPATED EMISSION LOADING

4.1 PROCESS GENERAL BACKGROUND

As described in the Operational Report (Attachment-4-8-1) submitted with the IED application, the cooling units or Air Handling Units (AHUs) on the data centre roofs provide conditioned air to maintain temperature, relative humidity and pressurisation in the data halls. The cooling units operate under two modes; free cooling (normal temperatures) and evaporative cooling (when temperatures are elevated). Evaporative cooling is used when atmospheric temperatures are above a setpoint, to cool components within the facility it has been assumed for the purpose of this assessment that the discharge occurs 5 days a month. Evaporative cooling utilises mains water (at ambient temperature) from the mains supply as the cooling media. The majority of the evaporative cooling water is evaporated in this process.

No treatment chemicals are added to the evaporative cooling water. Prior to the cooling process, water is sanitised using ultraviolet disinfection. When water is used for cooling it is recirculated in a closed loop system. When a conductivity setpoint of 1,500 µS/cm is reached, the evaporative cooling water is automatically discharged to the onsite stormwater network at ambient temperature. As the water is supplied from the Irish Water mains, there is no risk of Principle Pollution Substances, Priority Substances or Priority Hazardous Substances (main polluting substances as defined in the Schedule of EPA (Licensing)(Amendment) Regulations 2004, S.I. No. 394 of 2004 being discharged from the installation above the limits outlined in the Surface Waters Regulations (S.I. No. 272 of 2009).

See Figure 4.1 below which details the water flow and evaporative cooling water discharge process. It should be noted that there is no ***direct*** discharge from the site to the Ballycoolen Stream and River Tolka; there is however, an ***indirect*** discharge via the FCC stormwater network on the public road to the south of the site, which subsequently discharges to the Ballycoolen Stream. A flow control system at the outlet of the site stormwater attenuation is used to achieve the controlled discharge rate to this FCC stormwater network.

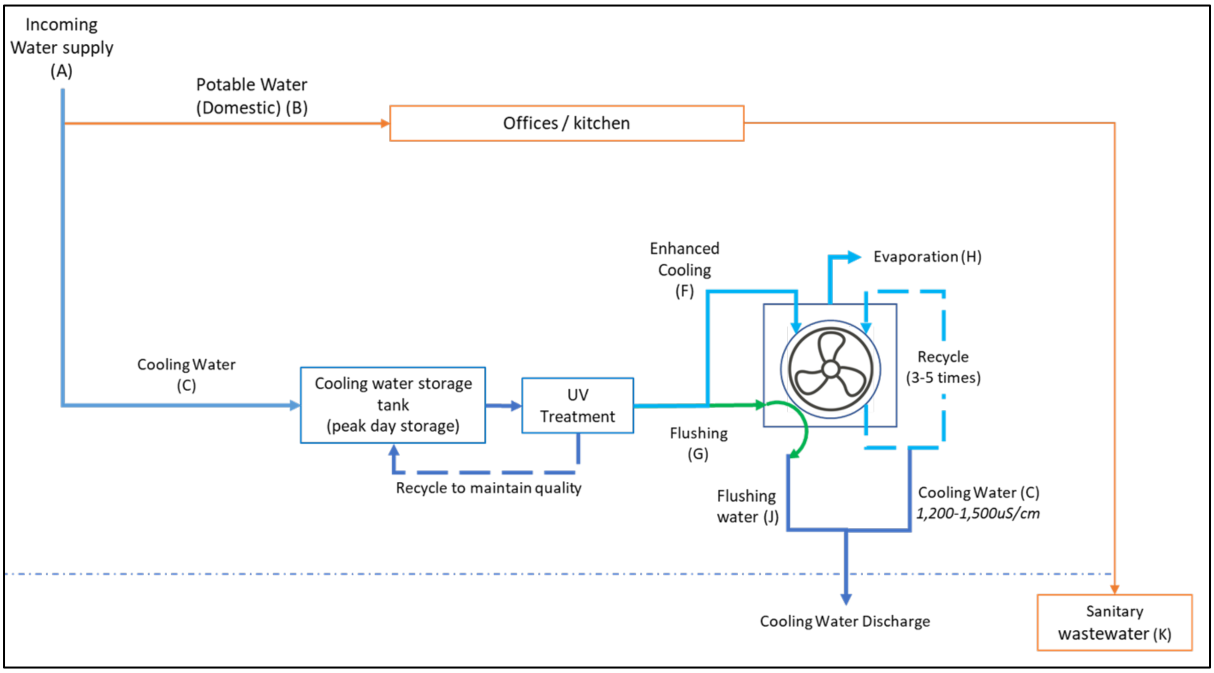

Figure 4.1 Flushing Process Diagram

4.2 EMISSION QUALITY AND FLOW

The expected concentrations for the parameters of interest and discharge flow from the flushing process are presented in Table 4.1 below. The parameters considered in the assessment are based on: (1) the data available from the Operator's Water Team (Table 2.1), and (2) the available data monitored by the EPA within the River Tolka (Mulhuddart Bridge (RS09T010800)) (Table 3.1). However, where specific parameters of the Operator's data and the EPA data do not correspond, the impact assessment has not been undertaken. Ammonia as N, BOD and Orthophosphate as P have been included in the assessment as they are used by the EPA to assess the water quality status of a river under the WFD.

Parameter	Unit	Value
Ammonia as N	mg/l	0.01
BOD	mg/l	1
Orthophosphate as P	mg/l	0.03
Chloride	mg/l	55
Sulfate	mg/l	131
Alkalinity	mg/l	458
Discharge Flow (95%ile scenario)	m^3/d	107
Discharge Flow (50%ile scenario)	m^3/d	18

Table 4.1 Emission Values (Source: Operator's Waters Team)

It should be noted that the parameters Ammonia as N, BOD and Orthophosphate as P have been assumed to be at the limit of detection in order to estimate the potential increase in assimilative capacity in the River Tolka due to possible dilution, given that the water quality in the river currently exceeds the established threshold values as set out in Table 2.2. For calculation purposes, it has been assumed that the discharge concentrations of these parameters are at the laboratory limit of detection reported in the EPA water quality data (refer to Section 3.3).

With regard to the discharge flow, two scenarios have been considered as follows:

- Dry Weather Flow or 95%ile: **107 m^3/d** evaporative cooling water discharge from the installation and Q_{95} in the River Tolka.
- Mean Flow or 50%ile: This scenario estimates that 107m^3/d discharge from the installation occurs 5 days month within a 30-day month, which equates a mean installation discharge flow rate of **18 m^3/d** (107 m^3/d x 5 days / 30 days) and Q_{50} in the River Tolka.

5.0 ASSESSMENT RESULTS

The assessment considers the assimilative capacity without the evaporative cooling water discharge (Section 5.1) and with the evaporative cooling water discharge (Section 5.2)

5.1 RIVER TOLKA ASSIMILATIVE CAPACITY (NO EVAPORATIVE COOLING WATER DISCHARGE)

Based on the Q_{95} and the EPA water quality data presented above, the Assimilative Capacity was calculated using the formula in Section 2.2.1 above, for the Dry Weather

Flow ('DWF') (or 95%ile condition). The results obtained are presented in Table 5.1 below.

Parameter	Q_{95} (m^3/d)	C_{MAX} (mg/l)	C_{BACK} (mg/l)	Assimilative Cap. (kg/d)
Ammonia	9,590	0.14	0.59	-4.3
BOD		2.6	4.0	-13.4
Orthophosphate as P		0.075	0.161	-0.8
Chloride		250	59	1,834
Sulphate		250	85	1,579

XXX	*Concentration over threshold value*
XXX	*Negative Assimilative capacity*

Table 5.1 Assimilative Capacity for 95%ile hydrological condition in the River Tolka

In addition, the assimilative capacity in the River Tolka was also estimated for a mean (or 50%ile) condition. The results obtained are presented in Table 5.2 below.

Parameter	Q_{50} (m^3/d)	C_{MAX} (mg/l)	C_{BACK} (mg/l)	Assimilative Cap. (kg/d)
Ammonia	73,440	0.065	0.143	-5.7
BOD		1.5	1.5	-2.7
Orthophosphate as P		0.035	0.083	-3.5
Chloride		250	36	15,725
Sulphate		250	52	14,531

XXX	*Concentration over threshold value*
XXX	*Negative Assimilative capacity*

Table 5.2 Assimilative Capacity for 50%ile hydrological condition in the River Tolka

Table 5.1 and Table 5.2 shows that for the parameters of Ammonia, BOD and Orthophosphate as P in the background concentration (C_{BACK}) is above the threshold established under the Surface Water Regulations for this waterbody (C_{MAX}) during both the dry weather (95%ile condition) and the mean condition (50%ile condition), with the exception of the BOD for the 50%ile condition. This means that there is no assimilative capacity within the River Tolka for these parameters of Ammonia, BOD and Orthophosphate as P which is reflected by the negative value of the assimilative capacity.

The background concentration (C_{BACK}) for the parameters of Chloride and Sulphate are below the threshold established under the Drinking Water Regulations. This means that there is assimilative capacity within the River Tolka for these parameters (Chloride and Sulphate).

5.2 RIVER TOLKA ASSIMILATIVE CAPACITY (WITH EVAPORATIVE COOLING WATER DISCHARGE)

This scenario assesses the assimilative capacity of the River Tolka with evaporative cooling water discharge from the cooling systems with emission values as presented in Table 4.1. The downstream concentrations in the River Tolka of the assessed parameters have been estimated (Refer to Table 5.3 below). It should be noted that:

- This scenario is conservative as it has assumed no dilution of evaporative cooling water discharge through the public stormwater water sewer or the Ballycoolen Stream;
- This assessment represents a maximum flow and maximum concentrations, which are only likely to occur under very high temperatures generally seen less than 5 days a year (> 30° C) as set out in Section 4.1.
- As explained in Section 4.2 above, 2 no. hydrological scenarios have been considered:
  - Dry Weather Flow or 95%ile: 107 m^3/d evaporative cooling water discharge from the Installation and Q_{95} in the River Tolka.
  - Mean Flow or 50%ile: This scenario estimates that **107 m^3/d** discharge from the installation occurs 5 days per month within a 30-day month, which equates a mean installation discharge flow rate of **18 m^3/d** (107 m^3/d x 5 days / 30 days) and Q_{50} in the River Tolka.

The results obtained for the Dry Weather Flow (DWF or 95%ile) condition are presented in Table 5.3 below.

Parameter	Q_{95} (m^3/d)	Discharge Flow (m^3/d)	C_{BACK} (mg/l)	C_{ADSIL} (mg/l)	$C_{D/S}$ (mg/l)	Assimilative Cap. (kg/d)
Ammonia	9,590	107	0.59	0.01	0.58	**-4.2**
BOD			4.0	1	3.97	**-13.1**
Orthophosphate as P			0.161	0.03	0.16	**-0.8**
Chloride			59	55	59	**1,834**
Sulphate			85	131	86	**1,574**
Alkalinity-total (*)			337	458	338	n/a

Notes:
(*): Assimilative Capacity was not estimated for Alkalinity due to the absence of threshold value for this parameter (refer to Table 2.2 above).
n/a: Not applicable as per note above.
Concentration over threshold value: XXX
Negative Assimilative capacity: **XXX**

Table 5.3 Downstream Concentrations during the discharge scenario (DWF condition)

The results obtained for the mean (50%ile) condition are presented in Table 5.4 below.

Parameter	Q_{50} (m^3/d)	Discharge Flow (m^3/d)	CBACK (mg/l)	CADSIL (mg/l)	CD/S (mg/l)	Assimilative Cap. (kg/d)
Ammonia	73,440	18	0.143	0.01	0.143	**-5.7**
BOD			1.5	1	1.5	**-2.7**
Orthophosphate as P			0.083	0.03	0.083	**-3.5**
Chloride			36	55	36	**15,724**
Sulphate			52	131	52	**14,530**
Alkalinity-total (*)			280	458	280	n/a

Notes:
(*): Assimilative Capacity was not estimated for Alkalinity due to the absence of threshold value for this parameter (refer to Table 2.2 above).
n/a: Not applicable as per note above.
Concentration over threshold value: XXX
Negative Assimilative capacity: **XXX**

Table 5.4 Downstream Concentrations during the discharge scenario (mean condition)

Table 5.3 and Table 5.4 show that the evaporative cooling water discharge (C_{ADSIL}) will increase the chloride and sulphate downstream concentrations ($C_{D/S}$) marginally in terms of the assimilative capacity of the river for both hydrological conditions. The concentrations of chloride and sulphate do not exceed any statutory water limits.

For the water quality parameters of interest, based on the objectives for achieving good status under the WFD in the river (i.e., Ammonia as N, BOD and Orthophosphate as P), it can be seen in Table 5.3 and Table 5.4 that the assimilative capacity in the river increases due to dilution from the evaporative cooling water discharge (particularly for the dry weather condition), although the resultant assimilative capacity is not adequate to achieve a 'Good' status as defined and established by the WFD (refer to S.I. 272/2009 and amendment S.I. 77/2019). As such, the evaporative discharge of cooling water improves the water quality within the river.

6.0 CONCLUSION

In order to assess the impact of the evaporative cooling water discharge from the Installation on the receiving water course (River Tolka), a conservative numerical analysis has been undertaken, based on the existing assimilative capacity of the surface water body. This has been assessed for two hydrological conditions: dry weather (95%ile) and mean condition (50%ile).

The assessment is conservative as considers that all of the evaporative cooling water discharge (at maximum discharge flow) is discharged directly to the River Tolka. In reality, the installation evaporative cooling water will discharge from the site at SW1 (discharge point) to the existing FCC stormwater network in the R121 Regional Road (Cruiserath Road) to the south-east of the Site. The FCC network(s) eventually discharge to the Ballycoolen Stream and the River Tolka which flows to the Liffey Estuary transitional water body (11.6 km hydrologically downgradient). The confluence between the Ballycoolen Stream and the River Tolka is located c. 1.54 km (straight line) southwest of the subject site.

The parameters assessed in the assimilative capacity study were based on available EPA water quality data (for the closest monitoring stations which was located 500 m upgradient of the river confluence point) which is used to determine the water body status as well as the characteristics of the evaporative cooling water discharge.

The effect of the evaporative cooling water discharge is considered to be temporary and not significant (i.e., an effect which causes noticeable changes in the character of the environment but without noticeable consequences) in terms of assimilative capacity of the river. The evaporative cooling water discharge will not result in exceedances in the statutory threshold values (as set out in Table 2.2) for the parameters (chloride, sulphate and alkalinity) in the River Tolka. The assimilative capacity of the River Tolka is sufficient to ensure that exceedances of these parameters do not occur under dry weather and mean flow conditions.

For the water quality parameters of interest, based on the objectives for achieving good status in the river (Ammonia, Orthophosphate as P and BOD), the evaporative cooling water discharge will provide dilution and as a result slightly increases the assimilative capacity in the River Tolka, although the resultant capacity is still not adequate to achieve 'Good' status. It should be noted that the River Tolka currently does not have existing assimilative capacity for these parameters (i.e., Ammonia as N, BOD and Orthophosphate as P) and is already at poor status.

In conclusion, based on the above assessment, the discharge of evaporative cooling water from the Installation is not anticipated to have a noticeable impact on the River Tolka.

7.0 LIMITATIONS AND ASSUMPTIONS

There are no low flow measurements or background water quality data available for the Ballycoolen Stream at the point of discharge from the FCC stormwater network.

In the absence of an available dataset for flow and water quality, the water quality and flow data from the EPA database and EPA Hydrotool is considered representative for the purpose of estimating the effect of the discharge on the receiving watercourse (River Tolka). The assessment has relied upon the estimated flow from the EPA Hydrotool ungauged ref. point 09-1459 in the River Tolka. The Hydrotool flow estimates represent flows that could be expected in rivers under naturalised conditions and do not take account of artificial influences of any kind such as water supply abstractions or wastewater discharges.

The evaporative cooling water discharge volumes and quality are an estimate made by the Operator’s Water Team. The criteria used to estimate the water use and evaporative cooling water discharge volumes and quality has been provided by the Operator’s Water Team and is presented below:

- A dry-bulb temperature of 30.4 degC and wet-bulb temperature of 21.2 degC is used for modelling water use for evaporative cooling. This is a conservative design criterion, and is greater than the ASHRAE n=50 year temperature for Dublin Airport, Ireland (WMO: 039690). Water use is evaluated based on a theoretical peak day with 6 hours of evaporative cooling working at these peak weather conditions.
- Evaporative cooling water discharge volume and quality is estimated based on the cooling systems operating at 3 cycles of concentration of the mains water supply, per mains water quality analyses carried out on-site.

In order to establish the average monthly flow for the calculation of the assimilative capacity in the River Tolka during the mean flow (or 50%ile) condition it has been assumed that the peak discharge occurs 5 days a month throughout the year. This is a highly conservative estimate as the discharge only occurs from the cooling systems to the stormwater sewer when elevated temperatures occur.

8.0 REFERENCES

EPA (2023). Environmental Protection Agency. Available on-line at: https://gis.epa.ie/EPAMaps/.

EPA Catchments (2023). Water Quality Data available on-line at: https://catchments.ie/.

EPA (2023). Hydronet Monitoring Data. Available on-line at: https://epawebapp.epa.ie/hydronet/