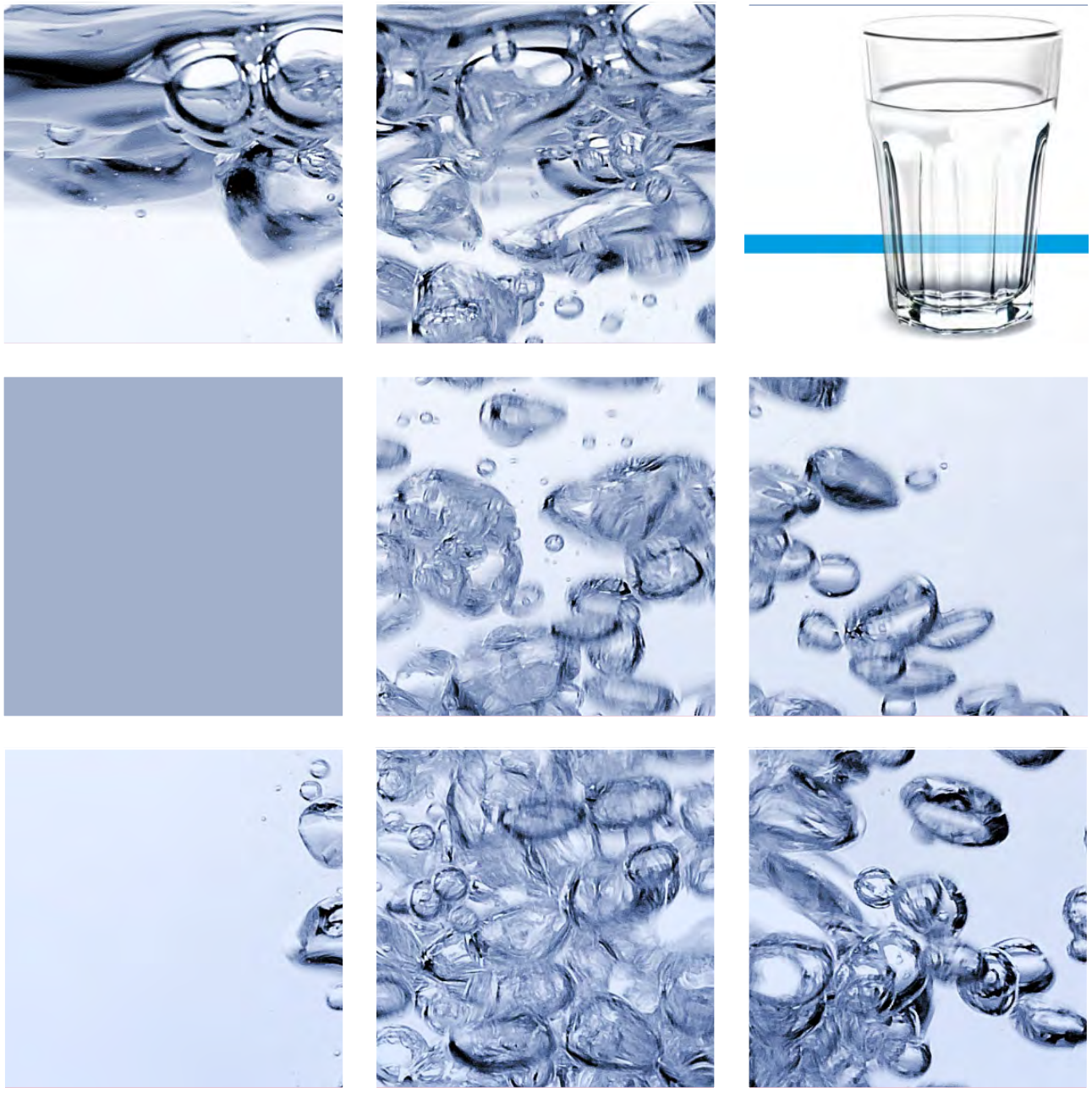
Uisce Éireann - Lead in Drinking Water Mitigation Plan

Screening for Appropriate Assessment

026 Glashaboy WTP - Zone 3 Glashaboy WSZ (0500PUB3303)



Lead in Drinking Water Mitigation Plan

Screening for Appropriate Assessment 026 Zone 3 Glashaboy (0500PUB3303) – Glashaboy WTP

Document Control Sheet

Client:	Uisce Éireann
Project Title:	Lead in Drinking Water Mitigation Plan
Document Title:	Screening for Appropriate Assessment 026 Zone 3 Glashaboy WSZ (0500PUB3303) – Glashaboy WTP
Document No:	MDW0766Rp_5.3_Screening_026_Glashaboy_F05

Text Pages:	58	Appendices:	3

Rev.	Status	Date	Author(s)		Reviewed By		Approved By	
A02	For Client Approval	19th June 2018	S M	Sheila Murphy	LC	Laoise Cawley	DC	David Connery
F01	Final	17th Aug 2018	LE	Laoise Cawley	LC	Laoise Cawley	DC	David Connery
F02	Final	11th Sep 2018	LE	Laoise Cawley	LE	Laoise Cawley	DC	David Connery
F03	Final	4th Dec 2018	LE	Laoise Cawley	LC	Laoise Cawley	DC	David Connery
F04	Final	24th July 2019	LE	Laoise Cawley	LC	Laoise Cawley	GJG	G Giggach
F05	Final	19th July 2023	A W	Aaron Ward	MM	Mark Myers	MM	Mark Myers

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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 Glashaboy Water Treatment Plant (WTP), Glashaboy, 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 Glashaboy 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 seven European Sites with potential hydrological or hydrogeological connectivity to the WSZ:

- SAC sites: Great Island Channel SAC, Ballymacoda (Clonpriest and Pillmore) SAC, The Gearagh SAC; and
- SPA sites: Cork Harbour SPA, Ballymacoda Bay SPA, 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);
- Third Cycle Draft River Basin Management Plan 2022-2027 Consultation Report - 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**).

[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

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, 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**.

2.5.3 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

Glashaboy WTP supplies the east of Cork City and neighbouring areas to a water supply zone (WSZ) named Zone 3 Glashaboy (0500PUB3303). The daily production and distribution input for the WTW is 15,500 m3/day (60% of which is accounted for, with the remainder assumed to be lost through leakage) serving a population of approximately 14,300. The non-domestic demand is 38% of the distribution input. The Cork City WWTP agglomeration covers part of the WSZ boundary with most of the remainder served by Carrigtwohill (upgraded in January 2016) and North Cobh 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. The Cobh agglomeration is now served by the Cork Lower Harbour Drainage Scheme treatment plant at Shanbally, Ringaskiddy, Co Cork and therefore benefits from secondary treatment before the wastewater discharges into Cork Harbour. There are an estimated 1678 properties across the WSZ that are serviced by a DWWTS.

Glashaboy WTP lies in the vicinity of the lower reaches of the Glashaboy River in the Glashaboy River subcatchments of the Lee, Cork Harbour and Youghal Bay Catchment. The EAM process identified seven European Sites with hydrological or hydrogeological connectivity to the WSZ:

- SAC sites: Great Island Channel SAC, Ballymacoda (Clonpriest and Pillmore) SAC, The Gearagh SAC; and
- SPA sites: Cork Harbour SPA, Ballymacoda Bay SPA, The Gearagh SPA.

3.2 CONSTRUCTION OF CORRECTIVE WATER TREATMENT WORKS

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

There are two possible locations for the orthophosphate dosing system at Glashaboy 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 Glashaboy 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. CORK

Glashaboy

N

Existing Reservoir

Existing Filter Beds

Proposed Orthophosphate Dosing Point (Common 750mm Reservoir Outlet Trunk Main)

Tks

Existing Valve House

Final Water Sump

750mm WTP Outlet Main

Lime, Chlorine, and Fluoride Dosing Point

Existing Safety Shower

Flouride BSTs

Proposed Coagulant Flash Mixer

Existing Soda Ash Batching Tank

Existing Reservoir

Store Room

Fuel Oil

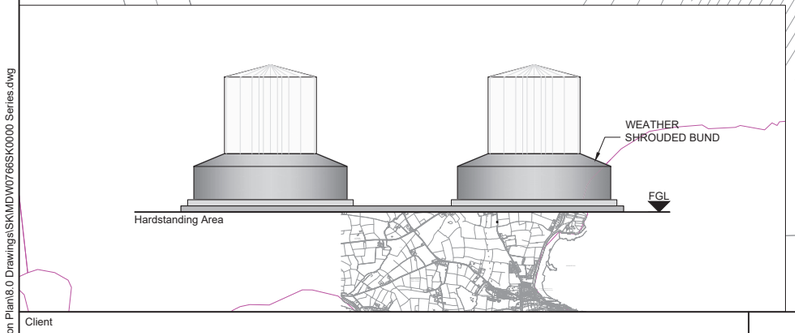
Tks

Proposed Dosing Pipework Path

Proposed Orthophosphate Dosing Facility Location (Disused Fluoride Stock Bund)

Water Treatment Plant
(Cork Co Council)

Proposed Polyelectrolyte Plant



10m SCALE 1:500

R:\MDW0766_Lead Mitigation Plan\8.0 Drawings\SK\MDW0766SK0000 Series.dwg

Client

Uisce Éireann Irish Water

No.	Date	Dft. Chk.	Amendment / Issue	App
F01	Mar'19	BL BR	Issue for Client Approval	GJG
D01	Oct'18	BL BR	Draft	DC

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Checked	BR
Approved	GJG
Date	12/03/2019
Scale	1:500 @ A1
	1:1,000 @ A3

Project

LEAD MITIGATION PLAN

Figure 3.1

GLASHABOY WATER TREATMENT PLANT
SITE LAYOUT

Job No.	File Ref.	Drg. No.	Rev.
MDW0766	MDW0766SK0000 Series.dwg	WTP0026	F01

The bulk storage tanks (2 no. tanks, each with a working volume of 1,500 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 3-2**).

Each storage tank will be self-bunded to accommodate greater than 110% of the tank working volume. The tanks shall conform to UE 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.

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 Glashaboy 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.

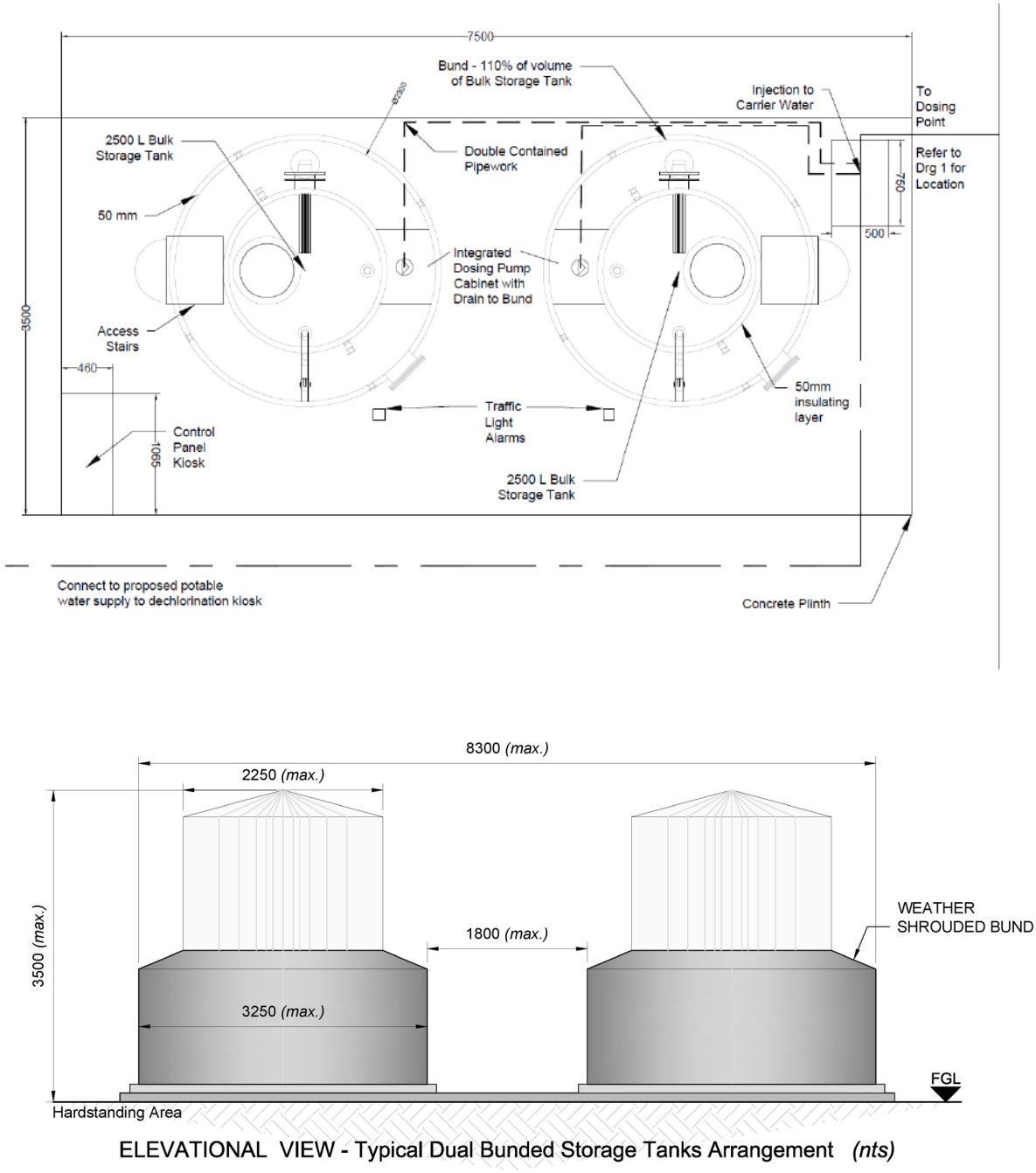


Figure 3-2: Plan and Elevation Drawings of a typical Orthophosphate Dosing Unit

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 Glashaboy 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 Glashaboy WTP, orthophosphate will be added to treated water at a rate of 0.6mg/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.

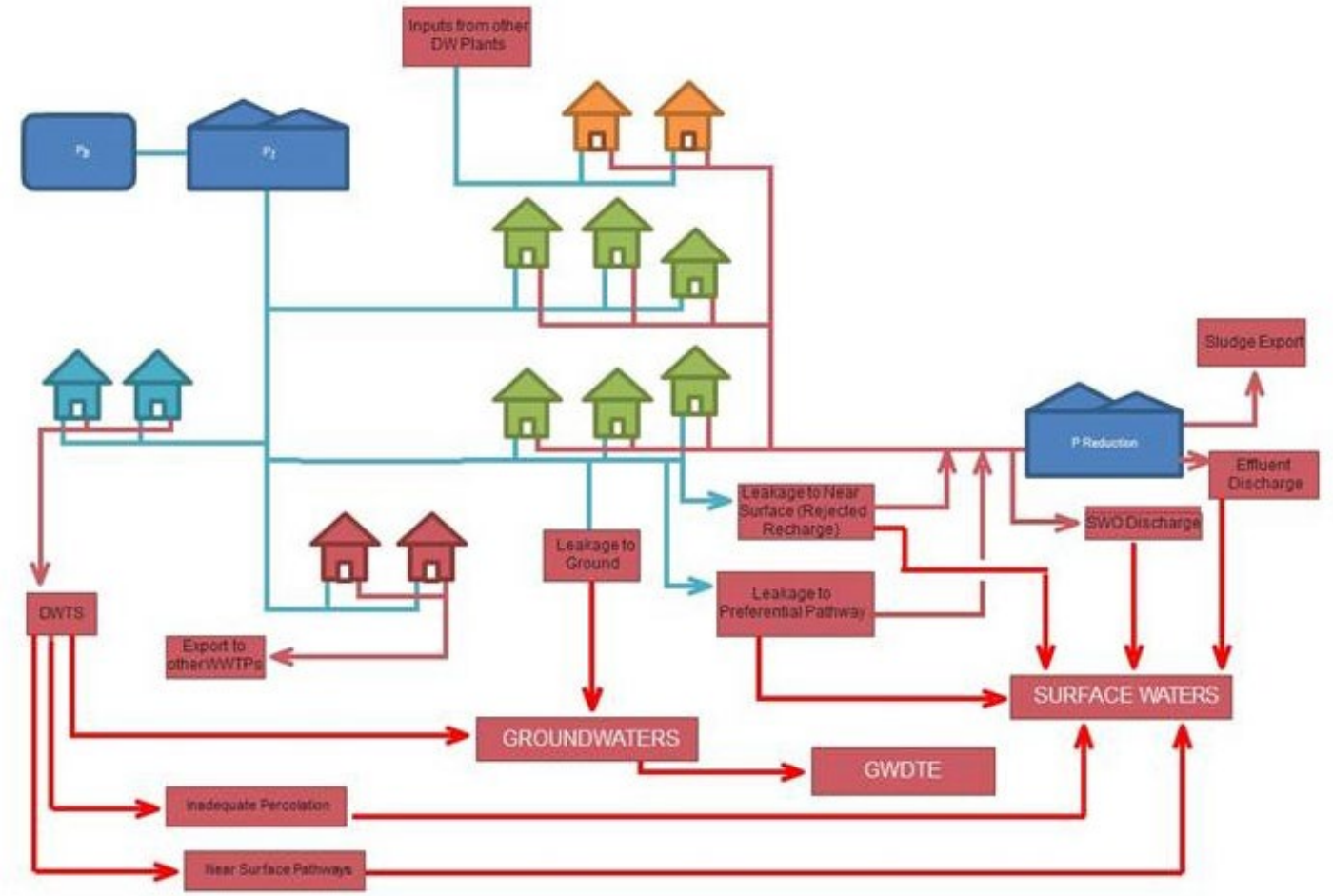


Figure 3-3: Conceptual Model of P Transfer

(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.)

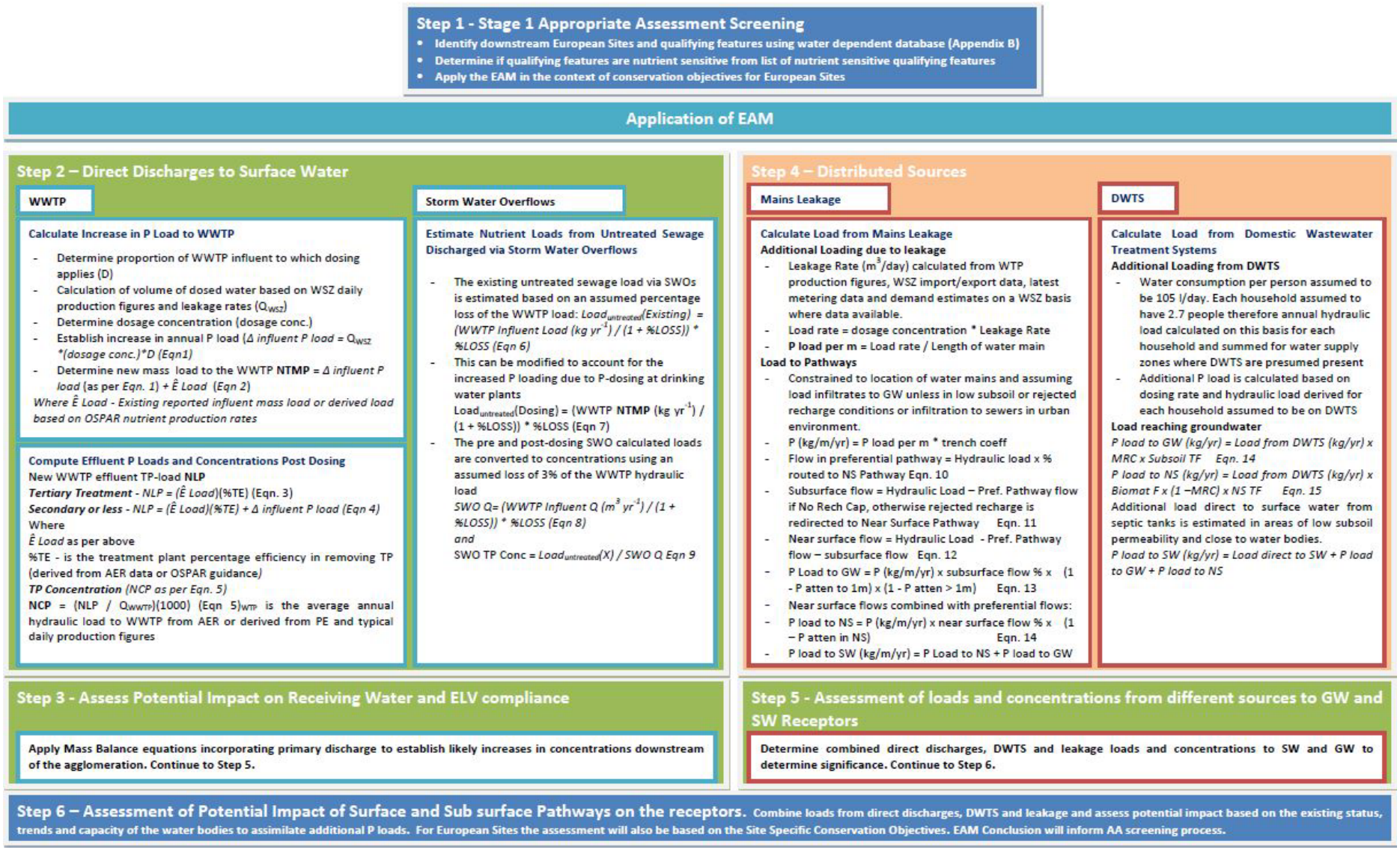


Figure 3-4: Stepwise Approach to the Environmental Assessment Methodology

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 Glashaboy 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 Glashaboy WTP followed by a review of hydrological and hydrogeological connectivity between the proposed development site and European Sites. The European Sites within the 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	SAC / SPA Code	Direct Impact	Water Dependent Species / Habitats	Nutrient Sensitive Species / Habitats	Surface Water Connectivity	Ground-water Connectivity[4][5]	Potential Source Pathway Receptor
1	The Gearagh SAC	SAC 000108	No	Yes	Yes	No	Yes (Ballinhassig East)	Yes
2	The Gearagh SPA	SPA 004109	No	Yes	Yes	No	Yes (Ballinhassig East)	Yes
3	Great Island Channel SAC	SAC 001058	No	Yes	Yes	No	Yes (Ballinhassig East)	Yes
4	Cork Harbour SPA	SPA 004030	No	Yes	Yes	No	Yes (Ballinhassig East)	Yes

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 Glashaboy WTP and associated WSZ and European Sites. The ZoI was therefore defined by the surface and groundwater bodies 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. Groundwater bodies touching or

[4] Ballinhassig East (IE_SW_G_004) GWB is a poorly productive bedrock aquifer. Groundwater flow paths are expected to be relatively short, typically from 30-300 m, with groundwater discharging to small springs, or to the streams that traverse the aquifer. Flow directions are expected to approximately follow the local surface water catchments. The Gearagh SAC and SPA intersect the Ballinhassig East GWB approximately 60km up-gradient of the WTP. As flow paths in the GWB are typically 30-300m and follow the local surface catchments, there is no potential source impact pathway to The Gearagh SAC and SPA as a result of construction activities.

[5] Ballinhassig GWB: Summary of Initial Characterisation

intersecting the WSZs are also included in the ZoI. Hydrogeological linkages in karst areas are taken into account. European Sites within the ZoI are listed in **Table 4-2** and are displayed in **Figure 4-1.**

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

	Site Name	SAC / SPA Code	Water Dependent Species / Habitats	Nutrient Sensitive Species / Habitats	Surface Water Connectivity	Groundwater Connectivity	Potential Source Pathway Receptor
1	Ballymacoda (Clonpriest and Pillmore) SAC	SAC 000077	Yes	Yes	No	Yes (Midleton)	Yes
3	The Gearagh SAC	SAC 000108	Yes	Yes	No	Yes (Ballinhassig East)	Yes
4	Ballymacoda Bay SPA	SPA 004023	Yes	Yes	No	Yes (Midleton)	Yes
5	The Gearagh SPA	SPA 004109	Yes	Yes	No	Yes (Ballinhassig East)	Yes
6	Great Island Channel SAC	SAC 001058	Yes	Yes	Yes – RWB (Tibbotstown)	Yes (Midleton, Knockdoon West, Little Island, Industrial Facility, Ballinhassig East)	Yes
7	Cork Harbour SPA	SPA 004030	Yes	Yes	Yes - (RWB - Tibbotstown& CWB – Cork Harbour)	Yes (Midleton, Knockdoon West, Little Island, Industrial Facility, Ballinhassig East)	Yes

Zone of Influence (ZoI) for Construction Phase

The Gearagh SAC (000108)
The Gearagh SPA (004109)
Great Island Channel SAC (001058)
Cork Harbour SPA (004030)
Cork Harbour SPA (004030)
Cork Harbour SPA (004030)
Cork Harbour SPA (004030)
Cork Harbour SPA (004030)
Cork Harbour SPA (004030)
Great Island Channel SAC (001058)
Cork Harbour SPA (004030)

Zone of Influence (ZoI) for Operational Phase

The Gearagh SAC (000108)
The Gearagh SPA (004109)
Great Island Channel SAC (001058)
Great Island Channel SAC (001058)
Cork Harbour SPA (004030)
Zone3 Glashaboy
Cork Harbour SPA (004030)
Cork Harbour SPA (004030)
Cork Harbour SPA (004030)
Cork Harbour SPA (004030)
Cork Harbour SPA (004030)
Cork City Water Supply
Zone2 Cork Harbour and City
Cork Harbour SPA (004030)
Cork Harbour SPA (004030)
Cork Harbour SPA (004030)
Cork Harbour SPA (004030)
Cork Harbour SPA (004030)
Cork Harbour SPA (004030)
Great Island Channel SAC (001058)
Cork Harbour SPA (004030)
Ballymacoda (Clonpriest and Pillmore) SAC (000077)
Ballymacoda Bay SPA (004023)
Bandon River SAC (002171)
Cork Harbour SPA (004030)
Cork Harbour SPA (004030)

Legend

LEMA Emission Type

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

Data Source:
Irish Water
NPWS (June 2019)
EPA

N

0 3.75 7.5 15 Kilometres

Client: Uisce Éireann Irish Water

Project: Lead Mitigation Plan
Corrective Water Treatment Works

Title

Zone 3 Glashaboy

European Sites within the ZoI of the Proposed Project

RPS

Scale: 1:350,000 @ A3	Date: 25/07/2019
File Ref: MDW0766Arc0002aF04	Map Projection: Irish National Grid (TM65)

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 5 and Section 6 at this stage of the process and those included, are detailed in **Table 4-3** and are displayed in **Figure 4-2.** Two 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 Glashaboy WTP. There is no surface water connectivity between the Glashaboy WTP and any European Site. The WTP is located within the Ballinhassig East groundwater body (IE_SW_G_004) and there is potential hydrogeological connectivity between the proposed development site and the Great Island Channel SAC and Cork Harbour SPA.

The WSZ for the Glashaboy WTP is located adjacent to Lough Mahon Estuary, Co. Cork. Two European Sites are directly intersected and hydrologically connected to the WSZ via river pathways: Great Island Channel SAC and Cork Harbour SPA. On that basis, both sites are included in **Section 5** and **Section 6** for further assessment.

The WSZ intersects six groundwater bodies: Ballinhassig East (IE_SW_G_004), Knockadoon_W (IE_SW_G_046), Midleton_1 (IE_SW_G_058), Janssen Pharmaceutical (IE_SW_G_089), Little Island (IE_SW_G_90) and Industrial Facility (P0028-01) (IE_SW_G_092). The following six European Sites overlay or intersect these groundwater bodies also: Great Island Channel SAC, Ballymacoda (Clonpriest and Pillmore) SAC, The Gearagh SAC, Cork Harbour SPA, Ballymacoda SPA and The Gearagh SPA.

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. Groundwater body specific information relating to flow and discharge is available from the GSI[6], and was consulted in making the assessment.

Ballinhassig East (IE_SW_G_004) GWB is a poorly productive bedrock aquifer. Groundwater flow paths are expected to be relatively short, typically from 30-300 m, with groundwater discharging to small springs, or to the streams that traverse the aquifer. Flow directions are expected to approximately follow the local surface water catchments[7]. The Great Island Channel SAC; The Gearagh SAC and SPA and, Cork Harbour SPA intersect the Ballinhassig East GWB (IE_SW_G_004). The Gearagh SAC and SPA are located approximately 60km up-gradient of the WSZ. As flow paths in the GWB are typically 30-300m and follow the local surface catchments, there is no potential for the transfer of orthophosphate loads from dosing at Glashaboy WTP to the European Sites. On that basis, both sites are excluded from

[6] https://www.gsi.ie/en-ie/programmes-and-projects/groundwater/activities/understanding-ireland-groundwater/Pages/Groundwater-bodies.aspx
[7] https://jetstream.gsi.ie/iwdds/delivery/GSI_Transfer/Groundwater/GWB/BallinhassigGWB.pdf

further assessment in **Section 6**. The Great Island Channel SAC and Cork Harbour SPA are located immediately downstream of the WSZ (i.e. within the typical 30-300m flow paths of the GWB). Both sites are previously included for further assessment in **Section 6** due to hydrological connectivity to the WSZ. The assessment will take into consideration the potential for the transfer of orthophosphate loads from the WSZ to the sites via the Ballinhassing East GWB.

Knockadoon_W (IE_SW_G_046) GWB is also a poorly productive bedrock aquifer. Groundwater flow is of a local nature. Groundwater flow paths are generally short, typically 30-300 m, with groundwater discharging to small springs, or to the streams and rivers that traverse the aquifer. Flow directions are expected to approximately follow the local surface topography. The Great Island Channel SAC and Cork Harbour SPA intersect Knockadoon_W (IE_SW_G_046) GWB. Both sites are previously included for further assessment in **Section 6** due to hydrological connectivity to the WSZ. This assessment will take into consideration the potential for the transfer of orthophosphate loads from the WSZ to the sites via the Knockadoon GWB.

Midleton_1 (IE_SW_G_058) GWB is a highly permeable karstic aquifer. It supports a regional scale flow system. Groundwater flow paths can be up to several kilometres long, but may be significantly shorter in areas where the water table is very close to the surface. Regional groundwater flow is towards the rivers draining the valley, to the sea in the east and to Lough Mahon and the surface water channels to the west and south west of the body. The WSZ intersects Midleton_1 (IE_SW_G_058) to the west of the GWB. The WSZ also intersects Great Island Channel SAC and Cork Harbour SPA at this location. Both sites are previously included for further assessment in **Section 6**. The assessment will take into consideration the potential for the transfer of orthophosphate loads from the WSZ to the sites via the Midleton_1 GWB. Ballymacoda (Clonpriest and Pillmore) SAC and Ballymacoda SPA are located to the east of the GWB, approximately 30km from the WSZ. As the groundwater flows in the west of the GWB, where it is intersected by the WSZ, are to the Lough Mahon and surface water channels it has been determined that there is no risk of the transfer of orthophosphate loads to Ballymacoda (Clonpriest and Pillmore) SAC and Ballymacoda SPA in the east and on that basis, the sites are excluded from further assessment.

The Industrial Facility (P0028-01) (IE_SW_G_092) and Little Island (IE_SW_G_090) GWBs are also intersected by both the WSZ and the Great Island Channel SAC. There is no site specific information on these GWB however; Great Island Channel SAC is previously included for further assessment in **Section 6** due to hydrological connectivity to the WSZ. This assessment will take into consideration the potential for the transfer of orthophosphate loads from the WSZ to the sites via the Industrial Facility (P0028-01) and Little Island GWBs.

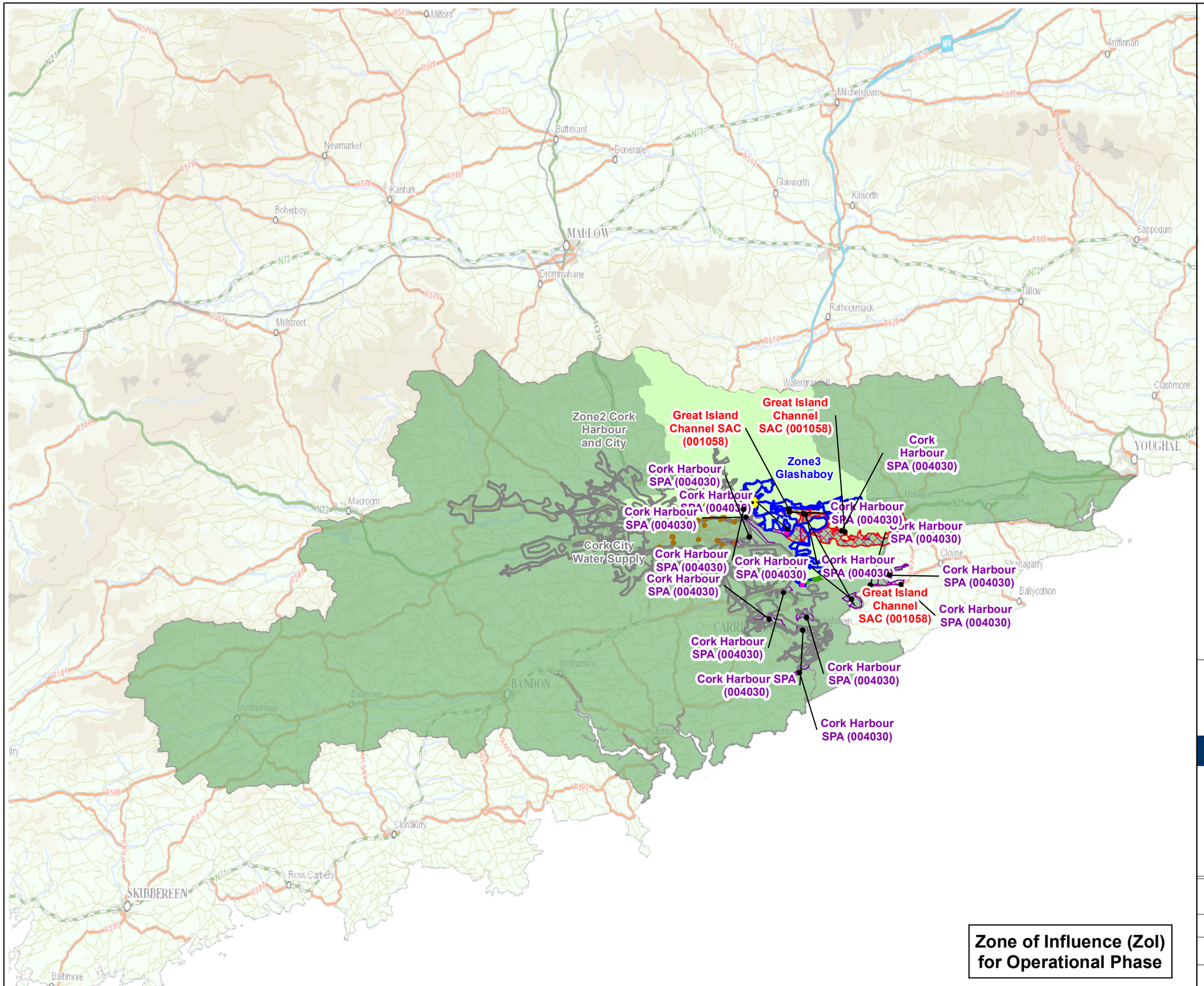
The Industrial Facility (P0028-01) (IE_SW_G_092); Industrial Facility (P0016-02) (IE_SW_G_089) and Little Island (IE_SW_G_090) GWBs are also intersected by both the WSZ and the Cork Harbour SPA. There is no site specific information on these GWB however; the Cork Harbour SPA is previously included for further assessment in **Section 6** due to hydrological connectivity to the WSZ. This assessment will take into consideration the potential for the transfer of orthophosphate loads from the WSZ to the sites via the Industrial Facility (P0028-01); Industrial Facility (P0016-02) and Little Island GWBs.

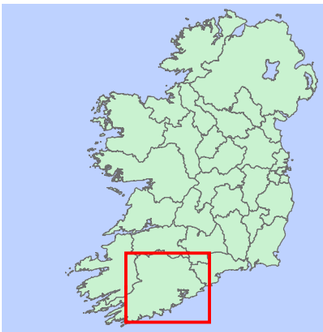
On this basis, two sites have been included for further assessment on order to evaluate the significance of potential effect arising during construction phase in Section 5 below i.e. the Great Island Channel SAC and Cork Harbour SPA. The same two sites have been included for further assessment for the operational phase in Sections 5 and 6 below i.e. the Great Island Channel SAC and Cork Harbour SPA.

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	Features of Qualifying Interests	Water Dependent Species / Habitats	Nutrient Sensitive	Potential Hydrological / Hydrogeological Connectivity	Potential Source Pathway Receptor
Great Island Channel	SAC 001058	06th 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		
Cork Harbour	SPA 004030	16th 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 (*Tadorna tadorna*)	Yes	Yes		
			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		

Site Name	SAC / SPA Code	Conservation Objectives Establishment Date	Feature Code	Features of Qualifying Interests	Water Dependent Species / Habitats	Nutrient Sensitive	Potential Hydrological / Hydrogeological Connectivity	Potential Source Pathway Receptor
			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		
			A183	Lesser Black-backed Gull (*Larus fuscus*)	Yes	Yes		
			A193	Common Tern (*Sterna hirundo*)	Yes	No		
			A999	Wetlands	Yes	Yes		





Legend

LEMA Emission Type

- Primary Discharge Point
- Secondary Discharge Point
- Storm Water Overflow
- Waste Water Treatment Plant
- Glashaboy 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 3.75 7.5 15 Kilometres

Client: Uisce Éireann Irish Water

Project: Lead Mitigation Plan
Corrective Water Treatment Works

Title

Zone 3 Glashaboy

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

Zone of Influence (ZoI) for Operational Phase

RPS

Scale: 1:350,000 @ A3	Date: 25/07/2019
File Ref: MDW0766Arc0002bF04	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 Glashaboy 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 Glashaboy 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 Glashaboy 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 Glashaboy WTP into account and therefore included both possible locations. The assessment of impacts associated with the construction of the corrective water treatment works at Glashaboy WTP is presented in **Table 5-1** and is based on a desktop study using the following information:

- Design descriptions and drawings for the proposed corrective water treatment works at Glashaboy 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
- Site synopses, conservation objectives and qualifying interest data for European Sites.

Table 5-1: Likely significant effects to European Sites arising as a result of the construction of the corrective water treatment works

Site Name (Code)	Contributing WB Code_Name	WB Type[8]	Evaluation of Potential Significant Effects
Great Island Channel SAC (001058)	Ballinhassig East (IE_SW_G_004)	GWB	The construction works will be located within the confines of the existing Glashaboy WTP. Glashaboy WTP is not located within or adjacent to a European Site. **Surface Water** There are no surface water connections within the confines of Glashaboy WTP. The nearest surface water body is Glashaboy (Lough Mahon)_030 (IE_SW_19G010600) river which is located approximately 700m and 1.2km to the east and west of the WTP. Glashaboy (Lough Mahon) river is hydrologically connected to Lough Mahon estuary >4.8km downstream which supports the following European Sites; Great Island Channel SAC and Cork Harbour SPA. There are no surface pathways from the WTP to Glashaboy (Lough Mahon)_030 (IE_SW_19G010600). In the absence of pathways, there is no potential for surface run-off to cause a deterioration in the water quality of the Lough Mahon (IE_SW_060_0750) estuary and Glashaboy (Lough Mahon)_030
Cork Harbour SPA (004030)	IE_SW_G_004 Ballinhassig East	GWB	

[8] Monitoring period is annual unless specified.

Site Name (Code)	Contributing WB Code_Name	WB Type[8]	Evaluation of Potential Significant Effects
			(IE_SW_19G_10600) river through sediment laden run-off, dust emissions or environmental incidents. Therefore, there is no potential for likely significant effects on the European Sites listed above as a result of the construction of the corrective water treatment works at Glashaboy WTP. **Groundwater** The WTP overlies the Ballinhassig East (IE_SW_G_004) groundwater body which intersects the Great Channel SAC and Cork Harbour SPA located >4.8km downstream of the WTP location. The excavation of trenches to install dosing pipelines, carrier water pipework and electrical cables to approximately 700mm below ground level has the potential to interfere with the water table potentially causing groundwater drawdown. The water table in the Ballinhassig East GWB can vary from a few metres up to more than 10 m below ground surface, depending upon topography. Groundwater is generally unconfined. Flow path lengths are generally short, ranging from 30-300 m. Local groundwater flow directions are controlled by local topography[9]. At the Glashaboy WTP, groundwater flow direction will be towards Glashaboy (Lough Mahon)_030 (IE_SW_19G010600). As the excavation works will not be extensive (up to c. 55m for pipework and to approximate depth of 700mm) interference with water table is unlikely. Any interference would be localised, minor and temporary. Therefore, there is no potential for likely significant effects on the Great Island Channel SAC, Cork Harbour SPA (located >4.8km downstream) as a result of the construction of the corrective water treatment works.

5.3.2 Operational Phase

In the case of the additional orthophosphate load due to dosing at Glashaboy 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 5-2.** The table identifies the following:

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

[9] Ballinhassig GWB: Summary of Initial Characterisation

- 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. 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.

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[10].

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

[10] 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.

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 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 6 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 baseline 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 the most up to date baseline data from the WFD monitoring programme. 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 5-2: 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[11]	Ortho P Indicative Quality[12] and Trends[13]	Baseline[14] Ortho P Conc.[15] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Total Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Increase in Conc.[16] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[17]	Evaluation
Great Island Channel SAC (001058)	IE_SW_19T250870 Tibbotstown_010	RWB	*Good*	0.030	0.033	8.1	0.0006	0.031	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_19B060800 Butlerstown_030	RWB	High Upwards Near	0.021	*0.019*	16.3	0.0002	0.021	The post dosing conc. exceeds the 75% upper indicative quality threshold; however, this is due to the baseline ortho P conc. The modelled conc. is insignificant (0.0002mg/l) therefore there is no risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_19G010600 Glashaboy (Lough Mahon)_030	RWB	*Good*	0.030	*0.033*	42.6	0.0003	0.030	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_060_0750 Lough Mahon	TWB Summer	High (S) Downwards Far	0.014	0.020	448.5	0.0000	0.014	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.

[11] Monitoring period is annual unless specified.
[12] Surrogate Indicative Quality in italic.
[13] Distance to threshold.
[14] Baseline year is 2014 for surface water bodies and 2012 for groundwater bodies.
[15] Surrogate concentration is given in italic mg/l
[16] 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.
[17] 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[11]	Ortho P Indicative Quality[12] and Trends[13]	Baseline[14] Ortho P Conc.[15] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Total Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Increase in Conc.[16] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[17]	Evaluation
		TWB Winter	Good (W) Downwards Far	0.027	0.042			0.027	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_060_0700 Lough Mahon (Harper's Island)	TWB Summer	High (S) Upwards Far	0.020	0.021	16.2	0.0000	0.020	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
		TWB Winter	Good (W) Downwards Far	0.036	0.040			0.036	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_060_0800 Glashaboy Estuary	TWB Summer	Good (S) Downwards Far	0.034	0.036	42.6	0.0003	0.034	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
		TWB Winter	High (W) Downwards Near	0.029	0.019			0.029	The post dosing conc. exceeds the 75% upper indicative quality threshold; however this is due to the baseline ortho P conc. The modelled conc. is 0.0003mg/l therefore there is no risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_060_0300 North Channel Great Island	TWB Summer	Good (S) Downwards Far	0.031	0.053	8.1	0.0000	0.031	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
		TWB Winter	Good (W) Downwards Far	0.027	0.041			0.027	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[11]	Ortho P Indicative Quality[12] and Trends[13]	Baseline[14] Ortho P Conc.[15] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Total Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Increase in Conc.[16] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[17]	Evaluation
	IE_SW_G_004 Ballinhassig East	GWB (multiple monitoring points)	Good Near	0.034	0.026	12.5	0.0001	0.034	The post dosing conc. exceeds the 75% upper indicative quality threshold; however this is due to the baseline ortho P conc. The modelled conc. Is 0.0001mg/l therefore there is no risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			Failing to achieve good Far	0.051	0.000			0.051	Existing baseline is failing to achieve good Ortho P indicative quality; however the modelled increase in concentration is negligible and does not exceed 5% of the High / Good indicative quality boundary and therefore there is no risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives..
			Failing to achieve good Far	0.037	0.000			0.037	Existing baseline is failing to achieve good Ortho P indicative quality; however the modelled increase in concentration is negligible and does not exceed 5% of the High / Good indicative quality boundary and therefore there is no risk of deterioration in the Ortho P

Site Name (Code)	Contributing WB Code_Name	WB Type[11]	Ortho P Indicative Quality[12] and Trends[13]	Baseline[14] Ortho P Conc.[15] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Total Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Increase in Conc.[16] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[17]	Evaluation
									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 Downwards Far	0.268	0.000			0.268	Existing baseline is failing to achieve good Ortho P indicative quality; however the modelled increase in concentration does not exceed 5% of the High / Good indicative quality boundary and therefore there is 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	0.026	0.026			0.026	No risk of deterioration in the Ortho P indicative quality or of

Site Name (Code)	Contributing WB Code_Name	WB Type[11]	Ortho P Indicative Quality[12] and Trends[13]	Baseline[14] Ortho P Conc.[15] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Total Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Increase in Conc.[16] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[17]	Evaluation
			Far						preventing the achievement of WFD objectives.
			Failing to achieve good Upwards Far	0.188	0.000			0.188	Existing baseline is failing to achieve good Ortho P indicative quality; however the modelled increase in concentration does not exceed 5% of the High / Good indicative quality boundary and therefore there is 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 Upwards Far	0.043	0.000			0.043	Existing baseline is failing to achieve good Ortho P indicative quality; however the modelled increase in concentration does not exceed 5% of the High / Good indicative quality boundary and therefore there is 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[11]	Ortho P Indicative Quality[12] and Trends[13]	Baseline[14] Ortho P Conc.[15] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Total Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Increase in Conc.[16] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[17]	Evaluation
			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.
	IE_SW_G_092 Industrial Facility (P0028-01)	GWB	*Good*	*0.018*	0.026	*0.0*	*0.0*	*0.0*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives
	IE_SW_G_046 Knockadoon West	GWB	*Good*	*0.018*	*0.026*	*0.2*	*0.0000*	*0.018*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives
	IE_SW_G_090 LittleIsland	GWB	*Good*	*0.018*	0.026	*5.8*	*0.0054*	*0.023*	The additional Ortho P load in this water body does not impact the ability of the dependent water bodies to achieve their WFD objectives (i.e. IE_SW_060_0700 - Lough Mahon (Harper's Island), IE_SW_060_0750 - Lough Mahon)
	IE_SW_G_058 Midleton	GWB	Good Upwards Far	0.017	0.026	7.4	0.0002	0.017	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
Cork Harbour SPA (004030)	IE_SW_19T250870 Tibbotstown_010	RWB	*Good*	*0.030*	*0.033*	*8.1*	*0.0006*	*0.031*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_19B060800 Butlerstown_030	RWB	High Upwards Near	0.021	0.019	16.3	0.0002	0.021	The post dosing conc. exceeds the 75% upper indicative quality threshold; however this is due to the baseline ortho P conc. The modelled conc. is insignificant (0.0002mg/l) and therefore there is no risk of deterioration in the Ortho

Site Name (Code)	Contributing WB Code_Name	WB Type[11]	Ortho P Indicative Quality[12] and Trends[13]	Baseline[14] Ortho P Conc.[15] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Total Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Increase in Conc.[16] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[17]	Evaluation
									P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_19G010600 Glashaboy (Lough Mahon)_030	RWB	*Good*	*0.030*	*0.033*	*42.6*	*0.0003*	*0.030*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_060_0750 Lough Mahon	TWB Summer	High (S) Downwards Far	0.014	0.020	448.5	0.0000	0.014	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
		TWB Winter	Good (W) Downwards Far	0.027	0.042			0.027	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_060_0700 Lough Mahon (Harper's Island)	TWB Summer	High (S) Upwards Far	0.020	0.021	16.2	0.0000	0.020	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
		TWB Winter	Good (W) Downwards Far	0.036	0.040			0.036	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives
	IE_SW_060_0800 Glashaboy Estuary	TWB Summer	Good (S) Downwards Far	0.034	0.036	42.6	0.0003	0.034	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
		TWB Winter	High (W) Downwards Near	0.029	0.019			0.029	The post dosing conc. exceeds the 75% upper indicative quality threshold; however this is due to the baseline ortho P conc. The modelled conc. is 0.0003mg/l therefore there is no risk of deterioration in the Ortho P

Site Name (Code)	Contributing WB Code_Name	WB Type[11]	Ortho P Indicative Quality[12] and Trends[13]	Baseline[14] Ortho P Conc.[15] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Total Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Increase in Conc.[16] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[17]	Evaluation
									indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_060_0300 North Channel Great Island	TWB Summer	Good (S) Downwards Far	0.031	0.053	8.1	0.0000	0.031	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
		TWB Winter	Good (W) Downwards Far	0.027	0.041			0.027	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives
	IE_SW_060_0000 Cork Harbour	CWB Summer	High (S) Downwards Far	0.003	0.019	1036.7	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 (W) Upwards Near	0.024	0.019			0.024	The post dosing conc. exceeds the 75% upper indicative quality threshold; however, this is due to the baseline ortho P conc. The modelled conc. Is undetectable, 0.0000mg/l therefore there is no risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives
	IE_SW_050_0000 Outer Cork Harbour	CWB Summer	High (S) Downwards Far	0.003	0.019	1036.7	0.0000	0.000	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
		CWB Winter	High (W) Upwards Far	0.024	0.018			0.016	The post dosing conc. exceeds the 75% upper indicative quality threshold; however, this is due to the baseline ortho P conc. The

Site Name (Code)	Contributing WB Code_Name	WB Type[11]	Ortho P Indicative Quality[12] and Trends[13]	Baseline[14] Ortho P Conc.[15] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Total Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Increase in Conc.[16] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[17]	Evaluation
									modelled conc. Is undetectable, 0.0000mg/l therefore there is no risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_G_004 Ballinhassig East	GWB (multiple monitoring points)	Good Near	0.034	0.026	12.5	0.0001	0.034	The post dosing conc. exceeds the 75% upper indicative quality threshold; however, this is due to the baseline ortho P conc. The modelled conc. Is 0.0001mg/l therefore there is no risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			Failing to achieve good Far	0.051	0.000			0.051	Existing baseline is failing to achieve good Ortho P indicative quality; however the modelled increase in concentration does not exceed 5% of the High / Good indicative quality boundary and therefore there is no risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			Failing to achieve good Far	0.037	0.000			0.037	Existing baseline is failing to achieve good Ortho P indicative quality; however the modelled increase in concentration does not exceed 5%

Site Name (Code)	Contributing WB Code_Name	WB Type[11]	Ortho P Indicative Quality[12] and Trends[13]	Baseline[14] Ortho P Conc.[15] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Total Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Increase in Conc.[16] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[17]	Evaluation
									of the High / Good indicative quality boundary and therefore there is no risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.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 Downwards Far	0.268	0.000			0.268	Existing baseline is failing to achieve good Ortho P indicative quality; however the modelled increase in concentration does not exceed 5% of the High / Good indicative quality boundary and therefore there is 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[11]	Ortho P Indicative Quality[12] and Trends[13]	Baseline[14] Ortho P Conc.[15] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Total Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Increase in Conc.[16] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[17]	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 Far	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 Upwards Far	0.188	0.000			0.188	Existing baseline is failing to achieve good Ortho P indicative quality; however the modelled increase in concentration does not exceed 5% of the High / Good indicative quality boundary and therefore there is 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 Upwards Far	0.043	0.000			0.043	Existing baseline is failing to achieve good Ortho P indicative quality; however the modelled increase in concentration does not exceed 5% of the High / Good indicative quality boundary and therefore there is

Site Name (Code)	Contributing WB Code_Name	WB Type[11]	Ortho P Indicative Quality[12] and Trends[13]	Baseline[14] Ortho P Conc.[15] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Total Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Increase in Conc.[16] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[17]	Evaluation
									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.
	IE_SW_G_089 Industrial Facility (P0016-02)	GWB	*Good*	*0.018*	*0.026*	*18.3*	*0.0194*	*0.037*	This groundwater body was delineated due to industrial point source pressures. The additional Ortho P load in this water body does not impact the ability of the dependent water bodies to achieve their WFD objectives (i.e. IE_SW_19T250870 Tibbotstown_010)
	IE_SW_G_092 Industrial Facility (P0028-01)	GWB	*Good*	*0.018*	0.026	*0.0*	*0.0*	*0.0*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_G_046 Knockadoon West	GWB	*Good*	*0.018*	*0.026*	*0.2*	*0.0000*	*0.018*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_G_090 LittleIsland	GWB	*Good*	*0.018*	0.026	*5.8*	*0.0054*	*0.023*	The modelled concentration is >5% High/Good indicative quality boundary but is within 75% of the upper indicative quality threshold therefore

Site Name (Code)	Contributing WB Code_Name	WB Type[11]	Ortho P Indicative Quality[12] and Trends[13]	Baseline[14] Ortho P Conc.[15] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Total Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Increase in Conc.[16] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[17]	Evaluation
									there is no risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SW_G_058 Midleton	GWB	Good Upwards Far	0.017	0.026	7.4	0.0002	0.017	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

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.

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.

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 5-3 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 5-4**, 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 5-3: 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***
Cork City Primary Discharge	2.5 (TP) 3.0 (TP with Cond. 2) Non compliance in 2017 AER	**Existing**	88006.0	0.951	0.761	1.293
		Post Dosing	88636.0	0.958	0.766	1.302
Cork City SWOs (36 no.)	n/a	**Existing**	2615.6	0.970	0.776	1.319
		Post Dosing	2633.9	0.977	0.782	1.329
Carrigtwohill Primary Discharge	1.0 (TP) 0.50 (Ortho P) Compliant with these ELVs in 2017 AER	**Existing**	723.2	0.177	0.141	0.240
		Post Dosing	723.2	0.177	0.141	0.240
Carrigtwohill SWOs (6 no.)	n/a	**Existing**	300.9	2.523	2.018	3.431
		Post Dosing	301.7	2.530	2.024	3.440
North Cobh Primary Discharge	n/a	**Existing**	150.0	0.312	0.250	0.425
		Post Dosing	240.3	0.500	0.400	0.680

Table 5-4: Mass balance assessment based on 0.6 mg/l dosing using available background concentrations and mean 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
Cork City	Lough Mahon (IE_SW_060_0750)	0.0315	0.0322	0.0322	0
Carrigtwohill	Lough Mahon (Harper's Island) IE_SW_060_0700	0.0200	0.0201	0.0201	0
North Cobh	Lough Mahon (IE_SW_060_0750)	0.0315	0.0315	0.0315	0

Cork City Agglomeration

Cork City Agglomeration discharges into Lough Mahon transitional water body (IE_SW_060_0750) which is hydrogeologically connected to Great Island Channel SAC and Cork Harbour SPA. The agglomeration was not compliant with total phosphorus ELVs set in the WWDL in 2017. The 2017 AER demonstrates that the TP ELV has been exceeded. However, as Cork City receives secondary treatment there is no treatment reduction assumed and the entire additional load from orthophosphate dosing is assumed to be discharged to the receiving water. The dosing will not significantly increase the effluent concentration and there is no risk of the receiving water failing to achieve WFD objectives as a result of the dosing. When fluvial and daily tidal exchange volumes are taken into account the increase in the receiving water is not detectable (0%) (**Table 5-4**). Therefore, there is no risk of failing to achieve WFD objectives for the Lough Mahon transitional water body (IE_SW_060_0750), and its hydrologically connected European Sites as a result of dosing at Glashaboy WTP.

Carrigtwohill Agglomeration

Carrigtwohill agglomeration discharges into Tibbotstown_010 river water body (IE_SW_19T250870) and Lough Mahon (Harper's Island) transitional water body (IE_SW_060_0700) which is hydrologically connected to Great Island Channel SAC and Cork Harbour SPA. Carrigtwohill 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.

Existing effluent concentrations are compliant with ELVs and the impact from orthophosphate dosing in this WSZ on the direct discharges to surface waters is virtually zero. When mean flows are taken into account the increase in the receiving water is not detectable (0%) (**Table 5-4**). Therefore, there is no risk of failing to achieve WFD objectives for the Tibbotstown_010 river water body (IE_SW_19T250870), and its hydrologically connected European Sites as a result of dosing at Glashaboy WTP.

North Cobh Agglomeration

North Cobh agglomeration discharges into Lough Mahon coastal water body (IE_SW_060_0750) which is hydrogeological connected to Great Island Channel SAC and Cork Harbour SPA. North Cobh agglomeration receives secondary treatment and therefore there is no treatment reduction assumed and the entire additional load from orthophosphate dosing is assumed to be discharged into the receiving water. Existing effluent concentrations are compliant with ELVs. When fluvial and daily tidal exchange volumes are taken into account the increase in the receiving water is not detectable (0%) (**Table 5-4**). Therefore, there is no risk of failing to achieve WFD objectives for the Lough Mahon transitional water body (IE_SW_060_0750), and its hydrologically connected European Sites as a result of dosing at Glashaboy WTP.

5.3.4 Assessment of Potential Indirect Impacts from Sub Surface Flow

5.3.4.1 Sub surface flows from leakage and DWWTP

Step 4 of the EAM model the distributed inputs to river water bodies from sub-surface pathways (**Appendix C**). The increased loads and predicted concentrations from subsurface pathways are less than 5% of the High / Good indicative quality boundary for all river water bodies. The highest increase recorded, 0.0006 mg/l, is for Tibbotstown_010 (IE_SW_19T250870). In Butlerstown (IE_SE_19B060800), the post dosing baseline concentration is exceeding the 75% indicative quality upper threshold. However, this is due to the existing baseline concentration as the modelled increase in Ortho P concentration is insignificant (0.0002mg/l). Therefore, there is no risk of deterioration in the orthophosphate indicative quality of the river water bodies, or of preventing the achievement of WFD objectives.

Step 4 of Appendix C outlines the distributed inputs to transitional and coastal water bodies receiving flows from river water bodies connected to the WSZs. The modelled loads in Tibbotstown river water body (IE_SW_19T250870) have been reapportioned to neighbouring water bodies due to the terrain in the catchment. The loads, after reapportionment are presented in Step 4 of Appendix C for Lough Mahon (Harper's Island) (IE_SW_060_0700), Lough Mahon (IE_SW_060_0750), Glashaboy Estuary

(IE_SW_060_0800), North Channel Great Island (IE_SW_060_0300), Slatty Bridge, Fota Island (IE_SW_060_0600), Cork Harbour (IE_SW_060_0000) and Outer Cork Harbour (IE_SW_050_0000). Susceptibility mapping information was missing from the area labelled Great Island, the 89.5 km of water main and small number of DWWTS are modelled using average delivery rates from Tibbotstown river water body (IE_SW_19T250870). The increased loads and predicted concentrations from subsurface pathways are significantly less than 5% of the high good indicative quality boundary. The following transitional/coastal waterbodies have post dosing concentrations which exceed 75% of the indicative quality upper threshold; Glashaboy Estuary (IE_SW_060_0800) during winter, Cork Harbour (IE_SW_060_0000) and Outer Cork Harbour (IE_SW_050_0000). This is due to the baseline concentration as the modelled increases in Ortho P concentration are undetectable for Cork Harbour and Outer Cork Harbour (0.0000mg/l) and insignificant for Glashaboy Estuary (0.0003mg/l). Therefore, there is no risk of deterioration in the orthophosphate indicative quality of the transitional and coastal water bodies due to subsurface pathways, or of preventing the achievement of WFD objectives.

5.3.4.2 Groundwater Assessment

The predicted loads to certain groundwater bodies (GWBs) are significant (i.e. exceed 5% of the Good / Fail indicative quality boundary) due the susceptibility and hydrological conditions in general as shown in **Table 7 of Appendix C**. As some GWBs are small, the corresponding flows are low and the concentrations are sometimes high.

Ballinhassig East (IE_SW_G_004) has a number of monitoring points, some of which are Failing to Achieve Good indicative quality or exceed the 75% upper indicative quality threshold, however the modelled increase in concentration does not exceed 5% of the Good / Fail indicative quality boundary (0.00175 mg/l) and therefore there is no risk of deterioration in the indicative quality of the groundwater body or of preventing the achievement of WFD objectives.

(IE_SW_G_089) Industrial Facility (P0016-02) is at Good surrogate indicative quality and the modelled load and corresponding increase in concentration is high raising the baseline above the 75% indicative quality threshold. However this small groundwater body has been delineated to capture industrial point source pressures. The additional orthophosphate load in this water body is not likely to be a key issue in this groundwater body or impact on the ability of the dependent water bodies to achieve their WFD objectives i.e. overlying river water bodies Tibbotstown_010 (IE_SW_19T250870), which is hydrologically connected with Great Island Channel SAC and Cork Harbour SPA, as demonstrated by the subsurface pathways to surface waters.

For LittleIsland (IE_SW_G_090), the modelled concentration is >5% High/Good indicative quality boundary but is within 75% of the upper indicative quality threshold therefore there is no risk to the surface water bodies [i.e. Lough Mahon (Harper's Island) (IE_SW_060_0700) and Lough Mahon (IE_SW_060_0750)] from the proposed orthophosphate dosing, and it will not impact on the ability of the dependent water bodies to achieve their WFD environmental objectives.

The information in susceptibility maps is missing around Great Island, so no modelled load is available directly for Knockadoon_W (IE_SW_G_046) and Industrial Facility P0028-01 (IE_SW_G_092). The potential load for Knockadoon_W (IE_SW_G_046) has been estimated by assuming similar hydrogeological conditions with neighbouring areas. It does not exceed 5% of the High / Good indicative quality boundary and the additional orthophosphate load in this water body is not impacting on the ability of the dependent surface water bodies to achieve their WFD objectives. There is no overlying waterbody defined for this GWB, but the load is modelled to Cork Harbour in the surface water assessment, where impact from combined pathways is shown to be insignificant. There is

minimal water main length and DWWTS in Industrial Facility (IE_SW_G_092) and the potential load has been estimated at 0.0 kg/yr., therefore it is determined that there will be no impact associated with orthophosphate dosing in this water body.

5.3.5 Combined Assessment

Table 9 of Appendix C provides details of the combined orthophosphate inputs to river water bodies from direct discharges, DWWTSs and leakage loads. The load from waterbody Tibbotstown IE_SW_19T250870 has been reapportioned, where appropriate to receiving waterbodies. The remaining load in the river, including from surface water pathways, causes an insignificant increase (<0.00125mg/l) in the modelled concentration.

Table 10 of Appendix C outlines the increased loading and concentrations to transitional and coastal water bodies receiving flows from river water bodies connected to the WSZ. For the transitional water bodies the concentrations have been calculated using all available riverine flows and tidal flows. Some of the orthophosphate concentrations following dosing exceed the 75% upper threshold for orthophosphate indicative quality, i.e., Glashaboy Estuary (IE_SW_060_0800) – winter. However, this is due to the high existing baseline concentration as the predicted increase in concentration does not exceed 5% of the High / Good indicative quality boundary (0.0003 mg/l) and is therefore negligible. Modelled increases in orthophosphate concentrations post dosing in all remaining water bodies are insignificant (I.e. <0.00125mg/l). Cork Harbour (IE_SE_060_0000) and Outer Cork Harbour (IE_SE_050_0000) have post dosing concentrations which exceed the 75% upper threshold for orthophosphate indicative quality. This is again due to the high existing baseline concentration as the predicted increase in concentration does not exceed 5% of the High / Good indicative quality boundary (0.0000 mg/l) and is therefore not detectable. Therefore, there is no risk of deterioration in the indicative quality of the water bodies as a result of dosing, or of preventing the achievement of WFD objectives.

5.3.6 Assessment of Cumulative Impacts from other WSZs

The cumulative effects from other dosed water supply zones in the Lee, Cork Harbour and Youghal Bay Catchment (HA19) i.e. 004 Lee Road WTP- Cork City Water Supply and 006 Inniscarra WTP- Cork Zone 2 City and Harbour have been assessed with Zone 3 Glashaboy WSZ. The common water bodies evaluated within the WSZs have been summarised in **Table 5-5** below.

- 004 Lee Road WTP - Cork City Water Supply
- 006 Inniscarra WTP - Zone 2 Cork City and harbour

The post dosing baseline concentration for the following transitional water bodies; Lee (Cork) Estuary Lower (IE_SW_060_0900) - summer, Lee (Cork) Estuary Upper (IE_SW_060_0950) - winter, are above 75% of the upper orthophosphate indicative quality threshold. However, the modelled post dosing concentration does not exceed 5% of the High / Good indicative quality boundary i.e. 0.00125mg/l and therefore will not cause a deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.

The following Coastal Waterbodies display post dosing baseline concentrations which exceed 75% of the indicative quality upper threshold; Cork Harbour (IE_SE_060_0000) – (winter) and Outer Cork Harbour (IE_SW_050_0000) – (winter). However, the modelled post dosing concentration is undetectable and does not exceed 5% of the High / Good indicative quality boundary i.e. 0.00125mg/l.

Therefore, there will be no deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.

Table 5-5: Cumulative assessment of the increased loading and concentrations to river water bodies common to the Cork WSZs

NAME / EU_CD	WB Type/ Period	Ortho P Indicative Quality and Trends (distance to threshold) Surrogate Indicative Quality indicated in *italic*	Baseline Year 2014 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_19B060800 Butlerstown_030	RWB	High Upwards Near	0.021	*0.019*	16.3	0.0002	0.021
IE_SW_19G010600 Glashaboy (Lough Mahon) _030	RWB	*Good*	0.030	*0.033*	42.6	0.0003	0.030
IE_SW_19T250870 Tibbotstown_010	RWB	*Good*	0.030	0.033	8.1	0.0006	0.031
Lough Mahon IE_SW_060_0750	TWB summer	High (S) Downwards Far	0.014	*0.020*	6556.6	0.0001	0.014
	TWB winter	Good (W) Downwards Far	0.027	*0.042*			0.027
Lee (Cork) Estuary Lower IE_SW_060_0900	TWB summer	High (S) Downwards Near	0.021	*0.020*	376.4	0.0002	0.021
	TWB winter	Good (W) Downwards Near	0.035	*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	0.037
	TWB winter	High (W) Downwards Near	0.026	0.019			0.027
Cork Harbour IE_SW_060_0000	CWB summer	High (S) Downwards Far	0.003	0.019	8546.2	0.0000	0.003
	CWB winter	High (W) Upwards Near	0.024	0.019			0.024
Outer Cork Harbour IE_SW_050_0000	CWB summer	High (S) Downwards Far	0.003	0.019	8627.1	0.0003	0.000
	CWB winter	High (W) Upwards Far	0.024	0.018			0.016

‡ Load from WWTP / SWO following treatment added

5.3.7 Conclusions

The modelled concentrations due to subsurface pathways are insignificant in all river water bodies, i.e. < 0.00125 mg/l (5% of the High / Good indicative quality boundary for surface water bodies). The highest concentration modelled for receiving water bodies is 0.0006 mg/l to Tibbotstown_010 (IE_SW_19T250870), which does not exceed 5% of the High / Good indicative quality boundary (0.00125 mg/l). Butlerstown_030 (IE_SW_19B060800) displays a post dosing baseline concentration which exceeds 75% of the indicative quality upper threshold. However, this is due to the existing baseline concentration as the modelled increase is insignificant (0.0002mg/l). Therefore there is no risk of deterioration in the orthophosphate indicative quality of the river water bodies, or of preventing the achievement of their WFD objectives.

In the transitional and coastal water bodies the post-dosing increases in concentration have been calculated using fluvial and tidal flows and hence are very low for all water bodies (i.e. within 5% of the Good / High indicative quality boundary). A number of water bodies; Glashaboy Estuary (IE_SW_060_0800) - winter, Cork Harbour (IE_SH_060_0000) – winter, and Outer Cork Harbour (IE_SH_050_0000) had post-dosing increases in concentration that exceeded the 75% upper threshold for orthophosphate indicative quality. However, this is as a result of a high pre-dosing baseline concentration. As the modelled increases in concentration are undetectable or insignificant (0.0000mg/l or 0.0003mg/l) and are below 5% of the High / Good indicative quality boundary, there is no risk of deterioration in the indicative quality of the water bodies as a result of dosing, or of preventing the achievement of WFD objectives.

The groundwater bodies Industrial Facility - (P0016-02) (IE_SW_G_089) and LittleIsland (IE_SW_G_090) had post-dosing modelled increases in concentration that exceeded the 5% Good / Fail indicative quality boundary for groundwater bodies. However, the post dosing concentration for LittleIsland (IE_SW_G_090) does not exceed 75% of the indicative quality upper threshold. In addition, the post dosing baseline concentration in Industrial Facility - (P0016-02) (IE_SW_G_089) following dosing also exceeds 75% of the indicative quality upper threshold for orthophosphate. However, this small groundwater body has been delineated to capture the industrial pressures and Ortho-P risk is not likely to be a key issue in this groundwater body as demonstrated by the subsurface pathways to surface waters. The groundwater body, Ballinhassig East (IE_SW_G_004) has a number of monitoring points, some of which are Failing to Achieve Good indicative quality or exceed the 75% upper indicative quality threshold, however the modelled increase in concentration does not exceed 5% of the Good / Fail indicative quality boundary (0.00175 mg/l) and therefore there is no risk of deterioration in the indicative quality of the groundwater body or of preventing the achievement of WFD objectives.

Increases in concentration for all remaining water bodies are within the 5% Good / High indicative quality boundary threshold following dosing. There are no lake water bodies directly affected by the Glashaboy WTP.

The cumulative assessment of dosing at Glashaboy WTP from other WTPs which may be subject to dosing in the same catchments has demonstrated that there will be no likely significant effect on most receiving water bodies. The river waterbody, Butlerstown_030 (IE_SW_19B060800) exceeds 75% of the upper indicative quality threshold. However, the modelled increase in Ortho P concentration is insignificant (0.0002mg/l) and therefore there is no risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives. Several transitional and coastal water bodies [Lee (Cork) Estuary Lower, Lee (Cork) Estuary Upper, Cork Harbour and Outer Cork Harbour] exceeded the 75% upper threshold for orthophosphate indicative quality, however, are below 5% of

the High / Good indicative quality boundary. As such, there is no risk of deterioration in the indicative quality of the water bodies as a result of dosing, or of preventing the achievement of WFD objectives 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

Glashaboy WTP is not located within or directly adjacent to the boundary of any European Site. There are no surface water connections within the confines of Glashaboy WTP. The nearest surface water body is Glashaboy (Lough Mahon)_030 (IE_SW_19G010600) river which is located approximately 700m and 1.2km to the east and west of the WTP. This river water body is hydrologically connected to Great Island Channel SAC and Cork Harbour SPA approximately 2km and 4.8km downstream. From the minor scale of the proposed construction works and the distance of potential overland flow over extensive agricultural land which will act as a barrier to prevent surface run-off from the works area to the river and impact assessment presented in **Section 5.3.1** above; there are no source-receptor-pathways identified which give rise to surface water connectivity between the proposed construction works and any other European Sites.

In addition, the WTP overlies the Ballinhassig East groundwater body (IE_SW_G_004). This groundwater body and intersects four European Sites: Great Island Channel SAC, Cork Harbour SPA, The Gearagh SAC and The Gearagh SPA. Potential source-receptor-pathways have been ruled out for The Gearagh SAC and The Gearagh SPA owing to the distance and direction of groundwater flow paths. For the remaining European Sites, the interference with the underlying water table will be unlikely to occur owing to the nature of the construction works. Any interference would be localised, minor and temporary.

Therefore, it can be concluded on the basis of objective scientific information that the construction of the corrective water treatment works at Glashaboy WTP, individually or in combination with other plans or projects, will not to 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[18]). 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 objectives supporting document for Marine habitats (NPWS, 2014[19]) require that activities or

[18] NPWS 2014 Great Island Channel SAC 001058 Conservation Objectives
[19] NPWS 2014 Great Island Channel SAC (site code 1058) Conservation Objectives Supporting Document - Marine Habitats

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 5-2 identifies the surface and ground water bodies which are hydrologically or hydrogeologically connected to Great Island Channel SAC and will receive inputs from the proposed orthophosphate dosing at Glashaboy WTP:

- The river water bodies hydrologically connected to the site include: Tibbotstown_010 (IE_SW_19T250870), Butlerstown_030 (IE_SW_19B060800) and Glashaboy (Lough Mahon)_030 (IE_SW_19G010600);
- The transitional water bodies connected to the site include: Lough Mahon (IE_SW_060_0750), Lough Mahon (Harper's Island) (IE_SW_060_0700), Glashaboy Estuary (IE_SW_060_0800) and North Channel Great Island (IE_SW_060_0300); and
- Groundwater bodies hydrogeologically connected to the site include: Ballinhassig East (IE_SW_G_004), Industrial Facility (P0028-01) (IE_SW_G_092), Knockadoon West (IE_SW_G_046), LittleIsland (IE_SW_G_090) and Midleton (IE_SW_G_058).

The habitat mudflats and sandflats not covered by seawater at low tide span the full extent of the SAC. The habitat is located in the transitional water bodies: Lough Mahon (IE_SW_060_0750); Lough Mahon (Harper's Island) (IE_SW_060_0700); and North Channel Great Island (IE_SW_060_0300) and receive direct discharges from the river water bodies Tibbotstown_010 (IE_SW_19T250870) and Glashaboy (Lough Mahon)_030 (IE_SW_19G010600).

The EAM has assessed the potential for impact on orthophosphate indicative water quality and nutrient conditions and 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 modelled increases in concentration in all river water bodies above do not exceed the 5% Good / High indicative quality boundary. Butlerstown_030 (IE_SW_19B060800) displays a post dosing baseline concentration which exceeds 75% of the indicative quality upper threshold. However, this is due to the existing baseline concentration as the modelled increase is insignificant (0.0002mg/l). Therefore, dosing at Glashaboy WTP does not risk deterioration in the indicative quality of the water bodies or prevent the achievement of WFD objectives.

In the transitional water body, Glashaboy Estuary (IE_SW_060_0800) the orthophosphate baseline following dosing exceeds 75% of the orthophosphate indicative quality upper threshold. However, this is due to the high baseline concentration as the modelled increase in concentration (0.0003mg/l) is below 5% of the High / Good indicative quality boundary and so would not be significant. All other transitional waterbodies pose no risk of deterioration to the indicative quality of the water bodies or prevent the achievement of WFD objectives.

The groundwater body LittleIsland (IE_SW_G_090) has a post-dosing modelled increase in concentration that exceeds the 5% Good / Fail indicative quality boundary for groundwater bodies. However, the post dosing concentration does not exceed 75% of the indicative quality upper threshold. The groundwater body, Ballinhassig East (IE_SW_G_004) has a number of monitoring

points, some of which are Failing to Achieve Good indicative quality or exceed the 75% upper indicative quality threshold, however the modelled increase in concentration does not exceed 5% of the Good / Fail indicative quality boundary (0.00175 mg/l) and therefore there is no risk of deterioration in the indicative quality of the groundwater body or of preventing the achievement of WFD objectives. The other listed groundwater bodies do not exceed the Good / Fail quality boundary and there is no risk of deterioration in the indicative quality of each of the groundwater bodies.

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

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

A review of the SSCOs for the SAC 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)[20] 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 5-2 identifies the surface and ground water bodies which are hydrologically or hydrogeologically connected to Great Island Channel SAC and will receive inputs from the proposed orthophosphate dosing at Glashaboy WTP:

- The river water bodies hydrologically connected to the site include: Tibbotstown_010 (IE_SW_19T250870), Butlerstown_030 (IE_SW_19B060800) and Glashaboy (Lough Mahon)_030 (IE_SW_19G010600);
- The transitional water bodies connected to the site include: Lough Mahon (IE_SW_060_0750), Lough Mahon (Harper's Island) (IE_SW_060_0700), Glashaboy Estuary (IE_SW_060_0800) and North Channel Great Island (IE_SW_060_0300); and
- Groundwater bodies hydrogeologically connected to the site include: Ballinhassig East (IE_SW_G_004), Industrial Facility (P0028-01) (IE_SW_G_092), Knockadoon West (IE_SW_G_046), LittleIsland (IE_SW_G_090) and Midleton (IE_SW_G_058).

The habitat Atlantic salt meadows span the full extent of the SAC. The habitat is located in the transitional water bodies: Lough Mahon (IE_SW_060_0750), Lough Mahon (Harper's Island) (IE_SW_060_0700) and North Channel Great Island (IE_SW_060_0300) and receives discharges from the river water bodies Tibbotstown_010 (IE_SW_19T250870) and Glashaboy (Lough Mahon)_030 (IE_SW_19G010600).

The EAM has assessed the potential for impact on orthophosphate indicative water quality and nutrient conditions and 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**.

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

The modelled increases in concentration in all river water bodies above do not exceed the 5% Good / High indicative quality boundary. Butlerstown_030 (IE_SW_19B060800) displays a post dosing baseline concentration which exceeds 75% of the indicative quality upper threshold. However, this is due to the existing baseline concentration as the modelled increase is insignificant (0.0002mg/l). Therefore, dosing at Glashaboy WTP does not risk deterioration in the indicative quality of the water bodies or prevent the achievement of WFD objectives.

In the transitional water body, Glashaboy Estuary (IE_SW_060_0800) the orthophosphate baseline following dosing exceeds 75% of the orthophosphate indicative quality upper threshold. However, this is due to the high baseline concentration as the modelled increase in concentration (0.0003mg/l) is below 5% of the High / Good indicative quality boundary and so would not be significant. All other transitional waterbodies pose no risk of deterioration in the indicative quality of the water bodies or prevent the achievement of WFD objectives.

The groundwater body LittleIsland (IE_SW_G_090) has a post-dosing modelled increase in concentration that exceeds the 5% Good / Fail indicative quality boundary for groundwater bodies. However, the post dosing concentration does not exceed 75% of the indicative quality upper threshold. The groundwater body, Ballinhassig East (IE_SW_G_004) has a number of monitoring points, some of which are Failing to Achieve Good indicative quality or exceed the 75% upper indicative quality threshold, however the modelled increase in concentration does not exceed 5% of the Good / Fail indicative quality boundary (0.00175 mg/l) and therefore there is no risk of deterioration in the indicative quality of the groundwater body or of preventing the achievement of WFD objectives. The other listed groundwater bodies do not exceed the Good / Fail quality boundary and there is no risk of deterioration in the indicative quality of each of the groundwater bodies.

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

6.2.2 CORK HARBOUR SPA 004030

Cork Harbour is a large, sheltered bay system, with several river estuaries – principally those of the Rivers Lee, Douglas, Owenboy and Owennacurra (NPWS, 2015)[21]. The SPA site comprises most of the main intertidal areas of Cork Harbour, including all of the North Channel, the Douglas River Estuary, inner Lough Mahon, Monkstown Creek, Lough Beg, the Owenboy River Estuary, Whitegate Bay, Ringabella Creek and the Rostellan and Poulnabibe inlets.

The site is an SPA under the E.U. Birds Directive, of special conservation interest for the following species: Little Grebe, Great Crested Grebe, Cormorant, Grey Heron, Shelduck, Wigeon, Teal, Mallard, Pintail, Shoveler, Red-breasted Merganser, Oystercatcher, Golden Plover, Grey Plover, Lapwing, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Greenshank, Black-headed Gull, Common Gull, lesser Black-backed Gull and Common Tern. The site is also of special conservation interest for holding an assemblage of over 20,000 wintering waterbirds.

[21] NPWS 2015 Cork Harbour SPA 004030 Site Synopsis

Cork Harbour has 25 SCIs all of which are considered nutrient sensitive (see **Appendix B**). The SSCOs for Cork Harbour SPA (NPWS, 2014[22]) lists 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.

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 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.

The Cork Lower Harbour Main Drainage Project is now complete and wastewater from the agglomerations of Ringaskiddy-Crosshaven-Carrigaline, Ringaskiddy village, Passage-Monkstown and Cobh town no longer discharges untreated to Cork harbour. Instead it is collected and fully treated before its safe discharge to sea. Uisce Éireann invested €144 million in the Cork Lower Harbour Main Drainage project to address the issue of raw sewage discharge to the harbour and to ensure that wastewater from the above named agglomerations is collected and fully treated before its safe discharge to sea. More than 20,000 homes and businesses are now connected to the overall scheme and raw sewage no longer discharges daily to the waters of the harbour, but are treated in compliance with the Urban Wastewater Treatment Directive (https://www.water.ie/projects/local-projects/cork-lower-harbour/).

[22] NPWS 2014 Cork Harbour SPA 004030 Conservation Objectives

Table 5-2 identifies the surface and ground water bodies which are hydrologically or hydrogeologically connected to Cork Harbour SPA and will receive inputs from the proposed orthophosphate dosing at Glashaboy WTP:

- The river water bodies hydrologically connected to the site include: IE_SW_19T250870 - Tibbotstown_010; IE_SW_19B060800 - Butlerstown_030; and, IE_SW_19G010600 - Glashaboy (Lough Mahon)_030.
- The transitional water bodies connected to the site include: IE_SW_060_0750 - Lough Mahon; IE_SW_060_0700 - Lough Mahon (Harper's Island); IE_SW_060_0800 - Glashaboy Estuary; and, IE_SW_060_0300 - North Channel Great Island.
- The groundwater bodies hydrogeologically connected to the site include: IE_SW_G_004 - Ballinhassig East; IE_SW_G_089 - Industrial Facility (P0016-02); IE_SW_G_092 - Industrial Facility (P0028-01); IE_SW_G_046 - Knockadoon West; IE_SW_G_090 – LittleIsland; and, IE_SW_G_058 – Midleton.

The SPA site comprises most of the main intertidal areas of Cork Harbour, including all of the North Channel, the Douglas River Estuary, inner Lough Mahon, Monkstown Creek, Lough Beg, the Owenboy River Estuary, Whitegate Bay, Ringabella Creek and the Rostellan and Poulnabibe inlets. It is located in the transitional water bodies: Lough Mahon (IE_SW_060_0750); Lough Mahon (Harper's Island) (IE_SW_060_0700); and North Channel Great Island (IE_SW_060_0300). It also occurs in the coastal water bodies: Cork Harbour (IE_SW_060_0000) and Outer Cork Harbour (IE_SW_050_0000). It receives discharges from the river water bodies Tibbotstown_010 (IE_SW_19T250870) and Glashaboy (Lough Mahon)_030 (IE_SW_19G010600).

The EAM has assessed the potential for impact on orthophosphate indicative water quality and nutrient conditions and 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**.

Butlerstown_030 (IE_SW_19B060800) displays a post dosing baseline concentration which exceeds 75% of the indicative quality upper threshold. However, this is due to the existing baseline concentration as the modelled increase is insignificant (0.0002mg/l). Therefore there is no risk of deterioration in the orthophosphate indicative quality of the river water bodies, or of preventing the achievement of their WFD objectives.

In the transitional water body, Glashaboy Estuary (IE_SW_060_0800) the orthophosphate baseline following dosing exceeds 75% of the orthophosphate indicative quality upper threshold. However, this is due to the high baseline concentration as the modelled increase in concentration (0.0003mg/l) is below 5% of the High / Good indicative quality boundary and so would not be significant. All other transitional waterbodies pose no risk of deterioration in the indicative quality of the water bodies or prevent the achievement of WFD objectives. All other transitional waterbodies pose no risk of deterioration in the indicative quality of the water bodies or prevent the achievement of WFD objectives.

The groundwater body LittleIsland (IE_SW_G_090) has a post-dosing modelled increase in concentration that exceeds the 5% Good / Fail indicative quality boundary for groundwater bodies. However, the post dosing concentration does not exceed 75% of the indicative quality upper threshold. The groundwater body, Ballinhassig East (IE_SW_G_004) has a number of monitoring points, some of which are Failing to Achieve Good indicative quality or exceed the 75% upper

indicative quality threshold, however the modelled increase in concentration does not exceed 5% of the Good / Fail indicative quality boundary (0.00175 mg/l) and therefore there is no risk of deterioration in the indicative quality of the groundwater body or of preventing the achievement of WFD objectives. The other listed groundwater bodies do not exceed the Good / Fail quality boundary and there is no risk of deterioration in the indicative quality of each of the groundwater bodies.

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

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 Team's 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 The plan outlines under Chapter 11: Water Management, the following objectives: **11.7.1** The Draft Guidelines on Water Services (published January 2018) emphasise the importance of Planning Authorities ascertaining the current position with regard to water services when preparing a plan. The Guidelines indicate that "the quantum, location and distribution of new development must have regard to the capacity of public water services and make efficient use of, and maximise the capacity of, existing and planned water services infrastructure." **11.7.2** As outlined, the National Planning Framework establishes a requirement for a Tiered Approach to Zoning (TAZ) comprising Tier 1 lands which are residential lands that are currently serviced and Tier 2 lands which are residential lands that will become serviced in the lifetime of the Plan. To ensure compliance with the above requirements an assessment has been undertaken of the capacity of water services for each settlement in the County and this has informed the approach to zoning across the County. **11.7.3** The assessment of capacity in this Plan is based on best available information at the time of preparation in relation to water and wastewater treatment plants, however, developers should engage directly with Uisce Éireann at pre-planning stage to confirm the availability and suitability of water services, in particular network upgrades or extensions. Where network upgrades or extensions are required these will be developer funded unless there are committed Uisce Éireann projects in place to progress such works. Evidence of consultation with Uisce Éireann should be submitted with development applications as appropriate.	▪ N/A	The Cork Development Plan emphasises the objectives of their water services which include the enhancement and improved quality of the service to its consumers. The plans also outline the importance of compliance with the River Basin Management Plan (2022-2027) and emphasises compliance with environmental objectives. The Plan also seeks to ensure the protection, integrity and conservation of European Sites and Annex I and II species listed in EU Directives. There is no potential for cumulative impacts with these plans.
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	▪ N/A	The objectives of the RBMP are to • Prevent deterioration; • Restore good status; • Reduce chemical pollution; and • Achieve water related protected areas objectives

Plan / Programme/Policy	Key Types of Impacts	Potential for In-combination Effects and Mitigation
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.		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 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.	▪ Habitat loss or destruction; ▪ Habitat fragmentation or degradation; ▪ Alterations to water quality and/or water movement; ▪ Disturbance; ▪ In-combination impacts within the same scheme	CFRAM Studies and their product Flood Risk Management Plans, will each undergo appropriate assessment. 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 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

Plan / Programme/Policy	Key Types of Impacts	Potential for In-combination Effects and Mitigation
		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[23]. 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 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	▪ Overgrazing; ▪ Land use change or intensification; ▪ Water pollution; ▪ Nitrogen deposition; ▪ Disturbance to habitats / species;	The RDP for 2014 – 2020 has been subject to SEA[24], and AA[25]. The AA assessed the potential for impacts from the RDP measures e.g. for the GLAS scheme to result in 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

[23] http://www.agriculture.gov.ie/media/migration/foodindustrydevelopmenttrademarkets/agri-foodandtheeconomy/foodwise2025/environmentalanalysis/AgriFoodStrategy2025NISDRAFT300615.pdf
[24] https://www.agriculture.gov.ie/media/migration/ruralenvironment/ruraldevelopment/ruraldevelopmentprogramme2014-2020/StrategEnvironmAssessSumState090615.pdf
[25] 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
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.		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 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	▪ Land use change or intensification ▪ Water pollution ▪ Nitrogen deposition ▪ Disturbance to habitats / species	This programme has been subject to a Screening for Appropriate Assessment and it concluded that the NAP will not have a significant effect on the Natura 2000 network and a Stage 2 AA was not required[26]. 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.

[26] http://www.housing.gov.ie/sites/default/files/migrated-files/en/Publications/Environment/Water/FileDownLoad,35218,en.PDF

Plan / Programme/Policy	Key Types of Impacts	Potential for In-combination Effects and Mitigation
regulations. It is spread across six catchments and encompasses approximately 300 farmers.		
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[27]. 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.
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	▪ Habitat loss and disturbance from new / upgraded infrastructure; ▪ Species disturbance;	The overarching strategy was subject to Appropriate Assessment 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.

[27] 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
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.	▪ Changes to water quality or quantity; ▪ Nutrient enrichment /eutrophication.	
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 (in prep.) 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 will need to take 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 for urban wastewater and urban runoff and also as part of other measures in relation to the lead in drinking water.	▪ 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 potential for in-combination impacts are unclear as the plan is not sufficiently developed at this stage.
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	▪ Habitat loss and disturbance from new / upgraded infrastructure;	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

Plan / Programme/Policy	Key Types of Impacts	Potential for In-combination Effects and Mitigation
infrastructure, the applications seek to connect to the city's foul and storm drainage systems.	▪ Species disturbance; ▪ Changes to water quality or quantity; ▪ Nutrient enrichment /eutrophication.	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/ in-combination impacts on the receiving environment.
Integrated Pollution Control (IPC) Licensing Cork City is home to many international pharmaceutical companies. 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 cumulative impacts on the receiving environment.

7 SCREENING CONCLUSION STATEMENT

This Screening to inform the AA process has considered whether the proposed construction works and operational orthophosphate dosing at the Glashaboy WTP, within Glashaboy 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 for 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 Glashaboy WTP the potential for direct, indirect and cumulative impacts affecting European Sites within the ZoI (i.e. the Great Island Channel SAC and Cork Harbour SPA) has 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 the Great Island Channel SAC and Cork Harbour SPA has been assessed. Due to the low orthophosphate inputs following dosing at Glashhaboy WTP and no risk of deterioration in the orthophosphate indicative quality of the receiving water bodies or of preventing the achievement of WFD objectives, 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 Glashaboy 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.

8 REFERENCES

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NPWS (2019c) Article 17 Species Conservation Assessments (Vol. 3) Version 1.1. The Status of EU Protected Habitats and Species in Ireland.

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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 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

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
8310	Caves not open to the public	Yes	Yes	Yes

Code	Qualifying Interest	Water dependant	GWDTE	Nutrient sensitive
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 nigra*)	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

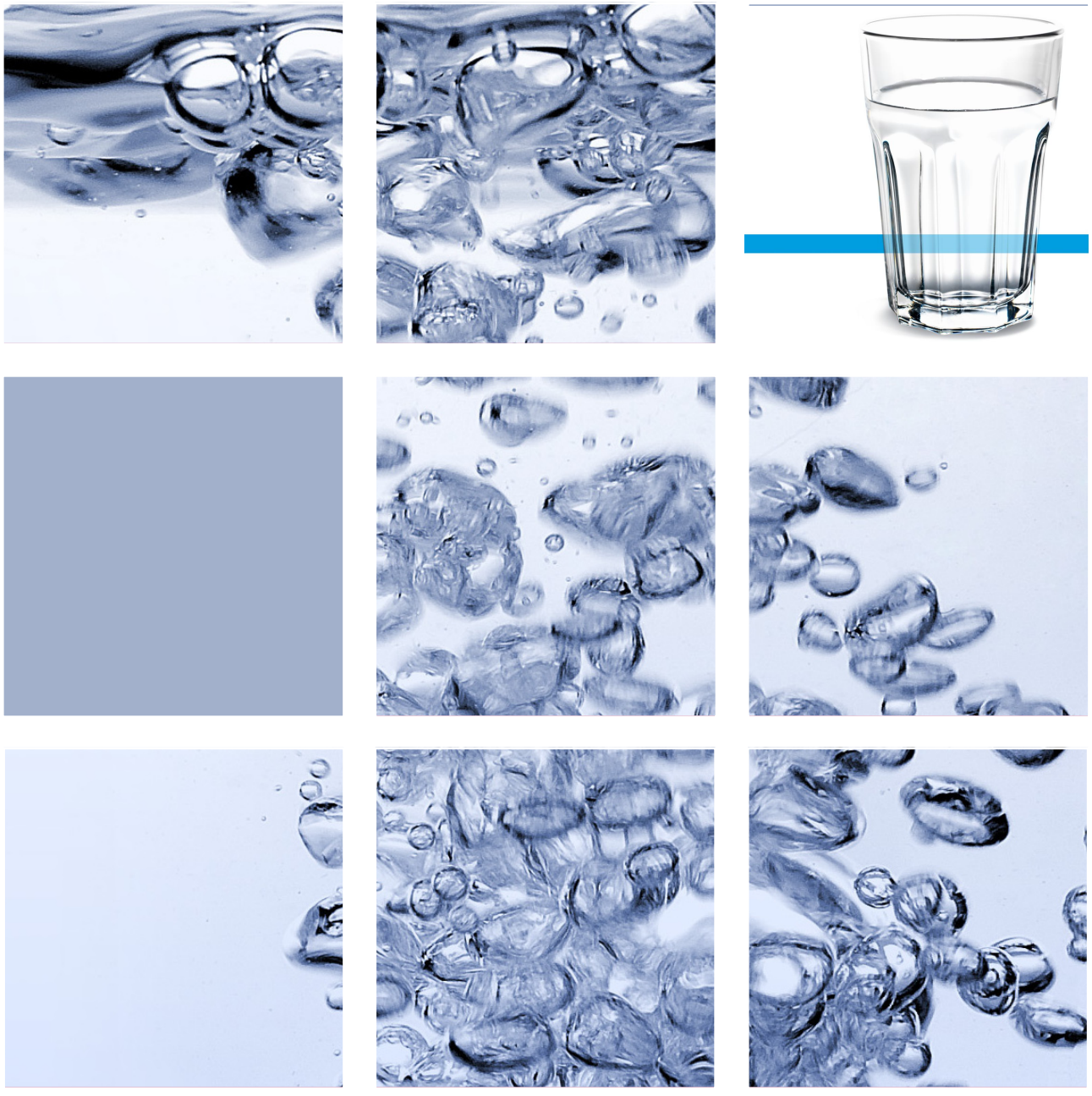
APPENDIX C

EAM Summary Report

Uisce Éireann - Lead in Drinking Water Mitigation Plan

Environmental Assessment Methodology (EAM) Summary Report

026 Glashaboy WTP – Zone 3 Glashaboy (0500PUB3303)



National Lead in Water Mitigation Strategy

Environmental Assessment Methodology Report: 026 Glashaboy WTP – Zone 3 Glashaboy (0500PUB3303)

Document Control Sheet

Client:	Uisce Éireann
Project Title:	National Lead in Water Mitigation Strategy
Document Title:	Environmental Assessment Methodology Report: 026 - Zone 3 Glashaboy
Document No:	MDW0766RP_EAM_026_Glashaboy_F05

Text Pages:	12	Appendices:	-

Rev.	Status	Date	Author(s)		Reviewed By		Approved By	
F01	Final	17th Aug 2018	YE		MM		IP	
F02	Final	10th Sep 2018	YE		MM		IP	
F03	Final	2nd May 2019	MH		MM		IP	
F04	Final	13th Aug 2019	IP		MM		GJG	
F05	Final	15th June 2023	YE		IP		MM	

026 - Zone 3 Glashaboy (0500PUB3303)

Supporting spreadsheet: 026 Glashaboy WTP - Zone3 Glashaboy_v10

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

Glashaboy WTP supplies the east of Cork City and neighbouring areas to a water supply zone (WSZ) named Zone 3 Glashaboy (0500PUB3303). The daily production and distribution input for the WTW is 15,500 m^3/day (60% of which is accounted for, with the remainder assumed to be lost through leakage) serving a population of approximately 14,300. The non-domestic demand is 38% of the distribution input. The Cork City WWTP agglomeration covers part of the WSZ boundary with most of the remainder served by Carrigtwohill (upgraded in January 2016) and North Cobh 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. The Cobh agglomeration is now served by the Cork Lower Harbour Drainage Scheme treatment plant at Shanbally, Ringaskiddy, Co Cork and therefore benefits from secondary treatment before the wastewater discharges into Cork Harbour. There are an estimated 1678 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 Recommendations, and Tables 11 and 12).

<table>
<tr><td>Water Supply Zone</td><td colspan="2">Zone 3 Glashaboy (0500PUB3303)
See Figure 4.1 / 4.2 of the AA Screening for a map of the WSZ and ZoI</td></tr>
<tr><td rowspan="3">Step 1 Appropriate Assessment Screening</td><td>Downstream European Sites</td><td>Nutrient Sensitivity</td></tr>
<tr><td>List of SAC/SPAs
Great Island Channel SAC
Cork Harbour SPA</td><td>Nutrient Sensitive Qualifying Interests present – Yes</td></tr>
<tr><td colspan="2">Appropriate Assessment Required – see AA screening report for details</td></tr>
<tr><td rowspan="2">Step 2 – Direct Inputs to Surface Water</td><td>Agglomerations within WSZ</td><td>Increased loading/concentration due to Orthophosphate Dosing – Optimum Dosing rate based on raw chemistry data assessment = 0.6 mg/l</td></tr>
<tr><td>Cork City</td><td>Table 1: Cork City Primary Discharge
<table>
<tr><th rowspan="2"></th><th rowspan="2">TP Load kg/yr</th><th colspan="3">Ortho P concentration mg/l TP – Ortho P Conversion factor varied for sensitivity analysis (40%, 50%, 68%)</th></tr>
<tr><th>0.5</th><th>0.4</th><th>0.68</th></tr>
<tr><td>Existing</td><td>88006.0</td><td>0.951</td><td>0.761</td><td>1.293</td></tr>
<tr><td>Post Dosing</td><td>88636.0</td><td>0.958</td><td>0.766</td><td>1.302</td></tr>
</table>
Note – Modelled concentrations are above the Total phosphorus ELVs (2.5mg/l) set in WWDL for both existing and post dosing concentrations. The 2017 AER also shows that there have been a number of non-compliances with the TP ELV of 2.5 mg/l.</td></tr>
</table>

Table 2: Cork City SWOs (36 no.)

	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***
Existing	2615.6	0.970	0.776	1.319
Post Dosing	2633.9	0.977	0.782	1.329

Carrigtwohill

Table 3: Carrigtwohill Primary Discharge

	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***
Existing	723.2	0.177	0.141	0.240
Post Dosing	723.2	0.177	0.141	0.240

Note – Compliant with Orthophosphate ELVs (0.5mg/l) set in WWDL for both existing and post dosing concentrations. This WWTP has 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.

Table 4: Carrigtwohill SWOs (6 no.)

	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***
Existing	300.9	2.523	2.018	3.431
Post Dosing	301.7	2.530	2.024	3.440

North Cobh

Effluent Quality

Table 5: North Cobh Primary Discharge

	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***
Existing	150.0	0.312	0.250	0.425
Post Dosing	240.3	0.500	0.400	0.680

Note – There are no ELVs set for TP or Ortho-P in this Agglomeration.

Table 6: North Cobh SWOs (0 no.)

	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***
Existing	9.5	0.679	0.543	0.923
Post Dosing	12.1	0.867	0.693	1.179

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

Table 9: Mass balance assessment based on 0.6 mg/l dosing using available background concentrations and flow information ***(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.*** **Mean *F*low information taken from inputting fluvial waterbodies and tidal flows based on RPS hydrodynamic model for Cork Harbour*)***

Agglom.	RWB Name / Code	Background Conc. (mg/l) (annual mean from AER u/s monitoring point)	Modelled conc. existing (mg/l)	Modelled conc. Post Dosing (mg/l)	% Inc
Cork City	Lough Mahon IE_SW_060_0750	0.0315	0.0322	0.0322	0
Carrigtwohill	Lough Mahon (Harper's Island) IE_SW_060_0700	0.0200	0.0201	0.0201	0
North Cobh	Lough Mahon IE_SW_060_0750	0.0315	0.0315	0.0315	0

Surface Assessment

Cork City **(**IE_SW_060_0750**)** – The existing and post dosing effluent concentrations for TP predicted from the model are compliant with ELVs (Table 1). The 2017 AER shows that there are operational issues at the plant and there have been a number of non-compliances with the TP ELV of 2.5 mg/l. As the plant uses secondary treatment, the EAM assumes 100% throughout of dosed Ortho P. However, Table 7 demonstrates an insignificant increase in the modelled concentration post dosing at the WWTP and Table 10 demonstrates that orthophosphate dosing will not cause an impact on the receiving waterbody, Lough Mahon (see Step 5 and 6: Combined Inputs to Surface Water Bodies). The orthophosphate dosing will therefore not impact on the performance of the WWTP or the indicative quality in the receiving water body.

Carrigtwohill **(IE*_SW_060_0700, IE_SW_19T250870*)** – Existing effluent concentrations are compliant with ELVs and the impact from orthophosphate dosing in this WSZ on the direct discharges to surface waters is virtually zero.

North Cobh **(IE_SW_060_0750)** – There are no ELVs set for TP or Ortho-P for North Cobh WWTP. The increase in load and concentration due to orthophosphate dosing is around 30% at the plant but when tidal flows are considered, no increase in the modelled concentration is predicted, thus dosing impact is negligible from this WWTP.

Step 4: Distributed Inputs to River Water Bodies

Subsurface Assessment

The predicted increases in concentration in subsurface pathways are all insignificant for the river water bodies (less than 0.00125 mg/l, which is 5% of Good/High boundary for surface waterbodies). The highest increase can be 0.0005 mg/l, taking place at Tibbotstown_010 (IE_SW_19T250870).

Transitional and Coastal waterbodies affected by this WSZ are Lough Mahon (Harper's Island) [IE_SW_060_0700], Lough Mahon [IE_SW_060_0750], Glashaboy Estuary [IE_SW_060_0800], North Channel Great Island [IE_SW_060_0300], Slatty Bridge, Fota Island [IE_SW_060_0600], Cork Harbour [IE_SW_060_0000], and Outer Cork Harbour [IE_SW_050_0000].

The modelled loads in IE_SW_19T250870 have been reapportioned to neighbouring water bodies due to the terrain in the catchment. The load labelled

IE_SW_19T250870_1 in Figure 1 below is modelled in Lough Mahon (Harper's island). The load labelled IE_SW_19T250870_2 is modelled in Lough Mahon. As susceptibility mapping information was missing from the area labelled Great Island, the 89.5 km of water main and small number of DWWTS within this area are modelled using average delivery rates from IE_SW_19T250870.

The increased loads and predicted concentrations from subsurface pathways are significantly below 5% of the high good indicative quality boundary.

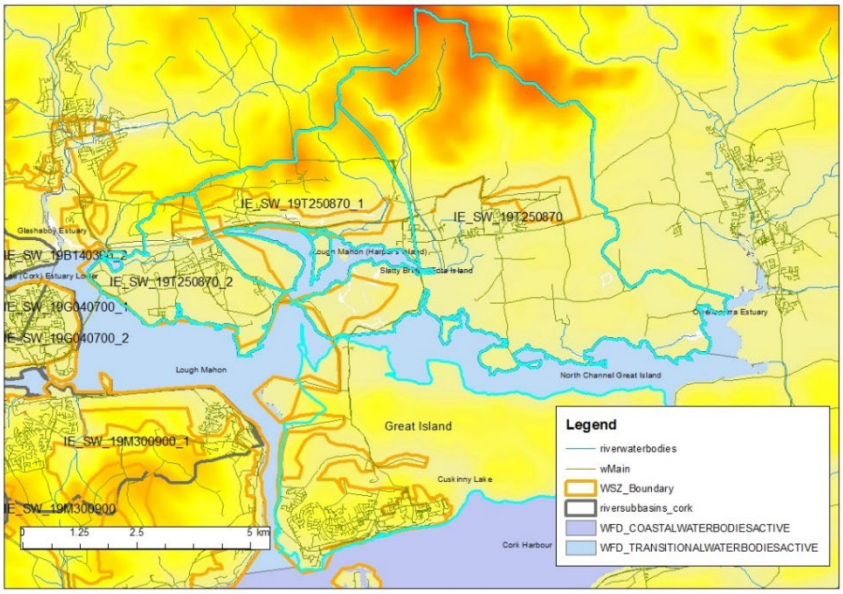


Figure 1: Load re-apportionment from the Tibottstown_010 water body (IE_SW_19T250870)

Step 5 and 6: Combined Impact on GW Receptor Assessment

Groundwater Bodies as receptors connected to WSZ

Table 10: 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	Ortho-P Indicative Quality and Trends (Distance to Threshold. Surrogate Indicative quality in *italic*	Baseline 2012 Conc. Surrogate Conc. given in *italic* mg/l	75% of indicative quality Upper threshold mg/l	PO4 Total GW Dosing Load kg/yr	PO4 Potential Conc. due to Dosing mg/l	PO4 Potential Baseline Conc. following dosing mg/l	Notes
IE_SW_G_004 Ballinhassig_1	Good Near	0.034	0.026	12.5	0.0001	0.034	MP1
	Failing to achieve good Far	0.051	0.000			0.051	MP2
	Failing to achieve good Far	0.037	0.000			0.037	MP3
	Good Upwards Far	0.021	0.026			0.021	MP4

	Good Upwards Far	0.015	0.026			0.015	MP5
	Good Upwards Far	0.006	0.026			0.006	MP6
	Good Upwards Far	0.023	0.026			0.023	MP7
	Failing to achieve good Downwards Far	0.268	0.000			0.268	MP8
	Good Upwards Far	0.006	0.026			0.006	MP9
	Good Upwards Far	0.026	0.026			0.026	MP10
	Failing to achieve good Upwards Far	0.188	0.000			0.188	MP11
	Good Upwards Far	0.012	0.026			0.012	MP12
	Failing to achieve good Upwards Far	0.043	0.000			0.043	MP13
	Good Upwards Far	0.013	0.026			0.013	MP14
IE_SW_G_046 Knockadoon_W	*Good*	*0.018*	*0.026*	*0.2*	*0.0000*	*0.018*	
IE_SW_G_058 Midleton 1	Good Upwards Far	0.017	0.026	7.4	0.0002	0.017	
IE_SW_G_089 Industrial Facility (P0016-02)	*Good*	*0.018*	*0.026*	*18.3*	*0.0194*	*0.037*	
IE_SW_G_090 LittleIsland	*Good*	*0.018*	0.026	*5.8*	*0.0054*	*0.023*	
IE_SW_G_092 Industrial Facility (P0028-01)	*Good*	*0.018*	0.026	*0.0*	*0.0*	*0.0*	

MP: multiple Monitoring Points given for waterbody

Groundwater Assessment

The predicted increase in concentrations to some groundwater bodies (GWBs) are significant (above 5% of the Good / Fail Ortho P Indicative Quality boundary for groundwater -0.00175 mg/l) due the susceptibility and hydrological conditions in general. As some GWBs are small, the corresponding flows are low, and the concentrations are sometimes high.

Ballinhassig_1 (IE_SW_G_004) has different monitoring points, some of which are Failing to Achieve Good Indicative quality, the modelled increase in concentration is negligible (0.0001 mg/l).

IE_SW_G_089, Industrial Facility (P0016-02), is highlighted in red in Table 8 as the modelled load and concentration is high in this small GWB, raising the baseline above the 75% of indicative quality threshold. However, this small groundwater body has been delineated to capture the industrial pressures and Ortho-P risk is not likely to be a key issue in this groundwater body as the overlying surface waters are not at risk from WFD Objectives due to dosing (see IE_SW_19T250870 Tibbotstown_010 in Table 9). As a result, the appropriate RAG status for this site is GREEN

For IE_SW_G_090, LittleIsland, the predicted baseline concentration following dosing is below 75% of the Good / Fail boundary for this small GWB, so there is no risk for this small GWB delineated to capture the industrial pressure is not at risk from orthophosphate dosing.

The information in susceptibility maps is missing around Great Island, so no modelled load is available directly for IE_SW_G_046 and IE_SW_G_092:

- A surrogate indicative quality of Good has been assigned to these GWBs. The potential load for IE_SW_G_046 has been estimated by assuming similar hydrogeological conditions with neighbouring areas, and the predicted increase in concentration raises the baseline to just over 75% of the upper threshold. There is no overlying waterbody defined for this GWB, but the load is modelled to Cork Harbour in the surface water assessment, where impact from combined pathways is shown to be insignificant (Table 10).
- There is 152m of water main length and no DWWTS in IE_SW_G_092, so there will be negligible impact.

Step 5 and 6: Combined Inputs to River Water Bodies

Table 11: Increased loading and concentrations to 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)***

NAME / EU_CD	Ortho P Indicative quality and Trends (distance to threshold) Surrogate Indicative quality indicated in *italic*	Baseline Year 2014 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_19B060800 BUTLERSTOWN_030	High Upwards Near	0.021	0.019	16.3	0.0002	0.021	
IE_SW_19G010600 GLASHABOY (LOUGH MAHON)_030	*Good*	*0.030*	*0.033*	*42.6*	*0.0003*	*0.030*	
IE_SW_19T250870 Tibbotstown_010	*Good*	*0.030*	*0.033*	*8.1*	*0.0006*	*0.031*	

‡ Load from WWTP / SWO following treatment added

Step 5 and 6: Combined Inputs to Surface Water Bodies

Table 12: Increased loading and concentrations to transitional water bodies receiving flows from 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)***

NAME / EU_CD	Ortho P Indicative quality and Trends (distance to threshold) Surrogate Indicative quality indicated in *italic*	Baseline Year 2014 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
Lough Mahon (Harper's Island) IE_SW_060_0700	High (S) Upwards Far	0.020	0.021	16.2	0.0000	0.020	‡*
	Good (W) Downwards Far	0.036	0.040			0.036	
Lough Mahon IE_SW_060_0750	High (S) Downwards Far	0.014	0.020	448.5	0.0000	0.014	‡
	Good (W) Downwards Far	0.027	0.042			0.027	
Glashaboy Estuary IE_SW_060_0800	Good (S) Downwards Far	0.034	0.036	42.6	0.0003	0.034	
	High (W) Downwards Near	0.029	0.019			0.029	
Slatty Bridge, Fota Island IE_SW_060_0600	*Good*	*0.030*	*0.033*	*8.1*	*0.0006*	*0.031*	
North Channel Great Island IE_SW_060_0300	Good (S) Downwards Far	0.031	0.053	8.1	0.0000	0.031	
	Good (W) Downwards Far	0.027	0.041			0.027	
Cork Harbour IE_SW_060_0000	High (S) Downwards Far	0.003	0.019	1036.7	0.0000	0.003	‡
	High (W) Upwards Near	0.024	0.019			0.024	
Outer Cork Harbour IE_SW_050_0000	High (S) Downwards Far	0.003	0.019	1036.7	0.0000	0.000	‡*
	High (W) Upwards Far	0.024	0.018			0.016	

‡ Load from WWTP / SWO following treatment added
S: Summer, W: Winter
* Statistically significant

Combined Assessment

The orthophosphate load from waterbody Tibbotstown IE_SW_19T250870 has been reapportioned, where appropriate to receiving waterbodies. The remaining load in the river, including from surface water pathways, causes an insignificant increase in the modelled concentration (Table 9).

For the transitional WBs shown in Table 10, the modelled increase in concentrations have been calculated using all available riverine flows and tidal flows. Some of the Orthophosphate concentrations following dosing exceed the relevant Ortho P indicative quality upper threshold, but this is due to the high baseline concentration as the predicted increase in concentration is below 5% of the High / Good threshold and in the majority of cases not detectable (0.0000 mg/l). Therefore no impact is expected in receiving waterbodies due to orthophosphate dosing.

Recommendation

The modelled increase in concentrations for water bodies and receiving water bodies due to this water supply zone alone suggest that impact is not significant in both surface water and groundwater bodies.

The breakdown of loads from source to pathway is shown in Figure 2 and the fate of P loads to Cork Harbour is depicted in Figure 3.

The cumulative impacts using the 2014 baseline on Lee, Cork Harbour, and Youghal Bay Catchment (HA 19) associated with phosphate dosing from following additional WTPs are summarised in Tables 11 and 12 below:

- 004 Lee Road WTP - Cork City Water Supply
- 006 Inniscarra WTP - Zone 2 Cork City and harbour

Table 13: Cumulative assessment of the increased loading and concentrations to river water bodies common to the Cork WSZs

NAME / EU_CD	Ortho P Indicative quality and Trends (distance to threshold) Surrogate Indicative quality indicated	Baseline Year 2014 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_19B060800 BUTLERSTOWN_030	High Upwards Near	0.021	*0.019*	16.3	0.0002	0.021	
IE_SW_19G010600 GLASHABOY (LOUGH MAHON)_030	*Good*	0.030	*0.033*	42.6	0.0003	0.030	
IE_SW_19T250870 Tibbotstown_010	*Good*	0.030	0.033	8.1	0.0006	0.031	

‡ Load from WWTP / SWO following treatment added

Table 14: Cumulative assessment of the increased loading and concentrations to transitional water bodies common to the Cork WSZs

NAME / EU_CD	Ortho P Indicative quality and Trends (distance to threshold) Surrogate Indicative quality indicated in *italic*	Baseline Year 2014 and Conc. Surrogate Conc. given in *italic* mg/l	75% of indicative quality threshold mg/l	Cumulative Ortho P load to SW from leakage, DWWTS & agglomerations kg/yr	Conc. using 30%ile flows g/l	PO4 Potential Baseline Conc. following dosing mg/l	Notes
Lough Mahon IE_SW_060_0750	High (S) Downwards Far	0.014	*0.020*	6556.6	0.0001	0.014	‡
	Good (W) Downwards Far	0.027	*0.042*			0.027	
Lee (Cork) Estuary Lower IE_SW_060_0900	High (S) Downwards Near	0.021	*0.020*	376.4	0.0002	0.021	‡
	Good (W) Downwards Near	0.035	*0.050*			0.044	‡
Lee (Cork) Estuary Upper IE_SW_060_0950	High (S) Downwards Far	0.013	0.019	376.4	0.0003	0.037	‡
	High (W) Downwards Near	0.026	0.019			0.027	‡
Cork Harbour IE_SW_060_0000	High (S) Downwards Far	0.003	0.019	8546.2	0.0000	0.003	‡
	High (W) Upwards Near	0.024	0.019			0.024	
Outer Cork Harbour IE_SW_050_0000	High (S) Downwards Far	0.003	0.019	8627.1	0.0003	0.000	‡*
	High (W) Upwards Far	0.024	0.018			0.016	

‡ Load from WWTP / SWO following treatment added
* Statistically significant

The cumulative assessment has demonstrated that there will not be a significant impact on the receiving waters and the dosing will not cause deterioration in indicative quality or prevent the achievement of the WFD objectives.

MITIGATION OPTION – None required

RAG STATUS – Green

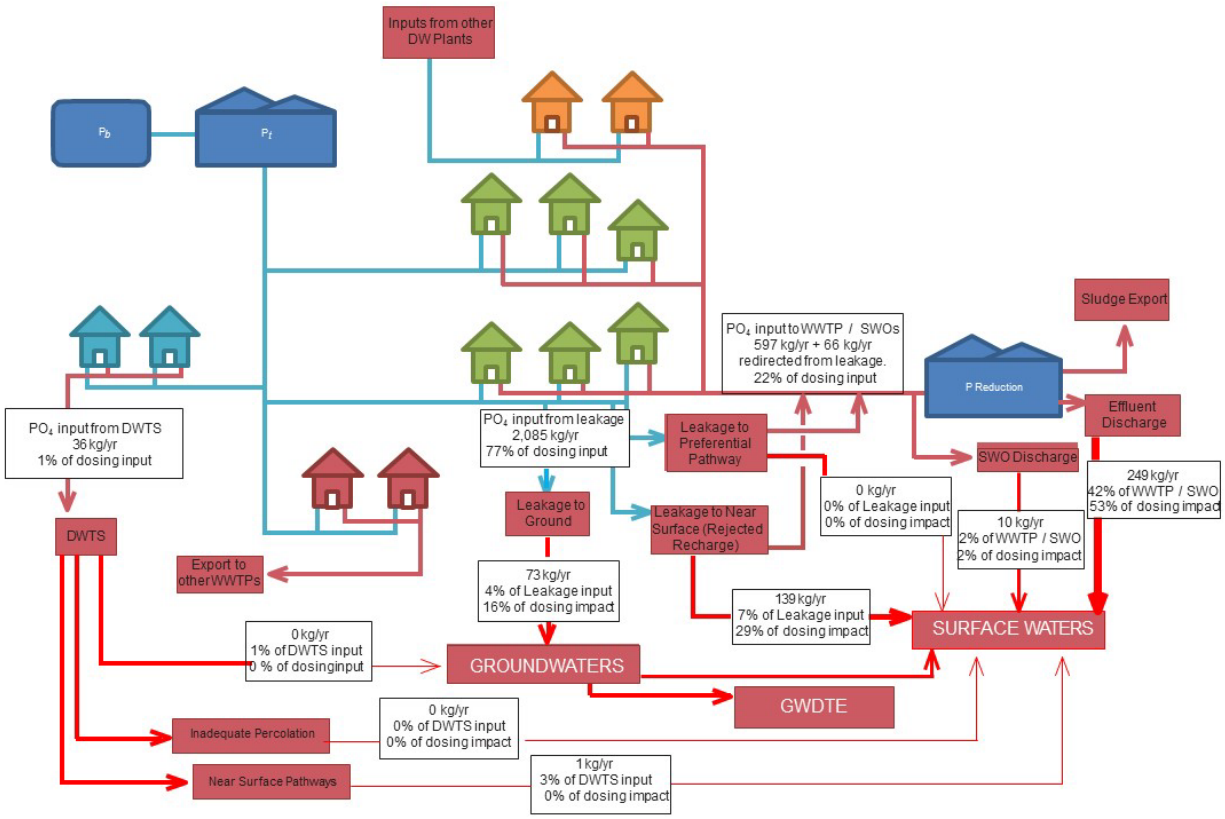
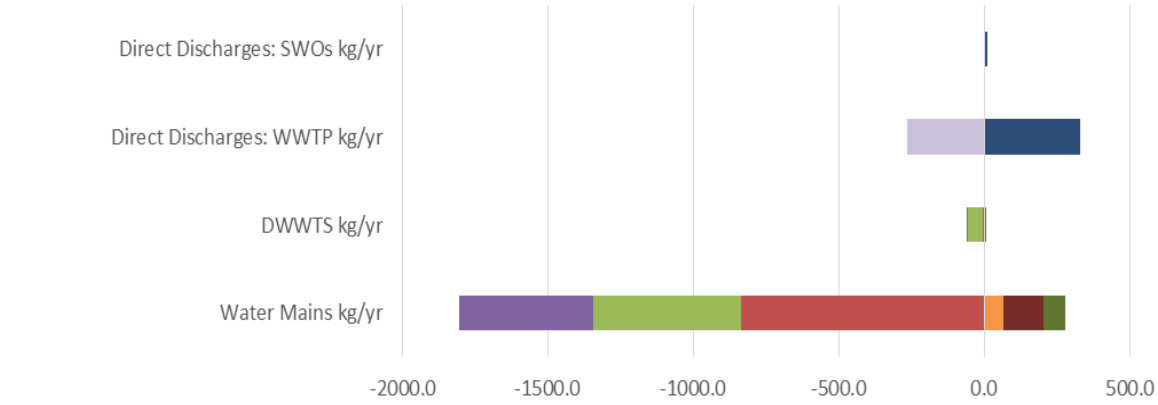


Figure 3 – Source Pathway Receptor model for Zone 3 Glashaboy WSZ illustrating key sources and pathways to Cork Harbour



	Water Mains kg/yr	DWWTS kg/yr	Direct Discharges: WWTP kg/yr	Direct Discharges: SWOs kg/yr
Load attenuated in Preference (inadequate percolation) pathway	0.0	0.0		
Load attenuated in Near Surface Pathway	-838.2	-5.4		
Load attenuated in 1m below trench	-505.8	-50.3		
Load attenuated in Subsurface Pathway	-462.3	-2.3		
Load intercepted by gravity main in Preference Pathway	0.0			
Load intercepted by gravity main in Near Surface Pathway	66.3			
Load reaching SW direct or via Preference (inadequate percolation) Pathway	0.0	0.0	331.7	9.7
Load reaching SW via Near Surface Pathway	139.1	1.9		
Load reaching SW via Subsurface Pathway	73.3	0.6		
Load treated in WWTP			-265.4	

Figure 4 – Fate of orthophosphate loads modelled for Zone 3 Glashaboy WSZ (impacting on the Cork Harbour) due to dosing by source type, indicating levels of attenuation in pathways and relative impact on the surface water receptor.