2026

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Sanitary Survey and Sampling Plan for Achill North, Co. Mayo – March 2026

AN t-ÚDARÁS UM CHOSAINT IASCAIGH MHARA | SEA-FISHERIES PROTECTION AUTHORITY

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DISCLAIMER

Under EU Regulation 2019/627, which lays down uniform practical arrangements for the performance of official controls on products of animal origin intended for human consumption, a sanitary survey relevant to bivalve mollusc production in Achill North was undertaken in 2025. The sanitary survey evaluates pollution sources and environmental factors so that the authorities can design a suitable hygiene-classification zoning and monitoring plan using the best available information and supporting evidence. Aqualicense Limited undertook the desktop component of this work on behalf of the SFPA; SFPA conducted the shoreline survey.

STATEMENT OF USE

This sanitary survey has been prepared by Aqualicense for the specific purpose of informing shellfish classification in accordance with regulatory requirements. The report draws on data provided by the Sea-Fisheries Protection Authority (SFPA) through the shoreline survey, as well as other publicly available sources, including state and semi-state bodies, and interprets that data within the context of this assessment.

Every effort has been made to ensure that the data used are the most accurate and up-to-date available at the time of preparation. However, Aqualicense does not independently verify third-party datasets and cannot accept responsibility for any errors, omissions, or inaccuracies arising from such sources.

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Every effort is made by the Sea Fisheries Protection Authority in preparing the material and content of this sanitary survey for publication, but no responsibility is accepted by or on behalf of the SFPA.

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Abbreviations

BMPA	Bivalve Mollusc Production Area (i.e. “production area”)
COP	Code of Practice
CSO	Central Statistics Office
CFU	Colony Forming Units
DWWTS	Domestic Waste Water Treatment System
E. coli	*Escherichia coli*
ED	Electoral Division
EPA	Environmental Protection Authority
EU	European Union
GPS	Global Positioning System
GSI	Geological Survey of Ireland
GWV	Groundwater Vulnerability
IE	Industrial Emissions
IFI	Inland Fisheries Ireland
IPC	Integrated Pollution Control
I-WeBS	Irish Wetland Bird Survey
MPN	Most Probable Number
NAP	Nitrates Action Programme
NM	Nautical Miles
NPWS	National Parks and Wildlife Service
PSU	Practical Salinity Unit
Q	Volumetric Flow Rate of Water
RMP	Representative Monitoring Point
SAC	Special Area of Conservation
SFPA	Sea Fisheries Protection Authority
SPA	Special Protection Area
S-P-R	Source-Pathway-Receptor
UWWTP	Urban Waste Water Treatment Plant
WFD	Water Framework Directive
WWTP	Waste Water Treatment Plant

EXECUTIVE SUMMARY

Faecal contamination in shellfish waters poses a significant public health risk, particularly for filter-feeding bivalve molluscs such as oysters and mussels, which can accumulate harmful bacteria and increase the risk of foodborne illness. To mitigate these risks, Article 56 of the EU Commission Implementing Regulation 2019/627 mandates that a Sanitary Survey be conducted before classifying a shellfish production or relay area (Article 56 of EU Regulation, 2019/627, 2020).

In line with regulatory requirements, Aqualicense has been contracted by the Sea-Fisheries Protection Authority (SFPA) to prepare this Sanitary Survey report. Its purpose is to ensure compliance with the relevant legislation, refine or confirm the delineation of the Bivalve Mollusc Production Area (BMPA), and identify appropriate Representative Monitoring Point(s) (RMP). This assessment provides the necessary evidence base to support reclassification and ongoing monitoring of the area to ensure that public health protections are maintained.

This report presents the findings of the sanitary survey conducted for Achill North, Co. Mayo, to support the classification of waters within the Achill North Bivalve Mollusc Production Area (BMPA), specifically addressing the existing shellfish classifications for Achill Sound, Bealacragher, Saula, Bunacurry, and Doriel Creek which currently hosts aquaculture activities for the commercial cultivation of Blue mussel (*Mytilus edulis*), Pacific oyster (*Magallana gigas*) and Manila clam (*Ruditapes philippinarum*) and an intermittent seasonal wild Native oyster (*Ostrea edulis*) fishery, which is only activated when there is a viable amount of wild oyster stock available. The wild oyster stock is subject differing restrictions/harvesting specifications (refer to Table 2-1).

This report encompasses the following key components:

1. A desk-based assessment of the bay's hydrodynamics and the seasonal potential for faecal contamination sources using a Source–Pathway– Receptor (S-P-R) model;
2. A field-based shoreline survey conducted by SFPA officers to confirm known risks and identify additional sources;
3. A bacteriological survey of selected inflows and runoff points;
4. A recommendation on the extent of the overall Bivalve Mollusc Production Area (BMPA) (geographic delineation) based on hydrodynamics, catchment influence, and aquaculture activity;
5. Species and location specific recommendations to support the development of appropriate sampling plans for the Representative Monitoring Points (RMPs) within the Achill North classified areas in line with EU and SFPA requirements.

The desk-based study employed a Source-Pathway-Receptor (S-P-R) model to assess contamination risks within Achill North. This study was based on the defined "Contributing Catchment," encompassing river networks and associated sub-basins draining into the Bay. This approach allowed for the identification of potential pollution sources, their transport pathways, and their circulation within the BMPA, considering seasonal variability and microbial loads. Highlights of the key stages of the S-P-R model and main findings are outlined below and discussed in further detail throughout the report.

1. The first step in the desk-based study was to characterise the BMPA, i.e. the receptor. The BMPA spans approximately 91.72 km^2 within Achill North, Co. Mayo. Currently there are 16 shellfish licences within the BMPA. There are 11 for Pacific oyster (*Magallana gigas*) only, 3 for Pacific oyster and European Flat (native) oyster (*Ostrea edulis*) combined, one for Manilla clam (*Ruditapes philippinarum*) and Pacific oyster combined, and a single site for Blue mussel (*Mytilus edulis*) (Bealacragher classification area) (see Section 2.3). There is also a short-term seasonal wild native oyster (*Ostrea edulis*) fishery in the North Sound classified area.

2. The desk-based study examined the movement of pollutants, hydrological pathways to, and hydrodynamics within the BMPA. It also assessed the influence of weather patterns on hydrography and hydrodynamics. The findings indicate that the primary source of freshwater inflow, and consequently potential contamination, is via the Owenmore River, entering the BMPA via Tullaghan Bay in the northern sector.
   Areas of greatest groundwater vulnerability were identified as occurring on the coastal fringe of the contributing catchment, especially immediately landward of the shoreline and tidal inlets where thin subsoils and exposed bedrock outcrops shorten flow paths.
   The currents are predominantly tidally driven with strong exchange through the mouth of the bay and Achill Sound, likely giving rise to short residence times along the central corridor, with reduced exchange and longer residence times expected in the sheltered areas and shallow pockets (notably Bealacragher bay and the intertidal flats). Seasonal variations in surface water run-off were also noted, with heavy rainfall events from autumn through winter likely to influence microbial loads entering the bay (see Section 2.4).

3. An inventory of potential pollutants was compiled, identifying UWWTP discharges (Achill Sound – directly to the BMPA, and from Bangor Erris via the Owenmore), widespread domestic wastewater systems/septic tanks concentrated along the southern/south-eastern coastal fringe and potential agricultural run-off from predominantly sheep-grazed catchments. Pressures have the potential to peak during summer grazing and tourist occupancy periods, and after periods of heavy rainfall (see Section 2.5).

Overall S-P-R conclusion

The overall S-P-R model determined that the key area of concern for organic pollutants is in the southern and south-eastern sector which drains into Achill Sound and Bealacragher Bay. In these areas in particular there is a higher DWWTS reliance which overlaps with elevated groundwater vulnerability and multiple riverine inflows. This zone also lies close to several licenced

Additional areas of interest include the western/north-western shoreline adjoining Ballycroy South where there are high sheep densities recorded and extreme groundwater vulnerability which together elevate the agricultural run-off risks near to T10-311, T10-312A and T10-332A. By contrast, the large inflows (Owenmore/Owenduff rivers) are relatively buffered by intervening distances and the probability of a strong Atlantic exchange and are therefore less likely to affect the southern licence cluster.

Sanitary Survey and Bacteriological Results

The entire shoreline of the BMPA was surveyed by SFPA personnel over a 3-day period, from 23rd to the 25th of September 2025. A total of 75 observations were recorded during the shoreline survey, each georeferenced and supported by photographic evidence. Of the observation sites 27 were sampled for bacteriological analysis. During the survey period 12 previously unmapped field drains, and 5 additional concrete discharge pipes were noted. At 7 of the 75 sites there were signs of possible contamination (algal matting (71, 72, 67a, 67c, 49, 55,52), foamed and or discoloured water (52 and 53). Minimal contamination was identified at 12 stations where concentrations were recorded as <10 MPN/100mL indicating insignificant faecal contamination. 11 of the stations (a mixture of rivers, streams, beaches and areas draining rough pastures) yielded minimal to moderate concentrations (20-240 MPN/100mL). These were likely influenced by nutrient runoff from agricultural activities (sheep were recorded in adjacent fields and or noticeably improved pasture land).

Despite no visual indicator elevated levels were noted at a single site the Achill sound WWTP outfall pipe (1180 MPN/100mL).

Comparative Statistics

Statistical analysis of historical *E. coli* results from 2010-2015 indicates that Achill North generally maintains good microbiological water quality, with most samples showing low concentrations and only occasional high results.

Spatial patterns reveal significantly higher levels at Bealacragher compared with Bunacurry, North Achill and Saula, suggesting localised influences such as runoff or reduced tidal flushing. Seasonal effects are also evident, with Autum showing the highest concentrations and Spring/Winter the lowest- this is consistent with rainfall-driven variability.

There were no significant long-term trend in *E. coli* levels were detected across the dataset, indicating overall stability in water quality conditions. Although some extreme values occur (notably in 2016 and 2024), these are isolated rather than persistent. The findings highlight that the occasional peaks are localised and most likely driven by episodic environmental factors rather than ongoing contamination.

Conclusion

Considering the findings of the desk-based study, S-P-R assessment, shoreline survey and bacteriological analysis, provide a comprehensive understanding of the contamination dynamics within the Achill North BMPA, encompassing the five classified areas – North Sound, Bealacragher, Saula, Bunacurry and Doriel Creek.

Overall, the water quality is good, with only localised and occasional faecal contamination linked to specific inflows and seasonal factors. These findings confirm the suitability of the production zones for continued shellfish cultivation and identify limited areas requiring focused monitoring. The evidence base established through his survey supports the delineation of appropriate RMPs and ensures that classification and management decisions remain aligned with EU regulatory requirements. In consideration of the available datasets and the absence of site-specific hydrodynamic survey data (with modelling outputs serving as the primary source of information for flushing estimations etc), a precautionary approach has been applied to the selection of the RMPs.

In conclusion, a sanitary survey has been completed following EU Regulation 2019/627. Based on the desk-based study, shoreline survey, and bacteriological monitoring, 9 RMPs were identified (8 active, 1 inactive), four RMPs were identified for Pacific oyster, three for European flat or native oyster, one RMP identified for Blue mussel and one for Manilla clam across the five classified zoned production areas.

Species-specific sampling plans were developed for the Achill North BMPA's microbiological monitoring programme, which will inform the annual review of classifications.

1 INTRODUCTION

The presence of faecal contamination in the marine environment can result in the accumulation of harmful microorganisms in shellfish, posing a public health risk. Bivalve molluscs such as oysters, mussels, and clams are filter feeders, meaning they draw in and process large volumes of water, which can lead to the concentration of microbial contaminants. *Escherichia coli* (*E. coli*) is a key indicator organism used to assess faecal contamination, as its presence suggests potential pollution from human or animal waste. If such contamination includes pathogenic bacteria or viruses, it can increase the risk of foodborne illness for consumers.

To mitigate these risks, the European Union has established a regulatory framework governing the classification and monitoring of shellfish production and relaying areas. EU Regulation 2019/627 outlines the requirements for sanitary surveys. Article 56 of the Regulation mandates that competent authorities (i.e. the SFPA in an Irish context) conduct a sanitary survey before classifying a production or relaying area. This survey must include:

a) *an inventory of the sources of pollution of human or animal origin likely to be a source of contamination for the production area;*

b) *an examination of the quantities of organic pollutants released during the different periods of the year, according to the seasonal variations of human and animal populations in the catchment area, rainfall readings, waste-water treatment, etc.;*

c) *determination of the characteristics of the circulation of pollutants by virtue of current patterns, bathymetry and the tidal cycle in the production area*.

Furthermore, under the SFPA Code of Practice (SFPA, 2020), a sanitary survey may include four elements:

1. A desk-based study to identify pollution sources
2. A shoreline survey to confirm initial findings of the desk-based study
3. A bacteriological survey
4. Data assessment

In addition, ongoing monitoring is required under Article 57, ensuring that sampling programmes are informed by sanitary surveys and designed to produce representative data on water quality and potential contamination risks. Article 58 further stipulates that authorities must establish procedures to ensure that both sanitary surveys and monitoring programmes accurately reflect the conditions within shellfish production areas.

The overall Achill North Bivalve Mollusc Production Area (BMPA) has previously been classified as a **Class A,** though the sub-classification (zoned production area) Doriel creek has been consistently classified as a **Class B.** Therefore, this report presents the findings of the sanitary survey conducted in advance of the review of the Recommended Monitoring Points (RMPs) for bivalve production within each classified area. It examines all potential sources of faecal contamination, pathways, circulation and seasonal variations, with particular consideration of the area's rural context. The report aims to inform classification decisions and provide the necessary evidence for effective monitoring in line with EU regulatory requirements.

2 Desk-Based Study

2.1 Introduction to the General Area

The Achill North classified Bivalve Mollusc Production Areas (BMPA) comprises a series of interconnected coastal and estuarine water bodies located along the northern approaches to Achill sound and inner reaches of Blacksod Bay, spanning approximately 91.72 km^2. Its boundaries are formed by Kinrovar point to Ridge Point and Achill Bridge East to Achill Bridge West including North sound, with an overall north- northeast aspect toward the Atlantic but locally sheltered by Achill Island and the Corraun Peninsula (Figure 2-1).

The surrounding landmass (Achill Island) covers ~14,800 hectares (Ha) and is characterised by high relief uplands and deeply indented, tidal channels that controls exchange with the bay. The physiographic controls, together with the narrow tidal throat at Achill Sound, influence flushing and residence times within the BMPA.

The BMPA boundary reflects the main hydrodynamic envelope influencing the licensed sites: the seaward limit corresponds to the principal tidal exchange zone, while the landward boundary captures the areas influenced by the Owenmore, Owenduff, Bellagarvaun and Tonragee systems. This extent ensures all inflow-driven contamination pathways relevant to shellfish production are included.

For the purposes of shellfish hygiene monitoring, production management and classification under the requirements of Regulation (EC) No. 854/2004, the Achill North BMPA is subdivided into five discrete sub-classification or zoned production areas. Each zoned production area supports distinct species and production activities, reflecting local hydrographic conditions and aquaculture practices.

The zoned production areas within the Achill North BMPA are as follows:

- Achill Sound- designated for the native European flat oyster (*Ostrea edulis*) fishery;
- Bealacragher bay- utilised primarily for the cultivation for mussels (*Mytilus edulis*) (currently inactive);
- Saula- site for the production of Pacific oyster and European flat oyster(*Magallana gigas*);
- Bunacurry- Pacific oyster and European flat oyster; and
- Doriel creek – also supporting Pacific oyster, European flat oyster cultivation and Manila clam (clams are not currently in production).

Each sub-area or zoned production area is managed and assessed individually for microbiological classification and harvesting status, while collectively forming the broader Achill North BMPA. This subdivision allows for more accurate representation of environmental variability, species specific risk assessment and targeted monitoring to ensure compliance with EU and national shellfish hygiene regulations.

Licenced aquaculture sites are distributed within the Achill North BMPA across 5 shellfish classifications, fringing the inner Blacksod bay to Achill Sound complex. 16 sites are currently licenced occupying the tidally influenced margins on the Achill and Inisbiggle sides of the Sound, covering an area of ~78.38 Ha in total (Table 2-1 and Figure 2-1). Local bathymetry and the constricted entrance of Achill Sound provides shelter and a short fetch, supporting trestle culture on sand-mud flats and limited subtidal longline/bottom allocations.

Hydrodynamic connectivity among the sub-areas is recognised, particularly through shared tidal exchange and freshwater inputs, however, classification boundaries are defined to reflect distinct operation and environmental zones. There are five pre-existing shellfish classifications within the Achill North BMPA that predate this sanitary survey. These classifications were originally established based on trends in *E. coli* levels across different areas of the BMPA. The ongoing suitability of the existing classification boundaries has been examined in this report, based on scientific evidence and data collected during the sanitary survey. The aggregated Achill North BMPA therefore functions as a single management unit composed of these five discrete sub-classification areas, each contributing to the overall production and classification framework of the region.

There is a wild population of native oysters in the North Achill BMPA. A short-term seasonal classification (North Sound) is in place for native oysters in this BMPA. The sampling plan for this species is not included in this sanitary survey, as the fishery sampling programme follows the "*Short Term Classifications* Guidelines" set out in the "*Code of Practice for the Classification and Microbiological Monitoring of Bivalve Mollusc Production Areas in Ireland"*.

While there are no non-bivalve aquaculture sites located within the Achill North classified beds, there are two in close proximity, including Atlantic salmon sea cage operation (T10-051) in Bealacragher bay and a licensed wild seaweed harvesting (*Ascophyllum nodosum*/Fucus spp.) (FS006108- intertidal hand harvest) along the Mayo coastline.

Commercial inshore fishing targets identified in the area are Cockle (*Cerastoderma edule*) and Lobster (*Homarus gammarus*) (Marine Institute, 2025a).

2.2 Characterisation of the Bivalve Mollusc Production Area

Key characteristics of the Bivalve Mollusc Production Area are outlined in Table 2-1.

Table 2-1. Characteristics of the Production Area

Criteria	Description
Location and extent	This Bivalve Mollusc Production Area (BMPA) is within Achill North, Co. Mayo. It covers an area of ~91.72km^2 and is made up 5 sub-classifications (North Sound, Saula, Bunacurry, Doriel Creek and Bealacragher)
Bivalve species	Currently Pacific oyster (*Magallana gigas*), Blue mussel (*Mytilus edulis*), Manila clam (*Ruditapes philippinarum*) are listed as the species being produced within Achill North.
Aquaculture or wild stocks	At present there are 16 active shellfish licences in the area. There are 11 for Pacific oyster: T10-323A, T10-315A, T10-314A, T10-312A, T10-311, T10-307B, T10-307C, T10-310A, T10-324A, T10-231, T10-324A, T10-231, three for Pacific oyster and European flat oyster: T10-332A, T10-331A, T10-330A, one for Pacific oyster and

CRITERIA	DESCRIPTION
	Manila clam: T10-327A; and a single site for blue mussel only: T10-043A (DAFM_Aquaculture Viewer)
Seasonality of harvest	Shellfish may be harvested year-round in accordance with market demand in the Bealacragher, Saula, Bunacurry and the Doriel Creek classifications. There is also a short term and seasonal classifications in place for North Sound classification in the Achill North BMPA for native oysters. Where there are clear seasonal patterns for commercial activity in Class A or B areas, in consultation with and enforced by local fishery regulations, monitoring may be considered for a reduced period of the year. This should start at least 1 month prior to the harvesting season for Class A areas and two months prior to the season for Class B areas and then continue throughout the season in prior agreement with the SFPA. • North Sound, classified for Native oysters has a short-term classification, where there are clear seasonal patterns to commercial activity in class A or B areas, in consultation with and enforced by local fishery regulations, monitoring may be considered for a reduced period of the year. This should start at least one month prior to the harvesting season for class A areas and two months prior to the season for class B areas and then continue throughout the season in prior agreement with the SFPA. Where it is intended to fish a short-term classification the SFPA should be contacted in writing in advance of fishing to seek approval to begin. • Bealacragher bay has a Classification of B with the formally dormant fishery having been reactivated early 2025. • Doriel Creek has a Classification of B at the time of writing this report • Saula and Bunacurry are both currently classified as A.
Growth and harvesting techniques	Pacific oyster: Bags and trestles Native oyster: Bags and trestles Manilla clam: Bags and trestles Blue mussels: Rope and barrel on longline
Any conservation controls (e.g. closed season)	No conservation controls are employed
Existing classification data	The following classes have been awarded to the sub-classifications within the Achill North BMPA: • North sound (Native oyster) A* (short term classification as noted above);

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CRITERIA	DESCRIPTION
	• Bealacragher bay (Blue mussel) B* • Saula (Pacific oyster and European flat oyster)- Class A • Bunacurry (Pacific oyster and European flat oyster) – Class A • Doriel Creek (Pacific oyster, European flat oyster and Manila clam)- Class B
Norovirus Data	There is no historic norovirus data for the Achill North BMPA

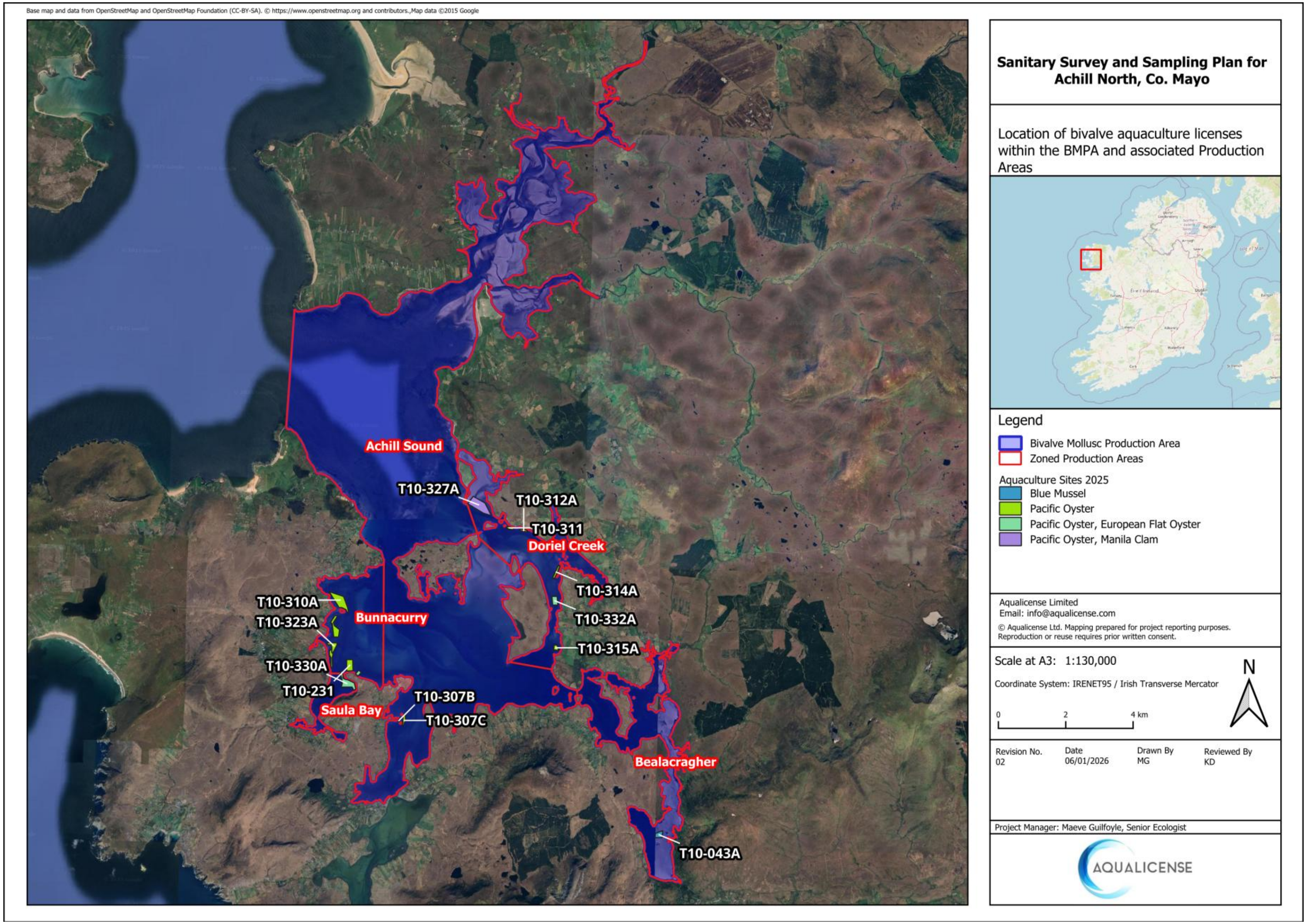

Figure 2-1. Location of bivalve aquaculture licenses within the BMPA (Accessed 11/08/25).

2.2.1 Bivalve Mollusc Production Area Delineation Process

The process for defining a BMPA boundary begins with the SFPA assessing the maximum area suitable for aquaculture that can be effectively covered by a localised sanitary survey. This is done in consultation with key stakeholders involved in aquaculture development and licensing, such as BIM, industry representatives, and the Department of Agriculture, Food and the Marine (DAFM).

The boundary is then finalised based on the findings of the sanitary survey, ensuring it encompasses both the potential shellfish production area and any zones that may impact it through pollutant inputs. This approach ensures that the designated RMPs provide reliable representation of the microbiological quality within the BMPA.

2.3 Assessment Methodology

The desk-based study will follow SFPA guidelines (COP SH01) and align with EU Regulation 627/2019, Article 56. It forms the first part of the sanitary survey, informing the shoreline and bacteriological surveys (if required).

A Source-Pathway-Receptor (S-P-R) model is applied to systematically identify and describe potential routes by which faecal contamination may be transferred from sources within the catchment and coastal environment to shellfish growing areas. The use of the S-P-R framework provides a structured and precautionary basis for the identification and screening of contamination pressures while focusing the assessment on relevant and plausible linkages affecting the overall BMPA.

The S-P-R model is applied here as a qualitative screening tool, consistent with its intended use and established regulatory practice. The evidence base comprises a review of a combination of desk-based information, published literature, historical information and professional judgement, to cautiously determine the presence of credible source-pathway- receptor linkages, rather than quantify risk.

Numerical scoring or weighted ranking is not applied, as this could imply a level of precision or comparability that is not supported by the available data and may obscure uncertainty. Pathways identified as plausible and potentially significant are considered in the context of subsequent requirements, such as targeted field investigations, shoreline surveys, sampling design and any further data gathering needed to confirm or refine initial conclusions. This ensures that follow up work is directed toward those sources and transport routes that are most likely to influence the BMPA, in accordance with the staged sanitary survey process.

This assessment applies the S-P-R model to evaluate the ecological risk associated with faecal contamination within the BMPA (i.e. the receptor).

- **Source:**

Faecal contaminants originate from identifiable inputs including but not limited to: agricultural runoff, wastewater treatment plant effluents, combined sewer overflows, and diffuse urban or wildlife sources. These inputs introduce microbiological pollutants such as *E. coli*, enteric viruses, and protozoan cysts into the aquatic environment.

- **Pathway:**

Contaminants are transported via hydrological and tidal processes, surface water flows, and stormwater conveyance systems. Transport dynamics are influenced by rainfall events, land use, catchment topography, and the retention or resuspension of faecal material in sediments. Temporal variation is considered to identify peak contamination windows.

- **Receptor:**

Shellfish species, particularly filter feeders, accumulate faecal contaminants present in the water column. These organisms serve as biological indicators and direct receptors of microbial loading.

If any element (source, pathway, receptor) is absent, no impact occurs, allowing targeted evaluation for the BMPA.

Key S-P-R components are indicated in Figure 2-2.

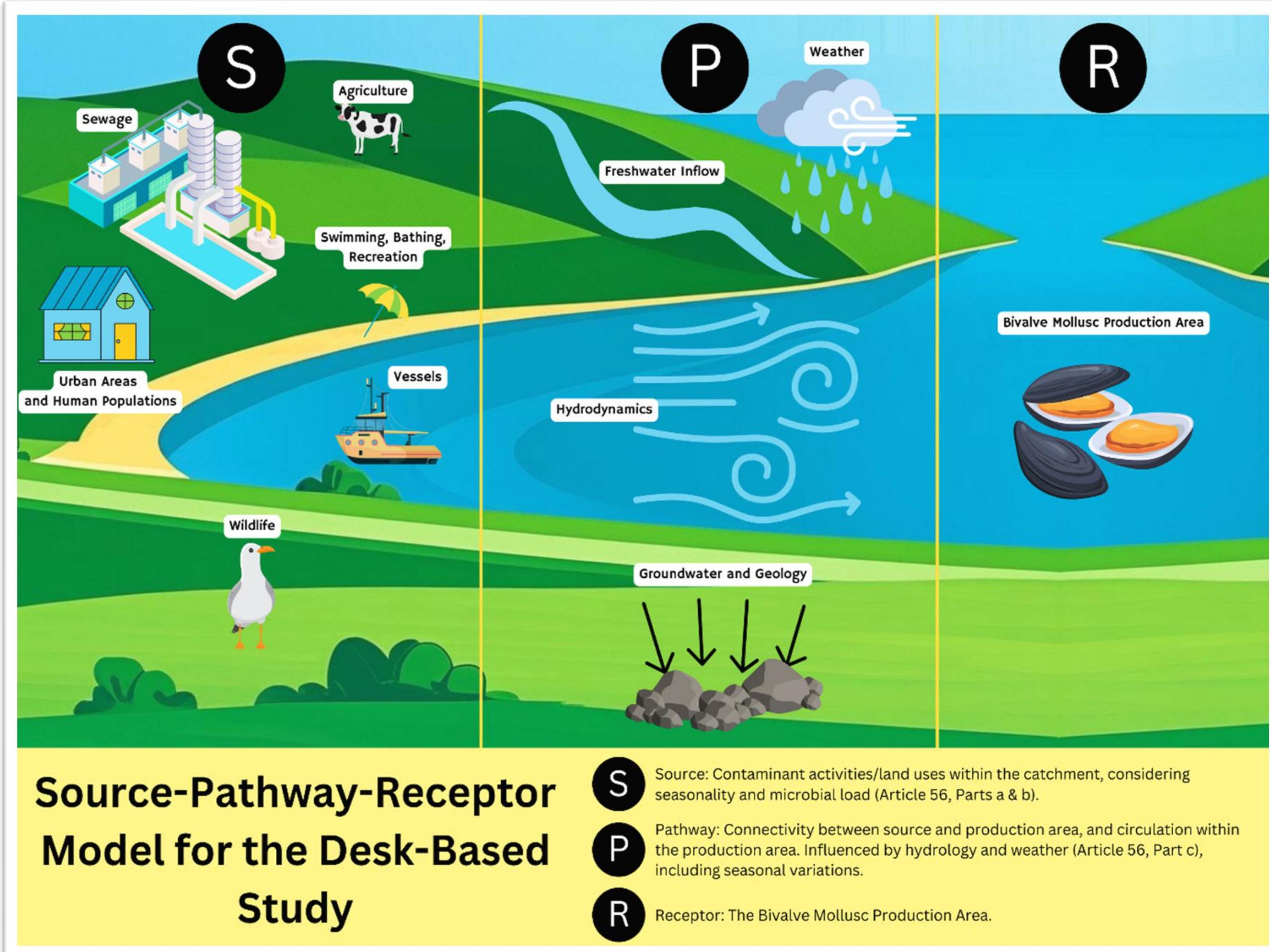

Figure 2-2. Key elements to be considered in this Desk-Based Study under the S-P-R Model

2.3.1 CONTRIBUTING CATCHMENT

The first step for assessing sources and pathways is to define the “Contributing Catchment”, from which there is a pathway to the BMPA. A catchment is defined as “*an area of land that drains into a river, lake or other body of water*” (EPA, 2025a). The EPA further identifies catchments and sub-catchments for the purposes of Water Framework Directive (WFD) monitoring; however, these are at too large a scale for the purposes of a sanitary survey.

For the purposes of this assessment, a tailored “Contributing Catchment” was delineated. This was achieved by first identifying all river networks (EPA, 2022) entering the proposed BMPA and then including the EPA-defined sub-basins (EPA, 2022) through which these rivers flow to capture the full extent of land draining into the bay.

The identified contributing catchment covers an area of 704.57 km^2 and contains 28 sub-basins. The defined contributing catchment is illustrated in Figure 2-3.

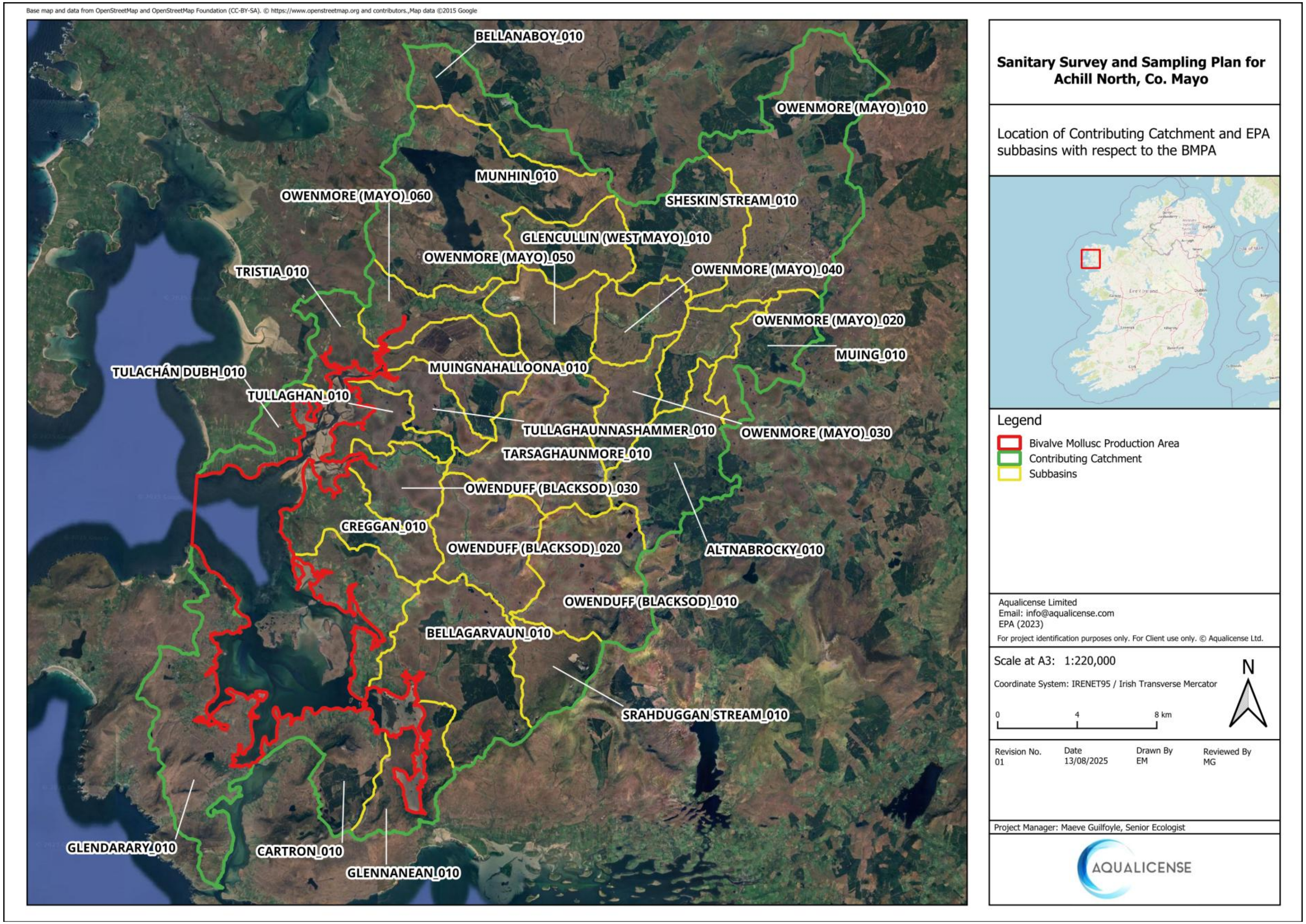

Figure 2-3. Location of contributing catchment and EPA subbasins with respect to the BMPA (Accessed 11/08/25).

2.4 CHARACTERISTICS OF CIRCULATION OF POLLUTANTS

Prior to identifying pollution sources and their seasonality, an examination of pollutant circulation within the BMPA was conducted. This analysis provided the foundation for the detailed pathway assessments presented in subsequent sections of this desk-based study. This section describes the movement of pollutants within the bay, outlining the hydrological pathways leading to the BMPA and the hydrodynamic processes operating within it. It also considers the influences of weather patterns, particularly their seasonal influences on hydrography and pollutant dispersion. These insights directly inform the delineation of the BMPA and placement of RMPs.

2.4.1 FRESHWATER INFLOWS

The contributing catchment consists of 28 river subbasins (Figure 2-3). These subbasins and associated watercourses have been categorised based on their points of inflow (87 in total) to the BMPA (Table 2-2). Assessing these inflows is the first step in understanding the entry of pollutants and lays the foundation for further examination of pollutant circulation.

11 hydrometric gauges are present within the contributing catchment, however only two are currently active as of 2025; Bangor (33008) and Srahnamanragh (33006). The Bangor station is positioned on the Owenmore river which enters the BMPA at its northernmost point (inflow 68). Only water level data is provided for the Bangor station with no flow records available. The water level data show peak levels in autumn and winter periods at this station.

The Srahnamanragh station is located on the Owenduff river, which enters the BMPA from the northeast (inflow 51). This station data shows that flow typically ranges between 20–30 Qm^3/s with peak flow of 65 Qm^3/s. Flow values peak in winter and spring and are at their lowest in summer.

The major sources of freshwater input to the BMPA are the Owenduff, Owenmore, Glenadarary and Bellagarvaun rivers (Figure 2-4). The Owenmore River is the primary freshwater input into the BMPA. Its catchment covers an area of ~655 km^2 comprising mountains and bogland before flowing out to sea through Tullaghan Bay in the north of the BMPA (Goodwillie, Buckley, & Douglas, 1992). It primarily flows through areas of 'High' and 'Moderate' groundwater vulnerability (GWV). For approximately 17.92 km the river flows through agricultural land classified as '*land principally occupied by agriculture with significant areas of natural vegetation*' (henceforth referred to as land principally occupied by agriculture) which overlaps with areas of 'Extreme' groundwater vulnerability (Corine, 2018).

The Owenduff flows through large areas of 'Extreme' groundwater vulnerability prior to entering the BMPA, as well as peat bogs, pastures and land principally occupied by agriculture. The pastures are located in close proximity to the BMPA, (~145.36 m from inflow 51) and the river flows through this agricultural land for 6.7 km. The Owenmore and Owenduff rivers will have a reduced impact on the active licensed sites as they are concentrated in the southern portion of the BMPA.

The Glenadarary river enters the BMPA from the southwest, flowing through large areas of 'Extreme' groundwater vulnerability located <1.5 km from the BMPA boundary, which overlap with several areas of agricultural land bordering the BMPA (classified as land principally occupied by agriculture). The Bellagarvaun river enters the BMPA from the southeast and flows through land principally occupied by agriculture, which overlaps with a region of 'Extreme' groundwater vulnerability ~2.1 km north of inflow 33.

The Water Framework Directive (WFD) aims to protect and enhance the quality of rivers, lakes, transitional waters, coastal waters, and groundwater. WFD monitoring assesses biological, physicochemical, and hydro-morphological parameters to determine waterbody status. While not all WFD parameters are directly relevant to sanitary surveys, some, such as the assessment of nutrients (nitrogen and phosphorus) and dissolved oxygen, serve as key indicators of organic pollution, including faecal contamination. WFD monitoring also identifies pressures on water quality, such as nutrient enrichment, wastewater discharges, and diffuse pollution, which are further explored in Section 2.5 to assess their relevance as pollutant sources.

The WFD status (2016-2021) of the river Owenmore as it enters the BMPA is 'High', while the status of the Owenduff and Glenadarary rivers is 'Good'. The majority of inflows (65.52%) to the BMPA are classified as 'Good' or 'High', with the exception of four river subbasins (with 30 inflow points) classified as 'Moderate'. These moderate areas include Cartron in the south of the BMPA (inflows 10-18), Bellagarvaun in the southeast (inflows 33-36), Tullaghan in the northeast (inflows 53-62) and Tulachán Dubh in the northwest (inflows 81-87). This will be discussed in more detail in Section 2.5 in respect of individual pollution sources (Table 2-2).

Table 2-2. Locations of freshwater inflow to the BMPA (EPA, 2023)

Inflow Point	River Subbasin (EPA Code)	River Name (EPA Code)	Inflow Point WFD Status (2016-2021)
1	Glendarary 010 (IE_WE_33G400250)	Tóin an tSeanbhaile (33T09)	Good
2		Unnamed River 1 Unnamed Tributary	Good
3		Unnamed River Tributary Bun an Churraigh (33B25) 2 Unnamed Tributaries	Good
4		Unnamed River An Caiseal (33C12) Mám na mBan (33M13) 4 Unnamed Tributaries	Good
5		Unnamed River 9 Unnamed Tributaries	Good
6		Unnamed River 1 Unnamed Tributary	Good
7		Unnamed River 1 Unnamed Tributary	Good
8		Sáile (33S15) 1 Unnamed Tributary	Good
9		Glendarary (33G40)	Good
10	Cartron 010 (IE_WE_33C020100)	Unnamed River	Moderate
11		Unnamed River 1 Unnamed River	Moderate
12		Unnamed River	Moderate

Inflow Point	River Subbasin (EPA Code)	River Name (EPA Code)	Inflow Point WFD Status (2016-2021)
13		Unnamed River 1 Unnamed River	Moderate
14		Unnamed River	Moderate
15		Unnamed River 1 Unnamed River	Moderate
16		Unnamed River	Moderate
17		Unnamed River 1 Unnamed River	Moderate
18		Cartron (33C02) Tributary An Leathchartúr (33L17) 14 Unnamed Tributaries	Moderate
19	Glennanean 010 (IE_WE_32G090920)	Unnamed River	Good
20		Unnamed River	Good
21		Unnamed River	Good
22		Unnamed River	Good
23		Unnamed River	Good
24		Glennanean (32G09) 3 Unnamed Tributaries	Good
25		Unnamed River	Good
26		Unnamed River	Good
27		Unnamed River 1 Unnamed River	Good
28		Unnamed River 1 Unnamed River	Good
29		Unnamed River	Good
30		Unnamed River	Good
31		Unnamed River	Good
32		Unnamed River	Good
33	Bellagarvaun 010 (IE_WE_33B040300)	Bellagarvaun (33B04 3 Unnamed Major Tributaries 55 Unnamed Minor Tributaries	Moderate
34		Unnamed River 4 Unnamed Tributaries	Moderate
35		Unnamed River 1 Unnamed Tributary	Moderate
36		Unnamed River	Moderate
37	Tallagh 010 (IE_WE_32T460890)	Unnamed River	Good
38		Unnamed River 3 Unnamed Tributaries	Good
39		Unnamed River	Good
40		Unnamed River	Good
41		Tallagh (32T46)	Good

Inflow Point	River Subbasin (EPA Code)	River Name (EPA Code)	Inflow Point WFD Status (2016-2021)
42		Unnamed River	Good
43	Creggan 010 (IE_WE_33C610950)	Unnamed River	Good
44		Unnamed River	Good
45		Creggan (33C61) 6 Unnamed Tributaries	Good
46		Unnamed River	Good
47		Unnamed River	Good
48		Unnamed River	Good
49	Owenduff [Blacksod] 030 (IE_WE_33O010100)	Unnamed River	Good
50		Unnamed River	Good
51	Owenduff [Blacksod] 010 (IE_WE_33O010010) Owenduff [Blacksod] 020 (IE_WE_33O010030) Owenduff [Blacksod] 030 (IE_WE_33O010100) Srahduggan Stream 010 (IE_WE_33S050005) Tarsaghaunmore 010 (IE_WE_33T010100)	Owenduff [Blacksod] (33O01) All associated rivers and tributaries within the 5 listed subbasins	Good
52	Owenduff [Blacksod] 030 (IE_WE_33O010100)	Unnamed River	Good
53	Tullaghan 010 (IE_WE_33T280770)	Unnamed River	Moderate
54		Unnamed River	Moderate
55		Unnamed River	Moderate
56		Unnamed River 3 Unnamed Tributaries	Moderate
57		Tullaghan (33T28) 2 Unnamed Tributaries	Moderate
58		Unnamed River 1 Unnamed Tributary	Moderate
59		Unnamed River 1 Unnamed Tributary	Moderate
60		Unnamed River	Moderate
61		Unnamed River	Moderate
62		Unnamed River	Moderate
63		Unnamed River	Good
64		Unnamed River	Good

Inflow Point	River Subbasin (EPA Code)	River Name (EPA Code)	Inflow Point WFD Status (2016-2021)
65	Tullaghaunnashammer 010 (IE_WE_33T210290)	Tullaghaunnashammer (33T21) Tributary Muingnanarnad (33M25) 6 Unnamed Tributaries	Good
66	Muingnahalloona 010 (IE_WE_33M190620)	Tawnanasool (33T22) Tributary Darraragh (33D20) Tributary Muingnahalloona (33M19) Tributary Croaghaun (33C47) 10 Unnamed Tributaries	Good
67	Owenmore [Mayo] 060 (IE_WE_33O040500)	Rosnagleragh (33R04)	High
68	Altnabrocky 010 (IE_WE_33A020100) Bellanaboy 010 (IE_WE_33B070200) Glencullin [West Mayo] 010 (IE_WE_33G030100) Muing 010 (IE_WE_33M010100) Munhin 010 (IE_WE_33M030200) Owenmore [Mayo] 010 (IE_WE_33O040050) Owenmore [Mayo] 020 (IE_WE_33O040200) Owenmore [Mayo] 030 (IE_WE_33O040250) Owenmore [Mayo] 040 (IE_WE_33O040270) Owenmore [Mayo] 050 (IE_WE_33O040325) Owenmore [Mayo] 060 (IE_WE_33O040500) Sheskin Stream 010 (IE_WE_33S030150)	Owenmore [Mayo] (33O04) All associated rivers and tributaries within the 12 listed subbasins	High
69	Owenmore [Mayo] 060 (IE_WE_33O040500)	Unnamed River	High
70		Unnamed River	Good

Inflow Point	River Subbasin (EPA Code)	River Name (EPA Code)	Inflow Point WFD Status (2016-2021)
71	Tristia 010 (IE_WE_33T070130)	Unnamed River	Good
72		Tristia (33T07) 1 Unnamed Tributary	Good
73		Unnamed River	Good
74		Unnamed River 1 Unnamed Tributary	Good
75		Unnamed River	Good
76		Unnamed River 5 Unnamed Tributaries	Good
77		Unnamed River 1 Unnamed Tributary	Good
78		Unnamed River	Good
79		Unnamed River 5 Unnamed Tributaries	Good
80		Unnamed River	Good
81	Tulachán Dubh 010 (IE_WE_33T130850)	Unnamed River	Moderate
82		Unnamed River	Moderate
83		Tulachán Dubh (33T13) 1 Unnamed Tributary	Moderate
84		Tulachán Bán (33T08) 1 Unnamed Tributary	Moderate
85		Unnamed River 1 Unnamed Tributary	Moderate
86		Dumha Thuama (33D10) 1 Unnamed Tributary	Moderate
87		Unnamed River 1 Unnamed Tributary	Moderate

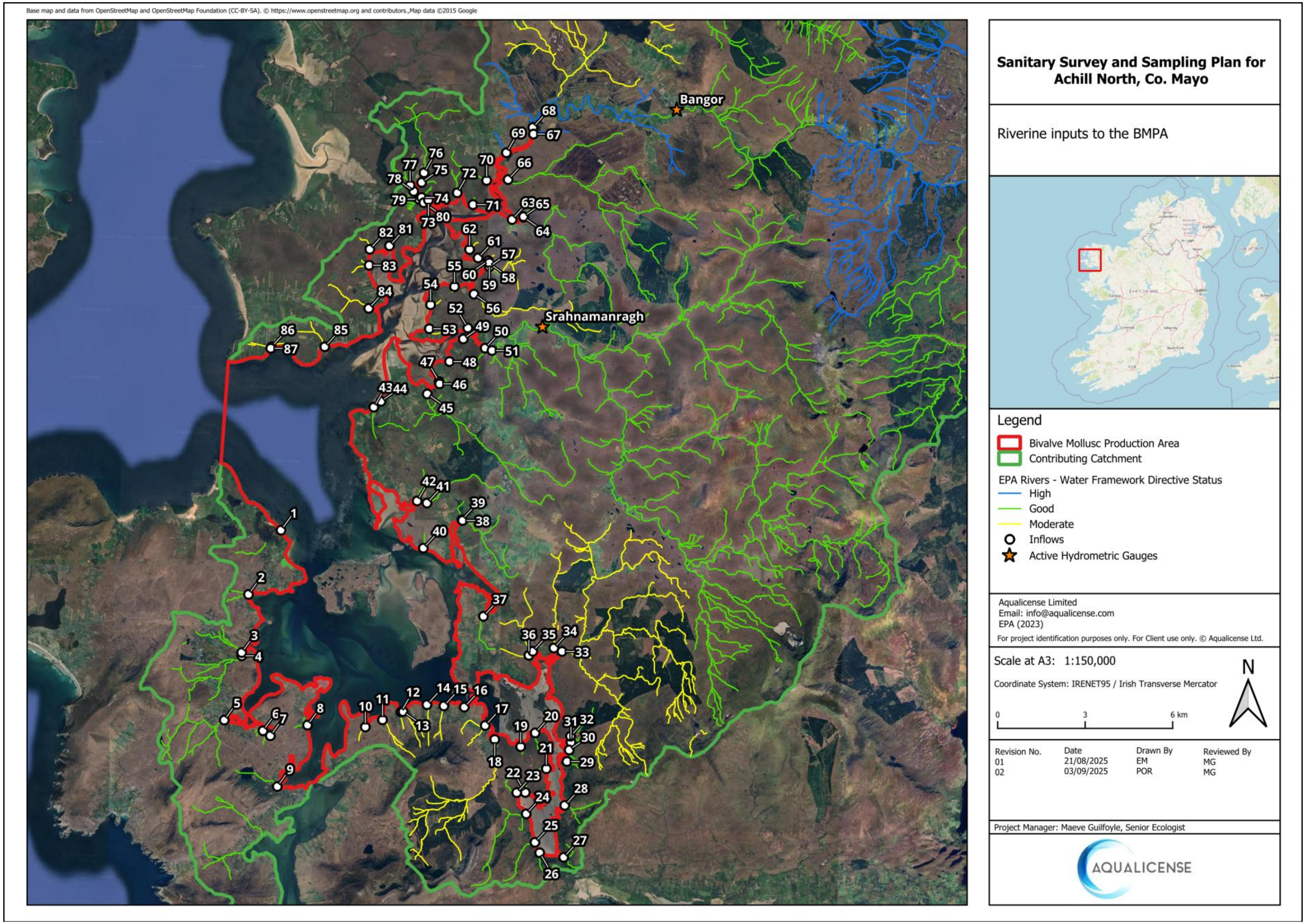

Figure 2-4. Riverine inputs to the BMPA (Accessed 11/08/25).

2.4.2 Geology and Groundwater

The movement of microbial pollutants, such as *E. coli*, within a catchment is influenced by the underlying geology. Groundwater plays a role in contaminant transport, as pollutants can infiltrate through soil and bedrock, entering the marine environment. Understanding the geological features, particularly groundwater vulnerability, helps assess how contaminants may disperse. Section 2.5 provides further detail on groundwater in relation to individual pollution sources.

Pollutants can enter the marine environment via groundwater through two primary pathways. The first is via surface water, where groundwater inflow contributes to rivers, lakes, and other surface waters that eventually discharge into the marine environment. The second pathway is direct submarine groundwater discharge, where groundwater seeps directly into the sea from the seabed, including the intertidal zone (Arévalo-Martínez et al., 2023).

The contributing catchment overlies 7 groundwater bodies: "Achill", "Malranny", "Laherdaun", "Deel", "Bellacorick-Killala", "Bangor and "Belmullet". These groundwater bodies were all classified as having "Good" WFD status respectively from 2016-2021 (EPA, 2023).

An analysis of groundwater vulnerability (GSI, 2021) within the contributing catchment reveals 12.32% and 8.30% of the contributing catchment as having “Rock at or near Surface or Karst” and “Extreme” vulnerability respectively (Figure 2-5).

These sections are predominantly located along the coastal fringe of the contributing catchment draining to the BMPA, with additional clusters on thin subsoil and bedrock outcrops immediately landward of the shoreline, where short groundwater flow paths converge on the tidal inlets. These areas pose the highest risk for pollutant infiltration via groundwater, particularly where they intersect with surface water pathways.

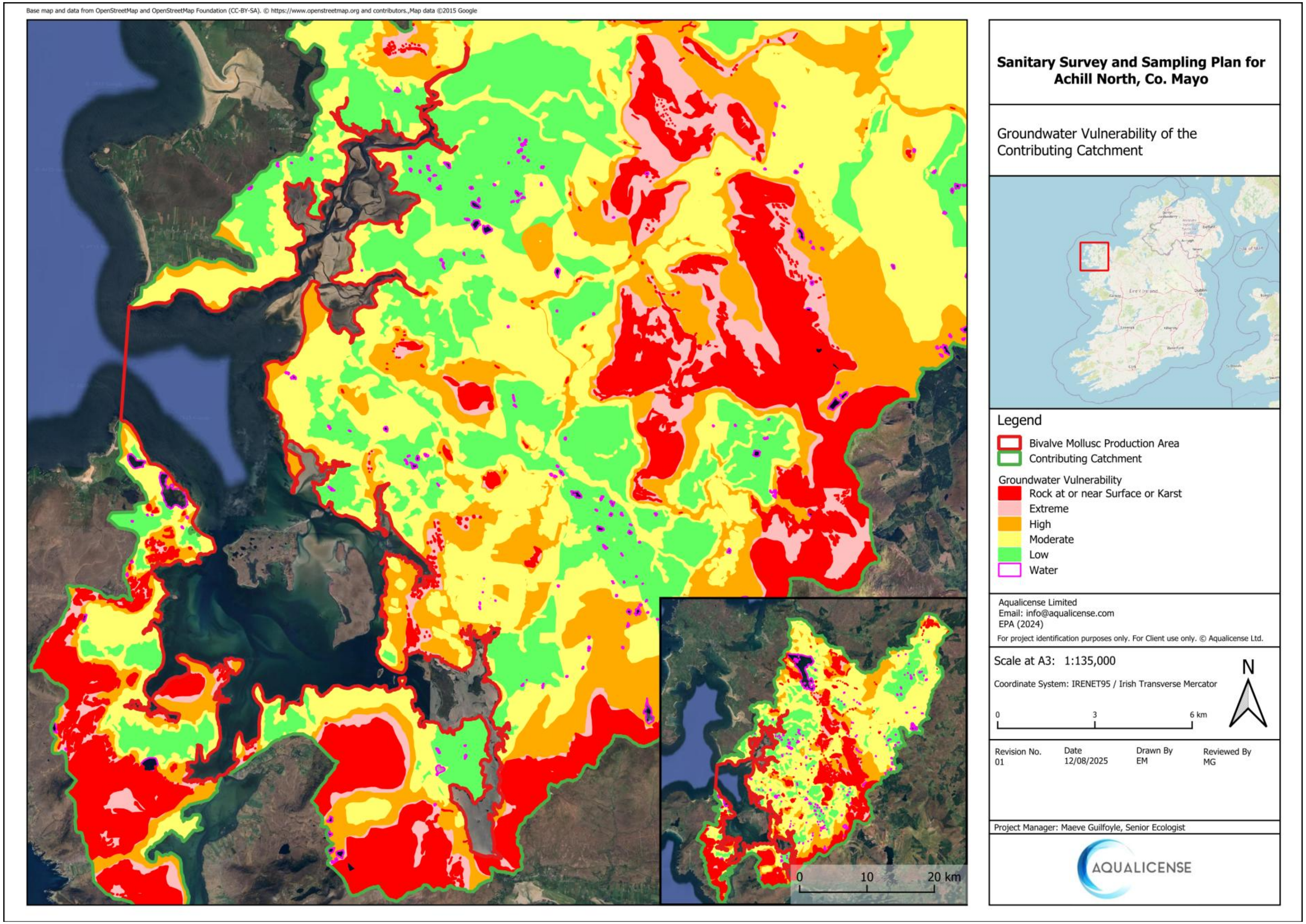

Figure 2-5. Groundwater vulnerability of the contributing catchment (Accessed 11/08/25)

2.4.3 Hydrodynamics

No detailed hydrodynamic studies specific to the Achill North area is available. In the absence of a site-specific hydrodynamic study for the area, the information herein is inferred from local adjacent and regional datasets. This constraint is restricting and challenging, and the findings should be interpreted with a high degree of caution.

A hydrographic study was undertaken in 2021 in the adjacent Blacksod Bay (Aquafact, 2005; Aquafact, 2021) had been used to infer data for Achill North. The validity and applicability of this data to Achill North is discussed below and potential limitations have been highlighted. Additional insights have been drawn from Admiralty Chart 2704-0_W and 2667-0_W (UK Hydrographic Office, 2025).

2.4.3.1 Bathymetry

Bathymetry was assessed through Admiralty Charts 2704-0_W (Blacksod Bay and Approaches) and 2667-0_W (Clew Bay and Approaches) (Figure 2-6). The area is bounded by the Achill North production area (Kinrover Point-Ridge Point and Achill Bridge east to west), depths in the area are generally shallow and gently graded, with extensive intertidal flats (predominantly sand) nearshore bars and isolated rocks, with deeper contours reached quickly seaward. The inner extents of the bay are generally in single digit depths at chart datum, rapidly deepening toward the western channel.

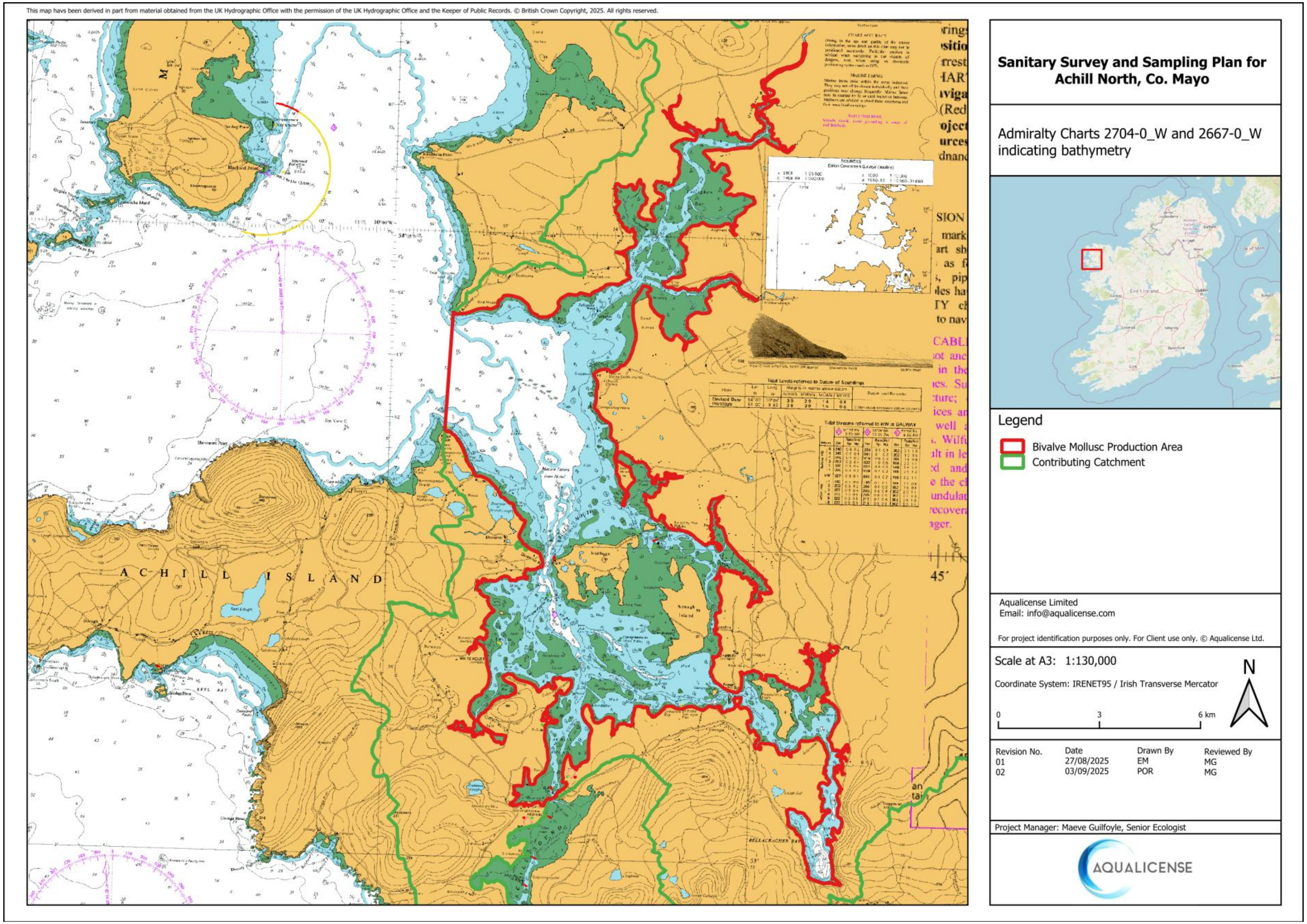

Figure 2-6. Admiralty charts 2704-0_W and 2667-0_W indicating bathymetry

2.4.3.2 TIDAL INFLUENCE

Tide predictions were sourced from INTGN harmonic analyses at nearby gauges and Marine Institute ROMS model output at non-gauge locations both providing astronomical tide levels for the area. Predicted tidal ranges along the Achill North coast are typically ~3.3-3.6 m (springs) and 1.4-1.6 m (neaps) respectively based on nearby reference ports (Blacksod Pier, Iniskea South) and at Keel Bay (Achill Island) Drogue tracking, dye release, water current and wind data assessed (Aquafact, 1999) indicated that currents are mainly tide driven with the main current flow direction is a north-northeasterly direction.

2.4.3.3 TEMPERATURE AND SALINITY

No data is available for temperature and salinity modelling within the Achill North BMPA. However, this absence does not undermine the determinations made in this sanitary survey area there is an abundance of data on tides and currents along with studies conducted in nearby Blacksod Bay for temperature and salinity. Studies for Blacksod bay found that in the inner bay (Trawmore Bay), salinity ranged from 32 to 35 PSU, while in the outer bay (in proximity to Blacksod Point), it was 33 to 34 PSU (Aquafact, 2021). Temperature recorded during surveys in Blacksod Bay ranged from 11.8 – 13.0 °C during neap tides and 14.6 – 15.4 °C for spring tides (Aquafact, 2005). Temperature ranges are likely to be similar for the Achill North BMPA.

2.4.3.4 CURRENT PATTERNS

Current patterns on the west coast of Ireland are impacted by the North Atlantic Oscillation and low-pressure systems (Ren, et al., 2023). Average current speeds in the region have been recorded to peak in winter and are lowest in spring (Ren, et al., 2023). The Achill North BMPA occupies the northern approaches to Achill Sound extending to the Inner reaches of Blacksod Bay. Bealacragher bay within this area is a highly sheltered inlet with a narrow connection to the sea, which modifies and attenuates the tidal flow within Bealacragher bay (McCorry&Ryle, 2009). Consequently, residence times in Bealacragher bay are expected to be longer than in adjacent open waters.

Outside the entrances and in nearby Achill Sound and the Clew- Blacksod approaches the tidal stream directions and rates are provided buy UKHO Admiralty Chart 2704 and 2667, with tidal diamond C indicating the hourly set and rate through the cycle for the area (approximately north to south- south easterly direction).

As there are no site-specific hydrodynamic studies for the area a tidal prism method was used to estimate the flushing time, this is used where flow/flux data is unavailable. The Tidal prism can be calculated from tidal wave heights and basin bathymetry (EMODNet, 2025) This process assumes that the tidal exchange is the dominant renewal process for the bay with the flushing time calculated from the ratio of basin volume to tidal prism, adjusted for tidal period and return flow factor. The return flow factor accounts for water re-entering on the flooding tide. The method also assumes that the system is well mixed and that the receiving waters outside the bay are large enough to dilute the outflowing water without feedback effects (Monsen et al 2002). As it treats the system as fully mixed, it generally provides slightly more conservative estimates of flushing times.

The application of the tidal prism method to Achill North indicates flushing times of approximately 0.7 days during spring tides and 1.7 days during neap tides under full exchange conditions. When partial return flow is included, flushing times increase to ~2.4 days (spring) and 5.7 days (neap tides) at a return factor of 70% (Figure 2-7).

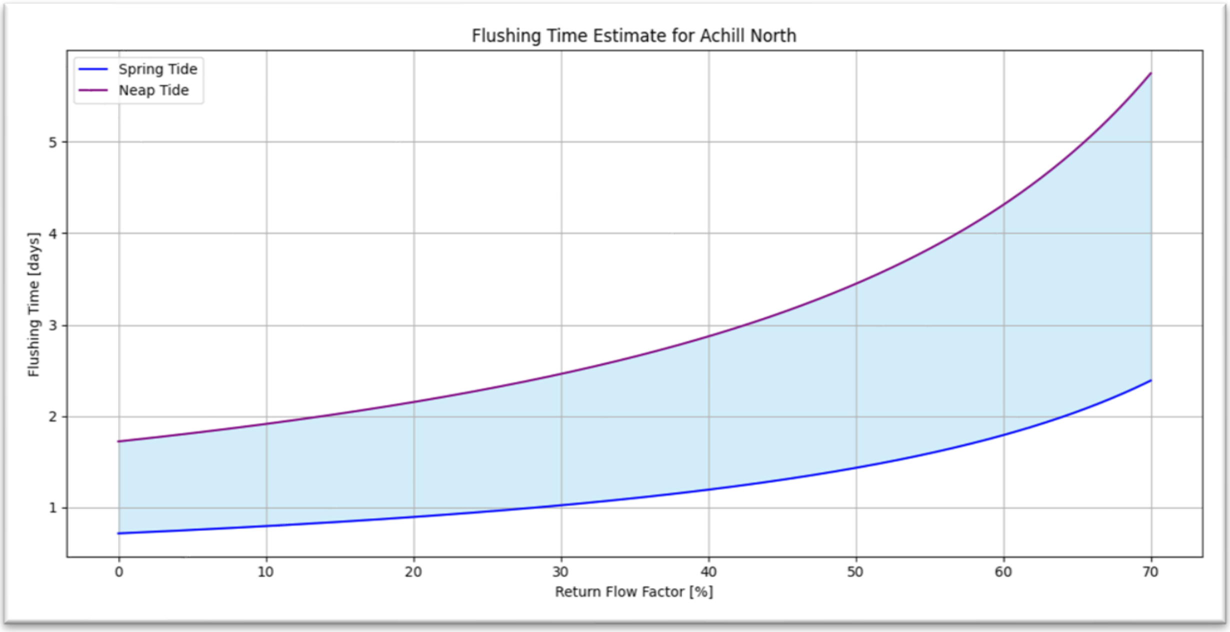

Figure 2-7. Flushing time estimate curve for Achill North on Spring and Neap tides

These results suggest that Achill north is flushed relatively quickly during spring tides, while renewal slows markedly during neaps, making tidal phase a key control on water renewal and water quality in the area.

However, there are sheltered and shallow areas to the north and south which are expected to have higher residence times due to reduced exchange and slower current speeds, particularly on ebb tides, leading to longer residence times in these regions. In practice, residence time varies spatially; the central corridor connected to the Atlantic and Achill Sound is well flushed, while the sheltered, shallow northern and southern pockets are likely to retain water longer, especially on the ebb tides, analogous to inner Broadhaven Bay (Aquafact, 2005).

2.4.4 Weather

Weather patterns significantly influence the transport of organic pollutants. The nearest synoptic weather station to the production area is Newport (furnace), located ~14.42 km west. Data from this station from July 2015 to June 2025 inclusive (Met Éireann, 2025a, 2025b) have been used to infer weather patterns and seasonality influencing pollutant circulation within the production area.

2.4.4.1 Wind and Waves

Wind

The prevailing wind direction is southerly (~17.6 ms^{-1}), accounting for 27.6% of all winds (Figure 2-10). The next strongest sector is south-west (SW) (accounting for 22.1%) with a maximum mean of ~16.6 ms^{-1}. There is a seasonal prevalence with winter having the strongest and most persistent flow, dominated by the west- southerly winds and higher overall mean speed (~7.5 ms^{-1}).

Autumn and spring retain the south- south westerly bias but with slightly lower wind speeds (~6.05-5.74 ms^{-1}), with south-westerly blasts more common during the summer. Summer remains southerly let yet is the gentlest wind speeds (~5.44 ms^{-1}) and displays a broader directional spread overall, including occasional westerly and north easterlies. For further details refer to *Summary Statistics* for Weather.

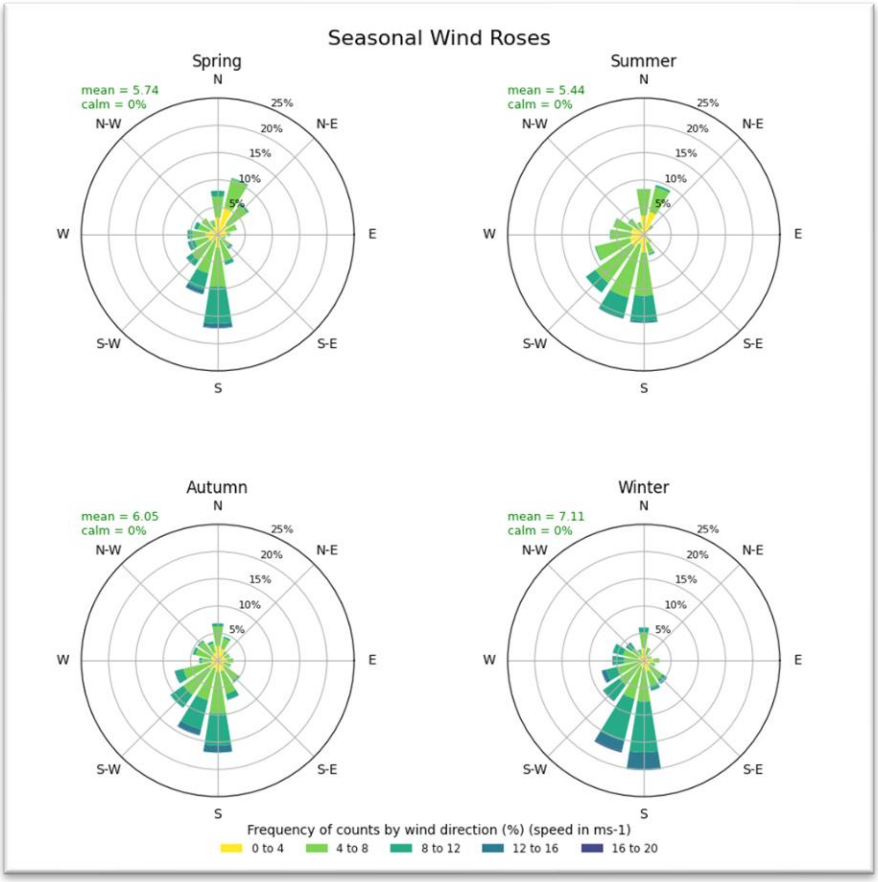

Figure 2-8. Seasonal wind roses for Newport Furnace (July 2015 to June 2025 inclusive)

Waves

Waves and currents play a crucial role in hydrographic conditions. Of particular relevance to sanitary surveys, wind-driven waves facilitate sediment resuspension and transport (Green and Coco, 2014) These waves are primarily generated by local prevailing winds and travel in the direction of those winds. Their characteristics are influenced by factors such as wind speed, duration, and fetch (Young, 1999)

An EPA study in Golden Strand, Achill (2.16 km from the BMPA) found that during storm events, the average significant wave height (H_s) and wave period ranged from 3.5m to 4.1m and 8.3 s to 13 s respectively (Farrell, et al., 2021). The Marine Institute East Atlantic SWAN Wave Model for local conditions in the area from 2015 to 2017 reported average H_s values of 1.5 to 2.5 m (Farrell, et al., 2021).

The WAVEWATCH III wave model gives a value for average wave direction in Achill Island as 250–300 degrees, which means that waves are typically coming from the west and moving towards the east (Gallagher, Tiron, & Dias, 2013). The same model reports the average energy period for waves in the region as 8 – 12 seconds (Gallagher, Tiron, & Dias, 2013).

2.4.4.2 PRECIPITATION

Heavy rainfall can lead to surface runoff, transporting organic pollutants from land-based sources, such as farms and wastewater overflows, into surface water bodies and potentially to the production area. The mean monthly rainfall is at its lowest levels during the spring period, followed by summer, with rain fall peaking in autumn and winter (Figure 2-9). The driest period occurs from April to July, with precipitation reaching a peak during the winter months.

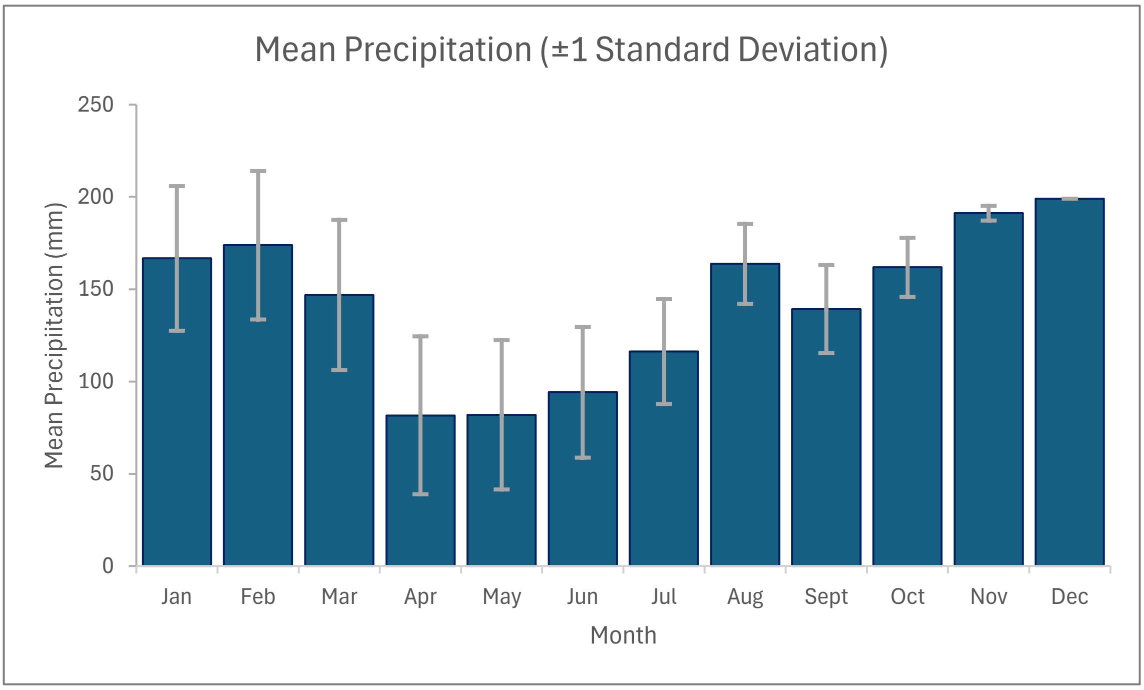

Figure 2-9. Mean monthly precipitation (± 1 standard deviation) at Newport Furnace (July 2015 to June 2025 inclusive)

Mean monthly rainfall levels are highest in December (199.09 mm), although heavy rainfall events occur throughout the year, with the exception of the months of April and may where precipitation levels drop to less than 82 mm per month.

Heavy rainfall during the spring and summer can result in increased faecal loadings, largely due to higher livestock stocking densities and the accumulation of faecal matter over the summer months. Therefore, the influence of precipitation on circulation of pollutants will be further discussed in Section 2.5 as relevant for each source of contamination.

2.4.5 Summary of the Characteristics of Circulation of Pollutants

For clarity at this stage of the Sanitary Survey, a brief overview of the findings of this section of the report will be provided. Key characteristics identified include:

- **Freshwater Inflows:** The major sources of freshwater inflow within the contributing catchment are the rivers Owenduff, Owenmore, Glenadarary, and Bellagarvaun. The Owenmore River is considered to be the primary inflow of freshwater to the Bay.
- **Groundwater:** Groundwater vulnerability is high in areas on the coastal fringe of the contributing catchment. These are the regions at greatest risk in terms of groundwater infiltration.
- **Hydrodynamics:** Current and tidal patterns may lead to localised areas of pollutant concentration, particularly in the central (around drying heights) and Bellacragher bay, which has a narrowed channel and abundant freshwater inflows to the south-east. Flushing time within the bay varies dependant on the tidal state, with best estimates ranging from ~2.4 days to 5.7days.
- **Weather:** Sediment resuspension and movement of contaminants (within surface waters) may occur during the stronger south/south-westerly winds. Heavy rainfall may influence the seasonality of the surface water run-off particularly during the summer and winter seasons.

These factors collectively affect the entry, movement, and dispersion of pollutants in the production area, with further details on individual pollution sources to be discussed in subsequent sections.

2.5 Inventory of Pollution Sources and Seasonal Variations of Pollutants

An inventory will be compiled detailing potential pollution sources of human and animal origin, focusing solely on those containing faecal matter. All identified sources within the contributing catchment (Figure 2-3) will be assessed, considering seasonal variations where relevant. This assessment complies with Part 1a and 1b of Article 56 of Commission Implementing Regulation (EU) 2019/627 (see Section 1 for details).

2.5.1 Sewage Discharges

This section examines sewage discharges from human sources, primarily Urban Wastewater Treatment Plants (UWWTPs) and septic tanks. Contamination risk is influenced by factors such as location, size, treatment level, and discharge frequency. The following sections will provide a detailed analysis of all identified discharges within the contributing catchment.

2.5.1.1 URBAN WASTE WATER TREATMENT PLANTS

UWWTPs are linked to various discharges, primarily the continuous release of treated and untreated sewage. They also produce intermittent discharges, including rainfall-dependent releases via combined sewer overflows and stormwater overflows, as well as emergency discharges under exceptional circumstances.

Following examination of EPA data (EPA, 2025), a total of 1 Urban Waste Water Treatment Plants exist serving a Population Equivalent (PE) of less than 500. A total of 2 UWWTPs serving a population equivalent of greater than 500 are present within the contributing catchment, and these are further elaborated on in Table 2-3.

Upon further review plants with a design capacity of below 500 PE were screened out as:

- Under both the Urban Waste Water Treatment Regulations (2001) and the Water Framework Directive, discharges from works of <500 PE are classed as "*small agglomerations*" and are not required to meet the same monitoring or reporting frequency as larger plants; they are therefore of lower regulatory priority.
- Including the <500 PE discharge would ultimately dilute the sampling effort without materially improving the source distribution as the >500 PE group captures the vast majority of the pollutant load and aligns with the threshold used to define "significant point sources".

Further detailed information was gleaned from the individual UWWTP reports generated from the annual environmental reports UISCE Eireann 2023.

Table 2-3. Characterisation of all Waste Water Discharge Authorisations for UWWTPs serving a Population Equivalent >500 within the Contributing Catchment (Uisce Eireann 2023).

Name	Discharge Point Reference (Inflow Point)	Storm Water Overflows (Irish Grid, Approx. Ultimate Inflow Point)	Treatment	Population Capacity	Capacity Remaining/	2023 AER Compliant (Y/N)	Parameters Failing	Incidents in 2023	Current Capacity to be Exceeded by 2026	Notes
Achill Sound D0511-01	TPEFF2200D0511SW001	No storm water overflows within the agglomeration	2 - Secondary treatment	1200	Remaining capacity is currently 658	Yes	N/A	None	No	The annual mean and max hydraulic loading is less than the peak Treatment Plant Capacity. The design of the wastewater treatment plant allows for peak values and therefore the peak loads have not impacted on compliance with Emission Limit Values. The WWTP is compliant with the ELV's set in the Wastewater Discharge Licence and does not have an observable impact on the water quality, on the WFD status or designated shellfish water quality. (D0511-01_Achill_Sound_Annual_Report_2023)
Bangor Erris D0215-01	TPEFF2200D0215SW001	85641,322726	3 Tertiary P removal	1080	Remaining capacity is currently 659	Non-compliant	ortho-Phosphate (as P) - unspecified mg/l Suspended Solids mg/l	5- Including 3 Abatement of equipment off-line caused by plant or equipment breakdown at WWTP, a single	No	The WWTP discharge was not compliant with the ELV's set in the wastewater discharge licence for the following: Suspended Solids mg/l, ortho-Phosphate (as P) - unspecified mg/l. The ambient monitoring results do not meet the required EQS at the upstream and

Name	Discharge Point Reference (Inflow Point)	Storm Water Overflows (Irish Grid, Approx. Ultimate Inflow Point)	Treatment Capacity	Population Capacity	Capacity Remaining/	2023 AER Compliant (Y/N)	Parameters Failing	Incidents in 2023	Current Capacity to be Exceeded by 2026	Notes
								breach of ELV due to Inadequate operational procedures/training and monitoring equipment offline due to the plant or equipment breakdown at WWTP.		the downstream monitoring locations. The EQS relates to the Oxygenation and Nutrient Conditions set out in the Surface Water Regulations 2009. Based on ambient monitoring results a deterioration in BOD mg/l, Ammonia (as N) mg/l, ortho-Phosphate (as P) mg/l, concentrations downstream of the effluent discharge is noted. (D0215-01 Bangor Erris Annual Report 2023)

2.5.1.2 SEPTIC TANKS AND OTHER SEWERAGE TYPES

Ireland has nearly half a million Domestic Waste Water Treatment Systems (DWWTSs), primarily septic tanks (EPA, 2021). In 2023, 45% of these systems failed inspection, posing risks to household drinking water and the wider environment, including surface and groundwater. The EPA categorises DWWTS risk zones as follows:

- Zone 1: Higher risk to surface waters.
- Zone 2: Higher risk to household wells.
- Zone 3: Lower risk areas.

Currently, no comprehensive database exists for DWWTS locations. Therefore, this section relies on Census 2022 small-area statistics (CSO, 2023c). Table 2-4 and Figure 2-11 present the percentage of each small area overlapping the contributing catchment and its population density.

Table 2-4. Statistics for Small Areas overlapping the contributing catchment and corresponding population density (CSO, 2023c)

SMALL AREA CODE	CONTRIBUTING CATCHMENT OVERLAP	POPULATION DENSITY (PEOPLE PER KM2)
A157001001	91.7%	35
A157001002	94.3%	17
A157001003	>99%	26
A157001004/A157001005	53.7%	0
A157001006	40.4%	12
A157022001/A157022002	2.9%	0
A157023001	>99%	10
A157023002	>99%	2
A157024001/A157024004	99.0%	0
A157024002/A157024003	89.3%	0
A157031001/A157031002	>99%	0
A157031003	>99%	4
A157032001	1.0%	2
A157034001/A157034002	19.4%	0
A157040001	4.6%	1
A157060001/A157060002	>99%	0
A157060003	41.3%	5
A157060004	36.1%	20
A157060005	<1%	8
A157071001	13.4%	3
A157074001/A157074002	3.7%	0
A157074003/A157074005/A157074006/A157074004	57.2%	0
A157074008/A157074007	95.9%	0
A157080001	59.1%	4

Small Area Code	Contributing Catchment Overlap	Population Density (People per km2)
A157081002	5.4%	6
A157082001/A157136001	>99%	0
A157084001	90.8%	4
A157092001	28.4%	3
A157093001	44.0%	1
A157111002	66.1%	9
A157111003	5.4%	20
A157111004	37.6%	22
A157122001/A157122002	53.1%	0
A157127001/A157127007	6.0%	0
A157127002/A157127005/A157127006	<1%	0
A157132001	16.4%	25
A157132002	82.8%	13
A157132003	95.4%	471
A157132004	10.9%	9
A157132005	18.1%	11
A157139002	<1%	15
A157142001	1.6%	2

Sewerage type estimates were also obtained from Census 2022 data (CSO, 2023c). These figures are presented as percentages for entire small areas, as individual data for overlapping catchments would not be representative (small areas do not directly align with the contributing catchment, see Table 2-4, Figure 2-10, and Figure 2-11 highlights the extent of reliance on septic tanks within the catchment.

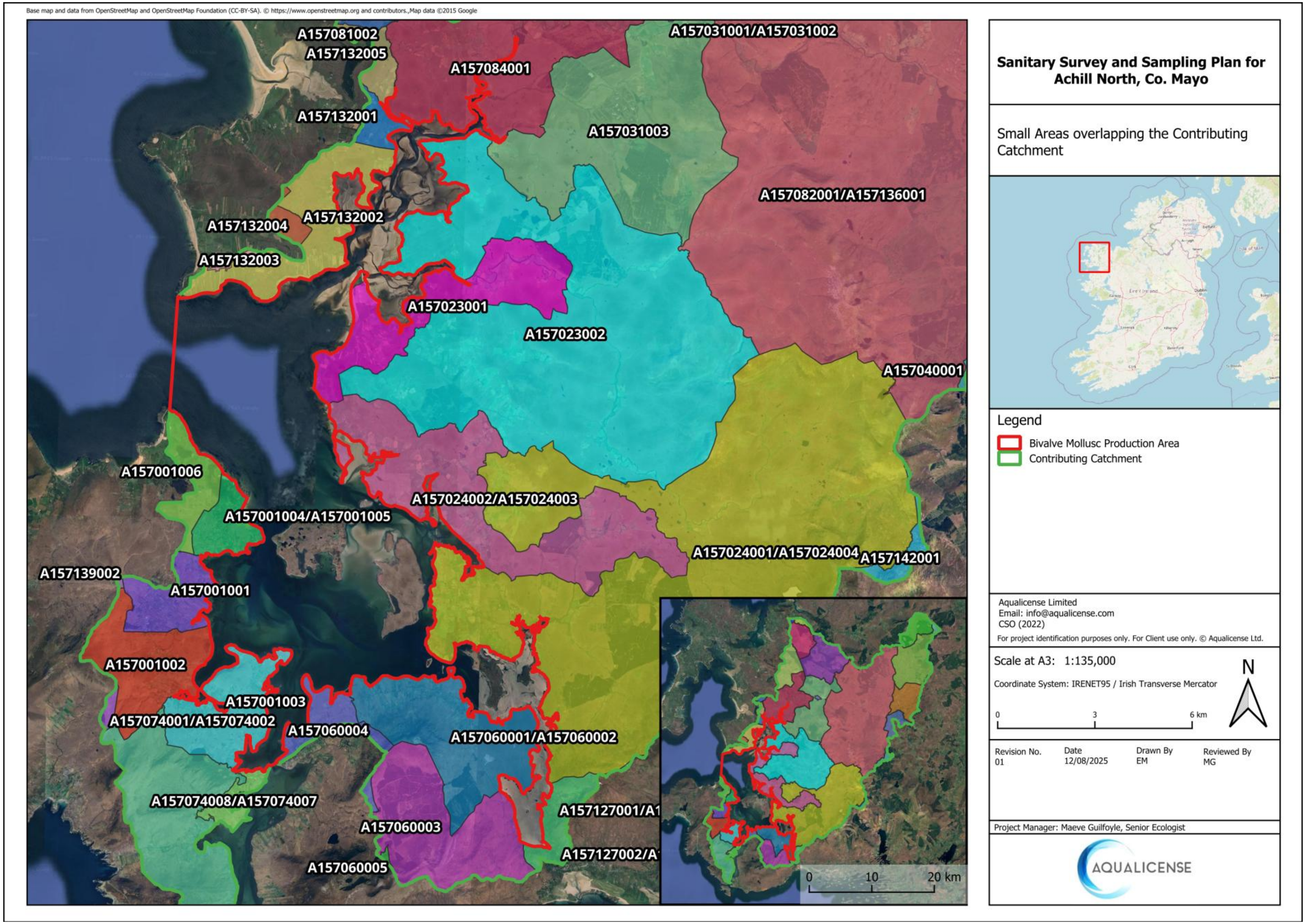

Figure 2-10. Small areas overlapping the contributing catchment (Accessed 11/08/2025)

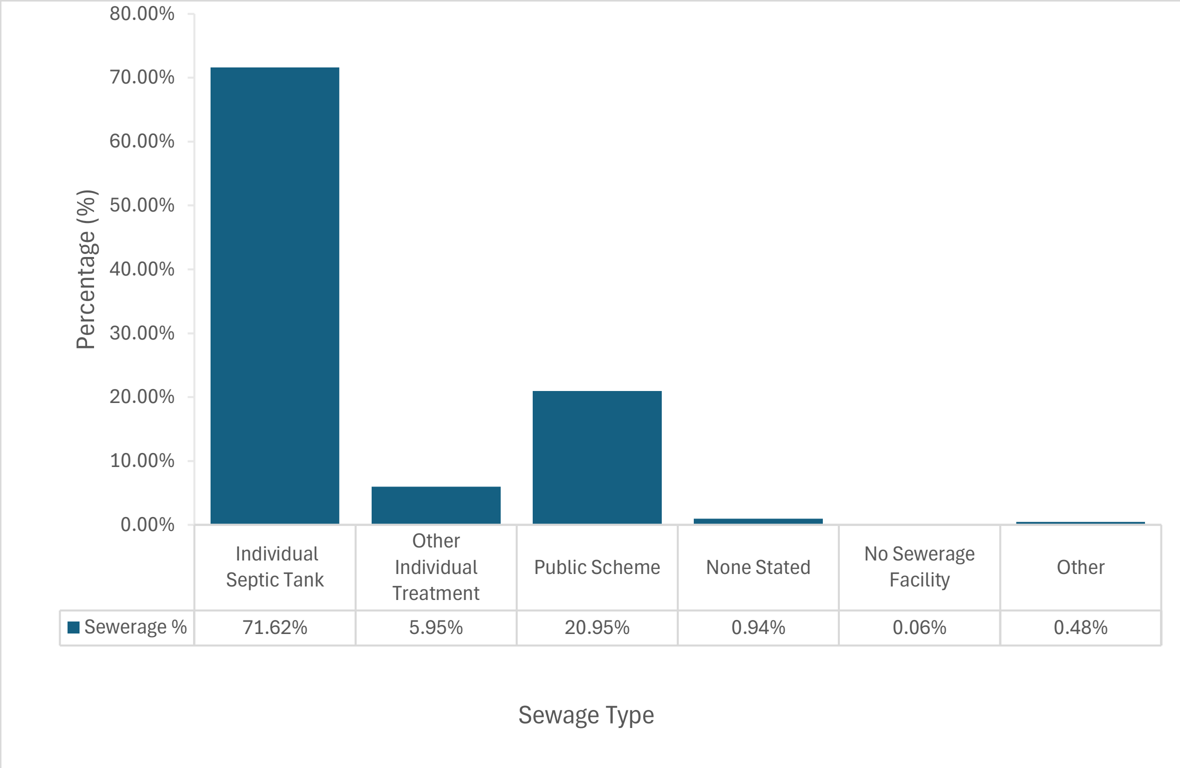

Figure 2-11. Percentage estimates of sewerage types for permanent private households according to the 2022 census

No areas within the contributing catchment are designated as Zone 1 (high environmental risk). The majority of the contributing catchment falls within Zone 3 Low (EPA, 2021). Several small areas that fall into Zone 2 (potential risk to human health) in the south part of the catchment; however, these are not located in close proximity to the BMPA (Figure 2-12). The exception is a Zone 2 area to the southeast within the Glennanean 010 and Cartron 010 river subbasins approximately 500 m to the south and southeast of the BMPA.

While these risk zones indicate potential contamination, other factors must be considered when assessing susceptibility to DWWTS failure or non-compliance. Given the widespread reliance on septic tanks, population density and hydrography provide valuable insights into the potential risk to the BMPA.

Although the population densities within Zone 2 are relatively modest (20-35 people per km^2 in A157711003, A157060004 and A157001001; see Table 2-4), the per-household DWWTS loads can elevate risk. Vulnerability peaks along the coastal fringes with 12.32% “Rock at/near Surface or Karst” and 8.30% “Extreme” where thin subsoils and bedrock outcrops shorten flow paths and limit attenuation before discharge into the BMPA. By comparison, the larger Zone 3 areas are sparsely populated (0-10 people per km2), would contribute little to the loading , with the inland zones having thicker subsoils which would provide greater dilution and pathogen die-off before reaching the BMPA (Gill, Johnston, Misstear, & Ó Súilleabháin, 2004).

Surface water hydrology also plays a crucial role in contamination risk. Groundwater-fed streams and drainage ditches that outfall to the BMPA’s tidal inlet can act as efficient conduits from adjacent risk areas. Where these outflows traverse high vulnerability coastal zones, any septic-related contamination is less attenuated and more likely to reach the intertidal zone.

Longer inflow flow paths through lower-vulnerability terrain tend to provide greater dilution and filtration.

Therefore, considering groundwater vulnerability, surface water flows, and population density, the coastal fringe immediately south-southeast of the BMPA, along the tidal inlets draining the Glennanean 010 and Cartron 010 sub-catchments where Zone 2 pockets intersect thin subsoils and short groundwater flow paths, are the most likely locations for sewage-contaminated discharges from DWWTSs.

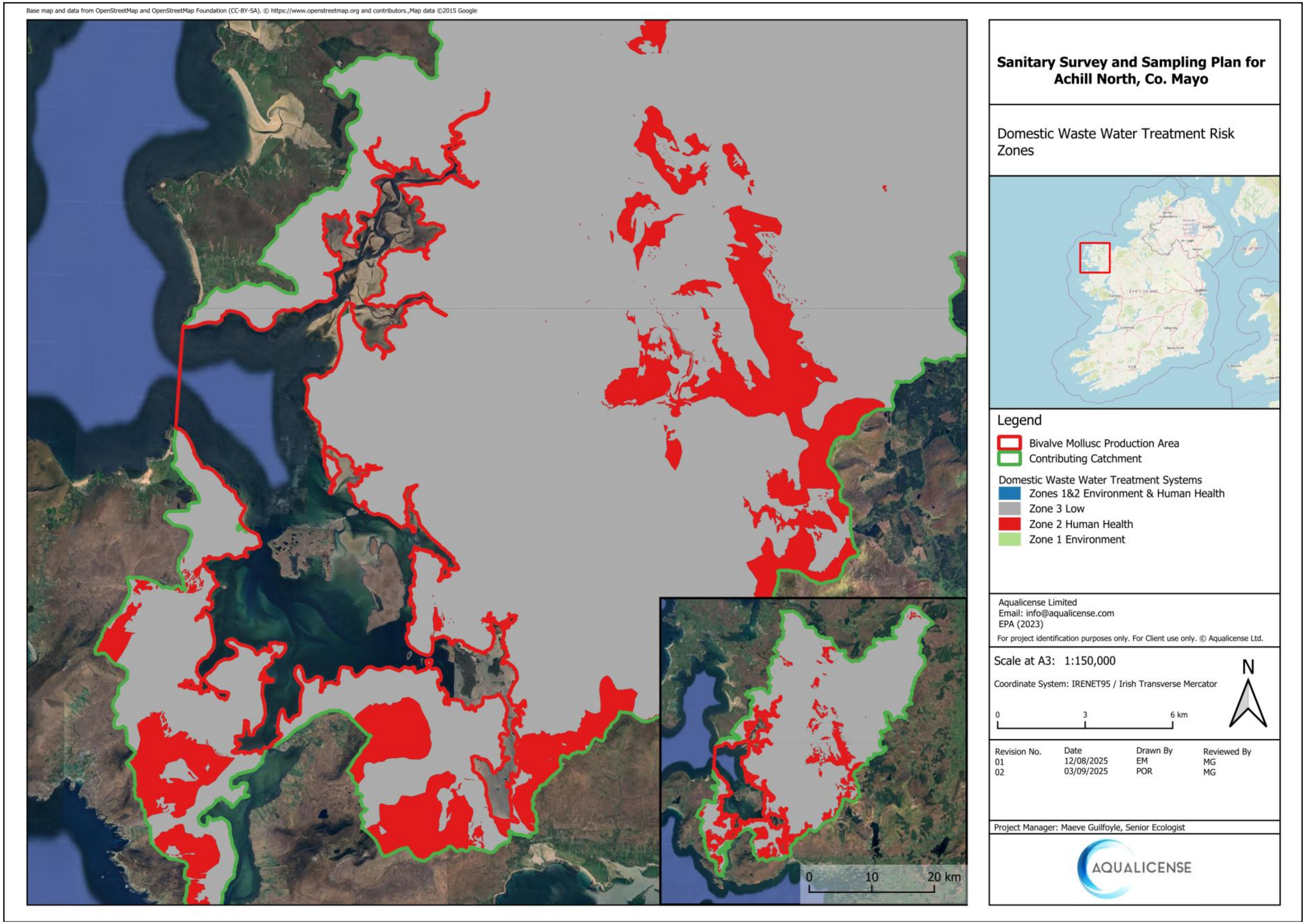

Figure 2-12. Domestic Waste Water Treatment Risk Zones (Accessed 11/08/25)

2.5.2 Industrial Emissions

2.5.2.1 IE and IPC Licences

The EPA regulates specific industrial and agricultural activities in Ireland through Industrial Emissions (IE) licences and Integrated Pollution Control (IPC) licences. While these cover a broad range of activities, only those relevant to potential faecal contamination from human or animal sources are considered in this desk-based study. The key categories assessed include:

- Food and Drink
- Waste
- Intensive Agriculture (Poultry and Pigs)
- Other Activities (including wastewater treatment)

A total of three licences [two IE licences, one IPC licence, and no Waste licences] have been granted within the contributing catchment (EPA, 2024a). Excluding any licences previously discussed in Section 2.5.2.1, the following section examines these licenses (Table 2-5).

Table 2-5. Characterisation of the relevant IE and IPC licenses granted within the contributing catchment.

License Type	License Number	Name	Pathways to the BMPA	Latitude (WGS 84)	Longitude (WGS 84)	Main Class of Activity
IEL	W0199	Srahmore Peat Deposition Site	Located inland ~3.14km to the north of the BMPA, feeds into the Owenmore river which has an ultimate inflow point of 68	54.15226	-9.777209	Decommissioning and rehabilitation efforts of peat harvesting area
IEL	P0738-03	Vermillion Exploration and Production Ireland Limited	Located inland ~12.08km to the north of the BMPA, feeds into the Owenmore river which has an ultimate inflow point of 68	54.23420	-9.742084	The operation of mineral oil and gas refineries and the refining of mineral oil and gas.
IPC	P0505-01	Bord na Mona Energy Limited	Located inland ~23.82km from the BMPA near to the Muing 010 river subbasin, feeds into the Owenmore river which has an ultimate inflow point of 68	54.115736	-9.544167	Decommissioning and rehabilitation efforts of peat harvesting area

2.5.2.2 SECTION 4 DISCHARGES

Section 4 Discharge licences, issued under Section 4 of the Local Government (Water Pollution) Act 1977 (as amended in 1990), regulate the discharge of trade and sewage effluent into surface water and groundwater. These licences set conditions to ensure effluent is treated and controlled to protect the receiving environment.

A total of 1 Section 4 discharges is present within the contributing catchment (EPA, 2024b), which will be characterised and discussed in further detail below (Table 2-6 and Figure 2-13).

Table 2-6. Characterisation of the Section 4 Discharges within the contributing catchment.

REFERENCE	NAME	FACILITY ADDRESS	LATITUDE (WGS 84)	LONGITUDE (WGS 84)	POTENTIAL PATHWAY TO THE BMPA	DISCHARGE TYPE
WP(W)78	Michael Barrett, Doohooma	Sea Road Inn, Doohooma, Bangor Erris, Co. Mayo	54.069327	-9.952224	Positioned equidistant between inflow points 87 and 86 in the Tulachán Dubh river subbasin in the northwest of the BMPA	Not specified

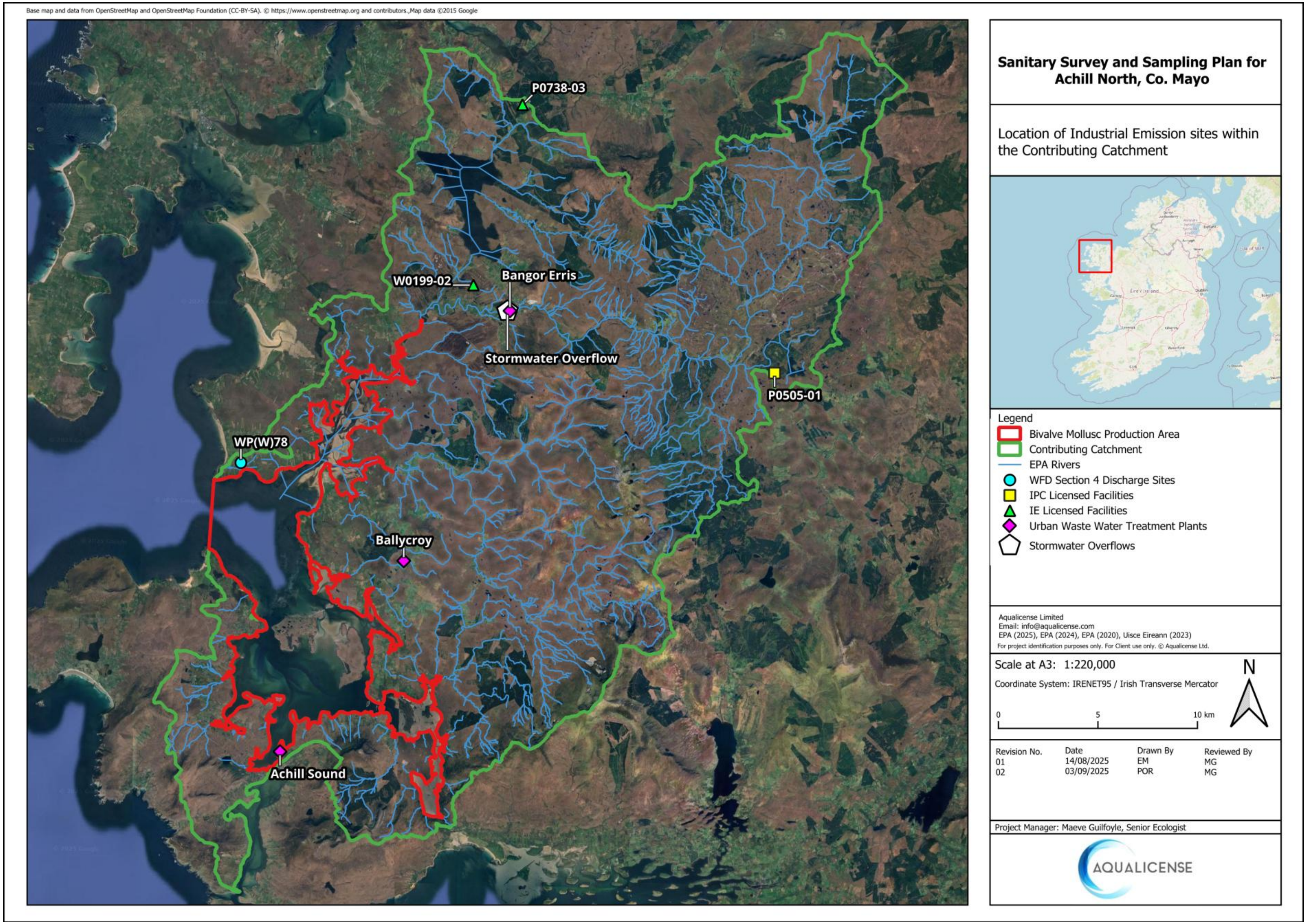

Figure 2-13. Industrial Emissions within the Contributing Catchment (Accessed 11/08/25)

2.5.3 LAND USE

According to Corine (2018), land cover within the contributing catchment is dominated by Peat bogs (461.1km^2, 65.4%). Coniferous forest is the next most dominant land cover type (76.9 km^2, 10.9%). Other land use types within the contributing catchment are: Land principally occupied by agriculture, with significant areas of natural vegetation (55.2 km^2, 7.8%); Transitional woodland-shrub (54.7 km^2, 7.8%); Pastures (15.3 km^2, 2.2%); Moors and heathland (11.8 km^2, 1.7%); Water bodies (10.3 km^2, 1.5%) and sparsely vegetated areas (9.2 km^2, 1.3%) (Figure 2-14*)*.

A number of land cover types cover areas of less than 1%, namely: Natural grasslands; sea and ocean; discontinuous urban fabric; beaches, dunes, sands; mixed forest; Intertidal flats; bare rocks; estuaries and Industrial or commercial units. .

Of the above land cover types, pastures and agricultural lands are the most likely to give rise to faecal contamination in the contributing catchment.

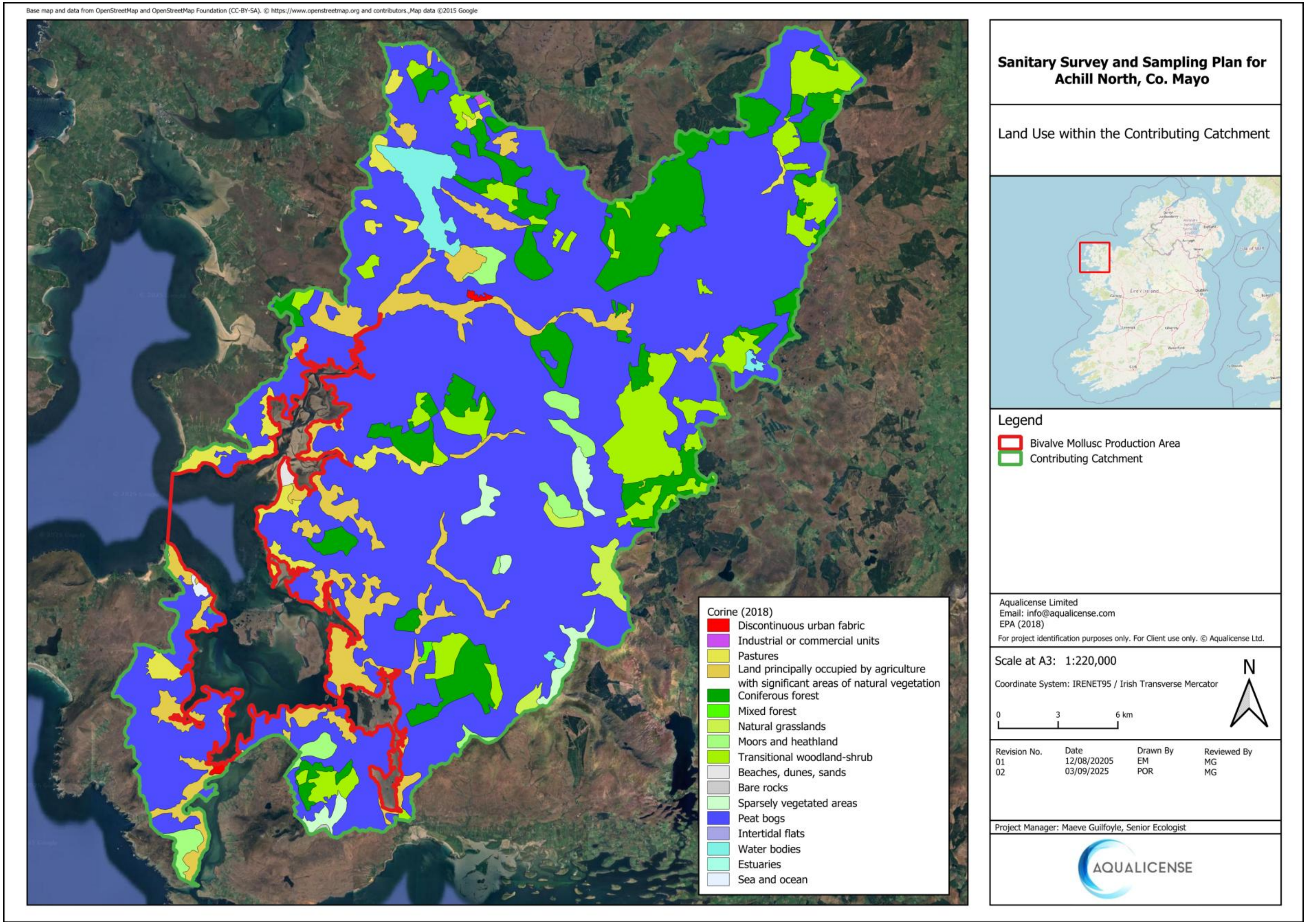

Figure 2-14. Land Use within the Contributing Catchment (Accessed 11/08/25)

2.5.3.1 AGRICULTURE

Animals

Faecal production and *E. coli* loads from domestic animals are often comparable to or greater than those from humans (Table 2-7). Sheep have the highest daily E. coli load, followed by pigs, cows, humans, and chickens. Contamination can occur through direct deposition into watercourses or run-off following rainfall, with seasonal patterns influencing agricultural contamination (see Section 2.4.4.2). Stocking densities also play a role, with higher faecal contamination typically observed during summer months (Hunter, Perkins, Tranter, & Gunn, 1999).

Table 2-7. Estimated faecal production and *E. coli* loadings of selected domestic animals in comparison with humans (Jones and White, 1982 as read in Taylor (2003))

SOURCE	FAECAL PRODUCTION (G/DAY)	AVERAGE NUMBER (*E. COLI*/G)	DAILY LOAD (*E. COLI*)
Man	150	13 x 106	1.9 x 109
Cow	23600	0.23 x 106	5.4 x 109
Sheep	1130	16 x 106	18.1 x 109
Chicken	182	1.3 x 106	0.24 x 109
Pig	2700	3.3 x 106	8.9 x 109

The most comprehensive agricultural data available is derived from 2020 Census of Agriculture (CSO, 2020) with the smallest reporting unit being the Electoral Division (ED). While data are not provided on chickens or pigs, intensive poultry farms (>40,000 places[1]) and pig farms requiring licences (>750 sows or >3,000 production pigs) that fall under EPA licensing control are discussed in Section 2.5.2.1.

A total of 23 Electoral Divisions (EDs) overlap with the contributing catchment (Figure 2-15). However, these EDs do not directly correspond to the contributing catchment boundary, requiring an estimation of the percentage overlap (Table 2-8). Table 2-8 also presents grazing animal census data for each ED, including both total livestock numbers and corrected estimates based on an assumed even distribution of animals across the ED.

Table 2-8. Statistics from the Census of Agriculture 2020 relating to grazing farm animals within the Electoral Divisions overlapping the contributing catchment

ELECTORAL DIVISION	PERCENTAGE OVERLAP OF CONTRIBUTING CATCHMENT	TOTAL (CORRECTED) DAIRY COWS	TOTAL (CORRECTED) LIVESTOCK	TOTAL (CORRECTED) OTHER COWS	TOTAL (CORRECTED) CATTLE	TOTAL (CORRECTED) SHEEP
Achill	74.2%	0 (0)	565 (419)	91 (68)	197 (146)	4319 (3205)
Ballycastle	2.1%	0 (0)	1733 (37)	791 (17)	2070 (45)	3630 (78)
Ballycroy north	>99%	0 (0)	1358 (1348)	384 (381)	780 (774)	8465 (8401)

[1] Refers to places for birds e.g. broilers, layers, etc.

Electoral Division	Percentage Overlap of Contributing Catchment	Total (Corrected) Dairy Cows	Total (Corrected) Livestock	Total (Corrected) Other Cows	Total (Corrected) Cattle	Total (Corrected) Sheep
Ballycroy south	96.1%	0 (0)	1660 (1596)	406 (390)	911 (876)	10640 (10230)
Bangor	>99%	0 (0)	523 (523)	91 (91)	287 (287)	3002 (3002)
Barroosky	1.0%	0 (0)	759 (8)	158 (2)	313 (3)	5408 (55)
Beldergmore	19.4%	0 (0)	1442 (280)	147 (28)	987 (191)	7692 (1491)
Bunaveela	4.8%	0 (0)	643 (31)	58 (3)	117 (6)	5643 (270)
Corraun Achill	40.1%	0 (0)	1124 (451)	62 (25)	160 (64)	10134 (4064)
Derry	13.3%	0 (0)	1316 (175)	328 (44)	857 (114)	7364 (980)
Dooega	43.5%	0 (0)	427 (185)	0 (0)	0 (0)	4204 (1827)
Glenamoy	59.3%	0 (0)	626 (371)	94 (56)	193 (114)	4901 (2905)
Glencastle	3.6%	0 (0)	898 (32)	390 (14)	980 (35)	2552 (92)
Goolamore	89.7%	0 (0)	439 (394)	206 (185)	423 (380)	1598 (1434)
Kilfian south	28.5%	0 (0)	1450 (413)	682 (194)	1995 (568)	1198 (341)
Kilfian west	44.0%	0 (0)	940 (414)	524 (230)	1240 (545)	1253 (551)
Knocknalower	41.2%	0 (0)	1551 (640)	378 (156)	797 (329)	10414 (4294)
Muings	53.1%	0 (0)	695 (370)	201 (107)	352 (187)	4595 (2442)
Newport west	4.7%	0 (0)	1359 (63)	233 (11)	503 (23)	10273 (479)
Rathhill	34.5%	0 (0)	963 (332)	592 (204)	1249 (430)	1440 (496)
Sheskin	>99%	0 (0)	1274 (1268)	157 (156)	646 (643)	8044 (8008)
Slievemore	<1%	0 (0)	1249 (3)	67 (0)	144 (0)	11442 (28)
Srahmore	1.7%	0 (0)	1391 (24)	192 (3)	409 (7)	11240 (195)

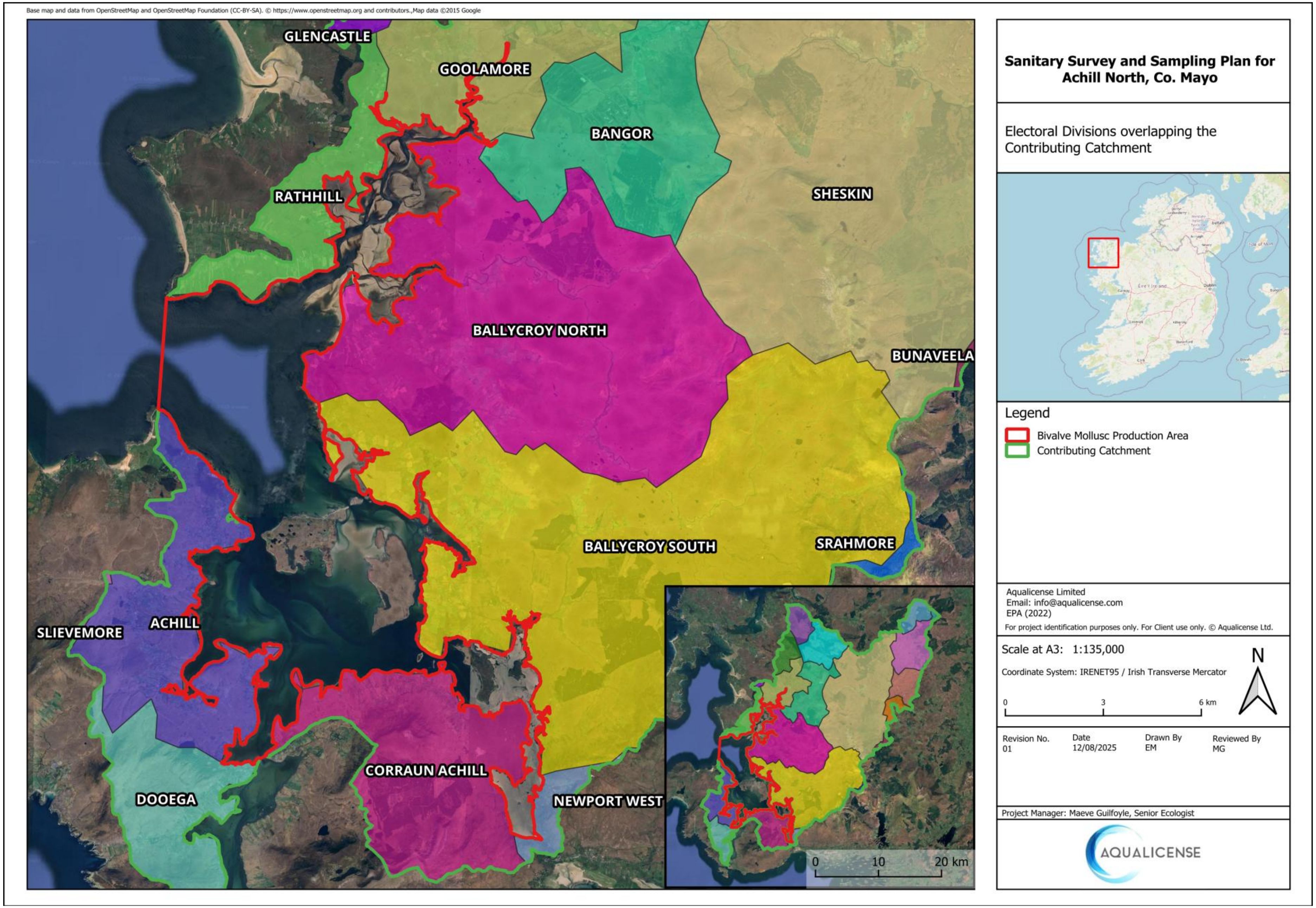

Figure 2-15. Electoral Divisions overlapping the Contributing Catchment (Accessed 11/08/25)

Under Ireland's Water Framework Directive (WFD) monitoring programme, waterbodies classified as "At Risk" of failing to meet their water quality objectives undergo assessment for significant pressures that must be addressed. Of particular relevance to this section are pressures from agriculture[2]. As part of the review of the third WFD cycle, 8 groundwater bodies (GWB) were found to be underlying the contributing catchment (Achill, Malranny, Laherdaun, Deel, Bellacorick-Killala, Bangor and Belmullet). None of these GWBs are considered "At Risk" and therefore have not been classified for agricultural pressures.

Although none of the groundwater bodies underlying the contributing catchment are currently classified as "At Risk" under the WFD, surface waters draining agricultural areas particularly those with high stocking densities, pose a contamination risk to the BMPA. This is of particular importance during heavy rainfall events that promote faecal run-off.

Census data (Table 2-8) indicate that sheep dominate the livestock numbers within the catchment with Ballycroy South (10,230), Sheskin (8,008), Ballycroy north (8,401) and Knocknalower (4,294) having the highest corrected counts. These Eds align with small areas of very low human population density suggesting animal sources are the primary pressures rather than domestic waste.

Critically, many of these areas coincide with coastal zones of "Extreme" or "Rock at/near Surface or Karst" groundwater vulnerability (GSI, 2021), where thin subsoils and shallow flow paths would limit natural attenuation, while being in close proximity to the BMPA boundary.

Agricultural pressures are seasonally driven, with increased faecal loading expected during summer grazing periods and after heavy rainfall, which promotes run-off and increased shallow subsurface flow. Surface water pathways, particularly in the western and southern sections (see Figure 2-16) , where areas of "extreme" groundwater vulnerability overlap with areas of agricultural activity and poor riverine quality act as direct conduits to the BMPA.

Therefore, considering grazing animal densities, groundwater vulnerability, and surface water inflows, the western and central areas of the catchment (particularly Ballycroy North and South, Sheskin and Knocknalower) are the most likely locations for pollution discharges from agriculture. The potential for contamination from combined factors such as high animal loading, limited attenuation and direct discharge routes, indicate that these zones are key for potential high load contamination zones, that are likely to be greatest during the summer months and following periods of high precipitation.

Land

In addition to the direct source of organic pollution from animals, agricultural land use contributes to organic pollution through the spreading of slurry and soiled water. To provide a clearer understanding of agricultural land use, the 2020 Census of Agriculture (CSO, 2020) can again be consulted, with a correction to account for the percentage overlap of each ED in the contributing catchment (Table 2-9). The largest assumed area of farmed land is in the Sheskin,

[2] Not all parameters from WFD apply, please refer to Section 2.4

followed by Ballycroy south. Cereal farming is absent across all EDs, and all recorded farmland is grassland, indicating a landscape used for grazing rather than arable farming.

Under the 5th Nitrates Action Programme (Government of Ireland, 2022), the contributing catchment is designated Zone B. In this zone, slurry spreading is prohibited from 1st October to 15th January inclusive, while the spreading of soiled water is also prohibited throughout December. Therefore, the greatest risk to the BMPA primarily exists outside this period, assuming the regulations are adhered to. Additional restrictions on spreading of soiled water apply in areas designated as "*Extreme Vulnerability Areas on Karst Limestone Aquifers*" under S.I. No. 113/2022. The contributing catchment itself does not overlie a karst limestone aquifer (GSI, 2023) however, a portion of the catchment coincides with zones of “extreme” groundwater vulnerability- where bedrock is at or near the surface (Figure 2-16)-suggesting potential karst vulnerability.

Considering the 2020 Agriculture Census, ~27.64% of the contributing catchment is farmed. As there are no refined spatial data available for the Census, Corine mapping has been used to calculate areas of higher groundwater vulnerability overlapping agricultural land. Approximately 100.00% (~1058.80 ha) of agricultural land overlaps areas classified as having "extreme" or "rock-at-surface" groundwater vulnerability (GSI, 2021). Additionally, 34 EPA-mapped rivers (Table 2-9) in the contributing catchment flow through agricultural land before entering the BMPA (Figure 2-16).

Therefore, considering the agricultural land use and groundwater vulnerability, in addition to all riverine inputs, areas to the west and north of the BMPA are the most likely locations for pollution discharges from spreading of slurry and soiled water. Considering the regulatory restrictions in place, this risk is likely to be greatest from mid-January to September inclusive.

Table 2-9. Statistics from Census of Agriculture 2020 relating to land utilisation within the Electoral Divisions overlapping the contributing catchment

Electoral Division	Percentage Overlap of Contributing Catchment	Total (Corrected) Number of Holdings	Average Size of Holdings	Total (Corrected) Area Farmed (Hectares)	Total (Corrected) Cereals	Total (Corrected) Grassland
Achill	74.2%	98 (73)	8	781.1 (579.5)	0.0 (0.0)	780.0 (578.7)
Ballycastle	2.1%	94 (2)	31.2	2930.5 (63.0)	0.0 (0.0)	2921.5 (62.8)
Ballycroy north	>99%	84 (83)	36.2	3043.5 (3020.6)	0.0 (0.0)	3041.3 (3018.4)
Ballycroy south	96.1%	94 (90)	34.8	3270.5 (3144.4)	0.0 (0.0)	3256.9 (3131.3)
Bangor	>99%	35 (35)	41.4	1448.0 (1448.1)	0.0 (0.0)	1436.4 (1436.5)
Barroosky	1.0%	48 (0)	39.7	1906.5 (19.5)	0.0 (0.0)	1903.6 (19.5)
Beldergmore	19.4%	64 (12)	34.7	2223.9 (431.2)	0.0 (0.0)	2223.9 (431.2)
Bunaveela	4.8%	32 (2)	55.9	1788.2 (85.5)	0.0 (0.0)	1784.6 (85.4)
Corraun Achill	40.1%	121 (49)	9.8	1184.7 (475.1)	0.0 (0.0)	1184.7 (475.1)
Derry	13.3%	63 (8)	48.9	3080.8 (410.1)	0.0 (0.0)	3080.7 (410.1)
Dooega	43.5%	62 (27)	6.8	422.5 (183.6)	0.0 (0.0)	422.5 (183.6)
Glenamoy	59.3%	63 (37)	24.2	1524.4 (903.7)	0.0 (0.0)	1524.4 (903.7)
Glencastle	3.6%	76 (3)	18.7	1423.3 (51.2)	0.0 (0.0)	1414.2 (50.9)
Goolamore	89.7%	41 (37)	23.7	969.7 (870.3)	0.0 (0.0)	968.6 (869.3)
Kilfian south	28.5%	61 (17)	37.8	2306.3 (656.6)	0.0 (0.0)	2292.5 (652.6)
Kilfian west	44.0%	45 (20)	47.5	2138.8 (940.4)	0.0 (0.0)	2138.7 (940.3)
Knocknalower	41.2%	163 (67)	14.1	2291.3 (944.7)	0.0 (0.0)	2285.9 (942.5)
Muings	53.1%	63 (33)	22.7	1430.3 (760.0)	0.0 (0.0)	1430.3 (760.0)
Newport west	4.7%	97 (5)	19.7	1912.9 (89.1)	0.0 (0.0)	1912.9 (89.1)
Rathhill	34.5%	115 (40)	16.8	1927.5 (664.1)	0.0 (0.0)	1908.1 (657.4)
Sheskin	>99%	54 (54)	68.6	3704.0 (3687.5)	0.0 (0.0)	3702.6 (3686.1)
Slievemore	<1%	141 (0)	6.2	878.7 (2.2)	0.0 (0.0)	867.2 (2.1)
Srahmore	1.7%	54 (1)	43.6	2356.3 (40.9)	0.0 (0.0)	2355.0 (40.9)

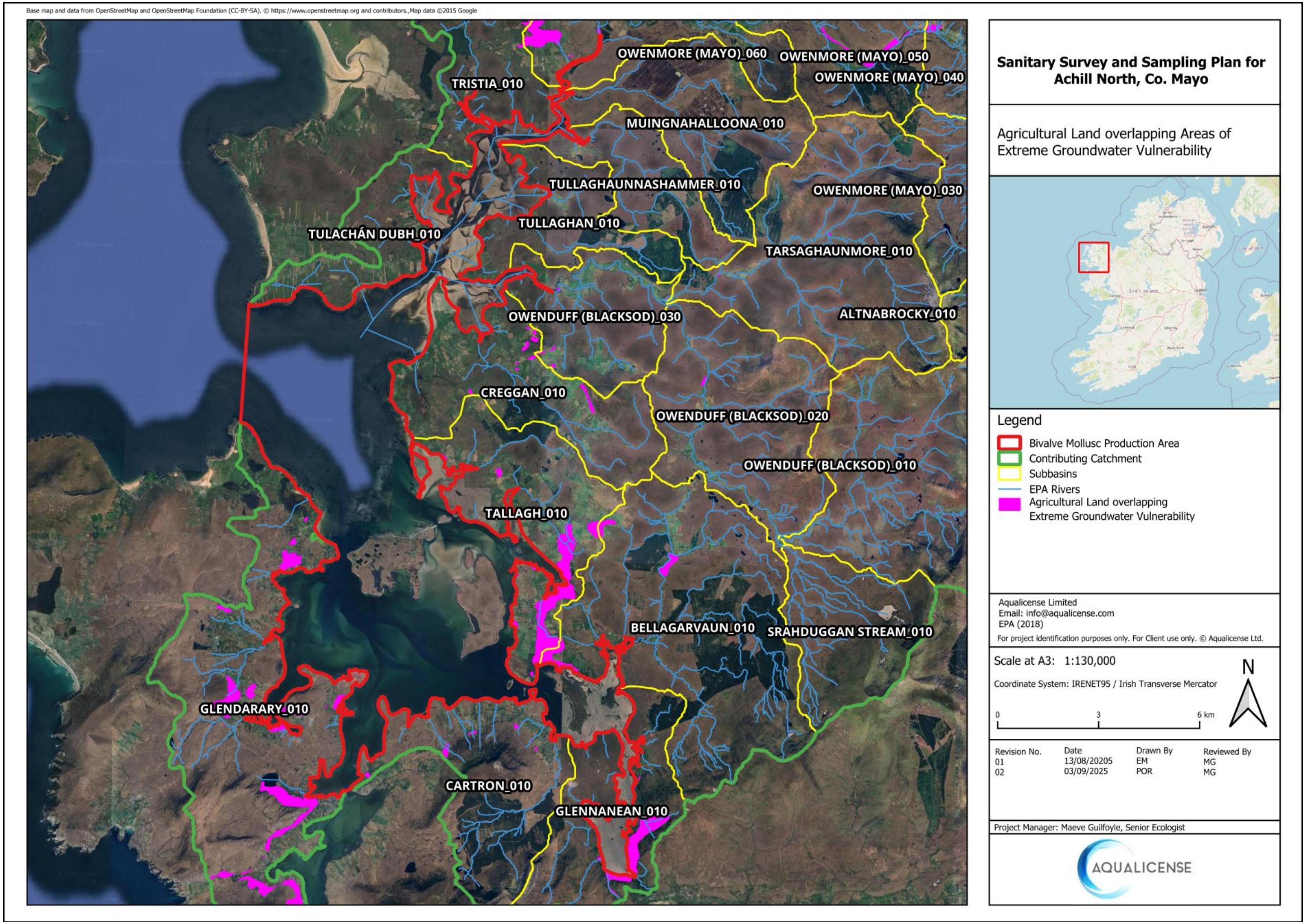

Figure 2-16. Agricultural land of mixed use (including pastures) overlapping areas of “Extreme” GW vulnerability in the area adjacent to the BMPA.

2.5.3.2 Urban Areas and Human Populations

Human populations contribute to contamination from sewerage, as previously discussed in Section 2.5.1. However, examining urban areas and population dynamics can provide further insight into pollution sources and the seasonality of contamination.

The highest population density (Table 2-4) is recorded in Small Area A157132003, which is highly nucleated (471 people/km^2), The remainder of the catchment is very sparsely populated (≤35 people/km^2, frequently zero) (Figure 2-10). This density of is above the national average, though the remainder of the catchment is below the national average of 73 persons/km^2 (CSO, 2023b).

During the most recent census 11.43% of holiday homes within the catchment were identified as unoccupied holiday homes (CSO, 2023a). This represents a relatively high proportion compared with both the national share of unoccupied holiday homes (~3.2% of dwellings nationally) and the Co. Mayo average (~8.8% of dwellings in 2022). This indicates a marked seasonal occupancy pattern and associated seasonal increases in organic loading/wastewater generation during the summer months. For further information refer to Section 2.5.1.2 relating to septic tanks.

In addition to domestic and urban wastewater treatment, facilities such as nursing homes, schools, hospitals, and other large developments can be sources of pollution. A search of the Environmental Impact Assessment (EIA) database and of Google Maps for relevant facilities (e.g. schools, universities, nursing homes, hospitals, barracks, and prisons) identified the following relevant facilities:

- Valley National School- (1.05 km ESE)
- St Fionnan's Community Nursing Unit (Achill Sound)- HSE residential care (10.3 km SSE)
- Achill Health Care (10.6 km SSE)
- Coláiste Pobail Acla (Polranny/keel- Currane area) (12.6 km SES)

Tourist facilities can contribute to organic pollution, particularly in peak seasons. The contributing catchment lies within a low to moderate density area of accommodation providers, including hotels, B&Bs, and campsites (Fáilte Ireland, 2018).

While hotels and B&Bs typically use domestic or urban wastewater treatment, campsites and caravan parks may pose additional pollution risks. A Google Maps search [accessed 21/08/2025] identified the following facilities:

- The Valley House Hostel and Bar (Tóin an tSeanbhaile/The Valley) Hostel/bar

2.5.4 Other Pollution Sources

2.5.4.1 Marine Vessels

Marine vessels, including ferries, cargo ships, fishing boats, and recreational craft, may contribute to faecal contamination, depending on passenger volume, waste management practices, onboard treatment, and regulatory compliance.

Under S.I. No. 492/2012 (which transposes Annex IV of the MARPOL Annex IV), treated sewage can be discharged at a minimum of 3 nautical miles from shore, while untreated sewage must be released no closer than 12 nautical miles. Since sewage is typically discharged at sea or stored onboard for disposal, vessels are unlikely to be a major source of organic contamination.

However, for this desk-based study, the greatest risk is in areas where vessels converge, given the potential for accidental spillages and compliance variations.

No commercial ports lie within the BMPA (Marine institute, 2010). Following the Marine Institute and Marine Atlas there are two small slips listed within the boundary, with six additional slips nearby (though out with the area) (ref Figure 2-17). Admiralty chart (2740-0_W) records a single anchorage north of Achill Sound (in the deepest section of Achill North), within a natural narrow channel recorded as 9.8 m deep chart datum (Figure 2-17). Bunacurry Harbour, a small-scale fishing area, is situated on the BMPA's western side. Ship density data at 500 m resolution for 2015 - 2020 (World Bank Group & International Monetary Fund, 2020) shows that marine traffic primarily transits to the north and west, effectively bypassing the BMPA area.

Given the lack of significant commercial marine traffic within the area, the small scale of recreational use, and expected compliance with S.I. No. 492/2012, the overall risk of vessel derived faecal contamination is assessed as low. In addition, the bathymetry of Achill North would only allow vessels to gain access to limited outer sections of the area, where the hydrodynamic assessment demonstrated that the flushing times are fastest (refer to Section 2.4.3.4). As such marine vessels are not considered further within this report due to lack of potential sources or probable pathways.

In contrast, land-based discharges including wastewater treatment plants and domestic systems present a more significant and sustained contamination risk.

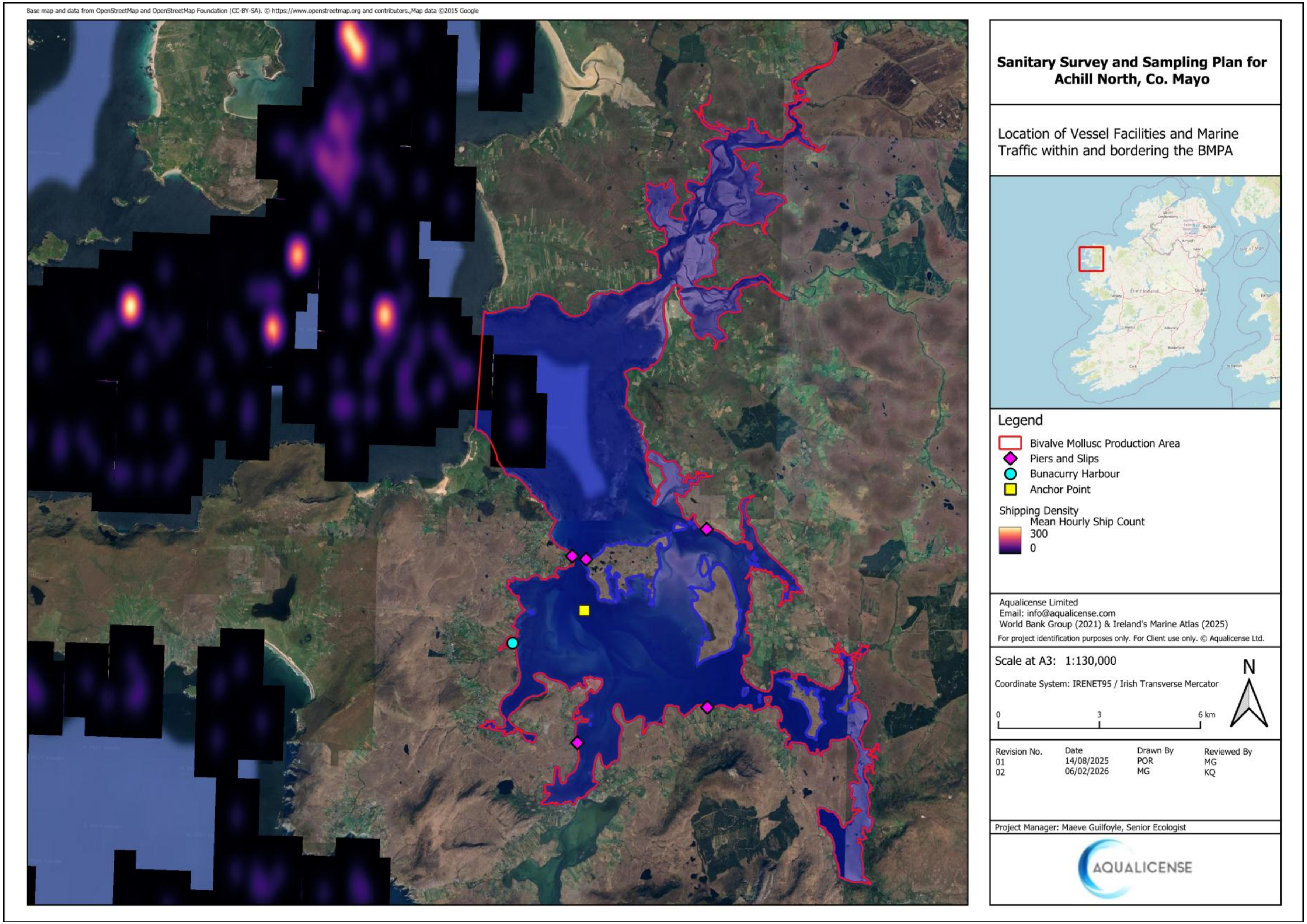

Figure 2-17. Location of vessel facilities and marine traffic routes within and bordering the BMPA (Accessed 06/02/26)

2.5.4.2 Swimming, Bathing and Recreation

The recreational use of beaches and shorelines acts as a source of faecal contamination. Bathers are a non-point source of faecal bacteria, including *E. coli*, due to the shedding of microbes from skin (Elmir *et al.*, 2007). Dog walking is also a contamination source in recreational waters (An *et al.*, 2020) and may contribute up to 20% of faecal indicator bacteria in urban Irish areas (Martin *et al.*, 2024). Such contamination is expected to peak during the summer months in association with warmer weather.

Following review of the google satellite imagery (Search Date: 12 August 2025) to identify beaches and coastal walks within the BMPA, no beaches or coastal walks were noted. The EPA has 7 Blue flag beaches and 8 bathing water locations listed in the areas outwith the BMPA and catchment area. The 5 campsites in the local also correspond with the locations of the beaches and bathing waters outside the BMPA and catchment areas. As such are not considered further in this report.

2.5.4.3 Wildlife

Wildlife, including birds and aquatic animals, has been shown to act as a source of faecal contamination in the marine environment (Alderisio and Deluca, 1999; Godino Sanchez et al., 2024). To identify key areas of wildlife-related faecal contamination, a search was conducted for locations with potentially high densities of animals in proximity to the BMPA (Figure 2-18 and Figure 2-19, Table 2-11). This search included Special Protection Areas (SPAs), Special Areas of Conservation (SACs), RAMSAR sites (wetlands of International importance- Ramsar convention 1971) and Irish Wetland Bird Survey (I-WeBS) sites (Birdwatch Ireland, 2025; NPWS, 2025), which are detailed in Table 2-11.

Only SACs where fauna are listed as a qualifying interest were examined further, therefore the following SACs have been excluded: Erris Head SAC (001501), Broadhaven Bay SAC (000472), Slieve Fyagh Bog SAC (000542), Carrowmore Lake Complex SAC (000476), Bellacorick Iron Flush SAC (000466), Lough Dahybaun SAC (002177), Doogort Machair/Lough Doo SAC (001497), Croaghaun/Slievemore SAC (001955), Achill Head SAC (002268), Keel Machair/Menaun Cliffs SAC (1220), Lough Gall Bog SAC (000522), Bellacragher Saltmarsh SAC (002005), Corraun Plateau SAC (000485) and Clare Island Cliffs SAC (002243).

Three SPAs are located within 1.1 km of the BMPA; Doogort Machair SPA (NPWS, 2013), Owenduff/Nephin Complex SPA (NPWS, 2025) and Blacksod Bay/Broadhaven SPA (NPWS, 2018). Doogairt Machair SPA supports low bird numbers, with only four dunlins (*Calidris alpina*) (a single pair with two young recorded in 2024 (NPWS, 2013)). Owenduff/Nephin Complex SPA likewise supports small bird populations, (e.g. two Merlin's (*Falco columbarius*) recorded at the site in 2018; five breeding pairs of golden plover (*Pluvialis apricaria*) in 2019 (NPWS, 2025)). In contrast, Blacksod Bay/Broadhaven SPA recorded high peak numbers of waterbirds during the 2009/2010 winter survey (NPWS, 2014), although the majority of these species exhibited localised distributions within the SPA (NPWS, 2014). As such, the potential for faecal contamination from these nearby SPAs is considered minimal.

More distant SPAs can nevertheless influence the BMPA. For example, Duvillaun Islands SPA (NPWS, 2025), support large seabird populations with extensive foraging ranges, including the storm petrel (*Hydrobates pelagicus*), which can forage over distances >226 km (Wilkinson, 2021). As a result, such sites cannot be ruled out as potential sources, particularly during breeding season.

Four SACs lie within 1 km of the BMPA, namely West Connacht Coast SAC (NPWS, 2025); Mullet/Blacksod Bay Complex SAC (NPWS, 2014); Owenduff/Nephin Complex SAC (NPWS, 2017); and Clew Bay Complex SAC (NPWS, 2011). There are several Annex II fauna listed as qualifying interests, including bottlenose dolphin (*Tursiops truncatus*), harbour porpoise (*Phocoena phocoena*), harbour seal (*Phoca vitulina*), otter (*Lutra lutra*) and salmon (*Salmo salar*). Annex II species are protected under the 1992 Habitats Directive and every six years European Union member states must report on their conservation status (Morris & Duck, 2019). Their potential contributions to faecal contamination to the BMPA are outlined below.

A coastal bottlenose dolphin population of 189 individuals has been estimated for the Connemara-Mayo-Donegal area with 5% of individuals being observed across all of the survey zones, indicating movements over distances up to 215 km (Berrow, Daly, Levesque, Regan, & O'Brien, 2021). Bottlenose dolphins are known to travel hundreds to thousands of kilometres and frequently use shallow sheltered waters for foraging, socialising, resting and nursing (NPWS, 2015; Nykanen, Ingram, & Rogan, 2015; NPWS, 2024). Given this mobility and habitat use, their presence within the BMPA is plausible.

Aerial surveys in the West Connacht Coast SAC and its adjacent waters estimated harbour porpoise abundance at 4,989 individuals, albeit with broad confidence intervals (NPWS, 2024). The harbour porpoise are typically recorded in shallow coastal shelf waters (<200 m) and may travel distances spanning hundreds to thousands of kilometres (NPWS, 2024). Population size, mobility and habitat preference indicates a high likelihood of harbour porpoises entering the BMPA.

Harbour seals are a qualifying interest for Clew Bay Complex SAC, located < 1 km south of the BMPA. A national aerial thermal-imaging survey recorded 4,007 harbour seals 41% of which were recorded in the west of the country (Morris & Duck, 2019). Adult harbour seals can travel as far as 50km to feed (Martin B. , 2017) and typically use sheltered areas as their haul-out sites (Morris & Duck, 2019). Consequently, harbour seals from the SAC may enter the BMPA, posing a potential contamination risk.

No site-specific otter population estimates are available for Mullet/Blacksod Bay Complex SAC or in Clew Bay Complex SAC. However, the national population is estimated at 6,416 adult females (95% CI: 4,537 – 9,724) (Marnell, O Neill, & Lynn, 2011). Given that otter territories can extend up to 5 – 15 km in length, their presence within the BMPA is considered possible and they may therefore contribute to faecal inputs (Bailey & Rochford, 2006).

Salmon are listed as qualifying interests in Glenamoy Bog Complex SAC (NPWS, 2017), River Moy SAC (NPWS, 2016), Owenduff/Nephin Complex SAC (NPWS, 2017) and Newport River SAC (NPWS, 2019). The Newport Research facility recorded 7,093 wild salmon smolts in 2022, with 5.96% (422) of the 2021 smolts returning to the site as grilse (Marine Institute, 2022). Wild salmon migrate rapidly downstream to the open sea during the smolt stage, and the transient nature of this movement means they are unlikely to represent a significant faecal input to the BMPA (Thorstad, et al., 2012).

Newport River SAC also lists the freshwater pearl mussel (*Margaritifera margaritifera*) as a qualifying interest; however, due to their typically low population density and filter feeding ecology, it is unlikely to contribute to downstream faecal contamination (NPWS, 2019).

Other Annex II species are designated by SACs further from the BMPA, including the grey seal (*Halichoerus grypus*), which is listed as a qualifying interest in Inishkea Islands SAC (NPWS, 2015) and Duvillaun Islands SAC (NPWS, 2024). A national count recorded 3,968 grey seals in Ireland, 32% of which were found in the west (Morris & Duck, 2019). The Inishkea Islands SAC supports approximately one-third of the Irish grey seal breeding population, with 984-1265 individuals estimated there and 648-833 at the Duvillaun Islands SAC (NPWS, 2013; NPWS, 2015).Grey seals, however, preferentially haul out on more exposed shorelines, including islands and rocky skerries (Morris & Duck, 2019), making regular use of the comparatively sheltered BMPA less likely.

The white-clawed crayfish (*Austropotamobius pallipes*), sea lamprey (*Petromyzon marinus*) and brook lamprey (*Lampetra planeri*) are Annex II species listed for the River Moy SAC (NPWS, 2016). Crayfish abundance within the River Moy SAC is low overall and individuals are relatively small (<12 cm), which means that they are unlikely to significantly contribute to faecal contamination entering the BMPA (Gammell, et al., 2021; National Biodiversity Data Centre, 2025).

Brook lamprey is a non-migratory freshwater species and therefore presents a low risk of contributing to faecal contamination in the BMPA (O'Connor, 2004). Sea lampreys are anadromous though numbers are relatively small (e.g. 88 adult fish recorded across spawning hotspots throughout the country –though the Moy catchment excluded due to floods) (Inland Fisheries Ireland, 2024). Therefore, their contribution to faecal contamination within the BMPA is likely minimal.

Geyer's whorl snail (*Vertigo geyeri*) is a qualifying interest species for Bellacorrick Bog Complex SAC (NPWS, 2017). However, given its 'vulnerable' status in the Irish Red List and the location of its habitat onshore in flush-fens ~15.28 km from the BMPA, as well as its relatively diminutive size (<2 mm), it is unlikely to contribute to contamination in the BMPA (Byrne, Moorkens, Anderson, Killeen, & Regan, 2009).

In summary, several large mobile species with extensive foraging ranges or territories occur near the BMPA. The BMPA area offers a mosaic of deeper channels, potential haul-out sites and hunting and foraging grounds, that may attract marine mammals in particular may be attracted to the area for resting, feeding and social behaviours. In addition, SPAs with large breeding populations are located in the vicinity of the BMPA. The presence of these animals presents a potential source of faecal contamination at the site. The impacts of which are assessed further within Table 2-11.

Table 2-10. Wildlife areas within or bordering the BMPA

Type	Name (Code)	Qualifying Interests	Location
SPA	Doogort Machair SPA (004235)	Dunlin (*Calidris* alpina *schinzii*) [A466]	Overlapping the Contributing Catchment in the West, ~50 m from the BMPA border

Type	Name (Code)	Qualifying Interests	Location
	Owenduff/Nephin Complex SPA (004098)	Merlin (*Falco columbarius*) [A098], Golden Plover (*Pluvialis apricaria*) [A140]	Overlapping the Contributing Catchment in the East, ~28 m from the BMPA boundary at its closest point
	Carrowmore Lake SPA (004052)	Sandwich Tern (*Thalasseus sandvicensis*) [A863]	In the Northwest of the Contributing Catchment, ~4.3 km from the BMPA boundary
	Blacksod Bay/Broad Haven SPA (004037)	Red-throated Diver (*Gavia stellata*) [A001], Great Northern Diver (*Gavia immer*) [A003], Slavonian Grebe (*Podiceps auritus*) [A007], Light-bellied Brent Goose (*Branta bernicla hrota*) [A046], Common Scoter (*Melanitta nigra*) [A065], Red-breasted Merganser (*Mergus serrator*) [A069], Ringed Plover (*Charadrius hiaticula*) [A137], Sanderling (*Calidris alba*) [A144], Dunlin (*Calidris alpina*) [A149], Bar-tailed Godwit (*Limosa lapponica*) [A157], Curlew (*Numenius arquata*) [A160], Dunlin (*Calidris alpina schinzii*) [A466], Sandwich Tern (*Thalasseus sandvicensis*) [A863], Wetlands and Waterbirds [A999]	Overlapping the BMPA in the north
	Duvillaun Islands SPA (0041111)	Fulmar (*Fulmarus glacialis*) [A009], Storm Petrel (*Hydrobates pelagicus*) [A014], Barnacle Goose (*Branta leucopsis*) [A045]	Outside the Contributing Catchment to the northwest ~10.37 km from the BMPA
	Inishkea Islands SPA (004004)	Shag (*Phalacrocorax aristotelis*) [A018], Barnacle Goose (*Branta leucopsis*) [A045], Ringed Plover (*Charadrius hiaticula*) [A137], Sanderling (*Calidris alba*) [A144], Purple Sandpiper (*Calidris maritima*) [A148], Turnstone (*Arenaria interpres*) [A169], Common Gull (*Larus canus*) [A182], Herring Gull (*Larus argentatus*) [A184], Arctic Tern (*Sterna paradisaea*) [A194], Dunlin (*Calidris alpina schinzii*) [A466], Little Tern (*Sternula albifrons*) [A885]	Outside the Contributing Catchment to the northwest ~14.64 km from the BMPA

Type	Name (Code)	Qualifying Interests	Location
	Inishglora and Inishkeeragh SPA (004084)	Storm Petrel (*Hydrobates pelagicus*) [A014], Cormorant (*Phalacrocorax carbo*) [A017], Shag (*Phalacrocorax aristotelis*) [A018], Barnacle Goose (*Branta leucopsis*) [A045], Lesser Black-backed Gull (*Larus fuscus*) [A183], Herring Gull (*Larus argentatus*) [A184], Arctic Tern (*Sterna paradisaea*) [A194]	Outside the Contributing Catchment to the northwest ~18.55 km from the BMPA
	Mullet Peninsula SPA (004227)	Corncrake (*Crex crex*) [A122]	Outside the Contributing Catchment to the northwest ~14.2 km from the BMPA
SAC	Glenamoy Bog Complex SAC (000500)	Salmon (*Salmo salar*) [1106]	North of the Contributing Catchment, ~13.31 km from the BMPA
	West Connacht Coast SAC (002998)	Common Bottlenose Dolphin (*Tursiops truncatus*) [1349], Harbour Porpoise (*Phocoena phocoena*) [1351]	~173.4 m northwest of the BMPA
	Mullet/Blacksod Bay Complex SAC (000470)	Otter (*Lutra lutra*) [1355]	~149.73 m northwest of the BMPA
	Bellacorick Bog Complex SAC (001922)	Geyer's Whorl Snail (*Vertigo geyeri*) [1013]	In the west of the Contributing Catchment ~15.28 km from the BMPA boundary
	Inishkea Islands SAC (000507)	Grey Seal (*Halichoerus grypus*) [1364]	~17.8 km northwest of the BMPA
	Duvillaun Islands SAC (000495)	Common Bottlenose Dolphin (*Tursiops truncatus*) [1349], Grey Seal (*Halichoerus grypus*) [1364]	~10.55 km northwest of the BMPA
	River Moy SAC (002298)	White-clawed Crayfish (*Austropotamobius pallipes*) [1092], Sea Lamprey (*Petromyzon marinus*) [1095], Brook Lamprey (*Lampetra planeri*) [1096], Salmon (*Salmo salar*) [1106], Otter (*Lutra lutra*) [1355]	~18.46 km east of the BMPA

TYPE	NAME (CODE)	QUALIFYING INTERESTS	LOCATION
	Owenduff/Nephin Complex SAC (000534)	Salmon *(Salmo salar)* [1106], Otter (*Lutra lutra*) [1355]	Overlapping the BMPA in the southeast
	Newport River SAC (002144)	Freshwater Pearl Mussel *(Margaritifera margaritifera*) [1029], Salmon *(Salmo salar*) [1106]	Southwest of the Contributing Catchment, ~17.65 km from the BMPA boundary
	Clew Bay Complex SAC (001482)	Otter *(Lutra lutra*) [1355], Harbour Seal *(Phoca vitulina*) [1365]	~936 m south of the BMPA
RAMSAR sites	Owenduff catchment (336)	Blanket bog	~11.72 km east of the BMPA
	Blacksod Bay and Broadhaven (844)	Dune grasslands, saltmarshes, internationally important numbers of Brent geese (*Branta bernicla*)	~7.08 km north of the BMPA
	Knockmoyle/Sheskin (372)	Blanket bog	~18.07 km northeast of the BMPA
	Owenboy (371)	Blanket bog, feeding sites for wintering white-fronted goose (*Anser albifrons*)	~25 km west of the BMPA
I-WeBS	Blacksod and Tullaghan Bays (0D499)	Site Summary Table	Overlapping the entire north of the BMPA and the area to the immediate west of the BMPA
	Carrowmore Lake (0D062)	Site Summary Table Site Trends Report	~4.36 km north of the BMPA
	Broadhaven and Sruwadaccon Bays (0D498)	Site Summary Table	~10.17 km north of the BMPA
	Mullet West (0D921)	Site Summary Table	~6.63 km northwest of the BMPA
	Temoncarragh and Annagh Marsh (0D020)	Site Summary Table	~17.85 km north of the BMPA
	Duvillaun Islands (0D922)	No Qualifying Interests provided	~11.29 km west of the BMPA
	Inishkea Islands (0D920)	No Qualifying Interests provided	~15.66 km northwest of the BMPA

TYPE	NAME (CODE)	QUALIFYING INTERESTS	LOCATION
	Clew Bay (0D405)	Site Summary Table Site Trends Report	~981 m south of the BMPA
	Achill Island (0D041)	Site Summary Table	~5.08 km west of the BMPA

*I-WeBS hyperlinks to the data sets have been provided for the sites listed due to repetition of species where they support the relevant SPAs

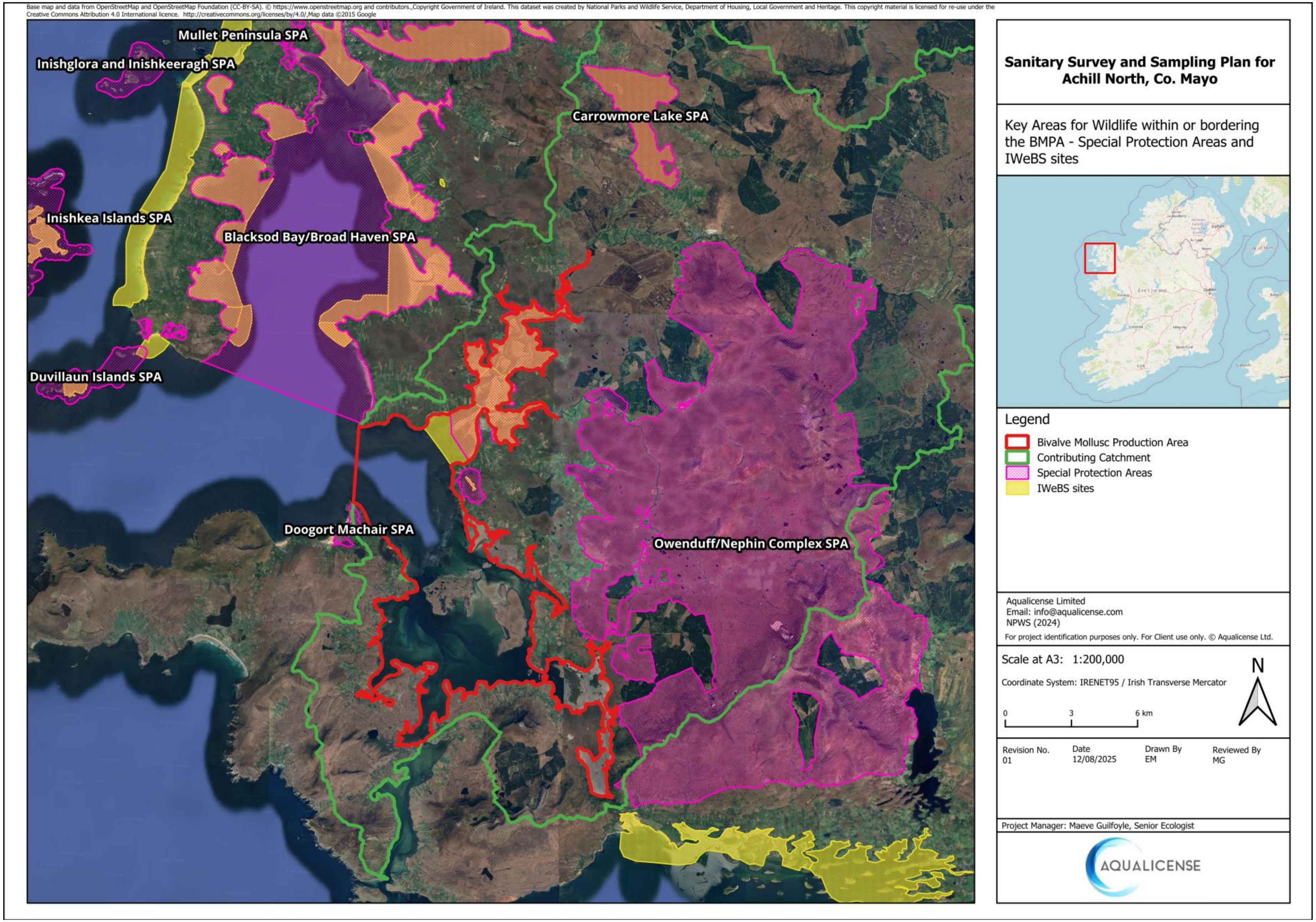

Figure 2-18. Key areas for wildlife within the contributing catchment and within or bordering the BMPA: SPAs and I-WeBS sites (Accessed 11/08/25)

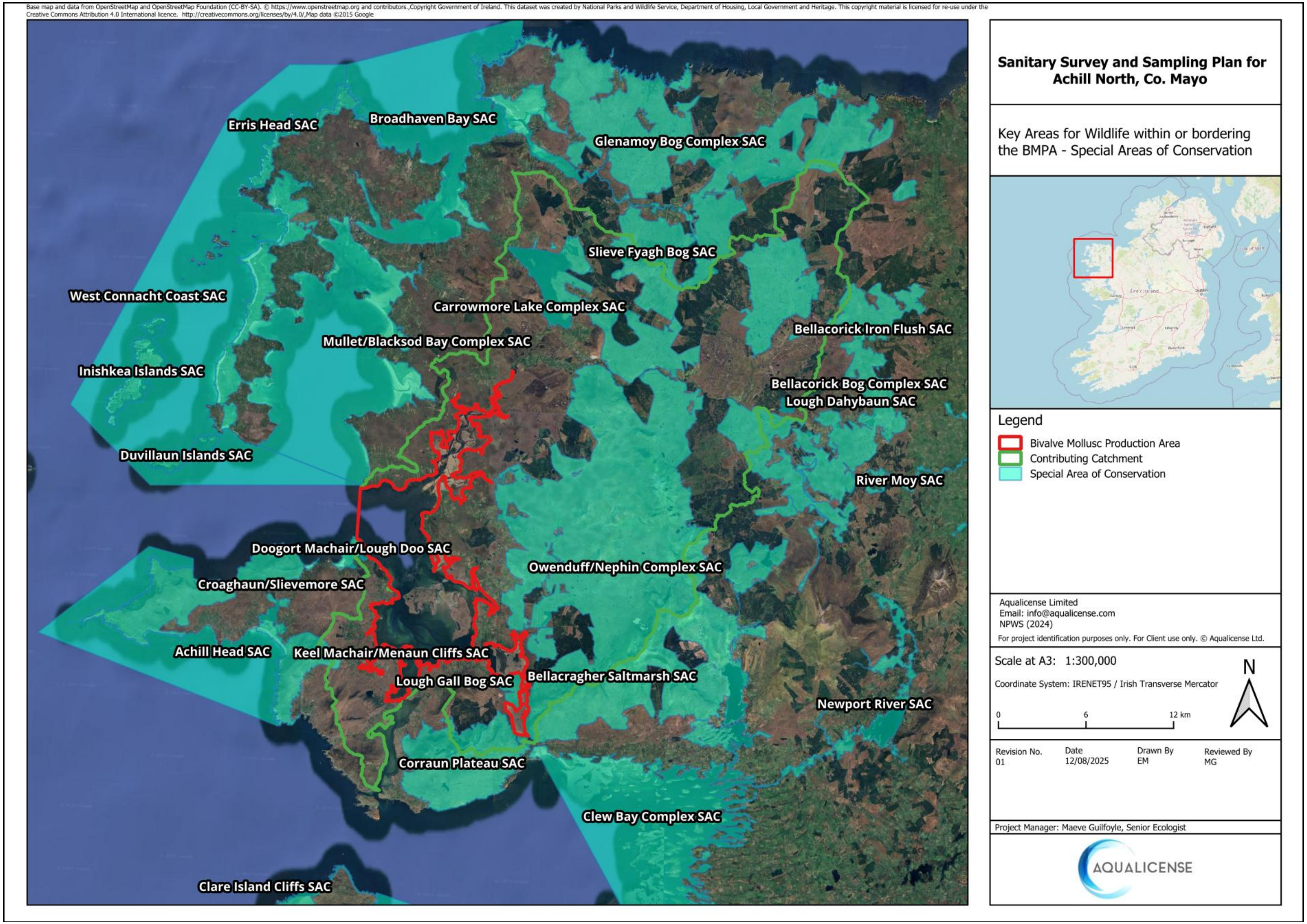

Figure 2-19. Key areas for wildlife within the contributing catchment and within or bordering the BMPA: SACS (Accessed 11/08/25)

2.5.5 SOURCE-PATHWAY-RECEPTOR MODEL OF POLLUTION SOURCES AND SEASONAL VARIATIONS OF POLLUTANTS

Considering the details in the above section, the S-P-R model was used to assess the relative risk of faecal contamination in Achill North by identifying potential contamination sources and transport pathways to the receiving environment and determining the likely impact on licensed shellfish sites (Table 2-11). Each source was assessed qualitatively based on potential loading, the existence and strength of transport pathways (surface water, groundwater, or direct discharge), and known seasonal variability associated with agricultural pressure, human activity and wildlife presence.

The S-P-R model integrates the desk-based assessment and contributing catchment characterisation. Seasonal factors were included to reflect the higher agricultural runoff and DWWTS loading during wetter winter months, and increased human and wildlife inputs during summer and migratory periods.

The resulting impacts identified represent the likelihood of each source contributing contamination to the BMPA and the licenced sites under typical conditions.

Table 2-11. Source-Pathway-Receptor Model and Relative Risk to the Production Area and Licensed Sites

Source	Source Description	Pathway to Production Area	Pathway to Licensed Sites*	Details
UWWTPs	Achill Sound (D0511-01) to the south of the BMPA. Bangor Erris (D0215-01) to northeast of the BMPA.	Achill Sound discharges directly to the BMPA. Bangor Erris discharges into the river Owenmore which enters the BMPA at inflow 68 in the north.	Achill Sound discharges into the BMPA ~1.38 km and ~1.52 km from licensed sites T10-307C and T10-307B respectively. Bangor Erris discharges into the Owenmore river in the north of the BMPA >19km from the nearest licensed site.	**Yes**, the presence of a discharge point into the BMPA in proximity to all of the licensed sites contributes to a possibility of risk. UWWTP-related discharges present a risk of contamination in the south of the BMPA, which has the potential to impact all of the licensed sites and T10-307C and T10-307B in particular.
Septic Tanks and Other Sewerage Types	DWWTSs, primarily septic tanks, are the main sources of human sewage discharges. There are areas along the coastal fringe to the immediate south and southeast of the BMPA where there is potential risk of sewage-contaminated discharges from DWWTS	Surface water via the rivers Cartron, Glennanean, Bellagarvaun and Glendarary. Elevated groundwater vulnerability along the coastal fringe in the area immediately south of the BMPA	The areas of concern in the south and southeast of the contributing catchment are ~675.55 m from licensed site T10-310A (pathway via the Glendarary river and surface runoff), ~748.62 m from licensed site T10-324A (pathway via the Glendarary river and surface runoff), ~1.22 km from licensed site T10-310B (pathway via the Glendarary river and surface runoff), ~3.38 km from licensed site T10-231 (pathway via the Glendarary river and surface runoff), ~3.13 km from site T10-307B (pathway via the Glendarary river and surface runoff), ~3.27 km from site T10-307C (pathway via the Glendarary river and surface runoff), ~569.54 m from site T10-043A (pathway via the Glennanean 010 river and surface runoff), and ~676.35 m from site T10-332A (pathway via the Tallagh 010 river and surface runoff).	**Yes**, the high dependence on septic tanks, presence of discharge points and overlap with areas of high groundwater vulnerability all contribute to a possibility of risk. Sewage discharges are likely highest in the southern and southeast region of the BMPA, in proximity to the areas of concern (these have 'Extreme' or 'High' groundwater vulnerability and are designated Zone 2: Human Health). Contaminants from these areas have the potential to flow into the south of the BMPA in proximity to all of the licensed sites via the large number of inflows from the Glendarary, Glennanean and Tallagh rivers.
IE and IPC Licenses	W0199-02 (IE) located north of the BMPA ~3.091km from the BMPA boundary.	Pathway from W0199-02 to the production area via the Munhin 010 river subbasin which flows to the river and enters the BMPA at inflow 68.	The pathway to the production area for these licenses is in the north of the BMPA, >19km from the nearest licensed site.	**No**, while the presence of discharge points from these sources does contribute to a possibility of risk, the intervening distance, dilution rates, and close proximity of the inflow point to the exchange point with the Atlantic

Source	Source Description	Pathway to Production Area	Pathway to Licensed Sites*	Details
	P0738-03 (IE) located in the north of the contributing catchment ~12.065km from the BMPA boundary. P0505-01 (IPC) located in the northeast of the contributing catchment ~18.262km from the BMPA boundary.	Pathway from P0738-03 to the production area via the Bellanaboy 010 river subbasin which flows to the river and enters the BMPA at inflow 68. Pathway from P0505-01 to the production area via the Muing 010 river subbasin which flows to the river and enters the BMPA at inflow 68.		would reduce the impact to minimal levels.
Section 4 Discharges	WP(W)78 located in Doohooma, ~364.88 m from the BMPA border	Pathway to the BMPA via the Tulachán Dubh_010 river subbasin (inflows 86 and 87) in the northwest of the BMPA.	The discharge point into the west of the BMPA is ~8.84 km from the nearest licensed site T10-311.	**No**, while the presence of a single discharge point from this source does contribute to a possibility of risk, its proximity to the mouth of the bay and resultant dilution factor would reduce this impact to minimal levels
Agriculture	Sheep, which have the highest *E. coli* loading of assessed grazing animals, are the dominant livestock in the catchment. The EDs in the western and central areas of the catchment (in particular Ballycroy North and South, Sheskin, Knocknalower) have the highest numbers of sheep and are the most likely locations for pollution discharges from agriculture .	Pathway from Ballycroy South to the production area via surface runoff (ED borders the BMPA), areas of extreme groundwater vulnerability in the east, and the river Bellagarvaun Pathway from Ballycroy North to the BMPA via surface runoff (ED borders the BMPA), and the rivers Creggan and Tullaghan. Pathway from Sheskin to the BMPA via the Owenmore and Tarsaghaunmore rivers (the latter flows to the river Owenduff), areas of extreme groundwater vulnerability in the west of the ED. Pathway from Knocknalower via the Munhin river subbasin, which flows to the river Owenmore.	Ballycroy South borders three of the licensed sites: T10-311, T10-312A and T10-332A (these sites are ~104.47 m, ~69.27 m and ~114.04 m from Ballycroy South respectively) Outflows from Ballycroy North are >4.74 km from the nearest licensed site (T10-311). The Owenmore river enters the BMPA in the north >19 km from the nearest licensed site. The river Tarsaghaunmore flows to the river Owenduff which enters the BMPA in the north > 12.6 km from the nearest licensed site. The Owenmore enters the BMPA in the north >19 km from the nearest licensed site, contaminants from agriculture in Knocknalower are therefore less likely to significantly impact the BMPA.	**Yes**, the presence of grazing livestock (sheep)s, known surface water runoff, and significant numbers of inflow points all contribute to the possibility of risk. Inputs from Ballycroy South present the greatest risk to the licensed sites in terms of contamination from agriculture. This area has the highest numbers of sheep, is within 115 m of 3 of the licensed sites and overlaps with areas of extreme groundwater vulnerability.

Source	Source Description	Pathway to Production Area	Pathway to Licensed Sites*	Details
Urban Areas and Human Populations	The highest population density in the catchment is in small area A157132003 Contamination mainly via septic systems (as described above). Potential for tourism-related discharges.	Pathway via the river subbasin Tulachán Dubh 010. 'High' groundwater vulnerability overlapping this small area.	The small area is 9.18km from the nearest licensed site (T10-311).	**Yes**, the presence of an area of high population density combined with high reliance on septic tanks presents a potential risk of contamination.
Marine Vessels	There are two small slips and one harbour (Bunacurry Harbour) on the west side of the BMPA. There is one anchorage north of Achill Sound.	Ship sewage entering Achill North, with subsequent circulation.	Licensed site T10-310A lies within 2km of the two slips. Bunacurry Harbour lies ~328.76 m from licensed site T10-310B, ~360.89 m from licensed site T10-324A, ~895.57 m from licensed site T10-231, ~1.15km from licensed site T10-310A and ~1.373 km from licensed site T10-331A.	**No** potential impact from this source, refer to section 2.5.4.1 Marine Vessels for further details. Given the small scale of operations in this region and regulatory controls, the risk of contamination posed by marine vessels is considered minimal. Additionally, MARPOL dictates that no blackwater or greywater discharges be allowed within 3 nm of the shore.
Swimming, Bathing and Recreation	There are no Blue Flag-listed beaches or designated bathing waters in the contributing catchment. However, there are 7 Blue Flag beaches and 8 bathing water locations in the areas outwith the BMPA and catchment.	Contamination from beach users in the surrounding area.	Golden strand (designated bathing water) and Doogort beach (Blue Flag beach) are located ~3 km and ~4.36 km respectively from the entrance to the BMPA .	**No** significant impact from this source, refer to section 2.5.4.2 Swimming, Bathing and Recreation for further details. Contaminants from Golden strand and Doogort beach have the potential to be washed into the BMPA, with the potential to impact licensed sites close to the BMPA's entrance such as T10-311, T10-312A and T10-310A. However, the sites are >10.7km away from these bathing waters and the contamination risk posed by these areas is therefore considered to be minimal.
Wildlife	Doogort Machair SPA, with dunlins Owenduff/Nephin Complex SPA, with merlins and golden plovers	Direct input from wildlife into BMPA waters.	Doogort Machair SPA overlaps west of contributing catchment at the BMPA's entrance and is within 7.6 km of all of the licensed sites (apart from T10-043 A, which is 15.02 km from the SPA) and is	**Yes**, although the presence of large mobile marine animals with extensive foraging ranges or territories presents

Source	Source Description	Pathway to Production Area	Pathway to Licensed Sites*	Details
	Carrowmore Lake SPA, with sandwich terns. Blacksod Bay/Broad Haven SPA, with red-throated divers, great northern divers, Slavonian grebes, light-bellied brent geese, common scoters, red-breasted mergansers, ringed plovers, sanderlings, dunlins, bar-tailed godwits, curlews, dunlins and sandwich terns. Duvillaun Islands SPA, with fulmars, storm petrels and barnacle geese. Inishkea Islands SPA, with shag, barnacle geese, ringed plovers, purple sandpipers, turnstones, common gulls, herring gulls, arctic terns, dunlins and little terns. Inishglora and Inishkeeragh SPA, with storm petrels, cormorants, shags, barnacle geese, lesser black-backed gulls, herring gulls and arctic terns. Mullet Peninsula SPA, with corncrakes. Glenamoy Bog Complex SAC, with salmon. West Connacht Coast SAC, with common bottlenose dolphins and harbour porpoises. Mullet/Blacksod Bay Complex SAC, with otters. Bellacorrick Bog Complex SAC, with Geyer's whorl snails. Inishkea Islands SAC, with grey seals.		particularly close to licensed site T10-310A (~3.30 km away), T10-324A (~3.99km away), T10-310B (~4.95 km away), T10-231 (~5.4 km away), T10-331A (~5.81 km away), T10-311(~6.12 km away). Owenduff/Nephin Complex SPA is within 8.7 km of all of the licensed sites and is particularly close to T10-043A (~1.09 km away), T10-322A (~1.89 km away), T10-312A (~2.93 km away), T10-331 (~3.36 km away). Carrowmore Lake SPA is ~19.05 km and c.19.16 km from the two nearest licensed sites (T10-312A and T10-311) Blacksod Bay/Broad Haven SPA is within 13.24 km of all of the licensed sites and is particularly close to T10-311 (~3.14 km away), T10-312A (~3.33km away), T10-332A (~5.4 km away). Duvillaun Islands SPA is 16.01 km from the nearest licensed site (T10-310A) Duvillaun Islands SPA is ~16.01 km from the nearest licensed site (T10-310A). Inishkea Islands SPA is 22.44 km from the nearest licensed site (T10-310A). Inishglora and Inishkeeragh SPA is 26.6 km from the nearest licensed site (T10-310A). Mullet Peninsula SPA is ~15.34 km from the nearest licensed site (T10-310A). Glenamoy Bog Complex SAC is ~25.71 km from the nearest licensed site (T10-312A). West Connacht Coast SAC is ~8.56 km from the nearest licensed site (T10-310A). Mullet/Blacksod Bay Complex SAC is ~10.13 km from the nearest licensed site (T10-310A). Bellacorrick Bog Complex SAC is ~21.37 km from the nearest licensed site (T10-332A). Inishkea Islands SAC is ~24.91km from the nearest licensed site (T10-311).	a risk of contamination, the sources are diffuse. Considering the ephemeral nature of marine life, and the large aggregations of birds in some of the surrounding SPAs outside the BMPA, seasonal increases in contamination may occur during the winter along with contamination potentially being input in vicinity of all of the licensed sites.

Source	Source Description	Pathway to Production Area	Pathway to Licensed Sites*	Details
	Duvillaun Islands SAC, with common bottlenose dolphins and grey seals. River Moy SAC, with white-clawed crayfish, sea lamprey, brook lamprey, salmon and otters. Owenduff/Nephin Complex SAC, with salmon and otters. Newport River SAC, with freshwater pearl mussels and salmon. Clew Bay Complex SAC, with otters and harbour seals		Duvillaun Islands SAC is ~19.12 km from the nearest licensed site (T10-311). River Moy SAC is ~20.95 km from the nearest licensed site (T10-312A). Owenduff/Nephin Complex SAC is ~ 327.87 m from the nearest licensed site (T10-043A). Owenduff/Nephin Complex SAC is within 9.05 km of all of the licensed sites, and it is particularly close to those on the west side of the BMPA such as T10-043A (~342.40 m away) and T10-332A (~2.31 km away). Newport River SAC is ~17.25 km from the nearest licensed site (T10-043A). Clew Bay Complex SAC is ~2.30 km from the nearest licensed site (T10-043A).	

2.6 Conclusions of the Desk-Based Survey

This desk-based component of the sanitary survey employed the S-P-R model to assess the principal potential impacts from the possible sources of faecal contamination identified during the desktop study (Sections: 2.4.2 – 2.5.4.3), the mechanisms by which these contaminants are transported, and their circulation dynamics within the production area.

The analysis identified the Owenduff, Owenmore, Glenadarary and Bellagarvaun rivers as the largest contributors for freshwater inflows, with additional smaller contributions from the numerous agricultural streams, Section 4 licenced areas, and diffuse run off distributed throughout the bay.

S-P-R Model

The S-P-R model was applied to identify potential faecal contamination sources, assess the viability of transport pathways to the Achill North BMPA and evaluate the likelihood of impact on licensed shellfish sites. Each source was assessed qualitatively based on potential loading, the existence and strength of surface water, groundwater, or marine pathways and seasonal variations in both contamination pressure and transport conditions.

The predominant sources of faecal pollution were attributed to the widespread use of domestic septic tank systems and the extensive agricultural activity in the catchment, particularly livestock farming. Seasonal dynamics are expected to significantly influence contaminant loading, with elevated faecal inputs during summer months driven by increased animal stocking densities. Furthermore, extended dry periods followed by rainfall events may exacerbate pollutant runoff through the "first flush" effect.

Other assessed sources - including urban areas without direct hydrological pathways, marine vessels operating under regulatory controls, and recreational use - present negligible to no meaningful risk to the BMPA due to the absence of viable transport routes or minimal contamination loading.

Circulation and Seasonal Influence

The predominant sources of faecal pollution were attributed to the widespread use of domestic septic tank systems and the extensive agricultural activity in the catchment, particularly livestock farming. Seasonal variations are anticipated to play a significant role, particularly during the summer months when increased stocking densities may lead to higher faecal loads. Furthermore, extended dry periods followed by rainfall events may exacerbate pollutant runoff through the "first flush" effect.

Seasonal variations are anticipated to play a significant role, particularly during the summer months when increased stocking densities may lead to higher faecal loads. Additionally, dry land conditions in summer can increase the likelihood of pollutant runoff during rainfall events. Conversely, winter rainfall increases hydraulic loading on septic tanks and promotes localised pollutant mobilisation potential.

A tidal prism method was applied to the area to estimate flushing times, as no site- specific hydrodynamic data is available, this approach assumes the system is well mixed and tidal exchange is the dominant renewal process. Results indicate rapid flushing during spring tides (~0.7 - 2.4 days) but much slower renewal during neaps (~1.7 - 5.7 days).

Summary

The implications for the Achill North BMPA can be summarised as follows. The dominant risk zones including Ballycroy North and South, Sheskin and Knocknalower, drain primarily to the Bellagarvaun, Owenmore and Owenduff catchments. These in turn exert influence on the Doriel Creek and Bealacragher bay zoned production areas. In contrast, pressures arising from the southern fringe, including Achill Sound and surrounding areas, predominantly affect the Achill Sound and Saula classifications.

Further validation and refinement of these findings will be undertaken upon completion of the shoreline survey, which will provide data on the presence and severity of faecal pollution sources, thereby enhancing the resolution and accuracy of the overall risk assessment.

Together, these relationships will provide the functional basis for linking contributing catchment activities to contamination pressures within the Achill North BMPA.

3 SHORELINE SURVEY

This section of the sanitary survey relates to the shoreline survey, which has been undertaken by the SFPA following receipt of the desk-based study conducted by Aqualicense. The purpose of this shoreline survey is to confirm the findings of the desk-based study and identify any sources of contamination previously unidentified.

3.1 SHORELINE SURVEY METHODOLOGY

The SFPA Code of Practice for the Classification and Microbiological Monitoring of Bivalve Mollusc Production Areas identifies the methodology for carrying out shoreline surveys under Appendix 9.1 (SFPA, 2020). Any identified pollution risks were clearly documented, including GPS coordinates, photographs, and detailed descriptions. Photographs were also obtained for all identified risk locations.

Evidence of faecal contamination, such as odours, discolouration, or algae growth, were documented. Surveyors recorded observations even in situations where there was uncertainty regarding potential contamination. Where faecal contamination of an inflow, waterbody, or discharge location was suspected, bacteriological samples were obtained in accordance with the COP.

3.1.1 SURVEY RESULTS

Due to logistical reasons, the entire shoreline of the BMPA was surveyed by SFPA personnel over a 3-day period, from 23rd to the 25th of September 2025. Weather conditions during the survey were initially dry and settled conditions and are therefore likely to represent baseline conditions rather than worst-case scenarios for contamination. As the days preceding the survey had no rainfall, any potential peaks that would normally be associated with rainfall-driven runoff were not captured during this sampling effort. Surveys commenced two hours before low tides on all days.

Table 3-1 and Figure 3-1 present all observations recorded during the shoreline survey. Photographs for each observation have been provided in *Appendix 3*.

Table 3-1- Locations and Details of Observations made during the Shoreline Survey for Achill North BMPA in September 2025

Date	Low Tide		High Tide		ID	Latitude*	Longitude*	Feature	Comment
	Time	Height (m)	Time	Height (m)		(WGS84)	(WGS84)		
23/09/2025	01:27 13:44	0.8 1.0	07:38 19:48	3.5 3.9	1	54.022356	-9.9654318	Freshwater inflow, drainage stream	Bog land no agriculture use
					2	54.0096130,	-9.9427275	Freshwater lake outfall	Small number of sheep on land, swans in the lake_
					3	54.0010913	-9.9384062	Freshwater outlet	Dooniver Beach
					4	53.99584	-9.92899	Sea	Dooniver Point
					5	53.9900235	-9.9588305	Stream_	Ashill Stream
					6	53.9696361	-9.9684234	River	1st of two rivers flowing Bunacurry Pier
					7	53.96889976	-9.9675034	River	2nd of two rivers flowing Bunacurry Pier
					8	53.9509447	-9.9699962	Freshwater inflow	Saula West
					9	53.9461476	-9.9449997	River	Saula - River
					14	53.9312722	-9.9415289	River Stream	Sraheens River/Stream /
					15	53.9328245	-9.9230431	Sea	Achill Sound Bridge exchange
					16	53.9502021	-9.8955287	River/Stream	Tonragee West River/Stream
					17	53.9530329	-9.8906374	River/Stream	Lynchaghan River/Stream
					19	53.9532452	-9.8735118	River/Stream	Tonragee West
					27	53.9481343	-9.82975461	River/Stream	Tonragee East
					30	53.9244846	-9.8109553	Lake source	Mallaranny Ind Est
					36	53.9116805	-9.8027824	River/Stream	Mulranny
					38	53.9273932	-9.7905987	Stream	Claggan Mountain Stream
					41	53.9475137	-9.788926	Stream	Claggan Mountain
					42a	53.9772512	-9.8139694	River	Tonragee East
					42b	53.9751037	-9.794739	River	Claggan Bellaveeny bridge

Date	Low Tide		High Tide		ID	Latitude*	Longitude*	Feature	Comment
	Time	Height (m)	Time	Height (m)		(WGS84)	(WGS84)		
					51	54.06458	-9.95266	Slipway	Six small boats, none live aboard.
					52	54.0661	-9.95049	Concrete discharge pipe	Steady flow, some green algae evident at outflow
23/09/2025	01:27 13:44	0.8 1.0	07:38 19:48	3.5 3.9	53	54.06623	-9.94989	Concrete discharge pipe	Low flow, some foam evident in discharge water.
					54a	54.06641	-9.9498	Concrete discharge pipe	Steady flow, no signs of enrichment.
					54b	54.06581	-9.9259	Drain	Black field drain, through rough grazing/scrub. Low flow.
					55b	54.06729	-9.92345	Drain	Field drain through rough grazing. Trickle flow.
					55a	54.06754	-9.92312	Stone culvert	Good flow, through rough grazing. Some green algae evident at outflow.
					56	54.0611	-9.93169	Pipe	Piped field drain. Good flow.
					59a	54.07297	-9.89486	Field drain	Low flow.
					60a	54.0793	-9.90079	Stream.	Small stream.
					60b	54.07276	-9.89386	Slipway	Two small boats.
					61a	54.07698	-9.989444	Tidal channel	Downstream of multiple inputs.
					61b	54.09228	-9.0008	Stream	Good flow of water.
					62a	54.09719	-9.90015	Stream	Good flow of water. Through pasture land.
					63	54.10935	-9.83817	Channel	Downstream of inputs.
					64	54.10921	-9.86373	Tidal channel	Downstream of multiple inputs.
					65	54.12382	-9.87232	Stream	Good flow through bogland.
					66	54.11182	-9.84645	Stream	Diffuse water from stream, flowing through bogland. Low flow. No signs of enrichment.
					WWTP	53.9374518	-9.9192803	Outflow	Achill WWTP Overflow
24/09/2025	01:58 14:18	0.8 1.0	08:07 20:22	3.5 3.8	49	54.04868	-9.89578	Drain	Field drain. Some green algae present
					50	54.04746	-9.8922	Drain	Field drain of rough grazing area.

Date	Low Tide		High Tide		ID	Latitude*	Longitude*	Feature	Comment
	Time	Height (m)	Time	Height (m)		(WGS84)	(WGS84)		
					56	54.05409	-9.86465	Stream	Good flow through rough grazing area.
24/09/2025	01:58 14:18	0.8 1.0	08:07 20:22	3.5 3.8	57	54.05626	-9.8609	Stream	Good flow, through rough grazing area.
					58	54.07234	-9.8448	River	Owenduff river channel
					59b	54.07795	-9.86612	River	Small river, low flow. Through bogland
					62b	54.08062	-9.86616	River	Small river, low flow. Through bogland.
					67b	54.10121	-9.84903	Stream	Stream, trickle flow. Evidence of enrichment/green algae.
					67c	54.10049	-9.84889	Stream	Small stream
					67a	54.09815	-9.84824	Stream	Stream, clear flow. Minimal amount of green algae.
					68	54.09533	-9.84815	Drain	Natural field drain, very low flow in conditions.
					69b	54.09439	-9.83787	Stream	Stream, clear flow
					69a	54.09351	-9.83745	Stream	Stream, low flow. Through bogland.
					70	54.09307	-9.83731	Stream	Stream, low flow.
					71	54.09266	-9.83662	Stream	Stream, low flow. Some signs of green algae
					72	54.09268	-9.8378	Small river	Some algae evident.
					73	54.08513	-9.84745	Small river	Low flow.
25/10/2025	02:30 14:52	0.9 1.0	08:38 20:56	3.6 3.7	38	53.92769	-9.79053	Stream.	Steady flow. Drain hill above
					39	54.94337	-9.79235	Drain	Trickle flow into tide. Drain hill above.
					40	53.94463	-9.78899	Stream	Medium flow. Draining small area of pasture hill above.
					41	53.95134	-9.78696	Drain	Road drain. Low flow.
					42c	53.9693	-9.80610	Sea	Shoreline south of river inputs
					43	53.97813	-9.83755	Stream	Low flow. Through improved pasture land.
					44	54.0003	-9.5051	Sea	Shore south of riverine inputs
					45	54.0053	-9.86786	Stream	Low flow stream. Draining rough pasture.
					46	54.00522	-9.86895	Sea	Pier, two small boats.

<table>
<tr><th rowspan="2">Date</th><th colspan="2">Low Tide</th><th colspan="2">High Tide</th><th rowspan="2">ID</th><th>Latitude*</th><th>Longitude*</th><th rowspan="2">Feature</th><th rowspan="2">Comment</th></tr>
<tr><th>Time</th><th>Height (m)</th><th>Time</th><th>Height (m)</th><th>(WGS84)</th><th>(WGS84)</th></tr>
<tr><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td>47</td><td>53.96781</td><td>-9.80437</td><td>Sea</td><td>Channel downstream of multiple inputs</td></tr>
<tr><td>Add PT1</td><td>53.91949</td><td>-9.79533</td><td>Sea</td><td>Slipway/pier. Boats to service salmon farm.</td></tr>
<tr><td rowspan="8">25/10/2025</td><td rowspan="8">02:30
14:52</td><td rowspan="8">0.9
1.0</td><td rowspan="8">08:38
20:56</td><td rowspan="8">3.6
3.7</td><td>Add PT2</td><td>53.94878</td><td>-9.78872</td><td>Stream</td><td>Through bogland. Low flow.</td></tr>
<tr><td>Add PT3</td><td>54.0057</td><td>-9.85137</td><td>Stream</td><td>Good flow. Piped under bridge.</td></tr>
<tr><td>Add PT4</td><td>54.02184</td><td>-9.89459</td><td>Shoreline</td><td>Approx 30 sheep, tracks going onto shoreline also.</td></tr>
<tr><td>Add PT5</td><td>54.02302</td><td>-9.88824</td><td>Drain</td><td>Field drain. Area of rough grazing behind, low flow.</td></tr>
<tr><td>Add PT6</td><td>54.01991</td><td>-9.88974</td><td>Natural field drain</td><td>Low flow</td></tr>
<tr><td>Add PT7</td><td>54.011176</td><td>-9.854724</td><td>Stream</td><td>Flowing, along road side. No sign of enrichment.</td></tr>
<tr><td>Add PT8</td><td>54.00734</td><td>-9.853157</td><td>Field drain</td><td>Field drain, flowing from rough pasture ground.</td></tr>
<tr><td>Add PT9</td><td>54.006542</td><td>-9.853104</td><td>Sea</td><td>Old pier, not in use.</td></tr>
</table>

**Further comparative table for latitude and longitude is provided in Appendix 2*

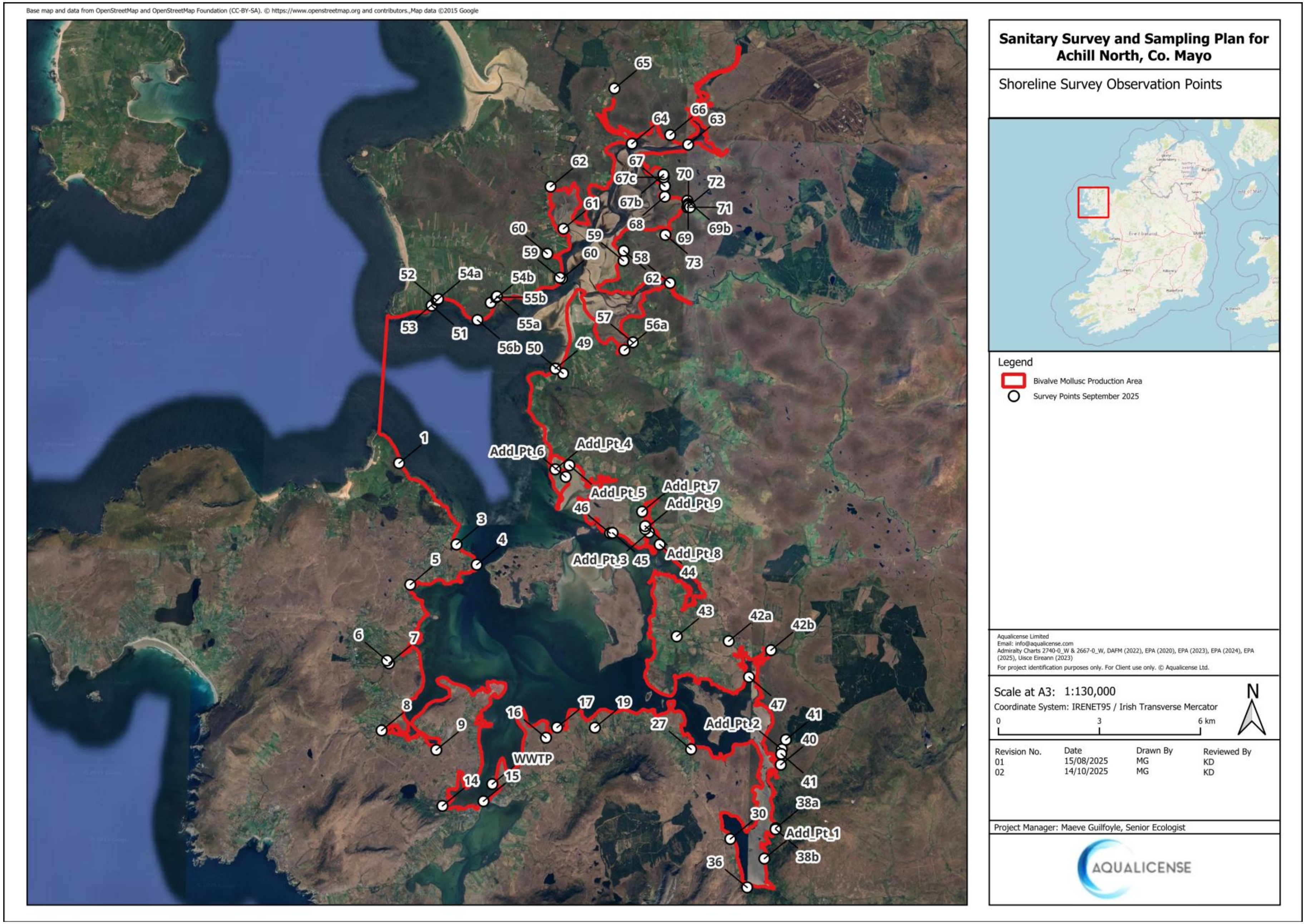

Figure 3-1 Location of Observations made during the Shoreline Survey for Achill North in September 2025

A total of 75 observations were recorded during the shoreline survey, each georeferenced and supported by photographic evidence. Of the observation sites 27 were sampled for bacteriological analysis, the results of which are further detailed in Section 4.

The discharge points around Achill north generally corresponded with the EPA mapped rivers (Figure 2-5). During the survey period 12 previously unmapped field drains, and 5 additional concrete discharge pipes were noted. At 7 of the 75 sites there were signs of possible contamination (algal matting (71, 72, 67a, 67c, 49, 55,52), foamed and or discoloured water (52 and 53)) noted during the three-day survey period.

It should be noted that during the survey period weather conditions were calm and dry, which may have limited observable contamination signals at the time of sampling.

A summary of each observation, its contamination risk level, and sampling location is included in Table 3-2. These findings informed both the delineation of the BMPA and the selection of the most appropriate RMPs.

Table 3-2 Summary of inflows, observations, contamination levels and proposed bacteriological sampling locations

Inflow ID	Survey ID	Latitude (WGS84)	Longitude (WGS84)	Feature	Bacteriological Sample Taken (Y/N)
N/a	1	54.022356	-9.9654318	Freshwater inflow, drainage stream,	Y
1	2	54.0096130	-9.9427275	Freshwater lake outfall	Y
N/a	3	54.0010913	-9.9384062	Freshwater outlet_	Y
N/a	4	53.99584	-9.92899	Sea	Y
2	5	53.9900235	-9.9588305	Stream_	Y
3	6	53.9696361	-9.9684234	River	Y
4	7	53.96889976	-9.9675034	River	Y
5	8	53.9509447	-9.9699962	Freshwater inflow_	Y
7	9	53.9461476	-9.9449997	River	Y
9	14	53.9312722	-9.9415289	River Stream_	Y
N/a	15	53.9328245	-9.9230431	Sea	Y
10	16	53.9502021	-9.8955287	River/Stream	Y
11	17	53.9530329	-9.8906374	River/Stream	Y
13	19	53.9532452	-9.8735118	River/Stream	Y
18	27	53.9481343	-9.82975461	River/Stream	Y
24	30	53.9244846	-9.8109553	Lake source	Y
26	36	53.9116805	-9.8027824	River/Stream	Y
28	38	53.9273932	-9.7905987	Stream	Y
31	41	53.9475137	-9.788926	Stream	Y
35	42a	53.9772512	-9.8139694	River	Y
33	42b	53.9751037	-9.794739	River	Y
N/a	51	54.06458	-9.95266	Slipway.	N

Inflow ID	Survey ID	Latitude (WGS84)	Longitude (WGS84)	Feature	Bacteriological Sample taken (Y/N)
87	52	54.0661	-9.95049	Concrete discharge pipe.	N
86	53	54.06623	-9.94989	Concrete discharge pipe.	N
N/a	54a	54.06641	-9.9498	Concrete discharge pipe.	N
N/a	54b	54.06581	-9.9259	Drain	N
N/a	55b	54.06729	-9.92345	Drain	N
85	55a	54.06754	-9.92312	Stone culvert.	N
45	56	54.0611	-9.93169	Pipe.	N
N/a	59	54.07297	-9.89486	Field drain	N
84	60a	54.0793	-9.90079	Stream.	N
N/a	60b	54.07276	-9.89386	Slipway	N
N/a	61a	54.07698	-9.989444	Tidal channel	N
83	61b	54.09228	-9.0008	Stream	N
82	62a	54.09719	-9.90015	Stream,	N
N/a	63	54.10935	-9.83817	Channel	N
N/a	64	54.10921	-9.86373	Tidal channel	N
76	65	54.12382	-9.87232	Stream,	N
71	66	54.11182	-9.84645	Stream	N
N/a	WWTP	53.9374518	-9.9192803	Outflow	Y
43	49	54.04868	-9.89578	Drain	N
N/a	50	54.04746	-9.8922	Drain	N
45	56a	54.05409	-9.86465	Stream	N
47	57	54.05626	-9.8609	Stream	N
50-51	58	54.07234	-9.8448	River	N
N/a	59b	54.07795	-9.86612	River	N
82	62b	54.08062	-9.86616	River	N
N/a	67b	54.10121	-9.84903	Stream	N
N/a	67c	54.10049	-9.84889	Stream	N
62	67a	54.09815	-9.84824	Stream	N
N/a	68	54.09533	-9.84815	Drain	N
60	69b	54.09439	-9.83787	Stream	N
58	69a	54.09351	-9.83745	Stream	N
N/a	70	54.09307	-9.83731	Stream	N
57	71	54.09266	-9.83662	Stream	N
57	72	54.09268	-9.8378	Small river	N
56	73	54.08513	-9.84745	Small river	N
28	38	53.92769	-9.79053	Stream.	N
29	39	54.94106	-9.79043	Drain	N

Inflow ID	Survey ID	Latitude (WGS84)	Longitude (WGS84)	Feature	Bacteriological Sample taken (Y/N)
30	40	53.94463	-9.78899	Stream	N
31	41	53.95134	-9.78696	Drain	Y
32	42	53.5801	-9.7806	Sea	Y
33	43	53.97813	-9.83755	Stream	Y
35	44	54.0003	-9.5051	Sea	Y
40	45	54.0053	-9.86786	Stream	Y
40	46	54.00522	-9.86895	Sea	N
N/a	47	53.96781	-9.80437	Sea	Y
N/a	Add PT1	53.91949	-9.79533	Sea	N
32	Add PT2	53.94878	-9.78872	Stream	N
N/a	Add PT3	54.0057	-9.85137	Stream	N
N/a	Add PT4	54.02184	-9.89459	Shoreline	N
N/a	Add PT5	54.02302	-9.88824	Drain	N
N/a	Add PT6	54.01991	-9.88974	Natural field drain	N
N/a	Add PT7	54.011176	-9.854724	Stream	N
N/a	Add PT8	54.00734	-9.853157	Field drain	N
N/a	Add PT9	54.006542	-9.853104	Sea	N

4 Bacteriological Survey

Where possible, the COP (SFPA, 2020) recommends that water samples for *E. coli* should be taken from inflows or watercourses discharging near the shellfish harvesting areas. Shellfish sampling may also be conducted if uncertainty regarding RMPs remains following the desk-based survey and shoreline survey.

For the purposes of this sanitary survey, bacteriological surveys and analysis are the responsibility of the SFPA, with Aqualicense relaying the relevant results within the report.

4.1 Bacteriological Survey Methodology

To complement shoreline observations and better understand contamination risks under current conditions, a bacteriological survey was carried out by SFPA at 27 targeted locations where faecal contamination was suspected. The sampling was undertaken at low tide using protocols outlined in Appendix 9.2 of the SFPA Code of Practice (2025). The COP recommends collecting samples under worst-case conditions, such as after heavy rainfall, to provide a more representative assessment of contamination levels. Each sample is assigned a clear identification code, with location codes following the format SS1, SS2, etc., to designate them as sanitary survey shellfish samples.

Samples are gathered in sterile plastic bottles. All samples are transferred to the testing laboratory within 48 hours of collection and are maintained at a temperature below 15ºC during transport to ensure sample integrity.

4.2 Bacteriological Survey Results

A total of 27 water samples were obtained at areas where faecal contamination was suspected. Samples were obtained in dry conditions. While it is recommended within the COP to obtain samples under worst-case environmental conditions, samples were obtained during three separate sampling efforts for logistical reasons. Sampling results are presented in Table 4-1.

Table 4-1 Results of water sampling for *E. coli* in Achill North BMPA. ID corresponds with observations from the shoreline survey.

Water Sample	Observation (ID)	MPN/ 100ml*	Date	Latitude (WGS84)	Longitude (WGS84)
1	Ridge Point [1]	<10	23/09/2025	54.022356	-9.9654318
2	Ships Point [2]	<10	23/09/2025	54.0096130	-9.9427275
3	Dooniver Beach [3]	240	23/09/2025	54.0010913	-9.9384062
4	Dooniver Point [4]	<10	23/09/2025	53.99584	-9.92899
5	Ashill Stream [5]	20	23/09/2025	53.9900235	-9.9588305
6	1st of two rivers flowing Bunacurry Pier [6]	80	23/09/2025	53.9696361	-9.9684234
7	2nd of two rivers flowing Bunacurry Pier [7]	20	23/09/2025	53.96889976	-9.9675034
8	Saula West freshwater inflow[8]	<10	23/09/2025	53.9509447	-9.9699962
9	Saula – River [9]	<10	23/09/2025	53.9461476	-9.9449997
14	Sraheens River/Stream [14]	20	23/09/2025	53.9312722	-9.9415289

AQUALICENSE

Water Sample	Observation (ID)	MPN/ 100mL*	Date	Latitude (WGS84)	Longitude (WGS84)
15	Achill Sound Bridge exchange [15]	<10	23/09/2025	53.9328245	-9.9230431
WWTP	Achill WWTP Outflow [WWTP]	1180	23/09/2025	53.9374518	-9.9192803
16	Tonragee West River/Stream [16]	180	23/09/2025	53.9502021	-9.8955287
17	Lynchaghan River/Stream [17]	<10	23/09/2025	53.9530329	-9.8906374
19	Tonragee West [19]	270	23/09/2025	53.9532452	-9.8735118
27	Tonragee East [27]	100	23/09/2025	53.9481343	-9.82975461
30	Mallaranny Ind Est [30]	<10	23/09/2025	53.9244846	-9.8109553
36	Mulranny [36]	110	23/09/2025	53.9116805	-9.8027824
38	Claggan Mountain Stream [38]	<10	23/09/2025	53.9273932	-9.7905987
42	Tonragee East [42]	20	23/09/2025	53.9772512	-9.8139694
42	Claggan Bellaveeny bridge [42]	20	23/09/2025	53.9751037	-9.794739
41	Claggan Mountain [41]	<10	23/09/2025	53.9475137	-9.788926
42	Shoreline south of river inputs [42]	5	25/09/2025	53.96781	9.80437
43	Stream, low flow, through improved pasture land [43] (Dooriel Creek)	440	25/09/2025	53.97813	-9.83755
44	Shore south of riverine inputs [44]	60	25/09/2025	54.013908	-9.849222
45	Low flow stream. Draining rough pasture [45] (Dooriel Creek)	140	25/09/2025	54.0053	-9.86786
47	Channel downstream of multiple inputs [47]	<10	25/09/2025	54.017567	-9.877739

Bacteriological water sampling results across the surveyed area demonstrated varying levels of contamination, with *E. coli* concentrations measured at all 27 locations.

Minimal contamination was identified at 12 stations where concentrations were recorded as <10 MPN/100mL indicating insignificant faecal contamination. 11 of the stations (a mixture of rivers, streams, beaches and areas draining rough pastures) yielded minimal to moderate concentrations (20-240 MPN/100mL). These were likely influenced by nutrient runoff from agricultural activities (sheep were recorded in adjacent fields and or noticeably improved pasture land).

Despite no visual indicator elevated levels were noted at a single site the Achill sound WWTP outfall pipe (1180 MPN/100mL). Although sampling occurred under dry conditions, preceding dry weather followed by intermittent rainfall events could have mobilised contaminants, thereby increasing the measured *E. coli* concentrations. These results informed the final decision on the BMPA boundary and confirmed the location of the RMP.

These bacteriological results indicate that the primary sources of faecal contamination within the study area are associated with known point discharge, outfalls, and localised land-based sources such as land drainage. The absence or low levels of *E. coli* detected at other locations, particularly within the streams and rivers, suggests limited contamination at the time of sampling.

However, it is noted that seasonal factors, including variations in rainfall, river flow, and agricultural activity, may influence contamination patterns over time. Such seasonal variations in such sources should be considered when devising a suitable sampling plan.

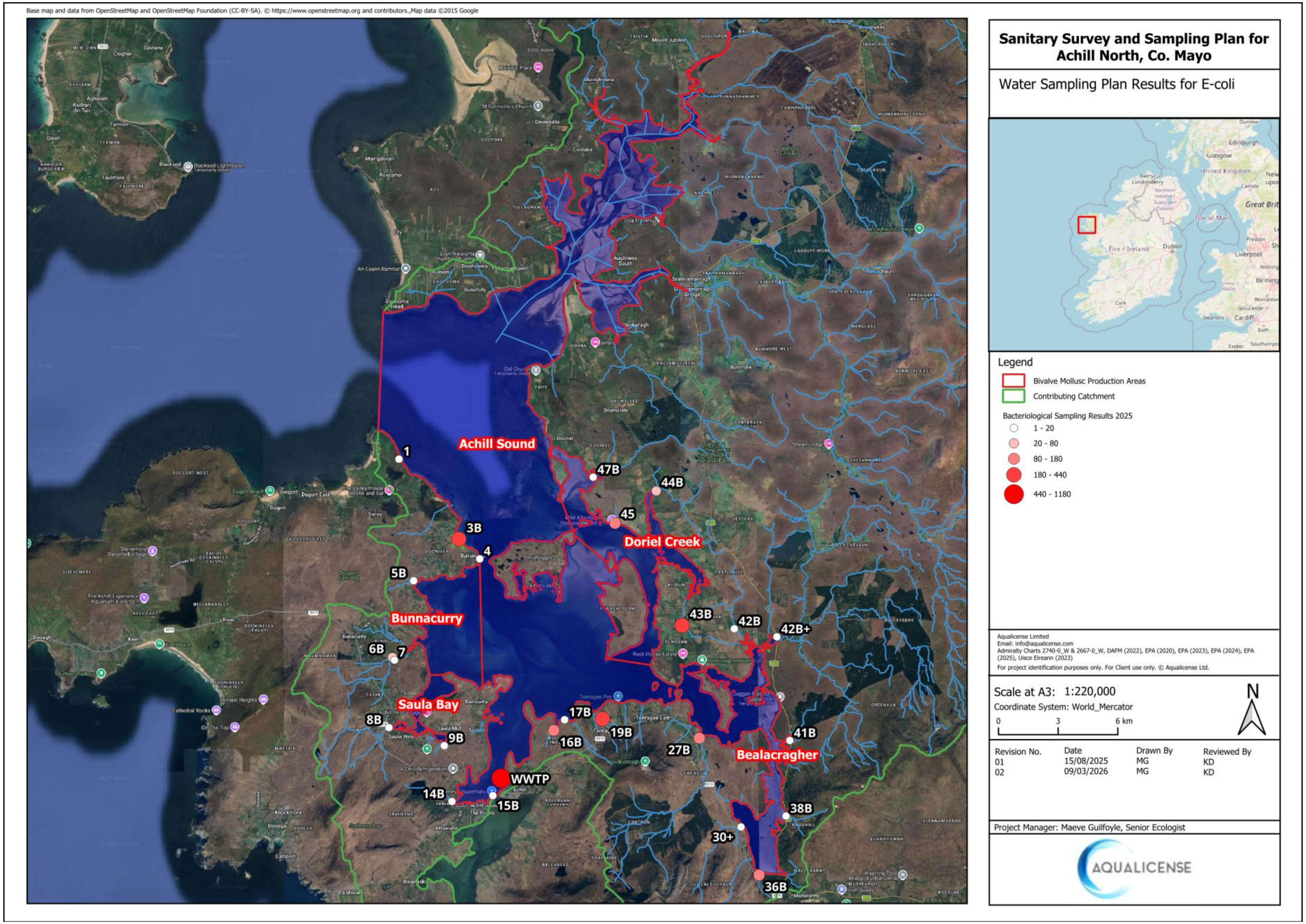

Figure 4-1- Water Sampling Results for *E. coli*

5 COMPARATIVE STATISTICS

Due to the absence of peer-reviewed data on hydrodynamics within the Achill North BMPA, a range of statistical methods was applied to analyse and interpret the *E. coli* monitoring results from 2010 to 2025 inclusive, with the aim of characterising local hydrodynamic movement patterns. Initial descriptive statistics (mean, median, standard deviation, percentiles, and maximum values) were used to summarise the distribution of results across locations, seasons, and years, providing a baseline understanding of variability (Appendix 4).

Given the highly skewed and non-normal distribution of the *E. coli* data, non-parametric tests were employed to assess differences between groups. The Kruskal-Wallis rank-sum test was used to detect overall differences, followed by post-hoc Dunn tests to identify which specific sites or seasons differed significantly. To complement these non-parametric comparisons, Generalised Linear Mixed Models (GLMMs) with a negative binomial distribution were developed to estimate the magnitude and direction of effects while accounting for over-dispersion, unbalanced sampling effort, and random variation between years and seasons.

These models enabled estimation of percentage differences between groups and the testing of potential long-term trends, providing a robust statistical framework for exploring the variability and complexity of environmental monitoring data.

Over the 15-year period, *E. coli* levels at the Achill North monitoring sites were therefore analysed using this combination of summary statistics, non-parametric tests, and advanced mixed-effects models to capture differences between locations, seasons, and years.

Overall, *E. coli* concentrations were highly variable, with most samples showing low to moderate values but occasional very high results (outliers—for example, 9,600 MPN/100 mL in 2024), resulting in a strongly skewed data distribution. This pattern indicates that while contamination events are relatively infrequent, when they do occur, they can be substantial.

From preliminary observations, there appears to be no consistent annual trend, with some years showing notably high (e.g. 2024) or low (e.g. 2019, 2021) deviations from the norm. In contrast, moderate differences by location and season were evident, with potential interaction effects—suggesting that for some locations, the influence of seasonality is stronger, weaker, or distinct. These indicative relationships will be further examined through detailed statistical testing and modelling.

5.1 NOTABLE DATA LIMITATIONS

While the chosen approach provides strong basis for interpreting patterns in *E. coli* data, several limitations should be noted. The dataset contains uneven sample sizes between the five locations and four seasons, which can influence the relative statistical power of group comparisons. Censored results below the detection limit (18 MPN/100g) were treated conservatively, which may slightly underestimate true variability at the lower end of the range. The data also exhibit high skewness and occasional extreme values, meaning that averages are influenced by a few large observations despite the use of non-parametric and distribution adjusted models.

In addition – potential temporal autocorrelation – arising from repeated measurements at the same sites cannot be fully accounted for in the available time series. Despite these constraints, the combined use of non-parametric testing and negative binomial mixed modelling provides a credible statistically defensible interpretation of the main spatial, seasonal and inter-annual trends in *E. coli* levels at Achill North.

5.1.1 Interpretation and Caveats

The uneven number of samples between sites and seasons, along with occasional, extreme readings, limits the precision of some of the comparisons. Some of the sample results were below detection limits, which can result in a slight underestimate of the true range of the lower *E. coli* levels. Despite these challenges the combination of robust non- parametric tests and mixed modelling provides credible evidence that spatial and seasonal differences are real and meaningful, even if year to year changes are less pronounced.

5.1.2 Key Findings:

A detailed breakdown of the annual results and comparative analyses is provided in Appendix 4, a summary of the key findings of the statical analyses is provided below:

- **Differences between pre-existing classifications**:

  E. coli levels were not consistent across the five sampling locations.
  - Bealacragher consistently recorded the highest levels of *E. coli*
  - Saula, North and Bunacurry generally had significantly lower levels- between 40-65% lower on average compared with Bealacragher.
  - Doriel Creek showed intermittent levels and was not statistically different from Belacragher.
- **Seasonal Patterns**:

  Levels varied significantly by season
  - Autumn and Summer tended to show higher *E. coli* concentrations, while Spring and Winter had notable lower levels (typically 50-65% lower than Autumn).
  - This suggests that environmental factors such as rainfall, runoff and temperature may influence the concentration of contamination.
- **Changes over time (2010-2025):**

  No clear long-term trend was detected.
  - While individual years (notably 2024 at Bealacragher bay) showed spikes in *E. coli*, these appear to be isolated events rather than part of a consistent upward or downward trend.
  - The statistical model suggested a possible small increase (up to 17%) over the 15-year period though this was not statistically significant.

5.2 Historical Statistics Summary

E. coli levels around Achill North are highly variable but show consistent spatial and seasonal patterns. Some locations (especially Bealacragher and Doriel creek classified areas) and seasons (autumn and summer) are more prone to elevated bacterial concentrations. This highlights potential site specific or seasonal influences on water quality.

6 SANITARY SURVEY CONCLUSIONS

The sanitary survey findings were synthesised through the integration of three primary data sources: a desk-based study using the Source–Pathway–Receptor (S–P–R) model, on-site shoreline inspections, targeted bacteriological analysis, and comparative statistics. Each component contributed distinct and complementary insights to the overall assessment of contamination risks within the Achill North BMPA.

The defined BMPA boundary reflects the principal hydrodynamic envelope influencing the licensed sites, with the seaward limit aligned to the main tidal exchange zone and the landward boundaries encompassing areas influenced by the Owenmore, Owenduff, Bellagarvaun and Tonragee systems. The spatial extent ensures that all inflow-driven contamination pathways are relevant to shellfish production are captured.

The desk-based study attributed the predominant sources of faecal pollution to the widespread use of domestic septic tank systems and the extensive agricultural activity in the catchment, particularly livestock farming. These preliminary conclusions were substantiated by field-based shoreline surveys and bacteriological sampling, both of which confirmed the presence of faecal contamination at identified discharge points and freshwater inflows. In addition to this, during the survey period 12 previously unmapped field drains, and 5 additional concrete discharge pipes were noted. At 7 of the 75 sites there were signs of possible contamination (algal matting (71, 72, 67a, 67c, 49, 55,52), foamed and or discoloured water (52 and 53)).

Of the 75 survey observations 27 were sampled for further analysis for bacteriological concentrations. Elevated *E. coli* levels were detected in areas associated with agricultural run-off (e.g. Inflow point 43, flowing through improved agricultural land 440 MPN/100mL (Table 4-1)). The Achill Sound WWTP discharge outfall yielded the highest *E. coli* results for the survey area (Table 4-1). These locations represent the areas of greatest risk for shellfish contamination within the BMPA.

Hydrodynamic considerations indicate that contaminant dispersion within Achill North BMPA is primarily governed by semi-diurnal tidal cycles, characterised by moderate-strength ebb currents, resulting in flushing times between ~0.7 and 5.7 days. Consequently, contaminants entering during low- flow periods or dry conditions can persist, especially in sheltered intertidal and shallow embayment areas.

The analysis of historical bacteriological datasets shows that while there are significant differences between locations and seasons there is no consistent long-term trends increasing or decreasing found over the 15-year period. Overall, the *E. coli* concentrations at Achill North are highly variable, with certain locations (the pre-existing Bealacragher and Doriel Creek classified areas) and season (Autumn and summer) consistently showing higher risk levels. This reinforcing the interpretation that contamination risk is predominantly driven by episodic events.

Overall, the combined evidence indicates that while there are multiple potential high-risk sources of faecal contamination within the wider catchment area, their impact within the shellfish production area is highly variable and strongly moderated by hydrodynamics and episodic rainfall events.

The desk-based study effectively identified the principal risk sources and zones of concern; the shoreline survey confirmed the presence of unrecorded discharges and bacteriological analysis demonstrated generally low contamination levels with isolated elevated detections linked to identifiable pressures.

7 RECOMMENDATIONS FOR RMPS FOR CURRENTLY LICENSED SPECIES

The selection of the Representative Monitoring Points (RMPs) are critical components of this report, as they provide the basis for protecting public health by ensuring that shellfish harvested for human consumption are effectively monitored for contamination risks, including *E. coli*.

The RMP represents the location within the BMPA most likely to reflect the highest contamination risk to shellfish production, thereby providing a conservative and protective basis for classification. In determining the RMP and BMPA boundaries, multiple factors were considered in line with established regulatory guidance.

These included hydrographic conditions; pre-existing classified area boundaries and their ongoing suitability; contaminant sources and pathways; historical and current bacteriological data; historic aquaculture activity and existing aquaculture licences; and practical accessibility for sampling. The selection of the RMPs within the BMPA and each classified area was informed by the best available evidence, including existing environmental datasets, hydrodynamic modelling outputs and localised hydrodynamic features such as restricted circulation. In consideration of the absence of site-specific hydrodynamic survey data, a precautionary approach was adopted to ensure that the RMPs appropriately capture areas of potential variability in water quality and environmental conditions across the BMPA.

A spatial tolerance is applied around the RMP to ensure that the monitoring point remains representative of the wider production area while maintaining sufficient proximity to potential shellfish production sites. These determinations are therefore central to ensuring that the classification accurately reflects the sanitary quality of shellfish production waters and supports the safe commercial harvesting of bivalve molluscs, in accordance with Regulation (EU) 2019/627 and relevant Food Standards Agency (FSA) sanitary survey protocols.

In the case of the wild native oyster fishery, it should be noted that harvesting activity operates only intermittently and targets naturally occurring wild stocks rather than managed or cultivated beds. The spatial distribution and intensity of fishing effort may therefore vary between seasons and a fixed RMP cannot be established. Instead, the RMP is treated as a floating reference, reflecting the variable spatial extent of fishing activity in any given season. This adaptive approach allows monitoring to remain responsive to the actual location of harvesting operations while continuing to uphold public health protection standards and regulatory compliance. Sampling will be undertaken in accordance with that specific year's sampling plan as issued by the SFPA (refer to Section 9).

In accordance with Article 61 of Regulation (EU) 2019/627, the following recommendations are made for incorporation into future sampling plans. It should be noted that these recommendations, based on the completed sanitary survey (desktop review and shoreline visit), relate specifically to the positioning of RMPs and should not be misconstrued as a full sampling plan.

7.1 REPRESENTATIVE MONITORING POINTS (PACIFIC OYSTERS)

Considering the extent of the proposed BMPA, prevailing circulation patterns, and the distribution of licensed sites, it is considered that the existing classified areas and boundaries are maintained, including the 4 RMPs is appropriate. However, the locations of the existing classified area boundaries and RMPs were originally selected without production of a sanitary survey. It is now recommended that these locations are revised, considering the findings of this sanitary survey (summarised in Section 6) and ensuring that the RMPs represent the area's most at risk of contamination under worst-case scenarios.

It is recommended that the Achill Sound classification, RMP 1, is located within the centre of Site T10-307C at ITM coordinates 53.95305 N, -9.9178 W (Figure 7-1). This location is likely to be influenced by contamination from the Achill WWTP which has a discharge pipe ~1.5 km to the south of the south. This RMP will remain inactive until production at the site is active. Oyster harvesting is contingent upon the availability of stock.

In the Saula classification, RMP 2 is in the centre of Site T10-330A at ITM coordinates 53.96231N, -9.9445W), situated within a shallow embayment with multiple input flows. Furthermore, this area is characterised by reduced water circulation, which has the potential to result in increased contaminant accumulation.

RMP 3 is recommended within the centre of T10-324A within the Bunacurry classification at ITM coordinates 53.97497N, -9.95037W. Although *E. coli* levels recorded at this location during the survey were relatively low, this site is located near Inflow 5, which was identified as an inflow of concern during the desk-based study.

RMP 4 is recommended within the centre of T10-332A at ITM coordinates 53.9859N, -9.8510W, within Doriel Creek. *E. coli* levels recorded at this location during the survey were relatively moderate, this site is located near Inflow 43, which was identified as an inflow of concern during the desk-based study and had elevated levels during the bacteriological survey.

While specific RMPs have been identified for Pacific oysters, it is recognised that, oysters may not always be available within 100 metres of the RMP. In such circumstances, the SFPA sample coordinator and local industry representatives should be informed, and an alternative sampling location agreed. This alternative location should be selected with reference to the findings of the sanitary survey and should continue to represent a worst-case scenario for contamination risk.

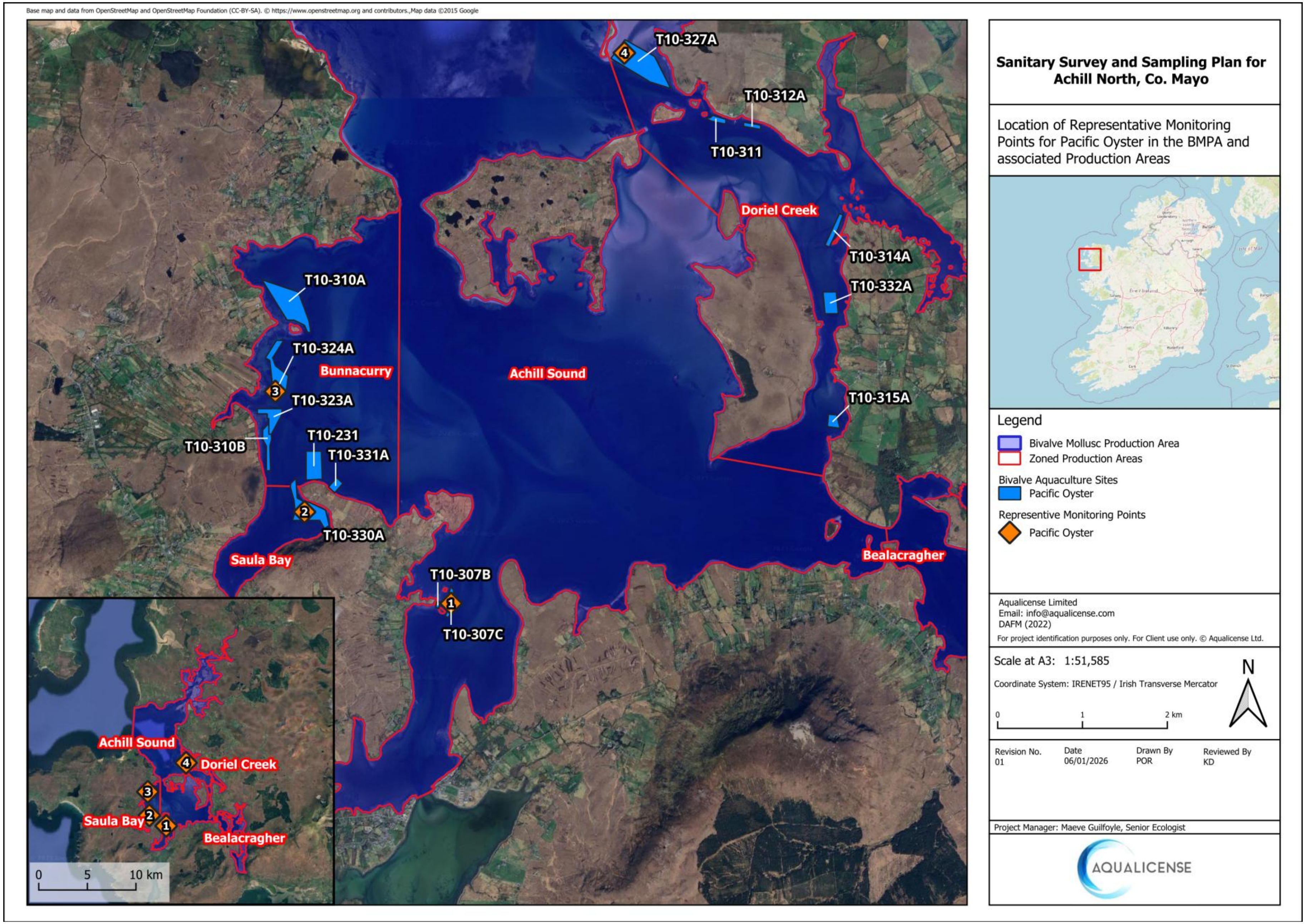

Figure 7-1 Location of RMPs for Pacific Oysters within Achill North BMPA

7.2 Sampling Plan for Pacific Oyster

Species-specific sampling plans have been developed in line with EU Regulation 2019/627 and the SFPA Code of Practice (2025). Key features of the plans are detailed in Figure 7-1 to Table 7-4:

Table 7-1. Sampling Plan for Pacific Oysters Achill Sound classification

Species	*Magallana gigas*
Site Name	Achill Sound
Sample Point Identifier	MO-AN-AS
Geographical location of sampling point (RMP)	53.95305 N, -9.9178 W
Sampling Frequency	Samples shall be taken monthly from Achill Sound. Sampling will occur throughout the year.
Sampling Depth	Samples should be taken as close to the surface as possible, within the top one metre of the water column.
Maximum Allowed Distance from Sampling Point	Samples are to be collected within 100m of the RMP. Where this is not possible, the SFPA sample coordinator and local industry shall be informed to agree an alternative sampling location.
Sampling Method	Sampling will be conducted in accordance with the SFPA Code of Practice for the Classification and Microbiological Monitoring of Bivalve Mollusc Production Areas (SFPA, 2020), specifically in accordance with Appendix 9.2.
Sample Size	A minimum of 10 oysters of market size
Authorised Samplers	It is the responsibility of the SFPA Killybegs Port Office to arrange sampling, with designated sampling officers assigned to collect samples.

Table 7-2 Sampling Plan for Pacific Oysters within Saula classification

Species	*Magallana gigas*
Site Name	Saula classification
Sample Point Identifier	MO-AN-SA
Geographical location of sampling point (RMP)	53.96231N, -9.9445W
Sampling Frequency	Samples shall be taken monthly from Saula classification. Sampling will occur throughout the year.
Sampling Depth	Samples should be taken as close to the surface as possible, within the top one metre of the water column.
Maximum Allowed Distance from Sampling Point	Samples are to be collected within 100m of the RMP. Where this is not possible, the SFPA sample coordinator and local industry shall be informed to agree an alternative sampling location.

SAMPLING METHOD	Sampling will be conducted in accordance with the SFPA Code of Practice for the Classification and Microbiological Monitoring of Bivalve Mollusc Production Areas (SFPA, 2020), specifically in accordance with Appendix 9.2.
SAMPLE SIZE	A minimum of 10 oysters of market size
AUTHORISED SAMPLERS	It is the responsibility of the SFPA Ros an Mhil Port Office to arrange sampling, with designated sampling officers assigned to collect samples.

Table 7-3 Sampling Plan for Pacific Oysters within Bunacurry classification

SPECIES	*Magallana gigas*
SITE NAME	Bunacurry Classification
SAMPLE POINT IDENTIFIER	MO-AN-BY
GEOGRAPHICAL LOCATION OF SAMPLING POINT (RMP)	53.97497N, -9.95037W
SAMPLING FREQUENCY	Samples shall be taken monthly from Bunacurry classification. Sampling will occur throughout the year.
SAMPLING DEPTH	Samples should be taken as close to the surface as possible, within the top one metre of the water column.
MAXIMUM ALLOWED DISTANCE FROM SAMPLING POINT	Samples are to be collected within 100m of the RMP. Where this is not possible, the SFPA sample coordinator and local industry shall be informed to agree an alternative sampling location.
SAMPLING METHOD	Sampling will be conducted in accordance with the SFPA Code of Practice for the Classification and Microbiological Monitoring of Bivalve Mollusc Production Areas (SFPA, 2020), specifically in accordance with Appendix 9.2.
SAMPLE SIZE	A minimum of 10 oysters of market size
AUTHORISED SAMPLERS	It is the responsibility of the SFPA Ros an Mhil Port Office to arrange sampling, with designated sampling officers assigned to collect samples.

Table 7-4 Sampling Plan for Pacific Oysters within Doriel Creek classification

SPECIES	*Magallana gigas*
SITE NAME	Doriel Creek Classification
SAMPLE POINT IDENTIFIER	MO-AN-DC
GEOGRAPHICAL LOCATION OF SAMPLING POINT (RMP)	54.0004553N, -9.86703W

SAMPLING FREQUENCY	Samples shall be taken monthly form Doriel Creek Classification. Sampling will occur throughout the year.
SAMPLING DEPTH	Samples should be taken as close to the surface as possible, within the top one metre of the water column.
MAXIMUM ALLOWED DISTANCE FROM SAMPLING POINT	Samples are to be collected within 100m of the RMP. Where this is not possible, the SFPA sample coordinator and local industry shall be informed to agree an alternative sampling location.
SAMPLING METHOD	Sampling will be conducted in accordance with the SFPA Code of Practice for the Classification and Microbiological Monitoring of Bivalve Mollusc Production Areas (SFPA, 2020), specifically in accordance with Appendix 9.2.
SAMPLE SIZE	A minimum of 10 oysters of market size
AUTHORISED SAMPLERS	It is the responsibility of the SFPA Killybegs Port Office to arrange sampling, with designated sampling officers assigned to collect samples.

These plans ensures the data collected will be representative of contamination affecting the production areas, supporting both the initial classifications and ongoing official controls.

7.3 Representative Monitoring Point- Blue Mussels

Considering the size of the BMPA, assumed circulation patterns and historically variable *E. coli* levels, and site activity a single RMP is recommended at ITM coordinates 53.9236N, -9.8014W within the licensed site T10-043A (Figure 7-2) within the Bealacragher classification. Mussel harvesting in the area is contingent upon the availability of stock.

The findings of the desk based current pattern analysis (Section 2.5 and Figure 2-7), S-P-R outcome (Table 2-11) and sanitary survey results, summarised in Section 6. Based on these findings, and to reflect the currently licenced activities within the BMPA, site T10-043A is identified as the only representative sampling location. In the Bealacragher classification, the RMP is in the centre of site T10-043A, situated within a constricted embayment with multiple input flows. Furthermore, this area is characterised by reduced water circulation, which has the potential to result in increased contaminant accumulation.

While a specific RMP has been identified for Blue mussels, it is recognised that, Blue mussels may not always be available within 100 metres of the RMP. In such circumstances, the SFPA sample coordinator and local industry representatives should be informed, and an alternative sampling location agreed. This alternative location should be selected with reference to the findings of the sanitary survey and should continue to represent a worst-case scenario for contamination risk.

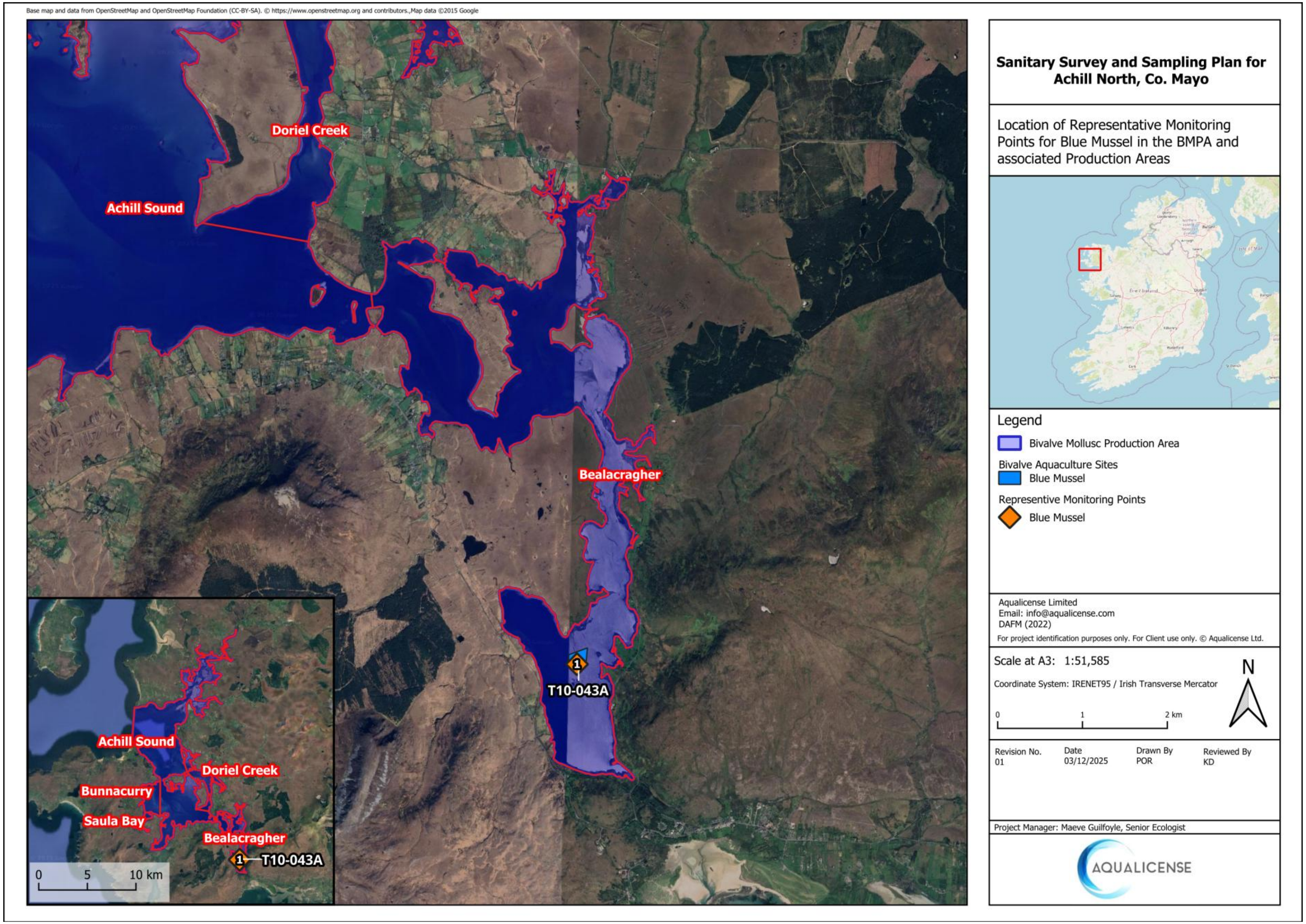

Figure 7-2 Location of RMP for Blue Mussel within Achill North BMPA

7.4 Sampling Plan for Blue Mussels

A species-specific sampling plan has been developed in line with EU Regulation 2019/627 and the SFPA Code of Practice (2025). Key features of the plan are detailed in Table 7-5*:*

Table 7-5. Sampling Plan for Blue Mussels Bealacragher classification

Species	*Mytilus edulis*
Site Name	Bealacragher Classification
Sample Point Identifier	MO-AN-BR
Geographical location of sampling point (RMP)	53.9236N, -9.8014W
Sampling Frequency	Samples shall be taken monthly from Bealacragher classification. Upon commencement of production sampling will occur throughout the year.
Sampling Depth	Samples should be taken as close to the surface as possible, within the top one metre of the water column.
Maximum Allowed Distance from Sampling Point	Samples are to be collected within 100m of the RMP. Where this is not possible, the SFPA sample coordinator and local industry shall be informed to agree an alternative sampling location.
Sampling Method	Sampling will be conducted in accordance with the SFPA Code of Practice for the Classification and Microbiological Monitoring of Bivalve Mollusc Production Areas (SFPA, 2020), specifically in accordance with Appendix 9.2.
Sample Size	A minimum of 15 mussels of market size (minimum length of 4 cm).
Authorised Samplers	It is the responsibility of the SFPA Ros an Mhil Port Office to arrange sampling, with designated sampling officers assigned to collect samples.

This plan ensures the data collected will be representative of contamination affecting the production area, supporting both initial classification and ongoing official controls.

7.5 Representative Monitoring Point- European Flat Oysters

Considering the size of the BMPA, assumed circulation patterns, historically variable *E. coli* levels, and site activity, three RMPs are recommended for European flat oyster. These locations are at ITM coordinates 53.96507 N, -9.9390 W at the licensed site T10-331A within Bunacurry Bay (Figure 7-2), ITM coordinates 53.98590N, -9.85106W at the licensed site T10-043A within Saula Bay zoned production area, and at the centre of T10-332A, ITM coordinates 53.98590N, -9.85106W , within Doriel Creek. European flat oyster harvesting in the area is contingent upon the availability of stock.

The findings of the desk based current pattern analysis (Section 2.5 and Figure 2-7), S-P-R outcome (Table 2-11) and sanitary survey results, summarised in Section 6, and nature of the currently licenced activities within the BMPA have been used to determine the RMPs. The following sites have been identified as RMPs, site T10-331A within Bunacurry Bay, T10-330A within Saula Bay, and site T10-332A within Doriel Creek.

In Bunacurry Bay, the RMP is on the southern portion of site T10-331A, which following the site survey and consultation with the port authorities, was identified as an area in proximity to inflows of concern. In the Saula Bay classification, the RMP is in the centre of site T10-330A, situated within a constricted embayment with multiple input flows. Furthermore, this area is characterised by reduced water circulation, which has the potential to result in increased contaminant accumulation. The third RMP for European flat oyster is recommended within the centre of T10-332A at ITM coordinates 53.9859N, -9.8510W, within Doriel Creek. *E. coli* levels recorded at this location during the survey were relatively moderate, this site is located near Inflow 43, which was identified as an inflow of concern during the desk-based study and had elevated levels of *E. coli* during the bacteriological survey.

While specific RMPs have been identified for European flat oysters, it is recognised that oysters may not always be available within 100 metres of the RMP. In such circumstances, the SFPA sample coordinator and local industry representatives should be informed, and an alternative sampling location agreed. This alternative location should be selected with reference to the findings of the sanitary survey and should continue to represent a worst-case scenario for contamination risk.

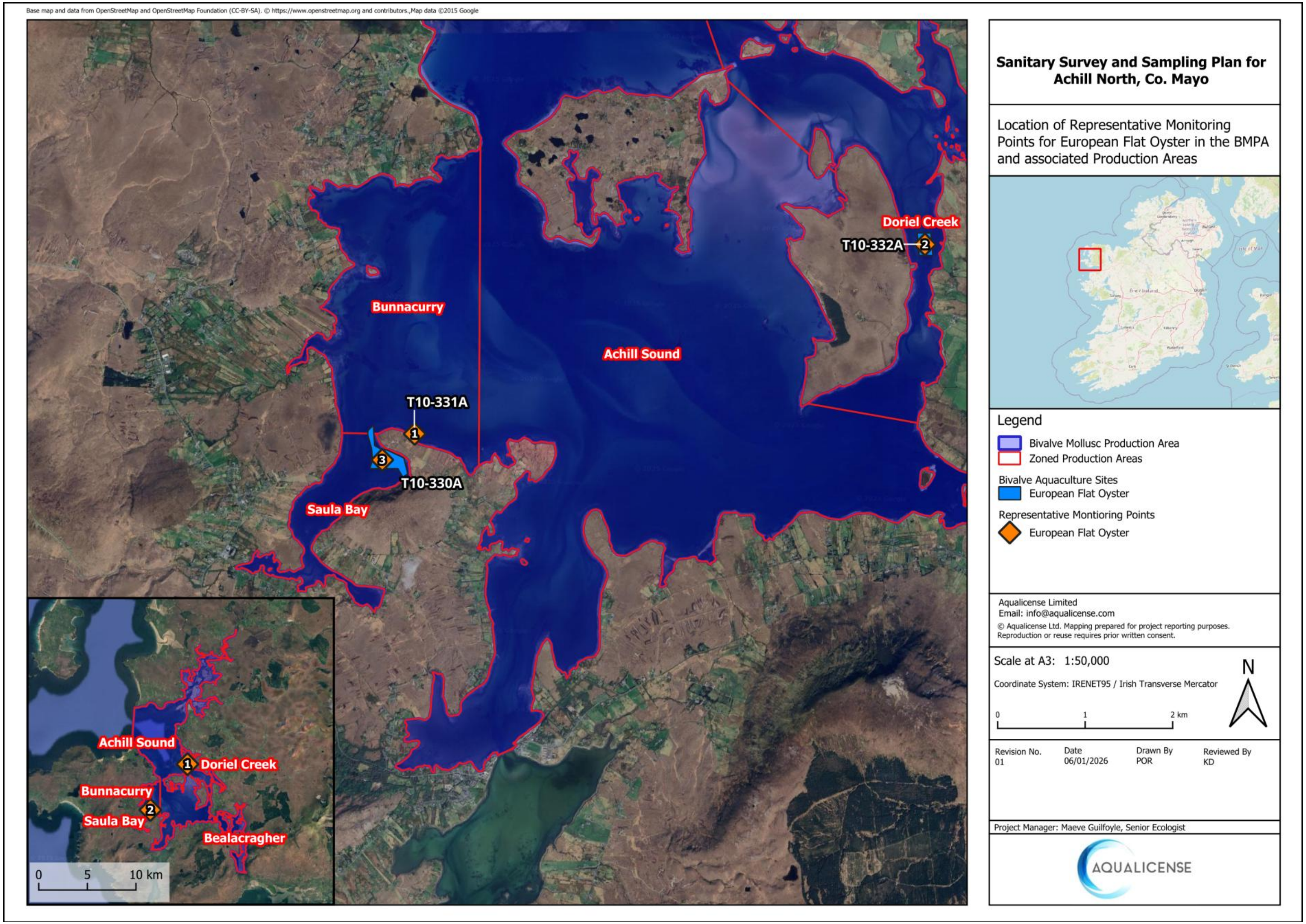

Figure 7-3 Location of RMPs for European Flat Oyster within Achill North BMPA

7.6 Sampling Plan for European Flat Oyster

Species-specific sampling plans has been developed in line with EU Regulation 2019/627 and the SFPA Code of Practice (2025). Key features of the plans are detailed in Table 7-6, Table 7-7 and Table 7-8 below.

Table 7-6 Sampling Plan for European Flat Oyster Bunacurry

Species	Ostrea edulis
Site Name	Bunacurry bay zoned production area
Sample Point Identifier	MO-AN-BY
Geographical location of sampling point (RMP)	53.96507 N, -9.9390 W
Sampling Frequency	Samples shall be taken monthly from Bunacurry Bay zoned production area. Upon commencement of production sampling will occur throughout the year.
Sampling Depth	Samples should be taken as close to the surface as possible, within the top one metre of the water column.
Maximum Allowed Distance from Sampling Point	Samples are to be collected within 100 m of the RMP. Where this is not possible, the SFPA sample coordinator and local industry shall be informed to agree an alternative sampling location.
Sampling Method	Sampling will be conducted in accordance with the SFPA Code of Practice for the Classification and Microbiological Monitoring of Bivalve Mollusc Production Areas (SFPA, 2020), specifically in accordance with Appendix 9.2.
Sample Size	
Authorised Samplers	A minimum of 10 oysters of market size.

Table 7-7. Sampling Plan for European Flat Oyster Doriel Creek

Species	*Ostrea edulis*
Site Name	Doriel Creek
Sample Point Identifier	MO-AN-DC-NO
Geographical location of sampling point (RMP)	53.98590N, -9.85106W
Sampling Frequency	Samples shall be taken monthly from Doriel Creek zone production area. Upon commencement of production sampling will occur throughout the year.
Sampling Depth	Samples should be taken as close to the surface as possible, within the top one metre of the water column.

Maximum Allowed Distance from Sampling Point	Samples are to be collected within 100 m of the RMP. Where this is not possible, the SFPA sample coordinator and local industry shall be informed to agree an alternative sampling location.
Sampling Method	Sampling will be conducted in accordance with the SFPA Code of Practice for the Classification and Microbiological Monitoring of Bivalve Mollusc Production Areas (SFPA, 2020), specifically in accordance with Appendix 9.2.
Sample Size	A minimum of 10 oysters of market size.
Authorised Samplers	It is the responsibility of the SFPA Killybegs Port Office to arrange sampling, with designated sampling officers assigned to collect samples.

Table 7-8. Sampling Plan for European Flat Oyster Saula Bay

Species	*Ostrea edulis*
Site Name	Saula bay zoned production area
Sample Point Identifier	MO-AN-SA-NO
Geographical location of sampling point (RMP)	53.97497N, -9.95037W
Sampling Frequency	Samples shall be taken monthly from Saula bay zoned production area. Upon commencement of production sampling will occur throughout the year.
Sampling Depth	Samples should be taken as close to the surface as possible, within the top one metre of the water column.
Maximum Allowed Distance from Sampling Point	Samples are to be collected within 100 m of the RMP. Where this is not possible, the SFPA sample coordinator and local industry shall be informed to agree an alternative sampling location.
Sampling Method	Sampling will be conducted in accordance with the SFPA Code of Practice for the Classification and Microbiological Monitoring of Bivalve Mollusc Production Areas (SFPA, 2020), specifically in accordance with Appendix 9.2.
Sample Size	A minimum of 10 oysters of market size.
Authorised Samplers	It is the responsibility of the SFPA Ros an Mhil Port Office to arrange sampling, with designated sampling officers assigned to collect samples.

This plan ensures the data collected will be representative of contamination affecting the production area, supporting both initial classification and ongoing official controls.

8 SAMPLING PLAN FOR CURRENTLY LICENCED SPECIES (IN THE EVENT OF FUTURE PRODUCTION)

8.1 REPRESENTATIVE MONITORING POINT- MANILA CLAM

In the event that commercial production starts and considering the size of the BMPA, assumed circulation patterns and historically variable *E. coli* levels, one RMP is recommended for Manila clam. RMP1 at ITM coordinates 54.010998N, -9.88695W, within the central portion of licensed site T10-327A (Doriel Creek) (Figure 8-1*)*. Manila clam harvesting in the area is contingent upon the availability of stock. In the absence of Manila clam production, the RMP will remain inactive until harvesting activities begin.

Based on the findings of the desk based current pattern analysis (Section 2.4, Figure 2-6)*,* S-P-R outcome (Table 2-11*)*, contamination inputs summarised in Section 6 and currently licensed area, site T10-327A (Doriel Creek) has been identified as the most representative sampling location. Within the Doriel Creek *E. coli* levels recorded during the survey were relatively moderate, this site is located near Inflow 43, which was identified as an inflow of concern during the desk-based study and had elevated levels during the bacteriological survey.

While a specific RMP have been identified for site T10-327A, it is recognised that, due to the intermittent growth at this site, samples may not always be available within 100 metres of the RMP. In such circumstances, the SFPA sample coordinator and local industry representatives should be informed, and an alternative sampling location agreed. This alternative location should be selected with reference to the findings of the sanitary survey and should continue to represent a worst-case scenario for contamination risk.

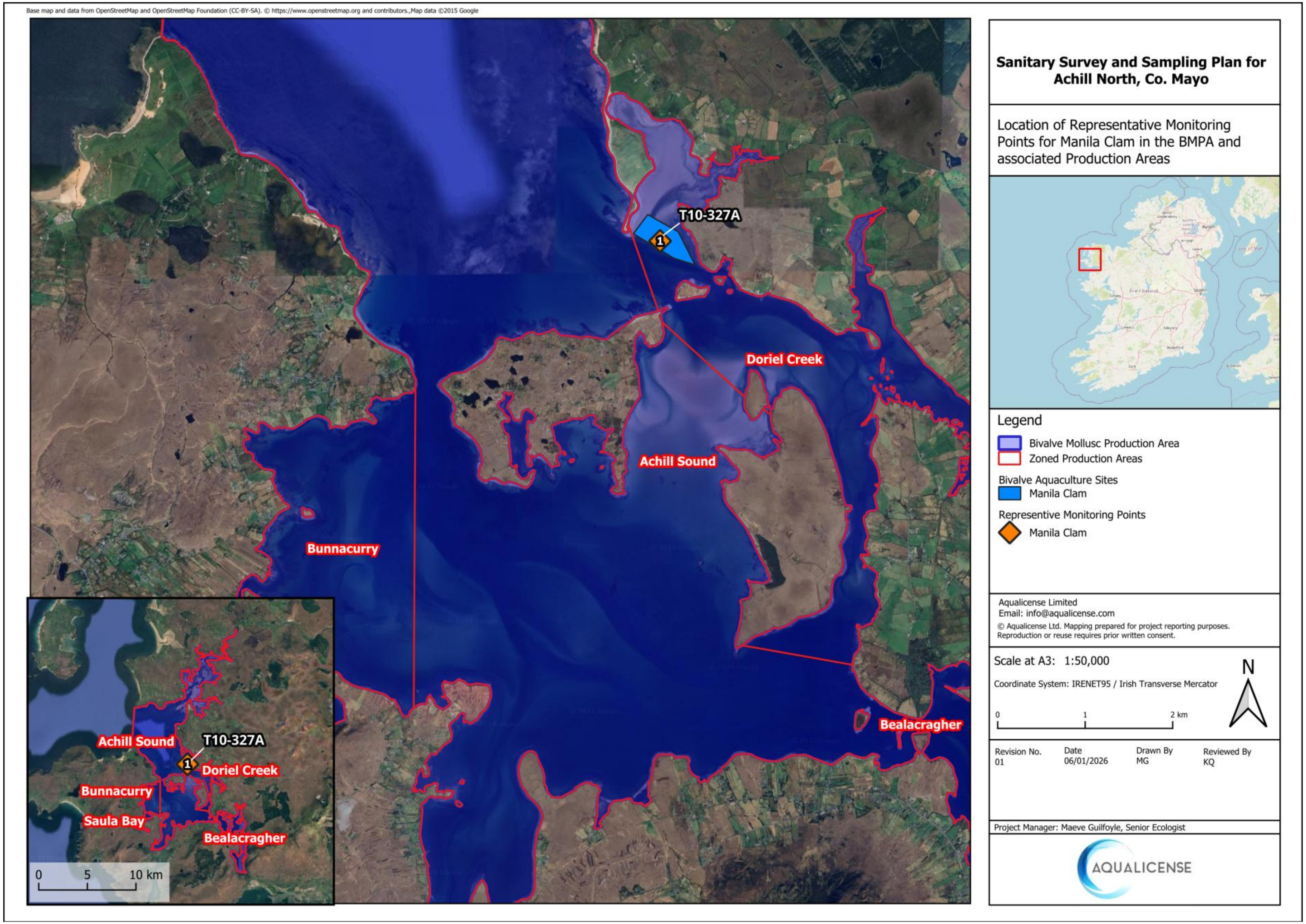

Figure 8-1 Location of RMP for Manila Clam within Achill North BMPA

8.2 Sampling Plan for Manila Clam

Species-specific sampling plans have been developed in line with EU Regulation 2019/627 and the SFPA Code of Practice (2025). Key features of the plan are detailed in Table 8-1 and Figure 8-1.

Table 8-1. Sampling Plan for Manila Clam within the Doriel Creek production area

Species	*Ruditapes philippinarum*
Site Name	Doriel Creek
Sample Point Identifier	MO-AN-DL
Geographical location of sampling point (RMP)	54.010998N, -9.88695W
Sampling Frequency	Samples shall be taken monthly upon classification of Doriel Creek for Manila clam. Sampling will occur throughout the year.
Sampling Depth	Samples should be taken as close to the surface as possible, within the top one metre of the water column.
Maximum Allowed Distance from Sampling Point	Samples are to be collected within 100 m of the RMP. Where this is not possible, the SFPA sample coordinator and local industry shall be informed to agree an alternative sampling location.
Sampling Method	Sampling will be conducted in accordance with the SFPA Code of Practice for the Classification and Microbiological Monitoring of Bivalve Mollusc Production Areas (SFPA, 2020), specifically in accordance with Appendix 9.2.
Sample Size	A minimum of 15 clams of market size
Authorised Samplers	It is the responsibility of the SFPA Killybegs Port Office to arrange sampling, with designated sampling officers assigned to collect samples.

This plan ensures the data collected will be representative of contamination affecting the production area, supporting both initial classifications and ongoing official controls.

9 Sampling Plan for Wild Fisheries

9.1 Representative Monitoring Point- European Flat Oyster

In the event that commercial harvesting of Native oysters (*Ostrea edulis*) is proposed under the short-term classification, it is recognised that fishing activity is intermittent and targets naturally occurring wild stocks rather than fixed or cultivated beds. Consequently, a single permanent RMP is not appropriate. A season-specific, fishery-representative RMP will therefore be identified in advance of each proposed fishing period, based on the anticipated location of harvesting activity. The intended fishing period (duration in months) and proposed RMP will be notified to the SFPA prior to sampling, in accordance with the requirements as set out in the short-term classification note 4 .

The season-specific RMP will be selected with reference to the sanitary survey, including identified freshwater inflows, shoreline contamination pressures, hydrodynamic influences, and historic microbiological data. Following SFPA approval, two initial samples will be collected from the agreed upon RMP not closer than two weeks apart prior to the commencement of harvesting. Subsequent samples are to be taken during the authorised fishing period in accordance with the sampling plan issued by SFPA for that year. The selected RMP will be located within, or immediately representative of, the active fishing area and will reflect a conservative (worst-case) representation of contamination risk in the area.

Where harvesting activity shifts materially during the authorised period such that sampling at the agreed RMP is no longer representative, this will be notified to the SFPA sample coordinator. Any alternative sampling location will be agreed in advance and selected with reference to the sanitary survey findings and the approved sampling plan ensuring that monitoring remains representative of the active fishery and that public health protection and regulatory compliance are maintained throughout the fishing period.

9.2 Sampling Plan for Wild Native Oyster

Species-specific sampling plans have been developed in line with EU Regulation 2019/627 and the SFPA Code of Practice (2025). Key features of the plan are detailed in Table 9-1:

Table 9-1. Sampling Plan for Wild Native Oyster within the Achill North BMPA

Species	*Ostrea edulis*
Site Name	Achill North BMPA
Sample Point Identifier	MO-AN-NO
Geographical location of sampling point (RMP)	This is treated as a floating RMP. There will be a defined and supervised sampling regime for an authorised period in accordance with the requirements of the short-term classification process.
Sampling Frequency	As this is a wild bivalve fishery, fishers must submit a request to carry out initial collection of two samples not closer than two weeks apart before risk assessment is carried out by the SFPA and prior to approval or refusal of permission to fish in a given year. Regular monitoring required during fishing period, subject to a tailored sampling plan and sufficient availability of local SFPA personnel for adequate supervision of this sampling plan. The sampling frequency is to be decided specific to this fishery, with a sampling plan issued following risk assessment if fishing is approved.
Sampling Depth	Samples should be taken as close to the surface as possible, within the top one metre of the water column.
Maximum Allowed Distance from Sampling Point	Samples are to be collected within 100 m of the pre-approved RMP. Where this is not possible, the SFPA sample coordinator and local industry shall be informed to agree an alternative sampling location.
Sampling Method	Sampling will be conducted in accordance with the SFPA Code of Practice for the Classification and Microbiological Monitoring of Bivalve Mollusc Production Areas (SFPA, 2020), specifically in accordance with Appendix 9.2.
Sample Size	A minimum of 10 oysters of market size.
Authorised Samplers	It is the responsibility of the SFPA Ros an Mhil and Killybegs Port Office to arrange sampling, with designated sampling officers assigned to collect samples.

10 Conclusion

A sanitary survey has been conducted in accordance with Article 56 of Regulation (EU) 2017/625 and Regulation (EU) 2019/627 (European Commission, 2024). The survey integrated a catchment-scale desk assessment, field-based shoreline verification, and bacteriological sampling to evaluate faecal contamination risks in Achill North.

These findings informed the delineation of the Bivalve Mollusc Production Area (BMPA), identification of Representative Monitoring Points (RMPs), and the development of recommendations for microbiological sampling plans.

The outputs of the survey are as follows:

- A geographically defined BMPA boundary of approximately 91.72 km^2.
- The native oyster fishery operates only intermittently and targets naturally occurring wild stocks rather than managed or cultivated beds. As a result, a fixed RMP cannot be established. Accordingly, it is not possible to develop a predetermined sampling plan for this site. The RMPs is instead treated as a floating reference, reflecting the variable spatial extent of fishing activity in any given year.
- To capture the dominant contamination pressures 9 RMPs (8 active, 1 inactive) have been created located at the following:
  - Pacific Oyster (Only RMP1 Inactive- all other active)
    - RMP 1 (inactive) at site T10-307C (53.95305N, -9.9178W) (Achill Sound)
    - RMP 2 at site T10-330A (53.96231N, -9.9445W) (Saula Bay)
    - RMP 3 at site T10-324A (53.97497N, -9.95037W) (Bunacurry Bay)
    - RMP 4 at site T10-327A (54.0004553N, -9.86703W) (Doriel Creek)
  - Blue Mussel (Active)
    - RMP 1 at site T10-043A (53.9236N, -9.8014W) (Bealacragher Bay)
  - Manila Clam (Inactive)
    - RMP 1 at site T10-327A (54.010998N, -9.88695W,) (Doriel Creek)
  - European Flat (Native) Oyster (Active)
    - RMP 1 at site T10-331A (53.96507N, -9.9390W) (Bunacurry Bay)
    - RMP 2 at site T10-332A (53.98590N, -9.85106W) (Doriel Creek)
    - RMP 3 at site T10-330A (53.97497N, -9.95037W) (Saula Bay)
  - Wild European Flat (Native) Oyster (Floating)
    - This is treated as a floating RMP. There will be a defined and supervised sampling regime for an authorised period in accordance with the requirements of the short-term classification process.
- Recommendations for a species-specific sampling plan for, Pacific Oyster (*Magallana gigas),* Blue Mussel (*Mytilus edulis*) and Manila Clam (*Ruditapes philippinarum)* in line with SFPA COP (2020) and EU (2019/627) regulatory requirements.

These components provide the scientific basis for the classification and ongoing monitoring of Achill North BMPA as a shellfish production area.

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Appendix 1 SUMMARY STATISTICS FOR WEATHER

Appendix 1 Table 11-1 - Summary statistics for wind derived from Newport Furnace weather station (July 2015 to June 2025 inclusive)

DIRECTION	FREQUENCY (%)	MAX. MEAN WIND SPEED (M/S)	MEAN WIND SPEED (M/S)
S	27.6	17.6	7.5
SW	22.1	16.6	6.6
N	11.5	12.5	4.8
W	10.7	14.4	5.7
NW	8.2	13.3	5.3
NE	7.9	10.3	4.4
SE	7.9	14.5	5.5
E	4.1	9.1	3.9

Appendix 1 Table 11-2 - Summary statistics for daily rainfall derived from Newport Furnace weather station (July 2015 to June 2025 inclusive)

MONTH	MAX. DAILY RAIN (MM)	MEAN DAILY RAIN (MM)	MEDIAN DAILY RAIN (MM)
January	228.3	128.82	125.95
February	241.9	132.48	117.8
March	151.3	98.52	103.6
April	95.2	61.53	63.55
May	95.6	57.22	50.05
June	100.9	77.48	84.65
July	148.5	92	97.45
August	208.1	118.99	119.45
September	145.8	104.46	102.1
October	222.4	134.27	131.85
November	191.8	136.5	141.65
December	255.7	157.28	151.3

Appendix 2 COMPARATIVE COORDINATES

Appendix 2 Table 11-3 - Comparative Coordinates for Survey Locations

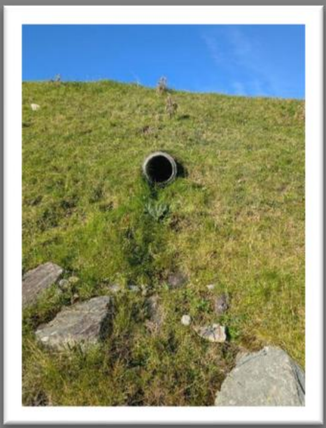
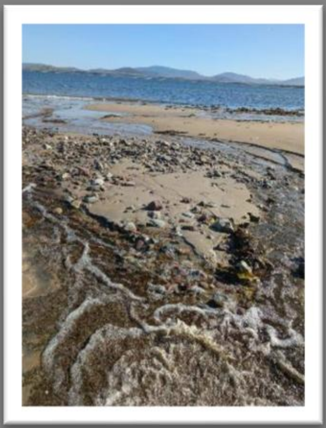
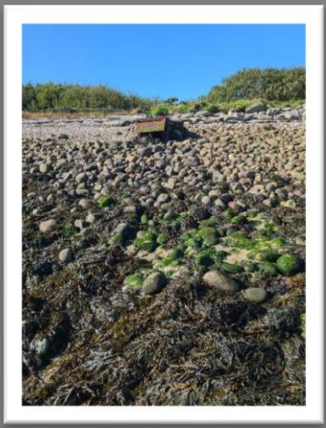
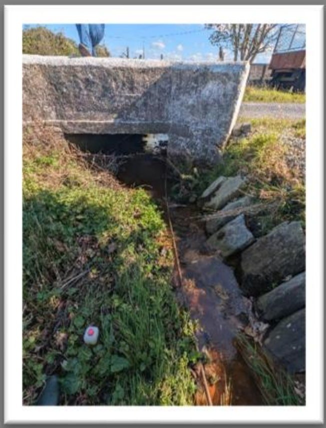
ID	LATITUDE (WGS 84) (DECIMAL)	LONGITUDE (WGS 84) (DECIMAL)	LATITUDE (WGS 84) (DMS)	LONGITUDE (WGS 84) (DMS)
1	54.022356	-9.9654318	-9° 57′ 55.5	54° 1′ 20.48
2	54.009613	-9.9427275	-9° 56′ 33.8	54° 0′ 34.61
3	54.0010913	-9.9384062	-9° 56′ 18.2	54° 0′ 3.93″
4	53.99584	-9.92899	-9° 55′ 44.3	53° 59′ 45.0
5	53.9900235	-9.9588305	-9° 57′ 31.7	53° 59′ 24.0
6	53.9696361	-9.9684234	-9° 58′ 6.32	53° 58′ 10.6
7	53.96889976	-9.9675034	-9° 58′ 3.01	53° 58′ 8.04
8	53.9509447	-9.9699962	-9° 58′ 11.9	53° 57′ 3.40
9	53.9461476	-9.9449997	-9° 56′ 42.0	53° 56′ 46.1
14	53.9312722	-9.9415289	-9° 56′ 29.5	53° 55′ 52.5
15	53.9328245	-9.9230431	-9° 55′ 22.9	53° 55′ 58.1
16	53.9502021	-9.8955287	-9° 53′ 43.9	53° 57′ 0.73
17	53.9530329	-9.8906374	-9° 53′ 26.2	53° 57′ 10.9
19	53.9532452	-9.8735118	-9° 52′ 24.6	53° 57′ 11.6
27	53.9481343	-9.82975461	-9° 49′ 47.1	53° 56′ 53.2
30	53.9244846	-9.8109553	-9° 48′ 39.4	53° 55′ 28.1
36	53.9116805	-9.8027824	-9° 48′ 10.0	53° 54′ 42.0
38	53.9273932	-9.7905987	-9° 47′ 26.1	53° 55′ 38.6
41	53.9475137	-9.788926	-9° 47′ 20.1	53° 56′ 51.0
42a	53.9772512	-9.8139694	-9° 48′ 50.2	53° 58′ 38.1
42b	53.9751037	-9.794739	-9° 47′ 41.0	53° 58′ 30.3
51	54.06458	-9.95266	-9° 57′ 9.58	54° 3′ 52.49
52	54.0661	-9.95049	-9° 57′ 1.76	54° 3′ 57.96
53	54.06623	-9.94989	-9° 56′ 59.6	54° 3′ 58.43
54a	54.06641	-9.9498	-9° 56′ 59.2	54° 3′ 59.08
54b	54.06581	-9.9259	-9° 55′ 33.2	54° 3′ 56.92
55b	54.06729	-9.92345	-9° 55′ 24.4	54° 4′ 2.24″
55a	54.06754	-9.92312	-9° 55′ 23.2	54° 4′ 3.14″
56	54.0611	-9.93169	-9° 55′ 54.0	54° 3′ 39.96
59	54.07297	-9.89486	-9° 53′ 41.5	54° 4′ 22.69
60	54.0793	-9.90079	-9° 54′ 2.84	54° 4′ 45.48
60	54.07276	-9.89386	-9° 53′ 37.9	54° 4′ 21.94
61a	54.07698	-9.89444	-9° 53′ 39.9	54° 4′ 37.13
61b	54.09228	-9.90008	-9° 54′ 0.29	54° 5′ 32.21
62a	54.09719	-9.90015	-9° 54′ 0.54	54° 5′ 49.88

ID	Latitude (WGS 84) (Decimal)	Longitude (WGS 84) (Decimal)	Latitude (WGS 84) (DMS)	Longitude (WGS 84) (DMS)
63	54.10935	-9.83817	-9° 50′ 17.4	54° 6′ 33.66
64	54.10921	-9.86373	-9° 51′ 49.4	54° 6′ 33.16
65	54.12382	-9.87232	-9° 52′ 20.3	54° 7′ 25.75
66	54.11182	-9.84645	-9° 50′ 47.2	54° 6′ 42.55
WWTP	53.9374518	-9.9192803	-9° 55′ 9.41	53° 56′ 14.8
49	54.04868	-9.89578	-9° 53′ 44.8	54° 2′ 55.25
50	54.04746	-9.8922	-9° 53′ 31.9	54° 2′ 50.86
56	54.05409	-9.86465	-9° 51′ 52.7	54° 3′ 14.72
57	54.05626	-9.8609	-9° 51′ 39.2	54° 3′ 22.54
58	54.07234	-9.8448	-9° 50′ 41.2	54° 4′ 20.42
59b	54.07795	-9.86612	-9° 51′ 58.0	54° 4′ 40.62
62b	54.08062	-9.86616	-9° 51′ 58.1	54° 4′ 50.23
67b	54.10121	-9.84903	-9° 50′ 56.5	54° 6′ 4.36″
67c	54.10049	-9.84889	-9° 50′ 56.0	54° 6′ 1.76″
67a	54.09815	-9.84824	-9° 50′ 53.6	54° 5′ 53.34
68	54.09533	-9.84815	-9° 50′ 53.3	54° 5′ 43.19
69b	54.09439	-9.83787	-9° 50′ 16.3	54° 5′ 39.80
69a	54.09351	-9.83745	-9° 50′ 14.8	54° 5′ 36.64
70	54.09307	-9.83731	-9° 50′ 14.3	54° 5′ 35.05
71	54.09266	-9.83662	-9° 50′ 11.8	54° 5′ 33.58
72	54.09268	-9.8378	-9° 50′ 16.0	54° 5′ 33.65
73	54.08513	-9.84745	-9° 50′ 50.8	54° 5′ 6.47″
38	53.92769	-9.79053	-9° 47′ 25.9	53° 55′ 39.6
39	54.04106	-9.79043	-9° 47′ 25.5	54° 2′ 27.82
40	53.94463	-9.78899	-9° 47′ 20.3	53° 56′ 40.6
41	53.95134	-9.78696	-9° 47′ 13.0	53° 57′ 4.82
42c	53.9801	-9.4806	-9° 28′ 50.1	53° 58′ 48.3
43	53.97813	-9.83755	-9° 50′ 15.1	53° 58′ 41.2
44	54.00025	-9.8463	-9° 50′ 46.6	54° 0′ 0.90″
45	54.0053	-9.86786	-9° 52′ 4.30	54° 0′ 19.08
46	54.00522	-9.86895	-9° 52′ 8.22	54° 0′ 18.79
47	53.96781	-9.80437	-9° 48′ 15.7	53° 58′ 4.12
Add_PT_1	53.91949	-9.79533	-9° 47′ 43.1	53° 55′ 10.1
Add_PT_2	53.94878	-9.78872	-9° 47′ 19.3	53° 56′ 55.6
Add_PT_3	54.0057	-9.85137	-9° 51′ 4.93	54° 0′ 20.52
Add_PT_4	54.02184	-9.89459	-9° 53′ 40.5	54° 1′ 18.62
Add_PT_5	54.02302	-9.88824	-9° 53′ 17.6	54° 1′ 22.87
Add_PT_6	54.01991	-9.88974	-9° 53′ 23.0	54° 1′ 11.68

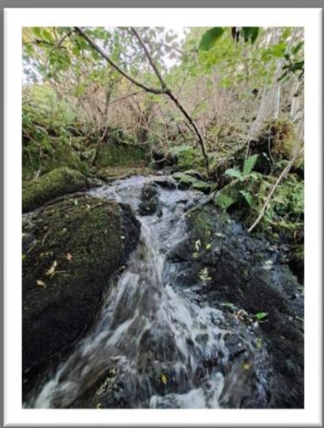
ID	Latitude (WGS 84) (Decimal)	Longitude (WGS 84) (Decimal)	Latitude (WGS 84) (DMS)	Longitude (WGS 84) (DMS)
Add_PT_7	54.011176	-9.854724	-9° 51′ 17.0	54° 0′ 40.23
Add_PT_8	54.00734	-9.853157	-9° 51′ 11.3	54° 0′ 26.42
Add_PT_9	54.006542	-9.853104	-9° 51′ 11.1	54° 0′ 23.55

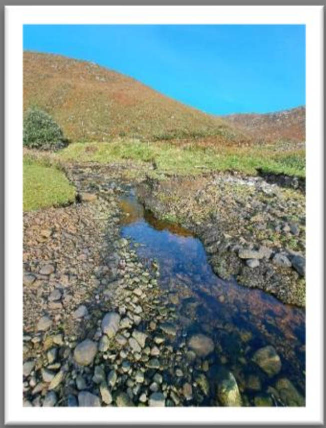
Appendix 3 SHORELINE Survey Photographs

Appendix 3 Table 11-4 - Survey Photographs

1 	**2** 
3 	**4** 
5 	**6** 

7 	**8** 
9 	**10 No Photograph Taken**
11 No Photograph Taken	**12 No Photograph Taken**

WWTP Outflow 	**14** 
15 	**16** 
17 	**18 No Photograph Taken**

19 	20 No Photograph Taken
21 No Photograph Taken	22 No Photograph Taken
23 No Photograph Taken	24 No Photograph Taken

25 No Photograph Taken	**26 No Photograph Taken**
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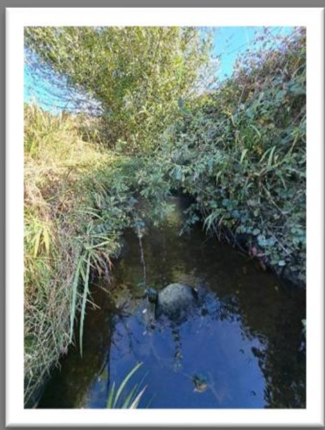
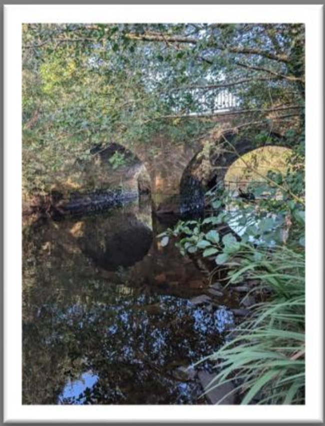
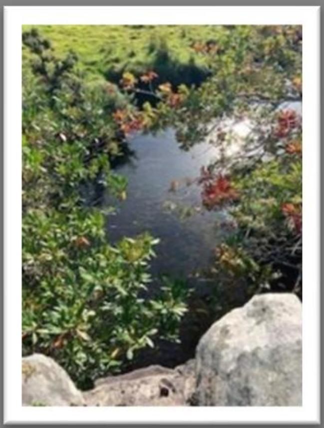
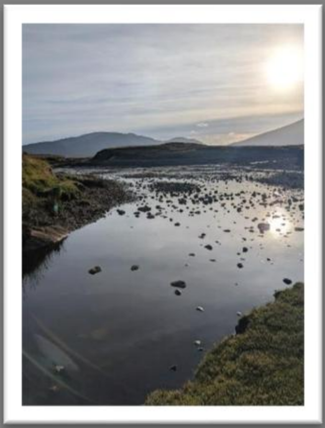
29 No Photograph Taken	**30** 

31 No Photograph Taken	**32 No Photograph Taken**
33 No Photograph Taken	**34 No Photograph Taken**
35 No Photograph Taken	**36** 

37 No Photograph Taken	**38** 
38B 	**39** 
40 	**41** 

41 No Photograph Taken	**41B** 
42 	**42B+** 
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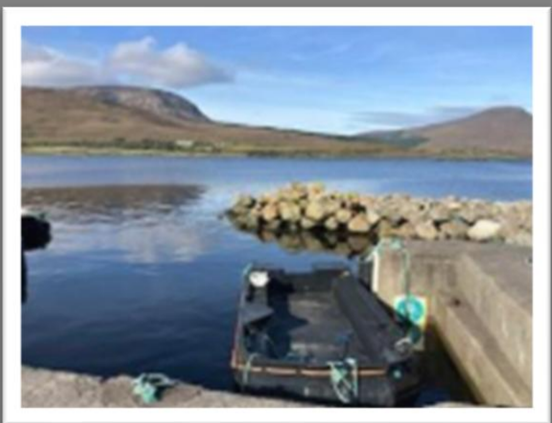
Additional Point 1



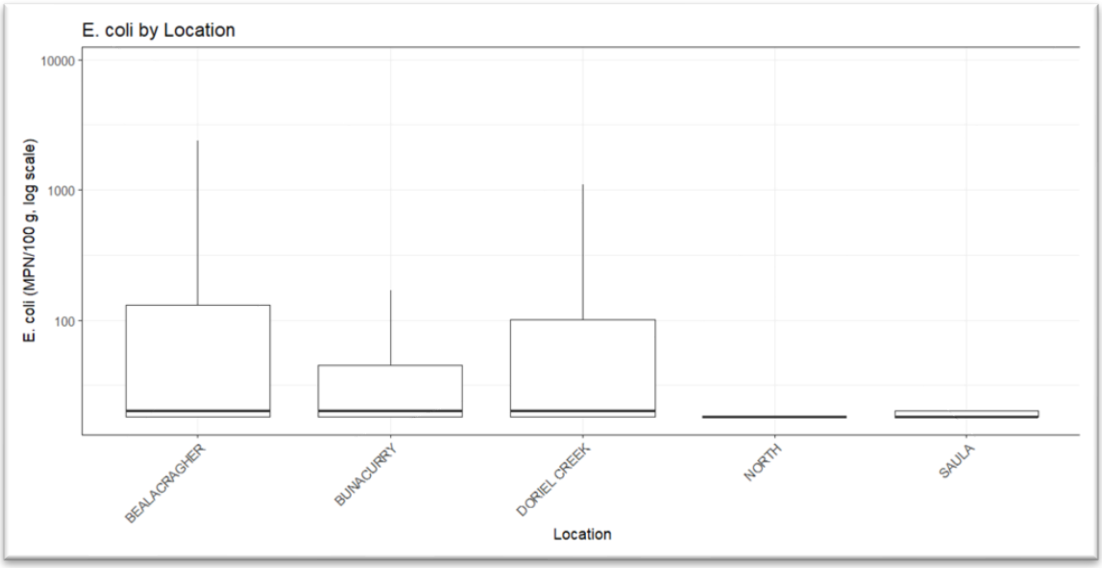
Additional Point 2

Additional Point 3

Appendix 4 HISTORICAL STATISTICAL COMPARISONS

Appendix 4.1 VARIATIONS BETWEEN LOCATIONS

E. coli levels varied considerably across the five monitoring locations at Achill North, as shown in Appendix 4 Figure 11-1 and summarised in Appendix 4 Table 11-5.



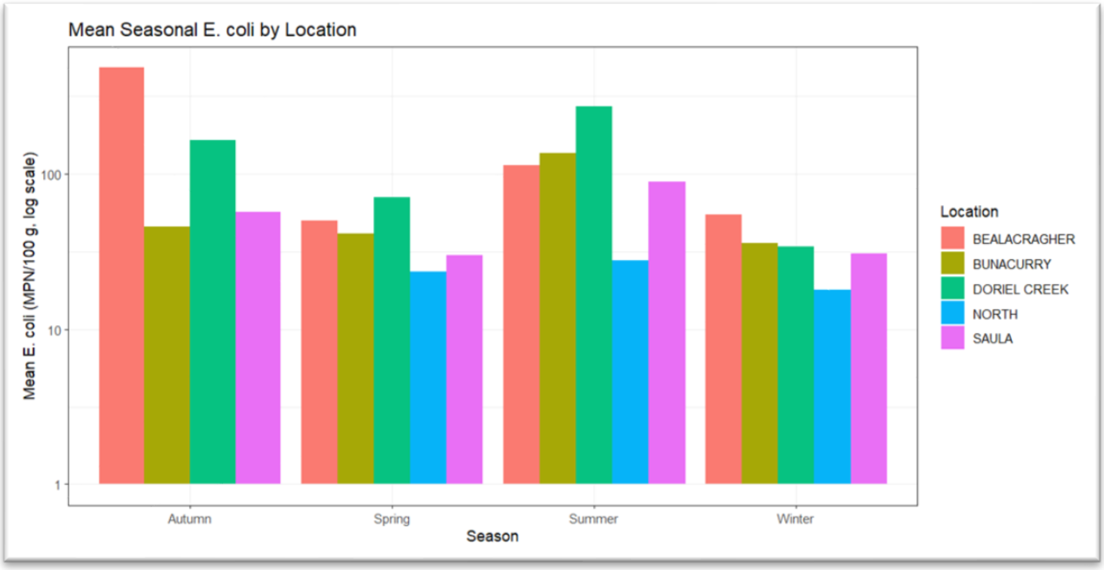
Appendix 4 Figure 11-1 - Boxplot of E. *Coli* by location

While the majority of sites recorded relatively low to moderate concentrations, Bealacragher consistently showed the highest average and maximum values, indicating occasional high contamination events. In contrast, north and Saula recorded the lowest overall levels, suggesting more stable and less contaminated conditions.

Appendix 4 Table 11-5 – *E. coli* Descriptive Statistics grouped by Location

LOCATION	COUNT	MEAN	MEDIAN	STANDARD DEVIATION	90TH PERCENTILE	MAXIMUM
Overall	**690**	**104.6826**	**20**	**425.4869**	**230**	**9200**
BEALACRAGHER	143	178.0140	20	801.8047	230	9200
BUNACURRY	191	65.7330	20	189.2807	130	2400
DORIEL CREEK	190	137.6316	20	350.0365	330	2800
NORTH	16	23.5625	18	15.9957	32.5	78
SAULA	150	51.2867	18	106.1565	112	790

The accompanying Appendix 4 Figure 11-3 highlights that these spatial patterns are further influenced by seasonal effects, with some sites showing stronger seasonal variation (e.g. Doriel creek and Bealacragher) than others.



Appendix 4 Figure 11-2 – Mean Seasonal *E. coli* by Location

Appendix 4.1.1 DISTRIBUTIONAL TESTING

The statistical comparison of contaminants between locations (Appendix 4 Table 11-6) confirmed that differences across sites are statistically significant. The Kruskal-Wallis rank sum test indicated strong overall variation (p 2×10^(-11), chi-squared of 55.989 with 4 degrees of freedom), and post-hoc Dunn tests identified which specific locations differed from each other.

Appendix 4 Table 11-6 below contains the results of the post hoc Dunn test with Hochberg correction.

Appendix 4 Table 11-6 – Results of post-hoc Dunn test on effect of Location

PAIRING	Z VALUE	P VALUE	ADJUSTED P VALUE	SIGNIFICANT?
Bealacragher - Bunacurry	3.519	4.33E-04	2.60E-03	Yes
Bealacragher - Doriel Creek	0.310	7.57E-01	7.57E-01	No
Bunacurry - Doriel Creek	-3.463	5.34E-04	2.67E-03	Yes
Bealacragher - North	4.139	3.49E-05	2.79E-04	Yes
Bunacurry – North	2.697	6.99E-03	2.80E-02	Yes
Doriel Creek – North	4.060	4.91E-05	3.44E-04	Yes
Bealacragher - Saula	5.560	2.70E-08	2.43E-07	Yes
Bunacurry – Saula	2.390	1.69E-02	5.06E-02	No
Doriel Creek – Saula	5.635	1.75E-08	1.75E-07	Yes
North - Saula	-1.678	9.34E-02	1.87E-01	No

From these results, there is enough statistical evidence to state the following:

- Bealacragher has a different *E. coli* distribution than Bunacurry, North, and Saula
- Doriel Creek has a different *E. coli* distribution than Bunacurry, Noth, and Saula
- Bunacurry has a different *E. coli* distribution than North

Results show that Bealacragher and Doriel Creek typically have higher contamination levels than Bunacurry, North and Saula, while North consistently recorded the lowest values. These findings highlight clear spatial variation in contamination levels across the Achill North monitoring sites.

Appendix 4.1.2 GLMM Effect Estimation

To better understand the scale of the differences between locations, a Generalised Linear Mixed Model (GLMM) was applied, allowing for natural variability between years and seasons (Appendix 4 Table 11-7). The table below contains the fitted model parameters with 95% confidence intervals for their estimation, alongside a description of what they mean.

Appendix 4 Table 11-7 –Negative Binomial GLMM Location Effect Estimates

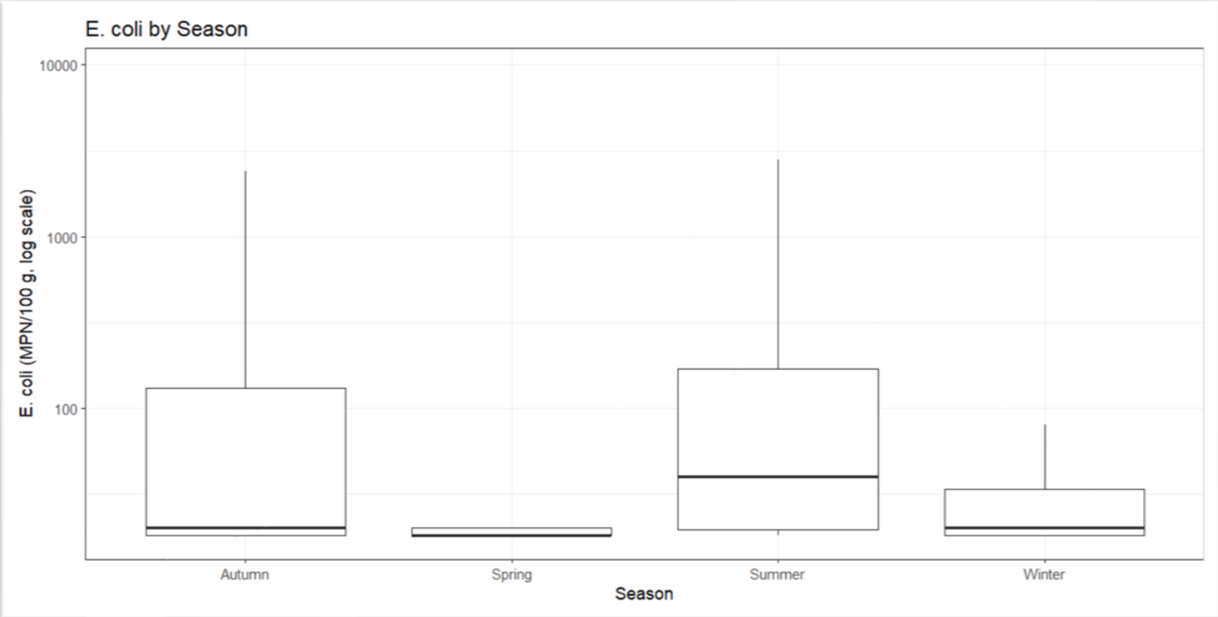
Parameter	Lower CI Bound	Upper CI Bound	P Value	Significant?	Description
Intercept	60	176	5.53E-64	Yes	Estimated mean *E. coli* level with all influences set to zero. In this case, this is the estimated mean *E. coli* level for Bealacragher
Bunacurry	63%	39%	2.23E-09	Yes	Effect of sampling from Bunacurry instead of Bealacragher, given in the form of percentage decrease. In this case, this means that estimated mean *E. coli* levels in Bunacurry are predicted to be 39-63% lower than in Bealacragher
Doriel Creek	30%	-14%	3.70E-01	No	Effect of sampling from Doriel instead of Bealacragher, given in the form of percentage decrease. In this case, there is not enough evidence to declare significant difference between the two, as there could be an increase of up to 14% or decrease of up to 30%
North	81%	41%	1.72E-04	Yes	Effect of sampling from North instead of Bealacragher, given in the form of percentage decrease. In this case, this means that estimated mean *E. coli* levels in North are predicted to be 41-81% lower than in Bealacragher
Saula	70%	49%	6.80E-13	Yes	Effect of sampling from Saula instead of Bealacragher, given in the form of percentage decrease. In this case, this means that estimated mean *E. coli* levels in Saula are predicted to be 49-70% lower than in Bealacragher

The model shows that, Bealacragher remains the site with the highest estimated *E. coli* levels. In comparison, Bunacurry, North, and Saula show substantially lower concentrations- typically between 40-70% lower- while Doriel Creek shows no significant difference from Bealacragher.

Of note – this model tends to underestimate the low-to-median *E. coli* levels and overestimate the extreme levels (i.e. outliers at 9200) based on the given dataset. In the context of the outliers present this may be suitable, but these results are to be taken with caution, especially considering the potential dependence structure that may not have been sufficiently captured by random effects.

Appendix 4.1.3 SEASONAL PATTERNS

Seasonal analysis of *E. coli* levels (Appendix 4 Figure 11-3 and Appendix 4 Table 11-8*)* shows clear variation throughout the year.



Appendix 4 Figure 11-3– Boxplot of *E. coli* by Season

Autum and summer generally recorded the highest average concentrations, suggesting greater contamination risk during warmer or wetter periods. In contrast, spring and winter displayed lower and more stable levels indicating reduced bacterial presence. These seasonal differences highlight the influence of environmental factors such as rainfall, temperature and runoff on *E. coli* levels at Achill North.

Appendix 4 Table 11-8 – *E. coli* Descriptive Statistics grouped by Season

SEASON	COUNT	MEAN	MEDIAN	STANDARD DEVIATION	90TH PERCENTILE	MAXIMUM
Overall	**690**	**104.6826**	**20**	**425.4869**	**230**	**9200**
Spring	184	47.25543	18	102.63253	80	1100
Summer	176	158.50568	40	354.19299	330	2800
Autumn	164	178.73171	20	773.95032	230	9200
Winter	166	38.11446	20	53.12654	78	460

Appendix 4.1.4 DISTRIBUTIONAL TESTING

Statistical testing confirmed that *E. coli* levels differ significantly between seasons (Appendix 4 Table 11-9). The Kruskal-Wallis rank sum test indicated strong overall variation (p-value of 2×10^{-13}, chi-squared of 62.088 with 3 degrees of freedom) and follow up Dunn tests identified where those differences occur.

Appendix 4 Table 11-9 below contains the results of the post hoc Dunn test with Hochberg correction.

Appendix 4 Table 11-9 –Results of post-hoc Dunn test on effect of Season

PAIRING	Z VALUE	P VALUE	ADJUSTED P VALUE	SIGNIFICANT?
Autumn - Spring	5.111	3.20E-07	1.28E-06	Yes
Autumn - Summer	-1.769	7.70E-02	1.54E-01	No
Spring - Summer	-7.026	2.12E-12	1.27E-11	Yes
Autumn - Winter	3.564	3.66E-04	1.10E-03	Yes
Spring - Winter	-1.462	1.44E-01	1.44E-01	No
Summer - Winter	5.400	6.65E-08	3.33E-07	Yes

Autumn and summer recorded significantly higher *E. coli* levels compared with spring and winter, which showed consistently lower results. These findings reinforce the visual patterns observed in the season boxplot *(Appendix 4 Figure 11-3)* suggest that environmental conditions during warmer months promote higher bacterial concentrations.

Appendix 4.1.5 GLMM EFFECT ESTIMATION

To quantify the seasonal difference in *E. coli* levels GLMM was applied, accounting for variation between years and monitoring locations (Appendix 4 Table 11-10). The table below contains the fitted model parameters with 95% confidence intervals for their estimation, alongside a description of what they mean.

Appendix 4 Table 11-10 – Negative Binomial GLMM Season Effect Estimates

PARAMETER	LOWER CI BOUND	UPPER CI BOUND	P VALUE	SIGNIFICANT?	DESCRIPTION
Intercept	62	136	1.19E-111	Yes	Estimated mean *E. coli* level with all influences set to zero. In this case, this is the estimated mean *E. coli* level for Autumn
Spring	66%	46%	2.23E-09	Yes	Effect of sampling in Spring instead of Autumn, given in the form of percentage decrease. In this case, this means that estimated mean *E. coli* levels in Spring are predicted to be 46-66% lower than in Autumn
Summer	5%	-52%	3.70E-01	No	Effect of sampling in Summer instead of Autumn, given in the form of percentage decrease. In this case, there is not enough evidence to

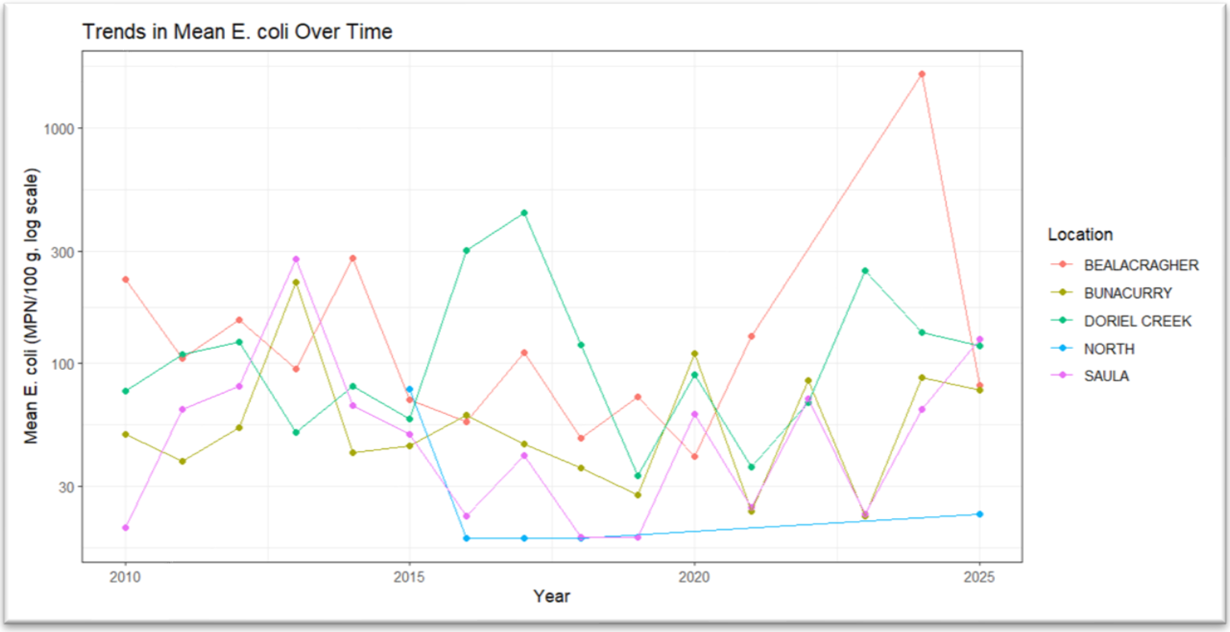
PARAMETER	LOWER CI BOUND	UPPER CI BOUND	P VALUE	SIGNIFICANT?	DESCRIPTION
					declare significant difference between the two, as there could be an increase of up to 52% or decrease of up to 5%
Winter	69%	51%	1.72E-04	Yes	Effect of sampling in North instead of Autumn, given in the form of percentage decrease. In this case, this means that estimated mean *E. coli* levels in Winter are predicted to be 51-69% lower than in Autumn

The model confirms that spring and winter have significantly lower *E. coli* concentrations than Autumn. Summer showed no significant difference from Autumn, indicating that these two seasons share broadly similar contamination levels. Overall, this analysis supports the conclusion that higher levels are most likely to occur during the warmer or wetter months, while levels tend to drop during cooler periods.

Of note – similar to the Location analysis, this model tends to underestimate the low-to-median *E. coli* levels and overestimate the extreme levels (i.e. outliers at 9200) based on the given dataset. In the context of the outliers present this may be suitable, but these results are again to be taken with caution, especially considering the potential dependence structure that may not have been sufficiently captured by random effects.

Appendix 4.1.6 CHANGES OVER TIME

Annual patterns in *E. coli* levels from 2010-2025 are displayed in *Appendix 4 Figure 11-3* and summarised in Appendix 4 Table 11-11. *E. coli* levels from 2010-2025 are displayed in Appendix 4 Figure 11-3 and summarised in Appendix 4 Table 11-11. While results fluctuate from year to year, there is no clear long-term downward or upwards trend in the overall concentrations found.



Appendix 4 Figure 11-4 – Trends in Mean *E. coli* by Year

Most years show moderate levels, though some, such as 2016 and 2024 *(Appendix 4 Table 11-11),* recorded unusually high mean values driven by a few extreme results. These findings suggest that year to year variation is mainly influenced by short-term environmental factors rather than a sustained change in water quality over time.

Appendix 4 Table 11-11 – *E. coli* Descriptive Statistics grouped by Year

YEAR	COUNT	MEAN	MEDIAN	STANDARD DEVIATION	90TH PERCENTILE	MAXIMUM
Overall	**690**	**104.6826**	**20**	**425.4869**	**230**	**9200**
2010	37	98.91892	20	281.1562	176	1700
2011	41	81.70732	40	100.4715	330	340
2012	39	106.66667	50	153.4744	230	790
2013	39	141.53846	20	397.5156	250	2400
2014	43	123.74419	20	375.2482	130	2400
2015	47	56.40426	18	64.1458	134	230
2016	55	109.72727	18	388.0323	190	2800
2017	53	153.73585	20	458.2214	230	2400
2018	49	54.95918	18	118.1766	114	790
2019	46	37.26087	18	44.9338	78	230
2020	46	76.43478	19	107.3451	230	460
2021	39	36.02564	18	53.4393	68	330
2022	37	75.05405	20	118.2295	194	490
2023	39	109.5641	18	239.5369	230	1100
2024	43	318.9535	20	1393.1013	330	9200
2025	37	89	20	162.7952	170	790

Appendix 4.1.7 GLMM EFFECT ESTIMATION

To assess whether *E. coli* have been changed over time, a GLMM was used accounting for variability between locations and seasons *(Appendix 4 Table 11-12)*. Here, year has been standardised in the traditional manner, i.e. $Year_z = \frac{Year - mean(Year)}{std(Year)}$, where, for this dataset, the mean year is approx. 2017 and the standard deviation is approx. 4-5 years.

Appendix 4 Table 11-12 below contains the fitted model parameters with 95% confidence intervals for their estimation, alongside a description of what they mean.

Appendix 4 Table 11-12 – Negative Binomial GLMM Trend by Year Effect Estimates

Parameter	Lower CI Bound	Upper CI Bound	P Value	Significant ?	Description
Intercept	32	126	1.16E-32	Yes	Estimated mean *E. coli* level with all influences set to zero. In this case, this is the estimated mean *E. coli* level for 2017
Year (standardised)	0%	17%	5.17E-02	No	Effect of increasing the year by a standard deviation, given in the form of percentage increase. In this case, this would mean that an increase of 4-5 year (e.g. going from 2020-2024 or 2011-2016) would result in a 0-17% increase in estimated mean *E. coli* levels.

The model found no statistically significant long- term trends across the 2010-2025 period. While the estimates suggest a possible small increase of up to 17% over approximately 5 years, this effect is not statistically strong enough to confirm a consistent upward pattern. Overall, *E. coli* levels appear to fluctuate naturally between years rather than showing any sustained change over time.

Between 2010 and 2025, *E. coli* levels at the Achill North monitoring sties were analysed using a combination of summary statistics, non- parametric tests, and advanced mixed-effects models to account for the differences between locations, seasons and years.

Overall, *E. coli* concentrations were highly variable with most samples showing low to moderate values but occasionally very high results (outliers- e.g. 2024- 9,600 MPM/mL), leading to a skewed data distribution. This indicates that while contamination events are not frequent , when they do occur the can be substantial.

Appendix 5 INDUSTRY ENGAGEMENT SUMMARY (PREPARED BY SFPA)

Date of circulation of draft report: 03/12/2025

Stakeholders contacted: IFA Aquaculture, BIM, Industry

Method of engagement: email circulation

Period for responses: 03/12/2025 – 11/12/2025

Summary of feedback received:

- Clarification sought on licensed activities within the Bivalve Mollusc Production Area (BMPA).
- Clarification requested on access to certain shoreline sampling points.
- Clarification sought on location of water sampling.

Outcome:

* Given the feedback, this report is recommended for publication and finalisation.