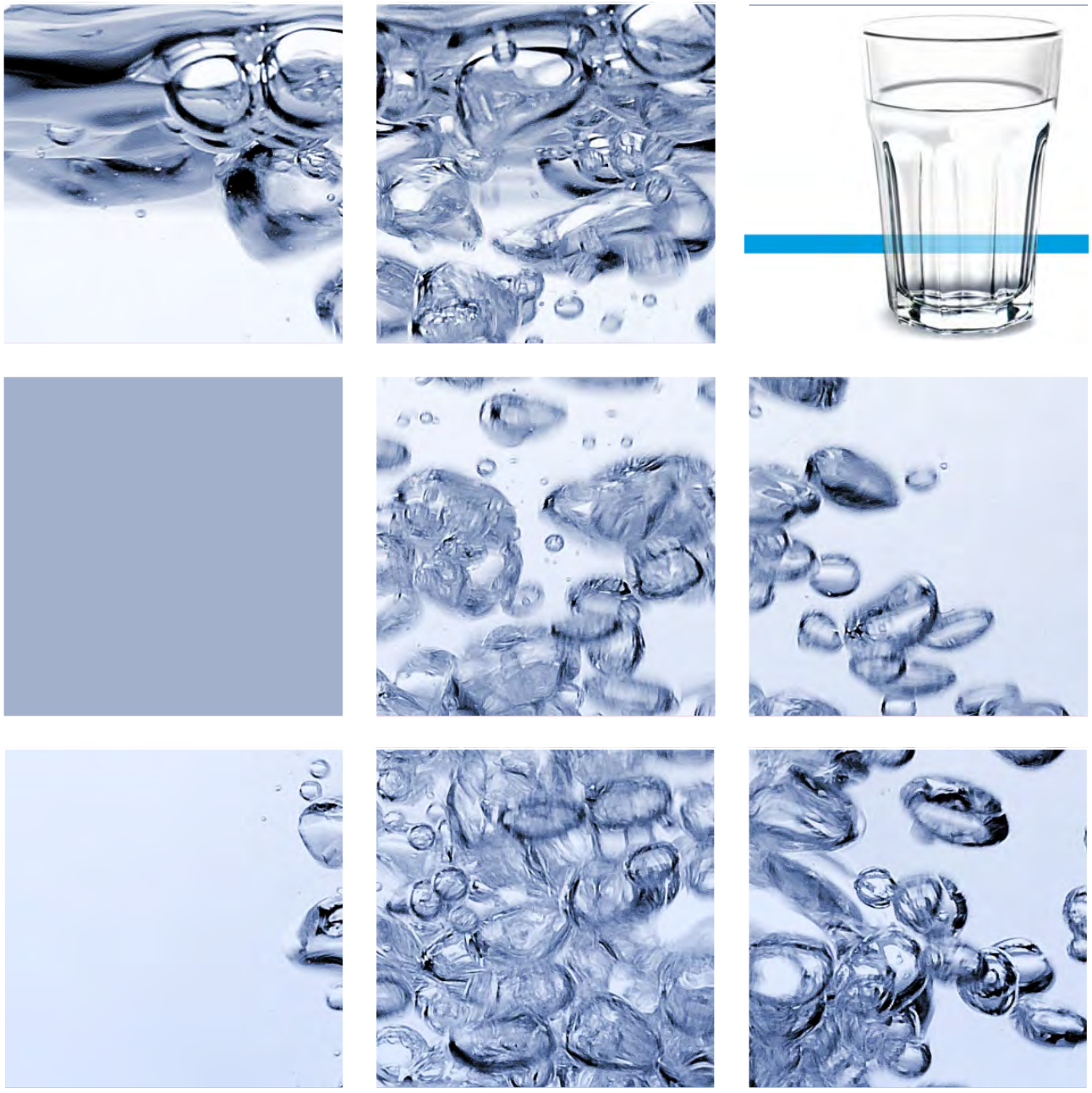
Uisce Éireann - Lead in Drinking Water Mitigation Plan

Screening for Appropriate Assessment

030 Innishannon WTP - Zone 2 Innishannon WSZ (0500PUB3501)



Lead in Drinking Water Mitigation Plan

Screening for Appropriate Assessment 030 Zone 2 Innishannon (0500PUB3501) WSZ – Innishannon WTP

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GLOSSARY OF TERMS & ABBREVIATIONS

Appropriate Assessment: An assessment of the effects of a plan or project on European Sites.

Biodiversity: Word commonly used for biological diversity and defined as assemblage of living organisms from all habitats including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part.

Birds Directive: Council Directive of 2nd April 1979 on the conservation of wild birds (79/409/EEC) as codified by Directive 2009/147/EC.

Geographical Information System (GIS): A GIS is a computer-based system for capturing, storing, checking, integrating, manipulating, analysing and displaying data that are spatially referenced.

Habitats Directive: European Community Directive (92/43/EEC) on the Conservation of Natural Habitats and of Wild Flora and Fauna and has been transposed into Irish law by the Planning and Development Act 2000 (as amended) and the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. 477/2011). It establishes a system to protect certain fauna, flora and habitats deemed to be of European conservation importance.

Mitigation measures: Measures to avoid/prevent, minimise/reduce, or as fully as possible, offset/compensate for any significant adverse effects on the environment, as a result of implementing a plan or project.

Natura 2000: European network of protected sites, which represent areas of the highest value for natural habitats and species of plants and animals, which are rare, endangered or vulnerable in the European Community. The Natura 2000 network of sites will include two types of area. Areas may be designated as Special Areas of Conservation (SAC) where they support rare, endangered or vulnerable natural habitats and species of plants or animals (other than birds). Where areas support significant numbers of wild birds and their habitats, they may become Special Protection Areas (SPA). SACs are designated under the Habitats Directive and SPAs are classified under the Birds Directive. In some situations, there may be overlap in extent of SAC and SPA.

Screening: The determination of whether implementation of a plan or project would be likely to have significant environmental effects on the Natura 2000 network.

Special Area for Conservation (SAC): An SAC designation is an internationally important site, protected for its habitats and species. It is designated, as required, under the EC Habitats Directive (1992).

Special Protection Area (SPA): An SPA is a site of international importance for breeding, feeding and roosting habitat for bird species. It is designated under the EC Birds Directive (1979).

Statutory Instrument: Any order, regulation, rule, scheme or byelaw made in exercise of a power conferred by statute.

1 INTRODUCTION

RPS was commissioned by Uisce Éireann (UE) to undertake Screening for Appropriate Assessment (AA) for the proposed orthophosphate dosing (herein referred to as the proposed project) of drinking water supplied by Innishannon Water Treatment Plant (WTP), Innishannon, Co. Cork.

This report comprises information to support the Screening for AA in line with the requirements of Article 6(3) of the EU Habitats Directive (Directive 92/43/EEC) on the Conservation of Natural Habitats and of Wild Fauna and Flora (hereafter referred to as the Habitats Directive). The report assesses the potential for likely significant effects resulting from the additional phosphorus (P) load to environmental receptors, resulting from orthophosphate dosing being undertaken to mitigate against consumer exposure to lead in drinking water. It is therefore necessary to consider the sources, pathways and receptors in relation to added phosphorus.

1.1 PURPOSE OF THIS REPORT

The overall purpose of the Screening for AA, as a first step in determining the requirement for AA, is to determine whether the project is likely to have a significant effect on any European Site within the zone of influence (ZoI) of the Water Supply Zone (WSZ), either individually or in combination with other plans or projects, in view of the site's conservation objectives. This Screening report complies with the requirements of Article 6 of the Habitats Directive transposed in Ireland principally through the Planning and Development Act 2000 (as amended) and the European Communities (Birds and Natural Habitats) Regulations, S.I. No. 477 of 2011 (as amended). In the context of the proposed project, the governing legislation is the EC Birds and Habitats Regulations 2011 (as amended).

1.2 THE PLAN

Uisce Éireann, as the national public water utility, prepared a Lead in Drinking Water Mitigation Plan (LDWMP) in 2016 (here after referred to as the Plan). The Plan provides a framework of measures for implementation to effectively address the currently elevated levels of lead in drinking water experienced by some UE customers as a result of lead piping. The Plan was prepared in response to the recommendations in the *National Strategy to reduce exposure to Lead in Drinking Water* which was published by the Department of Environment, Community and Local Government[1] and Department of Health in June 2015.

The overall objective of the Plan is to effectively address the risk of failure to comply with the drinking water quality standard for lead due to lead pipework in as far as is practical within the areas of UE's responsibility. Lead in drinking water is derived from lead pipes that are still in place in the supply network. These pipes are mostly in old shared connections or in the short pipes connecting the (public) water main to the (private) water supply pipes (UE, 2016[2]). Problems can also be caused by lead leaching from domestic plumbing components made of brass and from lead-containing solder, with the most significant portion of the lead pipework lying outside of UE's ownership in private properties (UE, 2016). Lead can be dissolved in water as it travels through lead supply pipes and internal lead plumbing. When lead is in contact with water it can slowly dissolve, a process known as

[1] Now known as the Department of Housing, Planning and Local Government (DHPLG).
[2] Uisce Éireann (UE) (2016) Lead in Drinking Water Mitigation Plan. https://www.water.ie/projects-plans/lead-mitigation-plan/Lead-in-Drinking-Water-Mitigation-Plan.pdf

plumbosolvency. The degree to which lead dissolves varies with the length of lead pipe, local water chemistry, temperature and the amount of water used at the property.

Health studies have identified risks to human health from ingestion of lead. In December 2013, the acceptable limit for lead in drinking water was reduced to 10 micrograms per litre (µg/l) as per the European Union (Drinking Water) Regulations. From 2003 to 2013, the limit was 25µg/l, which was a reduction on the previous limit (i.e. pre 2003) of 50µg/l.

The World Health Organisation (WHO), Environmental Protection Agency (EPA) and Health Service Executive (HSE) recommend lead pipe replacement (both lead service connections in the public supply, and lead supply pipes and internal plumbing in private properties) as the ultimate goal in reducing long-term exposure to lead. It is recognised that this will inevitably take a considerable period of time. In recognition of this, short to medium term proposals to mitigate the risk are being examined.

The Plan sets out the short, medium and longer term actions that UE intends to undertake, subject to the approval of the economic regulator, the Commission for Regulation of Utilities (CRU). It is currently estimated that 85% to 95% of properties meet the lead compliance standards when sampled at the customer's tap. The goal is to increase this compliance rate to 98% by end of 2021 and 99% by the end of 2027 (UE, 2016). This is subject to a technological alternative to lead replacement being deemed environmentally viable.

The permanent solution to the lead issue is to replace all water mains that contain lead. UE proposes that a national programme of replacement of public lead service pipes is required. However, replacing the public supply pipe or the private pipe on its own will not resolve the problem. Research indicates that unless both are replaced, lead levels in the drinking water could remain higher than the Regulation standards. Where lead pipework or plumbing fittings occur within a private property, it is the responsibility of the property owner to replace it.

The Plan assesses a number of other lead mitigation options available to UE. Other measures, including corrective water treatment in the form of pH adjustment and orthophosphate treatment, are being considered as an interim measure for the reduction of lead concentrations in drinking water in some WSZs.

UE initially assessed 400 water treatment plants for the introduction of corrective water treatment. Following this process 138 priority plants have been identified and corrective water treatment will be rolled out during the Lead in Drinking Water Mitigation programme, subject to site-specific environmental assessments. The corrective water treatment will reduce plumbosolvency risk over the short to medium term in high risk water supplies where it is technically, economically and environmentally viable to do so. This practice is now the accepted method of lead mitigation in many countries e.g. Great Britain and Northern Ireland. The dosing would be required to continue whilst lead pipework is still in use, subject to annual review on a scheme by scheme basis.

Orthophosphate is added in the form of Phosphoric acid, which is approved for use as a food additive (E338) in dairy, cereals, soft drinks, meat and cheese. The average adult person consumes between 1,000 and 1,500 milligrams (mg) of phosphorus every day as part of the normal diet. The quantity of orthophosphate that UE will be required to add to treated water is between 0.5 mg/l to 1.5 mg/l. At Innishannon WTP orthophosphate will be added at a rate of 0.6 mg/l, with seasonal variation in the proposed dose, as set out within the Preliminary Design Report for the proposed dosing.

The typical concentration of phosphorus ingested from drinking 3 litres of water per day that has been treated with food grade phosphoric acid at 1.5 mg/l phosphorus, would be 4.5 milligrams.

The orthophosphate is dosed into the water at a rate which is dependent on raw water chemistry in a similar process to the addition of chlorine for disinfection. Orthophosphate dosing takes a period of 6-12 months to develop a full coating, after which dosing must be maintained in order to sustain the protective coating.

1.3 PROJECT BACKGROUND

Phosphorus can influence water quality status through the process of nutrient enrichment and promotion of excessive plant growth (eutrophication). It is therefore necessary to evaluate the significance of any potential environmental impact and the pathways by which the added orthophosphate may reach environmental receptors. To facilitate the assessment, an Environmental Assessment Methodology (EAM) has been developed based on a conceptual model of phosphorus transfer (from the water distribution and wastewater collection systems), using the source-pathway-receptor framework.

The first step of the EAM is to identify the European Sites that have a hydrological or hydrogeological connectivity to the WSZs affected by the proposed orthophosphate dosing. The EAM recognises that for those European Sites with nutrient sensitive Qualifying Interests (habitats and species) and connectivity to the WSZ indicates that pathways for effects exist. The project effects on these European Sites, and an evaluation as to whether these are potentially significant, are the subject of the Screening for AA. The Screening report applies objective scientific information from the EAM as outlined in this document in the context of the Site Specific Conservation Objectives (SSCO) as published on the NPWS website.

The EAM process identified 21 European Sites with potential hydrological or hydrogeological connectivity to the WSZ:

- SAC sites: Ardmore Head SAC, Bandon River SAC, Barley Cove To Ballyrisode Point SAC, Castletownshend SAC, Clonakilty Bay SAC, Lough Hyne Nature Reserve And Environs SAC, Myross Wood SAC, Roaringwater Bay And Islands SAC, The Gearagh SAC, Courtmacsherry Estuary SAC, Great Island Channel SAC, and Kilkeran Lake and Castlefreke Dunes SAC; and
- SPA sites: Clonakilty Bay SPA, Cork Harbour SPA, Courtmacsherry Bay SPA, Galley Head to Duneen Point SPA, Old Head of Kinsale SPA, Seven Heads SPA, Sheep's Head to Toe Head SPA, Sovereign Islands SPA, and The Gearagh SPA.

Each of these European Sites includes habitats and/or species identified as nutrient sensitive. Following the precautionary principle the potential for likely significant effects arising from the proposed project requires assessment, due to connectivity to each of the identified European Sites, in light of their nutrient sensitive Qualifying Interests.

2 APPROPRIATE ASSESSMENT METHODOLOGY

2.1 LEGISLATIVE CONTEXT

Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora better known as the "Habitats Directive" provides legal protection for habitats and species of European importance. Articles 3 to 9 provide the legislative means to protect habitats and species of Community interest through the establishment and conservation of an EU-wide network of sites known as Natura 2000. These are Special Areas of Conservation (SACs) designated under the Habitats Directive and Special Protection Areas (SPAs) designated under the Conservation of Wild Birds Directive (79/409/ECC) as codified by Directive 2009/147/EC.

The obligation to undertake appropriate assessment derives from Articles 6(3) and 6(4) of the Habitats Directive and both involve a number of steps and tests that need to be applied in sequential order. Article 6(3), which is concerned with the strict protection of sites, establishes the requirement for AA:

"Any plan or project not directly connected with or necessary to the management of the [European] site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subjected to appropriate assessment of its implications for the site in view of the site's conservation objectives. In light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public".

Article 6(4) states:

"If, in spite of a negative assessment of the implications for the [European] site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, Member States shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted".

The results of each step must be documented and recorded so there is full traceability and transparency of the decisions made.

Over time legal interpretation has been sought on the practical application of the legislation concerning AA, as some terminology has been found to be unclear. European and National case law has clarified a number of issues and some aspects of European Commission (EC) published guidance documents have been superseded by case law.

2.2 GUIDANCE FOR THE APPROPRIATE ASSESSMENT PROCESS

The assessment completed has had regard to the following legislation and guidance documents:

European and National Legislation:

- Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (also known as the 'Habitats Directive');
- Council Directive 2009/147/EC on the conservation of wild birds, codified version, (also known as the 'Birds Directive');
- European Communities (Birds and Natural Habitats) Regulations 2011 to 2015; and
- Planning and Development Act 2000 (as amended).

Guidance / Case Law:

- *Article 6 of the Habitats Directive – Rulings of the European Court of Justice*. Final Draft September 2014;
- *Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities.* DEHLG (2009, revised 10/02/10);
- *Assessment of Plans and Projects Significantly Affecting Natura 2000 sites: Methodological Guidance on the Provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC.* European Commission (2002);
- *Communication from the Commission on the Precautionary Principle*. European Commission (2000b);
- *EC study on evaluating and improving permitting procedures related to Natura 2000 requirements under Article 6.3 of the Habitats Directive 92/43/EEC*. European Commission (2013);
- *Guidance Document on Article 6(4) of the 'Habitats Directive' 92/43/EEC. Clarification of the concepts of: Alternative Solutions, Imperative Reasons of Overriding Public Interest, Compensatory Measures, Overall Coherence, Opinion of the Commission*. European Commission (2007); and
- *Managing Natura 2000 sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC*. European Commission (2000a).

Departmental/NPWS Circulars:

- *Appropriate Assessment under Article 6 of the Habitats Directive: Guidance for Planning Authorities.* Circular NPWS 1/10 and PSSP 2/10. (DEHLG, 2010);
- *Appropriate Assessment of Land Use Plans*. Circular Letter SEA 1/08 & NPWS 1/08;
- *Water Services Investment and Rural Water Programmes – Protection of Natural Heritage and National Monuments*. Circular L8/08;
- *Guidance on Compliance with Regulation 23 of the Habitats Directive.* Circular Letter NPWS 2/07; and

- *Compliance Conditions in respect of Developments requiring (1) Environmental Impact Assessment (EIA); or (2) having potential impacts on Natura 2000 sites*. Circular Letter PD 2/07 and NPWS 1/07.

2.3 STAGES OF THE APPROPRIATE ASSESSMENT PROCESS

According to European Commission Methodological Guidance on the provisions of Article 6(3) and 6(4) of the Habitats Directive, the assessment requirements of Article 6 establish a four-staged approach as described below. An important aspect of the process is that the outcome at each successive stage determines whether a further stage in the process is required. The four stages are as follows:

- Stage 1 – Screening of the proposed plan or project for AA;
- Stage 2 – An AA of the proposed plan or project;
- Stage 3 – Assessment of alternative solutions; and
- Stage 4 – Imperative Reasons of Overriding Public Interest (IROPI)/ Derogation.

Stages 1 and 2 relate to Article 6(3) of the Habitats Directive; and Stages 3 and 4 to Article 6(4).

Stage 1: Screening for a likely significant effect

The aim of screening is to assess firstly if the plan or project is directly connected with or necessary to the management of European Site(s); or in view of best scientific knowledge, if the plan or project, individually or in combination with other plans or projects, is likely to have a significant effect on a European Site. This is done by examining the proposed plan or project and the conservation objectives of any European Sites that might potentially be affected. If screening determines that there is potential for likely significant effects or there is uncertainty regarding the significance of effects then it will be recommended that the plan is brought forward to full AA.

Stage 2: Appropriate Assessment (Natura Impact Statement or NIS)

The aim of stage 2 of the AA process is to identify any adverse impacts that the plan or project might have on the integrity of relevant European Sites. As part of the assessment, a key consideration is 'in combination' effects with other plans or projects. Where adverse impacts are identified, mitigation measures can be proposed that would avoid, reduce or remedy any such negative impacts and the plan or project should then be amended accordingly, thereby avoiding the need to progress to Stage 3.

Stage 3: Assessment of Alternative Solutions

If it is not possible during the stage 2 to reduce impacts to acceptable, non-significant levels by avoidance and/or mitigation, stage 3 of the process must be undertaken which is to objectively assess whether alternative solutions exist by which the objectives of the plan or project can be achieved. Explicitly, this means alternative solutions that do not have negative impacts on the integrity of a European Site. It should also be noted that EU guidance on this stage of the process states that, 'other assessment criteria, such as economic criteria, cannot be seen as overruling ecological criteria' (EC, 2002). In other words, if alternative solutions exist that do not have negative impacts on European Sites; they should be adopted regardless of economic considerations.

Stage 4: Imperative Reasons of Overriding Public Interest (IROPI)/Derogation

This stage of the AA process is undertaken where no alternative solutions exist and where adverse impacts remain. At this stage of the AA process, it is the characteristics of the plan or project itself that will determine whether or not the competent authority can allow it to progress. This is the determination of 'over-riding public interest'.

It is important to note that in the case of European Sites that include in their qualifying features 'priority' habitats or species, as defined in Annex I and II of the Directive, the demonstration of 'over-riding public interest' is not sufficient and it must be demonstrated that the plan or project is necessary for 'human health or safety considerations'. Where plans or projects meet these criteria, they can be allowed, provided adequate compensatory measures are proposed. Stage 4 of the process defines and describes these compensation measures.

2.4 INFORMATION SOURCES CONSULTED

To inform the assessment for the project and preparation of this Screening report, the following key sources of information have been consulted, however it should be noted that this is not an exhaustive list and does not reflect liaison and/ or discussion with technical and specialist parties from UE, RPS, NPWS, IFI, EPA etc. as part of Plan development.

- Information provided by UE as part of the project;
- Environmental Protection Agency – Water Quality www.epa.ie and www.catchments.ie;
- Geological Survey of Ireland – Geology, Soils and Hydrogeology www.gsi.ie;
- Information on the conservation status of birds in Ireland (Colhoun & Cummins 2013);
- National Parks and Wildlife Service – online Natura 2000 network information www.npws.ie;
- National Biodiversity Action Plan 2017 - 2021 (DCHG 2017);
- Article 17 Overview Report Volume 1 (NPWS, 2019a);
- Article 17 Habitat Conservation Assessments Volume 2 (NPWS, 2019b);
- Article 17 Species Conservation Assessment Volume 3 (NPWS, 2019c);
- EPA Qualifying Interests database, (EPA, 2015) and updated EPA Characterisation Qualifying Interests database (EPA/RPS, September 2016);
- River Basin Management Plan for Ireland 2018 - 2021 - www.housing.gov.ie;
- Ordnance Survey of Ireland – Mapping and Aerial photography www.osi.ie;
- National Summary for Article 12 (Cummins et Al., 2019); and
- Format for a Prioritised Action Framework (PAF) for Natura 2000 (2014) www.npws.ie/sites/default/files/general/PAF-IE-2014.pdf.

2.5 EVALUATION OF THE RECEIVING ENVIRONMENT

Ireland has obligations under EU law to protect and conserve biodiversity. This relates to habitats and species both within and outside designated sites. Nationally, Ireland has developed a National Biodiversity Plan (DCHG, 2017) to address issues and halt the loss of biodiversity, in line with international commitments. The vision for biodiversity is outlined: "*That biodiversity and ecosystems in Ireland are conserved and restored, delivering benefits essential for all sectors of society and that Ireland contributes to efforts to halt the loss of biodiversity and the degradation of ecosystems in the EU and globally*".

Ireland aims to conserve habitats and species, through designation of conservation areas under both European and Irish law. The focus of this Screening report is on those habitats and species designated pursuant to the EU Birds and EU Habitats Directives in the first instance, however it is recognised that wider biodiversity features have a supporting role to play in many cases if the integrity of designated sites is to be maintained/restored.

In relation to protected water-dependent habitats and species under the Birds and Habitats Directive, the river basin management planning process contributes towards achieving water related environmental supporting conditions that support Favourable Conservation Status. In preparing the RBMP (2018-2021) (DHPLG, 2018[3]) the characterisation assessment carried out by the EPA for these water dependent European Site protected areas has focussed on looking at the risks to the water standards/objectives established for the purpose of supporting Good Ecological Status (GES), or High Ecological Status (HES) where required. GES, which is the default objective of the WFD, is considered adequate for supporting many water dependent European Site protected areas where site specific environmental supporting conditions have not been defined within SSCOs by the NPWS. A number of lake habitats (e.g. oligotrophic lakes) and species (e.g. the freshwater pearl mussel) will require a more stringent environmental objective i.e. high status. Where this applies, this has been taken into account in the EAM and evaluated within the context of this Screening report.

2.5.1 Identification of European Sites

Current guidance (DEHLG, 2010) on the ZoI to be considered during the Screening for AA states the following:

"A distance of 15km is currently recommended in the case of plans, and derives from UK guidance (Scott Wilson et al., 2006). For projects, the distance could be much less than 15km, and in some cases less than 100m, but this must be evaluated on a case-by-case basis with reference to the nature, size and location of the project, and the sensitivities of the ecological receptors, and the potential for in-combination effects".

As stated above, a buffer of 15km is typically taken as the initial ZoI extending beyond the reach of the footprint of a plan or project, although there may be scientifically appropriate reasons for extending this ZoI further depending on pathways for potential impacts. With regard to the current project, the 15km distance is considered inadequate to screen all likely significant effects that might impact upon European Sites. This is primarily due to the need to consider the potential for likely significant effects on European Sites with regard to aquatic and water dependent receptors. Therefore, the ZoI for this project includes all of the hydrologically connected surface water sub catchments and groundwater bodies (**Figure 4-2**).

2.5.2 Conservation Objectives

Article 6(3) of the Habitats Directive states that:

Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects,

[3] DHPLG (2018) The River Basin Management Plan for Ireland (2018-2021). Available at: https://www.housing.gov.ie/water/water-quality/river-basin-management-plans/river-basin-management-plan-2018-2021-0

shall be subject to appropriate assessment of its implications of the site in view of the site's ***conservation objectives****.*

Qualifying Interests (QIs)/ Special Conservation Interests (SCIs) are annexed habitats and annexed species of community interest for which an SAC or SPA has been designated respectively. The Conservation Objectives (COs) for European Sites are set out to ensure that the QIs/ SCIs of that site are maintained or restored to a favourable conservation condition. Maintenance of favourable conservation condition of habitats and species at a site level in turn contributes to maintaining or restoring favourable conservation status of habitats and species at a national level and ultimately at the Natura 2000 Network level.

In Ireland 'generic' COs have been prepared for all European Sites, while 'site specific' COs have been prepared for a number of individual Sites to take account of the specific QIs/ SCIs of that Site. Both the generic and site specific COs aim to define favourable conservation condition for habitats and species at the site level.

Generic COs which have been developed by NPWS encompass the spirit of site specific COs in the context of maintaining and restoring favourable conservation condition as follows:

For SACs:

- '*To maintain or restore the favourable conservation condition of the Annex I habitats and/or Annex II species for which the SAC has been selected'.*

For SPAs:

- '*To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for the SPA*'.

Favourable Conservation status of a habitat is achieved when:

- Its natural range, and area it covers within that range, are stable or increasing;
- The specific structure and functions which are necessary for its long term maintenance exist and are likely to continue to exist for the foreseeable future; and
- The conservation status of its typical species is "favourable".

Favourable Conservation status of a species is achieved when:

- Population dynamics data on the species concerned indicate that it is maintaining itself on a long term basis as a viable component of its natural habitats;
- The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future; and
- There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long term basis.

A full listing of the COs and QIs/ SCIs for each European Site, as well as the attributes and targets to maintain or restore the QIs/ SCIs to a favourable conservation condition, are available from the NPWS website www.npws.ie. Web links for COs for the European Sites relevant for this Screening report, are included in **Appendix A**.

2.5.2 Existing Threats and Pressures to EU Protected Habitats and Species

Given the nature of the proposed project, a review has been undertaken of those QIs/SCIs which have been identified as having sensitivity to orthophosphate loading. Information has been extracted primarily from a number of NPWS authored reports, including recently available statutory assessments on the conservation status of habitats and species in Ireland namely; *The Status of EU Protected Habitats and Species in Ireland* (NPWS 2013a, b & c) and on information contained in Ireland's most recent Article 12 submission to the EU on *the Status and Trends of Birds Species* (NPWS 2013d). Water dependent habitats and species were identified as having the greatest sensitivity to the proposed dosing activities, and the Water Framework Directive SAC water dependency list (NPWS, December 2015), was used as part of the criteria for screening European Sites.

There are 60 habitats, 25 species and 68 bird species which are water dependent and / or where nutrients are a key pressure or threat and where compliance with the Environmental Quality Standards for nutrient levels (including orthophosphate) will contribute to achieving or maintaining favourable conservation status. These are listed in **Appendix B**.

3 DESCRIPTION OF THE PROJECT

3.1 OVERVIEW OF THE PROPOSAL

Innishannon WTP supplies small towns to the South of Cork City. The distribution input for Zone 2 Innishannon is 5447 m^3/day (74% of which is accounted for) serving a population of in excess of 25,459. The non-domestic demand is 23% of the distribution input. The area is served by Kinsale (D0132-01), Ringaskiddy (D0436-01), Riverstick (D0433-01), Kilbrittain (D0425-01), Innishannon (D0429-01) and Ballygarvan (D0540-01) WWTPs, which are all licensed in accordance with the requirements of the Waste Water Discharge (Authorisation) Regulations 2007 as amended and the potential impact of the orthophosphate dosing on the emission limit values and the receiving water body downstream of the point of discharge are assessed. There are smaller agglomerations with a population equivalent of less than 500, i.e. Annaghmore, Ballinspittle/Garretstown, Halfway and Kilmacsimon and the estimated additional load from these plants from the orthophosphate dosing is considered at the water body level via the surface water pathways. There are an estimated 1,763 properties across the WSZ that are serviced by a domestic waste water treatment system DWWTS (see **Appendix C**).

Innishannon WTP lies in the vicinity of the Bandon River, in the Bandon_SC_60 sub-catchment of the Bandon Ilen catchment. The EAM process identified 21 European Sites with potential hydrological or hydrogeological connectivity to the WSZ:

- SAC sites: Ardmore Head SAC, Bandon River SAC, Barley Cove To Ballyrisode Point SAC, Castletownshend SAC, Clonakilty Bay SAC, Lough Hyne Nature Reserve And Environs SAC, Myross Wood SAC, Roaringwater Bay And Islands SAC, The Gearagh SAC, Courtmacsherry Estuary SAC, Great Island Channel SAC, and Kilkeran Lake and Castlefreke Dunes SAC; and
- SPA sites: Clonakilty Bay SPA, Cork Harbour SPA, Courtmacsherry Bay SPA, Galley Head to Duneen Point SPA, Old Head of Kinsale SPA, Seven Heads SPA, Sheep's Head to Toe Head SPA, Sovereign Islands SPA, and The Gearagh SPA.

3.2 Construction of Corrective Water Treatment Works

The corrective water treatment works at Innishannon WTP will involve the provision of orthophosphate dosing, pH control works and associated safety equipment.

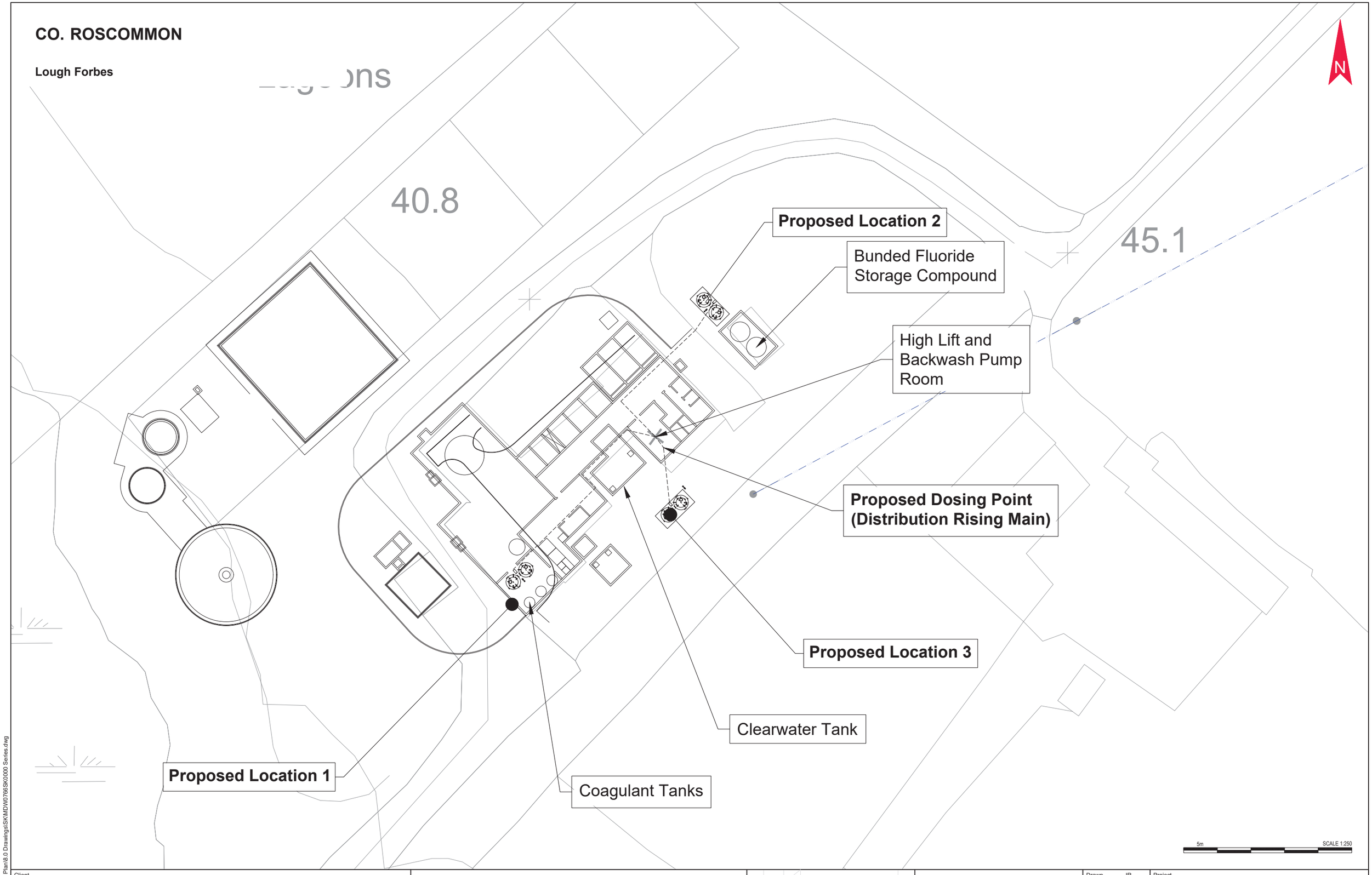
There are two possible locations for the orthophosphate dosing system at Innishannon WTP both of which will be located within the confines of the existing WTP boundary. The surrounding landscape is dominated by agricultural grassland. The location of the works is shown on **Figure 3-1**.

The implementation of orthophosphate dosing at the Innishannon WTP will require the following elements:

- Bulk Storage Tanks for phosphoric acid;
- Dosing pumps;
- Dosing pipework and carrier water pipework; and,
- Associated electrical installations.

CO. ROSCOMMON

Lough Forbes



Client

Uisce Éireann Irish Water

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No.	Date	Dm. Chk.	Amendment / Issue	App
F01	MAR 19	BL BR	ISSUED FOR INFORMATION	GJG
D01	JAN 19	JR BR	DRAFT	DC

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Drawn	JR
Checked	BR
Approved	GJG
Date	26/03/2019
Scale	1:250 @ A1
	1:500 @ A3
Job No.	MDW0766

Project **LEAD MITIGATION PLAN**

Figure 3.1 LOUGH FORBES WATER TREATMENT PLANT - SITE LAYOUT

File Ref. MDW0766SK0000 Series.dwg | Drg. No. SK0034 WTP | Rev. F01

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The bulk storage tanks (2 no. tanks, each with a working volume of 750 l) will sit upon an above ground reinforced concrete plinth, designed to support the combined weight of the storage tanks, equipment and total volume of chemical to be stored (**Figure 3-4**).

Each storage tank will be self-bunded to accommodate greater than 110% of the tank working volume. The tanks shall conform to Uisce Éireann design guidelines and will include the following environmental safety design features; level detection sensors, visual level indicators and alarms and a bund leak detection system. All materials and associated equipment, fixtures and fittings shall be compatible with 75% phosphoric acid.

Innishannon water treatment currently implements Lime for pH correction. Conversations with operators of the Innishannon revealed no significant pH control issues and that the final water pH was steady and stayed within the range of 7.5 to 8.0 pH units. As such no additional pH control works are proposed for the Innishannon WTP as the recommended optimum lies within the normal operating point of the Innishannon WTP.

Dosing pipelines, carrier water pipework and electrical cables shall be installed within 100mm diameter ducts, placed in trenches constructed within existing made ground at the Innishannon WTP. The ducts will be installed at approximately 700mm below ground level and following installation the trench will be backfilled and the surface reinstated to match the existing surface. Where pipework and cables are routed through existing structures, they shall be surface mounted within trunking.

A suitable kiosk will be installed on an above ground concrete plinth to house all electrical and control equipment required for the orthophosphate system. This control system will be incorporated into the existing Supervisory Control and Data Acquisition (SCADA) system on site. The proposed automation solution will be managed using a new Programmable Logic Computer (PLC) / Human Machine Interface (HMI) controller.

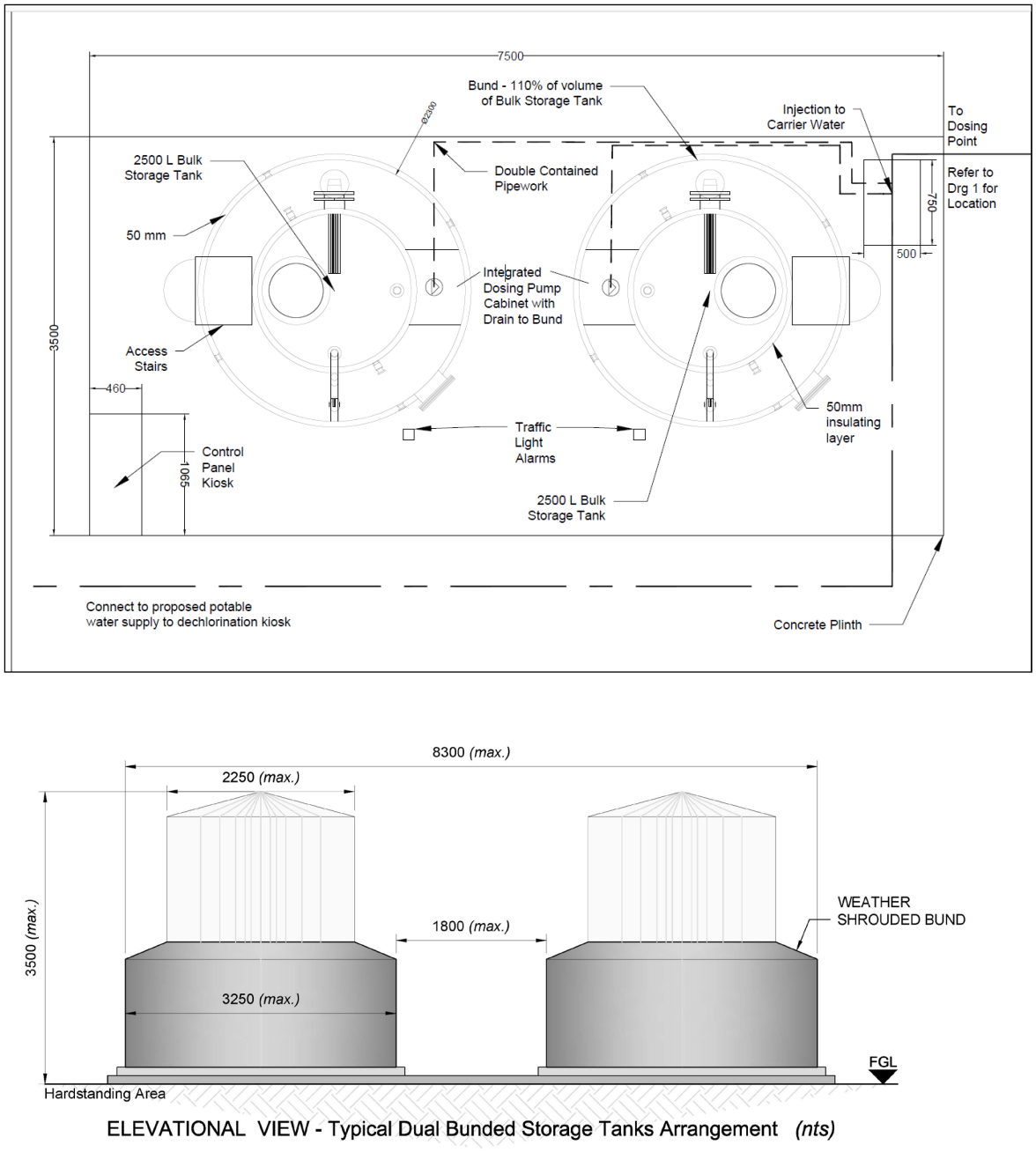


Figure 3-2: Plan and Elevation Drawings of a typical Orthophosphate Dosing Unit

3.3 CONSTRUCTION METHODOLOGY

The proposed works will be carried out by suitably qualified contractors. The proposed dosing unit will be located within the bounds of the existing Innishannon WTP on an area of made ground.

3.4 OPERATION OF CORRECTIVE WATER TREATMENT WORKS

The operational stage for the corrective water treatment works will be a part of the day to day activities of the WTP and will be operated in accordance with the SOPs.

The orthophosphate dosing system will be controlled by the site SCADA system, whereby, orthophosphoric acid will be dosed proportional to the flow of the water being distributed to the network. At Innishannon WTP, orthophosphate will be added to treated water at a rate of 0.6 mg/l. The onsite storage tanks have been designed to provide 60 days of storage so it is anticipated that deliveries will be approximately once every two months. All deliveries will be via existing access roads within the boundary of the WTP.

3.5 LDWMP APPROACH TO ASSESSMENT

3.5.1 Work Flow Process

In line with the relevant guidance, the Screening report for AA comprises of two steps:

- **Impact Prediction** – where the likely impacts of this project (impact source and impact pathways) are examined.
- **Assessment of Effects** - where the significance of project effects are assessed on the basis of best scientific knowledge (the EAM); in order to identify whether they are likely to give rise to likely significant effects on any European Sites, in view of their conservation objectives.

At the early stages of consideration, UE identified the requirement to evaluate environmental impact and the pathways by which the added orthophosphate may reach and / or affect environmental receptors including European Sites. In order to carry out a robust and defensible environmental assessment and to ensure a transparent and consistent approach, UE devised a conceptual model based on the 'source – pathway – receptor' framework. This sets out a specific environmental risk assessment of any proposed orthophosphate treatment and provides a methodology to determine the risk to the receiving environment of this corrective water treatment.

This EAM conceptual model, has been discussed with the EPA and has been developed using EPA datasets including the orthophosphate susceptibility output mapping for subsurface pathways; the nutrient risk assessment for water bodies; water quality information; available low flow estimation for gauged and ungauged catchments; and a new methodology which has been developed for the assessment of water quality risk from domestic wastewater treatment systems.

Depending on the potential impacts identified, appropriate measures may be built into the project proposal, as part of an iterative process to avoid / reduce those potential impacts for the orthophosphate treatment being proposed. Project measures adopted within the overall design proposal may include selected placement of the orthophosphate treatment point within the WSZ; enhanced wastewater treatment (to potentially remove equivalent phosphorus levels related to the orthophosphate treatment at the WTP); reduced treatment rate; and water network leakage control. The EAM will be the basis of the decision support matrix to inform any programmes developed as part of the LDWMP. Further detail on the model is presented in **Section 3.5.2** below.

3.5.2 Environmental Assessment Methodology

The EAM has been developed based on a conceptual model of P transfer (see **Figure 3-3**), based on the source-pathway-receptor model, from the water distribution and wastewater collection systems.

- The source of phosphorus is defined as the orthophosphate dosing at the water treatment plant which will be dependent on the water chemistry of the raw water quality, the integrity of the distribution network and the extent of lead piping.
- Pathways include discharges from the wastewater collection system (WWTP discharges and intermittent discharges – Storm Water Overflows (SWOs)), leakage from the distribution system and small point source discharges from DWWTSs.
- Receptors refer to SACs and SPAs which may receive orthophosphate dosed water via the pathway examples outlined above. Receptors and their sensitivity, is of key consideration in the EAM. A water body may be more sensitive to additional phosphorus loadings where it has a low capacity for assimilating the load e.g. high status sites, such as the habitat of the freshwater pearl mussel or oligotrophic lakes. Where a SAC/SPA could receive orthophosphate dosing inputs at more than one WSZ, the cumulative effects are considered in the EAM.

A flow chart of the methodology applied in the EAM is provided in **Figure 3-4** and illustrates the importance of the European Sites in the process. In all instances where nutrient sensitive qualifying features within the Natura 2000 network are hydrologically linked with the WSZ, a Screening to inform AA will be required in the first instance.

For each WSZ where orthophosphate treatment is proposed, the conceptual model allows the quantification of loads in a mass balance approach to identify potentially significant pathways, as part of the risk assessment process. A summary report outlining the EAM results is available in **Appendix C**, which further outlines P dynamics and the consideration of P trends and capacity in receiving waters and the risk to WFD objectives from any increase in P load from orthophosphate dosing.

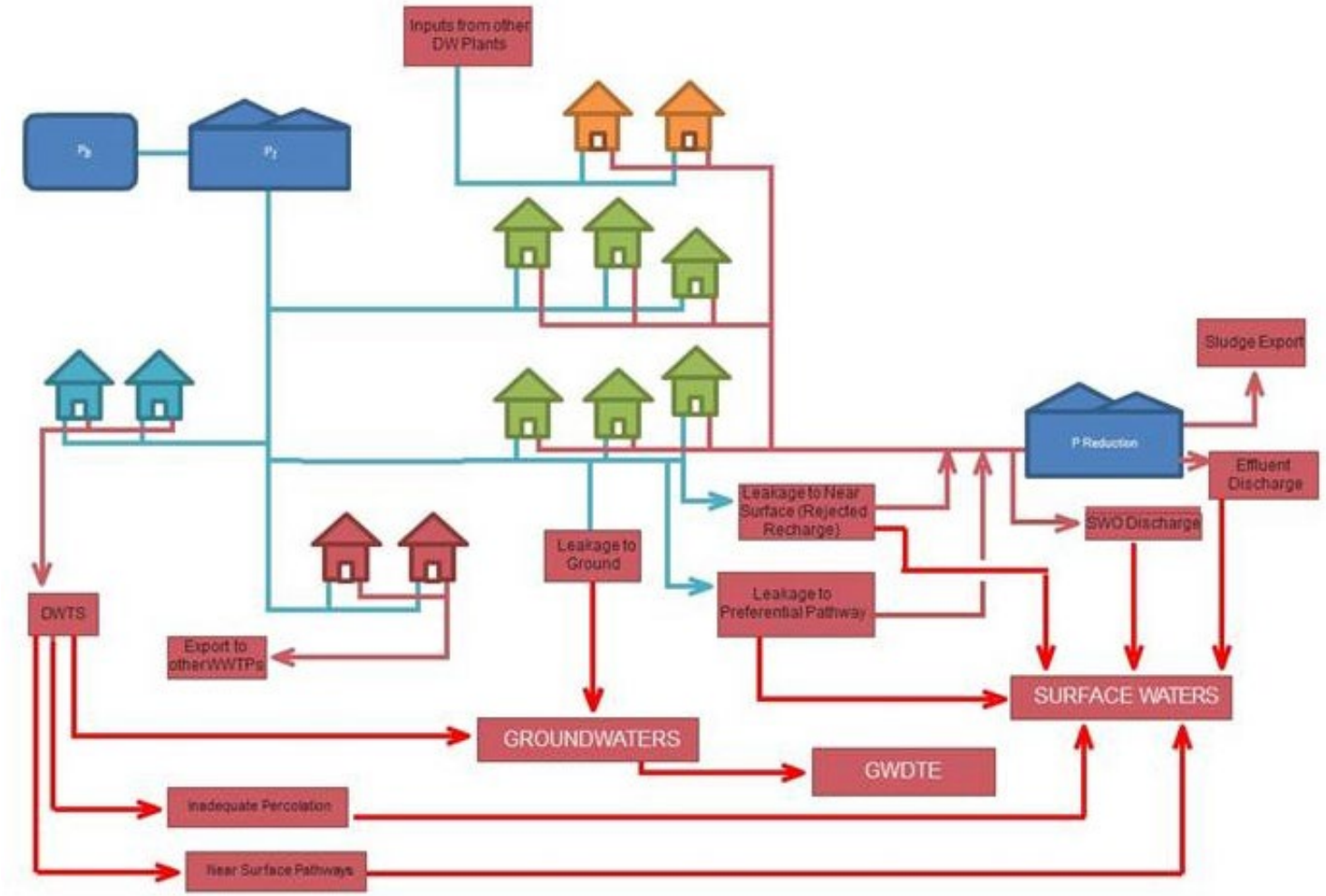


Figure 3-3: Conceptual Model of P Transfer

(Diagrammatic layout of P transfers from drinking water source (top left), through DW distribution (blue), wastewater collection (brown) and treatment systems to environmental receptors (red). P transfers that by-pass the WWTP (leakages, storm overflows, discharges to ground, and misconnections) are also indicated.)

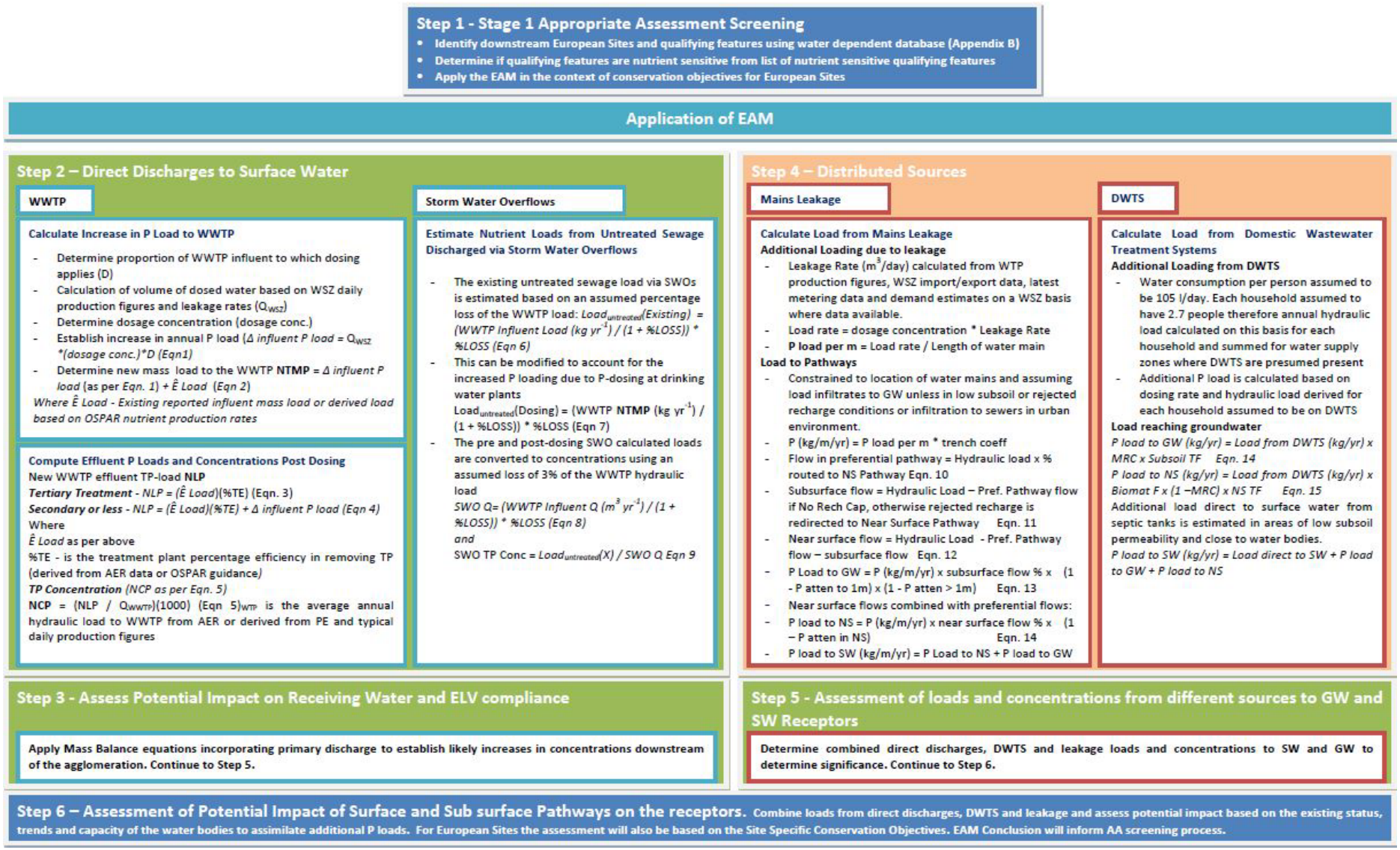


Figure 3-4: Stepwise Approach to the Environmental Assessment Methodology

4 PROJECT CONNECTIVITY TO EUROPEAN SITES

4.1 OVERVIEW OF THE PROJECT ZONE OF INFLUENCE

4.1.1 Construction Phase

The construction phase of the proposed project will take place within the confines of the existing Innishannon WTP. The WTP is not located within or directly adjacent to the boundary of any European Site. Given the small-scale nature of construction works, the ZoI was considered to include the footprint of the existing Innishannon WTP, followed by a review of hydrological and hydrogeological connectivity between the proposed development site and European Sites. The European Sites within the potential ZoI for the construction phase of the project are listed in **Table 4-1** and displayed in **Figure 4-1**.

Table 4-1: European Sites within the ZoI of the Proposed Project – Construction Phase

	Site Name[4]	SAC / SPA Code	Direct Impact	Water Dependent Species / Habitats	Surface Water Connectivity	Groundwater Connectivity[5,6]	Potential Source Receptor Pathway
1	Cork Harbour	SPA (004030)	No	Yes	No	Yes (Bandon)	No
2	Bandon River	SAC (002171)	No	Yes	No	Yes (Bandon)	No

4.1.2 Operational Phase

The ZoI for the operational phase of the proposed Project was determined by establishing the potential for hydrological and hydrogeological connectivity between the Innishannon WTP and associated WSZ and European Sites. The ZoI was therefore defined by the surface and GWBs that are hydrologically and hydrogeologically connected with the Project.

In the EAM, all water bodies linked to the WSZ have been identified. Downstream water bodies to the estuary and coastal water bodies have also been identified. GWBs touching or intersecting the WSZs are also included in the ZoI. Hydrogeological linkages in karst areas have also been taken into account. European Sites within the ZoI are listed in **Table 4-2** and are displayed in **Figure 4-1**.

[4] Innishannon WTP overlies the Bandon GWB (IE_SW_G_086). European Sites listed are those that are also situated upon the Bandon GWB (IE_SW_G_086). The Bandon River SAC is located > 45 km west of the WTP and Cork Harbour SPA is located >30 km to the east. Flow paths are expected to be relatively short (30-300m).

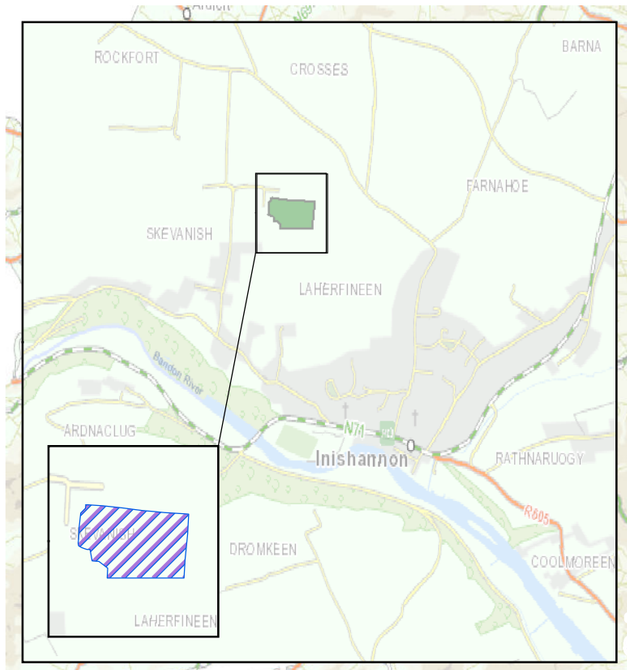
[5] Preferential groundwater flow of the Bandon GWB (IE_SW_G_086) is to the nearest watercourse which in the case of Innishannon WTP is the Bandon River (IE_SW_20B020900) & the Upper Bandon Estuary. The Upper Bandon Estuary (IE_SW_080_0300) and those water bodies located downstream do not support connectivity with Cork Harbour SPA or the Bandon River SAC. Therefore, there is no potential source impact pathways identified for these two European Sites.

[6] Bandon GWB: Summary of Initial Characterisation

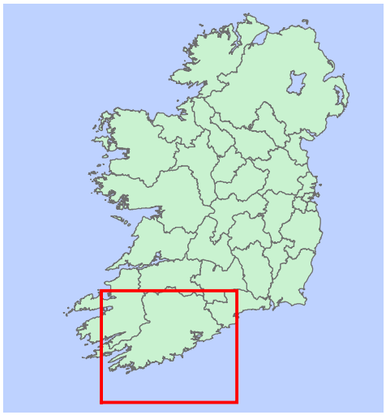
Table 4-2: European Sites within the ZoI of the Proposed Project – Operational Phase

	Site Name	SAC / SPA Code	Water Dependent Species / Habitat	Nutrient Sensitive	Surface Water Connectivity	Groundwater Connectivity	Potential Source Receptor Pathway
1	Great Island Channel SAC	SAC 001058	Yes	Yes	Yes- TWB (Lough Mahon)	Yes- (Skibbereen-Clonakilty)	Yes
2	Courtmacsherry Estuary SAC	SAC 001230	Yes	Yes	Yes –RWB (Kilbrittain)	Yes (Skibbereen-Clonakilty)	Yes
3	Clonakilty Bay SAC	SAC 000091	Yes	Yes	No	Yes (Skibbereen-Clonakilty)	No
4	Lough Hyne Nature Reserve and Environs SAC	SAC 000097	Yes	Yes	Yes –CWB (Western Celtic Sea)	Yes (Skibbereen-Clonakilty)	No
5	Roaringwater Bay and Islands SAC	SAC 000101	Yes	Yes	Yes –CWB (Western Celtic Sea)	Yes (Skibbereen-Clonakilty)	No
6	The Gearagh SAC	SAC 000108	Yes	Yes	No	Yes (Ballinhassig East)	No
7	Barley Cove to Ballyrisode Point SAC	SAC 001040	Yes	Yes	Yes –CWB (Western Celtic Sea)	Yes (Skibbereen-Clonakilty)	No
8	Kilkeran Lake and Castlefreke Dunes SAC	SAC 001061	Yes	Yes	No	Yes- (Skibbereen-Clonakilty)	No
9	Myross Wood SAC	SAC 001070	Yes	Yes	No	Yes- (Skibbereen-Clonakilty)	No
10	Castletownshend SAC	SAC 001547	Yes	Yes	No	Yes (Skibbereen-Clonakilty)	No
11	Ardmore Head SAC	SAC 002123	Yes	Yes	Yes –CWB (Western Celtic Sea)	No	No
12	Bandon River SAC	SAC 002171	Yes	Yes	No	Yes (Bandon)	No
13	Cork Harbour SPA	SPA 004030	Yes	Yes	Yes –TWB (Lough Mahon)	Yes- (Skibbereen-Clonakilty)	Yes
14	Courtmacsherry Bay SPA	SPA 004219	Yes	Yes	Yes-RWB (Kilbrittain)	Yes (Skibbereen-Clonakilty)	Yes
15	Old Head of Kinsale SPA	SPA 004021	Yes	Yes	No	Yes (Skibbereen-Clonakilty)	No
16	Clonakilty Bay SPA	SPA 004081	Yes	Yes	No	Yes (Skibbereen-Clonakilty)	No
17	The Gearagh SPA	SPA 004109	Yes	Yes	No	Yes (Ballinhassig East)	No

	Site Name	SAC / SPA Code	Water Dependent Species / Habitat	Nutrient Sensitive	Surface Water Connectivity	Groundwater Connectivity	Potential Source Receptor Pathway
18	Sovereign Islands SPA	SPA 004124	Yes	Yes	Yes –CWB (Western Celtic Sea)	No	No
19	Sheep's Head to Toe Head SPA	SPA 004156	Yes	Yes	Yes –CWB (Western Celtic Sea)	Yes (Skibbereen-Clonakilty)	No
20	Galley Head to Duneen Point SPA	SPA 004190	Yes	Yes	Yes –CWB (Western Celtic Sea)	Yes (Skibbereen-Clonakilty)	No
21	Seven Heads SPA	SPA 004191	Yes	Yes	Yes –CWB (Western Celtic Sea)	Yes (Skibbereen-Clonakilty)	No



Zone of Influence (ZoI) for Construction Phase



Legend

LEMA Emission Type

- Primary Discharge Point
- Secondary Discharge Point
- Storm Water Overflow
- Waste Water Treatment Plant
- Innishannon WTP
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- Water Supply Zone Boundary (WSZ)
- Additional WSZ considered for dosing
- Zone of Influence

Data Source:
Irish Water
NPWS (June 2019)
EPA

N

0 5 10 20 Kilometres

Client

Uisce Éireann Irish Water

Project Lead Mitigation Plan
Corrective Water Treatment Works

Title

Zone 2 Innishannon

European Sites within the ZoI of the Proposed Project

RPS

Scale: 1:500,000 @ A3	**Date:** 25/07/2019
File Ref: MDW0766Arc0011aF02	**Map Projection:** Irish National Grid (TM65)

Zone of Influence (ZoI) for Operational Phase

4.2 IDENTIFICATION OF RELEVANT EUROPEAN SITES

For the construction and operational phase of the project, each European Site was assessed for the presence of water dependent habitats and species, their associated nutrient sensitivity, together with the hydrological/hydrogeological connectivity of each site to the proposed project. A number of sites are excluded from further assessment in Section 6 at this stage of the process and those included, are detailed in **Table 4-3** and are displayed in **Figure 4-2.** Four sites are included for further assessment, with justification provided below.

The construction phase of the proposed project will take place within the confines of the existing Innishannon WTP. There is no potential for surface water connectivity to any European Site. The WTP is located within the Bandon groundwater body (IE_SW_G_086) and the potential hydrogeological connectivity between the proposed development site and the Cork Harbour has been ruled out in **Table 4-1** above.

The WSZ for Innishannon intersects a number of river water bodies that discharge to a range of transitional and coastal water bodies including: Lough Mahon IE_SW_060_0750; Oysterhaven IE_SW_070_0100; Upper Bandon Estuary IE_SW_080_0300; Lower Bandon Estuary IE_SW_080_0100; Kinsale Harbour IE_SW_080_0000; Courtmacsherry Bay IE_SW_090_0000; and Cork Harbour IE_SW_060_0000. As a result, four European Sites are intersected via river pathways. These four sites (Courtmacsherry Estuary SAC, Courtmacsherry Bay SPA, Cork Harbour SPA and Great Island Channel SAC) are included for assessment. The water bodies that connect the WSZ to the European Sites include:

- Courtmacsherry Estuary SAC and Courtmacsherry Bay SPA via river flows from Kilbrittain_020 IE_SW_20K010300, Artiteige_101 IE_SW_20A300900 and Ballinspittle_010 IE_SW_20B090100 into Courtmacsherry Bay IE_SW_090_0000; and
- Cork Harbour SPA and Great Island Channel SAC via river flows from Moneygurney_010 IE_SW_19M300900 into Lough Mahon IE_SW_060_0750; Hilltown_010 IE_SW_19H050470 into Cork Harbour IE_SW_060_0000; and Kilnaglery_101 IE_SW_19K20850 and Owenboy (Cork)_040 IE_SW_19O011400 in Owenboy Estuary IE_SW_060_1200.

The WSZ also intersects six GWBs: – Ballinhassig East IE_SW_G_004, Ringaskiddy IE_SW_G_072, Skibbereen-Clonakilty IE_SW_G_085, Bandon IE_SW_G_086, Brinny Gravels East IE_SW_G_087 and Brinny Gravels West IE_SW_G_088 (**Table 3, Appendix C**). The Bandon River SAC, Myross Wood SAC, The Gearagh SAC and The Gearagh SPA are connected to the WSZ via GWBs exclusively.

Groundwater flows through voids such as connected pore spaces in sand and gravel aquifers and through fissures, faults, joints and bedding planes in bedrock aquifers. Regional groundwater flows tend to follow the regional topography and generally discharge towards main surface water bodies including rivers, lakes and coastal water bodies. In areas of karstified limestones, high permeability zones give rise to rapid groundwater velocities with more complex flow directions, which may vary seasonally and are difficult to predict with certainty. In this case, the assumption is that groundwater flow direction is from areas of higher elevations to lower elevations, unless groundwater specific

information indicates otherwise. GWBs specific information relating to flow and discharge is available from the GSI[7], and was consulted in making the assessment.

The Gearagh SAC and The Gearagh SPA are connected to the WSZ via Ballinhassig East IE_SW_G_004 GWB. Ballinhassig East IE_SW_G_004 is a poorly productive bedrock aquifer. The main discharges are to the gaining rivers and streams, and groundwater will also discharge to the coast. Flow paths are relatively short, typically 30 – 300m, and flow directions are expected to approximately follow the local surface water catchments[8]. The Gearagh SAC and The Gearagh SPA are approximately 22km from the WSZ which is far beyond the expected maximum distance of groundwater travel in the Ballinhassig East IE_SW_G_004 GWB. Therefore, The Gearagh SAC and The Gearagh SPA are excluded from further assessment.

The Bandon River SAC is connected to the WSZ via Bandon IE_SW_G_086 GWB. Bandon IE_SW_G_086 is a poorly productive bedrock aquifer, the main discharges are to the gaining rivers and streams crossing the aquifer and to the coast. Flow paths are relatively short, typically 30 – 300m, and flow directions are expected to approximately follow the local surface water catchments[9]. The Bandon River SAC is approximately 28km from the WSZ in an upstream direction relative to surface water flows. This is beyond the expected maximum distance of groundwater travel in the Bandon IE_SW_G_086 GWB. Therefore, the Bandon River SAC is excluded out of the assessment.

Myross Wood SAC is connected to the WSZ via the Skibbereen-Clonakilty IE_SW_G_085 GWB. There are no GWB specific information available from the GSI for Skibbereen-Clonakilty IE_SW_G_085 GWB. GIS data from the EPA identifies the GWB as being a poorly productive aquifer. As described for Bandon IE_SW_G_086, flow paths in poorly productive aquifers are relatively short, typically 30 – 300m, and flow directions are expected to approximately follow the local surface water catchments. Therefore, the GWB Skibbereen-Clonakilty IE_SW_G_085 is unlikely to transport groundwater the large distance between Myross wood and the WSZ (33km). Therefore, Myross Wood SAC is excluded out of the assessment.

A large coastal water body i.e. the Western Celtic Sea (HAs 18;19;20) lies downstream of the WSZ. The WSZ is hydrologically connected to Western Celtic Sea (HAs 18;19;20) by rivers discharging directly into a number of transitional and coastal water bodies that are upstream of the Western Celtic Sea (HAs 18;19;20) including: Owenboy Estuary IE_SW_060_1200; Oysterhaven IE_SW_070_0100; Lower Bandon Estuary, IE_SW_080_0100; Upper Bandon Estuary IE_SW_080_0300; Cork Harbour IE_SW_060_0000; Kinsale Harbour IE_SW_080_0000; Courtmacsherry Bay IE_SW_090_0000; and Outer Cork Harbour IE_SW_050_0000.

The potential increase in orthophosphate concentration as a result of dosing at Innishshannon WTP is undetectable (i.e. 0.0000 mg/l) in Oysterhaven IE_SW_070_0100; Lower Bandon Estuary; IE_SW_080_0100; Upper Bandon Estuary IE_SW_080_0300; Cork Harbour IE_SW_060_0000; Kinsale Harbour IE_SW_080_0000; Courtmacsherry Bay IE_SW_090_0000; and Outer Cork Harbour IE_SW_050_0000. A potential increase of 0.0002mg/l was modelled in Owenboy Estuary IE_SW_060_1200 (**see Table 4B of Appendix C**). As the increase in orthophosphate concentration due to the dosing at Innishannon WTP is low in upstream water bodies, concentrations in the Western Celtic Sea (HAs 18;19;20) are subsequently undetectable (i.e. 0.000mg/l). On that basis, European Sites

[7] https://www.gsi.ie/en-ie/programmes-and-projects/groundwater/activities/understanding-ireland-groundwater/Pages/Groundwater-bodies.aspx
[8] GSI - Ballinhassig GWB: Summary of Initial Characterisation
[9] GSI - Bandon GWB: Summary of Initial Characterisation

hydrologically connected to the WSZ via the Western Celtic Sea (HAs 18;19;20) coastal water body are excluded for potential impacts. The European Sites connected to the Western Celtic Sea include: Ardmore Head SAC, Barley Cove To Ballyrisode Point SAC, Castletownshend SAC, Clonakilty Bay SAC, Kilkeran Lake And Castlefreke Dunes SAC, Lough Hyne Nature Reserve And Environs SAC, Roaringwater Bay And Islands SAC, Clonakilty Bay SPA, Galley Head to Duneen Point SPA, Sovereign Islands SPA, and Sheep's Head to Toe Head SPA.

The coastal water body Courtmacsherry Bay IE_SW_090_0000 receives flows from the WSZ via the river water bodies Kilbrittain_020 IE_SW_20K010300, Artiteige_101 IE_SW_20A300900 and Ballinspittle_010 IE_SW_20B090100. However, the EAM predicts that the orthophosphate concentration in the water body as a result of dosing at Innishannon will be 0.0000 mg/l. There is therefore no potential for impact to European Sites that are connected to the WSZ via Courtmacsherry Bay IE_SW_090_0000. On this basis, the following sites have been excluded: Old Head of Kinsale SPA and Seven Heads SPA.

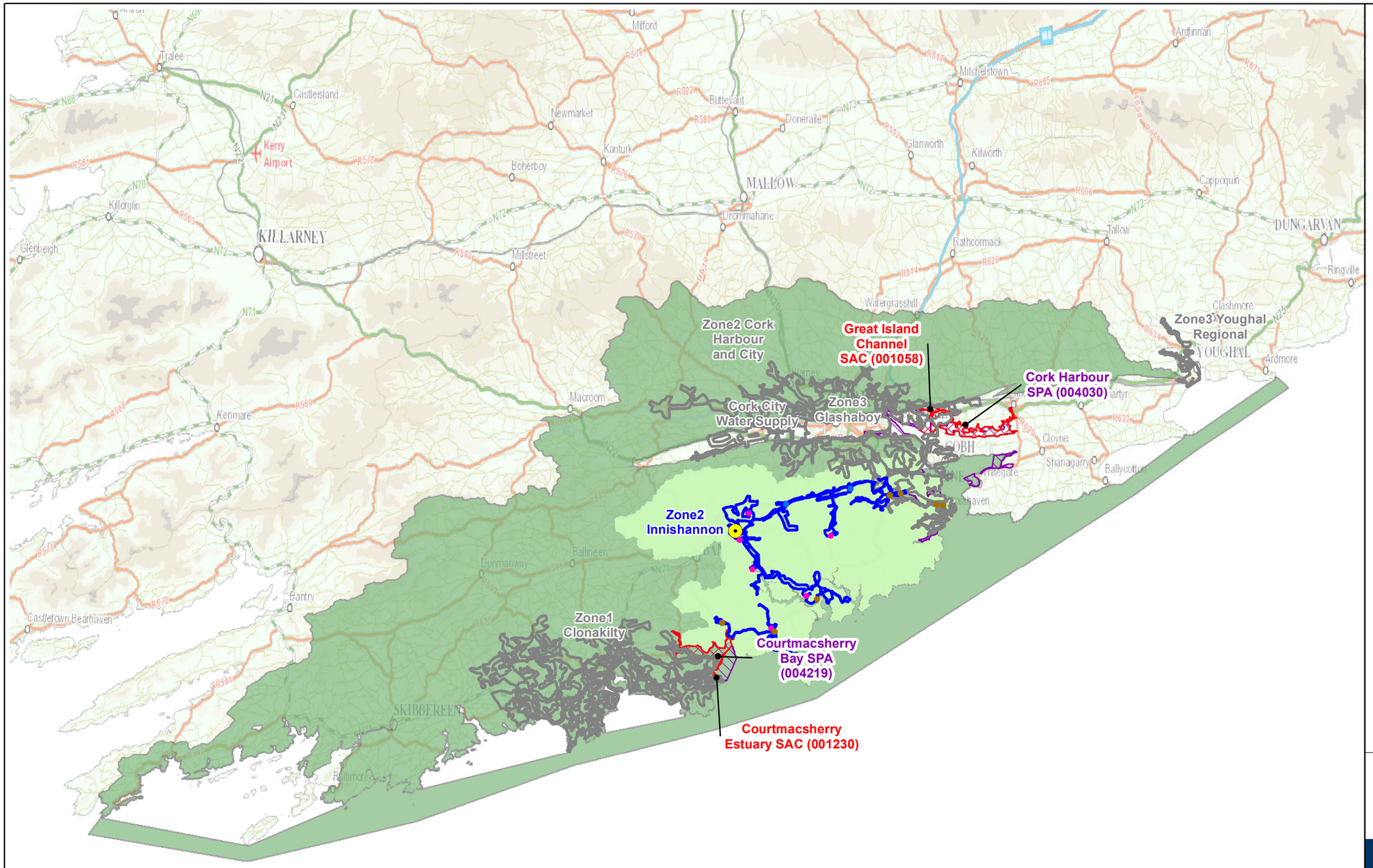
On this basis there are no European Sites included for further assessment in order to evaluate the significance of potential effect arising during construction phase in Section 5 below. Four European Sites have been included for further assessment for the operational phase in Sections 5 and 6 below i.e. Courtmacsherry Estuary SAC, Courtmacsherry Bay SPA, Cork Harbour SPA and Great Island Channel SAC.

Table 4-3: European Sites Hydrologically or Hydrogeologically Connected to or Downstream of the WTP and WSZ

Site Name	SAC / SPA Code	Conservation Objectives Establishment Date	Feature Code	Qualifying Interests/ Special Conservation Interests	Water Dependent Species/ Habitats	Nutrient Sensitive Species/ Habitats	Potential Hydrological / Hydrogeological Connectivity	Potential Source Receptor Pathway
Operation Phase Only								
Great Island Channel SAC	SAC 001058	06 Jun 2014 Version 1	1140	Mudflats and sandflats not covered by seawater at low tide	Yes	Yes	Yes	Yes
			1330	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	Yes	Yes		
Courtmacsherry Estuary SAC	SAC 001230	09 Jul 2014 Version 1	1130	Estuaries	Yes	Yes	Yes	Yes
			1140	Mudflats and sandflats not covered by seawater at low tide	Yes	Yes		
			1210	Annual vegetation of drift lines	Yes	Yes		
			1220	Perennial vegetation of stony banks	Yes	No		
			1310	*Salicornia* and other annuals colonising mud and sand Spartina swards (*Spartinion maritimae*)	Yes	Yes		
			1330	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	Yes	Yes		
			1410	Mediterranean salt meadows (*Juncetalia maritimi*)	Yes	Yes		
			2110	Embryonic shifting dunes	Yes	Yes		
			2120	Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)	Yes	Yes		
			2130	*Fixed coastal dunes with herbaceous vegetation (grey dunes)	Yes	Yes		
Cork Harbour SPA	SPA 004030	16 Dec 2014 Version 1	A004	Little Grebe (*Tachybaptus ruficollis*)	Yes	Yes	Yes	Yes
			A005	Great Crested Grebe (*Podiceps cristatus*)	Yes	Yes		
			A017	Cormorant (*Phalacrocorax carbo*)	Yes	Yes		
			A028	Grey Heron (*Ardea cinerea*)	Yes	Yes		
			A048	Shelduck	Yes	Yes		

Site Name	SAC / SPA Code	Conservation Objectives Establishment Date	Feature Code	Qualifying Interests/ Special Conservation Interests	Water Dependent Species/ Habitats	Nutrient Sensitive Species/ Habitats	Potential Hydrological / Hydrogeological Connectivity	Potential Source Receptor Pathway
				(*Tadorna tadorna*)				
			A050	Wigeon (*Anas penelope*)	Yes	Yes		
			A052	Teal (*Anas crecca*)	Yes	Yes		
			A054	Pintail (*Anas acuta*)	Yes	Yes		
			A056	Shoveler (*Anas clypeata*)	Yes	Yes		
			A069	Red-breasted Merganser (*Mergus serrator*)	Yes	Yes		
			A130	Oystercatcher (*Haematopus ostralegus*)	Yes	Yes		
			A140	Golden Plover (*Pluvialis apricaria*)	Yes	Yes		
			A141	Grey Plover (*Pluvialis squatarola*)	Yes	Yes		
			A142	Lapwing (*Vanellus vanellus*)	Yes	Yes		
			A149	Dunlin (*Calidris alpina alpina*)	Yes	Yes		
			A156	Black-tailed Godwit (*Limosa limosa*)	Yes	Yes		
			A157	Bar-tailed Godwit (*Limosa lapponica*)	Yes	Yes		
			A160	Curlew (*Numenius arquata*)	Yes	Yes		
			A162	Redshank (*Tringa totanus*)	Yes	Yes		
			A164	Greenshank (*Tringa nebularia*)	Yes	Yes		
			A179	Black-headed Gull (*Chroicocephalus ridibundus*)	Yes	Yes		
			A182	Common Gull (*Larus canus*)	Yes	Yes		

Site Name	SAC / SPA Code	Conservation Objectives Establishment Date	Feature Code	Qualifying Interests/ Special Conservation Interests	Water Dependent Species/ Habitats	Nutrient Sensitive Species/ Habitats	Potential Hydrological / Hydrogeological Connectivity	Potential Source Receptor Pathway
			A183	Lesser Black-backed Gull (*Larus fuscus*)	Yes	Yes		
			A193	Common Tern (*Sterna hirundo*)	Yes	Yes		
			A999	Wetlands	Yes	Yes		
Courtmacsherry Bay SPA	SPA 004219	03 Oct 2014 Version 1	A003	Great Northern Diver (*Gavia immer*)	Yes	Yes	Yes	Yes
			A048	Shelduck (*Tadorna tadorna*)	Yes	Yes		
			A050	Wigeon (*Anas penelope*)	Yes	Yes		
			A069	Red-breasted Merganser (*Mergus serrator*)	Yes	Yes		
			A140	Golden Plover (*Pluvialis apricaria*)	Yes	Yes		
			A142	Lapwing (*Vanellus vanellus*)	Yes	Yes		
			A149	Dunlin (*Calidris alpina alpina*)	Yes	Yes		
			A156	Black-tailed Godwit (*Limosa limosa*)	Yes	Yes		
			A157	Bar-tailed Godwit (*Limosa lapponica*)	Yes	Yes		
			A160	Curlew (*Numenius arquata*)	Yes	Yes		
			A179	Black-headed Gull (*Chroicocephalus ridibundus*)	Yes	Yes		
			A182	Common Gull (*Larus canus*)	Yes	Yes		
			A999	Wetlands	Yes	Yes		



Legend

LEMA Emission Type

- Primary Discharge Point
- Secondary Discharge Point
- Storm Water Overflow
- Waste Water Treatment Plant
- Innishannon WTP
- Water Supply Zone Boundary (WSZ)
- Additional WSZ considered for dosing
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- Subcatchments intersecting Water Supply Zone(s) related to the WTP
- Zone of Influence

Data Source:
Irish Water
NPWS (June 2019)
EPA

N

0 5 10 20 Kilometres

Zone of Influence (ZoI) for Operational Phase

Client

Uisce Éireann Irish Water

Project Lead Mitigation Plan
Corrective Water Treatment Works

Title

Zone 2 Innishannon

European Sites within the ZoI which are hydro(geo)logically connected

RPS

Scale: 1:500,000 @ A3	**Date:** 25/07/2019
File Ref: MDW0766Arc0011bF02	**Map Projection:** Irish National Grid (TM65)

5 EVALUATION OF POTENTIAL IMPACTS

5.1 CONTEXT FOR IMPACT PREDICTION

The methodology for the assessment of impacts is derived from the *Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites* (EC, 2002). When describing changes/activities and impacts on ecosystem structure and function, the types of impacts that are commonly presented include:

- Direct and indirect effects;
- Short and long-term effects;
- Construction, operational and decommissioning effects; and
- Isolated, interactive and cumulative effects.

5.2 IMPACT IDENTIFICATION

In considering the potential for impacts from implementation of the project, a "source–pathway–receptor" approach has been applied.

The Screening for AA has considered the potential for the following likely significant effects:

- Altered structure and functions relating to the physical components of a habitat ("structure") and the ecological processes that drive it ("functions"). For aquatic habitats these include attributes such as vegetation and water quality;
- Altered species composition due to changes in abiotic conditions such as water quality;
- Reduced breeding success (e.g. due to disturbance, habitat alteration, pollution) possibly resulting in reduced population viability; and
- Impacts to surface water and groundwater and the species they support (changes to key indicators).

5.2.1 Construction Phase

The source-pathway-receptor approach has identified a number of impact pathways associated with the construction of orthophosphate treatment works at Innishannon WTP. These will be evaluated with regard to the potential for likely significant effects on European Sites. These are potential effects and in the absence of pathways (which is evaluated in **Section 5.3.1** below) the construction phase may not give rise to these effects.

- Sediment laden run-off from excavation areas (trenches for dosing pipelines, carrier water pipework and electrical cables) and the introduction of fine sediments to watercourses connected to the works area causing a deterioration in water quality;
- Dust and noise emissions from excavation (trenches for dosing pipelines, carrier water pipework and electrical cables and transportation of material and equipment close to watercourses causing a deterioration in water quality or disturbance to species (e.g. birds);

- Environmental incident or accident during the construction phase e.g. spillage of a contaminant such as diesel or phosphoric acid causing a deterioration in water quality;
- Groundwater level drawdown through the excavation of trenches for dosing pipelines, carrier water pipework and electrical cables.

5.2.2 Operational Phase

The source-pathway-receptor approach has identified a number of impact pathways associated with the operation of orthophosphate treatment works at Innishannon WTP. These will be evaluated with regard to the potential for likely significant effects on European Sites in relation to:

- Excessive phosphate within an aquatic ecosystem may lead to eutrophication with a corresponding reduction in oxygen levels, reduction in species diversity and subsequent impacts on animal life;
- Groundwater dependent habitats include both surface water habitats (e.g. hard oligo-mesotrophic lakes) and Groundwater Dependent Terrestrial Ecosystems (GWDTEs, e.g. alkaline fens). Any change in the water quality of these systems may have subsequent impacts for these habitats and species;
- The discharge of additional orthophosphate loads to the environment (through surface and sub surface pathways) may have potentially negative effects on nutrient sensitive species such as the freshwater pearl mussel, Atlantic salmon and the white-clawed crayfish;
- Phosphorus in wastewater collection systems is the result of drinking water and derived from a number of other sources, including phosphorus imported from areas outside the agglomeration through import of sludges or leachates for treatment at the plant. The disposal and use of phosphorus removed in wastewater sludge is regulated (i.e. through nutrient management plans) and should not pose further threat of environmental impact;
- Leakage of phosphates from the drinking water supply network to the environment from use of orthophosphate;
- Direct discharges of increased orthophosphate to water bodies from the wastewater treatment plant licensed discharges; and
- Potential discharges to water bodies of untreated effluent potentially high in orthophosphate from Storm Water Overflows (SWOs).

5.3 ASSESSMENT OF IMPACTS

Article 6 of the Habitats Directive states that:

Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications of the site in view of the site's conservation objectives.

The focus of this Screening to inform AA is the evaluation of the potential for likely significant effects associated with the additional orthophosphate load due to orthophosphate dosing and the construction of treatment works at Innishannon WTP.

5.3.1 Construction Phase

There are two possible locations for the orthophosphate dosing system both of which will be located within the confines of the existing WTP boundary. The assessment of potential significant effects associated with construction of the corrective water treatment works was conducted taking the whole Innishannon WTP into account and therefore included both possible locations.

The assessment of impacts associated with the construction of the corrective water treatment works at Innishannon WTP is based on a desktop study using the following information:

- Design descriptions and drawings for the proposed corrective water treatment works at Innishannon WTP;
- A review of hydrological connectivity between the proposed works and European Sites using the EPA Mapping Resources: http://gis.epa.ie/; www.Catchments.ie;
- Ordnance Survey Ireland Map viewer: http://maps.osi.ie/publicviewer/#V1,591271,743300,0,10 ; and
- Site synopses, conservation objectives and qualifying interest data for European Sites.

The construction works will be located within the confines of the existing Innishannon WTP which is not located within or directly adjoins a European Site. The Zone of Influence assessment completed for the proposed construction works is presented in **Table 4-1.** This confirms that the proposed development site does not support connectivity with European Sites through either hydrological or hydrogeological vectors. The proposed WTP site does not support or adjoin hydrological features such as drains, streams or rivers linking it to the surrounding environment.

Innishannon WTP site overlies the Bandon groundwater body (IE_SW_G_086) and groundwater flow for this water body is concentrated in the upper 15m of the aquifer, although deeper inflows along fault zones or connected fractures can be encountered. Groundwater flow directions for this water body are expected to approximately follow the local surface water catchments with short flow paths (30-300m)[10]. The nearest surface water body to the WTP boundary is the Bandon River (IE_SW_20B020900) which connects to the Upper Bandon Estuary (IE_SW_080_0300), Lower Bandon Estuary (IE_SW_080_0100) before discharging to the Kinsale Harbour Coastal Water body (IE_SW_080_0000). These water bodies do not support nor provide connectivity to European Sites. Potential source impact pathway to Cork Harbour SPA or Bandon River SAC have been ruled out in Table 4.1 above. Therefore there are no groundwater vectors linking the WTP site and European Sites.

5.3.2 Operational Phase

In the case of the additional orthophosphate load due to dosing at Innishannon WTP, the EAM conceptual model developed for orthophosphate transfer identified the surface and groundwater bodies that have the potential to be affected by the orthophosphate dosing and for which hydrological or hydrogeological pathways to the European Sites exist. These water bodies are listed in **Table 5-1**. The table identifies the following:

- European Sites included for assessment;
- Water bodies hydrologically or hydrogeologically connected to the European Sites;

[10] https://jetstream.gsi.ie/iwdds/delivery/GSI_Transfer/Groundwater/GWB/BandonGWB.pdf

- Existing orthophosphate indicative quality and trend of each water body as presented in the EPA's WFD APP;
- The baseline orthophosphate concentration of each water body;
- 75% of the upper threshold for the indicative quality;
- Cumulative orthophosphate load to surface from leakage, DWWTS and agglomerations;
- The modelled orthophosphate concentration following dosing at the WTP; and,
- The orthophosphate potential baseline concentration (mg/l) following dosing at the WTP.

The EAM has been undertaken assuming the capacity of a water body is a measure of its ability to absorb extra pressures before its indicative quality changes. In order to do this the indicative quality as presented in the EPA's WFD APP is used as the baseline concentration for the different monitoring points within a water body. For example, a river water body with Good orthophosphate indicative quality will have mean orthophosphate value in the range 0.025 to 0.035 mg/l. River water bodies with mean orthophosphate concentrations of 0.0275 mg/l have 75% capacity left, i.e. high capacity, while river water bodies with a mean of 0.0325 mg/l have lower capacity (25%) as the baseline concentrations are closer to the Good/Moderate indicative quality boundary. Where a water body does not have monitored orthophosphate concentrations, a conservative approach is used whereby the surrogate indicative quality is calculated based on the ecological status assigned to that water body by the EPA.

When assessing the increase in orthophosphate concentrations as a result of proposed dosing, an increase which is <5% of the Good / High indicative quality boundary, i.e. 0.00125mg/l, is excluded from further assessment and is assumed to result in no significant impact to a water body. If the baseline orthophosphate concentration in addition to the potential increase in orthophosphate concentration as a result of dosing is less than the 75% upper threshold of the indicative quality band for a water body, this also results in no significant impact.

For significance threshold band (i.e. 75% of the upper threshold for the indicative quality band) in transitional and coastal water bodies, a sliding linear scale is used depending on median salinity. The EAM determines if the dosing will result in a baseline concentration that exceeds the relevant 75% threshold for the indicative quality bands (based on salinities) in order to evaluate whether there could be an increased risk of deterioration in indicative quality.

Where a transitional or coastal water body does not have monitored orthophosphate concentrations or salinity levels, a conservative approach is used whereby the surrogate indicative quality is calculated based on the ecological status assigned to that water body by the EPA but the more conservative freshwater orthophosphate limits for the different indicative quality bands are applied[11].

Therefore, in assessing the additional loads from the proposed orthophosphate dosing, the capacity of the water body will be assessed. This information is available on the WFD App on a national basis using the "Distance to Threshold" parameter, where water bodies with high capacity are termed "Far" from the threshold and those with low capacity are "Near" the threshold.

It is predicted that orthophosphate dosing will not have a significant effect on water bodies (or the Conservation Objectives of a European Site) where it does not cause the P concentration to increase

[11] The conservative thresholds in transitional and coastal water bodies for orthophosphate indicative quality in unassigned water bodies i.e. upper limits are: High 0.025 mg/l; Good 0.04 mg/l; Moderate 0.06 mg/l; Poor 0.09 mg/l; Bad – N/A. The higher range for transitional and coastal water bodies with a median salinity ≤ 17mg/l are: High 0.03 mg/l; Good 0.06 mg/l; Moderate 0.1 mg/l; Poor 0.2 mg/l; Bad N/A.

to a level within 25% of the remaining capacity left within the existing orthophosphate indicative quality band, i.e. cause a change in the distance to threshold from far to near. This assessment will be supported by trend analysis as outlined below to ensure the additional orthophosphate dosing and statistically significant trends for a water body will not result in deterioration in status even where the distance to threshold is currently assessed to be far. Where the water body baseline indicative quality concentration is "Near" to the threshold before the effect of orthophosphate dosing is considered, this does not cause an automatic fail for this test. If the predicted increase in concentration due to orthophosphate is very low (i.e. below 5% of the Good/Moderate indicative quality) this test will pass as the orthophosphate dosing itself can be defined as having no risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.

The identification of statistically and environmentally significant trends for water bodies is a specific requirement of the WFD and the Groundwater Daughter Directive. Guidance on trends in groundwater assessments (UKTAG 2009, EPA 2010) indicates that trends are environmentally significant if they indicate that the Good Ecological Status will not be achieved within two future river basin cycles, i.e. within the next 12 years.

This test applies only when the trend for orthophosphate concentration for the water body is considered statistically significant in the WFD App. For surface water bodies, the predicted concentration is given and the additional concentration due to orthophosphate dosing is added and assessed as appropriate. If the new calculated predicted concentration prevents the achievement of good indicative quality then this test fails.

This assessment assumes a dosing rate of 0.6 mg/l.

An additional test for groundwater bodies states that downward trends should not be reversed as a result of pollution. This test applies to GWB with statistically significant trends according to the WFD App and the Sens Slope provided is used to assess direction and strength of trend. If the trend is negative and the predicted increase in orthophosphate concentration is lower than the absolute value of the Sens Slope, then the test passes.

The initial assessment is automated using existing WFD App data. If tests fail and more investigation is required, more recent data can be used and the assessment rerun. For example, where 2019 - 2021 concentrations for a river water body are available, the 2019 – 2021 average can be used instead of the 2017 baseline provided in the WFD App.

Table 5-1: Surface and Groundwater Bodies within the WSZ with a Hydrological or Hydrogeological Connection to European Sites

Site Name (Code)	Contributing WB Code_Name	WB Type[12]	Ortho P Indicative Quality[13] and Trends[14]	Baseline[15] Ortho P Conc.[16] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Cumulative Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Conc.[17] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[18]	Evaluation
Courtmacsherry Estuary SAC (001230)	IE_SW_20A300900 Artiteige_010	RWB	*Good*	*0.030*	*0.033*	2.0	0.0002	*0.030*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_20B090100 Ballinspittle_010	RWB	*Moderate*	*0.046*	*0.051*	*10.9*	*0.0005*	*0.046*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_20W050990 White Strand_010	RWB	Good	0.030	0.033	*0.4*	*0.0001*	0.030	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_20K010300 Kilbrittain_020	RWB	Moderate Upwards Far	0.042	0.051	5.7	0.0003	0.042	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			Good Upwards Far	0.028	0.033			0.029	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_G_085 Skibbereen-Clonakilty	GWB	*Good*	*0.018*	*0.026*	0.4	0.0000	0.018	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_090_0000 Courtmacsherry Bay	CWB Summer	High None Far	0.003	0.019	18.5	0.0000	0.003 ‡	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.

[12] Monitoring period is annual unless specified.
[13] Surrogate indicative quality in italic.
[14] Distance to threshold.
[15] Baseline year is 2014 for surface water bodies and 2012 for groundwater bodies.
[16] Surrogate concentration is given in italic mg/l
[17] Values above 5% of Good / High indicative quality boundary (0.00125 mg/l) for SW or 5% of Good / Fail indicative quality boundary (0.00175 mg/l) for GW highlighted in yellow.
[18] Green cells signify that there is no risk of deterioration in indicative quality of the water body following dosing at the WTP.

Site Name (Code)	Contributing WB Code_Name	WB Type[12]	Ortho P Indicative Quality[13] and Trends[14]	Baseline[15] Ortho P Conc.[16] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Cumulative Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Conc.[17] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[18]	Evaluation
		CWB Winter	High Downwards Near	0.021	0.019			0.021 ‡	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
Great Island Channel SAC (001058)	IE_SW_19A020300 Aughnaboy (Cork)_010	RWB	Moderate None Far	0.034	0.051	0.5	0.0000	0.034	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_19H050470 Hilltown_010	RWB	*Good*	*0.030*	*0.033*	2.5	0.0001	0.030	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_19K620850 Kilnaglery_010	RWB	*Good*	*0.030*	*0.033*	0.1	0.0000	0.030	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_19M300900 Moneygurney_010	RWB	*Moderate*	*0.046*	*0.051*	0.1	0.0000	*0.046*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_19O010400 Owenboy (Cork)_010	RWB	Poor Upwards Far	0.080	0.087	0.0	0.0000	0.080	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_19O010800 Owenboy (Cork)_020	RWB	Good Downwards Far	0.027	0.033	9.9	0.0002	0.027 ‡	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_19O011000 Owenboy (Cork)_030	RWB Multiple Monitoring Points	High Upwards Near	0.021	0.019	14.3	0.0002	0.021 ‡	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			Good Upwards Far	0.026	0.033			0.026 ‡	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_19O011400	RWB	Good Upwards Far	0.026	0.033	23.0	0.0003	0.026 ‡	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.

Site Name (Code)	Contributing WB Code_Name	WB Type[12]	Ortho P Indicative Quality[13] and Trends[14]	Baseline[15] Ortho P Conc.[16] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Cumulative Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Conc.[17] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[18]	Evaluation
	Owenboy (Cork)_040								
	IE_SW_060_0000 Cork Harbour	CWB Summer	High Downwards Far	0.009	0.019	22.0	0.0000	0.009 ‡	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
		CWB Winter	Good Downwards Far	0.031	0.036			0.031 ‡	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
Courtmacsherry Bay SPA (004219)	IE_SW_20A300900 Artiteige_010	RWB	*Good*	*0.030*	*0.033*	2.0	0.0002	*0.030*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_20B090100 Ballinspittle_010	RWB	*Moderate*	*0.046*	*0.051*	*10.9*	*0.0005*	*0.046*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_20W050990 White Strand_010	RWB	Good	0.030	0.033	*0.4*	*0.0001*	0.030	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_G_085 Skibbereen-Clonakilty	GWB	*Good*	0.018	0.026	0.4	0.0000	0.018	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_090_0000 Courtmacsherry Bay	CWB Summer	High None Far	0.003	0.019	18.5	0.0000	0.003 ‡	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
		CWB Winter	High Downwards Near	0.021	0.019			0.021 ‡	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_20K010300 Kilbrittain_020	RWB	Moderate Upwards Far	0.042	0.051	5.7	0.0003	0.013 ‡	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			Good Upwards Far	0.028	0.033			0.029	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.

Site Name (Code)	Contributing WB Code_Name	WB Type[12]	Ortho P Indicative Quality[13] and Trends[14]	Baseline[15] Ortho P Conc.[16] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Cumulative Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Conc.[17] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[18]	Evaluation
Cork harbour SPA (004030)	IE_SW_19A020300 Aughnaboy (Cork)_010	RWB	Moderate None Far	0.034	0.051	0.5	0.0000	0.034	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_19H050470 Hilltown_010	RWB	*Good*	*0.030*	*0.033*	2.5	0.0001	0.030	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_19K620850 Kilnaglery_010	RWB	*Good*	*0.030*	*0.033*	0.1	0.0000	0.030	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_19M300900 Moneygurney_010	RWB	*Moderate*	*0.046*	*0.051*	0.1	0.0000	*0.046*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_19O010400 Owenboy (Cork)_010	RWB	Poor Upwards Far	0.080	0.087	0.0	0.0000	0.080	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_19O010800 Owenboy (Cork)_020	RWB	Good Downwards Far	0.027	0.033	9.9	0.0002	0.027 ‡	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_19O011000 Owenboy (Cork)_030	RWB	High Upwards Near	0.021	0.019	14.3	0.0002	0.021 ‡	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			Good Upwards Far	0.026	0.033			0.026 ‡	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_19O011400 Owenboy (Cork)_040	RWB	Good Upwards Far	0.026	0.033	23.0	0.0003	0.026 ‡	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.

Site Name (Code)	Contributing WB Code_Name	WB Type[12]	Ortho P Indicative Quality[13] and Trends[14]	Baseline[15] Ortho P Conc.[16] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Cumulative Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Conc.[17] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[18]	Evaluation
	IE_SW_G_004 Ballinhassig East	GWB (multiple monitoring points)	Good Upwards Near	0.034	0.026	3.1	0.0000	0.034	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			Good Upwards Far	0.013	0.026			0.013	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			Failing to achieve good Upwards Far	0.051	-			0.051	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			Failing to achieve good Upwards Far	0.037	-			0.037	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			Good Upwards Far	0.021	0.026			0.021	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			Good Upwards Far	0.015	0.026			0.015	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			Good Upwards Far	0.006	0.026			0.006	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			Good Upwards Far	0.023	0.026			0.023	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			Failing to achieve good Upwards Far	0.268	-			0.268	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.

Site Name (Code)	Contributing WB Code_Name	WB Type[12]	Ortho P Indicative Quality[13] and Trends[14]	Baseline[15] Ortho P Conc.[16] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Cumulative Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Conc.[17] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[18]	Evaluation
			Good Upwards Far	0.006	0.026			0.006	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			Good Upwards Near	0.026	0.026			0.026	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			Failing to achieve good None Far	0.188	-			0.188	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			Good Upwards Far	0.012	0.026			0.012	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			Failing to achieve good Downwards Far	0.043	-			0.043	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_G_072 Ringaskiddy	GWB	*Good*	*0.018*	*0.026*	4.4	0.0009	*0.018*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_G_086 Bandon	GWB	*Good*	*0.018*	*0.026*	3.6	0.0000	*0.018*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_060_1200 Owenboy Estuary	TWB	Moderate	0.080	0.090	23.1	0.0002	*0.080*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.

‡ Load from WWTP / SWO following treatment added
*Trends are statistically significant.

5.3.3 Assessment of Potential Direct Impacts from WWTPs and Storm Water Overflows

The conceptual model developed for P transfer identifies a number of pathways by which orthophosphate can reach receptors. In the case of these pathways, factors contributing to potential direct impacts are:

- the quantitative increase in P loading to wastewater collecting systems;
- the efficiency of P removal at WWTPs;
- the increased P loading to surface waters via storm water overflows; and
- the sensitivity of receptors.

For the purposes of assessing the potential impact on the receiving environment a number of scenarios have been assessed at the agglomerations which receive water from the WSZ (**Table 5-2**). The existing baseline prior to orthophosphate dosing is established and compared to the potential impact on the receiving waters post-dosing. In-combination effects of the operation of the SWO and the continuous discharge from the WWTP were also assessed.

The pre-dosing scenario is based on a mass balance calculation of both the intermittent SWO discharges, in combination with the continuous discharge from the WWTP. A comparison of the pre- and post-dosing scenarios is made to identify changes in predicted concentrations downstream of the point of discharge. A summary of the results and evaluation of orthophosphate dosing downstream of each agglomeration is provided below.

Table 5-2 provides the data used for the WWTP continuous discharge, and the SWO intermittent discharge, to compare with the emission limit values (ELVs) from the waste water discharge licence (WWDL) (if it has been set) that are applicable to the agglomeration discharge to transitional waters or freshwaters. The resultant concentration in the waters downstream of the discharge point from the agglomerations is provided in **Table 5-3** assuming mean flows**.**

The quantification of loads in a mass balance calculation was carried out using the standardised approach developed in the EAM which was devised using national data sets and applying a series of conservative and robust assumptions. The model was prepared in discussion with and utilises data supplied by the EPA, NPWS and the DHPLG to ensure that a robust model simulation is provided.

Table 5-2: Increased loading/concentration due to Orthophosphate Dosing – Dosing rate = 0.6 mg/l

Agglom. and Discharge Type	ELV from WWDL (mg/l)	Scenario	TP Load Kg/Yr	Ortho P Concentration mg/l *TP – Ortho P Conversion factor varied for sensitivity analysis (40%, 50%, 68%)*		
				0.5	*0.4*	*0.68*
Kinsale Primary Discharge	1.0 (Ortho P) 1.2 (Cond. 2) Non compliance in 2017 AER for orthoP	**Existing**	641	0.22	0.18	0.30
		Post Dosing	641	0.22	0.18	0.30
Kinsale SWOs (7 no.)	n/a	**Existing**	186.6	2.20	1.76	2.99
		Post Dosing	197.8	2.33	1.86	3.17
	1	**Existing**	657	0.26	0.21	0.35

Agglom. and Discharge Type	ELV from WWDL (mg/l)	Scenario	TP Load Kg/Yr	Ortho P Concentration mg/l *TP – Ortho P Conversion factor varied for sensitivity analysis (40%, 50%, 68%)*		
				0.5	*0.4*	*0.68*
Kinsale Primary Discharge		**Post Dosing**	657	0.26	0.21	0.35
Kinsale SWOs (7 no.)	n/a	**Existing**	191.5	2.56	2.05	3.49
		Post Dosing	202.7	2.71	2.17	3.69
Ringaskiddy Primary Discharge	n/a	**Existing**	10499	3.74	2.99	5.08
		Post Dosing	10628	3.78	3.03	5.14
Ringaskiddy SWOs (6 no.)	n/a	**Existing**	654.8	8.00	6.40	10.88
		Post Dosing	662.8	8.10	6.48	11.01
Kilbrittan Primary Discharge	1.0 (Ortho P) 1.2 (Cond. 2) Non compliance in 2021 AER for orthoP	**Existing**	21	0.28	0.23	0.39
		Post Dosing	27	0.37	0.29	0.50
Kilbrittain SWOs (1 no.)	n/a	**Existing**	6.0	2.84	2.27	3.86
		Post Dosing	6.2	2.92	2.34	3.98
Innishannon Primary Discharge	n/a	**Existing**	414	3.00	2.40	4.08
		Post Dosing	425	3.08	2.46	4.19
Riverstick Primary Discharge	0.75 (Ortho P) Compliant with ELV in 2021 AER for orthoP	**Existing**	48	0.46	0.37	0.62
		Post Dosing	48	0.46	0.37	0.62
Riverstick SWOs (1 no.)	n/a	**Existing**	14.1	4.57	3.65	6.21
		Post Dosing	14.3	4.65	3.72	6.32
Ballygarvan Primary Discharge	3.0 (Ortho P) Compliant with ELV in 2021 AER for orthoP	**Existing**	217	2.09	1.68	2.85
		Post Dosing	217	2.09	1.68	2.85

Table 5-3: Mass balance assessment based on 0.6 mg/l dosing using available background concentrations and mean flow information for fluvial flows with tidal volumes estimated from tidal prism

Agglom.	RWB Name / Code for Primary Discharge	Background Conc.[19] (mg/l)	Modelled Conc. Existing (mg/l)	Modelled Conc. Post Dosing (mg/l)	% Inc
Kinsale (D0132-01)	Lower Bandon Estuary IE_SW_080_0100	0.034	0.0342	0.0342	0.01
Ringaskiddy (D0057-01)	Cork Harbour IE_SW_060_0000	0.0275	0.0278	0.0278	0.02
Kilbrittain (D0435-01)	Kilbrittain_020 IE_SW_20K010300	0.0280	0.0287	0.0288	0.59
Innishannon (D0429-01)	Upper Bandon Estuary IE_SW_080_0300	0.031	0.0313	0.0313	0.03
Riverstick (D0433-01)	Stick_010 IE_SW_20S030800	0.0225	0.0252	0.0252	0.05
Ballygarvan (D0540-01)	Owenboy (Cork)_030 IE_SW_19O011000	0.0211	0.0226	0.0226	0.00

[19] Annual mean from AER u/s monitoring point

Kinsale Agglomeration

Kinsale agglomeration discharges into Lower Bandon Estuary (IE_SW_080_0100) which is hydrologically connected to Courtmacsherry Estuary SAC, Courtmacsherry Bay SPA, Cork Harbour SPA and Great Island Channel SAC via The Western Celtic Sea (Has 18;19;20). Kinsale agglomeration receives tertiary treatment i.e. nutrient removal and it is assumed any additional orthophosphate load to the WWTP will be removed during the treatment process. This is based on the assumption that there is adequate capacity in the chemical dosing system to effectively manage the removal of the additional phosphorus without affecting the performance of the treatment process at the WWTP or the quality of the effluent discharged under the current operating regime. The Kinsale WWTP was non-compliant with ELVs for ortho P in the 2021 AER. The 2021 AER report notes that the discharge is not having an observable impact on the WFD status. The ELV non-compliances reported in the 2021 AERs for Kinsale was due to a shock load. Nonetheless, the DBO contractor will review dosing rates, and a review of reported operational results was undertaken and no further exceedances were reported in 2022. When fluvial and daily tidal exchange volumes are taken into account the increase in the receiving water is negligible (0.01%) (**Table 5-3**). Therefore, there is no risk of failing to achieve WFD objectives for the Lower Bandon Estuary IE_SW_080_0100 and its hydrologically connected European Sites as a result of dosing at Innishannon WTP.

Ringaskiddy

Ringaskiddy agglomeration discharges into Cork Harbour (IE_SW_060_0000) which is hydrologically connected to Greater Island Channel SAC and Cork Harbour SPA. No ELVs have been set for this agglomeration. When fluvial and daily tidal exchange volumes are taken into account the increase in the receiving water is negligible (0.02%) (**Table 5-3**). Therefore, there is no risk of failing to achieve WFD objectives for Cork Harbour IE_SW_060_0000 and its hydrologically connected European Sites as a result of dosing at Innishannon WTP.

Kilbrittain Agglomeration

Kilbrittain agglomeration discharges into Kilbrittain_020 (IE_SW_20K010300) which is hydrologically connected to Courtmacsherry Estuary SAC and Courtmacsherry Bay SPA. Kilbrittain agglomeration receives tertiary treatment i.e. Nutrient removal, however the WWTP was non-compliant with the ELV's set in the WWDL for ortho P in the 2022 AER. The non-compliance was due to inadequate operational procedures / training. This is a recurring incident with one incident recorded in 2022. As this is a recurring incident the assumption that there is adequate capacity in the chemical dosing system to effectively manage the removal of the additional phosphorus without affecting the performance of the treatment process at the WWTP or the quality of the effluent discharged under the current operating regime is not applicable and for the purposes of the assessment all the additional load is assumed to pass through the WWTP. When mean flows are taken into account the increase in the receiving water is insignificant (0.59%) (**Table 5-3**). Therefore, there is no risk of failing to achieve WFD objectives for Kilbrittain_020 IE_SW_20K010300 and its hydrologically connected European Sites as a result of dosing at Innishannon WTP.

Innishannon Agglomeration

Innishannon agglomeration discharges into Upper Bandon Estuary (IE_SW_080_0300) which is hydrologically connected to Courtmacsherry Estuary SAC, Courtmacsherry Bay SPA, Cork Harbour SPA and Great Island Channel SAC via The Western Celtic Sea (HAs 18;19;20). Innishannon was upgraded in 2022 to improve the performance of the WWTP. There are no Phosphorus ELVs set in the WWDL for Innishannon. The EAM has assumed that all the additional load from the dosing passes through the plant as a conservative assessment. When fluvial and daily tidal exchange volumes are taken into

account the increase in the receiving water is negligible (0.03%) (**Table 5-3**). Therefore, there is no risk of failing to achieve WFD objectives for the Upper Bandon Estuary IE_SW_080_0300 and its hydrologically connected European Sites as a result of dosing at Innishannon WTP.

Riverstick

Riverstick agglomeration discharges to the Stick_010 (IE_SW_20S030800) which is hydrologically connected to Courtmacsherry Estuary SAC, Courtmacsherry Bay SPA, Cork Harbour SPA and Great Island Channel SAC via The Western Celtic Sea (Has 18;19;20). Riverstick agglomeration receives tertiary treatment, i.e. nutrient removal is assumed to remove any additional orthophosphate load to the WWTP during the treatment process. This is based on the assumption that there is adequate capacity in the chemical dosing system to effectively manage the removal of the additional phosphorus without affecting the performance of the treatment process at the WWTP or the quality of the effluent discharged under the current operating regime. The modelled concentrations for both existing and post dosing scenarios are compliant with orthophosphate ELVs set in WWDL (0.75mg/l). Monitoring of the effluent in the latest AER, 2021, also shows that the agglomeration was compliant with its orthophosphate ELV. When mean flows are taken into account the increase in the receiving water is negligible (0.05%) (**Table 5-3**). Therefore, there is no risk of failing to achieve WFD objectives for the Stick_010 IE_SW_20S030800 and its hydrologically connected European Sites as a result of dosing at Innishannon WTP.

Ballygarvan

Ballygarvan agglomeration discharges into Owenboy (Cork)_030 (IE_SW_19O011000) which is hydrologically connected to Great Island Channel SAC and Cork Harbour SPA. Ballygarvan agglomeration has secondary treatment and therefore all the additional load from the dosing is assumed to pass through the WWTP to allow for a conservative assessment. The modelled concentrations for both existing and post dosing scenarios are compliant with total phosphorus ELVs set in WWDL (3mg/l).

When mean flows are taken into account the increase in the receiving water is not detectable (0.00%) (**Table 5-3**). Therefore, there is no risk of failing to achieve WFD objectives for Owenboy (Cork)_030 (IE_SW_19O011000) and its hydrologically connected European Sites as a result of dosing at Innishannon WTP.

5.3.4 Assessment of Potential Indirect Impact from Subsurface Flow

5.3.4.1 Sub surface flows from leakage and DWWTP

Step 4 of Appendix C outlines the distributed inputs to river water bodies from sub-surface pathways. There are no river water bodies with predicted increases in concentration exceeding 5% of the Good / High indicative quality boundary (0.00125 mg/l). The largest increase is 0.0005 mg/l, taking place in Knocknabohilly_010 (IE_SW_20K190980) which is not directly connected to any European Site. This does not exceed 5% of the Good / High indicative quality boundary (0.00125 mg/l). There is therefore no risk of deterioration in the indicative quality of river water bodies as a result of dosing at Innishannon WTP, or of preventing the achievement of WFD objectives.

The predicted increase in concentration is undetectable (0.0000 mg/l) for all transitional and coastal waterbodies except IE_SW_060_1200 (Owenboy Estuary) where the modelled increase in concentration is 0.0002 mg/l.

As the modelled increase in orthophosphate concentration is not detectable (0.0000 mg/l) i.e. <5% of the Good / High indicative quality boundary, there is no risk of deterioration in the indicative quality of the water bodies or of preventing the achievement of WFD objectives.

There are no lake water bodies directly affected by the WSZ.

5.3.4.2 Groundwater Assessment

The predicted loads and concentrations to groundwater bodies are low in all cases (i.e. do not exceed 5% of the Good / Fail indicative quality boundary 0.00175 mg/l). Concentration in the GWBs Skibbereen-Clonakilty IE_SW_G_085, Bandon IE_SW_G_086, Brinny Gravels East IE_SW_G_087, Brinny Gravels West IE_SW_G_088 and Ballinhassig East IE_SW_G_004 due to dosing are not detectable i.e. 0.0000 mg/l. In the GWB Ringaskiddy IE_SW_G_072 the increase in concentration due to dosing is 0.0009 mg/l (**Table 3 Appendix C**).

For IE_SW_G_004, Ballinhassig East, five of the monitoring points shows orthophosphate Indicative Quality as “Failing to achieve Good” but the trends are neither statistically nor environmentally significant. The modelled increase in concentration is undetectable (0.0000) mg/l and since there is no significant impact due to orthophosphate dosing on any of the overlying surface water bodies and they are not failing WFD objectives, this groundwater body is not considered a risk to surface waters.

5.3.5 Combined Assessment

Table 4-A and **4-B of Appendix C** provide details of the combined orthophosphate inputs to rivers and transitional / coastal water bodies respectively from direct discharges, DWWTSs and leakage loads.

The pre-dosing baseline concentration for the water bodies Owenboy (Cork)_030 IE_SW_19O011000, Stick_010 IE_SW_20S030800, Outer Cork Harbour IE_SW_050_0000 and Courtmacsherry Bay IE_SW_090_0000 exceed 75% of the orthophosphate indicative quality upper threshold for the water bodies. However, the modelled increase in concentration would have a undetectable impact (0.0000 mg/l). Therefore there is no risk of deterioration in the indicative quality of the water bodies or of preventing the achievement of WFD objectives.

Individual monitoring points in IE_SW_19O011000 (OWENBOY (CORK)_030), IE_SW_20S030800 (STICK_010), IE_SW_060_0000 (Cork Harbour) IE_SW_080_0000 (Kinsale Harbour) and IE_SW_050_0000 (Outer Cork Harbour) have statistically significant upward trends, but as the modelled increase in concentration is undetectable (0.0000 mg/l) or 0.0002mg/l in the case of OWENBOY (CORK)_030)), there is no impact due to orthophosphate dosing.

There are no lake water bodies directly affected by the WSZ.

5.3.6 Assessment of Cumulative Impacts from other WSZs

The cumulative loads to the Lee, Cork Harbour and Youghal catchment (HA19) and the Bandon-Ilen catchment (HA20) associated with the orthophosphate dosing have been assessed with Zone 2 Innishannon (0500PUB3501) WSZ. The common water bodies that are impacted by the WSZs supplied by these WTPs have been summarised in **Table 5-4.**

- 004 Lee Road WTP Cork City Water Supply (0400PUB1001),
- 006 Inniscarra WTP Zone 2 Cork City and Harbour (0500PUB3401),
- 026 Glashaboy WTP Zone 3 Glashaboy (0500PUB3303),
- 036 Clonakilty RWSS WTP Zone 1 Clonakilty (2900PUB0134) and
- 059 Glendine WTP Zone 3 Youghal Regional (0500PUB2510).

An assessment of the Cumulative impacts indicates that increases in concentration will be above significant levels (0.00125 mg/l) in two streams; Hilltown_010 IE_SW_19H050470 which is hydrologically connected Cork Harbour SPA and Moneygurney_010 IE_SW_19M300900, which is hydrologically connected to Great Island Channel SAC and Cork Harbour i.e. the modelled increase in ortho P concentration is 0.0025 mg/l and 0.0048 mg/l respectively; however, these increases will not result in a risk to WFD objectives as the predicted baseline concentration following dosing is below 75 % of the upper threshold for Ortho P indicative quality boundary in each case.

The cumulative assessment for all other waterbodies has demonstrated that the cumulative modelled increase in concentration is not significant and there will be no risk to the achievement of the WFD objectives for any of the waterbodies potentially affected.

The cumulative assessment has demonstrated that there is no risk of deterioration in the orthophosphate indicative quality of the water bodies or of failing to achieve WFD objectives.

Table 5-4: Cumulative assessment of the increased loading and concentrations to water bodies in the Lee, Cork Harbour & Youghal (HA19) and Bandon-Ilen (HA20) catchments from Zone 2 Innishannon and other WSZs proposed for corrective water treatment.

NAME / EU_CD	WB type/ Period	Ortho P Indicative Quality and Trends (distance to threshold) Surrogate Indicative Quality indicated in *italic*	Baseline and Conc. Surrogate Conc given in *italic* mg/l	75% of Ortho P Indicative Quality Upper threshold mg/l	Cumulative Ortho P load to SW from leakage, DWWTS & agglomerations kg/yr	Modelled increase in Conc. Using Flows (30%ile tidal or gauged) mg/l	PO4 Potential Baseline Conc. following dosing mg/l
IE_SW_19H050470 Hilltown_010	RWB n/a	*Good*	*0.030*	*0.033*	*77.5*	*0.0025*	*0.032*
IE_SW_19K620850 Kilnaglery_010	RWB n/a	*Good*	*0.030*	*0.033*	*11.8*	*0.0009*	*0.081*
Moneygurney 19_010 IE_SW_19M300900	RWB n/a	*Moderate*	*0.046*	0.051	102.2	*0.0048*	*0.051*
IE_SW_19O011400 Owenboy (Cork)_040	RWB n/a	Good Upwards Near	0.026	0.033	26.6	0.0003	0.026‡
Two Pot (Cork City)_010 IE_SW_19T050890	RWB n/a	Poor Upwards Far	0.070	0.073	10.0	0.0009	0.071
IE_SW_090_0000 Courtmacsherry Bay	CWB Summer	High None Far	0.003	0.019	54.5	0.0000	0.003‡

NAME / EU_CD	WB type/ Period	Ortho P Indicative Quality and Trends (distance to threshold) Surrogate Indicative Quality indicated in *italic*	Baseline and Conc. Surrogate Conc given in *italic* mg/l	75% of Ortho P Indicative Quality Upper threshold mg/l	Cumulative Ortho P load to SW from leakage, DWWTS & agglomerations kg/yr	Modelled increase in Conc. Using Flows (30%ile tidal or gauged) mg/l	PO4 Potential Baseline Conc. following dosing mg/l
	CWB Winter	High Downwards Near	0.021	0.019			0.021‡
Lough Mahon IE_SW_060_0750	CWB Summer	High	0.014	0.020	6556.6	0.0001	0.014‡
	CWB Winter	High	0.027	0.020			0.027
Lee (Cork) Estuary Lower IE_SW_060_0900	TWB Summer	Good (S) Downwards Near	0.043	0.050	376.4	0.0002	0.044
	TWB Winter	Good (W) Downwards Far	0.043	0.050			0.044
Lee (Cork) Estuary Upper IE_SW_060_0950	TWB Summer	High (S) Downwards Far	0.013	0.019	376.4	0.0003	0.013
	TWB Winter	High (W) Downwards Near	0.013	0.019			0.013
Cork Harbour IE_SW_060_0000	CWB Summer	High Downwards Far	0.003	0.019	8546.2	0.0000	0.003‡
	CWB Winter	Good Downwards Far	0.028	0.045			0.028
Outer Cork Harbour IE_SW_050_0000	CWB Summer	High Downwards Far	0.003	0.019	8627.1	0.0000	0.003‡
	CWB Winter	High Downwards Far	0.024	0.019			0.024
IE_SW_060_1200 Owenboy Estuary	*CWB*	*Moderate*	*0.080*	0.090	106.0	0.0000	0.080‡
IE_SW_010_0000 Western Celtic Sea	*CWB*	*High*	*0.013*	*0.019*	9671.7	0.0001	0.013‡

‡ Load from WWTP / SWO following treatment added.

5.3.7 Conclusions

Discharges from agglomerations connected to the WSZ result in no significant increases (i.e. do not exceed 5% of the Good / High indicative quality boundary) in the orthophosphate concentrations in the receiving water bodies. There will therefore be no impact to the receiving waters from the dosing at Innishannon WTP due to direct discharges.

All river, transitional or coastal water body have modelled increases in orthophosphate concentration that do not exceed 5% of the Good / High indicative quality boundary (0.00125 mg/l) following dosing at Innishannon WTP.

The pre-dosing baseline concentrations in the water bodies

IE_SW_19O011000 (OWENBOY (CORK)_030), IE_SW_20S030800 (STICK_010), IE_SW_090_0000 (Courtmacsherry Bay) and IE_SW_050_0000 (Outer Cork Harbour) have baseline concentrations above 75% of the Ortho P upper threshold, but the modelled increase in concentration would have a undetectable impact (0.0000 mg/l) and will not result in any further risk to the achievement of the WFD objectives in these water bodies.

The groundwater bodies have modelled increases in concentration that do not exceed 5% of the Good / Fail indicative quality boundary following dosing. Five monitoring points in Ballinhassig East IE_SW_G_004 have a baseline concentration that exceeds 75% of the indicative quality upper threshold pre-dosing. The modelled increase in concentration due to dosing will be 0.0000 mg/l and therefore dosing poses no risk of deterioration in the indicative quality of these groundwater bodies, or of preventing the achievement of WFD objectives.

Increases in concentration for all remaining river and transitional water bodies are within the 5% Good / High indicative quality boundary threshold following dosing. Increases in all remaining groundwaters are within 5% if of the Good / Fail indicative quality boundary. There are no coastal water bodies directly affected by the Innishannon WTP.

The cumulative assessment of dosing at Innishannon WTP together with other WTPs which may be subject to dosing in the same catchments, has demonstrated that there will not be a significant effect on receiving water bodies. These WTPs are also subject to their own Screening for AA.

Therefore there is no risk of deterioration in the orthophosphate indicative quality of the water bodies as a result of the proposed project and the dosing will not prevent the achievement of the WFD objectives for these water bodies.

6 EVALUATION OF LIKELY SIGNIFICANT EFFECTS

6.1 CONSTRUCTION PHASE

Innishannon WTP is not located within or directly adjacent to the boundary of any European Site. The WTP site does not support or provide connectivity with surface water features including drainage channels, streams and rivers.

Innishannon WTP site overlies the Bandon groundwater body (IE_SW_G_086). Groundwater flow directions for this water body are expected to approximately follow the local surface water catchments with short flow paths (30-300m)[20]. To this end, potential groundwater interactions at Innishannon WTP site may support connectivity with nearby watercourses including the estuarine, transitional and coastal areas of the Bandon River, namely the Upper Bandon Estuary (IE_SW_080_0300), Lower Bandon Estuary (IE_SW_080_0100) and the Kinsale Harbour Coastal Water body (IE_SW_080_0000). These water bodies do not support nor provide connectivity to European Sites. Therefore there are no groundwater vectors linking the WTP site and European Sites.

The proposed construction works will be localised and contained to the immediate development area which supports amenity grassland / buildings and artificial surfaces. Works such as excavations will be contained to the defined working area and necessary works with cast in place concrete will be undertaken within sealed shuttered units. Such works practices will retain all potential construction related pollutants at source.

Therefore, it can be concluded on the basis of objective scientific information, that the construction of the corrective water treatment works at Innishannon WTP, individually or in combination with other plans or projects, will not have a likely significant effect on European Sites.

6.2 OPERATIONAL PHASE

The key pressure associated with the proposed orthophosphate dosing is the potential for increased orthophosphate levels in the receiving waters which support the qualifying interests (habitats and species) identified in **Table 4-3** that are both water dependent and nutrient sensitive (**Appendix B**). The likelihood of significant effects on these habitats and species, in view of their conservation objectives, are assessed in detail below.

6.2.1 Great Island Channel SAC 001058

6.2.1.1 (1140) Mudflats and sandflats not covered by seawater at low tide

The attributes and targets that will maintain the favourable conservation condition of this habitat in the Great Island Channel SAC do not make specific reference to water quality or nutrient condition (NPWS, 2014)[21]. There is, however, a requirement to conserve the community of mixed sediment to sandy mud with polychaetes and oligochaetes complex in its natural conditions. The conservation

[20] GSI - Bandon GWB: Summary ofInitial Characterisation
[21] NPWS 2014 Great Island Channel SAC 001058 Conservation Objectives

objectives supporting document for Marine habitats (NPWS, 2014[22]) requires that activities or operations that cause significant disturbance to communities but may not necessarily represent a continuous or ongoing source of disturbance over time and space may be assessed in a context-specific manner, giving due consideration to the proposed nature and scale of activities during the reporting cycle and the particular resilience of the receiving habitat in combination with other activities within the designated site.

Table 5-1 identifies the surface and groundwater bodies which are hydrologically or hydrogeologically connected to Great Island Channel SAC and will receive inputs from the proposed orthophosphate dosing at Innishannon WTP:

- The rivers water bodies hydrologically connected to the site include: Aughnaboy (Cork)_010 IE_SW_19A020300, Hilltown_010 IE_SW_19H050470, Kilnaglery_010 IE_SW_19K620850, Moneygurney_010 IE_SW_19M300900, Owenboy (Cork)_010 IE_SW_19O010400, Owenboy (Cork)_020 IE_SW_19O010800, Owenboy (Cork)_030 IE_SW_19O011000 and Owenboy (Cork)_040 IE_SW_19O011400; and
- The coastal water body hydrologically connected to the site is Cork Harbour IE_SW_060_0000.

The habitat mudflats and sandflats not covered by seawater at low tide, span the full extent of the SAC. The habitat was area was estimated to be 723 ha based on OSi data[21].

The EAM has assessed the potential for impact on orthophosphate indicative quality and has based this assessment on a conservative basis using all available flows data. Full details of the assessment results are provided in **Appendix C** and discussed above in **Section 5**.

Of the water bodies hydrologically connected to the SAC and the mudflats and sandflats habitat, Aughnaboy (Cork)_010 IE_SW_19A020300, Kilnaglery_010 IE_SW_19K620850, Moneygurney_010 IE_SW_19M300900, Owenboy (Cork)_010 IE_SW_19O010400 and Cork Harbour IE_SW_060_0000 were modelled as having a post-dosing increase in orthophosphate concentration of 0.0000 mg/l. Hilltown_010 IE_SW_19H050470 had a modelled increase in concentration of 0.0001 mg/l and Owenboy (Cork)_020 IE_SW_19O010800, Owenboy (Cork)_030 IE_SW_19O011000 have a modelled additional increase of 0.0002 mg/l and Owenboy (Cork)_040 IE_SW_19O011400 has a modelled additional increase of 0.0003 mg/l. None of the water bodies hydrologically connected to the SAC and habitat were assessed as having modelled increases in concentration that exceeded 5% of the Good / High indicative quality boundary (0.00125 mg/l) post-dosing at Innishannon WTP. Therefore there is no risk of deterioration in the indicative quality of the water bodies, or of preventing the achievement of WFD objectives.

In light of the EAM assessment results, which evaluates the additional orthophosphate loading from dosing at Innishannon WTP, it has been demonstrated that the potential for likely significant effects on this habitat can be excluded. Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of the habitat.

[22] NPWS 2014 Great Island Channel SAC (site code 1058) Conservation Objectives Supporting Document - MArine Habitats

6.2.1.2 (1330) Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)

A review of the SSCOs for the SAC (NPWS 2014)[21] found no nutrient specific targets for this habitat however there is a target to maintain the natural tidal regime. The CO supporting document on coastal habitats (NPWS, 2014)[22] for the SAC was reviewed, and discusses the flooding regime attribute and associated target in further detail. The regular ebb and flow of the tide brings salinity, but also nutrients, organic matter and sediment, which are central to the development, growth and survival of saltmarshes.

Table 5-1 identifies the surface and groundwater bodies which are hydrologically or hydrogeologically connected to Great Island Channel SAC and will receive inputs from the proposed orthophosphate dosing at Innishannon WTP:

- The rivers water bodies hydrologically connected to the site include: Aughnaboy (Cork)_010 IE_SW_19A020300, Hilltown_010 IE_SW_19H050470, Kilnaglery_010 IE_SW_19K620850, Moneygurney_010 IE_SW_19M300900, Owenboy (Cork)_010 IE_SW_19O010400, Owenboy (Cork)_020 IE_SW_19O010800, Owenboy (Cork)_030 IE_SW_19O011000 and Owenboy (Cork)_040 IE_SW_19O011400; and
- The coastal water body hydrologically connected to the site is Cork Harbour IE_SW_060_0000.

The habitat Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) is scattered throughout the site and are all of the estuarine type on mud substrate. Based on data from the Saltmarsh Monitoring Project (SMP)[23], two sub-sites that supported the habitat were mapped (1.30 ha) and additional areas of potential saltmarsh (17.60 ha) were identified from an examination of aerial photographs. NPWS note that further unsurveyed areas may be present within the SAC[21].

The EAM has assessed the potential for impact on orthophosphate indicative quality and has based this assessment on a conservative basis using all available flows data. Full details of the assessment results are provided in **Appendix C** and discussed above in **Section 5**.

Of the water bodies hydrologically connected to the SAC and the mudflats and sandflats habitat, Aughnaboy (Cork)_010 IE_SW_19A020300, Kilnaglery_010 IE_SW_19K620850, Moneygurney_010 IE_SW_19M300900, Owenboy (Cork)_010 IE_SW_19O010400 and Cork Harbour IE_SW_060_0000 were modelled as having a post-dosing increase in orthophosphate concentration of 0.0000 mg/l. Hilltown_010 IE_SW_19H050470 had a modelled increase in concentration of 0.0001 mg/l and Owenboy (Cork)_020 IE_SW_19O010800, Owenboy (Cork)_030 IE_SW_19O011000 have a modelled additional increase of 0.0002 mg/l and Owenboy (Cork)_040 IE_SW_19O011400 has a modelled additional increase of 0.0003 mg/l. None of the water bodies hydrologically connected to the SAC and habitat were assessed as having modelled increases in concentration that exceeded 5% of the Good / High indicative quality boundary (0.00125 mg/l) post-dosing at Innishannon WTP. Therefore there is no risk of deterioration in the indicative quality of the water bodies, or of preventing the achievement of WFD objectives.

In light of the EAM assessment results, which evaluates the additional orthophosphate loading from dosing at Innishannon WTP, it has been demonstrated that the potential for likely significant effects

[23] McCorry, M. and Ryle, T. (2009). *Saltmarsh monitoring project 2007-2008*. Uppublished report to National Parks and Wildlife Service.

on this habitat can be excluded. Furthermore, dosing will not prevent the restoration of the favourable conservation condition of the habitat.

6.2.2 Courtmacsherry Estuary SAC 001230

6.2.2.1 (1130) Estuaries

A review of the SSCOs for the SAC found no nutrient specific targets for this habitat however, there is a requirement to conserve community types in their natural conditions (NPWS, 2014)[24]. The COs supporting document for Marine habitats (NPWS, 2014)[25] require that activities or operations that cause significant disturbance to communities but may not necessarily represent a continuous or ongoing source of disturbance over time and space may be assessed in a context -specific manner, giving due consideration to the proposed nature and scale of activities during the reporting cycle and the particular resilience of the receiving habitat in combination with other activities within the designated site.

Table 5-1 identifies the surface and groundwater bodies which are hydrologically or hydrogeologically connected to Courtmacsherry Estuary SAC and will receive inputs from the proposed orthophosphate dosing at Innishannon WTP:

- The rivers water bodies hydrologically connected include: Artiteige_010 IE_SW_20A300900, Ballinspittle_010 IE_SW_20B090100, White Strand_010 IE_SW_20W050990 and Kilbrittain_020 IE_SW_20K010300;
- The groundwater bodies hydrogeologically connected is Skibbereen-Clonakilty IE_SW_G_085; and
- The coastal water body hydrogeoologically connected is Courtmacsherry Bay IE_SW_090_0000.

The habitat is located in the Argideen Estuary IE_SW_090_0200 and was estimated to be 490 ha using OSi data[24].

The EAM has assessed the potential for impact on orthophosphate indicative quality and has based this assessment on a conservative basis using all available flows data. Full details of the assessment results are provided in **Appendix C** and discussed above in **Section 5**.

The river water bodies connected to the site (Artiteige_010 IE_SW_20A300900, Ballinspittle_010 IE_SW_20B090100, White Strand_010 IE_SW_20W050990 and Kilbrittain_020 IE_SW_20K010300) have modelled post-dosing increases in concentration that range from 0.0001 mg/l to 0.0005 mg/l (**Table 5-1**). These do not exceed 5% of the Good / High indicative quality boundary, therefore there is no risk of deterioration in the indicative quality of the river water bodies, or of preventing the achievement of WFD objectives.

The EAM estimates that the increase in orthophosphate concentration in Courtmacsherry Bay IE_SW_090_0000 due to the dosing at Innishannon WTP will be 0.0000 mg/l which is does not exceed

[24] NPWS 2014 Courtmacsherry Estuary SAC 001230 Conservation Objectives
[25] NPWS 2014 Courtmacsherry Estuary SAC (site code: 1230) Conservation Objectives Supporting Document - Marine Habitats

5% of the Good / High indicative quality boundary. Therefore there is no risk of deterioration in the indicative quality of the water body, or of preventing the achievement of WFD objectives.

The Skibbereen-Clonakilty IE_SW_G_085 groundwater body is at Good surrogate indicative quality with a modelled post-dosing increase in concentration of 0.0000 mg/l. Therefore there is no risk of deterioration in the indicative quality of the water body, or of preventing the achievement of WFD objectives.

In light of the EAM assessment results, which evaluate the additional orthophosphate loading from dosing at Innishannon WTP, it has been demonstrated that the potential for likely significant effects on this habitat can be excluded. Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of the habitat.

6.2.2.2 (1140) Mudflats and sandflats not covered by seawater at low tide

The attributes and targets that will maintain the favourable conservation condition of this habitat in the Courtmacsherry Estuary SAC do not make specific reference to water quality or nutrient condition (NPWS, 2014)[24]. There is, however, a requirement to conserve the community types of sandy mud to mixed sediment in its natural conditions. The COs supporting document for Marine habitats (NPWS 2014)[25] require that activities or operations that cause significant disturbance to communities but may not necessarily represent a continuous or ongoing source of disturbance over time and space may be assessed in a context -specific manner, giving due consideration to the proposed nature and scale of activities during the reporting cycle and the particular resilience of the receiving habitat in combination with other activities within the designated site.

Table 5-1 identifies the surface and groundwater bodies which are hydrologically or hydrogeologically connected to Courtmacsherry Estuary SAC and will receive inputs from the proposed orthophosphate dosing at Innishannon WTP:

- The rivers water bodies hydrologically connected include: Artiteige_010 IE_SW_20A300900, Ballinspittle_010 IE_SW_20B090100, White Strand_010 IE_SW_20W050990 and Kilbrittain_020 IE_SW_20K010300;
- The groundwater bodies hydrogeologically connected is Skibbereen-Clonakilty IE_SW_G_085; and
- The coastal water body hydrogeoologically connected is Courtmacsherry Bay IE_SW_090_0000.

The habitat mudflats and sandflats not covered by seawater at low tide spans a large proportion of the SAC, representing approximately 442 ha estimated using OSi data[24]. It is primarily in the Argideen Estuary IE_SW_090_0200 but is also present in Courtmacsherry Bay IE_SW_090_0000.

The EAM has assessed the potential for impact on orthophosphate indicative quality and has based this assessment on a conservative basis using all available flows data. Full details of the assessment results are provided in **Appendix C** and discussed above in **Section 5**.

The river water bodies connected to the site (Artiteige_010 IE_SW_20A300900, Ballinspittle_010 IE_SW_20B090100, White Strand_010 IE_SW_20W050990 and Kilbrittain_020 IE_SW_20K010300) have modelled post-dosing increases in concentration that range from 0.0001 mg/l to 0.0005 mg/l

(**Table 5-1**). These do not exceed 5% of the Good / High indicative quality boundary, therefore there is no risk of deterioration in the indicative quality of the river water bodies, or of preventing the achievement of WFD objectives.

The EAM estimates that the increase in orthophosphate concentration in Courtmacsherry Bay IE_SW_090_0000 due to the dosing at Innishannon WTP will be 0.0000 mg/l which is does not exceed 5% of the Good / High indicative quality boundary. Therefore there is no risk of deterioration in the indicative quality of the water body, or of preventing the achievement of WFD objectives.

The Skibbereen-Clonakilty IE_SW_G_085 groundwater body is at Good surrogate indicative quality with a modelled post-dosing increase in concentration of 0.0000 mg/l. Therefore there is no risk of deterioration in the indicative quality of the water body, or of preventing the achievement of WFD objectives.

In light of the EAM assessment results, which evaluates the additional orthophosphate loading from dosing at Innishannon WTP, it has been demonstrated that the potential for likely significant effects on this habitat can be excluded. Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of the habitat.

6.2.2.3 (1210) Annual vegetation of drift lines

There are no nutrient specific targets in the SSCO for this QI (NPWS, 2014)[24]. However, there is a target that percentage of negative indicator species must be below 5%. The percentage of negative indicators may be increased with additional orthophosphate as they are often indicative of a change in the nutrient condition of the habitat. It is found on beaches along the high tide mark where tidal litter (marine algae, marine fauna, and seeds) accumulates. The decaying detritus releases nutrients into what would otherwise be a nutrient-poor environment, resulting in the growth of annual species.

Table 5-1 identifies the surface and groundwater bodies which are hydrologically or hydrogeologically connected to Courtmacsherry Estuary SAC and will receive inputs from the proposed orthophosphate dosing at Innishannon WTP:

- The rivers water bodies hydrologically connected include: Artiteige_010 IE_SW_20A300900, Ballinspittle_010 IE_SW_20B090100, White Strand_010 IE_SW_20W050990 and Kilbrittain_020 IE_SW_20K010300;
- The groundwater bodies hydrogeologically connected is Skibbereen-Clonakilty IE_SW_G_085; and
- The coastal water body hydrogeoologically connected is Courtmacsherry Bay IE_SW_090_0000.

The habitat Annual vegetation of drift lines is present in a small area of Courtmacsherry Bay IE_SW_090_0000, immediately downstream of the river water body Kilbrittain_020 IE_SW_20K010300. Based on data from the Coastal Monitoring Project (CMP), the habitat was

surveyed and mapped at one sub-site, giving a total estimated area of 0.14 ha. It is noted that the habitat is difficult to measure due to its dynamic nature[26].

The EAM has assessed the potential for impact on orthophosphate indicative quality and has based this assessment on a conservative basis using all available flows data. Full details of the assessment results are provided in **Appendix C** and discussed above in **Section 5**.

The river water bodies connected to the site (Artiteige_010 IE_SW_20A300900, Ballinspittle_010 IE_SW_20B090100, White Strand_010 IE_SW_20W050990 and Kilbrittain_020 IE_SW_20K010300) have modelled post-dosing increases in concentration that range from 0.0001 mg/l to 0.0005 mg/l (**Table 5-1**). These do not exceed 5% of the Good / High indicative quality boundary, therefore there is no risk of deterioration in the indicative quality of the river water bodies, or of preventing the achievement of WFD objectives.

The EAM estimates that the increase in orthophosphate concentration in Courtmacsherry Bay IE_SW_090_0000 due to the dosing at Innishannon WTP will be 0.0000 mg/l which is does not exceed 5% of the Good / High indicative quality boundary. Therefore there is no risk of deterioration in the indicative quality of the water body, or of preventing the achievement of WFD objectives.

The Skibbereen-Clonakilty IE_SW_G_085 groundwater body is at Good surrogate indicative quality with a modelled post-dosing increase in concentration of 0.0000 mg/l. Therefore there is no risk of deterioration in the indicative quality of the water body, or of preventing the achievement of WFD objectives.

In light of the EAM assessment results, which evaluates the additional orthophosphate loading from dosing at Innishannon WTP, it has been demonstrated that the potential for potentially significant effects on this habitat can be excluded. Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of the habitat.

6.2.2.4 (1310) *Salicornia* and other annuals colonising mud and sand *Spartina* swards (*Spartinion maritimae*), (1330) Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) and (1410) Mediterranean salt meadows (*Juncetalia maritimi*)

A review of the SSCOs for the SAC found no nutrient specific targets for these habitats (NPWS, 2014)[24] however, there is a target to maintain the favourable conservation condition of the habitats and to maintain the range of coastal habitats. The conservation objectives supporting document on coastal habitats for Courtmacsherry Estuary SAC (NPWS, 2014)[27] was reviewed, and discusses the flooding regime attribute and associated target in further detail. The regular ebb and flow of the tide brings salinity, but also nutrients, organic matter and sediment, which are central to the development, growth and survival of saltmarshes.

[26] Ryle, T., Murray, A., Connolly, K. and Swann, M., (2009). *Coastal Monitoring Project 2004-2006*. Unpublished report to National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.
[27] NPWS 2014 Courtmacsherry Estuary SAC (site code: 1230) Conservation Objectives Supporting Document - Coastal Habitats

Table 5-1 identifies the surface and groundwater bodies which are hydrologically or hydrogeologically connected to Courtmacsherry Estuary SAC and will receive inputs from the proposed orthophosphate dosing at Innishannon WTP:

- The rivers water bodies hydrologically connected include: Artiteige_010 IE_SW_20A300900, Ballinspittle_010 IE_SW_20B090100, White Strand_010 IE_SW_20W050990 and Kilbrittain_020 IE_SW_20K010300;
- The groundwater bodies hydrogeologically connected is Skibbereen-Clonakilty IE_SW_G_085; and
- The coastal water body hydrogeoologically connected is Courtmacsherry Bay IE_SW_090_0000.

The three habitats are primarily present in Courtmacsherry Bay IE_SW_090_0000 directly downstream of Kilbrittain_020 IE_SW_20K010300 in Garranefeen Strand. There are areas of the SAC in Argideen Estuary IE_SW_090_0200 which have potential to contain the habitats but are un-confirmed. Argideen Estuary IE_SW_090_0200 is not directly connected to the WSZ but is hydrologically connected via Courtmacsherry Bay IE_SW_090_0000.

The EAM has assessed the potential for impact on orthophosphate indicative quality and has based this assessment on a conservative basis using all available flows data. Full details of the assessment results are provided in **Appendix C** and discussed above in **Section 5**.

The river water bodies connected to the site (Artiteige_010 IE_SW_20A300900, Ballinspittle_010 IE_SW_20B090100, White Strand_010 IE_SW_20W050990 and Kilbrittain_020 IE_SW_20K010300) have modelled post-dosing increases in concentration that range from 0.0001 mg/l to 0.0005 mg/l (**Table 5-1**). These do not exceed 5% of the Good / High indicative quality boundary, therefore there is no risk of deterioration in the indicative quality of the river water bodies, or of preventing the achievement of WFD objectives.

The EAM estimates that the increase in orthophosphate concentration in Courtmacsherry Bay IE_SW_090_0000 due to the dosing at Innishannon WTP will be 0.0000 mg/l which is does not exceed 5% of the Good / High indicative quality boundary. Therefore there is no risk of deterioration in the indicative quality of the water body, or of preventing the achievement of WFD objectives.

The Skibbereen-Clonakilty IE_SW_G_085 groundwater body is at Good surrogate indicative quality with a modelled post-dosing increase in concentration of 0.0000 mg/l. Therefore there is no risk of deterioration in the indicative quality of the water body, or of preventing the achievement of WFD objectives.

In light of the EAM assessment results, which evaluates the additional orthophosphate loading from dosing at Innishannon WTP, it has been demonstrated that the potential for likely significant effects on this habitat can be excluded. Furthermore, dosing will not prevent the maintenance [or restoration in the case for the Annex I habitats (1310) *Salicornia* and other annuals colonising mud and sand *Spartina* swards (*Spartinion maritimae*) and (1330) Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)] of the favourable conservation condition of the habitat.

6.2.2.5 (2110) Embryonic shifting dunes, (2120) Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) and (2130) *Fixed coastal dunes with herbaceous vegetation (grey dunes)

A review of the SSCOs for the SAC found no nutrient specific targets for these habitats however, there is a target to maintain the favourable conservation condition. The conservation objectives supporting document on coastal habitats for Courtmacsherry Estuary SAC (NPWS, 2014)[24] was reviewed, and the objectives are based on an assessment of the recorded condition of the habitats under a range of attributes and targets (area, range, structure and function). The overall objective for the three habitats is to maintain favourable conservation condition.

There is a target that negative indicator species (including non-native species; species indicative of changes in nutrient status; and species not considered characteristic of the habitat) represent less than 5% cover. The COs supporting document for coastal habitats (NPWS, 2014)[27] does not outline any objectives in relation to water quality and nutrient requirements for the habitats. It does, however, outline the following with regard to nutrient development on the dunes systems - decaying detritus in the tidal litter releases nutrients into what would otherwise be a nutrient-poor environment. The habitat is often represented as patchy, fragmented stands of vegetation that are short-lived and subject to frequent re-working of the sediment. The supporting document also indicates that: species diversity and plant distribution in dunes is strongly controlled by a range of factors, including mobility of the substrate, grazing intensities, moisture gradients, nutrient gradients and human disturbance.

Table 5-1 identifies the surface and groundwater bodies which are hydrologically or hydrogeologically connected to Courtmacsherry Estuary SAC and will receive inputs from the proposed orthophosphate dosing at Innishannon WTP:

- The rivers water bodies hydrologically connected include: Artiteige_010 IE_SW_20A300900, Ballinspittle_010 IE_SW_20B090100, White Strand_010 IE_SW_20W050990 and Kilbrittain_020 IE_SW_20K010300;
- The groundwater bodies hydrogeologically connected is Skibbereen-Clonakilty IE_SW_G_085; and
- The coastal water body hydrogeoologically connected is Courtmacsherry Bay IE_SW_090_0000.

The three habitats are present in Courtmacsherry Bay IE_SW_090_0000 directly downstream of Kilbrittain_020 IE_SW_20K010300 in Garranefeen Strand. Based on data from the CMP[26], embryonic shifting dunes were surveyed and mapped at one sub-site, giving a total estimated area of 0.65 ha. The CMP also surveyed and mapped white dunes at one sub-site, giving a total area of 0.14 ha. It is noted that both of these habitats are difficult to measure due to their dynamic nature[24]. Finally grey dunes were mapped by the CMP at one sub-site, giving a total estimated area of 4.31 ha.

The EAM has assessed the potential for impact on orthophosphate indicative quality and has based this assessment on a conservative basis using all available flows data. Full details of the assessment results are provided in **Appendix C** and discussed above in **Section 5**.

The river water bodies connected to the site (Artiteige_010 IE_SW_20A300900, Ballinspittle_010 IE_SW_20B090100, White Strand_010 IE_SW_20W050990 and Kilbrittain_020 IE_SW_20K010300) have modelled post-dosing increases in concentration that range from 0.0001 mg/l to 0.0005 mg/l

(**Table 5-1**). These do not exceed 5% of the Good / High indicative quality boundary, therefore there is no risk of deterioration in the indicative quality of the river water bodies, or of preventing the achievement of WFD objectives.

The EAM estimates that the increase in orthophosphate concentration in Courtmacsherry Bay IE_SW_090_0000 due to the dosing at Innishannon WTP will be 0.0000 mg/l which is does not exceed 5% of the Good / High indicative quality boundary. Therefore there is no risk of deterioration in the indicative quality of the water body, or of preventing the achievement of WFD objectives.

The Skibbereen-Clonakilty IE_SW_G_085 groundwater body is at Good surrogate indicative quality with a modelled post-dosing increase in concentration of 0.0000 mg/l. Therefore there is no risk of deterioration in the indicative quality of the water body, or of preventing the achievement of WFD objectives.

In light of the EAM assessment results, which evaluates the additional orthophosphate loading from dosing at Innishannon WTP, it has been demonstrated that the potential for potentially significant effects on this habitat can be excluded. Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of the habitat.

6.2.3 Cork Harbour SPA 004030

Cork Harbour is a large, sheltered bay system, which stretches from the two main estuaries of the River Lee, near Cork City in the northwest, and the Owenacurra River, near Midleton, in the northeast, southwards as far as Roches Point. It is a complex site and encompasses many other estuaries and inlets including the North Channel, the Douglas River Estuary, inner Lough Mahon, Monkstown Creek, Lough Beg, the Owenboy River Estuary, Whitegate Bay and the Rostellan and Poulnabibe inlets (NPWS, 2015)[28].

Cork Harbour is an internationally important wetland site, regularly supporting in excess of 20,000 wintering waterfowl, for which it is amongst the top ten sites in the country. Of particular note is that the site supports internationally important populations of Black-tailed Godwit and Redshank, while a further 20 non-breeding waterbird species occur in numbers of national importance. The Annex I species Common Tern has a breeding population at the site.

According to the CO supporting document for the SPA (NPWS, 2014)[29], Cork Harbour has a history of problems associated with water pollution and eutrophication. Up to the 1960's most of the urban and industrial developments took place in Cork City and its immediate environs, and sewage and other waste were discharged directly into the River Lee. In the late 1980's, sewers were installed to convey waste water to two outfalls on the quays. While this improved the water quality status upstream, the Lee Estuary and Lough Mahon regularly suffered from problems of increased concentrations of organic matter (BOD), nutrient enrichment, faecal coliform bacteria and a decrease in dissolved oxygen levels. In addition to the Lee Estuary and Lough Mahon, the Owennacurra estuary below Midleton has also suffered with serious pollution in the past; again linked to sewage outfalls.

Water quality in the Upper Harbour was improved by the engineering works conducted under the Cork Main Drainage Scheme, which included the building of Carrigrennan WWTP (i.e. Cork City

[28] NPWS 2015 Cork Harbour SPA 004030 Site Synopsis
[29] NPWS 2014 Cork Harbout SPA 004030 Conservation Objectives

agglomeration) at Little Island, Co. Cork. The plant treats wastewater from Cork City and surrounding areas in the County including the City Environs, Glanmire and the proposed new town at Monard. The plant was commissioned in 2004 with a design organic load capacity of 413,000 population equivalent and provides primary and secondary treatment. Treated wastewater from the plant is discharged through a 500m long outfall pipe to Cork Harbour at Lough Mahon. However, the design of the existing plant did not include for nutrient removal or disinfection and since the plant was commissioned, the upper harbour has been designated as a sensitive area under the Urban Wastewater Treatment (Amendment) Regulations 2004 (S.I. No. 440 of 2004). Current discharges from the plant do not comply with these regulations and the plant therefore needs to be upgraded.

Several locations around the harbour currently have no treatment facilities i.e. Cobh, Passage West/ Monkstown, Carrigaline, Crosshaven and Whitegate/Aghada. Others have preliminary/primary treatment e.g. Ringaskiddy. Plans are currently underway to improve sewage facilities in the lower part of the Harbour (NPWS, 2014[29]). Uisce Éireann plans to invest €180m in the upgrade of the wastewater network in Cork including a €91m investment in Cork Lower Harbour Main Drainage Scheme, which will provide a new wastewater treatment plant serving Cobh, Carrigaline, Crosshaven, Passage West/Monkstown (including Glenbrook and Raffeen) and Ringaskiddy (including Shanbally and Coolmore). Work is already underway at the site in Shanbally where the new plant will start to treat wastewater from these towns in 2016 and be fully operational by 2018, bringing significant improvements to water quality in this area (https://www.water.ie/news/investment-of-228-million/).

Cork Harbour has 25 SCIs each of which are considered nutrient sensitive (see **Appendix B**). The SSCOs for Cork Harbour SPA (NPWS, 2014[29]) list targets for each species, specifically:

- Population trend: long term population trends should be stable or increasing; and
- Distribution: there should be no significant decrease in the range, timing or intensity of use of areas by the listed species, other than that occurring from natural patterns of variation.

There is also a target for the wetland habitat that supports the SPA in which the permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 2,587 hectares, other than that occurring from natural patterns of variation.

In relation to protected water-dependent habitats and species under the Birds and Habitats Directive, the river basin management planning process contributes towards achieving water conditions that support Favourable Conservation Status. In preparing the draft RBMP (2018-2021) (DHPLG, 2018)[30] the risk assessment carried out by the EPA for these water dependent European Site protected areas has focussed on looking at the risks to the water standards/objectives established for the purpose of supporting Good Ecological Status (GES). GES, which is the default objective of the WFD, is considered adequate for supporting many water dependent European Site protected areas where site specific environmental supporting conditions have not been defined within SSCOs by the NPWS. This is the case for SPA birds and wetlands.

Table 5-1 identifies the surface and groundwater bodies which are hydrologically or hydrogeologically connected to Cork Harbour SPA and will receive inputs from the proposed orthophosphate dosing at Innishannon WTP:

[30] DHPLG 2018 The River Basin Management Plan for Ireland (2018-2021)

- The rivers water bodies hydrologically connected include: Aughnaboy (Cork)_010 IE_SW_19A020300, Hilltown_010 IE_SW_19H050470, Kilnaglery_010 IE_SW_19K620850, Moneygurney_010 IE_SW_19M300900, Owenboy (Cork)_010 IE_SW_19O010400, Owenboy (Cork)_020 IE_SW_19O010800, Owenboy (Cork)_030 IE_SW_19O011000 and Owenboy (Cork)_040 IE_SW_19O011400;
- The groundwater bodies hydrogeologically connected include: Ballinhassig East IE_SW_G_004, Ringaskiddy IE_SW_G_072 and Bandon IE_SW_G_086; and
- The transitional water body hydrologically connected is Owenboy Estuary IE_SW_060_1200.

The EAM has assessed the potential for impact on orthophosphate indicative quality and has based this assessment on a conservative basis using all available flows data. Full details of the assessment results are provided in **Appendix C** and discussed above in **Section 5**.

Of the water bodies hydrologically or hydrogeologically connected to the SPA, Aughnaboy (Cork)_010 IE_SW_19A020300, Kilnaglery_010 IE_SW_19K620850, Moneygurney_010 IE_SW_19M300900, Owenboy (Cork)_010 IE_SW_19O010400, Ballinhassig East IE_SW_G_004 and Bandon IE_SW_G_086 were modelled as having an increase in orthophosphate concentration of 0.0000 mg/l.

Hilltown_010 IE_SW_19H050470 has a modelled orthophosphate concentration increase of 0.0001 mg/l. Owenboy (Cork)_020 IE_SW_19O010800, Owenboy (Cork)_030 IE_SW_19O011000 and Owenboy Estuary IE_SW_060_1200 have a modelled orthophosphate concentration increases of 0.0002 mg/l. Owenboy (Cork)_040 IE_SW_19O011400 has a modelled additional orthophosphate concentration increases of 0.0003 mg/l. Ringaskiddy IE_SW_G_072 was modelled as having orthophosphate concentration increase of 0.0009 mg/l.

In the case of all river, ground and transitional water bodies identified in **Table 5-1** as hydrologically or hydrogeologically connected to the SPA, the modelled increase in orthophosphate concentration following dosing at Innishannon WTP did not exceed 5% of the Good / High indicative quality boundary for surface waters or 5% of the Good / Fail indicative quality boundary for groundwaters. Therefore there is no risk of deterioration in the indicative quality of the water bodies, or of preventing the achievement of WFD objectives.

In light of the EAM assessment which has determined that there is no risk of deterioration in the orthophosphate indicative quality of the water bodies that support the structure and function of the SPA; the additional loading from the orthophosphate dosing will not result in likely significantly effects to the favourable conservation status of its SCIs, either in terms of individual bird species or wetland habitats.

6.2.4 Courtmacsherry Bay SPA 004219

The Courtmacsherry Bay SPA is located Co. Cork about 12km south of Bandon. The site is largely estuarine in nature and consists of the drowned valley of the Argideen River which is now filled with sediments, resulting in extensive mudflats and areas of saltmarsh. The site is a SPA under the E.U. Birds Directive, of special conservation interest for the following species: Great Northern Diver, Shelduck, Wigeon, Red-breasted Merganser, Golden Plover, Lapwing, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Black-headed Gull and Common Gull. The E.U. Birds Directive pays particular attention to wetlands, and as these form part of this SPA, the site and its associated waterbirds are of special conservation interest for Wetland & Waterbirds.

According to the CO supporting document for Courtmacsherry SPA (NPWS, 2014)[31] the pressures upon the system are listed as point source pollutants (WWTP), combined sewer overflows and treatment plant overflows. One of the major pressures upon water quality of Courtmacsherry Estuary is inadequate waste water treatment. A new sewerage scheme has been proposed for Timoleague and Courtmacsherry. The proposed route of the sewerage scheme will follow the R601 road linking Timoleague and Courtmacsherry. The sewerage system of Timoleague will be upgraded and a pumping station built in the village. This will link to sewerage pipes installed along the roadway to Courtmacsherry, where a WWTP will be installed. Currently, untreated waste is released from four point sources in Timoleague and waste is discharged from a septic tank overflow in Courtmacsherry on the receding tide.

Improvements in WWTP treatment are aimed at meeting objectives of the Urban Waste Water Treatment Regulations and the Water Framework Directive (2000/20/EC as transposed by the European Communities (Water Policy) (Amendment) Regulations, 2010)). However, a reduction in organic and nutrient loading to an estuary may have various consequences for the ecology of the estuarine system. For example, there could be a reduction in the abundance of benthic invertebrate prey species particularly those invertebrates that thrive (proliferate) in organically enriched sediments. This could therefore have subsequent knock-on effects upon waterbird foraging distribution, prey intake rates, and ultimately upon survival and fitness.

Given that sustained high levels of macroalgal growth is linked to organic enrichment, there is a potential for a reduction in macroalgal abundance as a result of improvements to sewage discharges (also refer to previous section). While exerting many influences upon the estuarine system, algal mats can have both negative and positive effects upon waterbird foraging ecology. Some waterbird species avoid them or may be negatively affected by lowered invertebrate abundances beneath them while on the other hand, herbivores such as Light-bellied Brent Geese and Wigeon benefit from the algae being a source of food. Although such factors are complex and may operate over the long-term, it is advised that they be considered in future assessments of waterbird distribution patterns at this site (NPWS, 2014).

Of the 12 SCIs in Courtmacsherry SPA, all are considered nutrient sensitive (see **Appendix B**). The SSCOs for Courtmacsherry Bay SPA (NPWS, 2014[31]) list targets for each species, specifically:

- Population trend: long term population trends should be stable or increasing; and
- Distribution: there should be no significant decrease in the range, timing or intensity of use of areas by the listed species, other than that occurring from natural patterns of variation.

There is also a target for the wetland habitat that supports the SPA in which the permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 1,299 hectares, other than that occurring from natural patterns of variation.

In relation to protected water-dependent habitats and species under the Birds and Habitats Directive, the river basin management planning process contributes towards achieving water conditions that support Favourable Conservation Status. In preparing the draft RBMP (2018-2021) (DHPLG, 2018)[30] the risk assessment carried out by the EPA for these water dependent European Site protected areas has focussed on looking at the risks to the water standards/objectives established for the purpose of supporting Good Ecological Status (GES). GES, which is the default objective of the WFD, is considered

[31] NPWS 2014 Courtmacsherry Bay SPA 004219 Conservation Objectives

adequate for supporting many water dependent European Site protected areas where site specific environmental supporting conditions have not been defined within SSCOs by the NPWS. This is the case for SPA birds and wetlands.

Table 5-1 identifies the surface and groundwater bodies which are hydrologically or hydrogeologically connected to Courtmacsherry Bay SPA and will receive inputs from the proposed orthophosphate dosing at Innishannon WTP:

- The river water bodies hydrologically connected include: Artiteige_010 IE_SW_20A300900, Kilbrittain_020 IE_SW_20K010300, Ballinspittle_010 IE_SW_20B090100 and White Strand_010 IE_SW_20W050990;
- The groundwater body hydrogeologically connected is Skibbereen-Clonakilty IE_SW_G_085; and
- The coastal water body hydrologically connected is: Courtmacsherry Bay IE_SW_090_0000.

The EAM has assessed the potential for impact on orthophosphate indicative quality and has based this assessment on a conservative basis using all available flows data. Full details of the assessment results are provided in **Appendix C** and discussed above in **Section 5**.

The post-dosing increase in concentration in the river water bodies Artiteige_010 IE_SW_20A300900 is 0.0002 mg/l, Kilbrittain_020 IE_SW_20K010300 0.0001 mg/l, Ballinspittle_010 IE_SW_20B090100 0.0005 mg/l and in White Strand_010 IE_SW_20W050990 is 0.0001 mg/l. In each case the modelled increase in concentration does not exceed 5% of the Good / High indicative quality boundary (0.0125 mg/l) and therefore poses no risk of deterioration in the indicative quality of the river water bodies following dosing at Innishannon WTP.

The EAM estimates that the increase in concentration in the groundwater body Skibbereen-Clonakilty IE_SW_G_085 due to the dosing at Innishannon WTP will be 0.0000 mg/l, which does not exceed 5% of the Good / High indicative quality boundary (0.0175 mg/l). Therefore, there is no risk of deterioration in the indicative quality of the groundwater body or of preventing the achievement of WFD objectives.

Similarly, the EAM estimates that the increase in concentration in the coastal water body Courtmacsherry Bay IE_SW_090_0000 due to the dosing at Innishannon WTP will be 0.0000 mg/l, which does not exceed 5% of the Good / High indicative quality boundary (0.0125 mg/l). Therefore, there is no risk of deterioration in the indicative quality of the coastal water body or of preventing the achievement of WFD objectives.

In light of the EAM assessment which has determined that there is no risk of deterioration in the orthophosphate indicative quality of the water bodies that support the structure and function of the SPA; the additional loading from the orthophosphate dosing will not result in likely significant effects on the favourable conservation status of its SCIs, either in terms of individual bird species or wetland habitats.

6.3 ASSESSMENT OF IN-COMBINATION EFFECTS WITH OTHER PLANS OR PROJECTS

In order to ensure all potential impacts upon European Sites within the project's ZoI were considered, including those direct and indirect impacts that are a result of cumulative or in-combination impacts, the following steps were completed:

1. Identify projects/ plans which might act in combination: identify all possible sources of effects from the project or plan under consideration, together with all other sources in the existing environment and any other effects likely to arise from other proposed projects or plans;
2. Impacts identification: identify the types of impacts that are likely to affect aspects of the structure and functions of the site vulnerable to change;
3. Define the boundaries for assessment: define boundaries for examination of cumulative effects; these will be different for different types of impact and may include remote locations;
4. Pathway identification: identify potential cumulative pathways (e.g., via water, air, etc.; accumulations of effects in time or space);
5. Prediction: prediction of magnitude/ extent of identified likely cumulative effects, and
6. Assessment: comment on whether or not the potential cumulative impacts are likely to be significant.

A search of Cork County Council's planning enquiry system was conducted for developments that may have in-combination effects on European Sites with the ZoI. Plans and projects relevant to the area were searched in order to identify any elements of the plans and projects that may act cumulatively or in-combination with the proposed development.

Based on this search and the Project Teams knowledge of the study area a list of those projects and plans which may potentially contribute to cumulative or in-combination impacts with the proposed project was generated as listed in **Table 6-1** below.

Table 6-1: In-Combination Impacts with Other Plans, Programmes and Policies

Plan / Programme/Policy	Key Types of Impacts	Potential for In-combination Effects and Mitigation
Cork County Development Plan 2022-2028[32] The plan outlines under WM 11-8: Water Supply, the following objectives: a) Support the prioritisation of the supply of adequate sustainable drinking water for the resident population and invest and expand the water supply in line with future population targets. b) Ensure that all drinking water in the County complies with the European Union Drinking Water Directive 98/83/EC and that all surface water and groundwater supplies comply with the requirements of Surface Water Directive 75/440/EC and Groundwater Directive 80/68/EEC. c) Conserve sources of drinking water and minimise threats to either the quality or quantity of drinking water reserves that might result from different forms of development or development activity and other sources of pollution. Conserve sources of drinking water and minimise threats to either the quality or quantity of drinking water reserves that might result from difference forms of development or development activity and other sources of pollution. The plan outlines under WM 11-1: EU Water Framework Directive and the River Basin Management Plan the following objectives: a) Protect and improve the County's water resources and ensure that development permitted meets the requirements of the River Basin Management Plan and does not contravene the objectives of the EU Water Framework Directive. b) Promote compliance with the River Basin Management Plan and associated environmental standards and objectives set out in the European Communities (Environmental Objectives) Surface Water Regulations, 2009 and the European Communities (Environmental Objectives) Groundwater Regulations, 2010, to prevent deterioration; restore good status; reduce chemical pollution, and achieve water related protected areas objectives in rivers, lakes, groundwater, estuaries and coastal waters (as applicable). The plan outlines under WM 11-2: Surface Water Protection	▪ N/A	The County Development Plan emphasis the objectives for water services in the county which include the enhancement and improved quality of the service to its consumers. The plan also outlines the importance of compliance with the South Western River Basin Management Plan (now replaced by the Draft RBMP 2018-2021), and emphasises compliance with environmental objectives. There is no potential for cumulative impacts with these plans.

[32] https://www.corkcoco.ie/en/resident/planning-and-development/cork-county-development-plan-2022-2028

Plan / Programme/Policy	Key Types of Impacts	Potential for In-combination Effects and Mitigation
a) Protect and improve the status and quality of all surface waters throughout the County, including transitional and coastal waters.		
River Basin Management Plan For Ireland 2022 – 2027 The Third Cycle Draft River Basin Management Plan 2022-2027 Consultation Report has been published. This report presents a summary of the issues raised in the submissions reviewed from the public consultation on the draft River Basin Management Plan for Ireland 2022-2027. The 3rd cycle of River Basin Management Plan (RBMP) for the period of 2022-2027 is currently being prepared by Department of Housing, Local Government and Heritage (DHLGH) in line with the EU Water Framework Directive (WFD) (2000/60/EC). The document (Chapter 3) sets out the condition of Waters in Ireland and a summary of status for all monitored waters in the 2013 – 2018 period, including a description of the changes since 2007 – 2009 and 2010-2015. A large number of river waterbodies are still declining and unless this is addressed, sustained and progressive improvements in water quality will be difficult to achieve. Overall, 53% of surface waters are in good or high ecological status while the remaining 47% are in unsatisfactory ecological status. For groundwater bodies, 92% are in good chemical and quantitative status. Chapter 3 of the RBMP presents results of the catchment characterisation process, which identifies the significant pressures on each water body that is *At Risk* of not meeting the environmental objectives of the WFD. Importantly, the assessment includes a review of trends over time to see if conditions were likely to remain stable, improve or deteriorate by 2027. This work was presented in the RBMP for 4,842 water bodies nationally. 1,603 water bodies were classed *At Risk* or 33%. An assessment of significant environmental pressures found that agriculture was the most significant pressure in 1,000 water bodies that are *At Risk*. Urban waste water, hydromorphology and forestry were also significant pressures amongst others.	▪ N/A	The objectives of the RBMP are to • Prevent deterioration; • Restore good status; • Reduce chemical pollution; and • Achieve water related protected areas objectives The implementation of the RBMP seeks compliance with the environmental objectives set under the plan, which will be documented for each water body. This includes compliance with the European Communities (Surface Waters) Regulations S.I. No. 272 of 2009 (as amended). The implementation of this plan will have a positive impact on biodiversity and the Project will not affect the achievement of the RBMP objectives given the detailed assessment of the effects of dosing on water body environmental objectives under the EAM.
Catchment based Flood Risk Assessment and Management (CFRAM) Programme, under the Floods Directive The Office of Public Works (OPW) is responsible for the implementation of the Floods Directive 2007/60/EC which is being carried out through a Catchment based Flood Risk Assessment and Management (CFRAM) Programme. As part of the directive Ireland is required to undertake a Preliminary Flood Risk Assessment, to	▪ Habitat loss or destruction; ▪ Habitat fragmentation or degradation;	CFRAM Studies and their product Flood Risk Management Plans, will each undergo AA. Any future flood plans will have to take into account the design and implementation of water management infrastructure as it has the potential to impact on hydromorphology and potentially on the ecological status and favourable conservation status of

Plan / Programme/Policy	Key Types of Impacts	Potential for In-combination Effects and Mitigation
identify areas of existing or potentially significant future flood risk and to prepare flood hazard and risk maps for these areas. Following this, flood risk management plans are developed for these areas setting objectives for managing the flood risk and setting out a prioritised set of measures to achieve the objectives. The CFRAM programme is currently being rolled out and Draft Flood Risk Management Plans have been prepared. These plans have been subject AA.	▪ Alterations to water quality and/or water movement; ▪ Disturbance; ▪ In-combination impacts within the same scheme.	water bodies. The establishment of how flooding may be contributing to deterioration in water quality in areas where other relevant pressures are absent is a significant consideration in terms of achieving the objectives of the WFD. The AA of the plans will need to consider the potential for impacts from hard engineering solutions and how they might affect hydrological connectivity and hydromorphological supporting conditions for protected habitats and species. There is no potential for cumulative impacts with the CFRAMS programme as no infrastructure is proposed as part of this project.
Foodwise 2025 Foodwise 2025 strategy identifies significant growth opportunities across all subsectors of the Irish agri-food industry. Growth Projection includes increasing the value added in the agri-food, fisheries and wood products sector by 70% to in excess of €13 billion.	▪ Land use change or intensification; ▪ Water pollution; ▪ Nitrogen deposition; ▪ Disturbance to habitats / species.	Foodwise 2025 was subject to its own AA[33]. Growth is to be achieved through sustainable intensification to maximise production efficiency whilst minimising the effects on the environment however there is increased risk of nutrient discharge to receiving waters and in turn a potential risk to biodiversity and Europe Sites if not controlled. With the required mitigation in the Food Wise Plan, no significant in-combination impacts are predicted. Mitigation measures included cross compliance with 13 Statutory Management Requirements, EIA Agricultural Regulations 2011, GLAS, and AA Screening of licencing and permitting in the forestry and seafood sectors.
Rural Development Programme 2014 – 2020 The agricultural sector is actively enhancing competitiveness whilst trying to achieve more sustainable management of natural resources. The common set of	▪ Overgrazing; ▪ Land use change or ▪ intensification;	The RDP for 2014 – 2020 has been subject to SEA[34], and AA[35]. The AA assessed the potential for impacts from the RDP measures e.g. for the GLAS scheme to result in

[33] http://www.agriculture.gov.ie/media/migration/foodindustrydevelopmenttrademarkets/agri-foodandtheeconomy/foodwise2025/environmentalanalysis/AgriFoodStrategy2025NISDRAFT300615.pdf
[34] https://www.agriculture.gov.ie/media/migration/ruralenvironment/ruraldevelopment/ruraldevelopmentprogramme2014-2020/StrategEnvironmAssessSumState090615.pdf
[35] https://www.agriculture.gov.ie/media/migration/agarchive/ruralenvironment/preparatoryworkfortherdp2014-2020/RDP20142020DraftAppropriateAssessmentReport160514.pdf

Plan / Programme/Policy	Key Types of Impacts	Potential for In-combination Effects and Mitigation
objectives, principles and rules through which the European Union co-ordinates support for European agriculture is outlined in the Rural Development Programme (RDP) 2014-2020 under the Common Agricultural Policy. The focus of the programme is to assist with the sustainable development of rural communities and while improvements are sought in relation to water management. Within the RDP are two targeted agri-environment schemes; Green Low Carbon Agri-Environment Scheme (GLAS) and Targeted Agriculture Modernisation Scheme (TAMS). They provide the role of a supportive measure to improve water quality and thus provide direct benefits in achieving the measures within the RBMP. The achievement of the objectives outlined within GLAS, to improve water quality, mitigate against climate change and promote biodiversity will be of direct positive benefit in achieving the measures within the RBMP and the goals of the Natura Directives. The scheme has an expected participation for 2014-2020 of 50,000 farmers which have to engage in specific training and tasks in order to receive full payment. Farmers within the scheme must have a nutrient management plan which is a strategy for maximising the return from on and off-farm chemical and organic fertilizer resources. This has a direct positive contribution towards protecting water bodies from pollution through limiting the amount of fertiliser that is placed on the land. The scheme prioritises farms in vulnerable catchments with 'high status' water bodies and also focuses on educating farmers on best practices to try and improve efficiency along with environmental outcomes. The TAMS scheme is open to all farmers and is focused on supporting productive investment for modernisation. This financial grant for farmers is focused on the pig and poultry sectors, dairy equipment and the storage of slurry and other farmyard manures. Within the TAMS scheme are two further schemes; the Animal Welfare, Safety and Nutrient Storage Scheme and the Low Emission Slurry Spreading Scheme. Both schemes are focused on productivity for farmers but have the ability to contribute towards a reduction in point and diffuse source pollution through improved nutrient management.	▪ Water pollution; ▪ Nitrogen deposition; ▪ Disturbance to habitats / species.	inappropriate management prescriptions; minimum stocking rates under the Areas of Natural Constraints measure leading to overgrazing in sensitive habitats with dependent species, and TAMS supporting intensification. Mitigation included project specific AA for individual building, tourism or agricultural reclamation projects, consultations with key stakeholders during detailed measure development, and site-based monitoring of the effects of RDP measures. With such measures in place, it was concluded that there would be no significant in-combination impacts on Natura 2000 sites.
National Nitrates Action Programme Ireland is obliged under the Nitrates Directive 91/676/EEC to prepare a National Nitrates Action Programme which is designed to prevent pollution of surface and ground waters from agricultural sources. This will directly contribute to the improvement of water quality and thus the objectives within the RBMP. Ireland's	▪ Land use change or intensification; ▪ Water pollution; ▪ Nitrogen deposition;	This programme has been subject to a Screening for AA and it concluded that the NAP will not have a significant effect on the Natura 2000 network and a Stage 2 AA was not

Plan / Programme/Policy	Key Types of Impacts	Potential for In-combination Effects and Mitigation
third Nitrates Action Programme came into operation in 2014 and has a timescale up to 2017. The Agricultural Catchments Programme is an ongoing programme that monitors the efficiency of various measures within the nitrate regulations. It is spread across six catchments and encompasses approximately 300 farmers.	▪ Disturbance to habitats / species.	required[36]. It concluded that the NAP was an environmental programme which imposes environmental constraints on all agricultural systems in the state. It therefore benefits Natura 2000 sites and their species. In terms of in-combination effects, it stated that the Food Wise 2025 strategy would have to operate within the constraints of the NAP.
Forest Policy Review: Forests, Products and People – A Renewed Vision (2014) / Forestry Programme 2014 - 2020 Ireland's forestry sector is striving to increase forestry cover and one of the recommended policy actions in the Forest Policy Review: Forests, Products and People – A Renewed Vision (2014) is to increase the level of afforestation annually over time and support afforestation and mobilisation measures under the Forestry Programme 2014-2020. Two key objectives within the Forestry Programme 2014-2020 that will influence the RBMP are to increase Ireland's forest cover to 18% and to establish 10,000 ha of new forests and woodlands per annum. As part of this programme there are a number of schemes that promote sustainable forest management and they include the Afforestation Scheme, the Woodland Improvement Scheme, the Forest Road Scheme and the Native Woodland Conservation Scheme. Under the Native Woodland Conservation Scheme funding is provided to restore existing native woodland which promotes Ireland's native woodland resource and associated biodiversity. Native woodlands provide wider ecosystem functions and services which once restored can contribute to the protection and enhancement of water quality and aquatic habitats. New guidance and plans are also being developed to address forestry adjacent to water bodies, Freshwater Pearl Mussel Plans for 8 priority catchments and a Hen Harrier Threat Response Plan (NPWS). The mitigation measures within these plans will be particularly important in terms of protecting sensitive habitats and species from such forestry increases.	▪ Habitat loss or destruction; ▪ Habitat fragmentation or degradation; ▪ Water quality changes; ▪ Disturbance to species.	Ireland's Forestry Programme 2014 – 2020 has undergone AA[37]. A key recommendation is that all proposed forestry projects should be subject to an assessment of their impacts and the proximity of Natura 2000 habitats and species should be taken into account when proposals are generated. In-combination effects will therefore be assessed at the project specific scale. Adherence to this recommendation will ensure that there is no potential for cumulative impacts with the proposed project.

[36] http://www.housing.gov.ie/sites/default/files/migrated-files/en/Publications/Environment/Water/FileDownLoad,35218,en.PDF
[37] https://www.agriculture.gov.ie/media/migration/forestry/publicconsultation/newforestryprogramme2014-2020/nis/ForestryProgrammeNaturalImpactStatement290914.pdf

Plan / Programme/Policy	Key Types of Impacts	Potential for In-combination Effects and Mitigation
Water Services Strategic Plan (WSSP, 2015) Uisce Éireann has prepared a Water Services Strategic Plan (WSSP, 2015), under Section 33 of the Water Service No. 2 Act of 2013 to address the delivery of strategic objectives which will contribute towards improved water quality and WFD requirements. The WSSP forms the highest tier of asset management plans (Tier 1) which Uisce Éireann prepare and it sets the overarching framework for subsequent detailed implementation plans (Tier 2) and water services projects (Tier 3). The WSSP sets out the challenges we face as a country in relation to the provision of water services and identifies strategic national priorities. It includes Uisce Éireann's short, medium and long term objectives and identifies strategies to achieve these objectives. As such, the plan provides the context for subsequent detailed implementation plans (Tier 2) which will document the approach to be used for key water service areas such as water resource management, wastewater compliance and sludge management. The WSSP also sets out the strategic objectives against which the Uisce Éireann Capital Investment Programme is developed. The current version of the CAP outlines the proposals for capital expenditure in terms of upgrades and new builds within the Uisce Éireann owned asset and this is a significant piece of the puzzle in terms of the expected improvements from the RBMP.	▪ Habitat loss and disturbance from new / upgraded infrastructure; ▪ Species disturbance; ▪ Changes to water quality or quantity; ▪ Nutrient enrichment /eutrophication.	The overarching strategy was subject to AA and highlighted the need for additional plan/project environmental assessments to be carried out at the tier 2 and tier 3 level. Therefore, no likely significant in-combination effects are envisaged.
National Wastewater Sludge Management Plan (2016) The National Wastewater Sludge Management Plan was prepared in 2015, outlining the measures needed to improve the management of wastewater sludge.	▪ Habitat loss and disturbance from new / upgraded infrastructure; ▪ Species disturbance; ▪ Changes to water quality or quantity; ▪ Nutrient enrichment /eutrophication.	The plan was subject to both AA and SEA and includes a number of mitigation measures which were identified in relation to transport of materials, land spreading of sludge and additional education and research requirements. This plan does not specifically address domestic wastewater loads, only those relating to Uisce Éireann facilities. In relation to the plan as it stands, no in-combination effects are expected with the implementation of proposed mitigation measures.
National Water Resources Plan – Framework Plan This Framework will deliver a sustainable water supply on a catchment and water resource zone basis, meeting growth and demand requirements through drought and critical periods. The resources plan takes account of WFD objectives and the programme of measures proposed in the relevant catchments and water resource zones. Specific measures in the plan with relevance to Uisce Éireann include those	▪ Increased abstractions leading to changes / pressure on existing hydrology / hydrogeological regimes.	The plan will seek to develop sustainable water supplies but must consider particularly critical drought periods when assimilation capacity for diffuse runoff may be reduced. The SEA Environmental Report for the Framework Plan has made mitigation recommendations for the

Plan / Programme/Policy	Key Types of Impacts	Potential for In-combination Effects and Mitigation
for urban wastewater and urban runoff and also as part of other measures in relation to the lead in drinking water.		implementation of the Framework Plan which are included in the Environmental Action Plan (EAP), and the EAP will provide a basis for tracking recommendations from the SEA and NIS during the Framework Plan implementation and Regional Plan development. A Monitoring Plan has also been developed which covers the integration of environmental and sustainability considerations throughout implementation of the Framework Plan and the options development methodology and provides a framework for future long-term monitoring. Therefore, no likely significant in-combination effects are envisaged.
Planning Applications There are a number of planning applications pending or recently approved in Cork City. The applications are predominantly for the construction of new infrastructure or renovations to existing infrastructure. In the case of new infrastructure, the applications seek to connect to the city's foul and storm drainage systems.	▪ Habitat loss and disturbance from new / upgraded infrastructure; ▪ Species disturbance; ▪ Changes to water quality or quantity; ▪ Nutrient enrichment /eutrophication.	Adherence to the overarching policies and objectives of the Cork County Development Plan 2014 will ensure that local planning applications and subsequent grant of planning will comply with the requirements of relevant environmental legislation including the WFD and Habitats Directive. Effluent from proposed and new infrastructure connected to the city's foul and storm drainage systems will be treated prior to discharge, negating the potential for cumulative impacts in the receiving environment.
Integrated Pollution Control (IPC) Licensing Cork City, and the surrounding towns (Bandon and Kinsale) are home to many companies with IPC licences. Under the Industrial Emissions Directive 2010/75/EU and Environmental Protection Agency Act, 1992 (as amended) industrial activities (e.g. pharmaceutical) are licenced by the EPA to prevent or reduce emissions to air, water and land, reduce water and use energy/resources efficiently. An IPC licence is a single integrated licence which covers all emissions from the facility and its environmental management. All related operations that the licence holder carries in connection with the activity are controlled by this licence.	▪ Changes to water quality or quantity; ▪ Nutrient enrichment /eutrophication.	The EPA is responsible for monitoring emissions and dealing with any infringements on IPC licences. All emissions must be within set limits which must not be contravened. Limits are set for phosphorus where relevant. Compliance with the limits set for phosphorus will ensure that there will be no significant in-combination impacts on Natura 2000 sites.

7 SCREENING CONCLUSION STATEMENT

This Screening to inform the AA process has considered whether the proposed construction works and operational orthophosphate dosing at the at the Innishannon WTP, within the Innishannon WSZ, in combination with other plans or projects, is likely to have a significant effect on European Sites.

The appraisal undertaken in this Screening assessment has been informed by an EAM (see **Appendix C**) with reference to qualifying interests/special conservation interests of the European Sites potentially affected by the proposed project, in order to provide a scientific basis for the evaluations.

During the construction phase of the corrective water treatment works at Innishannon WTP potential for direct, indirect and cumulative impacts affecting European Sites within the ZoI have been assessed. There will be no significant direct, indirect or cumulative impacts that will result in likely significant effects to the qualifying interests/special conservation interests of the European Sites within the ZoI.

During the operational phase, the potential for direct, indirect and cumulative impacts affecting European Sites within the ZoI including; Great Island Channel SAC, Cork Harbour SPA, Courtmacsherry Estuary Sac and Courtmacsherry Bay SPA have been assessed. Due to the low orthophosphate inputs following dosing at Innishannon WTP and no risk of deterioration in the status of the receiving water bodies, there will be no significant direct, indirect or cumulative impacts that will result in likely significant effects to the qualifying interests/special conservation interests of the European Sites within the ZoI. This is concluded with regard to the range, population densities and overall conservation status of the habitats and species for which these sites are designated (i.e. Conservation Objectives).

The screening has been carried out on the basis of the information presented in the Project Description. It has been concluded that the project it is not connected or necessary to the management of any European Site. It can be concluded on the basis of objective scientific information and in view of best scientific knowledge, the proposed orthophosphate dosing and associated construction works at the Innishannon WTP; individually or in combination with other plans or projects, will not have a significant effect on any European Sites. Therefore, AA is not required.

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APPENDIX A

European Sites- Conservation Objectives

A full listing of the COs and QIs/ SCIs for each European Site, as well as the attributes and targets to maintain or restore the QIs/ SCIs to a favourable conservation condition, are available from the NPWS website www.npws.ie. Links to the COs for the European Sites relevant to this AA Screening are provided below.

Site Name (Code)	Conservation Objectives Source
Great Island Channel SAC (001058)	https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO001058.pdf
Cork Harbour SPA (004030)	https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004030.pdf
Courtmacsherry Estuary SAC (001230)	https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO001230.pdf
Courtmacsherry Bay SPA (004219)	https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004219.pdf

APPENDIX B

Nutrient Sensitive Qualifying Interests

Water dependant and nutrient sensitive SAC species

Code	Qualifying Interest	Water dependant	Nutrient sensitive
1013	Whorl snail (*Vertigo geyeri*)	Yes	Yes
1014	Whorl snail (*Vertigo angustior*)	Yes	Yes
1016	Whorl snail (*Vertigo moulinsiana*)	Yes	Yes
1024	Kerry Slug (*Geomalacus maculosus*)	No	Yes
1029	Freshwater Pearl mussel (*Margaritifera margaritifera*)	Yes	Yes
1065	Marsh Fritillary (*Euphydryas aurinia*)	Yes	No
1092	White-clawed crayfish (*Austropotamobius pallipes*)	Yes	Yes
1095	Sea lamprey (*Petromyzon marinus*)	Yes	Yes
1096	Brook lamprey (*Lampetra planeri*)	Yes	Yes
1099	River lamprey (*Lampetra fluviatilis*)	Yes	Yes
1103	Twaite shad (*Alosa fallax*)	Yes	Yes
1106	Atlantic salmon (*Salmo salar* (freshwater only))	Yes	Yes
1303	Lesser Horseshoe bat (*Rhinolophus hipposideros*)	No	Yes
1349	Bottlenose dolphin (*Tursiops truncatus*)	Yes	Yes
1351	Harbour porpoise (*Phocoena phocoena*)	Yes	Yes
1355	Otter (*Lutra lutra*)	Yes	Yes
1364	Grey seal (*Halichoerus grypus*)	Yes	Yes
1365	Common seal (*Phoca vitulina*)	Yes	Yes
1393	Shining sickle moss (*Drepanocladus vernicosus*)	Yes	No
1395	Petalwort (*Petalophyllum ralfsii*)	Yes	Yes
1421	Killarney fern (*Trichomanes speciosum*)	Yes	Yes
1528	Marsh saxifraga (*Saxifraga hirculus*)	Yes	Yes
1833	Slender naiad (*Najas flexilis*)	Yes	Yes
1990	Nore freshwater pearl mussel (*Margaritifera durrovensis*)	Yes	Yes
5046	Killarney shad (*Alosa fallax killarnensis*)	Yes	Yes

Water dependant and nutrient sensitive SAC habitats

Code	Qualifying Interest	Water dependant	GWDTE	Nutrient sensitive
1110	Sandbanks which are slightly covered by sea water all the time	Yes		Yes
1130	Estuaries	Yes		Yes
1140	Mudflats and sandflats not covered by seawater at low tide	Yes		Yes
1150	Coastal lagoons	Yes		Yes
1160	Large shallow inlets and bays	Yes		Yes
1170	Reefs	Yes		Yes
1180	Submarine structures made by leaking gases	No		No
1210	Annual vegetation of drift lines	Yes		Yes
1220	Perennial vegetation of stony banks	Yes		No
1230	Vegetated sea cliffs of the Atlantic and Baltic coasts	Yes		Yes
1310	Salicornia and other annuals colonising mud and sand	Yes		Yes
1320	Spartina swards (*Spartinion maritimae*)	No		No
1330	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	Yes	Yes	Yes
1410	Mediterranean salt meadows (*Juncetalia maritimi*)	Yes	Yes	Yes
1420	Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*)	Yes		Yes
2110	Embryonic shifting dunes	Yes		Yes
2120	Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)	Yes		Yes
2130	Fixed coastal dunes with herbaceous vegetation (grey dunes)	Yes		Yes
2140	Decalcified fixed dunes with Empetrum nigrum	Yes		Yes
2150	Atlantic decalcified fixed dunes (*Calluno-Ulicetea*)	Yes		Yes
2170	Dunes with Salix repens ssp. argentea (*Salicion arenariae*)	Yes	Yes	Yes
2190	Humid dune slacks	Yes	Yes	Yes
21A0	Machairs (* in Ireland)	Yes	Yes	Yes
3110	Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*)	Yes		Yes
3130	Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or Isoeto-Nanojuncetea	Yes		Yes
3140	Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.	Yes		Yes
3150	Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation	Yes		Yes
3160	Natural dystrophic lakes and ponds	Yes		Yes
3180	Turloughs	Yes	Yes	Yes

Code	Qualifying Interest	Water dependant	GWDTE	Nutrient sensitive
3260	Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	Yes		Yes
3270	Rivers with muddy banks with *Chenopodion rubri* p.p. and Bidention p.p. vegetation	Yes	Yes	Yes
4010	Northern Atlantic wet heaths with Erica tetralix (Flushes only)	Yes	Yes	Yes
4030	European dry heaths	No		Yes
4060	Alpine and Boreal heaths	No		No
5130	Juniperus communis formations on heaths or calcareous grasslands	No		No
6130	Calaminarian grasslands of the *Violetalia calaminariae*	No (flood risk)*		Yes
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites)	No (flood risk)*		Yes
6230	Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe)	No		No
6410	Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)	Yes	Yes	Yes
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	Yes	Yes	Yes
6510	Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*)	No (flood risk)*		Yes
7110	Active raised bogs	Yes	Yes	Yes
7120	Degraded raised bogs still capable of natural regeneration	Yes	Yes	Yes
7130	Blanket bogs (* if active bog)	Yes	Yes	Yes
7140	Transition mires and quaking bogs	Yes	Yes	Yes
7150	Depressions on peat substrates of the Rhynchosporion	Yes	Yes	Yes
7210	Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*	Yes	Yes	Yes
7220	Petrifying springs with tufa formation (*Cratoneurion*)	Yes	Yes	Yes
7230	Alkaline fens	Yes	Yes	Yes
8110	Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani*)	No		No
8120	Calcareous and calcshist screes of the montane to alpine levels (*Thlaspietea rotundifolii*)	No		No
8210	Calcareous rocky slopes with chasmophytic vegetation	No		No
8220	Siliceous rocky slopes with chasmophytic vegetation	No		No
8240	Limestone pavements	No		Yes

Code	Qualifying Interest	Water dependant	GWDTE	Nutrient sensitive
8310	Caves not open to the public	Yes	Yes	Yes
8330	Submerged or partially submerged sea caves	Yes		Yes
91A0	Old sessile oak woods with Ilex and Blechnum in the British Isles	No		Yes
91D0	Bog woodland	Yes	Yes	Yes
91E0	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)	Yes	Yes	Yes
91J0	Taxus baccata woods of the British Isles	No		No

*While this habitat is determined to be non-water dependent, it is incuded in the assessment in terms of flood risk only

Water dependant and nutrient sensitive SPA birds

Code	Species of special conservation interest	Water dependant	Nutrient sensitive
A001	Red-throated Diver (*Gavia stellata*)	Yes	Yes
A003	Great Northern Diver (*Gavia immer*)	Yes	Yes
A004	Little Grebe (*Tachybaptus ruficollis*)	Yes	Yes
A005	Great Crested Grebe (*Podiceps cristatus*)	Yes	Yes
A009	Fulmar (*Fulmarus glacialis*)	Yes	Yes
A013	Manx Shearwater (*Puffinus puffinus*)	Yes	Yes
A014	Storm Petrel (*Hydrobates pelagicus*)	Yes	Yes
A015	Leach's Storm-petrel (*Oceanodroma leucorhoa*)	Yes	Yes
A016	Gannet (*Morus bassanus*)	Yes	Yes
A017	Cormorant (*Phalacrocorax carbo*)	Yes	Yes
A018	Shag (*Phalacrocorax aristotelis*)	Yes	Yes
A028	Grey Heron (*Ardea cinerea*)	Yes	Yes
A037	Bewick's Swan (*Cygnus columbianus bewickii*)	Yes	Yes
A038	Whooper Swan (*Cygnus cygnus*)	Yes	Yes
A043	Greylag Goose (*Anser anser*)	Yes	Yes
A045	Barnacle Goose (*Branta leucopsis*)	Yes	Yes
A046	Light-bellied Brent Goose (*Branta bernicla hrota*)	Yes	Yes
A048	Shelduck (*Tadorna tadorna*)	Yes	Yes
A050	Wigeon (*Anas penelope*)	Yes	Yes
A051	Gadwall (*Anas strepera*)	Yes	Yes
A052	Teal (*Anas crecca*)	Yes	Yes
A053	Mallard (*Anas platyrhynchos*)	Yes	Yes
A054	Pintail (*Anas acuta*)	Yes	Yes
A056	Shoveler (*Anas clypeata*)	Yes	Yes
A059	Pochard (*Aythya ferina*)	Yes	Yes
A061	Tufted Duck (*Aythya fuligula*)	Yes	Yes
A062	Scaup (*Aythya marila*)	Yes	Yes
A063	Eider (*Somateria mollissima*)	Yes	Yes
A065	Common Scoter (*Melanitta n*igra)	Yes	Yes
A067	Goldeneye (*Bucephala clangula*)	Yes	Yes
A069	Red-breasted Merganser (*Mergus serrator*)	Yes	Yes
A082	Hen Harrier (*Circus cyaneus*)	Yes	Yes
A098	Merlin (*Falco columbarius*)	Yes	Yes
A103	Peregrine (*Falco peregrinus*)	Yes	Yes
A122	Corncrake (*Crex crex*)	Yes	Yes
A125	Coot (*Fulica atra*)	Yes	Yes
A130	Oystercatcher (*Haematopus ostralegus*)	Yes	Yes
A137	Ringed Plover (*Charadrius hiaticula*)	Yes	Yes

Code	Species of special conservation interest	Water dependant	Nutrient sensitive
A140	Golden Plover (*Pluvialis apricaria*)	Yes	Yes
A141	Grey Plover (*Pluvialis squatarola*)	Yes	Yes
A142	Lapwing (*Vanellus vanellus*)	Yes	Yes
A143	Knot (*Calidris canutus*)	Yes	Yes
A144	Sanderling (*Calidris alba*)	Yes	Yes
A148	Purple Sandpiper (*Calidris maritima*)	Yes	Yes
A149	Dunlin (*Calidris alpina*) (non-breeding)	Yes	Yes
A156	Black-tailed Godwit (*Limosa limosa*)	Yes	Yes
A157	Bar-tailed Godwit (*Limosa lapponica*)	Yes	Yes
A160	Curlew (*Numenius arquata*)	Yes	Yes
A162	Redshank (*Tringa totanus*)	Yes	Yes
A164	Greenshank (*Tringa nebularia*)	Yes	Yes
A169	Turnstone (*Arenaria interpres*)	Yes	Yes
A179	Black-headed Gull (*Larus ridibundus*)	Yes	Yes
A182	Common Gull (*Larus canus*)	Yes	Yes
A183	Lesser Black-backed Gull (*Larus fuscus*)	Yes	Yes
A184	Herring Gull (*Larus argentatus*)	Yes	Yes
A188	Kittiwake (*Rissa tridactyla*)	Yes	Yes
A191	Sandwich Tern (*Sterna sandvicensis*)	Yes	Yes
A192	Roseate Tern (*Sterna dougallii*)	Yes	Yes
A193	Common Tern (*Sterna hirundo*)	Yes	Yes
A194	Arctic Tern (*Sterna paradisaea*)	Yes	Yes
A195	Little Tern (*Sterna albifrons*)	Yes	Yes
A199	Guillemot (*Uria aalge*)	Yes	Yes
A200	Razorbill (*Alca torda*)	Yes	Yes
A204	Puffin (*Fratercula arctica*)	Yes	Yes
A229	Kingfisher (*Alcedo atthis*)	Yes	Yes
A346	Chough (*Pyrrhocorax pyrrhocorax*)	Yes	Yes
A395	Greenland White-fronted Goose (*Anser albifrons flavirostris*)	Yes	Yes
A466	Dunlin (*Calidris alpina schinzii*) (breeding)	Yes	Yes

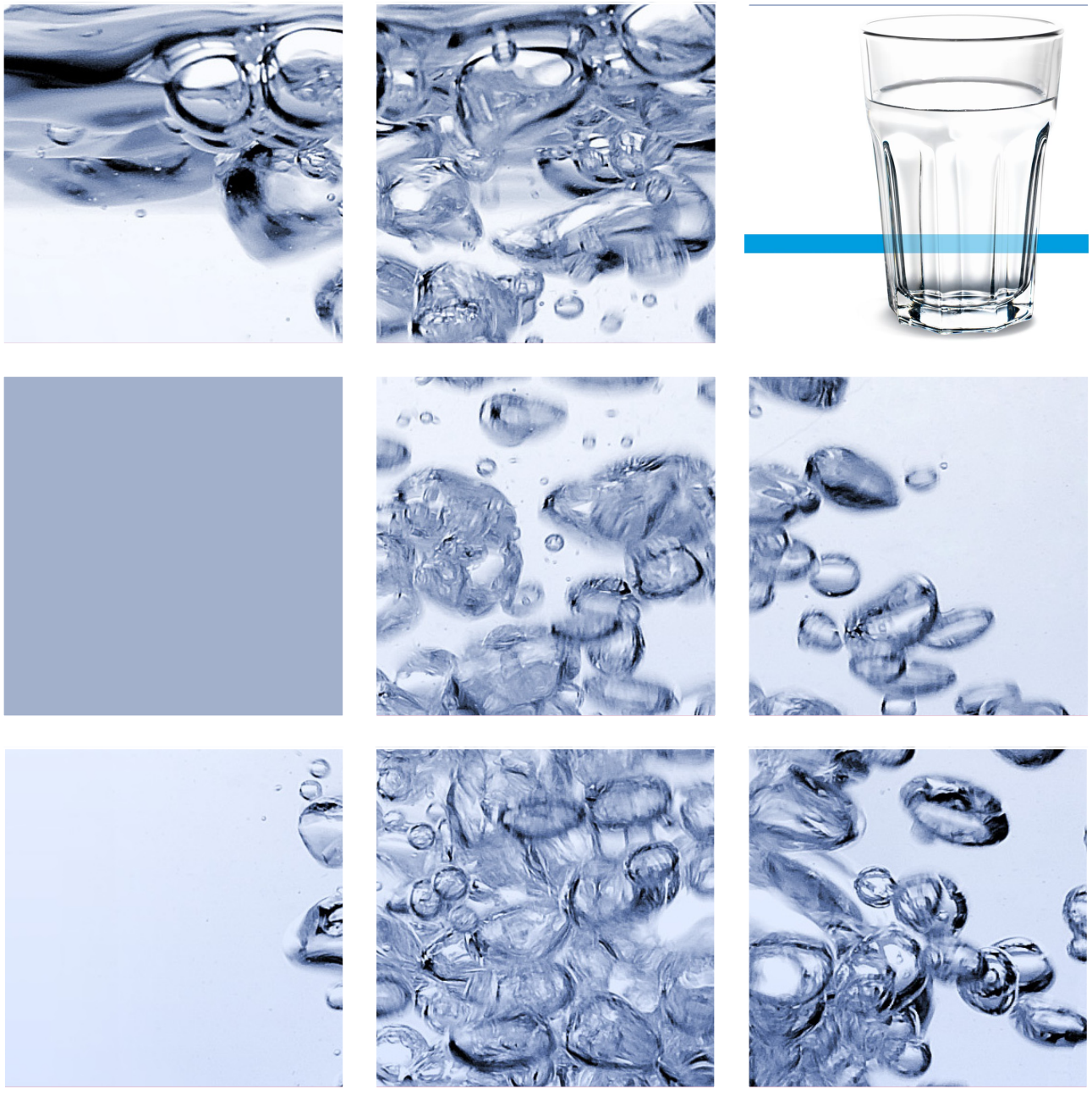
APPENDIX C

EAM Summary Report

Uisce Éireann - Lead in Drinking Water Mitigation Plan

Environmental Assessment Methodology (EAM) Summary Report

030 Innishannon WTP – Zone 2 Innishannon (0500PUB301)



National Lead in Water Mitigation Strategy

Environmental Assessment Methodology Report: 030 Innishannon WTP - Zone 2 Innishannon (0500PUB3501)

Document Control Sheet

Client:	Uisce Éireann
Project Title:	National Lead in Water Mitigation Strategy
Document Title:	Environmental Assessment Methodology Report: 030 Innishannon WTP – Zone 2 Innishannon (0500PUB3501)
Document No:	MDW0766RP_5.1_EAM_030_Innishannon_F06

Text Pages:	13	Appendices:	-

Rev.	Status	Date	Author(s)		Reviewed By		Approved By	
F01	Final	17th Aug 2018	YE		MJM, IP		DC	
F02	Final	7th Sep 2018	YE		MJM, IP		DC	
F03	Final	11th Sep 2018	YE MH		MJM, IP		DC	
F04	Final	21st May 2019	YE		IP		MJM	
F05	Final	13th Aug 2019	IP		MJM		GJG	
F06	Final	28th Mar 2023	YE		MJM		IP	

030 Innishannon WTP – Zone 2 Innishannon (0500PUB3501)

Supporting spreadsheet: 030 Innishannon WTP - Zone2 Innishannon V26

This EAM report should be read in conjunction with the Uisce Éireann Lead in Drinking Water Mitigation Plan – Environmental Assessment Methodology report (MDE1218Rp0005 F02).

Innishannon WTP supplies small towns to the South of Cork city. The distribution input for Zone 2 Innishannon is 5447 m^3/day (74% of which is accounted for, with the remainder assumed to be lost through leakage) serving a population of approximately 26,000. The non-domestic demand is 23% of the distribution input. The area is served by Kinsale (D0132-01), Ringaskiddy (D0436-01), Riverstick (D0433-01), Kilbrittain (D0425-01), Innishannon (D0429-01) and Ballygarvan (D0540-01) WWTPs, which are all licenced in accordance with the requirements of the Wastewater Discharge (Authorisation) Regulations 2007 as amended. The impact of the orthophosphate dosing on the emission limit values and the receiving water body downstream of the point of discharge are assessed. There are smaller agglomerations with a population equivalent of less than 500, i.e., Annaghmore, Ballinspittle/Garretstown, Halfway and Kilmacsimon and the estimated additional load from these plants from the orthophosphate dosing is considered at the water body level via the surface water pathways. There are an estimated 1,763 properties across the WSZ that are serviced by a DWWTS.

This assessment has been undertaken for the WSZ in isolation. However, if corrective water treatment is proposed for WTPs in the same catchment area, the cumulative impact from the combined loads to downstream water bodies are assessed (see Summary, Mitigation, and Tables 5-A and 5-B).

<table>
<tr><td>Water Treatment Plant</td><td colspan="2">Innishannon WTP</td></tr>
<tr><td>Water Supply Zone(s)</td><td colspan="2">Zone2 Innishannon (0500PUB3501)
See Figure 4.1 / 4.2 of the AA Screening for a map of the WSZ and ZoI</td></tr>
<tr><td rowspan="5">Step 1 Appropriate Assessment Screening</td><td colspan="2">European Sites within Zone of Influence</td></tr>
<tr><td colspan="2">SACs</td></tr>
<tr><td>Clonakilty Bay SAC
Lough Hyne Nature Reserve and Environs SAC
Roaringwater Bay And Islands SAC
The Gearagh SAC
Barley Cove To Ballyrisode Point SAC
Great Island Channel SAC</td><td>Kilkeran Lake and Castlefreke Dunes SAC
Courtmacsherry Estuary SAC
Bandon River SAC
Myross Wood SAC
Castletownshend SAC
Ardmore Head SAC</td></tr>
<tr><td colspan="2">SPA</td></tr>
<tr><td>Old Head of Kinsale SPA
Cork Harbour SPA
Clonakilty Bay SPA
The Gearagh SPA
Sovereign Islands SPA</td><td>Sheep's Head to Toe Head SPA
Galley Head to Duneen Point SPA
Seven Heads SPA
Courtmacsherry Bay SPA</td></tr>
<tr><td colspan="2">Appropriate Assessment Required – see AA screening report for details</td></tr>
</table>

Step 2 – Direct Inputs to Surface Water

Table 1: Increased loading/concentration at Agglomerations within the WSZ due to Orthophosphate Dosing – Dosing rate = 0.6 mg/l

Agglom. and discharge type	ELV (ortho-P unless otherwise stated) from WWDL (mg/l)	Scenario	TP Load kg/yr	Ortho P concentration mg/l *TP – Ortho P Conversion factor varied for sensitivity analysis (40%, 50%, 68%)*		
				0.5	***0.4***	***0.68***
Kinsale Primary Discharge	**1**	**Existing**	657	0.26	0.21	0.35
		Post Dosing	657	0.26	0.21	0.35
Kinsale SWOs (7 no.)	**n/a**	**Existing**	191.5	2.56	2.05	3.49
		Post Dosing	202.7	2.71	2.17	3.69
Ringaskiddy Primary Discharge	**n/a**	**Existing**	10499	3.74	2.99	5.08
		Post Dosing	10628	3.78	3.03	5.14
Ringaskiddy SWOs (6 no.)	**n/a**	**Existing**	654.8	8.00	6.40	10.88
		Post Dosing	662.8	8.10	6.48	11.01
Kilbrittan Primary Discharge	**1**	**Existing**	21	0.28	0.23	0.39
		Post Dosing	27	0.37	0.29	0.50
Kilbrittain SWOs (1 no.)	**n/a**	**Existing**	6.0	2.84	2.27	3.86
		Post Dosing	6.2	2.92	2.34	3.98
Innishannon Primary Discharge	**2**	**Existing**	414	3.00	2.40	4.08
		Post Dosing	425	3.08	2.46	4.19
Riverstick Primary Discharge	**0.75**	**Existing**	48	0.46	0.37	0.62
		Post Dosing	48	0.46	0.37	0.62
Riverstick SWOs (1 no.)	**n/a**	**Existing**	14.1	4.57	3.65	6.21
		Post Dosing	14.3	4.65	3.72	6.32
Ballygarvan Primary Discharge	**3**	**Existing**	217	2.09	1.68	2.85
		Post Dosing	217	2.09	1.68	2.85

The effluent concentrations are modelled to be compliant with ELVs in all WWTPs except Innishannon. Operational issues in Kinsale (Shock load), Kilbrittain (Inadequate operation procedures) and Innishannon (WWTP upgrade required to meet ELV) resulted in a number of non-compliances in the monitored effluent quality.

As Kinsale, Kilbrittain and Riverstick WTPs have chemical dosing for nutrient removal, the EAM assumes that the additional P loading to the plant can be dealt with and managed within the treatment process therefore there is no impact on the existing effluent quality. *See main text regarding Kilbrittain.*

Step 3 – Potential impact of Direct Inputs on Receiving Water Bodies

Table 2: Mass balance assessment based on 0.6 mg/l dosing using available background concentrations and mean flow and tidal flow information

Agglom.	RWB Name / Code for Primary Discharge	Background conc. (mg/l) (annual mean from AER u/s monitoring point)	Modelled conc. existing (mg/l)	Modelled conc. Post Dosing (mg/l)	% Inc
Kinsale	Lower Bandon Estuary / IE_SW_080_0100	0.034	0.0342	0.0342	0.01
Ringaskiddy	Cork Harbour IE_SW_060_0000	0.0275	0.0278	0.0278	0.02
Kilbrittain	KILBRITTAIN_020 IE_SW_20K010300	0.0280	0.0287	0.0288	0.59
Innishannon	Upper Bandon Estuary / IE_SW_080_0300	0.031	0.0313	0.0313	0.03
Riverstick	STICK_010 / IE_SW_20S030800	0.0225	0.0252	0.0252	0.05
Ballygarvan	OWENBOY (CORK)_030 IE_SW_19O011000	0.0211	0.0226	0.0226	0.00

Surface Assessment

ELVs have been set in the WWDLs for Ballygarvan (D0540-01), Riverstick (D0433-01), Kinsale (D0132-01), Innishannon (D0429-01) and Kilbrittain (D0425-01).

Tertiary treatment, i.e. nutrient removal, at Kinsale, Kilbrittain, Riverstick and Ballygarvan WWTPs is assumed to remove any additional orthophosphate load to the WWTP during the treatment process. This is based on the assumption that there is adequate capacity in the chemical dosing system to effectively manage the removal of the additional phosphorus without affecting the performance of the treatment process at the WWTP or the quality of the effluent discharged under the current operating regime.

The ELV non-compliances reported in the 2021 AERs for Kinsale was due to a shock load and no further exceedances were reported in 2022.

Kilbrittain WWTP reported non-compliances due to inadequate operation procedures in both 2021 and 2022. However as is outlined in the 2022 AER in terms of OP there is no impact in the downstream ambient monitoring point. If Kilbrittain WWTP is not compliant with its ELVs, it is not possible to assume complete removal of the load. Table 1 shows the results after modelling all the load due to dosing to pass through the plant. Table 2 shows that the impact is not significant and at the waterbody level, the water body will continue to pass (Table 4A).

	The modelled effluent concentration for Innishannon are higher than the ELV of 2 mg/l using Primary treatment. The most recent AER for Innishannon WWTP is from 2021, where non-compliances for the orthophosphate ELV are reported. However, an upgrade of the plant took place in 2022, designed to enable the plant to meet its ELV. Ballygarvan and Ringaskiddy do not have nutrient removal but the mass balance assessment shows they are having an insignificant impact on the receiving waters. The impact due to dosing for all waterbodies from agglomerations is negligible as shown by the mass balance assessment in Table 2.

Step 4 Distributed Inputs to surface water bodies from sub surface pathways	**Subsurface Assessment** The modelled increases in concentrations in the subsurface pathways are insignificant for all river water bodies (less than 0.00125 mg/l, which is 5% of the Good/High boundary for surface water bodies); the highest increase is 0.0005 mg/l, taking place in IE_SW_20K190980 Knocknabohilly_010. The predicted increase in concentration is undetectable (0.0000 mg/l) for all transitional and coastal waterbodies except IE_SW_060_1200 (Owenboy Estuary) where the modelled increase in concentration is 0.0002 mg/l.
Step 5 and 6: Combined Inputs to Groundwater Bodies	**Groundwater Bodies as receptors connected to WSZ** **Table 3: Increased loadings and concentrations in Groundwater bodies (*note where existing monitoring data not available, a surrogate indicative quality is derived from ecological status of the GWB or Ortho P / Ecological status of the Group GWBS, the mid-range of that indicative quality is used as Baseline Concentration)***

EU_CD / NAME	Ortho P Indicative Quality and Trends (distance to threshold) *[Surrogate indicative quality indicated in italic]*	Baseline Ortho P Conc. mg/l *[Surrogate Conc. given in italic]*	75% of status threshold mg/l	Ortho P load to GW due to dosing kg/yr	Potential Increase in Ortho P Conc. due to Dosing mg/l	Potential Baseline for Ortho P Conc. following dosing mg/l	Notes
IE_SW_G_004 Ballinhassig East	Good Upwards Near	0.034	0.026	3.1	0.0000	0.034	MP1
	Good Upwards Far	0.013	0.026			0.013	MP2
	Failing to achieve good Upwards Far	0.051	-			0.051	MP3

		Failing to achieve good Upwards Far	0.037	-			0.037	MP4 *
		Good Upwards Far	0.021	0.026			0.021	MP5 *
		Good Upwards Far	0.015	0.026			0.015	MP6
		Good Upwards Far	0.006	0.026			0.006	MP7 *
		Good Upwards Far	0.023	0.026			0.023	MP8
		Failing to achieve good Upwards Far	0.268	-			0.268	MP9
		Good Upwards Far	0.006	0.026			0.006	MP10
		Good Upwards Near	0.026	0.026			0.026	MP11
		Failing to achieve good None Far	0.188	-			0.188	MP12
		Good Upwards Far	0.012	0.026			0.012	MP13
		Failing to achieve good Downwards Far	0.043	-			0.043	MP14
	IE_SW_G_072 Ringaskiddy	*Good*	*0.018*	*0.026*	*4.4*	*0.0009*	*0.018*	
	IE_SW_G_085 Skibbereen-Clonakilty	*Good*	*0.018*	*0.026*	*0.4*	*0.0000*	*0.018*	
	IE_SW_G_086 Bandon	*Good*	*0.018*	*0.026*	*3.6*	*0.0000*	*0.018*	
	IE_SW_G_087 Brinny Gravels East	*Good*	*0.018*	*0.026*	*0.1*	*0.0000*	*0.018*	
	IE_SW_G_088 Brinny Gravels West	*Good*	*0.018*	*0.026*	*0.0*	*0.0000*	*0.018*	

MP: multiple Monitoring Points given for waterbody
*: Trends are statistically significant

Table 3 shows the increases in concentration for all ground water bodies are insignificant (less than 0.00175, which is 5% of the boundary for Good/Fail indicative quality in ground water bodies), with highest increase as 0.0009mg/l, taking place in IE_SW_G_072, Ringaskiddy.

	For IE_SW_G_004, Ballinhassig East, five of the monitoring points show Ortho P Indicative Quality as "Failing to achieve Good". These monitoring points are all remote from Zone2 Innishannon WSZ. The modelled increase in concentration is undetectable (0.0000 mg/l) and since there is no significant impact due to orthophosphate dosing on any of the overlying surface waterbodies, and they are not failing WFD objectives, this groundwater body is not considered a risk to surface waters.

Step 5 and 6: Combined Inputs to Surface Water Bodies

Combined Assessment

Table 4-A and 4-B gives the loads and modelled concentrations for the combined assessment to rivers and transitional / coastal waterbodies respectively. The increased loads due to orthophosphate dosing are predicted to be insignificant.

The baseline concentration for water bodies IE_SW_19O011000 (OWENBOY (CORK)_030), IE_SW_20S030800 (STICK_010), IE_SW_090_0000 (Courtmacsherry Bay) and IE_SW_050_0000 (Outer Cork Harbour) are above 75% of the Ortho P upper threshold, but the modelled increase in concentration would have a undetectable impact (0.0000 mg/l) and will not result in any further risk to the achievement of the WFD objectives in these water bodies.

Individual monitoring points in IE_SW_19O011000 (OWENBOY (CORK)_030), IE_SW_20S030800 (STICK_010), IE_SW_060_0000 (Cork Harbour) IE_SW_080_0000 (Kinsale Harbour) and IE_SW_050_0000 (Outer Cork Harbour) have statistically significant upward trends, but as the modelled increase in concentration is undetectable (0.0000 mg/l or 0.0002mg/l in the case of OWENBOY (CORK)_030)), there is no impact due to orthophosphate dosing.

Table 4-A: Increased loading and concentrations to River water bodies connected to the WSZs ***(note: where existing monitoring data not available, a surrogate indicative quality is derived from ecological status of the WB or Ortho P / Ecological status of neighbouring WBS, the mid-range of that indicative quality is used as Baseline Concentration)***

EU_CD / NAME River Water Bodies	Ortho P Indicative Quality and Trends (distance to threshold) *[Surrogate indicative quality given in italic]*	Baseline Ortho P Conc. mg/l *[Surrogate Conc. given in italic]*	75% of indicative quality upper threshold mg/l	Cumulative Ortho P load to SW from leakage, DWWTS & Agglomerations kg/yr	Potential increase in Ortho P Conc. using flows (30%ile or gauged) mg/l	Potential Baseline for Ortho P Conc. following dosing mg/l	Notes
IE_SW_19A020300 AUGHNABOY (CORK)_010	Moderate None Far	0.034	0.051	0.5	0.0000	0.034	
IE_SW_19H050470 HILLTOWN_010	*Good*	*0.030*	*0.033*	*2.5*	*0.0001*	*0.030*	
IE_SW_19K620850 KILNAGLERY_010	*Good*	*0.030*	*0.033*	*0.1*	*0.0000*	*0.030*	

	IE_SW_19M300900 MONEYGURNEY_010	*Moderate*	*0.046*	*0.051*	*0.1*	*0.0000*	*0.046*	
	IE_SW_19O010400 OWENBOY (CORK)_010	Poor Upwards Far	0.080	0.087	0.0	0.0000	0.080	
	IE_SW_19O010800 OWENBOY (CORK)_020	Good Downwards Far	0.027	0.033	9.9	0.0002	0.027	‡
	IE_SW_19O011000 OWENBOY (CORK)_030	High Upwards Near	0.021	0.019	14.5	0.0002	0.021	‡ MP1 *
		Good Upwards Far	0.026	0.033			0.026	‡ MP2
	IE_SW_19O011400 OWENBOY (CORK)_040	Good Upwards Far	0.026	0.033	23.0	0.0003	0.026	‡
	IE_SW_20A300900 ARTITEIGE_010	*Good*	*0.030*	*0.033*	*2.0*	*0.0002*	*0.030*	
	IE_SW_20B020900 BANDON_100	Good Downwards Far	0.030	0.033	0.2	0.0000	0.030	MP1
		Good Upwards Far	0.028	0.033			0.028	MP2
	IE_SW_20B090100 BALLINSPITTLE_010	*Moderate*	*0.046*	*0.051*	*10.9*	*0.0005*	*0.046*	‡
	IE_SW_20D600820 DERRYNAGASHA_010	*Good*	*0.030*	*0.033*	*1.3*	*0.0001*	*0.030*	
	IE_SW_20D730990 DROMDOUGH_010	*Good*	*0.030*	*0.033*	*0.0*	*0.0000*	*0.030*	
	IE_SW_20F330850 FARRANAMOY_010	*Good*	*0.030*	*0.033*	*0.8*	*0.0000*	*0.030*	
	IE_SW_20K010300 KILBRITTAIN_020	Moderate Upwards Far	0.042	0.051	5.7	0.0003	0.042	
		Good Upwards Far	0.028	0.033			0.029	
	IE_SW_20K190980 KNOCKNABOHILLY_010	*Good*	*0.030*	*0.033*	*4.3*	*0.0005*	*0.030*	
	IE_SW_20K800990 KILLANAMAUL_010	*Good*	*0.030*	*0.033*	*1.4*	*0.0001*	*0.030*	
	IE_SW_20K980910 KNOCKNACURRA_010	*Good*	*0.030*	*0.033*	*0.0*	*0.0000*	*0.030*	
	IE_SW_20L510960 LAHERFINEEN_010	*Good*	*0.030*	*0.033*	*3.9*	*0.0003*	*0.030*	
	IE_SW_20S030800 STICK_010	High Upwards Near	0.020	0.019	2.6	0.0000	0.020	‡ MP1
		High Upwards Near	0.022	0.019			0.022	‡ MP2
		High Upwards Near	0.020	0.019			0.020	‡ MP3 *
		High Upwards Near	0.025	0.019			0.025	MP4

	High Upwards Near	0.023	0.019			0.023	MP5
IE_SW_20W050990 WHITE STRAND_010	*Good*	*0.030*	*0.033*	*0.4*	*0.0001*	*0.030*	

MP: multiple Monitoring Points given for waterbody
‡ : Load from WWTP / SWO following treatment added
* : Trends are Statistically Significant

Table 4-B: Increased loading and concentrations to Transitional/Coastal water bodies connected to the WSZs ***(note: where existing monitoring data not available, a surrogate indicative quality is derived from ecological status of the WB or Ortho P / Ecological status of neighbouring WBS, the mid-range of that indicative quality is used as Baseline Concentration)***

EU_CD / NAME Transitional / Coastal Water Bodies	Ortho P Indicative Quality and Trends (distance to threshold) *[Surrogate indicative quality given in italic]*	Baseline Ortho P Conc. mg/l *[Surrogate Conc. given in italic]*	75% of indicative quality upper threshold mg/l	Cumulative Ortho P load to SW from leakage, DWWTS & Agglomerations kg/yr	Potential increase in Ortho P Conc. using flows (30%ile or gauged) mg/l	Potential Baseline for Ortho P Conc. following dosing mg/l	Notes
IE_SW_060_1200 Owenboy Estuary	*Moderate*	*0.080*	*0.090*	23.1	0.0002	*0.080*	‡
IE_SW_070_0100 Oysterhaven	*Good*	*0.030*	*0.053*	3.4	0.0000	*0.030*	‡
IE_SW_080_0100 Lower Bandon Estuary	High (S) Downwards Far	0.018	0.020	17.3	0.0000	0.018	‡
	Good (W) Downwards Far	0.033	0.046			0.033	‡
IE_SW_080_0300 Upper Bandon Estuary	Good (S) Upwards Far	0.034	0.036	9.7	0.0000	0.034	‡
	Good (W) Downwards Far	0.031	0.036			0.031	‡
IE_SW_010_0000 Western Celtic Sea (HAs 18;19;20)	*High*	*0.013*	*0.019*	*202.4*	*0.0000*	*0.013*	‡
IE_SW_060_0000 Cork Harbour	High (S) Downwards Far	0.003	0.019	158.5	0.0000	0.003	‡
	Good (W) Downwards Far	0.028	0.045			0.028	‡*
IE_SW_080_0000 Kinsale Harbour	High (S) Downwards Far	0.009	0.019	22.0	0.0000	0.009	‡*

		Good (W) Downwards Far	0.031	0.036			0.031	‡
	IE_SW_090_0000 Courtmacsherry Bay	High (S) None Far	0.003	0.019	18.5	0.0000	0.003	‡
		High (W) Downwards Near	0.021	0.019			0.021	‡
	IE_SW_050_0000 Outer Cork Harbour	High (S) Downwards Far	0.003	0.019	158.5	0.0000	0.003	‡*
		High (W) Near	0.024	0.019			0.024	‡*

‡ Load from WWTP / SWO following treatment added
* Trends are Statistically significant
(S) = Summer monitoring period, (W) = Winter monitoring period

Summary and Mitigation Proposed

The Assessment of Innishannon WTP in isolation suggests minimal impact on the receiving waterbodies due to orthophosphate dosing. The modelled load and increase in concentrations to both groundwater and surface water receptors are insignificant.

The fate of P loads from Innishannon is depicted in Figure 1 and the breakdown from source to pathway is shown in Figure 2.

The cumulative impacts on Lee, Cork Harbour & Youghal (HA19) and Bandon-Ilen (HA20) catchments associated with phosphate dosing from following additional WTPs are summarised in Tables 5-A and 5-B below:

- 004 Lee Road WTP - Cork City Water Supply
- 006 Inniscarra WTP - Zone 2 Cork City and harbour
- 026 Glashaboy WTP - Zone3 Glashaboy
- 036 Clonakilty RWSS WTP - Zone1 Clonakilty
- 059 Glendine WTP - Zone3 Youghal Regional

Table 5A indicates that predicted increases in concentration will be above significant levels (0.00125 mg/l) in two streams. A surrogate orthophosphate indicative quality of Good has been assigned to these waterbodies following the EPA Ecological status that has been assigned with Low Confidence.

For IE_SW_19H050470 (HILLTOWN_010), the increase following dosing is below 75 % of the upper threshold for Ortho P indicative quality boundary.

For IE_SW_19M300900 (MONEYGURNEY_010), given the urban diffuse pressures a surrogate indicative quality of moderate was assigned. The modelled increase in concentration will not cause the 75% threshold of the indicative quality boundary to be exceeded in this case. It is therefore concluded that the appropriate RAG status for the MONEYGURNEY 19_010 (IE_SW_19M300900) is GREEN.

Table 5-A: Cumulative assessment of the increased loading and concentrations to river water bodies impacted by more than WSZ in the Lee, Cork Harbour & Youghal (HA19) and Bandon-Ilen (HA20) catchments

EU_CD / NAME	Ortho P Indicative quality and Trends (distance to threshold) Surrogate indicative quality indicated in *italic*	Baseline and Conc. Surrogate Conc. given in *italic* mg/l	75% of indicative quality upper threshold mg/l	Cumulative Ortho P load to SW from leakage, DWWTS & agglomerations kg/yr	Conc. using 30%ile flows mg/l	PO4 Potential Baseline Conc. following dosing mg/l	Notes
IE_SW_19H050470 HILLTOWN_010	*Good*	*0.030*	*0.033*	*77.5*	*0.0025*	*0.032*	
IE_SW_19K620850 KILNAGLERY_010	*Good*	*0.030*	*0.033*	*11.8*	*0.0009*	*0.031*	
IE_SW_19M300900 MONEYGURNEY_010	*Moderate*	*0.046*	*0.051*	*102.2*	*0.0048*	*0.050*	
IE_SW_19O011400 OWENBOY (CORK)_040	Good Upwards Far	0.026	0.033	26.6	0.0003	0.026	‡
IE_SW_19T050890 TWO POT (Cork City)_010	Poor Upwards Far	0.070	0.073	10.0	0.0009	0.071	

‡ Load from WWTP / SWO following treatment added

Table 5-B: Cumulative assessment of the increased loading and concentrations to transitional water bodies impacted by more than WSZ in the Lee, Cork Harbour & Youghal (HA 19) and Bandon-Ilen (HA 20) catchments

EU_CD / NAME	Ortho P Indicative quality and Trends (distance to threshold) Surrogate Indicative quality indicated in *italic*	Baseline and Conc. Surrogate Conc. given in *italic* mg/l	75% of indicative quality upper threshold mg/l	Cumulative Ortho P load to SW from leakage, DWWTS & agglomerations kg/yr	Conc. using 30%ile flows mg/l	PO4 Potential Baseline Conc. following dosing mg/l	Notes
IE_SW_060_1200 Owenboy Estuary	*Moderate*	*0.080*	*0.090*	*106.0*	*0.0000*	*0.080*	‡
IE_SW_080_0100 Lower Bandon Estuary	High (S) Downwards Far	0.018	0.020	24.8	0.0000	0.018	‡
	Good (W) Downwards Far	0.033	0.046			0.033	‡

IE_SW_090_0000 Courtmacsherry Bay	High (S) None Far	0.003	0.019	54.5	0.0000	0.003	‡
	High (W) Downwards Near	0.021	0.019			0.021	‡
IE_SW_080_0000 Kinsale Harbour	High (S) Downwards Far	0.009	0.019	29.6	0.0000	0.009	‡ *
	Good (W) Downwards Far	0.031	0.036			0.031	‡
IE_SW_060_0950 Lee (Cork) Estuary Upper	High (S) Downwards Far	0.013	0.019	376.4	0.0003	0.013	‡
	High (W) Downwards Near	0.013	0.019			0.013	‡
IE_SW_060_0900 Lee (Cork) Estuary Lower	Good (S) Downwards Near	0.043	0.050	376.4	0.0002	0.044	‡ *
	Good (W) Downwards Far	0.043	0.050			0.044	*
IE_SW_060_0750 Lough Mahon	High (S)	0.014	0.020	6556.6	0.0001	0.014	‡
	High (W)	0.027	0.020			0.027	‡
IE_SW_060_0000 Cork Harbour	High (S) Downwards Far	0.003	0.019	8546.2	0.0000	0.003	‡
	Good (W) Downwards Far	0.028	0.045			0.028	‡
IE_SW_050_0000 Outer Cork Harbour	High (S) Downwards Far	0.003	0.019	8627.1	0.0000	0.021	‡
	High (W) Downwards Far	0.024	0.019			0.003	‡
IE_SW_010_0000 Western Celtic Sea	*High*	*0.013*	*0.019*	*9671.7*	*0.0001*	*0.013*	‡

‡ Load from WWTP / SWO following treatment added

The cumulative assessment has demonstrated that the impacts on the receiving waters due to dosing will not cause deterioration in orthophosphate indicative quality or prevent the achievement of the WFD objectives.

MITIGATION OPTION – None Required

RAG STATUS – GREEN

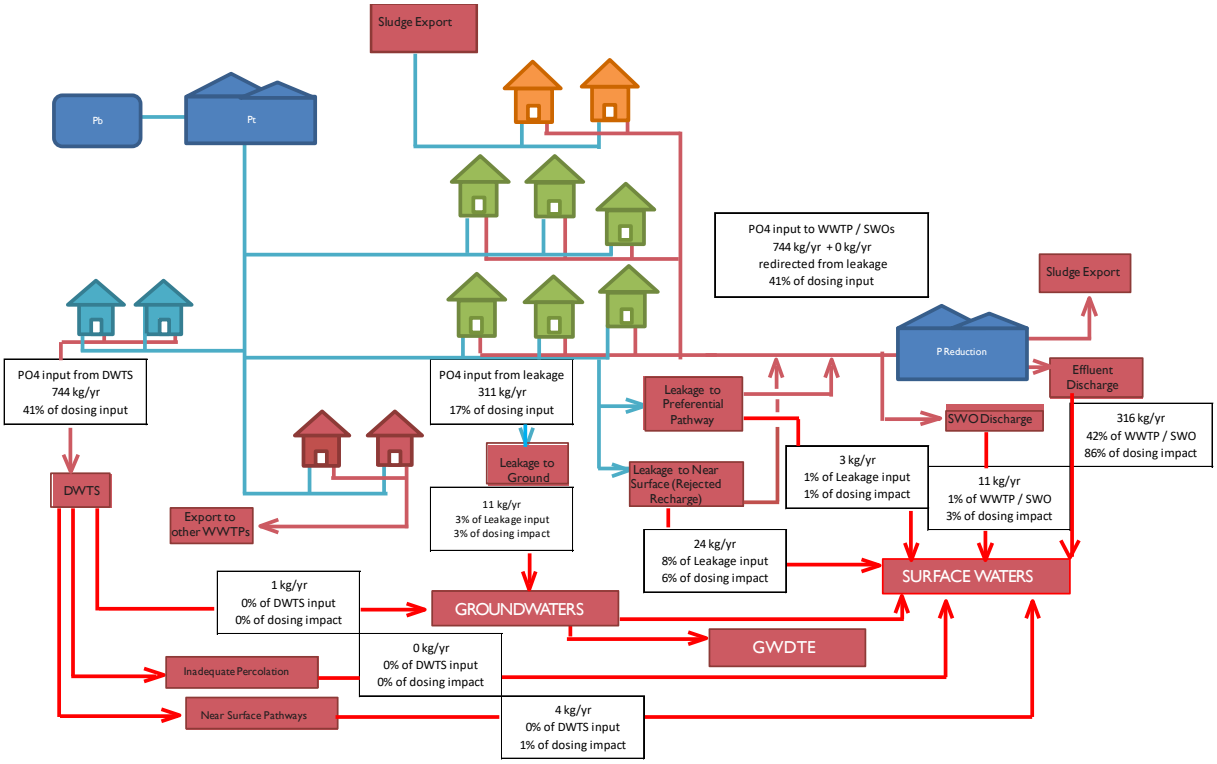
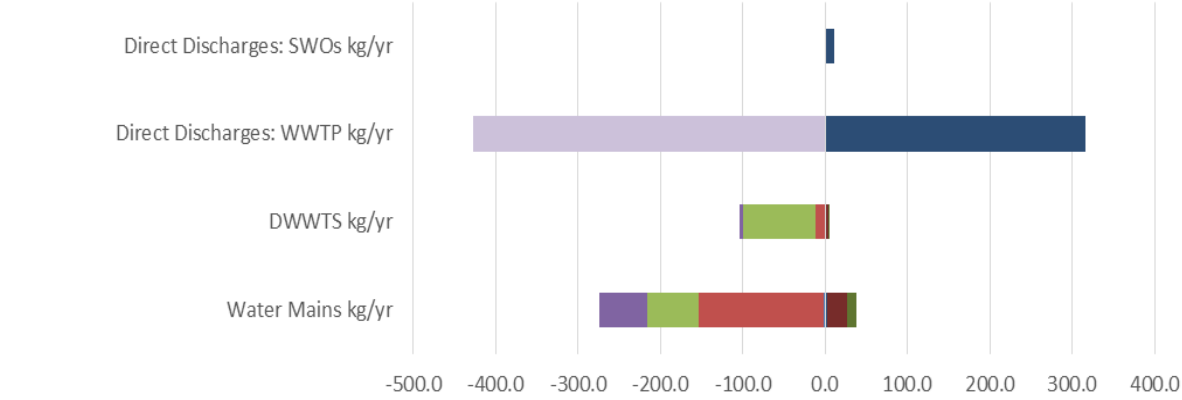


Figure 1 – Source Pathway Receptor model for Innishannon WTP illustrating key sources and pathways to the associated WSZs.



	Water Mains kg/yr	DWWTS kg/yr	Direct Discharges: WWTP kg/yr	Direct Discharges: SWOs kg/yr
Load attenuated in Preference (inadequate percolation) pathway	-1.9	-0.7		
Load attenuated in Near Surface Pathway	-151.5	-11.1		
Load attenuated in 1m below trench	-63.0	-88.3		
Load attenuated in Subsurface Pathway	-57.7	-4.1		
Load intercepted by gravity main in Preference Pathway	0.6			
Load intercepted by gravity main in Near Surface Pathway	0.3			
Load reaching SW direct or via Preference (inadequate percolation) Pathway	1.9	0.5	315.9	11.1
Load reaching SW via Near Surface Pathway	23.9	3.6		
Load reaching SW via Subsurface Pathway	10.5	1.0		
Load treated in WWTP			-427.6	

Figure 2 – Fate of orthophosphate loads modelled Innishannon WSZ impacting on the Western Celtic Sea (via Outer Cork Harbour, Kinsale Harbour, Courtmacsherry Bay and Oysterhaven) due to dosing by source type, indicating levels of attenuation in pathways and relative impact on the surface water receptor.