








SECTION D: IMPACT ASSESSMENT

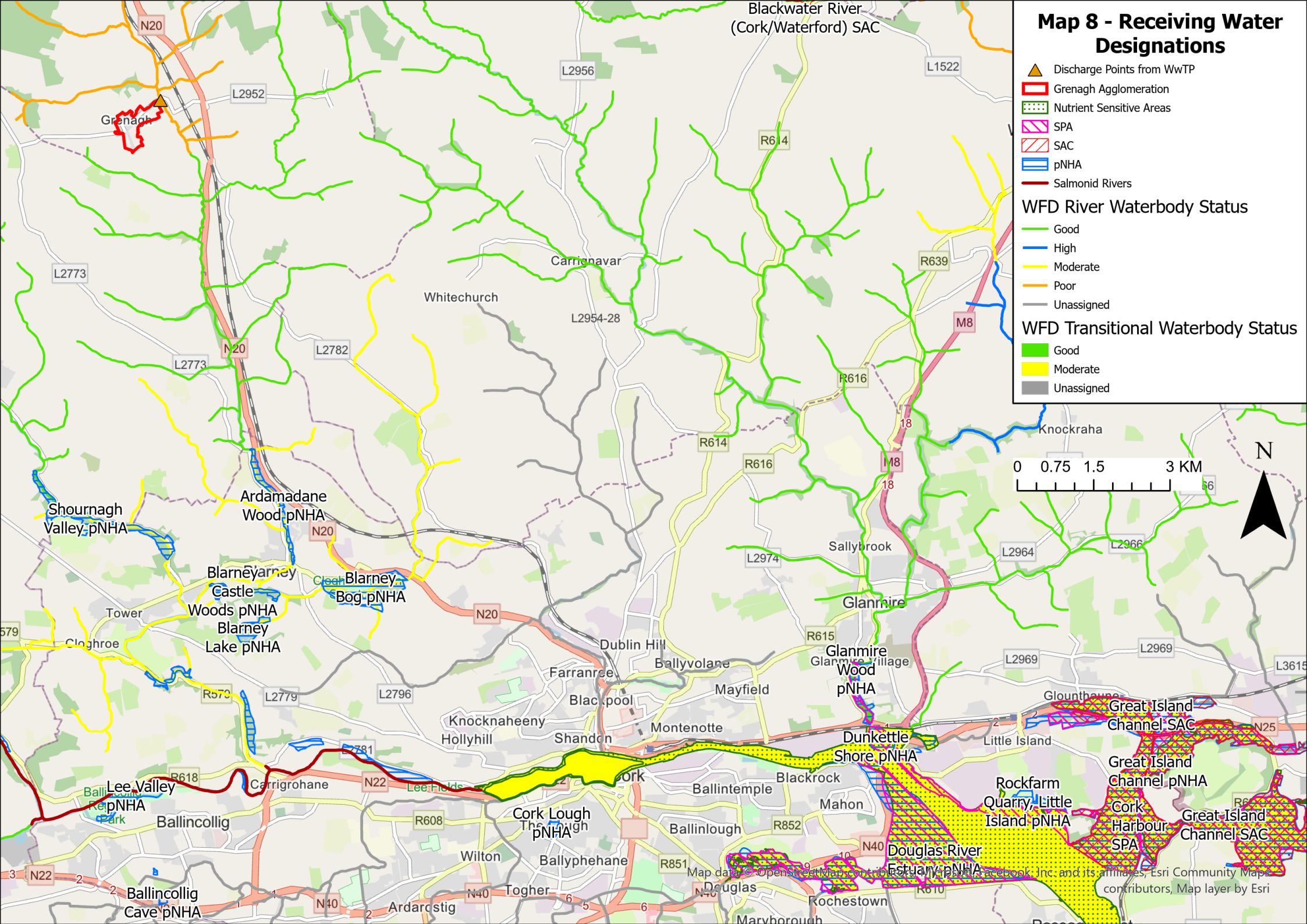


ATTACHMENT D.1:

MAP 8 - RECEIVING WATER DESIGNATIONS

Map 8 - Receiving Water Designations

-  Discharge Points from WWTP
 -  Grenagh Agglomeration
 -  Nutrient Sensitive Areas
 -  SPA
 -  SAC
 -  pNHA
 -  Salmonid Rivers
- WFD River Waterbody Status**
-  Good
 -  High
 -  Moderate
 -  Poor
 -  Unassigned
- WFD Transitional Waterbody Status**
-  Good
 -  Moderate
 -  Unassigned





ATTACHMENT D.2:

**ASSESSMENT OF IMPACT ON RECEIVING
WATERS**



ATTACHMENT D.2.1:

IMPACT ASSESSMENT REPORT

AUGUST 2022

Attachment D.2.1: Impact Assessment Report – August 2022

1. Introduction

This Report provides a summary of the Impact Assessments prepared to determine the impact of the discharges from the Grenagh agglomeration on the receiving waterbody, Martin River (Martin_010), and associated downstream receptors, and also addresses the criteria as outlined in **Section D.2** of the EPA guidance document.

2. Water Environment

Grenagh WwTP discharges to the Martin River (Martin_010). Martin_010 is within the Lee, Cork Harbour and Youghal Bay Catchment (Hydrometric Area 19). This catchment includes the area drained by the River Lee and all streams entering tidal water in Cork Harbour and Youghal Bay and between Knockaverry and Templebreedy Battery, Co. Cork, draining a total area of 2,153km².

The draft 3rd Cycle Catchment Report (2021) for this Hydrometric Area (HA), determined that for river waterbodies excess nutrients remain the most prevalent issue, along with morphology, organic pollution, and hydrology. Pressures identified affecting the greatest number of waterbodies within HA 19 include hydromorphology, followed by agriculture, urban run-off, urban wastewater, domestic waste water, forestry, mines and quarries and industry. Grenagh WwTP is not listed as a significant pressure in At Risk waterbodies in the draft 3rd cycle catchment assessment. The Martin_010 is listed as an area for action under the 3rd cycle (and the 2nd cycle).

The significant pressures for the Martin_010 have been cited within the draft 3rd cycle Catchment Report as Hydromorphology (embankments) and Other (illegal dumping), both of which are outside of the control of IW. Grenagh WwTP is not listed as a significant pressure on this At Risk Martin_010 waterbody.

The WFD status of the Martin_010 is Poor and At Risk of not achieving Good water quality status during 2022-2027. Further downstream the Martin_010 flows to the Martin_020 (Good Status) and then to the Martin_030 (Good Status) and the Martin_040 (Moderate Status). Approximately 13 km downstream, the Martin River flows into the Shournagh_030 (Moderate Status). The Shournagh River flows into the River Lee just north of Carrigrohane.

The EPA undertake biological monitoring of the Martin River at various locations. Upstream of the WwTP at RS19M010100 (ca. 1.6 km upstream), the 2020 monitoring reported a Q value of 3-4 (Moderate). Downstream of the WwTP at RS19M010200 and RS19M010300 (ca. 1.3 km and 4.3 km downstream, respectively) the 2020 monitoring reported a Q value of 4 (Good). Further downstream at RS19M010400 (ca. 7.1 km downstream of the WwTP), the 2020 monitoring reported a Q value of 4-5 (High).

Irish Water have conducted ambient monitoring sampling in 2022 ca. 1.6km d/s of RS19M010100 and directly u/s of the WwTP discharges and ca. 4km u/s of RS19M010300 and ca. 260m d/s of WwTP discharges. Details of the 2022 monitoring results are tabled below.

Table D.2.1- 2022 Ambient Monitoring – ca. 1.6km d/s of RS19M010100 and directly u/s of WwTP discharges (**Data Source: IW/CCC**)

Parameter	BOD (mg/l)	Ortho-P (mg/l)	Total Ammonia (mg/l)	DO (% sat)	Suspended Solids (mg/l)	Temp (°C)
Number of Samples	2	2	2	2	2	2
Mean Result	1.9	0.024	0.048	99.75	8	9.15
Mean EQS – Good status*	≤1.5	≤0.035	≤0.065			
95%ile – Good status*	≤2.6	≤0.075	≤0.14			

* Good status EQS under S.I. No. 77/2019

Table D.2.2 – 2022 Ambient Monitoring – ca. 4km u/s of RS19M010300 and ca. 260m d/s of WwTP discharges (Data Source: IW/CCC)

Parameter	BOD (mg/l)	Ortho-P (mg/l)	Total Ammonia (mg/l)	DO (% Sat)	Suspended Solids (mg/l)	Temp (°C)
Number of Samples	2	2	2	2	2	2
Mean Result	1.5	0.023	0.056	97.5	6.625	9.3
Mean EQS – Good status*	≤1.5	≤0.035	≤0.065			
95%ile – Good status*	≤2.6	≤0.075	≤0.14			

* Mean Good status under S.I. No. 77/2019

Based on grab sampling results obtained in 2022, the concentration for Ammonia and Ortho-P are within the required EQSs for Good status (mean and 95%ile). In relation to BOD, the mean upstream concentration was 1.9mg/l, indicating that the mean EQS for Good status is not met upstream of the WwTP. However, the 95%ile Good status EQS is met. The downstream mean BOD, Ortho-P and Ammonia concentrations are below the EQS for Good status (both mean and 95%ile).

As noted above, the significant pressures for the Martin_010 have been cited within the draft 3rd cycle Catchment Report as Hydromorphology (embankments) and Other (illegal dumping), both of which are outside of the control of IW. Grenagh WwTP is not listed as a significant pressure on this At Risk Martin_010 waterbody.

The above would indicate that the current effluent discharge from the Grenagh WwTP is not having an observable impact on the downstream Martin River.

3. Small Stream Risk Score Report

A Small Stream Risk Score (SSRS) Report was completed in April 2018. The report concluded that there was no apparent impact to the macroinvertebrate community of the Martin River downstream of the WwTP due to the WwTP's operational discharges.

Refer to **Attachment D.2.5** for a copy of the 2018 SSRS Report.

4. Waste Assimilative Capacity Calculations

Waste Assimilative Capacity (WAC) calculations have been completed to inform this WWDL application process and to show the impact of the primary discharge from the WwTP on the receiving waterbody, the Martin River (Martin_010).

The calculations were based on the 95%ile and mean river flow in the river, 0.06m³/s and 0.72m³/s (as determined by IW, see **Attachment D.2.6** Hydrological Estimation), the projected normal waste water loading of 135 m³/d (750 p.e x 180/p.e/day) and the proposed operational standards/ELVs. Due to limited background data, and the fact that the current WFD status of the Martin_010 is Poor, and that the significant pressures for the Martin_010 have been cited as Hydromorphology (embankments) and Other (illegal dumping), both of which are outside of the control of IW, the EPA's "notionally clean river" concentrations were applied in the WAC calculations.

It is important to reiterate that the Grenagh WwTP is not considered to be a significant pressure on the Martin_010. Catchment measures, which are not in the control or remit of IW, are required to be implemented to achieve Good status by 2027. As detailed in Sections 2 and 3 above, it is evident that the operational discharges from the Grenagh WwTP are not have an observable significant adverse effect on the receiving waterbody.

Table D.2.3 (a) - WAC for 750 PE (based on Notionally Clean River) – 95%ile River Flow

Parameter	Upstream River Conc ^{Note 1}	Proposed Standards/ ELVs	Contribution from Primary Discharge (mg/l)	Predicted D/S Conc (mg/l)	Relevant Standard (mg/l)
BOD	0.26	25	0.63	0.888	<2.6 ^{Note 2}
Total Ammonia	0.008	3	0.08	0.084	<0.14 ^{Note 2}
Ortho-Phosphate (MRP)	0.005	1.65	0.04	0.047	<0.075 ^{Note 2}

Note 1: Based on notionally clean river approach.

Note 2: European Union Environmental Objectives (Surface Waters) (Amendment). Regulations 2019 (S.I. No. 77 of 2019) – Good Status 95%ile EQS.

Table D.2.3 (b) - WAC for 750 PE (based on Notionally Clean River) – Mean River Flow

Parameter	Upstream River Conc ^{Note 1}	Proposed Standards/ ELVs	Contribution from Primary Discharge (mg/l)	Predicted D/S Conc (mg/l)	Relevant Standard (mg/l)
BOD	0.26	25	0.054	0.314	<1.5 ^{Note 2}
Total Ammonia	0.008	3	0.006	0.014	<0.065 ^{Note 2}

Parameter	Upstream River Conc ^{Note 1}	Proposed Standards/ ELVs	Contribution from Primary Discharge (mg/l)	Predicted D/S Conc (mg/l)	Relevant Standard (mg/l)
Ortho-Phosphate (MRP)	0.005	1.65	0.004	0.009	<0.035 ^{Note 2}

Note 1: Based on notionally clean river approach.

Note 2: European Union Environmental Objectives (Surface Waters) (Amendment). Regulations 2019 (S.I. No. 77 of 2019) – Good Status Mean EQS.

As shown above, the resultant downstream concentrations for BOD, Total Ammonia and Ortho-P comply with the relevant Good status EQSs for each parameter for both the 95%ile and mean river flows.

Refer to **Attachment D.2.3** for the WAC calculations.

5. Appropriate Assessment Screening

An Appropriate Assessment (AA) screening of the proposed operational discharges from the Grenagh WwTP was prepared to inform this WWDL application process (see **Attachment D.2.2**). It assessed whether the discharge activity, alone or in combination with other plans and projects, are likely to have significant effects on a European Site(s) in view of best scientific knowledge and the conservation objectives of the site(s).

A single European site, the River Blackwater (Cork/Waterford) SAC lies within 15km of the Grenagh discharge point. This SAC is not hydrologically connected to the Martin River and therefore there is no likelihood of any significant effects arising.

The Cork Harbour SPA and Great Channel Island SAC are both distantly hydrologically connected to the Martin River (over 30km downstream from the WwTP operational discharges). While ambient and effluent data is limited, the Martin River downstream of the WwTP meets the Surface Water Regulations standards as indicated by the available monitoring data. There is also no evidence to suggest that the WwTP discharge is impacting on the Martin River locally and the operational discharges from the WwTP are not considered to be a significant pressure on the Martin_010, consequently it can be confidently concluded that there is no likelihood of any significant effect on water quality in these remotely connected European sites arising from Grenagh WwTP operational discharges.

The screening assessment concluded that the proposed operational discharges are not likely to have significant effects on the Cork Harbour SPA and Great Channel Island SAC, or indeed any European sites, having regard to their conservation objectives, for the following reasons:

- The Grenagh agglomeration is a small catchment area currently serving 561 p.e. (2021 peak week loading) with a maximum p.e. of 750 for the duration of the licence.
- The fact that the Blackwater River (Cork/Waterford) SAC is not hydrologically connected to the Martin River into which the operational discharges are made.

- The fact that the Cork Harbour SPA and Great Island Channel SAC are greater than 30 km downstream of the operational discharges.
- The status of the receiving water downstream of the operational discharges.

Based on the above it has been concluded following screening that the operational discharges from the Grenagh agglomeration are not directly connected with or necessary to the management of any European Site and it is considered, for the reasons set out above, that it can be excluded, on the basis of objective information, that the operational discharges, individually or in combination with other plans or projects, will have a significant effect on any European Site and accordingly determined that an Appropriate Assessment is not required.

6. Environmental Impact Assessment

An Environmental Impact Assessment (EIA) Screening Report has been prepared to form an opinion as to whether or not the operational activities from the Grenagh agglomeration (i.e., the operational discharges from the Grenagh agglomeration in so far as they relate to the risk of environmental pollution of the receiving waters, the Martin River (Martin_010) should be subject to Environmental Impact Assessment (EIA) and if so, whether an Environmental Impact Assessment Report (EIAR) should be prepared in respect of it.

Based on the information as contained in the EIA Screening Report (see **Attachment B.5**), it is Irish Water's opinion that there is no significant and realistic doubt in regard to the likelihood of significant effects on the environment arising from the operational discharges from the Grenagh WwTP in so far as they relate to the risk of environmental pollution of the receiving waters, the Martin River) and it is considered that an EIA is not required for the authorisation to which this application relates by virtue of its nature, size and location.

7. Priority Substance Assessment

An assessment of the potential for impacts on receiving waters from priority substances in the primary discharge has been carried out to inform this WWDL application. Estimated data from the PRTR reporting tool was used to inform this desktop assessment. The assessment considered the primary discharge relevant to Environmental Quality Standards (EQS) for priority substances in surface waters, as set out in the European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended (now S.I No. 77 of 2019).

It was concluded that after dilution none of the substances listed in the Specific Pollutants, Priority and Priority Hazardous Substances as outlined in the Surface Water Regulations, are likely to be present in the effluent discharge to the Martin River, at concentrations above the specified standards as per European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended (now S.I No. 77 of 2019).

This Report is contained in **Attachment D.2.4**: Priority Substance Assessment.

8. Designated Shellfish Water/Area

There are no designated shellfish waters located in the downstream in the vicinity of the discharges.

9. Bathing Waters

There are no designated bathing waters on any of the receiving waters downstream of the WwTP.

10. River Flow Estimation

The 95%ile and mean river flow on the Martin _010 have been calculated by IW as 0.06m³/s and 0.72m³/s respectively (see **Attachment D.2.6** Hydrological Estimation).

11. Combined Approach

The Waste Water Discharge Authorisation under the European Union (Waste Water Discharge) Regulations 2007 to 2020, specify that a '*combined approach*' in relation to licensing of waste water works must be taken, whereby the emission limits for the discharge are established on the basis of the stricter of either or both, the limits and controls required under the Urban Waste Water Treatment Regulations, 2001, as amended, and the limits determined under statute or Directive for the purpose of achieving the environmental objectives established for surface waters, groundwater or protected areas for the water body into which the discharge is made.

The proposed standards/ELVs give effect to the principle of the Combined Approach as defined in Waste Water Discharge (Authorisation) Regulations, 2007 to 2020 in that they accommodate the Urban Waste Water Regulations and the relevant designations /status of the receiving waterbody, the Martin River.

12. Compliance with Relevant National or EU Legislation

As per **Attachment B.6**, the Grenagh WwTP has been designed to ensure that the emissions from the agglomeration will comply with and will not result in the contravention of EU Legislation and National Regulations.

The discharge standards will not compromise the achievement of the objectives and EQSs established for any European sites water dependant species and natural habitats and designations in the wider environs or downstream of the agglomeration.

13. Data Sources

The following key data sources were used to complete this application.

- Online data available on held by the NPWS, EPA, and Irish Water:
 - www.npws.ie
 - epawebapp.epa.ie
 - gis.epa.ie/EPAMaps
 - catchments.ie
- GIS data for European site boundaries obtained in digital format online from European Environmental Agency
- Irish Water/Cork County Council sampling and monitoring data.

14. Cumulative and In Combination Effects

The Appropriate Assessment Screening Report addresses in combination effects. Refer to **Attachments D.2.2.**

15. Mixing zone or transitional areas of exceedance

Based on the 95%ile river flow (0.06 m³/s) and the Grenagh WwTP DWF (135 m³/d), there are ca. 38 dilutions estimated immediately in the proximity of the primary discharge point.

16. Dilutions and retention times for lakes

Not applicable. No discharges to lakes.

17. The impact of the discharges on any environmental media other than those into which the emissions are to be made

Not applicable. No other relevant media into which the emissions are to be made.

18. Groundwater Details

Not applicable. No discharge to ground waters.

19. High Status Waterbodies

Not applicable. No High status waterbodies within the region of the Grenagh WwTP and/or the operational discharges.

20. Fresh Water Pearl Mussels

Not applicable. No Fresh Water Pearl Mussels within the region of the Grenagh WwTP and/or the Primary Discharge point.

21. Impacts on Transboundary / Territory of other States

The operational discharges to which this application relates will not result in transboundary impacts or impacts on the territory of other states.

22. For waste water treatment plants with coastal discharges, provide evidence that the end of the discharge pipe is below the mean spring tide low water line

Not applicable. Discharge is not to coastal water.



ATTACHMENT D.2.3:

WASTE ASSIMILATIVE CAPACITY (WAC)

AUGUST 2022

Waste Assimilative Capacity (WAC) Calculation					
WWTP	Grenagh				Date: 02 August 2022
Name of River	River Martin				Allowable Concentration
WFD Water Quality (Good/High)	Poor	Data Source:	EPA WFD Website	Good Status	High Status
95% Flow (m ³ /s)	0.060	Data Source:	IW - River Flow Assessment Report for Grenagh	95%ile mg/l	95%ile mg/l
95% Flow (m ³ /day)	5184			Carbonaceous BOD	2.60
Mean Flow (m ³ /s)	0.720	Data Source:	IW - River Flow Assessment Report for Grenagh	Ammonia Nitrogen (NH)	0.14
Mean Flow (m ³ /day)	62208			Ortho Phosphate (OP)	0.075
Effluent				Mean mg/l	Mean mg/l
PE	750			Carbonaceous BOD	1.50
Effluent flow (m ³ /day) (based on 180l/p/d)	135			Ammonia Nitrogen (NH)	0.065
Dilution @ 95%ile flows	38.4			Ortho Phosphate (OP)	0.035
Dilution @ mean flows	460.8				
95%ile River Flows					
Parameter	Background Concentration mg/l (Notionally Clean)	Proposed Effluent Standards	Contribution from Primary Discharge (mg/l)	Resultant Concentration (Notionally Clean)	Allowable Concentration 95%ile mg/l
Carbonaceous BOD	0.260	25.00	0.63	0.888	2.60
Ammonia Nitrogen (NH)	0.008	3.00	0.08	0.084	0.14
Ortho Phosphate (OP)	0.005	1.65	0.04	0.047	0.075
Mean River Flows					
Parameter	Background Concentration mg/l (Notionally Clean)	Proposed Effluent Standards	Contribution from Primary Discharge (mg/l)	Resultant Concentration (Notionally Clean)	Allowable Concentration Mean mg/l
Carbonaceous BOD	0.260	25.00	0.054	0.314	1.500
Ammonia Nitrogen (NH)	0.008	3.00	0.006	0.014	0.065
Ortho Phosphate (OP)	0.005	1.65	0.004	0.009	0.035



ATTACHMENT D.2.4:

PRIORITY SUBSTANCE ASSESSMENT

AUGUST 2022

Priority Substances Assessment

Agglomeration Name:	Grenagh Agglomeration
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Appendix 1 – Screening of Parameters for Priority Substances

1 Introduction

This report has been prepared for the Grenagh agglomeration, to inform the application of a wastewater discharge licence.

The Grenagh agglomeration is centred on the village of Grenagh. The current WwTP at NGR 158817E, 084754N has design capacity of the WwTP is 1,200 p.e. and is currently collecting loads of *ca.* 561 p.e. Based on the existing collected loads (2021), the projected 10-year load is 750 p.e.

The WwTP provides secondary treatment with treated wastewater discharging to the Martin River at NGR 158833E, 084980N.

The source of waste water in the Grenagh agglomeration is predominantly domestic. This desk top study has been undertaken to determine the necessity, if any, for further analysis of the primary discharge based on the *Guidance on the Screening for Priority Substances for Waste Water Discharge Licences*, issued by the EPA. Relevant inputs to the Grenagh WwTP and estimates for the emissions from the discharge point have been taken into account in the preparation of this report.

2 Desktop Study

2.1 Assessment of Analysis Required

A. Review of all industrial inputs into WWTP

A review of available online mapping and all EPA licensed facilities was undertaken to determine the non-domestic discharge types which will be received at the Grenagh WwTP. In addition, all planning applications within the agglomeration, since 2017, were reviewed to determine the associated non-domestic discharges being sent to the Grenagh WwTP. The IW Technical Assessment Manual Sectoral Profile Data was reviewed to determine the potentially dangerous substances which could be released to sewer from industrial inputs.

As per the EPA, IPC and IE database, there are currently no industrial premises with an IPC licence within the agglomeration.

There is one Trade Effluent FOG Licence (IW-FOG-836742-01 - fast food establishment) under Section 16 of the Water Pollution Act 1977 (amended 1990) within the agglomeration.

It is considered that the Priority Substances which are possibly being emitted to sewer have been well represented in this partial characterisation of the wastewater (**Table 2.1**).

Upon review of the types of businesses, amenities, and educational facilities in Grenagh, **Table 2.1** provides an indicative list of non-domestic discharge types to the WwTP and details potential dangerous/priority substance.

Table 2.1 – List of Non-Domestic Discharge Types to WwTP and Details of Potential Dangerous/Priority Substance

Type of Industry within the Agglomeration	Potential Source of Dangerous / Priority Substances (Yes / No)	Dangerous / Priority Substances Monitoring Undertaken (Yes / No)	List of Potential Dangerous Substances Based on Industry Type (Source: <i>Technical Assessment Manual - Sectoral Profile Data</i>)
Garages and Filling Stations	Yes	Unknown	Benzene Di (2-ethylhexyl) phthalate (DEHP) Lead and its compounds Naphthalene Nickel and its compounds Cadmium and its compounds Mercury and its compounds Chromium (III) Copper Toluene Xylenes (Total) Zinc
Manufacture of food products and beverages	Yes	Unknown	Lead and its compounds Nickel and its compounds Cadmium and its compounds Mercury and its compounds Chromium (III) Copper Zinc
Construction	Yes	Unknown	Lead and its compounds Nickel and its compounds Mercury and its compounds Arsenic Chromium (III) Copper Zinc
Other supporting transport activities	Yes	Unknown	Benzene

B. Discharge monitoring

No primary discharge monitoring for the possible presence of Specific Pollutants, Priority and Priority Hazardous Substances as outlined in Table 10, 11 and 12 of European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended is available for this agglomeration.

C. Downstream monitoring location's participation in relevant monitoring programme

There is no priority substances monitoring data for the downstream ambient monitoring location on the Martin River.

D. Participation in PRTR reporting

Estimated data from the PRTR reporting tool was required for this desktop assessment as measured data was unavailable for all parameters in Appendix 1.

2.2 Review Outcome of Desktop Study

Following the desktop study, all parameters in Appendix 1 have been assessed to establish any potential impact on the receiving waters. Priority substance measured concentrations in the primary discharge were not available for any parameters, as such estimated concentrations were assessed. This desktop study is considered to provide partial characterisation of the wastewater.

3 Assessment of Significance and Recommendations

An assessment of the potential for impacts on receiving waters from priority substances in the primary discharge has been carried out. The assessment considers the primary discharge relevant to Environmental Quality Standards (EQS) for priority substances in surface waters, as set out in the European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended.

Based on the estimated data, no parameters were identified as potentially being higher than the required EQS.

Does the assessment use the Desk Top Study Method or Screening Analysis to determine if the discharge contains the parameters in Appendix 1 of the EPA guidance	Desk Top Study
Does the assessment include a review of licensed / authorised inputs to the works?	Yes
Does the assessment include a review of other (unauthorised) inputs to the works?	Yes
Does the report include an assessment of the significance of the results where a listed material is present in the discharge? (e.g., impact on the relevant EQS standard for the receiving water)	Yes
Does the assessment identify that priority substances may be impacting the receiving water?	No
Does the Improvement Programme for the agglomeration include the elimination / reduction of all priority substances identified as having an impact on receiving water quality?	N/A

4 Conclusion

An assessment of the potential for impacts on receiving waters from priority substances in the primary discharge has been carried out to inform this WWDL application. Estimated data from the PRTR reporting tool was used to inform this desktop assessment. The assessment considered the primary

discharge relevant to Environmental Quality Standards (EQS) for priority substances in surface waters, as set out in the Surface Waters Regulations (S.I No. 77 of 2019).

After dilution, it can be concluded that none of the substances listed in the Specific Pollutants, Priority and Priority Hazardous Substances, are likely to be present in the effluent discharge to the Martin River, at concentrations above the standards in S.I No. 77 of 2019.

Based on the results of this desk top study, it can be determined that **no for further analysis** of the discharge, based on the *Guidance on the Screening for Priority Substances for Waste Water Discharge Licences*, issued by the EPA, is required.

Appendix 1 – Screening of Parameters for Priority Substances

AA: Annual Average

MAC: Maximum Allowable Concentration

EQS: Environmental Quality Standards

Dilution factor in receiving water: 38 dilutions estimated immediately in the proximity of the discharge point (based on a DWF of 135m³/day and 95%ile flow 0.06 m³/s) the nature of the receiving waterbody, Martin River)

No.	Compound	Group of compounds	AA-EQS Inland SW (µg/l)	AA-EQS Other SW (µg/l)	Estimated Conc. (µg/l) ¹	Data Source	Sample Date (if applicable)	Effluent Concentration above AA concentration (Yes/No)	Effluent Concentration above AA concentration after dilution (Yes/No)
1	Benzene	VOCs	10	8	0.0168	PRTR Electronic Toolset	N/A	No	No
2	Carbon tetrachloride	VOCs	12	12	0.000	PRTR Electronic Toolset	N/A	No	No
3	1,2-Dichloroethane	VOCs	10	10	0.000	PRTR Electronic Toolset	N/A	No	No
4	Dichloromethane	VOCs	20	20	0.0454	PRTR Electronic Toolset	N/A	No	No
5	Tetrachloroethylene	VOCs	10	10	0.000	PRTR Electronic Toolset	N/A	No	No
6	Trichloroethylene	VOCs	10	10	0.0591	PRTR Electronic Toolset	N/A	No	No
7	Trichlorobenzenes	VOCs	0.4	0.4	0.000	PRTR Electronic Toolset	N/A	No	No
8	Trichloromethane	VOCs	2.5	2.5	0.000	PRTR Electronic Toolset	N/A	No	No
9	Xylenes (all isomers)	VOCs	10	10	0.116	PRTR Electronic Toolset	N/A	No	No

No.	Compound	Group of compounds	AA-EQS Inland SW (µg/l)	AA-EQS Other SW (µg/l)	Estimated Conc. (µg/l) ¹	Data Source	Sample Date (if applicable)	Effluent Concentration above AA concentration (Yes/No)	Effluent Concentration above AA concentration after dilution (Yes/No)
10	Ethyl Benzene	VOCs	n/a	n/a	0.0166	PRTR Electronic Toolset	N/A	N/A	N/A
11	Toluene	VOCs	10	10	0.493	PRTR Electronic Toolset	N/A	No	No
12	Naphthlene ¹	PAHs	2	2	0.004	PRTR Electronic Toolset	N/A	No	No
13	Fluoranthene ¹	PAHs	0.0063	0.0063	0.0023	PRTR Electronic Toolset	N/A	No	No
14	Benzo[k]fluoranthene ²	PAHs	MAC of 0.017	MAC of 0.017	0.002	PRTR Electronic Toolset	N/A	No	No
15	Benzo[ghi]perylene ²	PAHs	MAC of 8.2×10^{-3}	MAC of 8.2×10^{-4}	0.002	PRTR Electronic Toolset	N/A	No	No
16	Indeno[1,2,3-c,d]pyrene ²	PAHs			0.0022	PRTR Electronic Toolset	N/A	No	No
17	Benzo[b]fluoranthene ²	PAHs	MAC of 0.017	MAC of 0.017	0.002	PRTR Electronic Toolset	N/A	No	No
18	Benzo[a]pyrene	PAHs	1.7×10^{-4}	1.7×10^{-4}	0.002	PRTR Electronic Toolset	N/A	No	No
19	Di(2-ethylhexyl)phthalate (DEHP)	Plasticiser	1.3	1.3	0.92	PRTR Electronic Toolset	N/A	No	No
20	Isodrin ³	Pesticides	$\Sigma=0.01$	$\Sigma=0.005$	0.000	PRTR Electronic Toolset	N/A	No	No

¹ The EQS for these substances shall take effect from 22 December 2015

² No indicative parameter is provided for this group of substances

³ Σ of Aldrin, Dieldrin, Endrin and Isodrin.

No.	Compound	Group of compounds	AA-EQS Inland SW (µg/l)	AA-EQS Other SW (µg/l)	Estimated Conc. (µg/l) ¹	Data Source	Sample Date (if applicable)	Effluent Concentration above AA concentration (Yes/No)	Effluent Concentration above AA concentration after dilution (Yes/No)
21	Dieldrin ³	Pesticides			0.000	PRTR Electronic Toolset	N/A	No	No
22	Diuron	Pesticides	0.2	0.2	0.0264	PRTR Electronic Toolset	N/A	No	No
23	Isoproturon	Pesticides	0.3	0.3	0.0075	PRTR Electronic Toolset	N/A	No	No
24	Atrazine	Pesticides	0.6	0.6	0.0104	PRTR Electronic Toolset	N/A	No	No
25	Simazine	Pesticides	1	1	0.0141	PRTR Electronic Toolset	N/A	No	No
26	Glyphosate	Pesticides	60	-	1.533	PRTR Electronic Toolset	N/A	No	No
27	Mecoprop	Pesticides	n/a	n/a	0.107	PRTR Electronic Toolset	N/A	N/A	N/A
28	2,4-D	Pesticides	n/a	n/a	0.051	PRTR Electronic Toolset	N/A	N/A	N/A
29	MCPA	Pesticides	n/a	n/a	0.089	PRTR Electronic Toolset	N/A	N/A	N/A
30	Linuron	Pesticides	0.7	0.7	0.000	PRTR Electronic Toolset	N/A	No	No
31	Dichlobenil	Pesticides	n/a	n/a	0.0043	PRTR Electronic Toolset	N/A	N/A	N/A
32	2,6-Dichlorobenzamide	Pesticides	n/a	n/a	0.0804	PRTR Electronic Toolset	N/A	N/A	N/A
33	PCBs	PCBs	n/a	n/a	0.000	PRTR Electronic Toolset	N/A	N/A	N/A

No.	Compound	Group of compounds	AA-EQS Inland SW (µg/l)	AA-EQS Other SW (µg/l)	Estimated Conc. (µg/l) ¹	Data Source	Sample Date (if applicable)	Effluent Concentration above AA concentration (Yes/No)	Effluent Concentration above AA concentration after dilution (Yes/No)
34	Phenols (as Total C)	Phenols	8	8	0.0910	PRTR Electronic Toolset	N/A	No	No
35	Lead	Metals	1.2	1.3	3.0394	PRTR Electronic Toolset	N/A	Yes	No
36	Arsenic	Metals	25	20	0.567	PRTR Electronic Toolset	N/A	No	No
37	Copper	Metals	5 or 30 ²	5	3	PRTR Electronic Toolset	N/A	No	No
38	Zinc	Metals	8 or 50 or 100 ³	40	49.36	PRTR Electronic Toolset	N/A	No	No
39	Cadmium	Metals	0.08 or 0.09 or 0.15 or 0.25 ⁴	0.2	0.267	PRTR Electronic Toolset	N/A	Yes	No
40	Mercury	Metals	MAC of 0.07	MAC of 0.07	0.000	PRTR Electronic Toolset	N/A	No	No
41	Chromium VI	Metals	3.4	0.6	0.8	PRTR Electronic Toolset	N/A	No	No
42	Selenium	Metals	n/a	n/a	0.000	PRTR Electronic Toolset	N/A	N/A	N/A
43	Antimony	Metals	n/a	n/a	0.1545	PRTR Electronic Toolset	N/A	N/A	N/A
44	Molybdenum	Metals	n/a	n/a	0.000	PRTR Electronic Toolset	N/A	N/A	N/A
45	Tin	Metals	n/a	n/a	0.144	PRTR Electronic Toolset	N/A	N/A	N/A

No.	Compound	Group of compounds	AA-EQS Inland SW (µg/l)	AA-EQS Other SW (µg/l)	Estimated Conc. (µg/l) ¹	Data Source	Sample Date (if applicable)	Effluent Concentration above AA concentration (Yes/No)	Effluent Concentration above AA concentration after dilution (Yes/No)
46	Barium	Metals	n/a	n/a	13.24	PRTR Electronic Toolset	N/A	N/A	N/A
47	Boron	Metals	n/a	n/a	61	PRTR Electronic Toolset	N/A	N/A	N/A
48	Cobalt	Metals	n/a	n/a	0.175	PRTR Electronic Toolset	N/A	N/A	N/A
49	Vanadium	Metals	n/a	n/a	2.727	PRTR Electronic Toolset	N/A	N/A	N/A
50	Nickel	Metals	4	8.6	4.26	PRTR Electronic Toolset	N/A	Yes	No
51	Fluoride	General	500	1,500	235	PRTR Electronic Toolset	N/A	No	No
52	Chloride	General	n/a	n/a	54120	PRTR Electronic Toolset	N/A	N/A	N/A
53	TOC	General	n/a	n/a	9219	PRTR Electronic Toolset	N/A	N/A	N/A
54	Cyanide	General	10	10	2.93	PRTR Electronic Toolset	N/A	No	No
	Conductivity	General	n/a	n/a	-	PRTR Electronic Toolset	N/A	N/A	N/A
	Hardness (mg/l CaCO ₃)	General	n/a	n/a	202	PRTR Electronic Toolset	N/A	N/A	N/A
	pH	General	n/a	n/a	-	PRTR Electronic Toolset	N/A	N/A	N/A

Notes:

1. Where measured values are available these should be used instead of estimated values from PRTR tool.
2. In the case of Copper, the value 5 applies where the water hardness measured in mg/l CaCO₃ is less than or equal to 100; the value 30 applies where the water hardness exceeds 100 mg/l CaCO₃. Estimated CaCO₃ value > 100 where no sampling data available (based on PRTR tool)
3. In the case of Zinc, the standard shall be 8 µg/l for water hardness with annual average values less than or equal to 10 mg/l CaCO₃, 50 µg/l for water hardness greater than 10 mg/l CaCO₃ and less than or equal to 100 mg/l CaCO₃ and 100 µg/l elsewhere. Estimated CaCO₃ value > 100 where no sampling data available
4. For Cadmium and its compounds the EQS values vary dependent upon the hardness of the water as specified in five class categories (Class 1: <40 mg CaCO₃/l, Class 2: 40 to <50 mg CaCO₃/l, Class 3: 50 to <100 mg CaCO₃/l, Class 4: 100 to <200 mg CaCO₃/l and Class 5: >200 mg CaCO₃/l)



ATTACHMENT D.2.5:

SMALL STREAM RISK SCORE REPORT

APRIL 2018



National Certificate of Authorisation Programme

SSRS Report for A0524 Grenagh WWTP

Document Control Sheet

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Project Title:	National Certificate of Authorisation Programme		
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1 INTRODUCTION

The purpose of this report is to present the results from the biological risk assessment undertaken upstream and downstream of the primary discharge of Grenagh wastewater treatment plant (WWTP), Co. Cork. The risk assessment, the Small Streams Risk Score (SSRS), is a system for detecting potential sources of pollution in small streams.

2 METHODOLOGY

A site visit was carried out at Grenagh on 18th January 2018 by RPS Ecologists. A survey was carried out at approximately 10 times the channel width upstream and downstream of the discharge point. A suite of physiochemical parameters were measured at each location including temperature, conductivity and pH using a HachHQ30D Portable Multi Meter. Dissolved oxygen was recorded using a Hach DR900. Aquatic macroinvertebrates were collected using a standard pond net (mesh size 0.5 mm) and kick-sampling technique. Faunal composition was analysed by the standard SSRS methodology.

3 RESULTS

Grenagh WWTP discharges to the Martin River¹. Upstream of the discharge the SSRS was 7.2 indicating that the watercourse **May be at Risk (Indeterminate)** at this location while downstream of the discharge, the watercourse is also **Indeterminate** (SSRS 7.2).

The WWTP and primary discharge and storm water over flow discharge to the Martin River are at the same location and are located in a rural area of Grenagh, Co. Cork. Land drainage was noted on both stream banks. Pasture is the dominant landuse type surrounding both the upstream and downstream sites. There is a large industrial unit on the opposite bank of the stream to the WWTP (left bank of the river facing downstream). A large pipe was noted on this same bank as the industrial unit, which may be coming from the unit (**Figure 4.3**). No discharge was seen from the pipe at the time of the survey. The location of the primary discharge and storm overflow could not be located due to dense overgrowth however their position was assumed using the location noted on the EPA's Waste Water Discharge Certificate of Authorisation Application Form.

No sewage fungus, bad odour or filamentous algae was found.

4 CONCLUSIONS AND RECOMMENDATIONS

It was noted that there was no change in the SSRS upstream and downstream of the discharge point. Therefore it can be concluded that there is no apparent impact to the macroinvertebrate community due to the discharge.

¹ Water Water Discharge Certificate of Authorisation Application Form

Table 4.1: SSRS results upstream location

River:	Manin	River Segment Code:	19_193	Date:	18/01/2018
WWTP Code:	A0524	Agglomeration name:	Grenagh	Location:	Upstream
SSRS Score:	7.2	Stream Assessment:	Indeterminate		
DO (%):	-	Bedrock:		Stream Flow:	Fast
DO (mg/l):	4.5	Boulder (>128mm):		Clarity:	Clear
Temp (°C):	7.2	Cobble (32-128mm):	20	Colour:	None
Conductivity (µS/cm):	756	Gravel (8-32mm):	40	Discharge	Normal
pH:	7.64	Fine Gravel (2-8mm):	20	Slope:	Low
Bank width (cm):	1200	Sand (0.25-2mm):	10	Sewage Fungus:	None
Wet width (cm):	800	Silt (<0.25mm):	10	Filamentous Algae:	None
Avg depth (cm):	50	Main land use US:	Pasture, Urban	Shading:	Low
Depth mud (cm):	0	Cattle Access US/DS:	None		
Comments:	Multiple land drains				
Invertebrate Groups			Number of specimens	Relative Abundance	
Group 1: Ephemeroptera			1-5	1	
Group 2: Plecoptera			6-20	2	
Group 3: Trichoptera			21-50	3	
Group 4: G.O.L.D (Gastropoda, Oligochaeta and Diptera)			51-100	4	
Group 5: Asellus			>100	5	
Ephemeroptera	Ab	Plecoptera	Ab	Trichoptera	Ab
Ecdyonurus:		Leuctra:		Hydropsyche:	1(5)
Rhitrogena:	1(5)	Isoperla:	1(3)	Polycentropus:	1(2)
Heptagenia:	1(3)	Protonemura:		Rhyacophila:	
Ephemerella:		Amphinemura:		Philopotamus:	
Caenis:		Perla:		Limnephilidae:	
Paraleptophlebia:		Dinocras:		Sericostomatidae:	1(5)
Emphemera danica:		Other Plecoptera:		Glossosomatidae:	
Other Ephemeroptera:				Leptostomatidae:	
				Other Trichoptera:	
Total No. of Taxa:	2	Total No. of Taxa:	1	Total No. of Taxa:	2
Total Relative Abundance:	2	Total Relative Abundance:	1	Total Relative Abundance:	3
GOLD (Gastropoda; Oligochaeta and Diptera)					
Lymnaea:		Lumbriculus:	1(2)	Simulium:	2(6)
Potamopyrgus:		Eiseniella:		Dicronata:	
Planorbis:		Tubificidae:		Tipula:	
Ancylus:		Chironomidae:		Ceratopogonidae:	
Physa:		Chironomus:		Other GOLD:	
Total No. of Taxa:	2				
Total Relative Abundance:	3				
Asellus					
Absent:	0	Few (1-20):		Common (>20):	
SSRS Calculation					
Group 1	4				
Group 2	4				
Group 3	4			Total Index Score	18
Group 4	2			Average Index Score	3.6
Group 5	4			SSRS	7.2

Table 4.2: SSRS results downstream location

River:	Manin	River Segment Code:	19_193	Date:	18/01/2018
WWTP Code:	A0524	Agglomeration name:	Grenagh	Location:	Downstream
SSRS Score:	7.2	Stream Assessment:	Indeterminate		
DO (%):	-	Bedrock:		Stream Flow:	Fast
DO (mg/l):	4.3	Boulder (>128mm):		Clarity:	Clear
Temp (°C):	7.6	Cobble (32-128mm):	40	Colour:	None
Conductivity (µS/cm):	724	Gravel (8-32mm):	20	Discharge	Normal
pH:	7.59	Fine Gravel (2-8mm):	20	Slope:	Low
Bank width (cm):	1200	Sand (0.25-2mm):	20	Sewage Fungus:	None
Wet width (cm):	800	Silt (<0.25mm):		Filamentous Algae:	None
Avg depth (cm):	60	Main land use US:	Pasture, Urban	Shading:	Low
Depth mud (cm):	0	Cattle Access US/DS:	None		
Comments:	Riffle area , pipe coming from opposite bank				
Invertebrate Groups			Number of specimens	Relative Abundance	
Group 1: Ephemeroptera			1-5	1	
Group 2: Plecoptera			6-20	2	
Group 3: Trichoptera			21-50	3	
Group 4: G.O.L.D (Gastropoda, Oligochaeta and Diptera)			51-100	4	
Group 5: Asellus			>100	5	
Ephemeroptera	Ab	Plecoptera	Ab	Trichoptera	Ab
Ecdyonurus:		Leuctra:		Hydropsyche:	
Rhitrogena:	2(6)	Isoperla:	1(3)	Polycentropus:	1(3)
Heptagenia:		Protonemura:		Rhyacophila:	
Ephemerella:		Amphinemura:		Philopotamus:	
Caenis:		Perla:		Limnephilidae:	1(4)
Paraleptophlebia:		Dinocras:		Sericostomatidae:	1(5)
Emphemera danica:		Other Plecoptera:		Glossosomatidae:	
Other Ephemeroptera:				Leptostomatidae:	
				Other Trichoptera:	
Total No. of Taxa:	1	Total No. of Taxa:	1	Total No. of Taxa:	2
Total Relative Abundance:	2	Total Relative Abundance:	1	Total Relative Abundance:	3
GOLD (Gastropoda; Oligochaeta and Diptera)					
Lymnaea:		Lumbriculus:		Simulium:	1(2)
Potamopyrgus:		Eiseniella:		Dicronata:	
Planorbis:		Tubificidae:		Tipula:	
Ancylus:		Chironomidae:		Ceratopogonidae:	
Physa:		Chironomus:		Other GOLD:	
Total No. of Taxa:	2				
Total Relative Abundance:	3				
Asellus					
Absent:	0	Few (1-20):		Common (>20):	
SSRS Calculation					
Group 1	4				
Group 2	4				
Group 3	4			Total Index Score	18
Group 4	2			Average Index Score	3.6
Group 5	4			SSRS	7.2



Figure 4.1: Upstream of primary discharge Grenagh WWTP



Figure 4.2: Downstream of primary discharge Grenagh WWTP



Figure 4.3 Pipe from industrial unit



ATTACHMENT D.2.6:

HYDROLOGICAL ESTIMATION REPORT

JULY 2022

Irish Water

Low Flows Hydrological Estimation

River Martin at Grenagh

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1 INTRODUCTION

River flow estimates are required by Irish Water for the purposes of assimilative capacity calculations for treated wastewater discharges from Grenagh Wastewater Treatment Plant (WWTP) discharging to the River Martin at Grenagh. The most important flow conditions are currently the Q_{95} low flow condition and Q_{30} average flow condition and the following note sets out the calculation process followed for this site.

2 SITE LOCATION AND LOCAL RIVER FLOW GAUGES

Grenagh WWTP discharges treated wastewater to the River Martin at Grenagh, at Ordnance Survey Ireland National Grid Reference 158833 084980. The River Martin catchment area at the discharge point is 16.5km². There are no continuous river flow gauges located on the River Martin in the immediate vicinity of the discharge point, however the River Martin is gauged at Kilmona, 3.7km downstream. The key flow estimate and flow measurement locations and river catchment areas are shown in Figure 1.

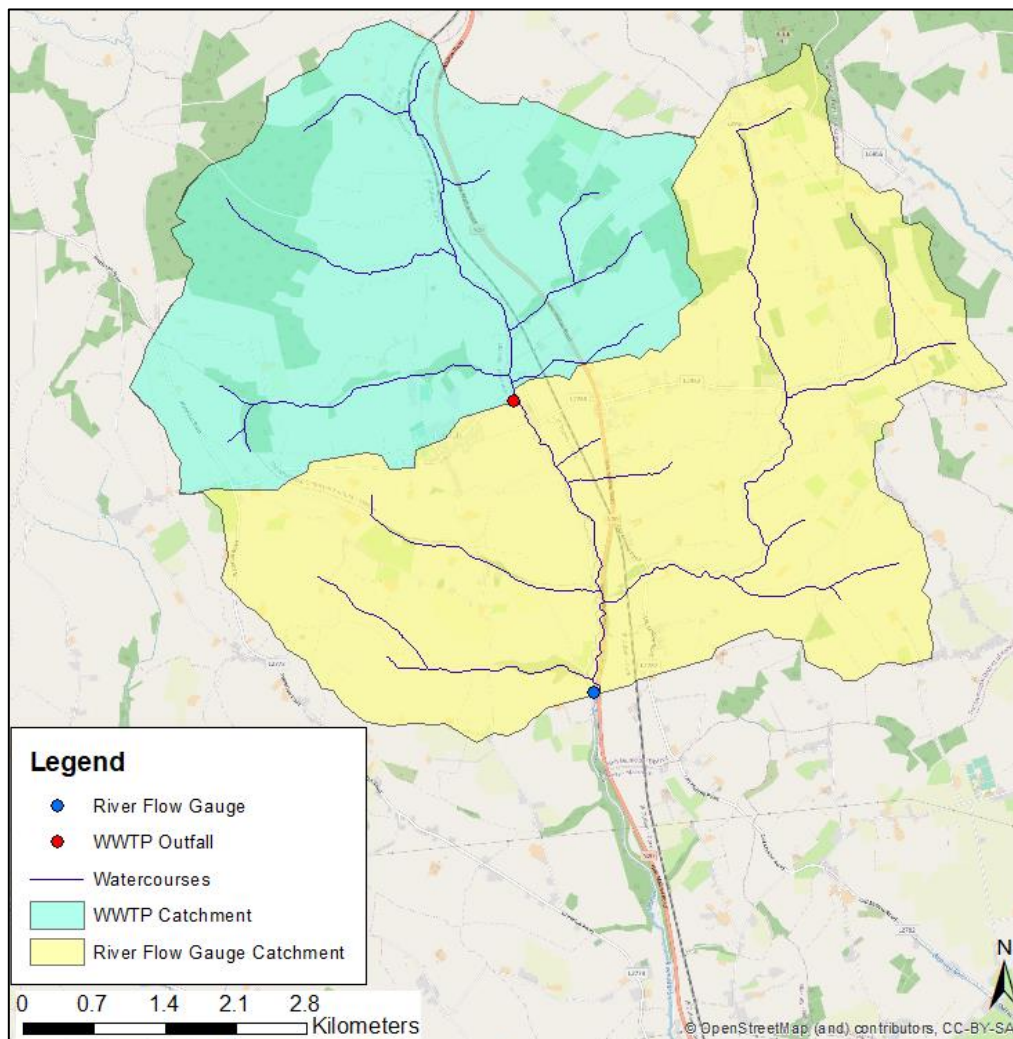


Figure 1: Glaslough WWTP Outfall, River Flow Measuring Location and Contributing Catchment Areas

3 RIVER FLOW GAUGE DATA

3.1 Continuous River Flow Gauge Record at Kilmona

Details of the gauged flow data at Kilmona are provided in Table 1 and the timeseries is shown in Figure 2. The annual flow data and flow percentiles at the Kilmona gauge are set out in Appendix A.

Table 1: Kilmona Bridge Gauging Station Details

Station Number	19044
Station Name	Kilmona
Waterbody	River Martin
Site Owner	Office of Public Works
Grid Reference	159617 082047
River Basin District	South Western
Catchment Area (km²)	41.2
Data Start Date	13/10/1992
Data End Date	26.07.2011
Daily Data Percent Complete	71.4

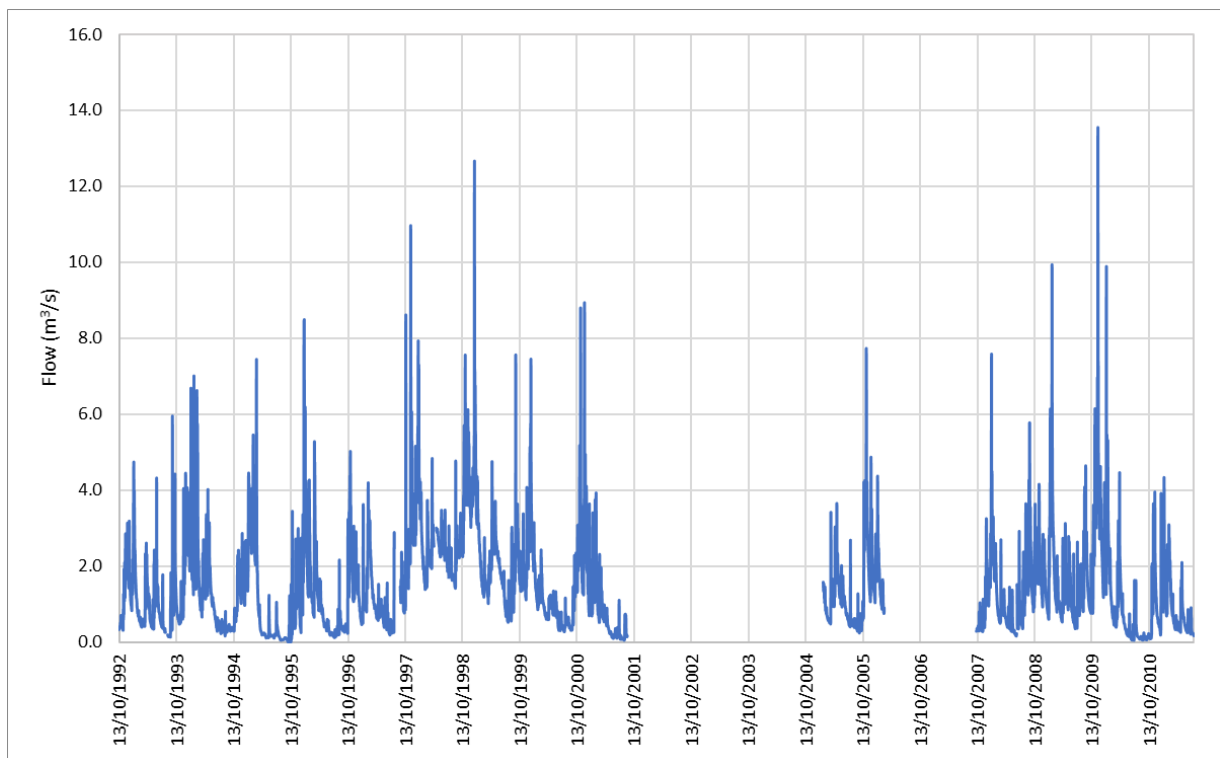


Figure 2: River Flow Timeseries for the River Martin at Kilmona (Daily Mean Flows from 1992 to 2011)

The gauge data have been reviewed for quality, non-stationarity and impact of missing data. This shows that there are no problems with flow measurement quality indicated by the flags provided with the river flow data. The principal gaps in the data, from 2001 to 2004 and 2005 to 2007, remove the entire range of measured flows and should therefore not skew the calculated flow statistics. The missing data does

reduce the number of complete and near complete hydrological years represented within the record from 19 to 12, however this is sufficient to allow a robust estimate of Q_{95} and there is no evidence of non-stationarity in the record. There are no major anthropogenic influences on river flow with no significant abstraction pressures or impounded river sections in the River Martin catchment. There are also no WWTP discharging to the River Martin upstream of Kilmona which serve more than 500 population equivalent.

On the basis of these checks, the daily mean flow data from the entire gauge record have been used to produce the flow duration curve and key flow percentiles shown in Figure 3.

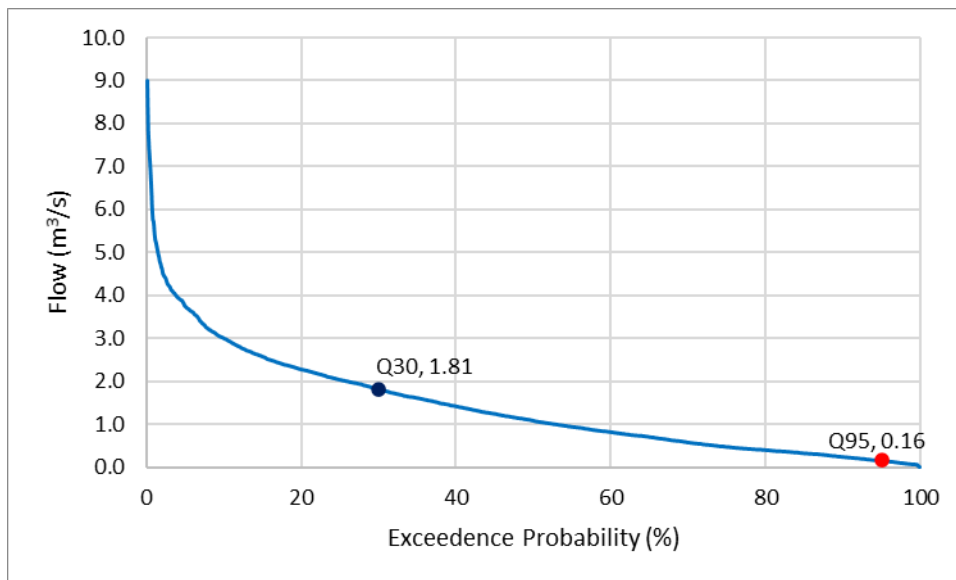


Figure 3: Flow Duration Curve and Key Flow Percentiles for the River Martin at Kilmona (daily mean flows from 1992 to 2011)

4 RIVER FLOW ESTIMATE METHODOLOGY

There are no continuous river flow gauges on the River Martin close to Grenagh WWTP discharge point. However, the River Martin catchment at the Kilmona gauge may be suitable as a donor catchment if there is no significant change in catchment hydrology between the discharge point and the gauge. A review of catchment descriptors at both locations has been carried out in Table 2 below.

Table 2: Catchment Descriptors for Subject Site and River Flow Gauges

Catchment Descriptor	Grenagh WWTP Discharge Point	Kilmona River Flow Gauge
Catchment Area (km ²)	16.5	41.2
FARL	1.000	1.000
SAAR	1230	1208
Evapotranspiration	512.1	512.7
Poorlydrained	2.18	1.73
Peat	0.19	0.08
Conduit Karst	0.0	0.0

The catchment descriptors in Table 2 show less than 2% difference in SAAR and no significant difference in evapotranspiration. There is no difference in FARL and neither catchment is underlain by conduit Karst geology. Only very small proportions of either catchment are underlain by poorly draining or peat soils. There is therefore not considered to be significant change in catchment hydrology between the Kilmona gauge and the WWTP discharge point and flow statistics calculated at the gauge will be applied at the Grenagh WWTP outfall with simple scaling for catchment area. On this basis, the Q₉₅ flow at Grenagh WWTP outfall would be 0.06m³/s and the Q₃₀ flow would be 0.72m³/s.

5 FINAL RIVER FLOW ESTIMATES

The above analysis has provided a Q_{95} flow estimate of $0.06\text{m}^3/\text{s}$ and a Q_{30} flow estimate $0.72\text{m}^3/\text{s}$ for the River Martin at Grenagh WWTP discharge point. The river flow gauge used to obtain this flow estimate is not located immediately downstream of the discharge point and therefore the flow estimates do not need to be corrected to account for the contribution of the discharge to river flows. The calculated flow percentiles can be used in wastewater assimilative capacity calculations to inform discharge permit applications.

6 APPENDIX A – Annual River Flow Statistics for River Martin at Kilmona

Year	% missing	Flow (m ³ /s)												
		Max	Min	Q ₅	Q ₁₀	Q ₂₀	Q ₃₀	Q ₄₀	Q ₅₀	Q ₆₀	Q ₇₀	Q ₈₀	Q ₉₀	Q ₉₅
1992	8	5.96	0.15	2.49	2.02	1.62	1.28	1.00	0.78	0.56	0.46	0.41	0.29	
1993	0	7.00	0.18	3.60	3.00	2.27	1.82	1.43	1.07	0.80	0.58	0.44	0.32	0.29
1994	0	7.42	0.01	3.41	2.85	2.10	1.36	0.83	0.37	0.24	0.19	0.14	0.10	0.07
1995	0	8.50	0.01	3.42	2.54	1.74	1.19	0.90	0.63	0.44	0.37	0.27	0.21	0.16
1996	10	5.03	0.20	2.91	2.44	1.74	1.41	1.14	0.90	0.70	0.54	0.37	0.20	
1997	4	10.9	0.78	4.76	3.89	3.04	2.78	2.56	2.39	2.20	2.03	1.77	1.47	0.85
1998	0	12.6	0.54	4.99	4.36	3.66	3.05	2.58	2.28	1.93	1.62	1.36	1.01	0.81
1999	0.5	7.46	0.29	3.12	2.39	1.91	1.49	1.20	1.04	0.83	0.69	0.50	0.39	0.36
2000	8	8.94	0.06	3.19	2.56	1.91	1.35	0.99	0.73	0.41	0.22	0.15	0.08	
2001	100													
2002	100													
2003	100													
2004	33	3.66	0.25	1.80	1.57	1.21	0.93	0.63	0.52	0.41				
2005	60	7.64	0.31	3.14	2.46	1.70	1.17	0.33						
2006	100													
2007	2	7.56	0.17	3.04	2.46	1.82	1.39	1.06	0.82	0.60	0.47	0.37	0.31	0.25
2008	0	9.90	0.36	3.63	2.83	2.27	1.83	1.60	1.36	1.11	0.99	0.87	0.69	0.57
2009	0	13.6	0.06	4.18	3.59	2.43	1.68	1.07	0.76	0.46	0.26	0.15	0.09	0.07
2010	18	4.31	0.10	2.16	1.82	1.15	0.79	0.61	0.41	0.33	0.25	0.11		