# Limerick WWTP Upgrade and Regional Bioresource Centre

## EIAR Chapter 16 - Water Environment

*June 2026*


Formerly JB Barry Partners who became part of Egis in 2023

# Table of Contents

# List of Figures



# List of Tables

# Glossary and Defined Terms

| Acronym | Description |
|---|---|
| **AA** | Appropriate Assessment |
| **AASR** | Appropriate Assessment Screening Report |
| **ACP** | An Coimisiún Pleanála |
| **AD** | Anaerobic Digestion |
| **AGS** | Aerobic Granular Sludge |
| **AER** | Annual Environmental Report |
| **BOD** | Biochemical Oxygen Demand |
| **BC** | Bioresource Centre |
| **C** | Carbon |
| **CAFÉ** | Clean Air for Europe Directive |
| **CHP** | Combined Heat and Power |
| **DIN** | Dissolved Inorganic Nitrogen |
| **ECJ** | European Court of Justice |
| **EIAR** | Environmental Impact Assessment Report |
| **ELV** | Emission Limit Value |
| **EPA** | Environmental Protection Agency |
| **ESB** | Electrical Supply Board |
| **EU** | European Union |
| **FOG** | Fats Oils and Grease |
| **FST** | Final Settling Tank |
| **GHG** | Greenhouse Gas |
| **HGV** | Heavy Goods Vehicle |
| **MLPS** | Main Lift Pumping Station |
| **MCA** | Multi-Criteria Analysis |
| **MRP** | Molybdate Reactive Phosphate |
| **IDA** | Industrial Development Agency |
| **IFAS** | Integrated Fixed-Film Activated Sludge |
| **N** | Nitrogen |
| **NDP** | National Development Plan |
| **NHA** | National Heritage Area |
| **NIS** | Natura Impact Statement |
| **NPF** | National Planning Framework |
| **NSO** | National Strategic Outcomes |
| **NSS** | National Spatial Strategy |
| **NWSMP** | National Wastewater Sludge Management Plan |
| **P** | Phosphorous |
| **PE** | Population Equivalent - The amount of wastewater received at a treatment plant (and its design capacity) is measured in units known as population equivalent (or PE). The wastewater received from all sources, e.g. industrial, tourism, commercial, residential, etc., is converted into these units, with one unit of PE representing the wastewater treatment load typically generated by a single person. |
| **PFF** | Pass Forward Flow |
| **PFT** | Picket Fence Thickener |
| **pNHA** | Proposed National Heritage Area |

| Acronym | Description |
|---|---|
| **SEA** | Strategic Environmental Assessment |
| **SBR** | Sequencing Batch Reactor |
| **SHC** | Sludge Hub Centre |
| **SIA** | Stable Isotope Analysis |
| **SID** | Strategic Infrastructure Development |
| **Sludge** | Solid by-products of wastewater |
| **SPA** | Special Protection Area |
| **SS** | Suspended Solids |
| **UWWTD** | Urban Wastewater Treatment Directive |
| **WFD** | Water Framework Directive |
| **WWDA** | Wastewater Discharge Authorisation |
| **WWTP** | Wastewater Treatment Plant |
| **WSPS** | Water Services Policy Statement |
| **ZTV** | Zone of Theoretical Visibility |
| **PS** | Pumping Station |
| **QI** | Qualifying Interest |
| **RAS** | Return Activated Sludge |
| **RBC** | Regional Bioresource Centre |
| **RSES** | Regional Spatial and Economic Strategy |
| **SAC** | Special Area of Conservation |
| **TDS** | Total Dry Solids |
| **THP** | Thermal Hydrolysis Process |

# Departments and Stakeholders

| Acronym (where applicable) | Departments & Stakeholders |
|---|---|
| **ACP** | An Coimisiún Pleanála |
| **DPER** | Department of Public Expenditure and Reform |
| **CACNaT** | Department of Climate Action, Communication Networks and Transport |
| **DCCAE** | Department of Communications, Climate Action and Environment – Changed in 2020 |
| **DCHG** | Department of Culture, Heritage and the Gaeltacht – Changed in 2020 |
| **DoF** | Department of Finance |
| **DHPLG** | Department of Housing, Planning and Local Government – Changed in 2020 |
| **HLGaH** | Department of Housing, Local Government and Heritage |
| **EPA** | Environmental Protection Agency |
| **GSI** | Geological Survey Ireland |
| **GWS** | Group Water Schemes |
| **IFI** | Inland Fisheries Ireland |
| **IR** | Irish Rail (Iarnród Éireann) |
| **UÉ** | Uisce Éireann |
| **LCCC** | Limerick City & County Council |
| **LA** | Local Authority |
| **NMS** | National Monuments Service |
| **NPWS** | National Parks & Wildlife Service |
| **NRA** | National Roads Authority |
| **NTA** | National Transport Authority |
| **OPW** | Office of Public Works |
| **OSi** | Ordnance Survey Ireland |
| **SRA** | Southern Regional Assembly |

# 16 WATER ENVIRONMENT

## 16.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) assesses the impact of the Limerick WWTP Upgrade and RBC (hereafter referred to as the Proposed Development) on the surface water environment during both the Construction and Operational Phases. The following attributes of each surface waterbody (receptor) are considered: hydrology, hydro-morphology and water quality. Hydrogeology is dealt with specifically in Chapter 14 (Land & Soils) of this EIAR, and ecological impacts are further assessed in Biodiversity Chapters 12 (Marine) & 13 (Terrestrial) of this EIAR.

The potential surface water impacts associated with the construction of the Proposed Development have been identified in Section 16.6.2. This includes potential impacts from construction runoff and watercourse disturbance due to site clearance, earthworks, construction of the proposed structures and associated drainage infrastructure. For further detail of the works associated with the Construction Phase of the Proposed Development, refer to Chapter 4 (Construction Strategy) of this EIAR.

During the Operational Phase, the potential surface water impacts associated with changes in surface water runoff, increased hardstanding and the upgraded treatment regime have been assessed in Section 16.6.3.

An assessment of the Proposed Development's compliance with the Water Framework Directive (WFD) (Directive 2000/60/EC) requirements is provided in Volume 4 - Appendix 16.1 of this EIAR. A summary of the WFD Assessment is presented in Section 16.3. 5. In addition, where relevant to the assessment of potential effects on European Sites, the water quality impact assessment has also informed the assessment of the Proposed Development's compliance with the requirements and conservation objectives established under the Habitats Directive (Directive 92/43/EEC).

Flooding has been assessed within a scheme-specific Flood Risk Assessment report (Volume 4 - Appendix 16.2 of this EIAR). The findings of this assessment are summarised in Section 16.3.7.

The objectives of the Proposed Development are to increase wastewater treatment capacity and stormwater storage capacity for the Limerick Agglomeration, as well as developing a Regional Bioresource Centre for the southwest. A full description of the Proposed Development is available in Chapter 3 of this EIAR, and characteristics in relation to the Water Impact Assessment are summarised in Section 16.6.

The design of the Proposed Development has evolved through comprehensive design iteration, with particular emphasis on minimising the potential for environmental impacts, where practicable, whilst ensuring the objectives of the Proposed Development are attained. In addition, feedback received from the comprehensive non-statutory consultation programme undertaken throughout the option selection and design development process have been incorporated, where appropriate.

## 16.2 Methodology

### 16.2.1 Hydrodynamic and Water Quality (WQ) Model

This assessment was required to assess whether the proposed upgrade of Limerick WWTP would result in exceedance of the Environmental Quality Standards (EQS), as defined in the Surface Waters Regulations 2009, in the receiving Upper Shannon Estuary.

MIKE 3 model software package was used for the numerical model study. MIKE is developed by Danish Hydraulic Institute (DHI) and is a widely and worldwide applied model software package. It was designed for simulating hydrodynamics, waves, sediment dynamics and water quality in coastal, estuarine, and riverine environments.

To provide input for the construction, calibration and validation of the numerical model, a survey campaign over a 35-day period from the end of September 2021 to the beginning of November 2021 was carried out. During these surveys, data describing the bathymetry, meteorology, river discharges, water levels, current

velocity timeseries at several fixed locations, currents velocity over cross-sectional profiles, current patterns by means of drogue tracking, water temperature, salinity, water quality, and dispersion by means of dye tracing was collected.

A Survey Interpretive Report was completed by Haskoning and provided analysis of the survey data including, identification of any unusual data and identification of specific weather events that may affect the study. The survey data was analysed, in combination with relevant data from other sources and used to verify the model, which provides the complete understanding of hydrodynamics and dispersion in the waterbody.

The calibrated and validated model, as documented in the Haskoning Calibration and validation and Stage 4 Modelling Reports, was applied to assess existing baseline conditions and impacts of the future upgraded WWTP on receiving water quality. A total of 11 no. scenarios were simulated to include seasonal variations, cumulative impacts with other WWTP upgrades and retention or improvement of WWTP discharge quality. Outcomes of the model simulations can be seen in sections 16.6.3.1 and 16.6.3.2 .

#### 16.2.1.1 Environmental Quality Standard (EQS)

Water quality was assessed in terms of WFD EQS values, as defined in the Surface Water (Amendment) Regulations 2019 (S.I. No. 77 of 2019). The WFD Environmental Quality Standards for a transitional waterbody, such as Limerick Dock, Upper Shannon Estuary and Maigue Estuary, are listed in Table 16-1 for BOD and MRP.

DIN is a non-regulatory target standard for the WFD transitional waterbodies. For coastal water bodies, the threshold DIN concentration is determined by interpolation based on median salinity. The median salinity around Limerick WWTP is below 1 psu, so the concentration of 2.6 mg/l required for obtaining a 'Good' indicative water quality status was considered as the reference for analysing water quality at this location.

For DIN and MRP, the status is based on the median concentration. For BOD, the status is based on the concentration below which 95% of the data were found (or in other words, the concentration that is exceeded by 5% of the dataset).

**TABLE 16-1: ENVIRONMENTAL QUALITY STANDARDS FOR TRANSITIONAL AND COSTAL WATERBODY EQS (SURFACE WATER (AMENDMENT) REGULATIONS 2019)**

| EQS | Transitional Waterbody | | Coastal Waterbody | |
|---|---|---|---|---|
| | 'Good' status | 'High' status | 'Good' status | 'High' status |
| BOD | <= 4.0 mg/l (95%ile) | <= 3.0 mg/l (95%ile) | N/A | N/A |
| DIN | N/A | N/A | (0 psu) <= 2.6 mg/l (median)<br>(34.5 psu) <= 0.17 mg/l (median) | (0 psu) <= 1.0 mg/l (median)<br>(34.5 psu) <= 0.25 mg/l (median) |
| MRP | (0-17 psu) <= 0.060 mg/l (median)<br>(>17-35 psu) <= 0.060-0.040 mg/l (median) | (0-17 psu) <= 0.030 mg/l (median)<br>(>17-35 psu) <= 0.030-0.025 mg/l (median) | N/A | N/A |

#### 16.2.1.2 Cumulative WWTP Discharges

In addition to Limerick WWTP, discharges from Castletroy and Shannon Town WWTPs were incorporated into the model development. The baseline scenario represents existing discharges from Limerick, Castletroy and Shannon Town WWTPs under current operating conditions.

For the future scenario (06 Scenario), discharges from Limerick (Bunlicky) WWTP represent the upgraded plant at the 25-year design horizon, with flows based on design dry weather flow (DWF) multiplied by a Peaking

Factor of 1.5, as agreed with Uisce Éireann. DIN has been applied as a point source input at Bunlicky, reflecting the estuarine environment.

The Castletroy and Shannon Town WWTP discharges have been represented as point source inputs using future Average Daily Flow (ADF) × 1.5 and assumed future effluent concentrations (mg/l), in line with the Model Scoping Study. This approach provides a conservative assessment of potential impacts.

#### 16.2.1.3 Model Scenarios

The calibrated and validated model was applied to assess impacts of the upgraded WWTP on receiving water quality under a number of simulated conditions, i.e. modelling scenarios. There were 11 scenarios in total that depicted seasonal variations, cumulative impacts with other WWTP upgrades and retention or improvement of WWTP discharge quality. Further information on scenario results specific to this impact assessment is available in Section 16.6.3 Potential Impacts/ Operational Phase.

For Limerick (Bunlicky) WWTP, reductions in BOD and MRP concentrations reflect improved treatment performance following the upgrade. There is no specified ELV for DIN, and it is not subject to a regulatory EQS in transitional waters; therefore, a representative DIN concentration has been applied to enable evaluation of potential nutrient impacts in the receiving environment.

For Castletroy WWTP, BOD and DIN concentrations are based on existing conditions, with MRP Informed by Uisce Éireann effluent monitoring data. Shannon Town WWTP is represented using existing effluent concentrations.

Where required, available parameters such as total phosphorus and ammonia have been adapted to derive representative MRP and DIN concentrations, ensuring consistency across model inputs.

The salinity of the effluent from the WWTPs is set to 0 PSU. The WWTP effluent temperature was assumed to be 10 °C in winter and 20 °C in summer.

The model input parameters for the future scenario are summarised in Table 16-2.

**TABLE 16-2 MODELED EFFLUENT CONCENTRATION USED IN MODEL 06 FUTURE SCENARIO**

| WWTP | Assumed modelled effluent Concentrations | | | Discharge Rates |
|---|---|---|---|---|
| | BOD (mg/l) | MRP (mg/l) | DIN (mg/l) | DWF * 1.5 [$m^3$/day] |
| Limerick WWTP | 25[1] | 6.5[2] | 30 | 101,560 |
| Castletroy WWTP | 25 | 1[3] | 7 | 15,866 |
| Shannon Town WWTP | 25 | 6.5[4] | 50 | 9,648[5] |

[1] *In Development Status Code 6 BOD is reduced from 25 to 20 mg/l.*

[2] *In Development Status Code 6 MRP is reduced from 6.5 to 1 mg/l.*

[3] *No MRP ELV defined, therefore the same concentration as for Limerick WWTP is applied. This assumes no phosphorus removal in the process.*

[4] *In Development Status Code 4 and 5 MRP concentration is reduced to 0.5 mg/l.*

[5] *The design PE of the Shannon Town WWTP is 28,000, while the current AER reports a peak week load of 15,183 PE. To be conservative, the design capacity is applied for both the existing and future scenario.*

Modelling scenarios were identified as a series of codes as defined below and summarised in Table 16-3.

**A:** Existing situation: baseline with current discharges and ELV concentrations;
**C:** Upgraded treatment with existing outfall: increased PE with current and ELVs concentrations as stated below.
**s:** summer
**w:** winter
**01:** Existing situation with a 130,000 PE and current ELV concentrations.

**02:** Upgrade of Limerick WWTP to 285,000 PE and current ELV concentrations;
**03:** Upgrade of Limerick WWTP to 325,000 PE and current ELV concentrations;
**04:** Combined upgrade of Limerick WWTP to 285,000 PE, Shannon Town WWTP to 28,000 PE and Castletroy WWTP to 81,000 PE within 25-year growth and current ELV concentrations
**05:** Combined upgrade of Limerick WWTP to 325,000 PE, Shannon Town WWTP to 28,000 PE Castletroy WWTP to 81,000 PE within 25-year growth and current ELV concentrations.
**06:** Combined upgrade of Limerick WWTP to 325,000 PE, Shannon Town WWTP to 28,000 PE Castletroy WWTP to 81,000 PE within 25-year growth and lowered ELV concentrations for BOD and MRP.

**TABLE 16-3: MODELLING SCENARIOS**

| Nr | Code | Above Ground Scheme Code | Development Status Code | | | | | | Season |
|---|---|---|---|---|---|---|---|---|---|
| | | | 01 | 02 | 03 | 04 | 05 | 06 | |
| 1 | A01s | Existing situation (A) | ✓ | | | | | | Summer (s) |
| 2 | A01w | Existing situation (A) | ✓ | | | | | | Winter (w) |
| 3 | C02s | Upgraded treatment with existing outfall (C) | | ✓ | | | | | Summer (s) |
| 4 | C02w | Upgraded treatment with existing outfall (C) | | ✓ | | | | | Winter (w) |
| 5 | C03s | Upgraded treatment with existing outfall (C) | | | ✓ | | | | Summer (s) |
| 6 | C03w | Upgraded treatment with existing outfall (C) | | | ✓ | | | | Winter (w) |
| 7 | C04s | Upgraded treatment with existing outfall (C) | | | | ✓ | | | Summer (s) |
| 8 | C04w | Upgraded treatment with existing outfall (C) | | | | ✓ | | | Winter (w) |
| 9 | C05s | Upgraded treatment with existing outfall (C) | | | | | ✓ | | Summer (s) |
| 10 | C05w | Upgraded treatment with existing outfall (C) | | | | | ✓ | | Winter (w) |
| 11 | C06s | Upgraded treatment with existing outfall (C) | | | | | | ✓ | Summer (s) |

#### 16.2.1.4 Mixing Zone Assessment

The mixing zone describes the allowable area within which contaminants discharged to a receiving water may exceed Environmental Quality Standards (EQS) while undergoing initial dilution.

In transitional (estuarine) waters, the behaviour of the discharge plume is influenced by both river flow and tidal processes. As a result, the plume may extend both downstream and upstream of the discharge location depending on ebb and flood conditions, and the position and extent of the mixing zone may vary dynamically over the tidal cycle.

The assessment of the mixing zone also considers the sensitivity of the receiving environment, including designated sites such as the Shannon Estuary SAC/SPA, as well as the location of WFD monitoring points and other relevant receptors within the waterbody.

### 16.2.2 Drainage Area Plan (DAP) Model

Uisce Éireann (under a separate project) developed a Stage 4 Drainage Area Plan (DAP) and Hydraulic Model, refer to Appendix 16.3 and Appendix 16.4 in Volume 4 of this EIAR, for the Limerick Main Drainage Network. The verified model forecasts flow rates from the Limerick Main Drainage Network to the WWTP Pumping Stations for the 'Future Strategic' (20+ years) design horizon and simulates a range of scenarios, including seasonal variation, network upgrades and varying infiltration rates.

Incoming flow rates predicted by the DAP model were utilised in the WWTP upgrade design and in the design of the proposed stormwater storage upgrade at Corcanree PS.

### 16.2.3 Flood Risk Assessment

The methodology used for the Flood Risk Assessment is based on 'The Planning System and Flood Risk Management, Guidelines for Planning Authorities' (2009). Under the sequential approach identified in the FRM Guidelines a three-step approach is required to confirm the appropriateness of the development in terms of flood risk. The sequential approach in flood risk management requires the following three steps to identify the necessity for the justification test for a development:

Step 1: Identification of the Flood Zone at the proposed development site;

- Using the Flood Zone criteria from the FRM Guidelines, the flood zones for each of the sites were determined.

Step 2: Identification of the vulnerability of the type of the Proposed Development (Table 3.1 of the FRM Guidelines);

- The different types of proposed infrastructure are then assigned a vulnerability classification according to the definitions in 'Table 3.1 – Classification of vulnerability of different types of development' of the FRM Guidelines. The Proposed Development consists of 'primary infrastructure'. This is classified as 'highly vulnerable development'.

Step 3: Using the matrix of vulnerability versus Flood Zone (Table 3.2 of the FRM Guidelines), identify the necessity for the justification test for the Proposed Development;

- If the Proposed Development is located in Flood Zone A, for example, it is categorised as a Highly Vulnerable Development. Table 3.2 of the FRM guidelines – Sequential approach mechanism in the planning process (FRM guidelines) stipulate that a justification test is required for such a development.

### 16.2.4 Relevant Legislation, Policy, and Guidelines

#### 16.2.4.1 Guidance

The following documents detailed in Table 16-4 have been consulted during the preparation of this Chapter.

**TABLE 16-4: LEGISLATION, STANDARDS AND GUIDELINES**

| Reference Material | Legislation, Standards and Guidelines |
|---|---|
| **Legislation** | Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for the Community action in the field of Water Policy (as amended) (hereafter referred to as the "WFD");<br>Directive 2011/92/EU of the European Parliament and the Council of 13 December 2011 on the Assessment of the Impacts of Certain Public and Private Projects on the Environment (hereafter referred to as the Environmental Impact Assessment (EIA) Directive);<br>Urban Waste Water Treatment Directive (91/271/EEC) / storm overflow procedures:<br>Directive 2007/60/EC the assessment and management of flood risks; |

| | |
|---|---|
| | S.I. No. 722/2003 – European Communities (Water Policy) Regulations 2003, as amended;<br>S.I. No. 272/2009 - European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended;<br>S.I. No. 9/2010 - European Communities Environmental Objectives (Groundwater) Regulations 2010, as amended;<br>S.I. No. 254/2001 - Urban Waste Water Treatment Regulations, 2001;<br>S.I. No. 684/2007 - Waste Water Discharge (Authorisation) Regulations 2007;<br>S.I. No. 94/1997 - European Communities (Natural Habitats) Regulations, 1997;<br>S.I. No. 477/2011 - European Communities (Birds and Natural Habitats) Regulations 2011; and<br>S.I. No. 122/2010 - European Communities (Assessment and Management of Flood Risks) Regulations 2010. |
| **Standards** | IW-TEC-800-03 Stormwater Overflows<br>IW-TEC-700-99-02 Inlet Works & Stormwater Treatment |
| **Guidelines** | The Planning System and Flood Risk Management Guidelines for Planning Authorities (Department of the Environment, Heritage and Local Government (DEHLG)) * and the Office of Public Works (OPW);<br>Guidelines on protection of fisheries during construction works in and adjacent to waters (Inland Fisheries Ireland, 2016);<br>Waste Water Discharge (Authorisation) Regulations (Department of Environment, Heritage and Local Government, 2007);<br>Urban Waste Water Treatment Regulations, (Department of the Environment and Local Government, 2001);<br>Environmental Protection Agency (EPA) Guidelines on the information to be contained in Environmental Impact Assessment Reports (hereafter referred to as the EPA Guidelines) (EPA, 2022);<br>Nature-based Solutions to the Management of Rainwater and Surface Water Runoff in Urban Areas - Best Practice Interim Guidance Document (Department of Housing, Local Government and Heritage, 2022);<br>Carrying out a Water Framework Directive (WFD) Assessment of EIA Developments (Northern Ireland Environmental Agency Water Management Unit, 2012);<br>Sustainable Drainage Design and Evaluation Guide 2021 (Dublin City Council, 2021);<br>and<br>UK's Planning Inspectorate (PINS) Advisory Note 18 'Water Framework Directive' June 2017 (Planning Inspectorate, 2017). |
| *** Now the Department of Housing, Local Government and Heritage.**<br>****The National Roads Authority merged with the Railway Procurement Agency and is known as Transport Infrastructure Ireland (TII) since 1 August 2015. All references to guidance documents and standards within this EIAR will retain the NRA reference until such time as these documents are updated.** | |

#### 16.2.4.2 Water Framework Directive (WFD)

The WFD established a framework for the protection of both surface and groundwaters. The WFD provides a vehicle for establishing a system to improve and/or maintain the quality of water bodies across the European Union. The Directive requires all water bodies (river, lakes, groundwater, transitional, coastal) to attain 'Good Status' (qualitative and quantitative) by 2027.

There are several WFD objectives under which the quality of water is protected. The key objectives at European level are the general protection of aquatic ecology, specific protection of unique and valuable habitats, the protection of drinking water resources, and the protection of bathing water. The objective is to achieve this through a system of river basin management planning and extensive monitoring. 'Good Status' means both 'Good Ecological Status' and 'Good Chemical Status'.

The WFD was initially transposed into Irish law by S.I. No. 722/2003 – European Communities (Water Policy) Regulations 2003, as amended (hereafter referred to as the Water Policy Regulations). The Water Policy Regulations outline the water protection and water management measures required to maintain high status

of waters where it exists, prevent any deterioration in existing water status and achieve at least 'Good' status for all waters.

Subsequently, S.I. No. 272/2009 - European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended (hereafter referred to as the Surface Waters Regulations), and S.I. No. 9/2010 - European Communities Environmental Objectives (Groundwater) Regulations 2010, as amended (hereafter referred to as the Groundwater Regulations), were promulgated to regulate WFD characterisation, monitoring and status assessment programmes, in terms of assigning responsibilities for the monitoring of different water categories, determining the quality elements and undertaking the characterisation and classification assessments.

The Water Policy Regulations require the assessment of permanent impacts of a scheme/project on WFD water bodies, (rivers, lakes, estuaries, coastal waters and groundwater). Typically, the permanent impacts include all operational impacts but can also include impacts from construction depending on the length and/or nature of the works, etc. of the project, as some potential construction impacts could be considered permanent in the absence of mitigation. An assessment of the compliance of the Proposed Development with WFD requirements is provided in Volume 4 - Appendix 16.1.

#### 16.2.4.3 River Basin Management Plans

River Basin Management Plans (RBMPs) provide the mechanism for implementing an integrated approach to the protection, improvement and sustainable management of the water environment and are published every six years. The third cycle RBMP 2022–2027 was published by the Department of Housing, Local Government and Heritage in 2024.

The Water Action Plan 2024 outlines essential measures to protect and restore water quality, with a focus on sustainable management of freshwater resources. The plan identifies the primary pressures affecting water quality, including agriculture, hydromorphology, forestry and urban wastewater, and sets out a Programme of Measures to address these pressures through targeted actions, integrated catchment management and investment in infrastructure.

Recent EPA assessments indicate that approximately 54% of surface water bodies achieve 'Good' or 'High' ecological status, representing a decline compared to earlier assessment cycles. Approximately 34% of water bodies are currently identified as being at risk of not meeting their environmental objectives. Agriculture remains the most significant pressure, followed by hydromorphology, forestry and urban wastewater.

The RBMP is set within a context of increasing environmental pressures, including climate change and population growth, and emphasises the need for continued investment in wastewater infrastructure and catchment-based management to improve water quality and protect aquatic ecosystems.

### 16.2.5 Appraisal Method for the Assessment of Impacts

#### 16.2.5.1 General Approach

An assessment of attribute importance has been undertaken in order to provide a basis for the assessment of impact provided. The impact type, magnitude and duration should be considered relative to the importance of the hydrological receptor and its sensitivity to change in order to determine the significance of the impacts.

#### 16.2.5.2 Sensitivity of Receptors

The sensitivity of surface water attributes to changes arising from the Proposed Development is assessed using a range of criteria, including their relative importance or "value" (for example, whether the features are of national, regional, or local significance). Table 16-5 below, outline the Criteria used to Evaluate the Sensitivity of Surface Water Receptors.

**TABLE 16-5: CRITERIA USED TO EVALUATE THE SENSITIVITY OF SURFACE WATER RECEPTORS (NRA 2008 ADAPTED TO INCLUDE WFD ASSESSMENT GUIDELINES (ENVIRONMENTAL AGENCY 2016)).**

| Sensitivity | Criteria | Typical Example |
|---|---|---|
| **Extremely High** | Attribute has a very high quality or value on an international scale | Any water body which is protected by EU legislation (e.g. Designated European Sites (Special Areas of Conservation (SAC) and Special Protection Areas (SPA)) or 'Salmonid Waters'; and<br>A waterbody that appears to be in natural equilibrium and exhibits a natural range of morphological features (such as pools and riffles). There is a diverse range of fluvial processes present, free from any modification or anthropogenic influence. |
| **Very High** | Attribute has a high quality or value on an international scale or very high quality or value at a national scale | Any waterbody (specific EPA segment) which has a direct hydrological connection (<2km) to European Sites or protected ecosystems of international status (Special Areas of Conservation (SAC) / Special Protected Areas (SPA) or Salmonid Waters);<br>A waterbody ecosystem protected by national legislation (Natural Heritage Area (NHA) status);<br>A waterbody that appears to be largely in natural equilibrium and exhibits a diverse range of morphological features (such as pools and riffles). There is a diverse range of fluvial processes present, with very limited modifications; and<br>Nutrient Sensitive Areas. |
| **High** | Attribute has a moderate value at an international scale or high quality or value on a national scale | A WFD water body with High or Good WFD Status;<br>A Moderate WFD Status (2016 - 2021) waterbody with some hydrological connection (<2km) to European Sites or protected ecosystems of international status (SAC/SPA or Salmonid Waters) further downstream;<br>A waterbody which has a direct hydrological connection to sites/ecosystems protected by national legislation (NHA status);<br>A waterbody that appears to be in some natural equilibrium and exhibits some morphological features (such as pools and riffles). There is a diverse range of fluvial processes present, with very limited signs of modification or other anthropogenic influences; and<br>Direct hydrological connectivity to Nutrient Sensitive Areas. |
| **Medium** | Attribute has some limited value at a national scale | A WFD waterbody with Moderate WFD Status (2016 - 2021);<br>A WFD waterbody with limited (>2km - <5km) hydrological importance for sensitive or protected ecosystems (much further downstream);<br>A waterbody showing signs of modification or culverting, recovering to a natural equilibrium, and exhibiting a limited range of morphological features (such as pools and riffles). The watercourse is one with a limited range of fluvial processes and is affected by modification or other anthropogenic influences;<br>Evidence of historical channel change through artificial channel straightening and re-profiling; and<br>Some hydrological connection downstream Nutrient Sensitive Areas. |
| **Low** | Attribute has a low quality or value on a local scale | A waterbody with Bad to Poor WFD Status (2016 – 2021);<br>A waterbody with (>5km or no) hydrological connection to European Sites or national designated sites; or<br>A non-WFD water feature with minimal hydrological importance to sensitive or protected ecosystems; and/or economic and social uses;<br>A highly modified watercourse that has been changed by channel modification, culverting or other anthropogenic pressures. The watercourse exhibits no morphological diversity and has a uniform channel, showing no evidence of active fluvial processes and not likely to be affected by modification. Highly likely to be affected by anthropogenic factors. Heavily engineered or artificially modified and could dry up during summer months; and<br>Many of which are adversely affecting biodiversity. |

### 16.2.5.3 Magnitude of Impacts on Waterbody Attributes

The magnitude of potential impacts (both beneficial and adverse) depends on the degree and extent to which the Proposed Development may impact the surface water receptors during the Construction and Operational Phases.

Factors that have been considered to determine the magnitude of potential impacts include the following (EPA 2022):

- Nature of the impacts;
- Intensity and complexity of the impacts;
- Expected onset, duration, frequency, and reversibility of the impacts;
- Cumulation of the impacts with other existing and/or approved projects impacts; and
- Possibility of effectively reducing the impacts.

The criteria for assessing the magnitude of impact on hydrology attributes are presented in Table 16-6 below.

**TABLE 16-6: CRITERIA FOR DETERMINING THE MAGNITUDE OF IMPACT ON SURFACE WATER RECEPTORS (NRA 2008)**

| Magnitude of Impact | Criteria | Typical Examples |
|---|---|---|
| **Major Adverse** | Results in loss of attribute and/or quality and integrity of attribute | Loss or extensive change to a waterbody or water dependent habitat;<br>Reduction in waterbody WFD classification or quality elements;<br>Extensive loss of fishery;<br>Major increase in predicted peak flood level;<br>Calculated risk of serious pollution incident >2% annually;<br>Extensive reduction in amenity value; or<br>An impact, with a high likelihood of occurrence that has some potential to alter the character of a small part or element of the receptor in the medium-long term. This could be on a frequently or consistently in occurrence, and result in an impact which have potential to alter the existing or emerging trends. |
| **Moderate Adverse** | Results in impact on integrity or loss of part of attribute | Partial loss of fishery;<br>Moderate increase in predicted peak flood level;<br>Contribution to reduction in waterbody WFD classification;<br>Calculated risk of serious pollution incident >1% annually;<br>Partial reduction in amenity value; or<br>An impact, with reasonable likelihood of occurrence that has some potential to alter the character of a small part or element of the receptor in the medium term. This could be intermittently or occasionally, and result in an impact which is consistent with existing or emerging trends. |
| **Minor Adverse** | Results in minor impact on integrity of attribute or loss of small part of attribute | Measurable impact but no change to WFD classification or the status of supporting quality elements;<br>Minor increase in predicted peak flood level;<br>Minor loss of fishery;<br>Calculated risk of serious pollution incident >0.5% annually;<br>Slight reduction in amenity value; or<br>An impact, with low likelihood of occurrence that has some potential to alter the character of a small part or element of the receptor in the short term. This could be on a once-off occasion or rare occurrence, and result in an impact which is consistent with existing or emerging trends. |
| **Negligible** | Results in an impact on attribute but of | No measurable impact on integrity of the attribute; |

| Magnitude of Impact | Criteria | Typical Examples |
|---|---|---|
| | insufficient magnitude to affect either use or integrity | Negligible change in predicted peak flood level; or<br>Calculated risk of serious pollution incident <0.5% annually. |
| **Minor Beneficial** | Results in minor improvement of attribute quality | Minor reduction in predicted peak flood level;<br>Calculated reduction in pollution risk of 50% or more where existing flood risk is <1% annually; or<br>Potential for minor improvement to WFD quality element(s). |
| **Moderate Beneficial** | Results in moderate improvement of attribute quality | Moderate reduction in predicted peak flood level;<br>Calculated reduction in pollution risk of 50% or more where existing risk is >1% annually; or<br>Contribution to improvement in waterbody WFD classification. |
| **Major Beneficial** | Results in major improvement of attribute quality | Major reduction in predicted peak flood level: or<br>Improvement in waterbody WFD classification. |

#### 16.2.5.4 Significance of Impacts

The sensitivity of the receptors, together with the magnitude of the potential impacts associated with the Proposed Development, are used to determine the significance of the resulting impacts, as outlined in Table 16-7 below.

**TABLE 16-7: SIGNIFICANCE OF ENVIRONMENTAL IMPACTS**

| Sensitivity of Receptor | Magnitude of Impact | | | |
|---|---|---|---|---|
| | Negligible | Minor | Moderate | Major |
| Extremely High | Imperceptible | Significant | Very Significant to Profound | Profound |
| Very High | Imperceptible | Significant/Moderate | Very Significant | Very Significant to Profound |
| High | Imperceptible | Moderate/Slight | Significant/Moderate | Very Significant |
| Medium | Imperceptible | Slight | Moderate | Significant |
| Low | Imperceptible | Imperceptible | Slight | Slight/Moderate |

### 16.2.6 Data Collection

Information on the baseline environment including hydrology, hydromorphology and water quality of the receptors within the study area has been compiled by undertaking a desktop review and field surveys.

#### 16.2.6.1 Data Sources

Table 16-8 details the data sources consulted during the assessment.

**TABLE 16-8 DATA SOURCES**

| Categorisation of Reference Material | Title |
|---|---|
| General | Ordnance Survey of Ireland (OSI): Discovery Mapping (1:50,000), Six Inch Raster Maps (1:10,560), Six Inch and 25 Inch OS Vector Mapping, Orthographic Aerial Mapping (Geohive);<br>EPA: Online mapping resource (Envision and www.catchments.ie): Teagasc subsoil classification mapping, WFD Mapping, Water Quality Monitoring Database, AER Database, Discharge Licencing Database;<br>National Parks and Wildlife Service (NPWS): Designated Areas Mapping (www.*npws.ie*);<br>Geological Survey of Ireland (GSI)-Online Mapping; and<br>National Development Plan 2021 – 2030 – Project Ireland 2040 (Department of Public Expenditure and Reform). |
| Hydrology/Flooding | River Basin Management Plan 2022–2027 (active cycle). and<br>OPW: Online Mapping Resources: Hydrometric data (*www.epa.ie/hydronet*), OPW CFRAM Flood Risk and Flood mapping (*floodinfo.ie*). |
| Development Plans | Limerick Development Plan (2022-2028); and<br>National Planning Policy-Project Ireland 2040-National Planning Framework (2018). |

## 16.3 Study Area/Existing Environment

### 16.3.1 Hydrological Receptors

#### 16.3.1.1 Shannon Estuary

The Shannon River, the longest river in Ireland at approximately 360 km, originates from Cuilcagh Mountain. It flows initially southwards, then southwest, before entering the Shannon Estuary at Limerick Dock. Freshwater discharge from the Shannon varies between about 11 $m^3/s$ (Q95) and over 500 $m^3/s$.

The Shannon Estuary is Ireland's largest estuary, covering approximately 31,500 ha, through which the Shannon and Fergus Rivers discharge into the Atlantic Ocean. The estuary is roughly 100 km long, with a width ranging from 1 to 8 km depending on location. The northern part of the estuary is referred to as the Fergus Estuary. Limerick City is located at the head of the estuary, with the downstream limit at Loop Head and Kerry Head. The estuary forms the boundary between counties, with Kerry and Limerick to the south and Clare to the north. In addition to the Shannon and Fergus Rivers, several other rivers flow into the estuary, including the Maigue and Deel Rivers. The estuary experiences a large tidal range of more than 5 m.

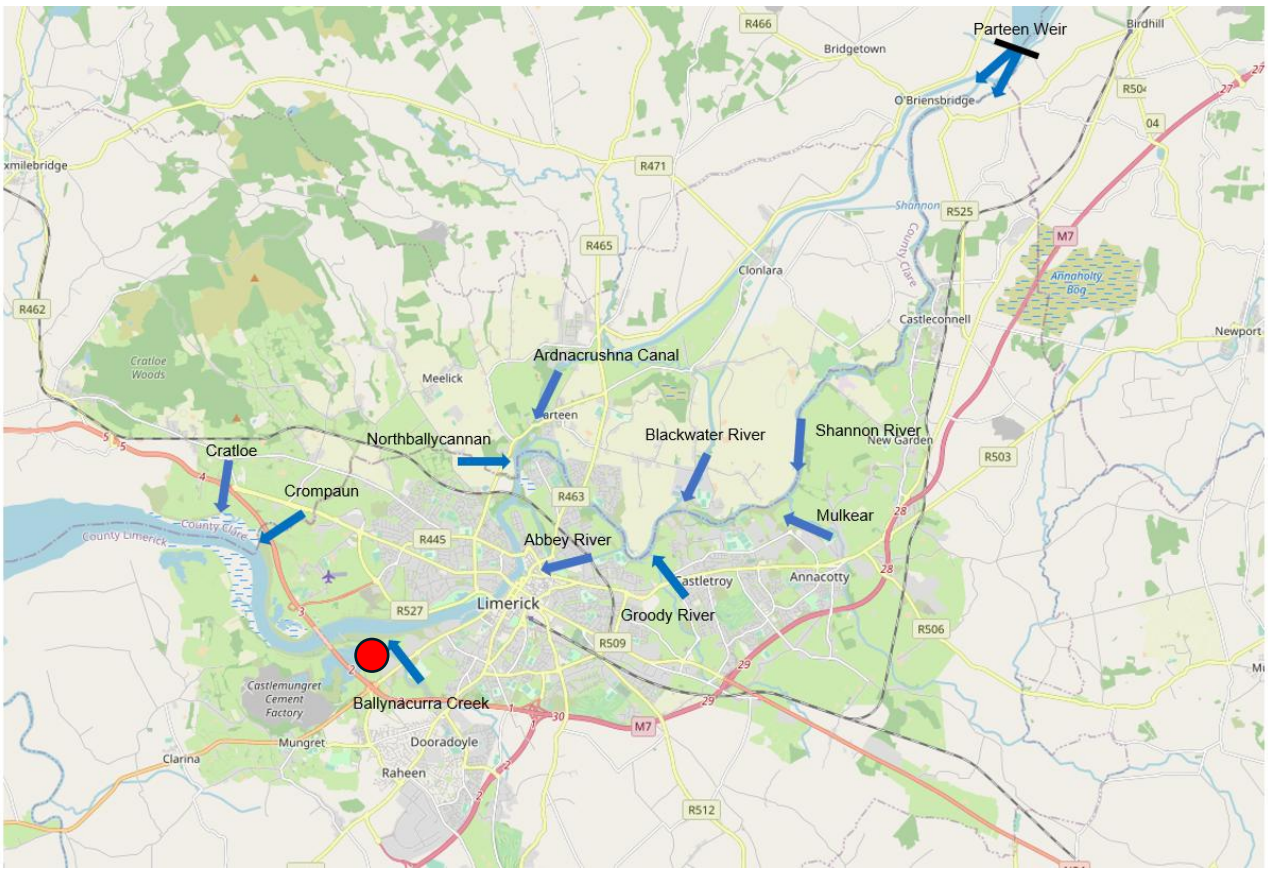


**FIGURE 16-1 TRIBUTARIES TO THE SHANNON AND FERGUS ESTUARY.**

#### 16.3.1.2 Bunlicky Lake

Bunlicky Lake is a man-made waterbody within the lower Shannon Estuary catchment. The main inflows to the lake are from surface water, with only minor contributions from groundwater. It receives surface runoff and drainage from the WWTP site and surrounding lands via a network of drains and ditches. Runoff from hard-standing areas within the site is conveyed directly to the outfall chamber, while other site drainage discharges to the lake via land drains. Outflow from the lake is controlled by a weir and non-return flap, which regulates discharge to the Shannon Estuary and prevents tidal backflow.

The lake acts as a settlement basin, helping to manage sediments and regulate water flow before water moves downstream. As part of this function, it provides controlled attenuation of site drainage prior to discharge to the estuary. Under normal operational conditions, the lake maintains stable water levels and water quality, supporting its role in managing flows to the estuary.

#### 16.3.1.3 Ballinacurra Creek

Ballinacurra Creek is a tributary of the Lower River Shannon estuarine system and lies within the Lower River Shannon SAC. The Creek's lower reaches, along with adjacent mudflat, salt-marsh, and tidal-wetland habitats, are highly sensitive to changes in water quality and hydrology. Under existing operational conditions, site drainage from the Bunlicky WWTP discharges primarily to Bunlicky Lake, and there is no direct connectivity to Ballinacurra Creek which is located approximately 200 m from the site boundary.

While the potential for surface-water connectivity to the Creek is very low under normal operations, extreme rainfall events or drainage bypass scenarios could create indirect pathways. As such, Ballinacurra Creek is considered a secondary hydrological receptor within the local catchment.

### 16.3.2 Model Domain

The model domain can be seen in Figure 16-2. The downstream boundary of the model domain is located at Shannon Airport, the upstream boundaries at the Ardnacrusha Dam and upstream of Castletroy. The downstream boundary is chosen such that a water level measurement location is nearby (for boundary

condition generation) and the distance to the Shannon Town WWTP is sufficiently large to ensure its effluent plume remains within the model domain. The upstream boundaries are chosen at the approximate tidal limit and to include Castletroy WWTP. Additionally, the boundary in the original River Shannon was chosen so that Castletroy WWTP can be included in the model as a point source, enabling modelling of the future upgraded WWTP. The contribution from the Groody River, Blackwater River and Mulkear are included in the upstream boundary of the original River Shannon.

Relevant tributaries to the estuary (see also Figure 16-1) are incorporated within the model domain up to the point at which a water quality monitoring station is available, thereby enabling the derivation of reliable water quality boundary conditions. Accordingly, the Maigue River is included up to the Carraigh West monitoring station, while the Owenogarney River is included up to the N18 bridge.

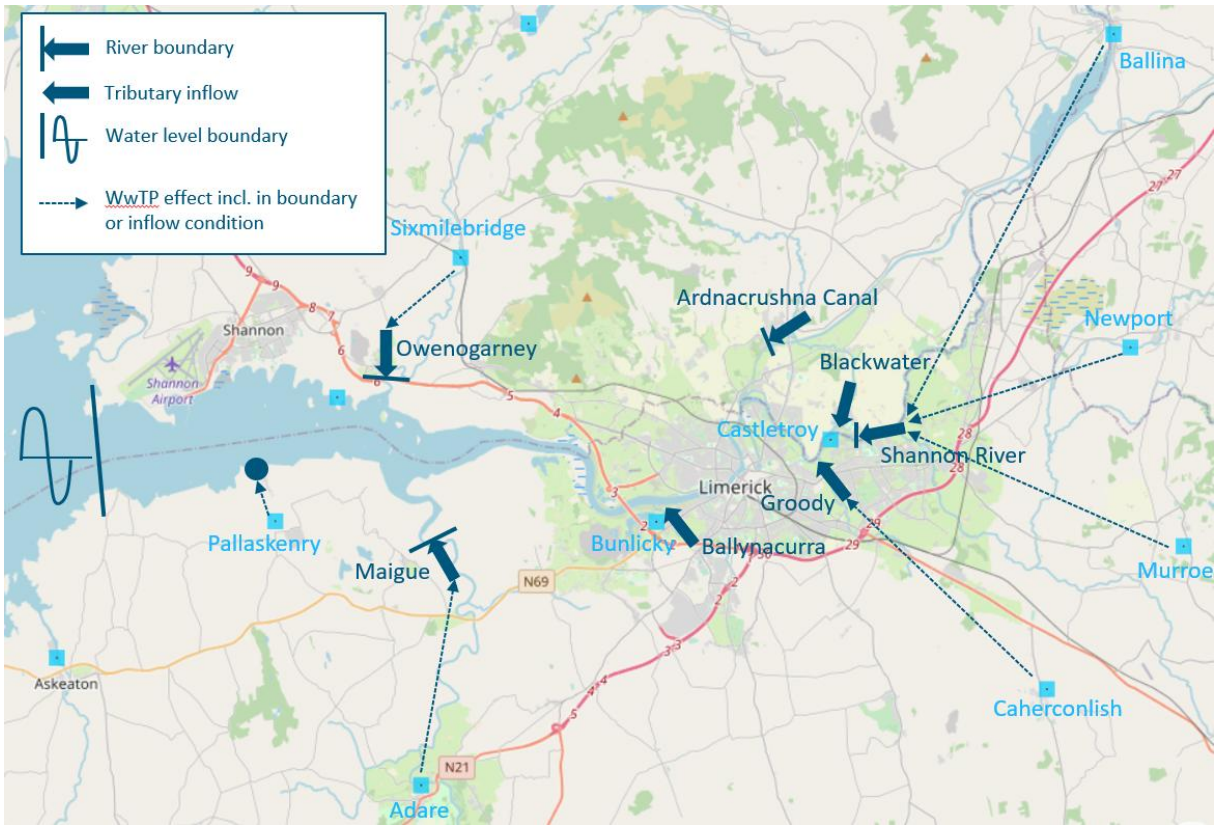


**FIGURE 16-2: MODEL DOMAIN**

### 16.3.3 Model Validation

This section presents model results for the effect of the WWTP point discharge on receiving water quality, as per the existing situation. Figure 16-3 to Figure 16-8 display the depth-average concentrations and indicative water quality for BOD, MRP and DIN during summer conditions. Summer conditions are deemed to be most critical in terms of water quality impacts, as higher water temperatures can increase biological activity within the receiving waters, while lower estuary flows reduce dilution and mixing capacity for the WWTP discharge.

#### BOD

In the existing situation (A01s), the concentration of BOD throughout the estuary is generally below 2 mg/l, which corresponds to high indicative quality for this supporting quality element of Water Framework Directive status. A localised area of increased concentrations up to 10 mg/l is predicted in the immediate vicinity of the existing Limerick WWTP outfall. The mixing zone with 'Good' indicative water quality extends approximately 110 m in the streamwise direction, and the area with 'Moderate' status extends over approximately 70 m. Refer to Volume 4 Appendix 16.3 Modelling Report of this EIAR.

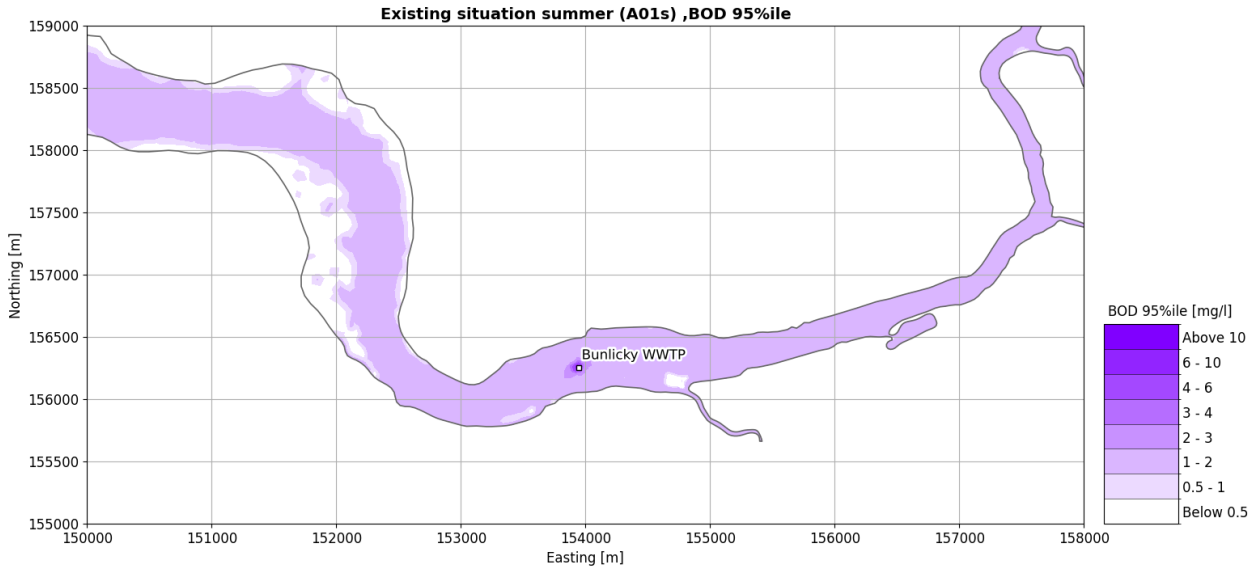


**FIGURE 16-3: BOD CONCENTRATIONS (EXISTING)**

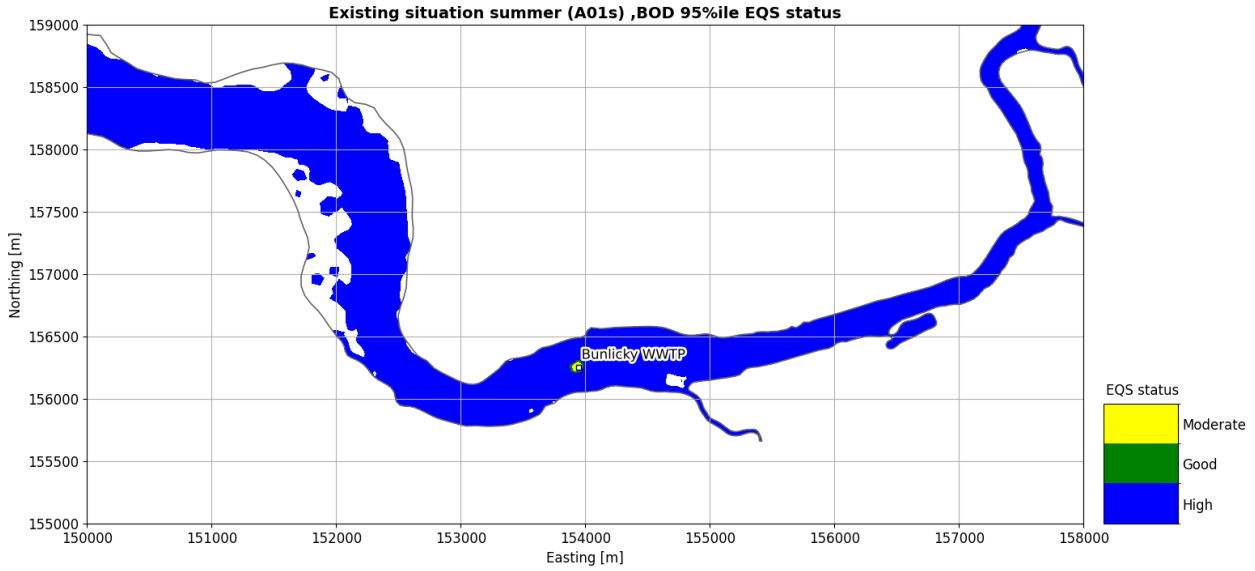


**FIGURE 16-4: BOD INDICATIVE WATER QUALITY (EXISTING)**

## DIN

For DIN, a large part of the study area is characterized by a good indicative water quality status in both summer and winter conditions under the baseline scenario, extending approximately 8 km downstream of the outfall and all the way to the upstream boundary (Figure 16-5). The maximum DIN concentration of around 1.9 mg/l is observed near the Limerick WWTP outfall and the threshold for 'Moderate' indicative water quality status is not exceeded in the current situation (Figure 16-6). Refer to Volume 4 Appendix 16.3 Modelling Report of this EIAR.

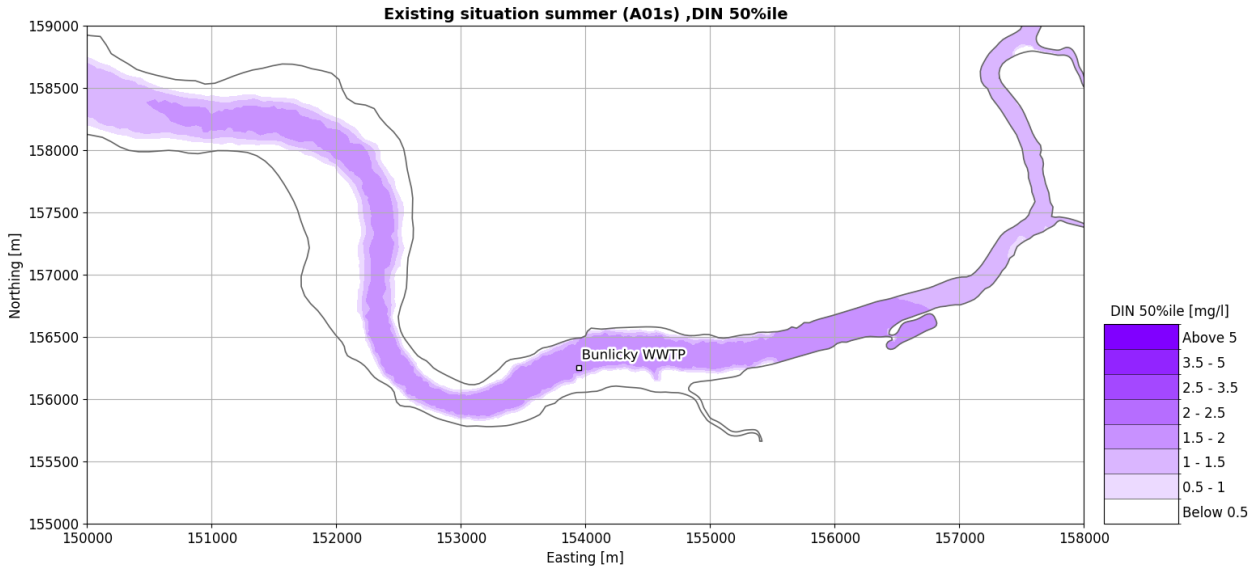


**FIGURE 16-5: DIN CONCENTRATIONS (EXISTING)**

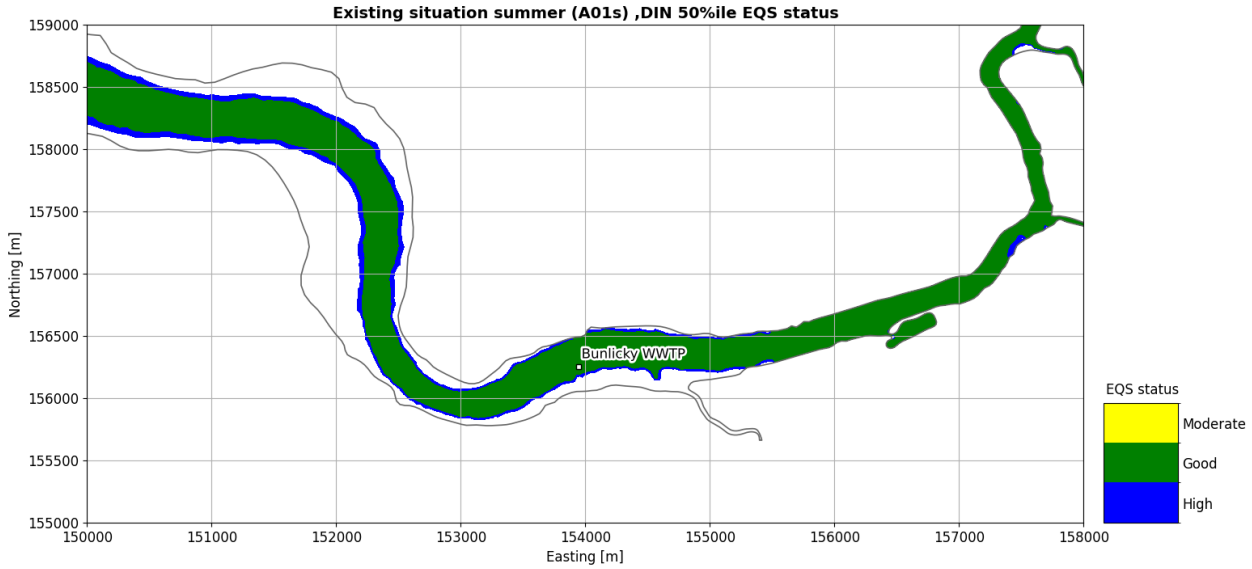


**FIGURE 16-6: DIN INDICATIVE WATER QUALITY (EXISTING)**

## MRP

In the existing situation (A01s), the concentration of MRP throughout a large part of the estuary exceeds the indicative 'Good' status threshold of 0.060 mg/l and therefore correspond to 'Moderate' indicative water quality status. This area extends from approximately 2.5 km upstream to 13.5 km downstream of the Limerick WWTP outfall. The zone with 'Good' indicative water quality status spans from the downstream boundary of the model to around 4 km upstream of the outfall (Figure 16-7). Maximum MRP concentration at the outfall itself in the existing situation reaches 0.16 mg/l (Figure 16-8). Refer to Volume 4 Appendix 16.3 Modelling Report of this EIAR.

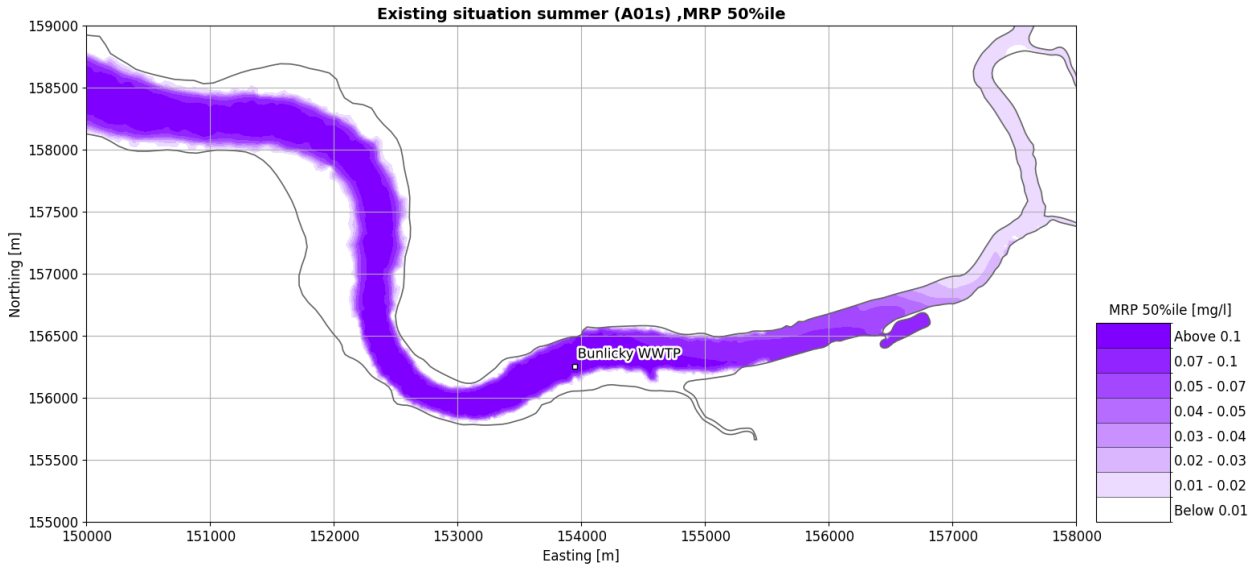


**FIGURE 16-7: MRP CONCENTRATIONS (EXISTING)**

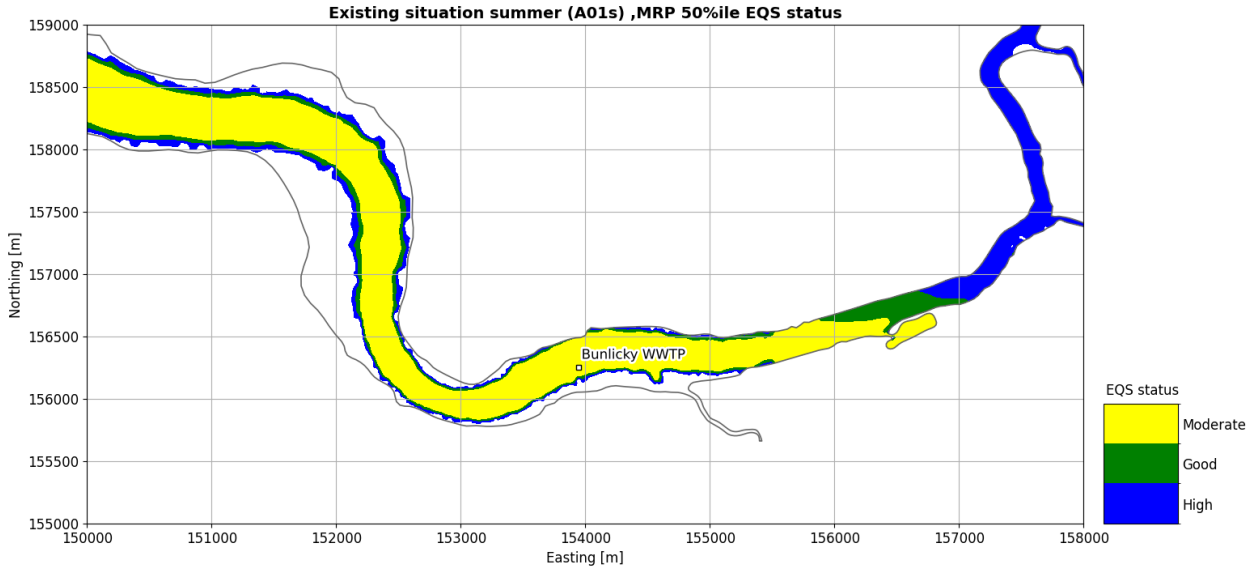


**FIGURE 16-8: MRP INDICATIVE WATER QUALITY (EXISTING)**

## 16.3.4 Receiving Water Quality

### 16.3.4.1 Marine Survey Results

Water quality sampling was carried out as part of the marine survey at locations at the upstream and downstream boundary of the model domain, and at relevant tributaries. The locations were chosen such that they agree with the EPA water quality points (national water monitoring stations). In this way the survey data could be compared to and complement existing historical data.

The samples were gathered during one spring on 5th October and one neap tidal cycle on 12th October 2021 during the survey period. Samples were taken near the water surface with a 3-hour interval, so a total of 5 samples were taken in the tidal cycle. For the most upstream locations outside the influence of the tide (Blackwater River, Shannon Bridge UL, Groody River, Parteen Bridge) one sample was taken during the tidal cycle.

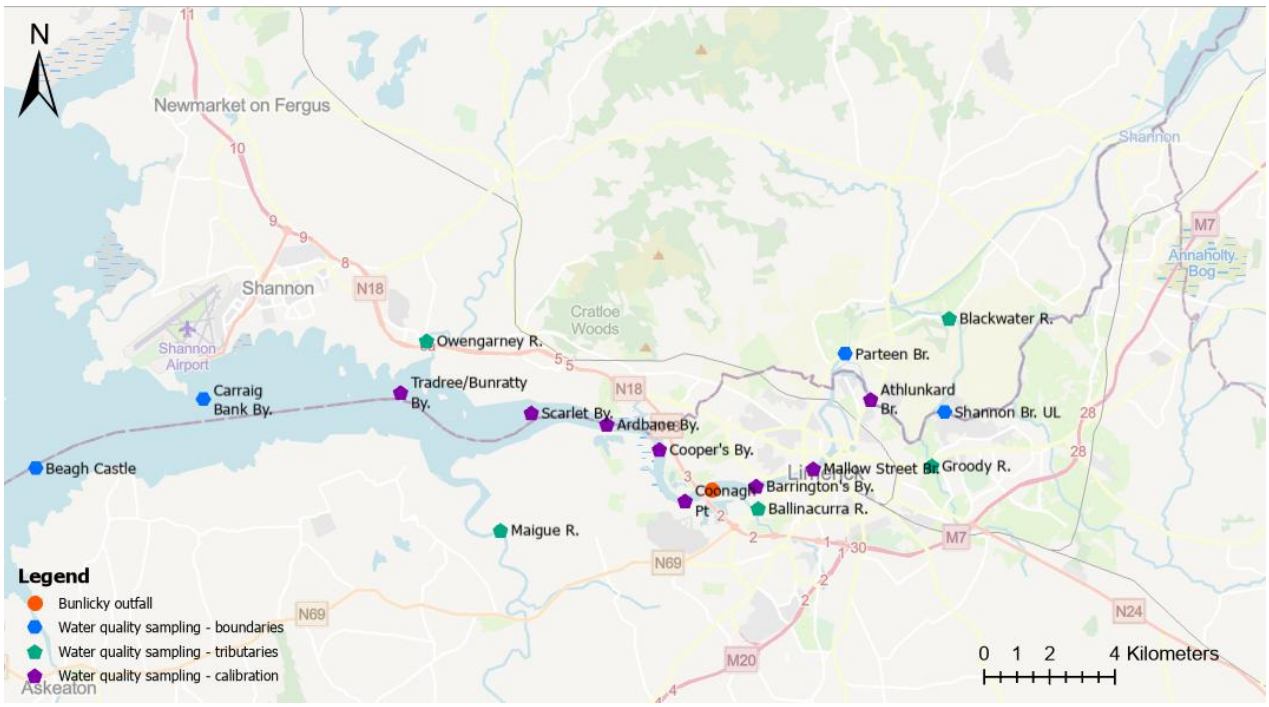


**FIGURE 16-9: WATER QUALITY SAMPLING**

Key findings for BOD, MRP and DIN include:

- BOD concentrations were below 3 mg $O_2$/l at all sampling locations. In accordance with the Surface Water Regulations for transitional waters, indicative "Good" status is achieved where the relevant Environmental Quality Standards (EQSs) are met, while "High" status is associated with BOD concentrations below 3 mg $O_2$/l. Although the survey dataset is not sufficient to derive a statistically robust 95th percentile value, the results are indicative of water quality consistent with "High" status, as all recorded BOD concentrations were below 3 mg $O_2$/l.
- MRP (phosphorus) concentrations are between 0.01 and 0.1 mg/l P. The water quality standard for a good water quality" Good Status" in WFD transitional water (below PSU 17) is 0.06 mg/l P. Most locations are below this value. Groody River, Ballinacurra Creek and Maigue River have higher MRP concentrations;
- DIN (nitrogen) concentrations are around 0.5 mg/l N. Again, Groody River, Ballinacurra Creek and Maigue River have higher DIN concentrations (up to 1.8 mg/l). This is consistent with the higher DIN concentrations at these locations observed in the EPA data.

### 16.3.4.2 Desktop Study

There are six water quality monitoring stations used for the boundary conditions of the marine model. The upstream (Ardnacrusha Canal and Shannon River) and downstream (Shannon Airport) boundary values were derived from EPA monitoring stations. Data covering the 2013–2020 period were assessed, and seasonal (summer and winter) mean values were calculated.

The data used for this desktop marine survey was collected by the EPA as part of the National Water Framework Directive (WFD) Monitoring Programme.

The average values from the water quality samples from the survey and from the EPA monitoring stations at the boundaries are listed in Table 16-9.

**TABLE 16-9: WATER QUALITY, SALINITY, AND TEMPERATURE**

| Boundary | Source | Summer | | | | | Winter | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | BOD [mg/l] | MRP [mg/l] | DIN [mg/l] | S [PSU] | T [°C] | BOD [mg/l] | MRP [mg/l] | DIN [mg/l] | S [PSU] | T [°C] |
| Shannon Airport | Monitoring station SN340 Beagh Castle (TW19004 123SN3001) | <1 | 0.034 | 0.30 | 18 | 15 | <1 | 0.034 | 0.89 | 18 | 8 |
| Ardnacrusha Canal | Monitoring station Parteen Bridge (RS25S750900) | <1 | 0.006 | 1.13 | <1 | 15 | <1 | 0.030 | 1.39 | <1 | 8 |
| Shannon River* | Monitoring station Shannon Bridge (RS25S012561) | 1.20 | 0.013 | 1.46* | <1 | 15 | 1.19 | 0.026 | 2.64* | <1 | 8 |
| Ballinacurra Creek | Survey campaign | 1.43 | 0.038 | 1.10 | <1 | 15 | 1.43 | 0.038 | 1.10 | <1 | 8 |
| Owenogarney River | Survey campaign | 0.76 | 0.024 | 0.60 | <1 | 15 | 0.76 | 0.024 | 0.60 | <1 | 8 |
| Maigue River | Survey campaign | 0.95 | 0.057 | 1.12 | 1 | 15 | 0.95 | 0.057 | 1.12 | 1 | 8 |

**DIN at Shannon River is based on the measured ammonium and ammonium/ Total Oxidised Nitrogen (TON) ratio found at Ardnacrusha Dam where DIN is calculated by the sum of ammonium and TON.*

### 16.3.5 Other Characteristics of Receiving Water

Cross sectional width of the estuary channel is 160 m at low tide and water depth at Mean Sea Level (MSL) is 3.77m at the WWTP outfall location. The tidal range is approximately 4 meters (neap tide) to 8 meters (spring tide).

An Acoustic Doppler Current Profiler (ADCP) survey was undertaken over a five-month period to characterise current velocities and tidal behaviour within the estuary. Measured current velocities ranged from 0 m/s to approximately 2 m/s, with generally balanced ebb and flood conditions observed during summer months and a more dominant ebb (river-influenced) flow during winter.

The field survey data were used to inform and validate the hydrodynamic modelling, and the assessment therefore reflects the range of tidal conditions observed, including variations over seasonal differences.

### 16.3.6 Current WFD Status

The Water Framework Directive (WFD) is European legislation aimed at protecting surface water and groundwater across all EU Member States. Under the WFD, waterbodies are classified as groundwater, rivers, lakes, transitional waters, or coastal waters. The WFD waterbodies in the vicinity of the Limerick WWTP include:

- Limerick Dock – transitional waterbody – IE_SH_060_0900
- Upper Shannon Estuary – transitional waterbody – IE_SH_060_0800
- Maigue Estuary – transitional waterbody – IE_SH_060_0700
- Shannon Lower River – river waterbody – IE_SH_25S012600

The Limerick WWTP discharges directly into the Limerick Dock Transitional Waterbody, which forms part of the wider Shannon Estuary system. Upstream inflows are derived from the Shannon Lower River WFD waterbody,

while downstream receiving waters include the Upper Shannon Estuary and the Maigue Estuary. The Upper Shannon Estuary is classified as Poor Status, while the Maigue Estuary is Moderate Status, based on the 2019-2024 EPA classification. WFD assessments consider ecological and chemical indicators including fish, phytoplankton, invertebrates, and nutrients. Key non-compliance conditions include insufficient aquatic flora in the Upper Shannon Estuary, and low dissolved oxygen and elevated orthophosphate in the Maigue and Deel Estuaries (Table 16-10).

Bunlicky Lake is a small, artificial waterbody within the local catchment that receives site drainage from the WWTP. It does not have a formally assigned WFD status, but for this assessment it is considered a precautionary receptor due to its role as the main settlement basin for site drainage before flows reach the Shannon Estuary.

**TABLE 16-10: LATEST 2019-2024 EPA WFD STATUS AND WFD RISK. SOURCE: HTTPS://GIS.EPA.IE/EPAMAPS/.**

| Waterbody | WFD Status 2019 - 2024 | Reason for status 'poor' or 'moderate' | WFD Risk |
|---|---|---|---|
| Limerick Dock | Poor | - | At Risk |
| Upper Shannon Estuary | Poor | Aquatic Flora is 'poor' | At Risk |
| Maigue Estuary | Moderate | Supporting chemistry conditions, dissolved oxygen and orthophosphate is 'moderate' | At Risk |
| Lower Shannon Estuary | Good | - | At risk |
| Deel Estuary | Moderate | Supporting chemistry conditions, dissolved oxygen and orthophosphate is 'moderate' | At Risk |
| Fergus Estuary | Moderate | Aquatic Flora is 'moderate' | At Risk |

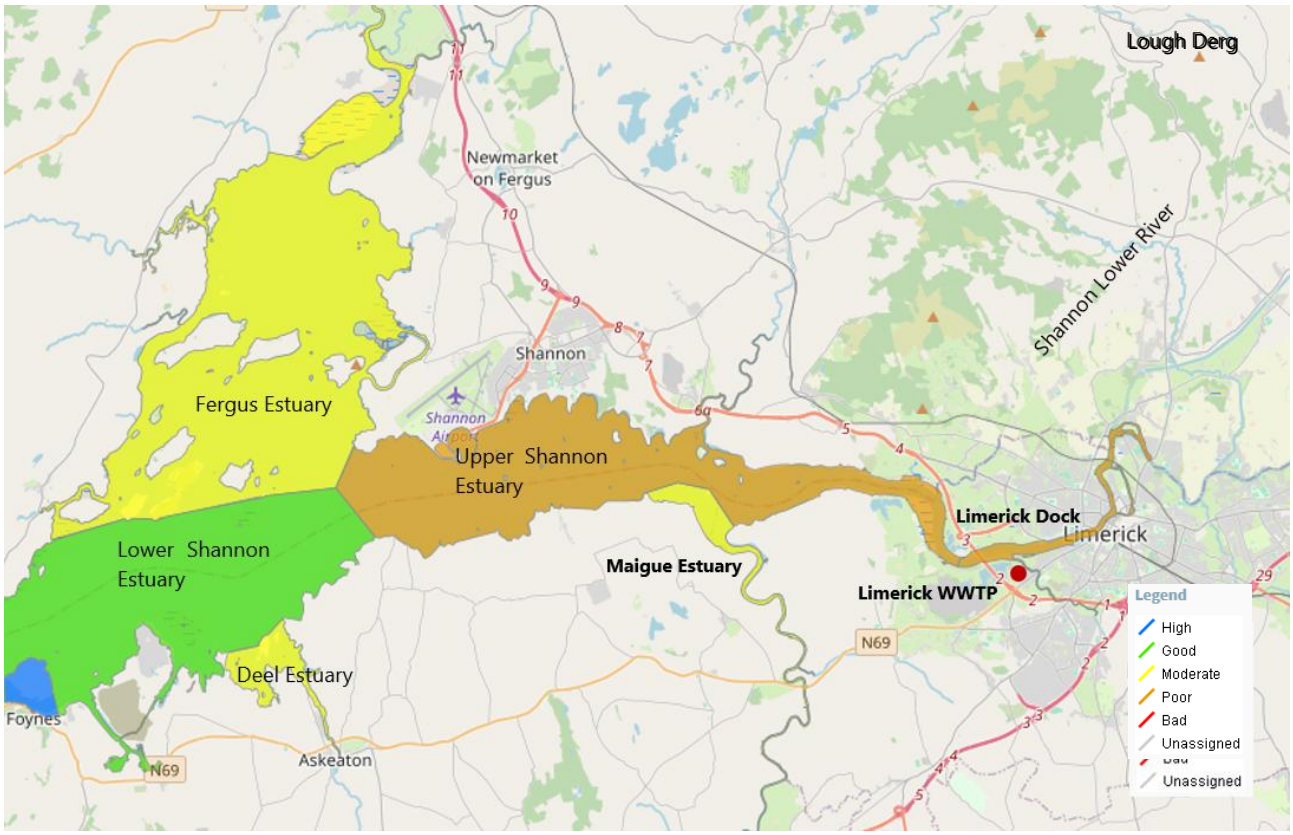


**FIGURE 16-10: STATUS OF WFD WATERBODIES IN THE STUDY AREA FOR THE ASSESSMENT PERIOD 2019-2024. SOURCE: HTTPS://GIS.EPA.IE/EPAMAPS/.**

The WFD risk assessment is based on monitoring data, information on ecological pressures, and details of implemented measures. Waterbodies classified as "At Risk" are prioritised for the implementation of measures. In addition, Priority Areas for Action identify specific WFD waterbodies selected by the Regional Operational Committees for prioritised implementation under the WFD programme. Not all waterbodies in the vicinity of the outfall are classified as "At Risk"; rather, Figure 16-11 identifies the relevant "At Risk" waterbodies and Priority Areas for Action in the area.

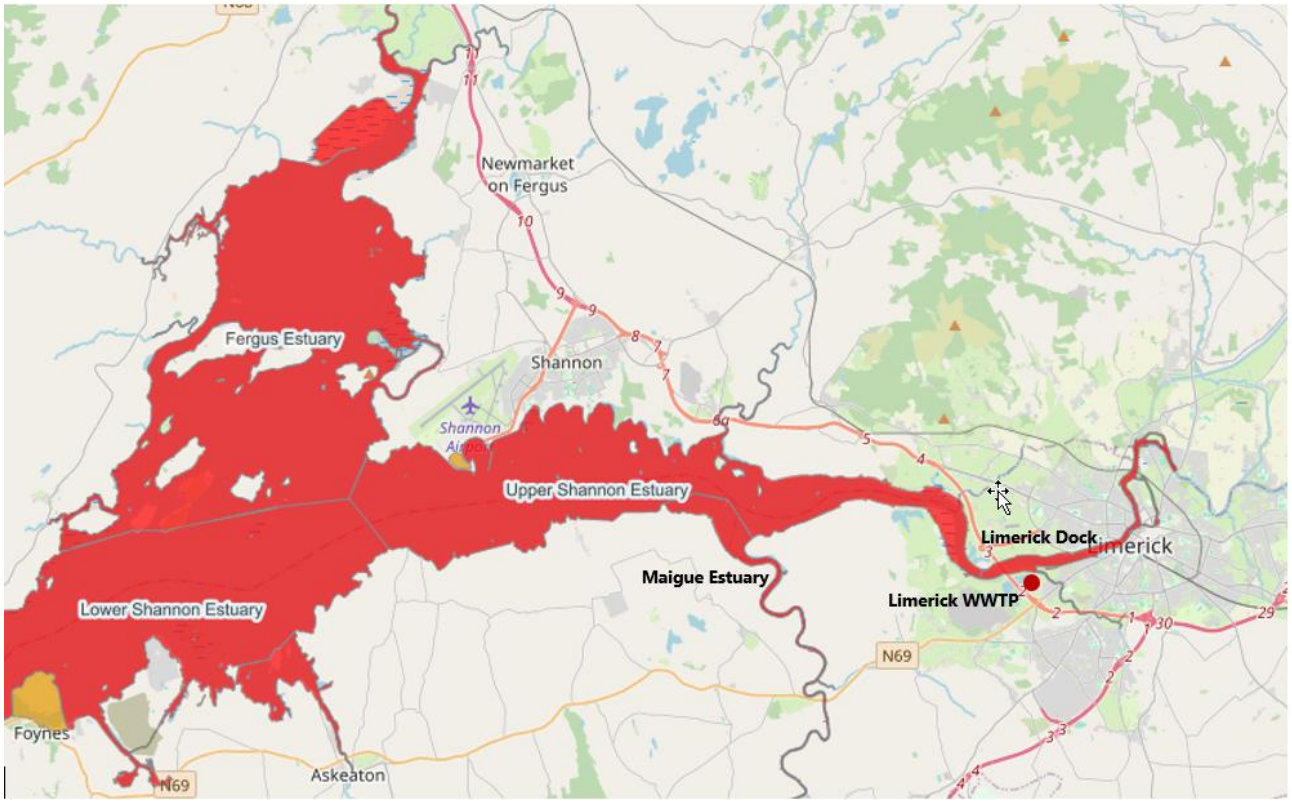


**FIGURE 16-11: WATERBODIES IN THE STUDY AREA THAT ARE 'AT RISK' ACCORDING TO WFD RISK ASSESSMENT. SOURCE: HTTPS://GIS.EPA.IE/EPAMAPS/.**

## 16.3.7 Sensitive Receptors

### 16.3.7.1 Designated Nutrient Sensitive Areas

There is one nutrient sensitive area in the wider area around the Limerick WWTP. This is the area of Lough Derg, upstream of the Shannon River. This area will not be affected by the discharge of the Limerick WWTP since this is further upstream. Other than Lough Derg there are no nutrient sensitive areas in the study area.

### 16.3.7.2 Designated Bathing Waters

The only designated bathing water area in the Shannon Estuary is at Kilrush (Cappagh Pier), approximately 60 km west of Limerick WWTP. Glin Pier and Kilteery Pier are proposed designated bathing waters, located approximately 40 km west of the Limerick WWTP outfall. These three bathing waters are considered to be located at a sufficient distance away to not be affected by the effluent discharge of Limerick WWTP.

### 16.3.7.3 Designated Shellfish Waters and Classified Shellfish Production Areas

There are three designated shellfish waters or classified shellfish productions sites approximately 53 km, 58km and 67km west of Limerick WWTP (Figure 16-12). West Shannon Ballylongford, West Shannon Poulnasherry Bay, and West Shannon Carrigaholt are located approximately 52km, 57km and 67km west of the Limerick WWTP outfall respectively. These three designated shellfish waters are considered to be located at a sufficient distance away to not be affected by the effluent discharge of Limerick WWTP.


**FIGURE 16-12: SHELLFISH PRODUCTION AREAS. THE LIMERICK WWTP IS INDICATED BY A RED CIRCLE. SOURCE: HTTPS://GIS.EPA.IE/EPAMAPS/.**

### 16.3.7.4 Special Areas of Conservation and Special Protected Areas

The Lower River Shannon is designated as a Special Area of Conservation (SAC) since 1998, see Figure 16-13. The habitats and species listed on Annex I and II of the E.U. Habitats Directive are typical habitats for estuaries such as tidal mudflats and sandflats, sandbanks, estuaries, coastal lagoons and typical species such as freshwater pearl mussel, lamprey, Atlantic salmon, dolphin and otters.

The River Shannon and the River Fergus Estuaries are designated as a Special Protected Area (SPA) under the E.U. Birds Directive since 2004, see Figure 16-14. Data was obtained from the EPA website *https://gis.epa.ie/EPAMaps*. The SPA River Shannon and the River Fergus Estuaries is of special conservation interest for the following bird species: Cormorant, Whooper Swan, Light-bellied Brent Goose, Shelduck, Wigeon, Teal, Pintail, Shoveler, Scaup, Ringed Plover, Golden Plover, Grey Plover, Lapwing, Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Greenshank and Black-headed Gull.

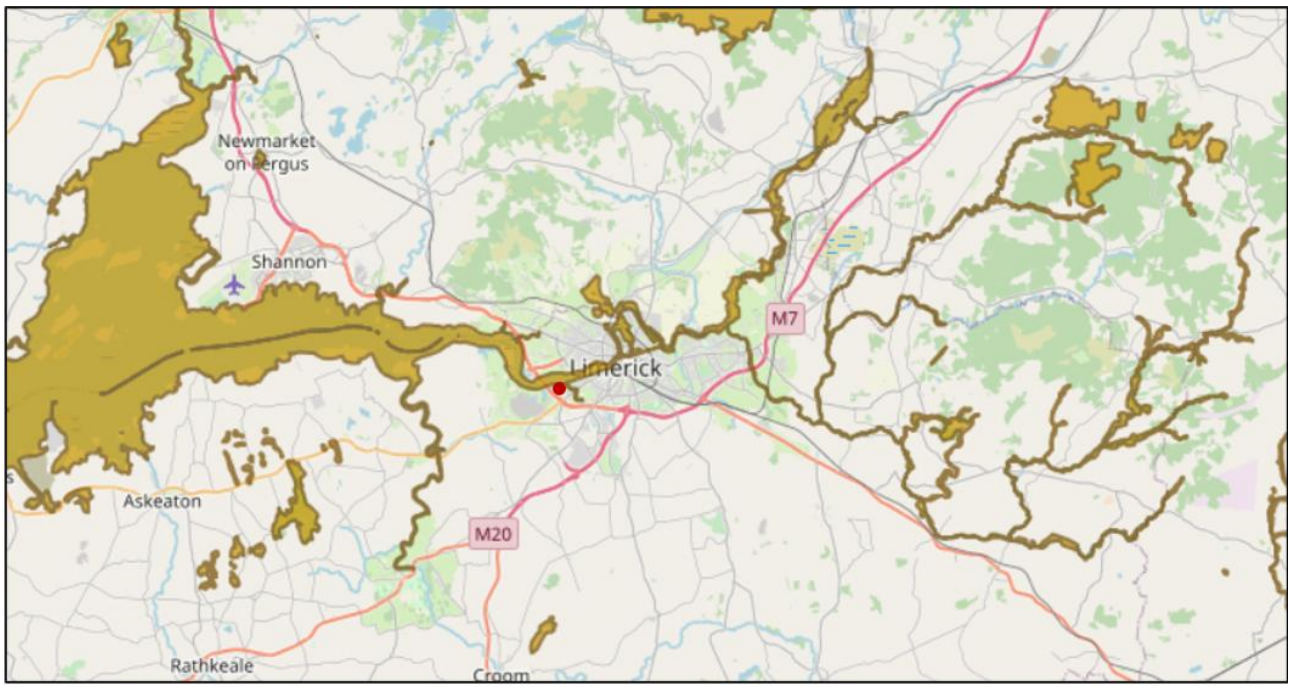


**FIGURE 16-13: SPECIAL AREAS OF CONSERVATION (SAC AREAS). THE LIMERICK WWTP IS INDICATED BY A RED CIRCLE. SOURCE: HTTPS://GIS.EPA.IE/EPAMAPS/.**


**FIGURE 16-14: SPA AREAS: RIVER SHANNON AND RIVER FERGUS ESTUARIES. THE LIMERICK WWTP IS INDICATED BY A RED CIRCLE. HTTPS://GIS.EPA.IE/EPAMAPS/.**

### 16.3.7.5 National Heritage Areas

National Heritage Areas are areas considered important for the habitats present or areas which hold species whose habitats require protection. They are the basic designation for wildlife protection in the Irish state. From information of the NPWS (National Parks and Wildlife Service) there are no NHA in the Shannon Estuary [26].

In the project area, there are two proposed NHAs: Inner Shannon Estuary – South Shore, and 'Fergus Estuary and Inner Shannon, North Shore' (Figure 16-15).

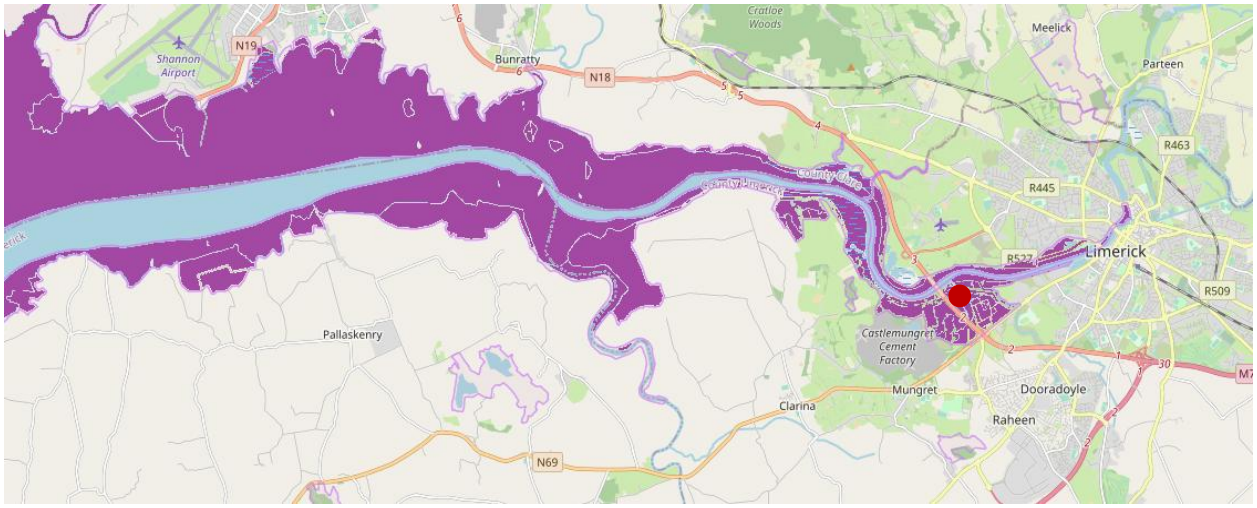


**FIGURE 16-15: PROPOSED NHAS INNER SHANNON ESTUARY SOURCE: *HTTPS://GIS.EPA.IE/EPAMAPS/*. THE LIMERICK WWTP IS INDICATED BY A RED CIRCLE**

### 16.3.7.6 Commercial/Recreational Fisheries

Areas of net fishing, pot fishing, line fishing and periwinkle harvesting were identified from http://atlas.marine.ie/. In the Shannon estuary only pot fishing is relevant. The pot fishing areas are located too far downstream to be influenced by discharges from the Limerick WWTP (see Figure 16-16). The Limerick WWTP is indicated by a red circle and Pot Fishing areas are highlighted in purple. There are two active (College Bay and Rinneville Beds) and one dormant (Carraigaholt) seasonal classified bivalve mollusc production areas in the Shannon estuary. As with the pot fishing areas, these mollusc production areas are located too far

downstream to be influenced by discharges from the Limerick WWTP. These areas are marked on Figure 16-16 with blue circles.

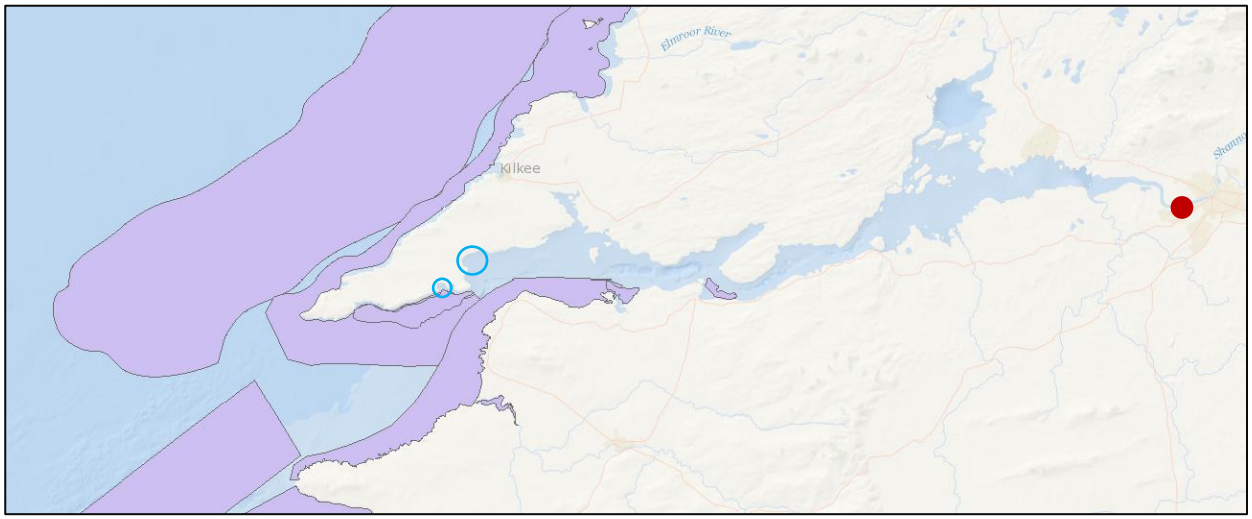


**FIGURE 16-16: FISHING AND MULLUSC PRODUCTION ACTIVITY IN THE SHANNON ESTUARY. SOURCE: HTTP://ATLAS.MARINE.IE/. THE LIMERICK WWTP IS INDICATED BY A RED CIRCLE**

#### 16.3.7.7 Summary

Key receptors in the vicinity of the Limerick WWTP outfall have been identified and considered in the assessment. The primary receptors relevant to this impact assessment are:

• WFD waterbodies (Limerick Dock, Upper Shannon Estuary and Maigue Estuary), which define the receiving environment and water quality objectives;

• The Upper Shannon Estuary, which is classified as a transitional waterbody under the WFD; and

• European sites, including the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA.

Other identified receptors, including bathing waters, shellfish waters, fisheries and proposed NHAs, are located at a sufficient distance from the outfall and are not considered to be at risk of impact from the proposed discharge.

### 16.3.8 Flood Risk Assessment

The development sites are located on the banks of Limerick Dock, a transitional waterbody predominantly influenced by tidal movements. A Flood Risk Assessment (FRA) has been undertaken in accordance with the Planning System and Flood Risk Management Guidelines for Planning Authorities (2009), refer to Appendix 16.2 in Volume 4 of this EIAR. Historically, the Irish Coastal Protection Strategy Study (ICPSS) provided information on extreme coastal water levels, including in the Shannon Estuary; however, the OPW National Catchment Flood Risk Assessment and Management (CFRAM) study now represents the primary source for flood risk assessment. As part of CFRAM, the Shannon Upper & Lower River Basin, including Limerick City, was assessed for fluvial and coastal flooding. A review of CFRAM Study as well as Limerick Strategic Flood Risk Assessment (SFRA), the Irish Coastal Wave and Water Level Study (ICWWS) and national flood mapping (*www.floodmaps.ie*), indicates that both sites are located at a high risk of flooding in Flood Zone A, within an area benefitting from existing arterial drainage and embankment defences.

CFRAM mapping indicates extensive flooding northwest of Limerick WWTP during a 0.1% Annual Exceedance Probability (AEP) event, much of which coincides with Bunlicky Lake. Overland flow is more widespread east of Ballinacurra Creek. Review of the CFRAM maps shows that, under defended conditions, flood waters do not currently inundate the Limerick WWTP site boundary due to the presence of flood defence embankments.

At Corcanree Pumping Station (PS), parts of the site are affected during a 0.1% coastal flood event. In the absence of defences, flood waters may encroach on the northwest corner of the site; however, this area is used only for temporary construction works, and flood waters do not reach the location proposed for the new storm tank.

As the Proposed Development comprises wastewater infrastructure, it is classified as highly vulnerable development and was therefore subject to the Justification Test. The Justification Test has confirmed that the development at both Limerick WWTP and Corcanree PS is acceptable, refer to Appendix 16.2 in Volume 4 of this EIAR.

In response to the CFRAM findings, Limerick City & County Council, in partnership with the OPW, is developing the Limerick City & Environs Flood Relief Scheme (FRS). Measures under the scheme are designed to protect the city against the 1% AEP fluvial flood event and the 0.5% AEP tidal flood event, providing enhanced protection for the wider Limerick area.

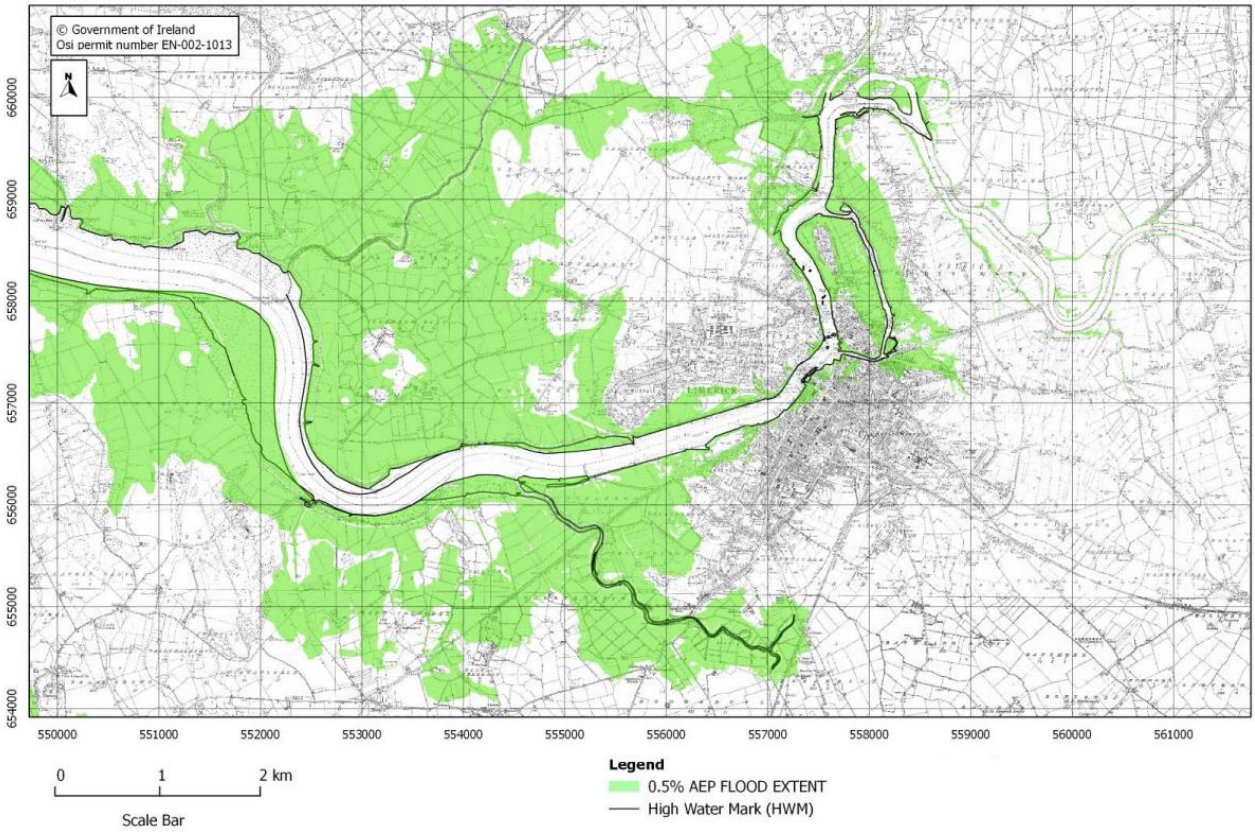


**FIGURE 16-17: PREDICTED COASTAL FLOOD EXTENT IN LIMERICK CITY FOR AN ANNUAL WATER LEVEL EXCEEDANCE PROBABILITY OF 0.5%**

Overall, considering the need for the development, the lack of suitable alternative sites, and the mitigation measures proposed, the development is considered appropriate in flood risk terms and will not increase flood risk either on-site or elsewhere.

## 16.4 The Existing WWTP

### 16.4.1 Site Description

Limerick WWTP and Corcanree Pump Station (PS) are adjacent to the south banks of Limerick Dock in the Shannon Estuary and can be accessed via the Dock Road off the N18 Galway/ Limerick Road. See location in Figure 16-18.

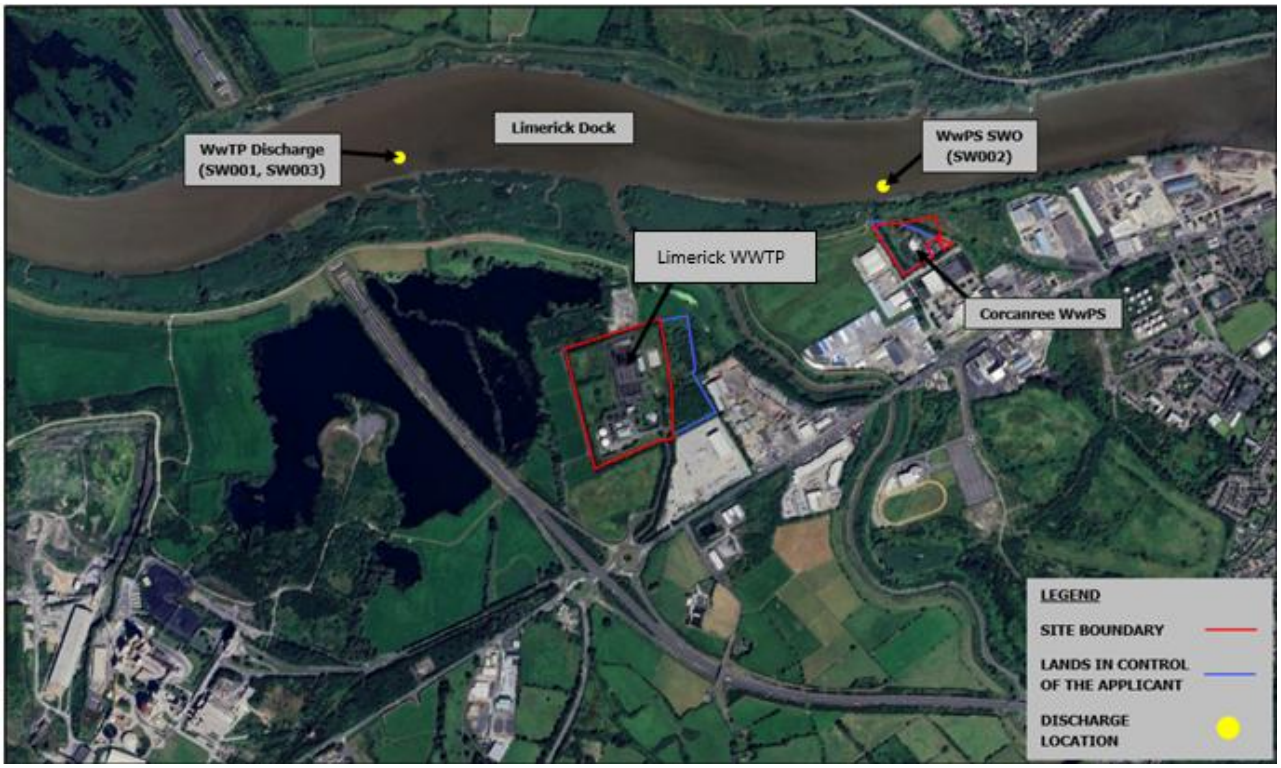


**FIGURE 16-18: SITE LOCATION DIAGRAM**

Corcanree PS is the main pumping station on the Limerick Main Drainage network, and it accounts for c. 90% of the flows to the WWTP. There is another smaller pumping station on the WWTP site from the Mungret network.

Treated effluent from the WWTP is discharged via a 1.1km long outfall pipe into the Shannon Estuary. When stormwater storage is exceeded at the WWTP, overflows discharge via the same outfall arrangement. There is currently no stormwater capacity at Corcanree PS so flows that exceed the maximum pumping rate to the WWTP are screened and discharged directly to the Shannon Estuary. An OPW surface water drain is also located within the Pumping station. An overview of the site locations and discharge points can be seen in Figure 16-18.

### 16.4.2 Discharge Licence

The Environmental Protection Agency (EPA) issued a Wastewater Discharge Licence (WWDL), Register No. D0013-01, for the Limerick agglomeration on 13 August 2009, in accordance with the Wastewater Discharge (Authorisation) Regulations 2007 (as amended). The licence authorises the discharge of treated effluent from Limerick Wastewater Treatment Plant (WWTP) to the Shannon Estuary and specifies emission limit values (ELVs), monitoring requirements and operational conditions applicable to the agglomeration.

At the time of licence grant, the Licensee was Limerick City Council. In accordance with national water services reform, responsibility for public water and wastewater services subsequently transferred to Uisce Éireann (formally Irish Water) in 2014 via the Water Service Act. The licence was amended in December 2016 to reflect this change of Licensee and to update certain administrative and monitoring provisions.

Following the grant of planning permission by ACP, a proposal will be submitted to the EPA for a Licence Review to address the increased loading and incorporate the proposed ELVs.

The Emission Limit Values (ELVs) applicable to the primary discharge are set out in Schedule A of the licence and are presented in Table 16.11.

**TABLE 16-11: LIMERICK WWTP DISCHARGE LICENCE ELVS**

| Parameter | Emission Limit Value | |
|---|---|---|
| **pH** | 6 - 9 | |
| | mg/l | kg/day |
| **BOD** | 25 | 750 |
| **COD** | 125 | - |
| **Suspended Solids** | 35 | - |
| **Orthophosphates (as P)** | 6.5 | - |

### 16.4.3 EPA & WFD Compliance

Information obtained from Uisce Éireann Annual Environmental Reports (AERs) indicate the WWTP has a design organic capacity of 186,233 PE and a peak hydraulic capacity of 88,500 $m^3$/day. Peak weekly organic loads (~120,000 PE) remain within design capacity, but annual maximum hydraulic loadings (~116,000 $m^3$/day) approach or exceed peak design flows, occasionally resulting in operational pressure. Compliance with Emission Limit Values (ELVs) has historically included exceedances for COD, BOD, Suspended Solids, and nutrients, with the plant recording around 10–12 EPA-reportable incidents per year since 2020. The most recent report indicates that final effluent compliance was achieved throughout 2024, although hydraulic loading remains a limiting factor.

Operational water quality monitoring is undertaken at locations upstream and downstream of the WWTP outfall, namely upstream Limerick Main Drainage (u/s LMD) (TW36004129SN1002) and downstream Limerick Main Drainage (d/s LMD) (TW36004129SN1001). In addition, a WFD monitoring station (Limerick Dock – TW36004129SN1003) is located approximately 2.1 km upstream of the outfall. These monitoring locations, as shown in Figure 16-19, are used to assess ambient water quality in the vicinity of the discharge and to monitor for any changes that may be associated with WWTP operations. However, the modelling assessment presented in Volume 4 Appendix 16.3 is based on the dedicated survey data and model boundary conditions. The EPA monitoring data was therefore not used directly as model input data.

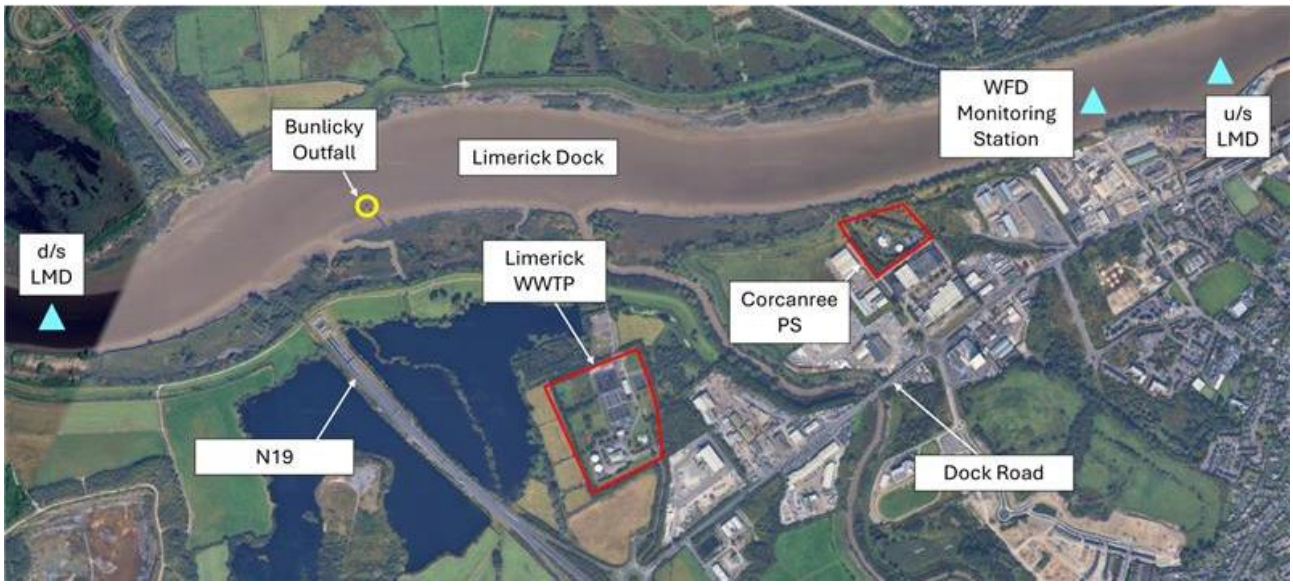


**FIGURE 16-19: MONITORING STATIONS AND OUTFALL LOCATION**

### 16.4.4 Stormwater Storage Capacity

The existing 7,500m$^3$ stormwater storage tank at the WWTP has limited capacity to manage excess flows from the drainage network during periods of heavy rainfall. The existing scenario, based on Stage 3 Drainage Area Plan (DAP) modelling and verified through TSR simulations undertaken by Egis, indicates an average of approximately 213 spill events per year from the stormwater overflows (SWOs) associated with the WWTP. These spills consist of screened storm flows discharged to the Shannon Estuary, which forms part of a designated Special Area of Conservation (SAC) under the Habitats Directive 92/43/EEC. The current frequency of spill events does not meet performance standards set out in the Urban Wastewater Treatment Directive (UWWTD) and Uisce Éireann Technical Standards, ensuing the need for additional storage capacity.

### 16.4.5 WWTP Outfall Arrangement

The Limerick Sewage outfall is located in the Upper Shannon Estuary with specific licenced details as follows;

| | |
|---|---|
| Primary Discharge Point Code: | DP1 |
| Location: | 153944E 156252N |
| WFD Code: | IE-SH-060-0900 |

The treated effluent travels 1.1 km from the main plant to the outfall point via a 1,200 mm diameter HDPE pipe. It is transported by gravity flow during low tide and pumped during high tide. The discharge is released via a submerged diffuser chamber located at the headwall of the outfall structure. It then flows along a gabion mattress that extends a further 20 meters into the main river channel. Details of the diffuser chamber and outlet structure can be seen in Figure 16-20 and Figure 16-21.

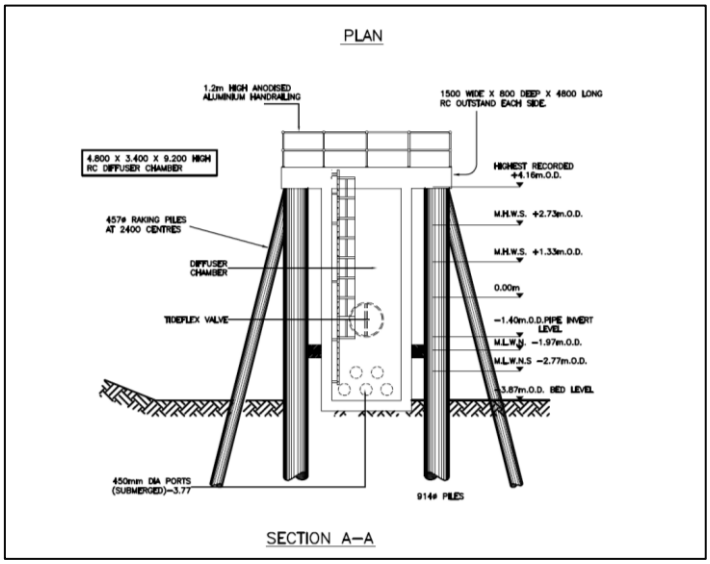


**FIGURE 16-20: THE DIFFUSER CHAMBER**


**FIGURE 16-21: OVERVIEW OF OUTFALL STRUCTURE**

## 16.5 The Proposed Development

### 16.5.1 Wastewater Treatment Plant Capacity Upgrade

As outlined in Chapter 3 (The Proposed Development) of this EIAR, the upgrade works will support growth demands in the agglomeration by improving the treatment processes at Limerick WWTP. The WWTP capacity upgrade element of the project will cater for the 10-year growth projections (Incl. 20% Headroom), extending the existing WWTP from 130,000PE to 285,000 PE. Additional capacity will be provided by a new Aerobic Granular Sludge (AGS) process stream with a capacity of up to 157,000PE. The new process stream will operate in parallel with the existing CAS system. The additional treatment capacity will facilitate domestic, commercial, and industrial future projected loadings, and it will ensure compliance with the requirements of UWWTD, WWDL and Uisce Éireann policies.

### 16.5.2 Stormwater Storage Capacity Upgrade

The Proposed Development includes the construction of a stormwater storage tank at Corcanree PS. The tank will be approximately 40m in diameter and 10–15m deep and will provide the additional stormwater storage capacity required to support the projected 25-year expansion to c. 325,000 PE, in accordance with UWWTD stormwater storage requirements. The total long-term storage requirement is calculated to be approximately 20,000m$^3$. As the existing stormwater holding tank at the WWTP provides 7,500m$^3$ of storage, the Proposed Development will deliver an additional minimum storage volume of 12,500m$^3$ at Corcanree PS.

During storm events, excess flows will be directed to the storage tank and retained until flows subside, then stormwater will be returned to the network at a controlled rate of 1 DWF for onward treatment at the WWTP. Any spills will pass through screening prior to discharge to the Shannon Estuary via the existing SWO chamber.

### 16.5.3 Regional Bioresource Centre (RBC)

The proposed Regional Bioresource Centre will be designed to treat indigenous sludge and imported sludges from Counties Limerick, Clare and Tipperary to the required Code of Good Practice standard for reuse of Biosolids in Agriculture, in alignment with the NWSMP. The current national strategy is to regionalise sludge treatment and achieve a Class A Biosolid through a combination of Anaerobic Digestion (AD) and heat treatment. Through Anaerobic Digestion, the plant can generate biogas, a source of renewable energy, which

will be used to generate electrical power for use on site and to produce heat which is required for the AD process. There will be liquor treatment plant for centrate returns from the RBC to the main treatment process works, so there will be minimal risk to ammonia overloading in the main treatment process.

### 16.5.4 Site Drainage and SuDS Design

A Technical Note has been prepared to set out the Sustainable Urban Drainage (SuDS) strategy for surface water management at the Limerick (Bunlicky) WWTP and Regional Bioresource Centre. The strategy has been informed by a site visit and topographical survey and has been developed in accordance with the principles of The SuDS Manual (C753) published by CIRIA, as well as the Limerick Development Plan 2022-2028.

The site is generally flat and located within an established industrial/commercial area, with ground levels falling gently towards the north-western boundary. It lies in proximity to the Shannon Estuary and is hydraulically connected to Bunlicky Lake via existing land drains. Soakaway testing undertaken in accordance with BRE Digest 365 confirmed that infiltration rates are insufficient to support infiltration-based SuDS features. Accordingly, a surface water management strategy based on attenuation and treatment, rather than infiltration, has been adopted.

Surface water runoff will be managed through a treatment system as follows:

- Permeable paving to hardstanding areas surrounding the new tanks and access routes, providing source control and initial treatment.
- Petrol interceptor to remove hydrocarbons from runoff prior to further conveyance.
- Dry swale to provide attenuation, filtration and additional water quality treatment before discharge to the pump sump.

Treated surface water will discharge via the final effluent chamber, prior to final discharge to the Shannon Estuary. Detailed drainage design information, including SuDS performance and hydraulic calculations, is provided in Appendix 3.1 in Volume 4 of this EIAR.

## 16.6 Potential Impacts

### 16.6.1 Do Nothing Scenario

The do-nothing scenario refers to what will happen if the Proposed Development is not implemented and the WWTP continues to operate at the current design PE.

The demands of population growth and industrial development within the agglomeration will result in hydraulic and organic loading increases at the WWTP. In the absence of the proposed capacity upgrades, the plant will become progressively overloaded and will fail to provide appropriate wastewater treatment. The treatment processes will operate beyond design capacity, and the discharge will pose a significant environmental risk to the Shannon Estuary, which is designated for conservation under the Habitats Directive 92/43/EEC (Commission of the European Communities, 2007). The WWTP would remain non-compliant with the EPA Wastewater Discharge Licence and associated legislative requirements.

As the agglomeration expands, additional impermeable surfaces will generate increased stormwater runoff volumes and peak flows within the combined sewer network. This may lead to more frequent and potentially higher-volume storm overflows, with a corresponding risk of deterioration in receiving water quality. The agglomeration would therefore remain non-compliant with the requirements of the Urban Waste Water Treatment Directive (UWWTD) and the proposed recast UWWTD in relation to stormwater management, and environmental incidents would likely continue to be reported in Annual Environmental Reports.

However, it is noted that future developments are expected to be implemented in accordance with Sustainable Drainage Systems (SuDS) principles. The application of SuDS and separate foul and surface water networks in new developments would help to attenuate runoff, reduce inflow to the combined sewer system, and mitigate the potential for storm overflow events.

The Regional Bioresource Centre (RBC) will not be constructed under the Do-Nothing scenario. Sludge management would continue via the existing sludge hub, with centrate returns to the main WWTP process remaining at current levels. Consequently, there will be no change in ammonia or hydraulic loading from sludge management activities compared to the current situation.

### 16.6.2 Construction Phase

#### 16.6.2.1 Limerick WWTP

Construction activities at Limerick WWTP have the potential to generate short-term impacts on receiving waters, primarily via the network of drains discharging to Bunlicky Lake. The proposed AGS works will directly intersect an existing land drain on the site, requiring careful management to prevent mobilisation of sediment or other pollutants into the drainage network during construction. Sediment, suspended solids, or accidental spills arising from excavation, earthworks, material handling, and vehicle movements could, if not properly controlled, be conveyed through these drains and temporarily affect water quality in Bunlicky Lake. A map illustrating the site layout, working areas, access routes, and existing drainage network is provided in the Planning Drawings.

Ground investigations indicate a moderate to high water table across the site, with levels approximately 5 m below ground in summer and saturated conditions in winter. Consequently, excavations will intersect groundwater, and dewatering may be required. Potential impacts associated with dewatering include mobilisation of suspended solids, transport of dissolved nutrients or other constituents into the drainage network, temporary lowering of local groundwater levels (drawdown), and alterations to local groundwater flow patterns.

Ballinacurra Creek, located approximately 200 m to the east of the site, is outside the immediate construction area, and the potential for impacts is considered very low to negligible. While indirect connectivity through perimeter drains could theoretically occur during extreme rainfall events, this risk is limited. The Shannon Estuary, approximately 0.5 km from the site, is not expected to experience any direct effects due to the intervening distance, and the nature of the proposed works.

In addition to potential runoff impacts, certain construction activities, particularly piling, compaction, and heavy vehicle movement, can give rise to localised ground vibration. In soft ground conditions, such vibration can mobilise fine sediments within drains or waterlogged soils, temporarily increasing turbidity if these materials enter the drainage network. These effects are expected to be short-lived, localised, and fully controllable with appropriate site management measures. Therefore, the impact is considered significant short term negative effect.

#### 16.6.2.2 Corcanree PS

The proposed storm tank excavation is located approximately 50m from the Shannon Estuary channel, within existing flood defence embankments that limit direct hydrological connectivity with the estuary. An OPW surface water drain is situated approximately 50m to the north-west of the excavation area and represents a potential pathway for indirect effects arising from construction activities.

A portion of the wider site, to the north-east, lies within a mapped coastal flood zone; however, the storm tank itself will not be constructed within this area. The presence of flood-prone lands in proximity to the works introduces the potential for interaction with elevated water levels during tidal surge or extreme rainfall events, particularly in relation to site access and movement of materials.

Ground investigations indicate that groundwater is encountered at approximately 5 m below ground level during summer conditions, with levels rising to saturation during winter months. Given the proposed excavation depth of approximately 10–15 m, works will extend significantly below the groundwater table and will require continuous dewatering throughout the excavation period.

Potential impacts associated with deep excavation and dewatering include mobilisation of fine sediments and entrained particulates, and transport of dissolved constituents. The required drawdown may result in temporary lowering of groundwater levels beyond the excavation footprint, with associated alteration of local

groundwater flow patterns and hydraulic gradients. These changes could influence nearby drainage features, including the OPW drain, and may introduce indirect pathways to the Shannon Estuary. Temporary groundwater drawdown may also affect surrounding soils and ground conditions in the vicinity of the works.

The installation of driven sheet steel piles using a vibratory method may result in temporary disturbance of saturated soils and short-term, localised changes in groundwater conditions in the immediate vicinity of the excavation.

While the proximity to the Shannon Estuary and the presence of shallow groundwater introduce potential pathways for impact during construction, any effects are anticipated to be temporary, localised, and reversible in nature. Therefore, the impact is considered significant short term negative effect.

### 16.6.3 Operational Phase

The main characteristics of the Proposed Development during the Operational Phase are as follows:

- WWTP treatment capacity will increase, therefore treated effluent outflow will increase.
- Site drainage and SuDs measures will be implemented.
- Quality of the treated effluent will improve with the reduced pressure on the existing system and new process stream in place.
- The additional 12,500m$^3$ stormwater storage capacity will greatly reduce uncontrolled spills to the Shannon Estuary.

#### 16.6.3.1 Future WWTP Discharges

Future wastewater loadings from the Limerick Agglomeration have been assessed in accordance with the National Development Plan, National Planning Framework and relevant UÉ policies. A detailed population assessment was carried out as part of a Feasibility Study in 2018 to establish the domestic, non-domestic and industrial contributions to the WWTP. This included a detailed review of load sources to the WWTP, annual growth rates, and headroom for future WWTP inflows. The population estimates were established using information from UÉ Asset Planning Team, Census results (2022), Limerick Local Area Development Plan (2009 to 2015), Geo-directory (2017) and UÉ Technical Guidance Notes (TGN).

To reaffirm the validity of the FSR and 2016 baseline figures, a review was carried out in 2024 using the following sources:

- Census results (2022);
- National Development Plan (NDP) 2025-2030;
- National Planning Framework; and
- Limerick Development Plan 2022 – 2028.

The WWTP upgrade will be implemented in 2 no. phases, the 10 year and 25-year design outlooks. Details of the phasing and Proposed Development are available in Chapter 3 of this EIAR. Characteristics of proposed future WWTP discharges are outlined in Table 16-12 below.

**TABLE 16-12: FUTURE DESIGN**

| Modelled Effluent Concentrations (at DWF) | | | 285,000PE / 10 Yr Design | 325,000PE / 25 Yr Design |
|---|---|---|---|---|
| BOD (mg/l) | MRP (mg/l) | DIN (mg/l) | DWF * 1.5 [m3/day] | DWF * 1.5 [m3/day] |
| 20 | 1 | 30 | 99,164 | 101,560 |

### 16.6.3.2 Water Quality Impacts & Mixing Zone Assessment

Modelling results for the depth-average concentrations and indicative water quality status are presented in the sections below for BOD, MRP and DIN. Model scenarios C05s (DIN only) and C06s are the focus in the assessment of future WWTP discharges, whereby;

- The scenarios depict the long term 25-year population design horizon of 325,000PE for WWTP discharges.
- They include combined inputs from Castletroy and Shannon Town WWTPs.
- Summer conditions are deemed to be most critical in terms of water quality impacts due to high receiving water temperatures enhancing microbial activity and low flows in the estuary channel limit mixing capacity for the WWTP discharge.
- ELVs for BOD and MRP that will be achieved by the upgraded WWTP treatment process and proposed in the licence review application are applied.
- The assessment considers the spatial extent of predicted indicative water quality status exceedance in the context of the receiving waterbody, including the relative scale of the mixing zone.
- The location of the mixing zone is considered in relation to WFD monitoring points used for waterbody classification; the nearest monitoring station is located approximately 2.1 km upstream of the outfall.
- The assessment also takes account of designated sites within the receiving environment, including the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA, to ensure that localised exceedance does not affect conservation objectives.

For clarity, the classifications presented for individual parameters including BOD, DIN and MRP, are modelled indicative quality classifications only. They relate to the specific quality element assessed and do not represent the overall WFD status of the waterbody.

Results are presented as contoured map plots and summary tables, showing the spatial variation of the analysed water quality parameters based on their depth-averaged concentrations over a spring-neap tidal cycle. The following outputs are provided for each parameter:

Concentration Plots – present the concentration in mg/l in each grid cell over the model domain. The concentration represents the relevant statistical measure required under the specific parameter EQS, e.g. 95$^{th}$ percentile for BOD, median for DIN and MRP. These plots provide an overview of the distribution of concentration of each parameter around the WWTP outfall.

Indicative Quality Plots – present contours of the indicative EQS class in each model cell. Indicative quality is determined by comparing the modelled concentration with the relevant statistical EQS threshold to determine its class (e.g. 1='High', 2='Good', 3='Moderate') for 95$^{th}$ percentile for BOD, and median for DIN and MRP and delineate the class boundaries. These plots provide an indication of the extent of the mixing zone where the EQS is not met for each of the water quality parameters. The EQSs published in the Surface Water Regulations Ireland (amended 2019) do not provide thresholds for 'Poor' or 'Bad' class; therefore, the plots present only 'High' (blue), 'Good' (green) and 'Moderate' (yellow) classes.

Summary tables support the plots by providing the streamwise extent of the mixing zone for each parameter, showing the distance over which concentrations correspond to the relevant EQS classes. They provide a concise overview of how parameter concentrations disperse from the WWTP outfall and demonstrate whether they remain within the allowable mixing zone for the waterbody.

#### BOD

In the Limerick WWTP upgrade scenarios (C02s–C05s) (see Volume 4 - Appendix 16.3 Modelling Report for details of scenarios), the ambient BOD concentration in the estuary (i.e. concentrations not influenced by the Limerick WWTP) increases by approximately 0.7 mg/l across all scenarios, while remaining within 'High' EQS status. An increase in BOD concentration of more than 2.5 mg/l is observed only near the WWTP outfall, which leads to the increase in the extent of the zone with 'Moderate' indicative water quality to 120 m.

The streamwise extent of the 'Good' indicative water quality zone also increases from 110 m in the existing situation to 270-290 m in the upgrade scenarios

In the combined upgrade scenario (C06s), which includes improvements at multiple WWTPs and reduced BOD concentrations at the outfall, conditions are comparatively improved (Figure 16-22). The increase in background BOD concentrations is lower (approximately 0.5 mg/l), and the extent of the 'Good' indicative water quality zone is reduced relative to C05, extending to approximately 170 m in the downstream direction compared to approximately 290 m in the C05 scenario.

The predicted mixing zone is therefore limited in extent for this waterbody. When considered in the context of the receiving environment, the mixing zone represents only a very small proportion of the 160 m channel width and overall extent of the Shannon Estuary.

Model results indicate that elevated BOD concentrations are confined to the immediate vicinity of the outfall and remain localised under tidal conditions, without significant upstream or downstream propagation. Background BOD levels remain at 'High' status in the wider estuary and are not impacted by the localised increase in concentrations within the mixing zone.

In the context of WFD objectives and designated sites within the Shannon Estuary, the limited and localised extent of the predicted mixing zone indicates no potential to affect waterbody status or conservation objectives, consistent with the assessment framework.

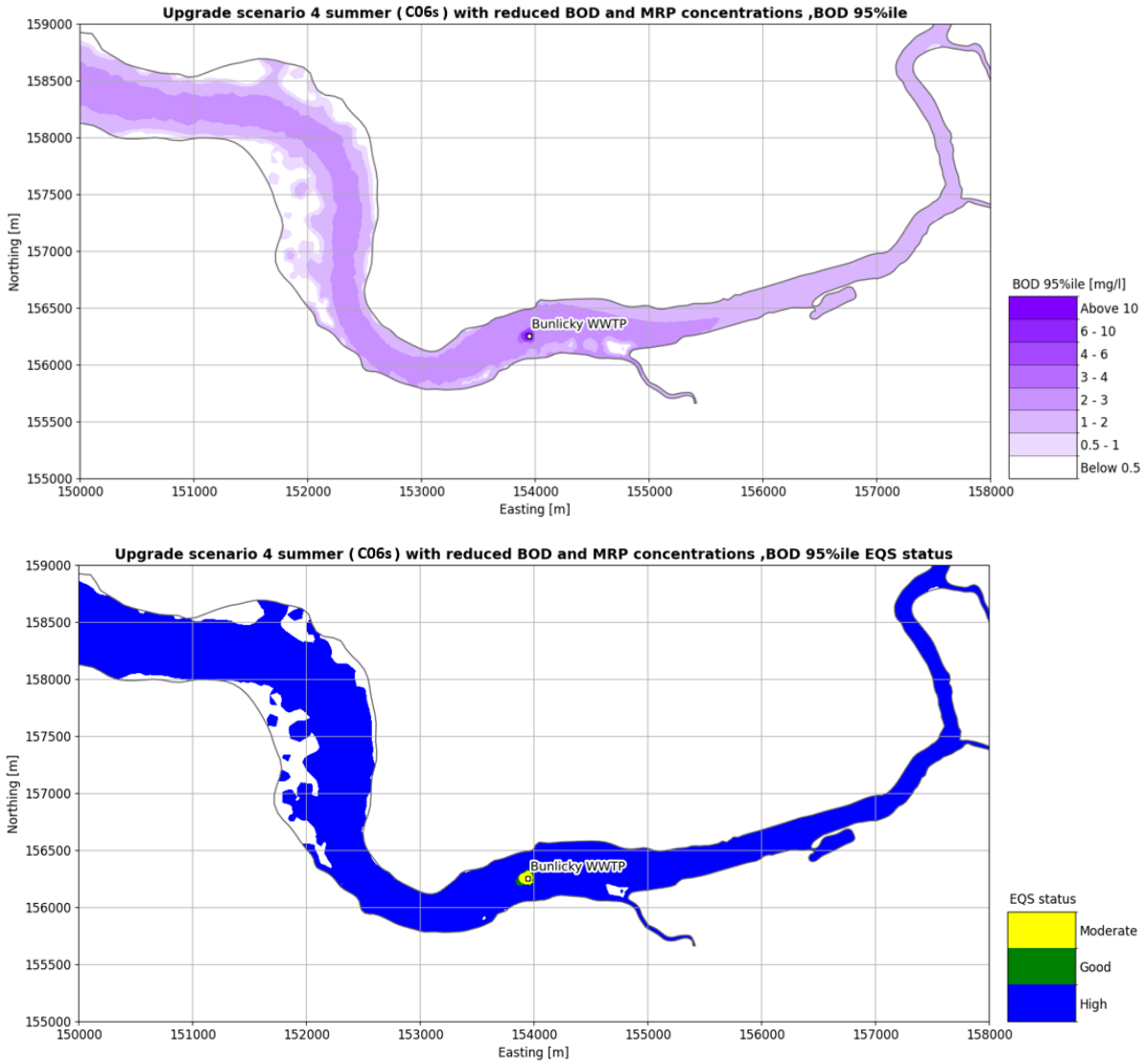


**FIGURE 16-22: DEPTH-AVERAGE CONCENTRATION OF BOD 95%ILE (UPPER PANEL) AND INDICATIVE QUALITY PLOT (LOWER PANEL) FOR FUTURE SITUATION (SUMMER).**

**TABLE 16-13: MIXING ZONE ASSESSMENT BOD**

| Model scenario | Mixing Zone Length | | Relative of total length Shannon Estuary (~100km) | |
|---|---|---|---|---|
| | 'Good' status | 'Moderate' status | 'Good' status | 'Moderate' status |
| A01s (Existing) | 110 m | 70 m | 0.1% | 0.1% |
| C06s (Future) | 170 m | 120 m | 0.2% | 0.1% |

## DIN

In the upgrade scenarios for Bunlicky WWTP (C02s–C05s) (see Volume 4 - Appendix 16.3 Modelling Report for details of scenarios), DIN concentrations in the immediate vicinity of the outfall exceed the non-regulatory DIN EQS threshold for 'Good' status of 2.6 mg/l at 0 psu. However, the extent of the resulting 'Moderate' status mixing zone is limited, extending approximately 50–80 m from the outfall depending on the scenario.

Further from the outfall, DIN concentrations increase by approximately 0.35–0.55 mg/l. The spatial extent of 'Good' indicative water quality in all upgrade scenarios increases to approximately 8–10 km downstream of the outfall, indicating an overall improvement in water quality conditions away from the immediate discharge area (Figure 16-23).

The predicted mixing zone is therefore highly localised. In the context of the receiving environment, the area of 'Moderate' status is confined to a very limited zone immediately adjacent to the outfall and represents a negligible proportion of the 160 m channel width and the overall extent of the Shannon Estuary (Table 16-14).

Model results indicate that elevated DIN concentrations are confined to the immediate vicinity of the outfall and remain localised under tidal conditions, without significant upstream or downstream propagation. Background DIN levels remain at 'Good' status in the wider estuary and are not impacted by the localised increase in concentrations within the mixing zone.

In the context of WFD objectives and designated sites within the Shannon Estuary, the limited and localised extent of the predicted mixing zone indicates no potential to affect waterbody status or conservation objectives, consistent with the assessment framework.

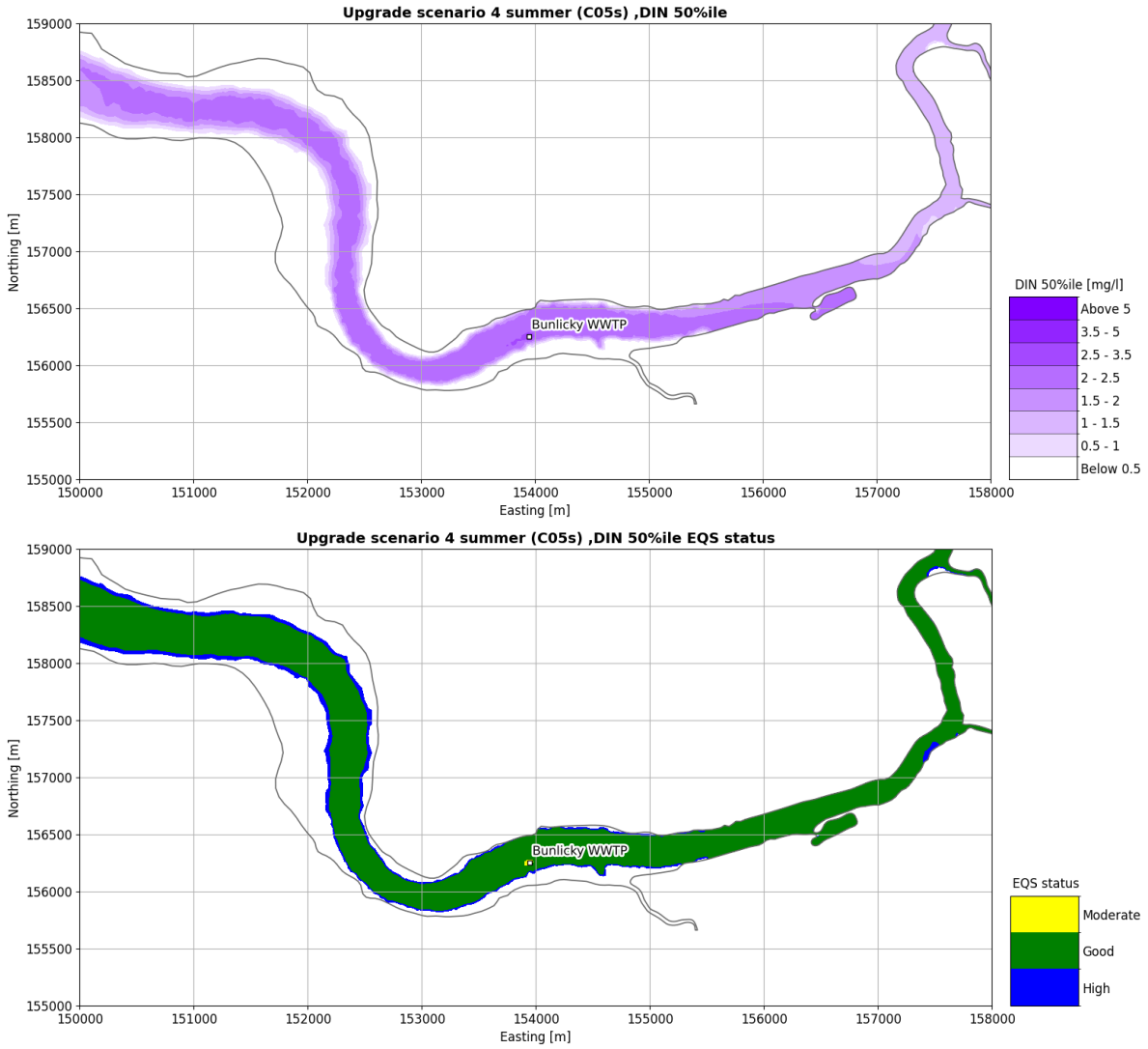


**FIGURE 16-23: DEPTH-AVERAGE CONCENTRATION OF DIN 50%ILE (UPPER PANEL) AND INDICATIVE QUALITY PLOT (LOWER PANEL) FOR FUTURE SITUATION (SUMMER).**

**TABLE 16-14: MIXING ZONE ASSESSMENT DIN**

| Model scenario | Mixing zone length | Relative of total length Shannon Estuary (~100km) | | |
|---|---|---|---|---|
| | 'Good' status | 'Moderate' status | 'Good' status | 'Moderate' status |
| A01s (Existing) | >8 km | - | 8.0% | - |
| C05s (Future) | >10 km | 80 m | 10.0% | 0.1% |

## MRP

In the future C06s scenario, with the combined upgrade of the WWTPs, there is a significant reduction in MRP concentrations associated with the improved ELVs applied at the WWTP (Figure 16-24) (Table 16-15). Concentrations in the vicinity of the outfall decrease from approximately 0.16 mg/l in the existing situation to approximately 0.07 mg/l. The extent of the area corresponding to 'Moderate' status is substantially reduced from approximately 16 km in the existing scenario to a localised mixing zone of approximately 510 m.

The predicted mixing zone is therefore significantly reduced in extent. When considered in the context of the receiving environment, the area of 'Moderate' status is confined to a localised zone adjacent to the outfall extending approximately 510 m from the outfall, while most of the Shannon Estuary remains within 'Good' EQS status.

Model results indicate that elevated MRP concentrations are confined to the immediate vicinity of the outfall and remain localised under tidal conditions, without significant upstream or downstream propagation. The extent of 'Good' status within the wider estuary remains largely unchanged, reflecting background concentrations in the receiving water.

In the context of WFD objectives and designated sites within the Shannon Estuary, the reduction in the spatial extent and magnitude of the mixing zone indicates an improvement in water quality conditions. Overall, effects on water quality are assessed as not significant (neutral to slight positive impact) in accordance with EPA (2022) Environmental Impact Assessment Report guidance terminology, as there is no predicted deterioration in waterbody status and a localised improvement in pollutant concentrations is evident.

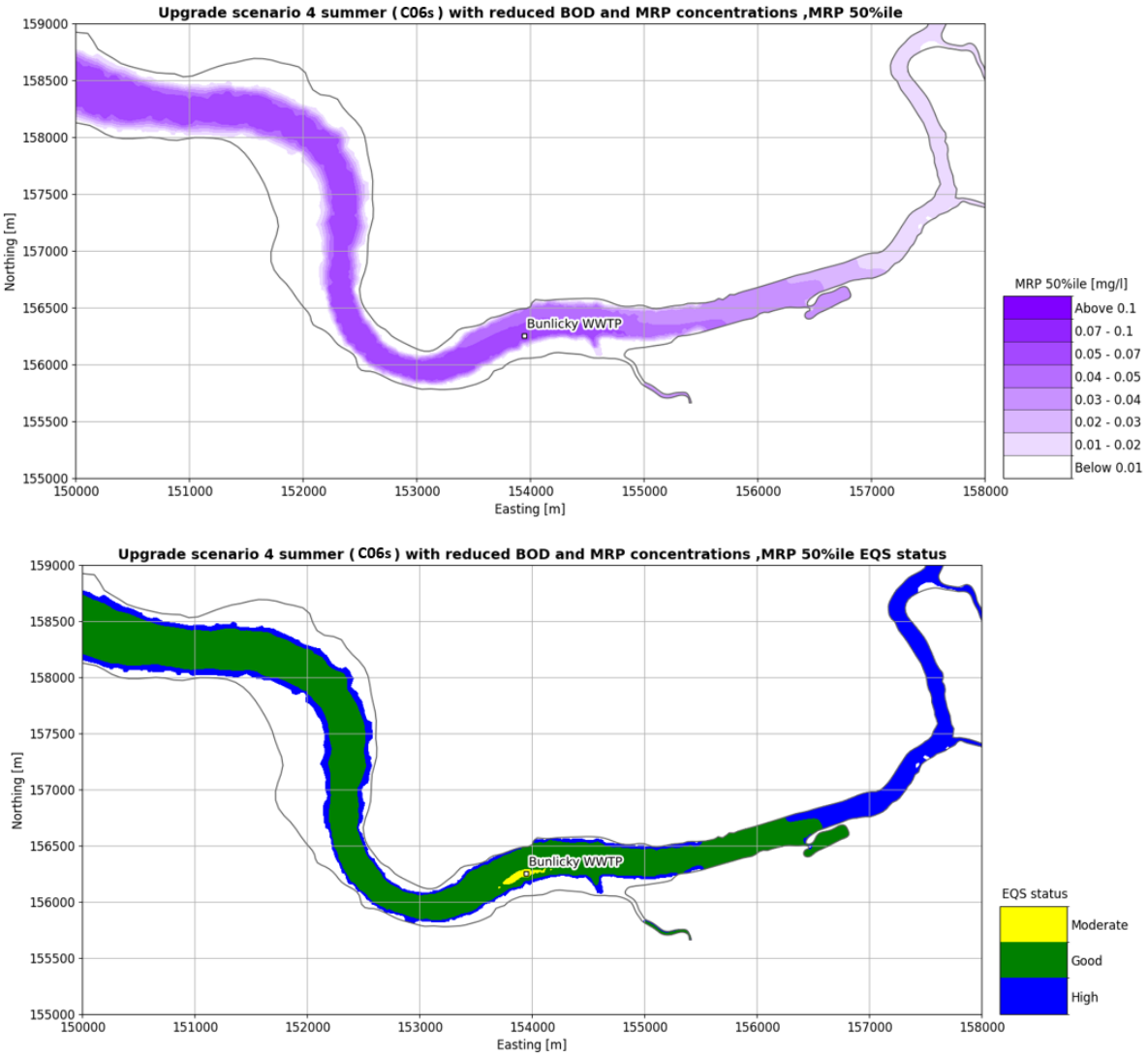


**FIGURE 16-24: DEPTH-AVERAGE CONCENTRATION OF MRP 50%ILE (UPPER PANEL) AND INDICATIVE QUALITY PLOT (LOWER PANEL) FOR FUTURE SITUATION (SUMMER).**

**TABLE 16-15: MIXING ZONE ASSESSMENT MRP**

| Model scenario | Mixing zone length (Modelled extent achieving) | | Relative of extent Shannon Estuary (~100km) achieving | |
|---|---|---|---|---|
| | 'Good' status | 'Moderate' status | 'Good' status | 'Moderate' status |
| A01s (Existing) | 25.5 km | 16 km | 25.5% | 16.0% |
| C06s (Future) | 25.2 km | 510 m | 25.2% | 0.5% |

*Note: The modelled MRP indicative quality extents are influenced by existing ambient/background MRP concentrations within the estuary and should not be interpreted as the spatial extent of impact from the WWTP discharge alone. The comparison between the existing scenario (A01s) and future improved treatment scenario (C06s) indicates that the extent of 'Moderate' indicative quality reduces from approximately 16 km to 510 m, reflecting the benefit of the proposed improved MRP treatment standard.*

#### 16.6.3.3 Stormwater Management

A Time Series Rainfall (TSR) assessment was undertaken by EGIS using the future hydraulic model configuration to evaluate the potential frequency and volume of stormwater spills under the proposed development scenario. The assessment was based on the preferred option, which includes additional stormwater storage at Corcanree Pumping Station (PS) and an increased Pass Forward Flow (PFF) to the Limerick WWTP.

The current baseline scenario was derived from Stage 3 Drainage Area Plan (DAP) modelling developed by Uisce Éireann and verified through the TSR simulations, which showed comparable spill frequency and volume under existing conditions.

The baseline assessment indicates that stormwater overflow (SWO) discharges currently occur at both Corcanree and WWTP. Spill frequencies are estimated at approximately 68 per annum at Corcanree and 145 per annum at the WWTP. Total spill volumes are estimated at approximately 5.6% (Corcanree) and 11.1% (WWTP) of annual dry weather flow (DWF).

The TSR model incorporated the proposed 12,500 $m^3$ stormwater storage tank at Corcanree PS, existing storage capacity at the WWTP, and upgraded pumping arrangements designed to optimise hydraulic performance and manage flows efficiently during extreme rainfall events. Simulations used a projected future loading of 325,000 population equivalent (PE) to represent the long-term operational design of the system.

The inclusion of the Corcanree stormwater storage tank and associated pumping and control upgrades results in a substantial reduction in both spill frequency and volume. Under the Committed Works scenario, total spill volumes are reduced to approximately 1–2% of annual DWF, with spill frequencies decreasing to approximately 5 per annum at Corcanree and 26 per annum at the WWTP on commencement of operation (Day 1). This represents a significant improvement in system performance and is sufficient to ensure compliance with the requirements of the rUWWTD.

Higher spill frequencies of up to approximately 9 per annum at Corcanree and 79 per annum at the WWTP represent a potential longer-term scenario in the absence of further upstream interventions. However, these conditions are not expected to occur in practice, as planned Stage 4 improvements will be implemented in the wastewater network over time and ahead of future design growth being realised, resulting in further reductions in spill frequency and volume.

Stage 4 DAP modelling, incorporating additional upstream improvements, demonstrates a further enhancement in system performance over the longer term. Spill volumes are reduced to approximately 0–1.4% of annual DWF, with spill frequencies decreasing to 14–16 per annum at Corcanree and 0–7 per annum at the WWTP.

Minor differences are evident between the future predictions results from the Limerick WWTP TSR hydraulic modelling and the Stage 4 DAP modelling. While the predicted spill frequencies at Corcanree are broadly consistent, the TSR simulations indicate a slightly higher frequency at the WWTP, although the predicted annual spill volume remains relatively low. These differences are attributed to minor hydraulic instabilities within the dynamic model simulations, including sensitivity to timestep resolution, control logic, and storm sequencing. Notwithstanding these variations, both modelling approaches demonstrate a significant reduction in spill frequency and volume relative to the baseline.

A summary of the storm overflow modelling results for the current baseline, Committed Works (Day 1 of operation), and Stage 4 upgrade scenarios is presented in Table 16-16. The results are based on the Stage 3 and Stage 4 Drainage Area Plan (DAP) models, which form the basis for design and assessment of system performance. The table provides a comparison of spill frequency and volume at Corcanree Pumping Station and the WWTP and details the predicted SWO spill frequencies and volumes of the proposed development and further improvement under long-term upgrades.

**TABLE 16-16: MODEL OUTPUTS - CURRENT V'S FUTURE SCENARIO (SIGNIFICANT SPILL≥50M³)**

| Model Scenario | Location | Spills per Annum | Spill Volume (m3/Annum) | Spill Volume (% of DWF) | Compliance |
|---|---|---|---|---|---|
| Current Baseline | Corcanree PS | 68 | 725,637 | 5.60% | Non-compliant |
| | Limerick WWTP | 145 | 1,730,913 | 11.10% | Non-compliant |
| Committed Works Model (Day 1 of operation) | Corcanree PS | 5 | 101,576 | 1.0 | Compliant |
| | Limerick WWTP | 26 | 122,000 | 0.8 | Compliant |
| Stage 4 Upgrades | Corcanree PS | 16 | 295,725 | 1.4 | Compliant |
| | Limerick WWTP | 0 | 0 | 0.0 | Compliant |

#### 16.6.3.4 Surface Water Run-off

Surface water runoff from the proposed development will be managed in accordance with Sustainable Drainage Systems (SuDS) principles to control runoff, manage water quality and protect receiving waters. The proposed SuDS measures, as outlined in Section 16.5.4, from an integrated management system consistent with best practice guidance and relevant planning and environmental standards.

Therefore, there will be no effect on the flood zone or receiving water quality due to surface water run-off during the Operational Phase.

Further details of the drainage design are available in the SuDS Technical Note in Appendix 3.1 in Volume 4 of this EIAR.

#### 16.6.3.5 Flood Risk

There are no other activities during the Operational Phase that will affect the risk of flooding. In the event of a flood occurring mitigation will be in place. Operational flood mitigation measures are discussed further in Section 16.7.2.

#### 16.6.3.6 Summary of Operational Impacts

Discharges from the upgraded Limerick WWTP, based on the 325,000 PE design horizon, will result in a localised increase in concentrations of BOD and DIN in the immediate vicinity of the outfall. WFD 'Good' status is achieved within approximately 120 m for BOD and 50–80 m for DIN. These effects are confined to a very small

area relative to the scale of the Shannon Estuary and do not influence water quality in the wider waterbody, where background conditions remain the dominant control on status.

A significant improvement in MRP concentrations is predicted as a result of the upgraded treatment process and reduced discharge ELVs. Concentrations in the vicinity of the outfall decrease from approximately 0.16 mg/l under existing conditions to approximately 0.07 mg/l, with the extent of 'Moderate' status reduced from approximately 16 km to a localised mixing zone of approximately 510 m.

The assessment of mixing zones considers both compliance and the position of the plume within the receiving environment. The predicted extent of EQS exceedance remains localised under tidal conditions and is not of a scale that would influence WFD monitoring locations or affect waterbody classification. While the discharge is located within the Shannon Estuary SAC and SPA, the limited spatial extent of the mixing zone indicates no potential to affect conservation objectives.

The proposed upgrade works also include additional stormwater storage at Corcanree Pumping Station and associated pumping and control improvements. These measures will significantly reduce the frequency and volume of untreated storm overflows and will bring the agglomeration into compliance with the requirements of the recast Urban Wastewater Treatment Directive from commencement of operation.

Overall, the predicted impacts are localised and consistent with WFD objectives and the protection of designated sites. On this basis, and in accordance with EPA Guidelines (2022), the Proposed Development is considered to result in a **long-term imperceptible to neutral** impact on water quality, i.e. an effect that alters the character of the environment without affecting its sensitivities.

## 16.7 Mitigation and Monitoring Measures

### 16.7.1 Construction Phase

Construction at the Limerick WWTP and Corcanree PS will be managed under a Construction Environmental Management Plan (CEMP), which sets out all measures to protect water quality, manage runoff and dewatering, control sediment, and prevent accidental spills. The CEMP provides the framework for implementing site-specific controls and ensuring consistent best-practice management throughout the construction phase.

The lake's role as a settlement basin and regulated outflow to the Shannon Estuary supports its capacity to buffer minor, short-term construction-related effects, provided best-practice controls are implemented and maintained.

The Project Manager has overall responsibility for the CEMP, ensuring that all mitigation measures are implemented, monitored, and maintained throughout the construction phase. Subcontractors will be required to comply fully with the CEMP and may prepare detailed method statements to demonstrate how they will implement the prescribed controls in their areas of work.

An Ecological Clerk of Works (ECoW) and the independent Project Supervisor for the Construction Stage (PSCS) will provide oversight and coordination across all contractors. The ECoW will ensure that ecological and hydrological protections are followed, particularly near Bunlicky Lake, Ballinacurra Creek, and the Shannon Estuary, while the PSCS will coordinate health and safety aspects associated with the environmental measures.

This management structure ensures that all mitigation measures are applied effectively, minimising the risk of impacts on sensitive waterbodies. The following sections present the detailed mitigation measures for each site.

#### 16.7.1.1 Limerick WWTP

**Dewatering and Surface Water Management**

- All surface water, construction runoff, and excavation groundwater shall be fully contained and managed in a controlled system. No uncontrolled discharge to ground, drainage channels, or the receiving environment is permitted.

- Excavation groundwater and surface water runoff shall be collected in lined sumps and pumped to mobile settlement tanks or equivalent treatment systems to allow suspended solids to settle prior to discharge.
- Temporary surface drains and bunds shall be lined to prevent infiltration and interaction with groundwater.
- Pumping and treatment systems shall be sized to manage combined excavation groundwater and surface runoff, including rainfall events up to the 1-in-30-year return period intensity, and maintained to prevent overtopping or system failure.
- Dewatering shall be undertaken in a controlled manner to manage groundwater drawdown to minimise hydraulic gradients, sediment mobilisation, or instability within the excavation.
- Groundwater levels shall be monitored during dewatering to verify that drawdown remains localised to the excavation area and does not adversely affect surrounding soils or structures.
- Final treated water shall meet a Suspended Solids limit of <35 mg/L prior to discharge.
- Water quality monitoring shall be undertaken at the treatment system outlet, with daily visual inspections and routine sampling as agreed.
- Treated water shall be discharged to the existing WWTP final effluent chamber and subsequently to the Shannon Estuary.
- All dewatering infrastructure (sumps, pumps, pipework, tanks) shall be inspected weekly and following significant rainfall events, with records maintained.
- The ECoW has the authority to suspend pumping immediately if suspended solids limits are exceeded or if any control measure fails, and all inspections, maintenance, and corrective actions shall be fully documented.

**Drainage Protection and Sediment Control**

- The contractor shall identify and map all existing drainage features prior to works commencing and protect them with temporary fencing and targeted silt control measures where they interface with construction areas.
- Silt fences shall be supported by timber posts and geotextile buried in an 'L' configuration to a minimum depth of 250 mm.
- Targeted silt fencing and sediment control measures shall be installed at locations where sediment mobilisation risk is identified during weekly or post-rainfall (>10 mm) inspections. Continuous perimeter fencing is not required due to full containment of surface water and the protected nature of drainage features.
- Construction works shall be sequenced to minimise exposed soil, ensuring no disturbed area remains uncovered for more than 7 days. Exposed areas where works are paused or completed shall be stabilised or covered to prevent sediment mobilisation.
- Temporary stockpiles shall be located within the active construction footprint, at least 20 m from drainage features, and managed with bunding, covers, or perimeter silt fencing to prevent erosion and runoff into drainage pathways.
- Drainage protection and sediment controls shall be inspected weekly by the Project Supervisor, and within 24 hours after rainfall events exceeding 10 mm, with any damaged or ineffective controls repaired or replaced within 48 hours.
- Where reasonably possible, bulk earthworks shall be scheduled during drier months (April–September) to reduce sediment generation.
- The Project Supervisor and ECoW shall oversee all inspections, verify compliance with sediment control measures, and review corrective actions to ensure that drainage features and the receiving water environment remain protected throughout construction.

**Pollution Prevention and Spill Management**

- Designated bunded areas shall be provided for refuelling, plant maintenance, and fuel/chemical storage, located at least 10 m from drainage features.
- Oils and fuels shall be stored in bunded tanks providing 110% retention capacity.
- No refuelling shall occur within 10 m of the excavation perimeter or drains, and vehicles must not be left unattended during refuelling.
- Spill kits, absorbent materials, and oil containment booms shall be available on-site, proportionate to the volume of materials stored, with staff trained in their correct use.

- Cementitious and hazardous materials shall be handled in designated areas at least 5 m from drainage features or the excavation, with controlled washout procedures to prevent discharge.
- An Emergency Spill Response Plan shall be implemented and maintained, including contact details for relevant statutory bodies, and made accessible to all site personnel.
- All spill response equipment shall be maintained in fully operational condition at all times.
- Weekly inspections of storage areas, bunds, and spill response equipment shall be undertaken by the Project Supervisor, with verification by the ECoW, and all inspections, maintenance, and corrective actions documented.

**Piling and Groundwater Controls**

- Excavation and piling for the AGS tank shall use low-vibration methods, with no hard rock expected, to minimise disturbance to saturated soils and surrounding groundwater.
- Temporary drainage protection measures (silt fences, sediment traps) shall be inspected and maintained to ensure any vibration-mobilised sediments are captured at source.
- Targeted monitoring of water quality and drainage features shall be undertaken during piling to verify that any mobilisation of sediments, changes in groundwater levels, or temporary hydraulic gradients remain localised and controlled.
- Drainage features, sediment controls, and water-sensitive areas shall be inspected by the Project Supervisor, with verification by the EcOW. Any failures or breaches shall be corrected immediately and fully documented.

#### 16.7.1.2 Corcanree PS

**Dewatering and Surface Water Management**

- All excavation groundwater and surface water runoff shall be fully contained and managed in a controlled system. No uncontrolled discharge to ground, drainage features, or the receiving environment shall occur.
- Groundwater abstracted during excavation shall be collected in lined sumps and pumped to mobile settlement tanks or equivalent treatment systems to remove suspended solids prior to discharge.
- Pumping and treatment systems shall be sized at detailed design stage to manage combined groundwater inflows and surface runoff, including rainfall events up to the 1-in-30-year return period intensity, and shall be maintained to prevent overtopping or system failure.
- Dewatering shall be undertaken in a staged and controlled manner to manage groundwater drawdown, minimise excessive hydraulic gradients, and reduce the risk of sediment mobilisation or instability within the excavation.
- Groundwater levels shall be monitored during dewatering to verify that drawdown remains localised to the excavation area and does not adversely affect surrounding soils or structures.
- Final treated water shall meet a Suspended Solids limit of <35 mg/L prior to discharge.
- Treated water shall be discharged to the storm overflow chamber and subsequently to the Shannon Estuary via the existing controlled outfall.
- Water quality monitoring shall be undertaken at the treatment system outlet, with daily visual inspections and routine sampling as agreed.
- All dewatering infrastructure (sumps, pumps, pipework, tanks) shall be inspected weekly and following significant rainfall events, with records maintained.
- The EcOW has the authority to suspend pumping immediately if suspended solids limits are exceeded or if any control measure fails, and all inspections, maintenance, and corrective actions shall be fully documented.

**Drainage and Sediment Control**

- All existing drainage features, including the OPW drain located approximately 50 m north-west of the excavation area, shall be identified and clearly demarcated prior to commencement of works.
- Temporary protective fencing shall be installed along the eastern and northern site boundaries to prevent encroachment, trafficking, or accidental discharge toward the OPW drain.

- Localised silt fencing and sediment control measures shall be installed at points where construction activities interface with drainage pathways or where there is a risk of sediment migration. Continuous perimeter buffering is not required given the site layout and flood defence embankments.
- Exposed soils shall be minimised through sequencing of works. Areas not actively under construction shall be stabilised as soon as practicable.
- Stockpiles shall be located within the active construction footprint, at least 15 m from any watercourse, and managed to prevent erosion, including bunding, covering, or temporary stabilisation during heavy rainfall.
- Sediment control measures shall be inspected weekly by the Project Supervisor, with daily checks by the ECoW in high-risk areas such as near drainage features, steep benches, or stockpiles. Any ineffective controls shall be repaired immediately, and all inspections and corrective actions documented.

**Pollution Prevention and Spill Management**

- Refuelling, plant maintenance, and fuel/chemical storage shall take place within designated bunded areas located at least 10 m from drainage features and outside the mapped flood zone.
- Oils and fuels shall be stored in bunded tanks providing 110% retention capacity.
- No refuelling shall occur within 10 m of the excavation perimeter or drains, and vehicles must not be left unattended during refuelling.
- Spill kits and absorbent materials shall be available on-site at all times, proportionate to the volume of materials stored, with staff trained in their correct use.
- Cementitious and hazardous materials shall be handled in designated areas at least 5 m from drainage features or the excavation, with controlled washout procedures to prevent discharge.
- An Emergency Spill Response Plan shall be implemented and maintained for the duration of the works, including contact details for relevant statutory bodies.
- All spill response equipment shall be maintained in fully operational condition at all times.
- Weekly inspections of storage areas, bunds, and spill response equipment shall be undertaken, with verification by the ECoW, and all records of inspections, maintenance, and corrective actions shall be documented.

**Piling and Groundwater Controls**

- Excavation and sheet pile installation for the storm tank shall use low-vibration methods to minimise disturbance to saturated soils and surrounding groundwater conditions.
- Sumps and sediment traps shall be inspected and secured prior to piling works and maintained throughout construction to ensure any mobilised sediment is captured at source.
- Targeted monitoring of water quality and drainage features shall be undertaken during piling to verify that any mobilisation of sediments or changes in groundwater conditions remain temporary and localised.
- Drainage features, sediment controls, and water-sensitive areas shall be inspected by the Project Supervisor, with verification by the ECoW. Any failures or breaches shall be corrected immediately and fully documented.

**Flood Risk Management**

- Stockpiles, plant and hazardous materials will be managed and stored in designated areas to minimise the risk of flood-related damage or pollution.
- Deployable measures such as portable bunds, sandbags, or silt fencing shall be installed if weather forecasts or river level monitoring indicate potential flooding.
- Drains, sumps, and pumping systems shall be maintained to ensure that any incidental water does not cause uncontrolled release or damage.
- Flood risk mitigation shall be inspected daily by the Project Supervisor, with review and verification by the ECoW where the area is in use. Any observed risk, breach, or failure shall be addressed immediately, and all actions recorded.

### 16.7.2 Operational Phase

During operation, the Limerick WWTP and Corcanree PS will implement measures to maintain water quality and protect Bunlicky Lake, Ballinacurra Creek, and the Shannon Estuary. Key measures include:

- **Wastewater treatment and discharge:** Ensure all treated effluent meets licence requirements, maintain storm tanks and pumps, and monitor effluent quality.
- **Stormwater management:** The new stormwater storage tank at Corcanree PS will increase storage capacity, reducing the risk of untreated storm spills to the Shannon Estuary. This brings the agglomeration into compliance with relevant legislation.
- **Surface water and drainage management:** Inspect and maintain all drainage systems, including perimeter drains and temporary attenuation features. Implement Sustainable Drainage Systems (SuDS) measures where practicable to manage runoff. Maintain sediment controls, manage vegetation, and control runoff from hardstanding areas.
- **Groundwater and flood management:** At Limerick WWTP, the FRA confirms flooding does not extend within the site. At Corcanree PS, the stormwater tank will be submerged (~10–15 m), with the top wall of the tank set at a minimum of 5.10 mOD to prevent flood water ingress, including allowances for climate change and freeboard.
- **Pollution prevention and spill control:** Store chemicals and fuels in bunded areas, maintain spill kits, and provide staff training in spill response.
- **Sediment and erosion control:** Stabilise exposed soils and stockpiles and maintain access routes to minimise sediment transport.
- **Monitoring and reporting:** Conduct routine water-quality monitoring, maintain operational logs, and report to regulatory authorities.
- **Training and procedures:** Provide environmental training, maintain Standard Operating Procedures (SOPs), and update practices based on monitoring and regulatory requirements.

## 16.8 Residual Effects

### Construction Phase:

With the implementation of the proposed mitigation measures, no significant residual effects are predicted on Bunlicky Lake, Ballinacurra Creek or the Shannon Estuary. Coordination of the Construction Environmental Management Plan (CEMP) by the Project Manager, Ecological Clerk of Works (EcoW) and Project Supervisor for the Construction Stage (PSCS) will ensure that potential effects on the water environment are appropriately managed and mitigated. Therefore, the residual impact during construction is considered negligible short-term negative effects.

### Operational Phase:

During operation, a positive residual impact on receiving waters in the Shannon Estuary is predicted. This will arise from reduced uncontrolled stormwater spills due to the provision of the new stormwater storage tank at Corcanree Pumping Station, improved effluent quality from the upgraded treatment process, and enhanced management of site drainage through Sustainable Drainage Systems (SuDS). Collectively, these measures will provide long-term improvements to water quality and hydrological management within the catchment. Therefore, the residual impact during operation is considered significant long-term positive effects.

## 16.9 Cumulative Impacts and Interactions

A review of other permitted and proposed developments in the wider study area has been undertaken to identify the potential for cumulative impacts on the water environment, including surface water quality, hydrology and flood risk. The assessment considers projects within the vicinity of the Limerick WWTP and Corcanree Pumping Station, as well as strategic infrastructure proposals within the Shannon Estuary catchment.

### 16.9.1 Castletroy WWTP Upgrade

Castletroy WWTP is located approximately 10 km upstream of Limerick WWTP and discharges to the River Shannon. An upgrade of the plant is proposed to increase treatment capacity and provide additional stormwater storage. As the plant is located upstream, its discharge has the potential to influence background water quality conditions within the Shannon Estuary and therefore forms part of the cumulative assessment.

Discharges from Castletroy WWTP were included in the hydrodynamic and water quality modelling undertaken for this EIAR. The modelling assessment considered the cumulative loading scenario and demonstrated that, with the proposed upgrades in place, no significant cumulative adverse effects on receiving water quality are predicted.

### 16.9.2 Shannon Town WWTP Upgrade

Shannon Town WWTP is located approximately 3.8 km south-east of Shannon Town and discharges treated effluent to the Shannon Estuary. Upgrade works are underway to increase treatment capacity and improve plant performance.

The discharge from Shannon Town WWTP was included in the cumulative modelling scenario for the Limerick WWTP Upgrade. The assessment indicates that, when considered in combination with the proposed development and other planned upgrades, no significant cumulative adverse impacts on water quality or assimilative capacity in the Shannon Estuary are predicted.

### 16.9.3 Limerick City Flood Relief Scheme

The proposed Limerick City Flood Relief Scheme (FRS) is currently at design and consultation stage. The scheme is expected to include flood defence and riverbank protection measures within the Shannon Estuary and potentially along Ballinacurra Creek. These works will be subject to separate environmental assessment and will incorporate appropriate mitigation measures to protect water quality and hydromorphology.

Given the current stage of design and the implementation of mitigation measures associated with the Proposed Development, no significant cumulative impacts on water quality, hydrology or flood risk are anticipated. The Proposed Development will not conflict with the objectives of the FRS and will provide improved stormwater management through additional storage capacity and controlled discharge.

### 16.9.4 Other Developments in the Vicinity of Limerick WWTP

Permitted and proposed developments in the vicinity of the WWTP site were reviewed, including the following:

- Planning Ref. 2561339 – Retention and modification of an existing waste transfer facility and associated access road and hardstanding areas.
- Planning Ref. 16/642 – Permitted waste transfer facility including buildings, hardstanding, drainage infrastructure and connection to the wastewater network.
- Planning Ref. 19/672 – Installation of roof-mounted solar panels at an existing materials recovery facility and associated works.
- Planning Ref. 16/345 – Industrial development at Irish Cement involving alternative fuels and materials handling, with associated drainage and containment infrastructure.

These developments incorporate standard surface water management measures such as attenuation systems, interceptors and controlled discharge to the drainage network.

During the construction phase, there is potential for short-term cumulative effects on surface water quality where works occur concurrently. However, any such effects would be temporary and localised and will be managed through the implementation of Construction Environmental Management Plans (CEMPs), pollution prevention measures and adherence to best practice guidance.

During operation, the Proposed Development will improve effluent quality and reduce uncontrolled stormwater discharges through the provision of additional storage capacity and upgraded treatment

processes. When considered in combination with surrounding permitted developments and their associated drainage controls, no significant cumulative adverse impacts on Bunlicky Lake, Ballinacurra Creek or the Shannon Estuary are predicted.

### 16.9.5 Other Developments in the Vicinity of Corcanree PS

Permitted and proposed developments adjacent to Corcanree Pumping Station include the following:

- Planning Ref. 22/1280 – Commercial and logistics development including warehouse units, drainage infrastructure, attenuation and pumping arrangements.
- Planning Ref. 20/687 – Extension and recladding works to an existing industrial building and associated site works.

These developments include surface water attenuation, drainage infrastructure and water quality control measures designed to protect local drainage channels and receiving waters. These measures will limit runoff and sediment inputs during construction and operation.

The Proposed Development includes a new stormwater storage tank and improved drainage management at Corcanree Pumping Station, which will reduce the frequency and volume of uncontrolled discharges to the Shannon Estuary. When considered in combination with adjacent developments and their associated mitigation measures, no significant cumulative impacts on surface water quality, hydrology or flood risk are predicted.

### 16.9.6 Other Strategic Developments in the Shannon Estuary

A number of strategic infrastructure and industrial developments within the wider Shannon Estuary have been reviewed for potential cumulative effects on the water environment.

- Shannon Foynes Port Capacity Extension (ABP Ref: 301561; MARA Ref: LIC230014) – Approved port infrastructure expansion at Foynes including a new jetty, quay works and associated dredging. The project has the potential to temporarily influence sediment transport and water quality during construction; however, it is located downstream of Limerick and subject to separate environmental controls and licensing.
- Moneypoint Hub Project (ABP Refs: 319080, 307798; MARA Ref: LIC230008) – Proposed redevelopment of the existing power station site to a renewable energy and port-support hub, including marine and onshore infrastructure. The project is located downstream in the estuary and may increase marine activity during construction but will be subject to environmental assessment and mitigation.
- Aughinish Alumina Operations and Expansion (EPA IE Licence Reg. No. P0035-07; MARA Ref: LIC230004) – Ongoing industrial operations including licensed discharges, abstraction and periodic maintenance dredging. Activities are regulated under the EPA Industrial Emissions licence and marine licensing regimes.
- Strategic Gas Emergency Reserve Project (ABP Ref: PA08.322568; MARA Ref: MUL240034) – Proposed floating storage and regasification unit and associated marine infrastructure within the Shannon Estuary. The development may increase vessel activity and include marine works, subject to separate assessment and licensing.

These projects are located within the wider Shannon Estuary and are subject to their own environmental assessments, licensing and mitigation measures. While they contribute to the overall level of activity within the estuary, they are geographically separated from the Limerick WWTP discharge location and will operate under regulated discharge and construction controls.

### 16.9.7 Summary of Cumulative Impacts

Other relevant projects in the Shannon Estuary catchment, including upgrades to Castletroy and Shannon Town WWTPs, the proposed Flood Relief Scheme and nearby permitted developments, have been considered as part of this assessment.

Any cumulative effects during construction would be short-term and localised and will be controlled through standard construction management and pollution prevention measures.

During operation, the Proposed Development will improve treatment performance and provide additional stormwater storage, reducing uncontrolled discharges to the Shannon Estuary. Cumulative modelling of relevant wastewater discharges indicates that the assimilative capacity of the receiving waters will not be adversely affected.

Overall, no significant adverse cumulative impacts on water quality, hydrology or flood risk are predicted. The Proposed Development is expected to result in a minor positive cumulative effect on the water environment.

## 16.10 Difficulties encountered in Compiling Information

No significant difficulties were encountered in preparing this assessment. The study was based on a combination of available published information, previous reports, consultation responses and site-specific survey data. Any limitations have been addressed through the use of recognised guidance, standard assessment methods and a precautionary approach where necessary.

## 16.11 References


Department of Housing, Local Government and Heritage (2024). Water Action Plan 2024: A River Basin Management Plan for Ireland 2022–2027.

Environmental Protection Agency (2022). Guidelines on the Information to be Contained in Environmental Impact Assessment Reports. EPA, Wexford.

Environmental Protection Agency website – https://gis.epa.ie/EPAMaps/

European Communities (2003). European Communities (Water Policy) Regulations 2003 (S.I. No. 722/2003), as amended.

European Communities (2009). European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. No. 272/2009), as amended.

European Communities (2010). European Communities Environmental Objectives (Groundwater) Regulations 2010 (S.I. No. 9/2010), as amended.

European Parliament and Council (2000). Directive 2000/60/EC establishing a framework for Community action in the field of water policy (Water Framework Directive).

European Parliament and Council (2011). Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (EIA Directive).

Inland Fisheries Ireland (2016). Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters.

Office of Public Works and Department of the Environment, Heritage and Local Government (2009). The Planning System and Flood Risk Management – Guidelines for Planning Authorities.

National Parks and Wildlife Service website – *https://www.npws.ie/*

NRA (2008). Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes

Ordnance Survey Ireland mapping – https://www.osi.ie/

Ireland

www.egis-group.com

egis